



**ENGINEERING & INFRASTRUCTURE REPORT  
TO SUPPORT A RESOURCE CONSENT APPLICATION  
FOR THE PROPOSED BAYSWATER MARITIME PRECINCT DEVELOPMENT  
21 SIR PETER BLAKE PARADE, BAYSWATER  
FOR BAYSWATER MARINA HOLDINGS LTD**

**12582-01**

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# Document Control Record

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## EXECUTIVE SUMMARY

This report addresses the civil engineering aspects and requirements for infrastructure for the proposed Bayswater Maritime Precinct development at 21 Sir Peter Blake Parade, Bayswater.

It is concluded that the development can be serviced by the existing and proposed infrastructure detailed within this report, the proposed buildings will be provided with stormwater, wastewater and water supply service, and will be connected to the local power and telecommunications reticulation.

Appropriate erosion and sediment control measures will be in place prior to the undertaking of any earthworks, and the site will be progressively stabilised upon completion of each portion of the works.

A new private roading network will be constructed in order to provide pedestrian and vehicle access to and within the development. The existing carparks associated with the marina berths will be replaced with new carparks and additional carparking will also be provided for use by the public and visitors. Boat trailer parking will also be provided near the existing boat ramp.

All stormwater runoff from the carparking and access network will be treated at source and prior to discharge to the Marina, as required under the Unitary Plan. The new stormwater system will utilise the existing outfalls on the site, and where possible treatment will be provided in raingardens and treepits. The new stormwater system will be private infrastructure.

The wastewater drainage network will discharge to the location of an existing Watercare pump station, this pump station is proposed to be replaced as part of the development. The new wastewater reticulation will be private infrastructure, with the exception of the pump station which will be vested in Watercare.

Water supply will be provided by way of connection to the existing reticulation within the site, although substantial modifications will be made and a new water reticulation system will be constructed in order to provide loops around each precinct of the development. All new water reticulation will be private infrastructure.

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## 1 INTRODUCTION

This Engineering Report is to accompany a Resource Consent Application for the development of 21 Sir Peter Blake Parade, Bayswater.

This report covers the engineering aspects for the resource consent application for the proposed development, which includes the construction of 3 multi-level residential apartment buildings (total of 27 apartments) and 94 terrace houses.

This Engineering Report identifies the engineering issues related to the proposed development and highlights the civil works that will be necessary to ensure that the buildings and proposed activities can be adequately serviced.

## 2 SITE DESCRIPTION

### 2.1 Location

The subject site is located at the south-western end of Bayswater Peninsula. The site is irregular in shape and lies between Ngataranga Bay and Shoal Bay. The site has road access from Sir Peter Blake Parade, which extends down to the site from a roundabout intersection with Bayswater Ave and Beresford St, the subject site is shown highlighted below in Figure 1.



Figure 1 - Site Location

### 2.2 Titles/Zoning

The legal description of the site is Lot 1 DP309604. The site is zoned Coastal - Marina under the Auckland Unitary Plan (AUP). The site has a total area of 3.34ha.

### 2.3 Topography

The site topography comprises a long irregular shaped site, the site has a slight fall from east to west and is bound by the Waitemata Harbour to the north, south and west. No overland flow paths are shown within the site on the Auckland Council GeoMaps system. Swales that run the length of the site on the western boundary currently direct flow into outfalls through the rock revetment wall/reclamation bund.

## **2.4 Geology**

The marina site is reclaimed land and is generally harbour muds that were constructed from the dredging of the adjacent marina; and are underlain by East Coast Bays formation at a depth that varies from approximately 5.5m to 12.5m. A geotechnical investigation report forms part of this application and should be referred to for detailed information regarding the geology of the site.



### 3 PROPOSED DEVELOPMENT

The proposal is to regenerate the Bayswater Marina landholding to enhance existing recreation, open space, access, marina and public transport opportunities whilst providing for the construction of three apartment buildings and 94 terrace houses, as well as a new roading and carparking network along with pedestrian paths and landscaping. The apartments and terrace houses will all be created as unit titles.

#### 3.1 Existing Conditions

The site is currently utilised as a marina for recreational boat owners and includes the following features:

- 419 berths enclosed by a floating breakwater
- An approximately 6500m<sup>2</sup> gravel yard for storing power boats and trailers and an engine servicing business
- Carparking for berth holders (310 carparks dedicated to berth holder use)
- Public carparking
- A public boat ramp
- A Fullers ferry terminal (note that this is located at the marina on a temporary basis and is proposed to be relocated when Auckland Transport constructs a new terminal on their land adjacent to the site)
- Two ablutions buildings for berth holders and public use
- Approximately 2600m<sup>2</sup> of grassed open space
- Marina offices

The existing marina is on reclaimed land and was constructed between 1994 and 1998. The reclamation consists of a compacted scoria bund with rock armour running around the perimeter. Marine silts and muds were dredged from the area now enclosed by the breakwater and deposited inside the bund to achieve the current existing levels. The reclamation is discussed in more detail in Section 3.4 of this report and in the Geotechnical Investigation Report prepared by KGA Geotechnical.

##### 3.1.1 Existing Services

Substantial existing underground services are present on the site, both public and private:

###### Public

- Watercare gravity wastewater running along the eastern boundary
- A Watercare wastewater pump station just outside the site (within the property owned by Auckland Council, Lot 1 DP 50556)

- A Watercare watermain running along the eastern boundary, with a bulk meter located inside the site
- Vector low and medium voltage power cabling and three transformers
- Chorus telecommunications cabling including a submarine cable connecting with Northcote

#### Private

- Stormwater pipes and swales collecting runoff from the roof and carparking areas
- Wastewater pipes servicing the existing ablutions buildings
- Water supply pipes servicing the existing ablutions buildings and the berths
- Low voltage electrical reticulation servicing the existing buildings and the berths
- Telecommunications (including security and fire alarm cabling) servicing the existing buildings and the berths

The existing services supplying the marina berths will be maintained throughout the construction works, the proposed staging and methodology is discussed in more detail in Section 3.2. Refer also to the Existing Conditions and Demolition drawings included in Appendix A.

### **3.2 Construction Methodology and Staging**

The civil works for the proposed development are proposed to be undertaken in a single stage. Bulk earthworks would be undertaken in sub-stages, with each sub-stage generally corresponding to one of the three precincts making up the development:

- South – Stage 1
- Central – Stage 2
- North – Stage 3

A detailed Construction Management Plan has been prepared for the project and is attached separately. The considerations regarding service relocation and carparking are summarised in this report below.

#### **3.2.1 Demolition and Service Relocations**

The existing services present on the site can generally be divided into three categories:

- Servicing the carpark – stormwater, street lighting, power and telecommunications to serve the boom gates
- Servicing the existing buildings – stormwater, wastewater, water supply, power and telecommunications
- Servicing the marina berths – water supply, power, telecommunications

The existing carpark services will be progressively removed and replaced as the new infrastructure is constructed. Portions of the existing stormwater system (primarily the outlets) will be retained and utilised by the new stormwater system serving the development. This is discussed in more detail in Section 3.7.

The existing buildings consist of two ablutions blocks with laundry and shower facilities (primarily provided for marina berth-holders but toilets are also accessible by users of the public boat ramp and other members of the public), the ferry terminal and marina administration buildings (which are temporary buildings) and several buildings associated with the businesses situated in the trailer-boat yard area in the northwest corner of the site. A small 'gazebo' style structure is also provided at the entrance to each of the piers (six total).

The buildings associated with the ferry terminal will be removed at the beginning of Stage 1. The southern ablutions block will also be removed at the beginning of Stage 1. The services associated with these buildings will also be removed.

The services to the marina berths will be maintained throughout the development. The services to the berths generally cross the site from east to west through two main corridors, both of which are located within the Stage 2 area. As part of the Stage 1 works it is proposed to relocate these services to be within the proposed east to west roads, Cross Street and Link Street (at the northern and southern end of Stage 2). New services will be installed before the existing services are removed, and the connection of the new services to the existing will be undertaken at a time so as to minimise disruption. Temporary generators may also be provided as required to ensure that power supply and the controlled access system for the berths is not disrupted.

In order to ensure that public toilet facilities are provided on the site, the northern ablutions block will be retained until a replacement is constructed.

The existing buildings at the trailer-boat yard have service feeds crossing under Sir Peter Blake Parade at the northern tip of the site. This area would generally be unaffected by the Stage 1 and Stage 2 works and therefore is proposed to be utilised for temporary carparking (refer to Section 3.2.2 below).

### **3.2.2 Berth access and carparking**

Under the current marina berth leasehold licenses, 310 carparks are required to be provided for use by berth holders, and this will be maintained throughout the construction period. In order to provide 310 carparks and the associated manoeuvring area, approximately 7800m<sup>2</sup> would be required.

The existing trailer-boat yard would provide the majority of the temporary berth holder carparks as it is being removed as part of the works and is already a large flat area with a similar surface to a typical unsealed carpark. However the yard only has an area of approximately 6200m<sup>2</sup> and therefore would only provide for approximately 250 carparks, leaving a shortfall of 60. Furthermore, the yard is physically distant from most of the pier ramps, with the southern corner approximately 200m walking distance from Pier E. We recommend that the shortfall of carparks be made up by providing 70 carparks closer to the piers, leaving 240 at the trailer-boat yard. The proposed berth holder carpark strategy can therefore be summarised as follows:

- 240 carparks to be provided at the trailer-boat yard, and safe access to these along with pedestrian routes to the piers to be maintained for as long as the carparks are located there. As construction work progresses carparks will progressively be relocated from the trailer-boat yard to newly constructed carparking areas closer to the marina piers. The temporary carpark will be surfaced with chip-seal and will be line-marked.

- 70 carparks to be located within the existing carpark area, and safe access to these along with pedestrian routes to the piers to be maintained for as long as the carparks are located there. Once construction in the southern precinct is complete these carparks will be relocated to the newly construction carparks in the southern precinct. This area is already sealed but some additional line-marking may be required.

### **3.3 Flooding Considerations & Overland Flow Paths**

This section should be read in conjunction with the Airey Consultants coastal inundation drawings (sheets 180-181) attached in Appendix A.

#### **3.3.1 Flood plain and flood sensitive areas**

The proposed development site is not subject to flooding as a result of stream or river flooding.

#### **3.3.2 Coastal Inundation**

Based on Auckland Council's GeoMaps, the site is not subject to coastal inundation in the 1% AEP storm event, but is subject to inundation under the 1% AEP storm event when 1m of sea level rise is accounted for.



- 1% AEP
- 1% AEP plus 1m sea level rise
- 1% AEP plus 2m sea level rise

**Figure 2 - Coastal Inundation Extents (Auckland Council GeoMaps)**

### 3.3.2.1 Finished Floor Levels

Auckland Council Technical Report TR 2016/017 – Coastal Inundation by Storm-tides and Waves in the Auckland Region provides projections for extreme sea-level rise in the Waitemata Harbour. The projected 1% AEP sea level at the Bayswater Marina site is RL2.37 (based on Auckland Vertical Datum). The relevant levels for determining minimum finished floor levels are as follows:

- 1% AEP sea level - RL2.37
- 1% AEP sea level plus 1m of sea level rise - RL3.37

The minimum habitable finished floor level on the site is therefore RL3.37. The proposed habitable floor levels on the site range from RL3.30 to RL6.20, such that habitable floor levels in the proposed

development are in accordance with E36.6.1.1 of the AUP (refer to Section 3.3.2.2) and are not a risk of inundation as a result of sea level rise.

The proposed development will include basement carparking for each terraced house. Basements will be ‘half basements’ generally sunk 1.2m below surrounding ground levels. The proposed apartment buildings will have full depth basements sunk 3.0m below surround ground levels. The lowest apartment basement level is RL0.60 and the lowest terraced house basement level is RL3.40. All terrace house basements will be above the sea level rise elevation of RL3.37. In order to prevent the site from becoming inundated, it is proposed to raise the perimeter of the site by approximately 1m (refer to the drawings attached in Appendix A for detailed levels). This will result in the perimeter of the site being at a higher elevation than RL3.37, and therefore preventing the majority of the site area from being inundated as a result of sea level rise. Therefore, these areas are not subject to any impacts of the 1% AEP sea level rise plus 1m.

### 3.3.2.2 Planning Considerations

The site is within the *Coastal erosion hazard area* in accordance with the definition of this area in the AUP as reproduced below. The site is at an elevation of less than 7m above mean high water springs and a substantial portion of the site is within 40m of mean high water springs.

#### Coastal erosion hazard area

Any land which is:

- (a) within a horizontal distance of 20m landward from the top of any coastal cliff with a slope angle steeper than 1 in 3 (18 degrees); or
- (b) at an elevation less than 7m above mean high water springs if the activity is within:
  - (i) Inner Harbours and Inner Hauraki Gulf: 40m of mean high water springs; or
  - (ii) Open west, outer and Mid Hauraki Gulf: 50m of mean high water springs; or
- (c) within a lesser distance from the top of any coastal cliff, or mean high water springs, than that stated in (a) and (b), where identified in a site-specific coastal hazard assessment technical report prepared by a suitably qualified and experienced professional to establish the extent of land which may be subject to coastal erosion over at least a 100 year time frame.

**AUP Section E36. Natural hazards and flooding** – Table E36.4.1. Activity Table states the following:

Activity	Activity status
<b>Activities on land in the coastal erosion hazard area</b>	



(A4)	All other buildings and structures on land in the coastal erosion hazard area	RD
(A5)	On-site septic tanks, wastewater treatment and disposal systems, effluent disposal fields, underground storage tanks, water tanks or stormwater pipes or soakage fields on land in the coastal erosion hazard area	RD
<b>Activities on land in the coastal storm inundation 1 per cent annual exceedance probability (AEP) plus 1 m sea level rise area</b>		
(A12)	Habitable rooms in new buildings and additions of habitable rooms (greater than 25m <sup>2</sup> ) to existing buildings in the coastal storm inundation 1 per cent annual exceedance probability (AEP) plus 1m sea level rise area that comply with standard E36.6.1.1	P

The development is assessed against these rules below.

#### **E36.4.1 (A4) & (A5)**

The restricted discretionary activity assessment criteria for activities in the coastal erosion hazard area, E36.8.2, are addressed as follows.

*(1) for external alterations to existing buildings which increase the gross floor area of the building in the coastal erosion hazard area; for all other buildings and structures in the coastal erosion hazard area; and for on-site septic tanks, wastewater treatment and disposal systems, effluent disposal fields, underground storage tanks, water tanks or stormwater pipes or soakage fields in the coastal erosion hazard area:*

- a) the likelihood of a coastal hazard event occurring, its magnitude and duration, the consequences of the event and its effects on public health, safety, property and the environment;*
- b) the extent to which site specific analysis, such as engineering, stability or flooding reports and its analysis have been undertaken and any other information the Council may have on the site and surrounding land;*
- c) the extent to which public access, landscape and other environmental values are affected by any works proposed in association with the building or structure, by way of mitigation of the hazard; and*
- d) the extent to which any building or structure can be relocated in the event of severe coastal erosion or shoreline retreat, taking into account the likely long term effects of climate change.*

The proposed activity being undertaken (residential development) is classified as a more vulnerable activity under the AUP definitions. As the existing site is surrounded by a rock revetment wall designed in order to prevent coastal erosion we consider that the site is not vulnerable to coastal erosion. The proposed development will further raise the site higher above mean high water springs and will include a retaining wall above the revetment wall which will further protect the site from coastal erosion. The extent of any damage to people, property or the environment is considered to be minimal during a storm event up to and including the 1% AEP storm (including allowance for climate change and sea level rise).

Public access is currently provided around the perimeter of the site by way of a footpath located behind the rock revetment wall. Public access will be enhanced by the development as the proposed pathway located on the new retaining wall will be substantially wider than the existing footpath; and will create a safe surface for the public. The methodology for construction of the pathway has taken into account the fact that public access must be maintained while the construction is being undertaken (refer to the Construction Management Plan prepared by Airey Consultants), however it is recognised that some temporary disruption to public access will be required in order to construct the pathway. We consider this disruption to be acceptable in order to ultimately provide superior public access. We consider that the impact of the proposed earthworks on landscape and other environmental values is negligible as long as good practice erosion and sediment controls measures are maintained, this is discussed further in Section 3.5.

We note that the proposed buildings and structures are not designed to be able to be relocated. We consider this to be acceptable owing to the substantial freeboard that has been provided above the 1% AEP plus 1m sea level rise elevation, and to the fact that the site is protected against coastal erosion.

#### **E36.4.1 (A12)**

The standard referred to in Rule E36.4.1(A12) is as follows:

*E36.6.1.1. Habitable rooms in new buildings and additions of habitable rooms (greater than 25m<sup>2</sup>) to existing buildings in the coastal storm inundation 1 per cent annual exceedance probability (AEP) plus 1m sea level rise area*

- (1) Finished floor levels of habitable rooms must be above the inundation level of the coastal storm inundation 1 per cent annual exceedance probability (AEP) plus 1 metre sea level rise area.*

As discussed in Section 3.3.2.1 above, all proposed habitable floor levels in the development will be above the 1% AEP coastal inundation plus 1m of sea level rise elevation, as shown on drawings 12582-01-180 – 181.

AUP Rule E36.9 requires that a hazard risk assessment be undertaken for any subdivision, use or development proposed on land which may be subject to coastal storm inundation 1% AEP plus 1m sea level rise. A hazard risk assessment has been undertaken in accordance with E36.9(2) and is provided below.

- a) *the type, frequency and scale of the natural hazard and whether adverse effects on the development will be temporary or permanent;*

The natural hazard pertaining to the site is *coastal storm inundation 1 per cent annual exceedance probability (AEP) plus 1m sea level rise* which, as discussed in Section 3.3.2, relates to approximately one-third of the site. The entire perimeter of the site is proposed to be raised above the *coastal storm inundation 1 per cent annual exceedance probability (AEP) plus 1m sea level rise* elevation, to eliminate the risk to buildings.

- b) *the type of activity being undertaken and its vulnerability to natural hazard events;*

The 1m of sea level rise is projected to occur over the next 100 years and therefore the proposed construction works (which are anticipated to be undertaken within several years of granting of the consent) to facilitate the development are not at risk from sea level rise.

- c) *the consequences of a natural hazard event in relation to the proposed activity and the people likely to be involved in that activity;*

Some inundation of the site onto the South Park area could occur during a *coastal storm inundation 1 per cent annual exceedance probability (AEP) plus 1m sea level rise* event, however the extent of inundation has been reduced to less than 8% of the site area, compared with the current extent of inundation which is approximately 35% of the site area. The extent of inundation exceeds 10m from all proposed habitable buildings, and therefore will not affect the safety of persons occupying or travelling to and from the buildings.

- d) *the potential effects on public safety and other property;*

Although the site is private property it does currently allow for public access due to the existing ferry terminal and bus stop and around the perimeter of the site. The proposed development includes enhanced public spaces and therefore it is anticipated that more members of the public

will visit the site after the development is completed. The public areas of the development will predominantly be located above the *coastal storm inundation 1 per cent annual exceedance probability (AEP) plus 1m sea level rise* and therefore we do not consider there to be any adverse risks in terms of public safety as a result of the development.

*e) any exacerbation of an existing natural hazard risks or creation of a new natural hazard risks;*

The proposed development does not exacerbate the existing coastal inundation hazard risk and effectively reduces it by elevating the site above the hazard level.

*f) whether any building, structure or activity located on land subject to natural hazards near the coast can be relocated in the event of severe coastal erosion, coastal storm inundation or shoreline retreat;*

After the completion of the development there will be no buildings within the site on land subject to coastal inundation and therefore no provision for the relocation of buildings is required. The proposed pathway along the perimeter of the site that will provide access to the marina berths will also be located above the *coastal storm inundation 1 per cent annual exceedance probability (AEP) plus 1m sea level rise* elevation and therefore no provision for relocation of marina activities is required.

*g) the ability to use of non-structural solutions, such as planting or the retention or enhancement of natural landform buffers to avoid, remedy or mitigate the hazard, rather than hard engineering solutions or protection structures;*

As the natural hazard pertaining to the site is coastal inundation as a result of projected sea level rise, we consider that non-structural solutions are not appropriate for mitigating the hazard. The hazard is fundamentally one of elevation, and the site needs to be raised above the elevation of RL3.37 to fully avoid the hazard. It should also be noted that the entire site is reclaimed land formed by way of a hard engineering solution. Therefore enhancement of the existing hard engineering is considered to be the most appropriate way to avoid the coastal inundation risk.

*h) the design and construction of buildings and structures to mitigate the effects of natural hazards;*

The proposed gabion retaining wall to be constructed on the existing rock revetment wall has been designed to be able to accommodate the projected coastal inundation including sea level rise. The gabion baskets are porous and therefore water will be able to run through them. Geotextiles will be provided to prevent water eroding the backfill soil behind the gabion baskets. Preliminary structural details of the retaining wall are included in the drawing set in Appendix A.

*i) the effect of structures used to mitigate hazards on landscape values and public access;*

The proposed retaining wall on the existing rock revetment wall will not be visible from the site or any neighbouring properties. The provision of this retaining wall facilitates the creation of the proposed public pathway, which will be elevated above the projected sea level rise elevation, ensuring public access can be maintained for the life of the development.

*j) site layout and management to avoid or mitigate the adverse effects of natural hazards, including access and exit during a natural hazard event;*

As has been discussed previously, the proposed development site layout has been designed in order to mitigate the adverse effects of coastal inundation. In particular it should be noted that the provision of the retaining wall and roads around the perimeter of the site being above RL3.37 will ensure that coastal inundation does not disrupt access and exit to the site or to individual buildings.

*k) the duration of consent and how this may limit the exposure for more or less vulnerable activities to the effects of natural hazards including the effects of climate change;*

The duration of the consent is largely irrelevant in relation to the coastal inundation hazard and the proposed development. The design life of the development would be anticipated to be 100 years or more and as such the fact that the habitable floor levels and the perimeter of the development are located above the *coastal storm inundation 1 per cent annual exceedance probability (AEP) plus 1m sea level rise* elevation is an important part of ensuring that the hazard is mitigated for the life of the development.

*l) any measures and/ or plans proposed to mitigate the natural hazard or the effects of the natural hazard.*

The proposed raising of the site is the primary measure by which the coastal inundation hazard is mitigated. No specific plans or otherwise are proposed.

### **3.3.3 Overland flow paths**

The site undulates, and generally falls from the centre of the site in a westerly or easterly direction towards the ocean. Several small overland flow paths are shown on the Auckland Council GeoMaps, as shown on Figure 3. These small overland flow paths are all generated within the subject site and are shown to flow into the Waitemata Harbour. Overland flows within the development have been designed to be directed

along the proposed parking and roading areas and into the harbour. There is no potential for any overland flow paths to cause flooding on any neighbouring property.



Figure 3 - Existing Overland Flow Paths

### **3.4 Geotechnical Engineering**

A geotechnical investigation has been undertaken by KGA Geotechnical and reference should be made to their report.

#### **3.4.1 Differential Settlement**

Based on the low quality of the material within the reclamation and the varied extent of both cut and fill across the site, differential will occur. Differential settlement is the process whereby the soil underlying constructed structures or pavements is compressed at different rates. This results in visible level differences in the finished surface can cause failures to the structures or pavements and are also undesirable from an aesthetic perspective. Differential settlement can also result in damage to services if they are not designed to accommodate differential movement. In order to manage differential settlement the following measures are proposed.

- Buildings will be supported on piles/ground improvements founded in bedrock so that no settlement of buildings will occur.
- Settlement slabs are proposed to be provided at the interface between buildings and pavements. The settlement slabs will be structurally connected to the structural slab at one end but will be isolated from the adjoining pavement. This slab will then pivot at one end to transition the level difference created by the differential settlement.
- The concrete pavements will be provided with a joint layout and joint system designed specifically to mitigate differential settlement. The design of this will be undertaken at the detailed design stage.
- The existing lime stabilised fill layers will be reused and recompact to provide stronger platforms for the construction of the pavements and services across these platforms.
- Any piped or ducted services that are suspended beneath structural slabs will be provided with flexible joints at the point where they become suspended. These joints will accommodate the movement that may arise due to differential settlement between the surrounding ground and the piled structure.

The Geotechnical Investigation Report prepared by KGA Geotechnical contains further information on earthworks and site formation recommendations.

### 3.5 Earthworks

This section should be read in conjunction with the Airey Consultants earthworks drawings (sheets 200 – 236) attached in Appendix A.

#### 3.5.1 Existing Site

The surface of the existing site is predominantly asphalt and is generally flat. The different site coverages are as follows:

- Asphalt pavement and concrete footpaths - 19,840m<sup>2</sup>
- Unsealed trailer-boat yard - 6,500m<sup>2</sup>
- Grassed areas - 6,200m<sup>2</sup>
- Buildings - 860m<sup>2</sup>

The site is fully reclaimed harbour silts/muds constructed from dredging of the adjacent marina. The upper 1.5 - 2.0m depth of the material was lime stabilised to provide a higher strength material on the upper surface to support the existing carparks, buildings and services. A rock revetment wall around the perimeter of the site provides edge support to the reclamation and protection against wave/tidal action.

Our assessment is that the extent of ground settlement since the reclamation is minimal, however reference should be made to the KGA Geotechnical report for more discussion of this.

#### 3.5.2 Proposed Earthworks

Cut to fill earthworks across the site are proposed in order to:

- raise the site above the 1% AEP sea level plus 1m of sea level rise elevation of RL3.37
- form building platforms
- create road and pavement subgrades

The earthworks have been designed to be undertaken as a cut to fill operation and will be undertaken in sub-stages, as described in section 3.2. Silt fences and sediment diversion drains will be provided around the harbour-side perimeter of each stage, and sediment retention ponds will be utilised to provide sediment control.

The estimated earthwork quantities are shown in Table 1.



**Table 1 – Bulk Earthworks Quantities**

	Area (m <sup>2</sup> )	Volume (m <sup>3</sup> )
Stripped material (pavement & topsoil) to be reused	32,000	3,200
Fill	13,600	13,900
Cut (incl 15% compaction factor)	20,000	12,800
Excess	-	1,100

The maximum depth of cut proposed is 3.6m and the maximum height of fill is 2.4m. The deep cuts are primarily associated with the apartment building basements and the nearby areas. There is also an area of deeper cut associated with the existing mound on the site, near the northern toilet block. The deepest fills are generally along the western edge of the site and are a result of the proposed perimeter retaining wall.

The earthworks result in an excess fill volume of approximately 1,100m<sup>3</sup>. All stripped topsoil will be able to be reused as part of the landscaping of the development, and stripped pavement basecourse will be able to be utilised in new pavement layers, as backfill in service trenches and to provide working pads below the basements of the buildings. The previously lime stabilised fill areas will also be fully recycled by reusing the material within the upper fill layers to provide a suitable platform for the new roading and services network to be constructed upon.

All unsuitable material taken off-site will be disposed of at an approved earthworks construction site or at a clean-fill facility authorised to accept excavated material.

All new buildings will be piled/supported on the bedrock below the reclamation.

A retaining wall with a maximum retained height of up to 2.60m will be constructed around the perimeter of the site in order to support the proposed pathway. This retaining wall is anticipated to be of gabion basket construction. A low retaining wall (max retained height approx. 0.5m) will be constructed along the eastern side of Sir Peter Blake Parade. Other low retaining walls (less than 1m retained height) will also be provided as part of the landscaping design. The detailed design of all retaining walls will be undertaken at the Building Consent stage for the development.

### 3.5.3 Auckland Unitary Plan (AUP)

AUP provisions relating to the proposed earthworks include:

- E11 – Land Disturbance – Regional
- E12 – Land Disturbance – District

**Section E11. Land disturbance – Regional** – Table 11.4.1. Activity Table – all other zones and roads states the following:

Activity		Activity status				
		Residential zones, business zones, Business – City Centre Zone, Future Urban Zone, rural zones (excluding Rural – Rural Conservation Zone)	Open space zones (excluding Open Space – Conservation Zone)	Rural – Rural Conservation Zone and Open Space – Conservation Zone	Special Purpose – Quarry Zone	All other zones and roads
(A9)	Greater than 2,500m <sup>2</sup> within the Sediment Control Protection Area <sup>1</sup>	RD	RD	RD	Refer to <a href="#">H28 Special Purpose – Quarry Zone</a>	RD

The Sediment Control Protection Area is defined in the AUP as:

- 100m either side of a foredune or 100m landward of the coastal marine area (whichever is the more landward of mean high water springs); or
- 50m landward of the edge of a lake, river or stream, or the edge of a wetland of 1,000m<sup>2</sup> or greater.

The site is located within 100m of mean high water springs and therefore is within the Sediment Control Protection Area. Therefore the proposed earthworks are classed as a *Restricted Discretionary Activity*. As such, the relevant assessment criteria will need to be addressed under E11.8 Assessment – restricted discretionary activities.

**Standard E11.8.2 Assessment criteria** states the following:

*“The Council will consider the relevant assessment criteria below for restricted discretionary activities:*

*(1) All restricted discretionary activities:*

*(a) whether applicable standards are complied with”*

We consider all applicable standards have been complied with as assessed above and that all proposed works comply with GD05.

*“(b) the proximity of the earthworks to any water body and the extent to which erosion and sediment controls and the proposed construction methodology will adequately avoid or minimise adverse effects on:*

- (i) water quality including of the coastal marine area;*
- (ii) ecological health including of the coastal marine area;*
- (iii) riparian margins;*
- (iv) the mauri of water; and*
- (v) the quality of taiāpure or mahinga mātaītai.”*

The Waitemata Harbour Coastal Marine Area (CMA) is the receiving environment for the site. The catchment area of Shoal Bay is approximately 457ha (as discussed above) and the site has an area of 3.34ha which is approximately 0.7% of the catchment. The proposed erosion and sediment controls are designed to prevent sediment laden runoff from being discharged from the site and therefore to minimise effects on the downstream environment. We consider that no adverse impact on the CMA is anticipated.

*“(c) the extent to which the earthworks minimises soil compaction, other than where it benefits geotechnical or structural performance”*

Substantial soil compaction will be required over most of the site in order to construct the proposed pavements. This compaction is required to ensure structural performance of the pavements. The building foundations will be piled into bedrock and therefore high levels of soil compaction are unlikely to be required in the areas where buildings are to be constructed. It should be noted that the site soils are of poor quality and that several hundred millimetres of settlement has occurred since the marina was constructed.

*“(d) the proximity of the earthworks to areas of significant ecological value and the extent the design, location and execution of the works provide for the maintenance and protection of these areas”*

The proposed earthworks are not in proximity to any areas of significant ecological value.

*“(e) whether monitoring the volume and concentration of sediment that may be discharged by the activity is appropriate within the scale of the proposed land disturbance”*

Monitoring by Council is anticipated for this site in addition to that provided by the contractors and Engineers. Monitoring will be undertaken by the bulk earthworks contractor and the controls will be checked before and after periods of heavy rain. Controls will also be checked by the Engineer at least once a fortnight. We do not consider that any specific monitoring programme is warranted for this site other than regular weekly or fortnightly visits by Council’s Erosion and Sediment Control Team.

*“(f) whether the extent or impacts of adverse effects from the land disturbance can be mitigated by managing the duration, season or staging of such works”*

The bulk earthworks will be undertaken in three primary stages as documented on the erosion and sediment control plans. Each stage will be progressively stabilised with metal or topsoil and hydroseeding. We consider that staging the bulk earthworks will help to minimise the adverse effects associated with the bulk earthworks.

*“(g) the extent to which appropriate methods are used to prevent the spread of total control pest plants or unwanted organisms (as listed under the Biosecurity Act 1993), such as kauri dieback disease.”*

No pest plants or unwanted organisms have been identified on the site.

**Section E12. Land disturbance – District** – Table 12.4.1. Activity Table – all other zones and roads states the following:

Activity		Activity status						
		Residential zones	Business zones and City Centre Zone	Conservation Zone)	Rural – Rural and rural zones (excluding Future Urban Zone and rural zones (excluding Conservation Zone)	Open space zones (excluding Open Space – Conservation Zone)	Rural – Rural Conservation and Open Space – Conservation Zone	Special Purpose – Quarry Zone
(A10)	Greater than 2500m <sup>3</sup>	RD	RD	RD	RD	RD	Refer to <a href="#">H28 Special Purpose – Quarry Zone</a>	RD

**Standard E12.8.1 Matters of discretion** states the following:

*The Council will restrict its discretion to all of the following matters when assessing a*

*restricted discretionary resource consent application:*

*(1) all restricted discretionary activities:*

*(a) compliance with the standards;*

The erosion and sediment control design has been prepared in accordance with GD05.

*(b) effects of noise, vibration, odour, dust, lighting and traffic on the surrounding environment;*

A Noise and Vibration Assessment of the proposed development has been undertaken by Marshall Day and a Traffic Impact Assessment has been undertaken by Stantec. Dust control in accordance with GD05 will be provided for the duration of the earthworks. Dust control will primarily be provided by watercart. No odours are anticipated to be generated by the earthworks.

*(c) effects on the stability and safety of surrounding land, buildings and structures;*

It should be noted that the site has no surrounding land to the north, south and west. The neighbouring land to the east is occupied by a carpark and a large shed-type structure. The shed is located approximately 6m from the property boundary. Bulk earthworks and retaining wall construction will be undertaken immediately adjacent to the property boundary. As the adjoining land is a much older reclamation than the subject site (approximately 80 years old), we do not anticipate any further settlement in this area. We consider that there will be no adverse effects on the stability and safety of the surrounding land, buildings and structures.

*(d) effects on overland flow paths and flooding;*

The site is not subject to flooding and the only overland flow paths running through it are minor and arise within the site. There we do not consider that there will be any effects on overland flow paths or flooding that will impact other properties.

*(e) protocol for the accidental discovery of kōiwi, archaeology and artefacts of Māori origin;*

As the site was reclaimed relatively recently (1990s), we consider that the likelihood of accidental discovery is very low. If any kōiwi, archaeology and artefacts of Māori origin are discovered works will be halted and the relevant Mana Whenua authority and Heritage New Zealand will be notified.

*(f) the treatment of stockpiled materials on the site including requirements to remove material if it is not to be reused on the site;*

Stockpiles will be located in appropriate locations set back from the coast. Stockpiles will be stabilised if they are not being actively used, and will be provided with specific erosion and sediment control measures if they are being actively used.

*(g) staging of works and progressive stabilisation;*

The bulk earthworks will be undertaken in three primary stages as documented on the erosion and sediment control plans. Each stage will be progressively stabilised with metal or topsoil and hydroseeding. We consider that staging the bulk earthworks will help to minimise the adverse effects associated with the bulk earthworks.

*(h) information and monitoring requirements;*

Monitoring by Council is anticipated for this site in addition to that provided by the contractors and Engineers. Monitoring will be undertaken by the bulk earthworks contractor and the controls will be checked before and after periods of heavy rain. Controls will also be checked by the Engineer at least once a fortnight. We do not consider that any specific monitoring programme is warranted for this site other than regular weekly or fortnightly visits by Council's Erosion and Sediment Control Team.

*(i) timing and duration of works;*

The bulk earthworks works are anticipated to be undertaken within a single earthworks construction season (from October to May).

*(j) term of consent;*

A five-year consent is requested to match the subdivision consent approval period.

*(k) potential effects on significant ecological and indigenous biodiversity values;*

The proposed earthworks are not in proximity to any areas of significant ecological value. The site primarily operates as a carpark and has very low ecological value. As many of the existing Pohutukawa trees as practicable are proposed to be retained, in particular the row of six trees south of the existing boat ramp which are to be retained in place. Other existing Pohutukawas will be replanted within the development.

*(l) risk that may occur as a result of natural hazards;*

Portions of the site are currently located within the 1% AEP plus 1m of sea level rise hazard area and therefore there is a very low risk of the earth-worked area being subject to inundation. As the proposed

earthworks are being undertaken in order to raise the site above the inundation level we consider that this risk is acceptable during the earthworks period.

*(m) protection of or provision of network utilities and road networks.*

The existing network utilities within or near the site include wastewater reticulation, water supply electricity reticulation and telecommunications reticulation. The existing public wastewater and water supply are outside the site boundary and will be unaffected by the proposed works. Electrical and telecommunications reticulation within the site will either be relocated prior to the bulk earthworks or will be protected during the works.

*(n) potential effects on the natural character and values of the coastal environment, lakes, rivers and their margins, where works encroach into riparian or coastal yards; and*

As the extents of the existing reclamation are not being altered we consider that there is no adverse effect on the natural character and values of the coastal environment, noting that the site is reclaimed land and is not natural.

*(o) positive effects enabled through the land disturbance.*

The development includes an approximately 3.5m wide (proposed width varies, refer to the Boffa Miskell landscape drawings for details) pathway that will replace the existing 1.5m wide concrete footpath that runs around the coastal perimeter of the site. The pathway will be open to the public and will make the coastal frontage much more accessible to members of the public. We consider this to be a highly positive effect that is enabled through the proposed land disturbance.

#### **3.5.4 Erosion and Sediment Control**

Full silt and sediment control measures will be provided throughout the development of the project in accordance with the requirements of Auckland Council GD05. Silt control measures will be installed to prevent sediment discharge to the Waitemata Harbour. The site will be split into the three sub-stages 1 - 3 catchment areas.

In each catchment the basement excavations for one row of terrace houses will be undertaken and the excavation will then be utilised as a sediment retention pond as shown on drawing 12582-01-230. Silt fences will also be provided around the entire perimeter of the site to capture any small, localised runoff from areas that cannot be directed towards the sediment retention ponds. The site will be filled from the

perimeter first moving gradually inwards as layers are built up, to shape the site towards the sediment retention ponds. Removal of the sediment ponds and final shaping of the townhouse basement excavations will be undertaken following the stabilisation of each earthworks catchment.

The deep excavations for the apartment building basements will be at lower elevations than the surrounding areas and therefore no runoff will occur from these areas. Due to the depth of these excavations (below mean high water springs) groundwater influx will occur and therefore dewatering will be provided. The dewatering pumps will pump the water to the sediment retention pond within the catchment for that stage which will ensure that sediment control is provided for this water.

The bulk earthworks within the development are proposed to be undertaken during the earthworks construction season from October to May.

All earth-worked areas will be progressively stabilised upon completion of earthworks in within each stage. Stabilisation will be provided by basecourse metalling of proposed pavement and building areas; and laying topsoil, grass seed and mulch for the landscaped areas.



### **3.6 Roading & Access**

This section should be read in conjunction with the Airey Consultants roading and access drawings (sheets 300 – 307) attached in Appendix A.

#### **3.6.1 Existing Site**

The site is accessed from the western end of Bayswater Ave via Sir Peter Blake Parade. The public road reserve terminates approximately 30m inside the site boundary, however there is no visual demarcation and the public road extent seamlessly transitions into the marina access road.

Sir Peter Blake Parade is a crowned road approximately 8m wide with a concrete footpath located on the western side. A footpath follows the rock revetment wall around the perimeter of the site, with another in a north-south direction along the middle of the site. The footpaths converge near the ferry terminal at the southern tip of the site.

The existing site primarily consists of sealed carparking and is generally flat but undulates due to areas of previous differential settlement. The existing pavement generally consists of 200mm thick GAP65 subbase overlain with 100mm AP40 basecourse with either asphaltic concrete or chip seal wearing course (as shown on the as-built drawings from the marina construction).

#### **3.6.2 Proposed Roading & Access**

Stantec have undertaken a Traffic Impact Assessment for the proposed development which will form part of this resource consent application.

The proposed development includes the construction of new private roads to provide access to the buildings and carparks while maintaining access to the marina berths. All roads will be private access roads and are not proposed to be vested.

The proposed pavement types are as follows:

- Asphalt – Sir Peter Blake Parade, Link Street, Cross Street, South Street
- Coloured concrete or similar – North Lane
- Concrete with black oxide – access and manoeuvring areas within the North, Central and South Precincts
- Concrete – footpaths and other pedestrian areas

- Concrete with planted reinforced soil infill – parking bays.

Reference should be made to the landscape architecture drawings prepared by Boffa Miskell for more details of the surface finishes and road widths.

### **3.7 Stormwater**

This section should be read in conjunction with the Airey Consultants stormwater drawings (sheets 400 – 420) attached in Appendix A.

#### **3.7.1 Existing Stormwater Reticulation**

There is no public stormwater infrastructure present on the site. There is private stormwater infrastructure draining the existing carpark and buildings. The private stormwater network consists of cesspits, manholes, swales and pipes which discharge to the harbour through six outlets through the rock revetment bund. The outlets are all located below Mean High Water Springs (MHWS). The existing stormwater pipes are generally 225 to 375mm diameter. No stormwater quality or quantity treatment is provided on the site, except for some minimal treatment from the existing swales.

The bulk of the existing stormwater reticulation (except for the outlets) will be decommissioned and replaced during the development, with the exception of the pipeline located adjacent to the eastern boundary of the site, which is within the neighbouring Auckland Council land.

#### **3.7.2 Proposed Stormwater Reticulation**

Stormwater runoff generated from the development is proposed to be collected in a private stormwater system and discharged to the Waitemata Harbour through seven outlets. All except one of these stormwater outlets are either existing outlets or upgrades of existing outlets, therefore the increase in the number of outfalls to the harbour is limited to one new outlet. It should be noted that two of the new outlets are located below MHWS.

The drainage network will collect runoff from buildings roofs, paved surfaces and any overland flow from pervious surfaces. The drainage network will generally be constructed within the central courtyards of each precinct and will direct stormwater to the perimeter of the site to discharge to the harbour. The stormwater drainage reticulation has been designed to accommodate runoff from rainfall events up to and including the 10% AEP storm with allowance for climate change, in accordance with Auckland Council's Stormwater Code of Practice. The detailed design of the stormwater reticulation will be undertaken at the Building Consent stage in accordance with the requirements of the NZ Building Code.

#### **3.7.3 Auckland Unitary Plan (AUP)**

AUP stormwater provisions relating to the site include:

- F2 - General Coastal Marine Zone
  - Policy F2.11.3 requires any discharge of stormwater into the coastal marine area to adopt the best practicable option to prevent or minimise adverse effects on the environment. This policy also aims to reduce the amount of litter entering receiving waters.
- E8 – Stormwater – Discharge and Diversion
  - Stormwater discharges to the Coastal Marine area are covered under E8.4.1(A3)
  - E8.6 General Standards are addressed as follows:

1) *The design of the proposed stormwater management device(s) must be consistent with any relevant precinct plan that addresses or addressed stormwater matters.*

The site is located within the Bayswater Marina Precinct but this precinct does not include any provisions with respect to stormwater matters.

2) *The diversion and discharge must not cause or increase scouring or erosion at the point of discharge or downstream.*

The stormwater outlets will be provided with suitable erosion control measures to ensure that there will be no increase in scouring or erosion at the point of discharge. We note that there will be no erosion or scour downstream as the receiving environment is the Waitemata Harbour. The detailed design of the stormwater outlets will be undertaken at the Building Consent Stage.

3) *The diversion and discharge must not result in or increase the following:*

- a. *flooding of other properties in rainfall events up to the 10 per cent annual exceedance probability (AEP); or*
- b. *inundation of buildings on other properties in events up to the 1 per cent annual exceedance probability (AEP).*

All stormwater runoff from rainfall events up to and including the 10% AEP storm will be captured in the proposed stormwater pipe network and discharged to the Waitemata through the stormwater outlets described above. The development will not result in flooding of other properties in rainfall events up to and including the 10% AEP storm.

Overland flow paths will be provided in order to ensure that no inundation of buildings occurs in events up and including the 1% AEP storm. The overland flow paths will direct runoff over the perimeter retaining walls and into the Waitemata Harbour. There are two locations (Link St & Cross St) where overland flow paths to the harbour are not possible due to the design levels of the development. At these locations stormwater inlets will be provided, these will direct runoff to large stormwater pipelines which will discharge the runoff to the Waitemata Harbour. These stormwater

inlets and pipelines will be designed to accommodate the 1% AEP storm with allowance for blockage in accordance with Auckland Council's Stormwater Code of Practice.

4) *The diversion and discharge must not cause or increase nuisance or damage to other properties.*

There are no downstream properties between the site and the receiving environment. The proposed stormwater discharge will not cause or increase nuisance or damage to other properties.

5) *The diversion and discharge of stormwater runoff must not give rise to the following in any surface water or coastal water:*

- a. *the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials;*
- b. *any conspicuous change in the colour or visual clarity;*
- c. *any emission of objectionable odour;*
- d. *the rendering of fresh water unsuitable for consumption by farm animals; or*
- e. *any significant adverse effects on aquatic life.*

As discussed in *Stormwater Management – Quality*, stormwater treatment raingardens and proprietary filtration devices will be provided to treat runoff from all impervious areas. Provision of these treatment devices will ensure that there is no:

- conspicuous oil/grease/scum/foams/floatable or suspended material in the coastal water
- conspicuous change in colour or visual clarity of the coastal water
- emissions of objectionable odour
- adverse effect on aquatic life.

Currently the site contains a large proportion of impervious carparking area with minimal stormwater quality treatment provided. We consider that the proposal will improve the water quality of the stormwater discharge from the site.

6) *Where the diversion and discharge is to ground soakage, groundwater recharge or peat soil areas any existing requirements for ground soakage, including devices to manage discharges or soakage, must be complied with*

The proposed discharge is not to ground soakage.

In order to comply with the intent, policy and rules of the AUP, the stormwater management for the development is proposed to achieve the following:

- No increase in stormwater flows and volumes for rainfall events up to and including the 10% AEP storm
- Provide stormwater quality treatment using a Best Practicable Option (BPO) approach
- Minimise the amount of litter entering the receiving environment
- Avoid erosion, land instability, scour and flooding

### Stormwater Management – Quantity

The proposed development increases the pervious area on the site by approximately 1,300m<sup>2</sup>, as shown below.

Pre-development:

- Pervious area - 6,200m<sup>2</sup>
- Impervious area - 27,200m<sup>2</sup>

Post-development:

- Pervious area – 7,530m<sup>2</sup>
- Impervious area - 7,620m<sup>2</sup> roof  
18,250m<sup>2</sup> paving  
25,870m<sup>2</sup> total

As a consequence of the increase in pervious area on the site, the flow rate and volume of stormwater runoff will decrease as a result of the development. Both peak flow rate and volume will reduce by approximately 1% as shown in Table 2.

**Table 2 - Runoff flow rates and volumes**

	10% AEP peak flowrate (m <sup>3</sup> /s)	10% AEP 24-hr volume (m <sup>3</sup> )	1% AEP peak flowrate (m <sup>3</sup> /s)	1% AEP 24-hr volume (m <sup>3</sup> )
Pre-development	0.800	4592	1.285	7428
Post-development	0.789	4518	1.275	7342
Percentage decrease	1%	2%	1%	1%

As the runoff volume and peak flow rate is actually decreased as a result of the development, no stormwater quantity treatment is proposed. The site discharges directly into the Waitemata Harbour and the effect of any increase or decrease in the quantity of flow would provide no ecological impact.

### Stormwater Management – Quality

Currently the site does not formally provide any stormwater quality treatment. A grassed swale does run around the western edge of the site but provides minimal stormwater treatment and is primarily for conveyance.

The proposed development includes the redevelopment of an existing high contaminant generating carpark, and therefore the controlled activity standards under AUP rule E9.6.2.1 must be complied with.

*E9.6.2.1. Development of a new or redevelopment of an existing high contaminant generating car park greater than 5,000m<sup>2</sup>*

- (1) *The development of a new or redevelopment of an existing high contaminant generating car park must not be located in an industrial and trade activity area.*

The development is not located in an industrial and trade activity area.

- (2) *Stormwater runoff from an impervious area used for a high contaminant generating car park must be treated by stormwater management device(s).*

Stormwater management devices will be provided to treat all runoff from impervious areas.

- (3) *Where a high contaminant generating car park is more than 50 per cent of the total impervious area of a site, stormwater runoff from the total impervious area on the site must be treated by stormwater management device(s).*

The proposed carpark area (including access and manoeuvring areas) makes up 63% of the total impervious area. As such AUP rule E9.6.2.1 requires that stormwater treatment devices compliant with Auckland Council GD01 are provided for all impervious areas, including roofs. This will be provided by way of raingardens and bioretention tree pits located along the road edges and in the central courtyards. A grass swale is also proposed running along the western edge of the site which will provide some additional stormwater quality treatment. In order to provide treatment of the roof runoff, it is proposed to provide proprietary treatment devices (hydrodynamic separators or filtration devices) located on the pipe networks. Seven proprietary devices will be required as shown on the stormwater plans. The specific proprietary treatment devices will be specified and designed at the building consent design stage and will be capable of providing treatment in accordance with GD01. Stormwater360 StormFilters or similar devices are anticipated.

(4) *The stormwater management device(s) must meet the following:*

- a. *the device or system must be sized and designed in accordance with ‘Guidance Document 2017/001 Stormwater Management Devices in the Auckland Region (GD01)’; or*
- b. *where alternative devices are proposed, the device must demonstrate it is designed to achieve an equivalent level of contaminant or sediment removal performance to that of ‘Guidance Document 2017/001 Stormwater Management Devices in the Auckland Region(GD01)’.*

All stormwater treatment devices will be in accordance with GD-1.

The proposed stormwater treatment devices and catchments are summarised in Table 3 below.

**Table 3 - Stormwater Treatment Devices/Catchments**

	Catchment area (m <sup>2</sup> )	Min. treatment area (m <sup>2</sup> )	Proposed treatment area (m <sup>2</sup> )
Bioretention	14,280	288	292
Proprietary devices	11,590	-	-

Raingardens/bioretention tree pits are considered to be the best practicable option for providing stormwater quality treatment of the paved areas within the development for the following reasons:

- Space constraints – due to the high density nature of the development, there is not considered to be suitable space for providing a pond or wetland. These treatment devices would need to be located in the northern or southeastern open spaces and would result in the majority of at least



one of these areas being essentially unusable. In urban areas ponds or wetlands can be desirable due to the positive impacts of providing a body of water in a community area, but as the development is surrounded by water on three sides this is considered to be unnecessary.

- Integrated into landscape – the raingarden and tree pit locations have been coordinated with the landscape design undertaken by Boffa Miskell, which has ensured that the overall design is quite efficient and provides stormwater treatment within aesthetically pleasing landscape areas.

In order to capture litter and gross pollutants, all stormwater cesspits will be fitted with EnviroPods or similar filter systems. These systems will also reduce the risk of blockage of the stormwater system.

### **Stormwater Management – Overland Flow**

The development has been designed so that overland flow in large rainfall events (up to and including the 1% AEP storm) is able to be discharged to the receiving environment without inundating buildings or other properties. Overland flow will generally be contained within road corridors and will flow over the perimeter retaining walls into the Waitemata Harbour. As there are two local low points proposed on the site (Cross St & Link St), two stormwater inlets with associated large diameter pipes will be provided to collect and convey overland flow to the Waitemata Harbour (this system is referred to as the major drainage system). The major drainage inlets and pipe will be designed to convey stormwater flows up to and including the 1% AEP storm including an allowance for blockage in accordance with Auckland Council's Stormwater Code of Practice. The overland flow paths are shown on drawing sheet 400.

It should be noted that one overland flow path will exit the site's eastern boundary and flow into the neighbouring property. There is an existing overland flow path generated within the subject site and flowing into this property, this will be replaced by the new overland flow path. The new flowpath is 25m north of the existing flow path and will not result in any increase in nuisance, damage or inundation of the neighbouring property.



**Figure 4 - Existing and Proposed Overland Flow Path within Bayswater Wharf property (existing blue, proposed red)**

The provision of overland flow paths and the major drainage pipe system will ensure that there will be no inundation of buildings within the site, or increase in flooding on other properties, in storm events up to and including the 1% AEP storm.

### **3.8 Wastewater**

This section should be read in conjunction with the Airey Consultants wastewater drawings (sheets 500 – 520) attached in Appendix A.

#### **3.8.1 Existing Wastewater**

The existing wastewater infrastructure present on the site consists of:

- A public gravity pipeline running north along the eastern boundary of the site
- A public pump station located northeast of the site (within the neighbouring property owned by Auckland Council)
- A private pump station located in the southern part of the site serving the ferry terminal and the southern ablutions block
- Private gravity pipeline running from the northern ablutions block to the public gravity pipeline
- Private rising mains running from the southern pump station to the private gravity pipeline

The majority of the existing private wastewater within the site will be decommissioned and removed, including the private pump station. The existing public gravity line running along the eastern boundary of the site is proposed to be retained. The existing public pump station is proposed to be replaced with a new pump station, refer to the Airey Consultants Pump Station report attached separately for further details regarding this.

#### **3.8.2 Proposed Wastewater**

A new private wastewater reticulation system will be constructed to service the development. The new wastewater reticulation will be a gravity system comprising pipes and manholes and will connect the three precincts of the development to the existing wastewater pipeline that runs along Sir Peter Blake Parade and which discharges into the existing pump station. A new upgraded public pump station is proposed to be constructed to replace the existing public pump station and will pump wastewater through the existing rising main to the existing gravity system located at Beresford Street. A capacity check of the existing rising main and the downstream reticulation has confirmed that it has capacity to accept the increased flows from the development. The capacity check calculations are attached as an appendix to the Airey Consultants Pump Station report.

The new pump station will continue to utilise the existing wastewater discharge consent for wastewater overflows; but the conditions of this consent may need to be varied to suit the new, substantially larger, pump station.

### **3.9 Water Supply**

This section should be read in conjunction with the Airey Consultants water supply drawings (sheets 600 – 604) attached in Appendix A.

#### **3.9.1 Existing Water Supply**

The existing water supply infrastructure within the site is predominantly private, with the exception of a 150mm diameter pipe and bulk meter supplying the property. A network of water supply pipes are fed from this service lead and supply water to the ablutions blocks, ferry terminal and the marina berths. Three fire hydrants are provided on the private network and are all located near the reclamation bund on the western side of the site.

A public watermain runs along the eastern boundary of the site within the neighbouring property. This watermain is fed by the public water supply reticulation from Bayswater Road and Lake Road, originating from the reservoir on top of Takarunga/Mount Victoria. Three hydrants are provided on the public network along the site boundary. The existing watermain will be retained and utilised to supply water to the development.

#### **3.9.2 Proposed Water Supply**

It is proposed to utilise the existing bulk meter to supply water to the development. The meter will be relocated and a new private water supply network will be constructed and connected to the bulk meter. The private water supply network will consist of 100mm ID watermains located around the perimeter of the site, with 50mm ID rider mains forming smaller loops around the three stages of the development. Although the water supply network would be privately owned it would generally be designed and constructed in accordance with Watercare standards.

Each terraced house will be provided with a property service connection and meter, and further bulk meters and backflow prevention devices will be provided for the apartment buildings. Booster pumps may be required for the apartment buildings to ensure adequate water pressures at the upper floors. Design will be undertaken at the building consent stage for each individual apartment building. Privately owned fire hydrants will be provided on the water supply network. The firefighting requirements are described in more detail in section 3.9.3 below.

### 3.9.3 Water Supply Fire Fighting

Under the New Zealand Fire Service Firefighting Water Supplies Code of Practice SNZ PAS 4509:2008, Table 1, the proposed development's water supply classifications are determined as follows:

- Terraced houses – FW2

It is assumed that the terraced houses will not be provided with sprinklers

- Apartment buildings – FW2

The apartment buildings will be provided with sprinklers.

FW2 classification requires a minimum of 12.5L/s to be available within 135m of every dwelling, and an additional 12.5L/s to be available within 270m for every dwelling, from a maximum of two hydrants. In practical terms this means that one hydrant is required within 135m of every dwelling and one further hydrant within 270m.

The existing public hydrants on the eastern boundary of the site have been pressure and flow tested and meet the requirements for FW3 firefighting water supply classification, and therefore also meet the requirements of FW2 firefighting water supply classification. The results of this test are included within Appendix .

All existing hydrants on or adjacent to the site are proposed to be retained and will provide firefighting service to the development.

One additional private hydrant is proposed to be constructed to provide additional firefighting security for the development. This is shown on the Airey Consultants water supply drawings (12582-01-600 – 604).

## **3.10 Utilities**

### **3.10.1 Power and Telecommunications**

The site is currently serviced by power and telecommunications running along Sir Peter Blake Parade and it is anticipated that upgrades and modifications will be made to this infrastructure to enable it to service the development. There are two Vector transformers within the site and one adjacent to the existing pump station. The design of the electrical reticulation for the development will be undertaken at the engineering approval/building consent stage by the project electrical engineer in conjunction with Vector.

Telecommunications infrastructure is also present within the site providing phone service to the marina berths and buildings, as well as facilitating the fire alarm and security systems. These systems will be required to be maintained for the duration of the construction works and upon completion of the development. Design of the telecommunications reticulation for the development will be undertaken at the engineering approval/building consent stage by the project electrical engineer in conjunction with Chorus.

## 4 SUMMARY

The proposed development is considered feasible subject to the engineering works and infrastructure upgrades/modifications described in this report, which will ensure that the development:

- Has habitable floor levels located above the projected coastal inundation levels taking into account sea level rise.
- Can be staged in such a way to ensure that access and use of the existing marina berths is not interrupted.
- Is provided with stormwater, wastewater, water supply and utility service connections.
- Does not result in adverse effects on the environment that are more than minor.
- Is provided with safe vehicle and pedestrian access to each dwelling.



# Appendix A

## Drawings

# Appendix B

## Calculations



## ENGINEERING CALCULATIONS

**Job:** Hydraulic Neutrality Report

**Location:** Bayswater Maritime Precinct

**Client:** Bayswater Marina Holdings Ltd

**Job No:** 12582-01

**Date:** Dec 2020

**Design Engineer:** AW

**Checked By:** MR

**Contact Phone:** (09) 486 4542      **Fax:** (09) 489 5455

**Email:** [ashleyw@aireys.co.nz](mailto:ashleyw@aireys.co.nz)

WORKSHEET 1: RUNOFF PARAMETERS & TIME OF CONCENTRATION				REFERENCE																										
<b>PRESENT CATCHMENT</b>				ARC TP108																										
Note: <input style="width: 400px; height: 20px;" type="text"/>																														
<b>1: Runoff Curve Number (CN) and Initial Abstraction (I<sub>a</sub>)</b>																														
Soil Classification	Cover Description	Connected Reticulation	Curve Number	Area (ha)	CN x Area																									
Waitematas, C	Grassed areas	No	74	0.6200	45.88																									
	Existing Impermeable Areas	Yes	98	2.7200	266.56																									
<b>Total</b>				<b>3.3400</b>	<b>312.44</b>																									
<table style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #cccccc;"> <th style="width: 30%;"></th> <th style="width: 15%;">Unconnected</th> <th style="width: 15%;">Connected</th> <th style="width: 10%;"></th> <th style="width: 30%;"></th> </tr> </thead> <tbody> <tr> <td>Total CN x Area</td> <td>45.88</td> <td>266.56</td> <td></td> <td></td> </tr> <tr> <td>Total Area</td> <td>0.6200</td> <td>2.7200</td> <td>ha</td> <td></td> </tr> <tr> <td><b>CN (Weighted)</b></td> <td><b>74</b></td> <td><b>98</b></td> <td></td> <td>= Total CN x Area / Total Area</td> </tr> <tr> <td><b>I<sub>a</sub> (Weighted)</b></td> <td><b>5.0</b></td> <td><b>0.0</b></td> <td>mm</td> <td>= 5 x Permeable Area / Total Area</td> </tr> </tbody> </table>							Unconnected	Connected			Total CN x Area	45.88	266.56			Total Area	0.6200	2.7200	ha		<b>CN (Weighted)</b>	<b>74</b>	<b>98</b>		= Total CN x Area / Total Area	<b>I<sub>a</sub> (Weighted)</b>	<b>5.0</b>	<b>0.0</b>	mm	= 5 x Permeable Area / Total Area
	Unconnected	Connected																												
Total CN x Area	45.88	266.56																												
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<b>I<sub>a</sub> (Weighted)</b>	<b>5.0</b>	<b>0.0</b>	mm	= 5 x Permeable Area / Total Area																										
<b>2: Time of Concentration</b>																														
Channelisation Factor: C	<input style="width: 60px;" type="text" value="0.6"/>	<input style="width: 60px;" type="text" value="0.6"/>			Table 4.2																									
Catchment Length: L	<input style="width: 60px;" type="text" value="0.100"/>	<input style="width: 60px;" type="text" value="0.100"/>	km		(Along drainage path)																									
Catchment Slope: S <sub>c</sub>	<input style="width: 60px;" type="text" value="0.005"/>	<input style="width: 60px;" type="text" value="0.005"/>	m/m		(by equal area method)																									
Runoff Factor: R <sub>f</sub>	0.59	0.96			= CN / (200 - CN)																									
t <sub>c</sub>	0.17	0.17	hrs		= 0.14.C.L <sup>0.66</sup> .R <sub>f</sub> <sup>-0.55</sup> .S <sub>c</sub> <sup>-0.30</sup>																									
SCS Lag for HEC-HMS	0.11	0.11	hrs		= <sup>2</sup> / <sub>3</sub> .t <sub>c</sub>																									
Area for HEC-HMS	0.0062	0.0272	km <sup>2</sup>																											

WORKSHEET 2: GRAPHICAL PEAK FLOW RATE				REFERENCE			
<b>PRESENT CATCHMENT</b>				ARC TP108  From Worksheet 1 From Worksheet 1 From Worksheet 1 From Worksheet 1  $= [(1000/CN)-10].25.4$  From TP108 Charts Auckland Council SW Code of Practice - Table 4.1  $= (P_{24}-2.I_a)/(P_{24}-2.I_a+2.S)$ From Fig. 5.1 $tc = 0.17$ $= q^*.A.P_{24}$ $= (P_{24}-I_a)^2 / [(P_{24}-I_a)+S]$ $= 1000.Q_{24}.A$  $= (P_{24}-2.I_a)/(P_{24}-2.I_a+2.S)$ From Fig. 5.1 $tc = 0.17$ $= q^*.A.P_{24}$ $= (P_{24}-I_a)^2 / [(P_{24}-I_a)+S]$ $= 1000.Q_{24}.A$			
Note:							
<b>1: Data</b>							
	<b>Unconnected</b>	<b>Connected</b>					
Catchment Area: <b>A</b> =	0.0062	0.0272	km <sup>2</sup>				
Runoff Curve Number: <b>CN</b> =	74	98					
Initial Abstraction: <b>I<sub>a</sub></b> =	5.0	0.0	mm				
Time of Concentration: <b>t<sub>c</sub></b> =	0.17	0.17	hrs				
Storage: <b>S</b> =	89.2	5.2	mm				
<b>2: Peak Flow Rate and Volume</b>							
	<b>Storm 1</b>	<b>Storm 2</b>	<b>Storm 3</b>		<b>Storm 4</b>	<b>Storm 5</b>	
Av Recurrence Int. <b>ARI</b> =	2	10	EDV		WQV	100	yr
24hr Rainfall Depth <b>P<sub>24</sub></b> =	80	135	34.5		26.6667	205	mm
Climate Change Depth <b>P<sub>24</sub></b> =	87.2	152.8	34.5		29.1	239.4	mm
<b>Unconnected Catchment</b>							
Unconnected Index <b>c*</b> =	0.30	0.44	0.12	0.10	0.56		
Specific Flow Rate <b>q*</b> =	0.085	0.115	0.038	0.031	0.134		
Peak Flow Rate <b>q<sub>p</sub></b> =	0.046	0.109	0.008	0.006	0.199	m <sup>3</sup> /s	
Runoff Depth <b>Q<sub>24</sub></b> =	39	92	7	5	170	mm	
Runoff Volume <b>V<sub>24</sub></b> =	244	571	45	32	1053	m <sup>3</sup>	
<b>Connected Catchment</b>							
Connected Index <b>c*</b> =	0.89	0.94	0.77	0.74	0.96		
Specific Flow Rate <b>q*</b> =	0.165	0.166	0.158	0.155	0.167		
Peak Flow Rate <b>q<sub>p</sub></b> =	0.391	0.691	0.148	0.122	1.086	m <sup>3</sup> /s	
Runoff Depth <b>Q<sub>24</sub></b> =	82	148	30	25	234	mm	
Runoff Volume <b>V<sub>24</sub></b> =	2239	4020	816	671	6375	m <sup>3</sup>	
<b>Total Catchment</b>							
Av Recurrence Int. <b>ARI</b> =	2	10	EDV	WQV	100	yr	
Peak Flow Rate <b>q<sub>p</sub></b> =	0.437	0.800	0.156	0.128	1.285	m <sup>3</sup> /s	
Runoff Volume <b>V<sub>24</sub></b> =	2483	4592	861	703	7428	m <sup>3</sup>	

WORKSHEET 1: RUNOFF PARAMETERS & TIME OF CONCENTRATION				REFERENCE																					
<b>DEVELOPED CATCHMENT</b>				ARC TP108																					
Note: <input type="text"/>																									
<b>1: Runoff Curve Number (CN) and Initial Abstraction (I<sub>a</sub>)</b>																									
Soil Classification	Cover Description	Connected Reticulation	Curve Number	Area (ha)	CN x Area																				
Waitematas, C	Proposed Grassed Areas	No	74	0.7530	55.72																				
	Proposed Impermeable Areas	Yes	98	2.5870	253.53																				
<b>Total</b>				<b>3.3400</b>	<b>309.25</b>																				
<table border="1"> <thead> <tr> <th></th> <th>Unconnected</th> <th>Connected</th> <th></th> </tr> </thead> <tbody> <tr> <td>Total CN x Area</td> <td>55.72</td> <td>253.53</td> <td></td> </tr> <tr> <td>Total Area</td> <td>0.7530</td> <td>2.5870</td> <td>ha</td> </tr> <tr> <td><b>CN (Weighted)</b></td> <td><b>74</b></td> <td><b>98</b></td> <td></td> </tr> <tr> <td><b>I<sub>a</sub> (Weighted)</b></td> <td><b>5.0</b></td> <td><b>0.0</b></td> <td>mm</td> </tr> </tbody> </table>							Unconnected	Connected		Total CN x Area	55.72	253.53		Total Area	0.7530	2.5870	ha	<b>CN (Weighted)</b>	<b>74</b>	<b>98</b>		<b>I<sub>a</sub> (Weighted)</b>	<b>5.0</b>	<b>0.0</b>	mm
	Unconnected	Connected																							
Total CN x Area	55.72	253.53																							
Total Area	0.7530	2.5870	ha																						
<b>CN (Weighted)</b>	<b>74</b>	<b>98</b>																							
<b>I<sub>a</sub> (Weighted)</b>	<b>5.0</b>	<b>0.0</b>	mm																						
				$= \frac{\text{Total CN x Area}}{\text{Total Area}}$																					
				$= \frac{5 \times \text{Permeable Area}}{\text{Total Area}}$																					
<b>2: Time of Concentration</b>																									
Channelisation Factor: C	<input type="text" value="0.6"/>	<input type="text" value="0.6"/>																							
Catchment Length: L	<input type="text" value="0.100"/>	<input type="text" value="0.100"/>	km																						
Catchment Slope: S <sub>c</sub>	<input type="text" value="0.005"/>	<input type="text" value="0.005"/>	m/m																						
Runoff Factor: R <sub>f</sub>	0.59	0.96																							
t <sub>c</sub>	0.17	0.17	hrs																						
SCS Lag for HEC-HMS	0.11	0.11	hrs																						
Area for HEC-HMS	0.0075	0.0259	km <sup>2</sup>																						
				<i>Table 4.2</i> (Along drainage path) (by equal area method)																					
				$= \frac{CN}{(200 - CN)}$																					
				$= 0.14.C.L^{0.66} .R_f^{-0.55} .S_c^{-0.30}$																					
				$= \frac{2}{3} .t_c$																					

WORKSHEET 2: GRAPHICAL PEAK FLOW RATE				REFERENCE			
<b>DEVELOPED CATCHMENT</b>				ARC TP108			
Note:							
<b>1: Data</b>							
		Unconnected	Connected				
Catchment Area: <b>A</b> =	0.0075	0.0259	km <sup>2</sup>		From Worksheet 1		
Runoff Curve Number: <b>CN</b> =	74	98			From Worksheet 1		
Initial Abstraction: <b>I<sub>a</sub></b> =	5.0	0.0	mm		From Worksheet 1		
Time of Concentration: <b>t<sub>c</sub></b> =	0.17	0.17	hrs		From Worksheet 1		
Storage: <b>S</b> =	89.2	5.2	mm		= [(1000/CN)-10].25.4		
<b>2: Peak Flow Rate and Volume</b>							
		Storm 1	Storm 2	Storm 3	Storm 4	Storm 5	
Av Recurrence Int. <b>ARI</b> =	2	10	EDV	WQV	100	yr	From TP108 Charts
24hr Rainfall Depth <b>P<sub>24</sub></b> =	87.2	152.8	34.5	29.1	239.4	mm	
<b>Unconnected Catchment</b>							
Unconnected Index <b>c*</b> =	0.30	0.44	0.12	0.10	0.56		= (P <sub>24</sub> -2.I <sub>a</sub> )/(P <sub>24</sub> -2.I <sub>a</sub> +2.S)
Specific Flow Rate <b>q*</b> =	0.085	0.115	0.038	0.031	0.134		From Fig. 5.1 <b>tc = 0.17</b>
Peak Flow Rate <b>q<sub>p</sub></b> =	0.056	0.132	0.010	0.007	0.242	m <sup>3</sup> /s	= q*.A.P <sub>24</sub>
Runoff Depth <b>Q<sub>24</sub></b> =	39	92	7	5	170	mm	= (P <sub>24</sub> -I <sub>a</sub> ) <sup>2</sup> /[(P <sub>24</sub> -I <sub>a</sub> )+S]
Runoff Volume <b>V<sub>24</sub></b> =	297	694	55	38	1279	m <sup>3</sup>	= 1000.Q <sub>24</sub> .A
<b>Connected Catchment</b>							
Connected Index <b>c*</b> =	0.89	0.94	0.77	0.74	0.96		= (P <sub>24</sub> -2.I <sub>a</sub> )/(P <sub>24</sub> -2.I <sub>a</sub> +2.S)
Specific Flow Rate <b>q*</b> =	0.165	0.166	0.158	0.155	0.167		From Fig. 5.1 <b>tc = 0.17</b>
Peak Flow Rate <b>q<sub>p</sub></b> =	0.372	0.657	0.141	0.116	1.033	m <sup>3</sup> /s	= q*.A.P <sub>24</sub>
Runoff Depth <b>Q<sub>24</sub></b> =	82	148	30	25	234	mm	= (P <sub>24</sub> -I <sub>a</sub> ) <sup>2</sup> /[(P <sub>24</sub> -I <sub>a</sub> )+S]
Runoff Volume <b>V<sub>24</sub></b> =	2129	3824	776	638	6063	m <sup>3</sup>	= 1000.Q <sub>24</sub> .A
<b>Total Catchment</b>							
Av Recurrence Int. <b>ARI</b> =	2	10	EDV	WQV	100	yr	
Peak Flow Rate <b>q<sub>p</sub></b> =	0.428	0.789	0.150	0.123	1.275	m <sup>3</sup> /s	
Runoff Volume <b>V<sub>24</sub></b> =	2426	4518	831	677	7342	m <sup>3</sup>	

HYDRAULIC NEUTRALITY REPORT SUMMARY						REFERENCE	
<b><u>PRESENT - DEVELOPED SUMMARY</u></b>							
<b>1: Data</b>							
<b>Catchment Area</b>							
Present: A =	3.3400	ha					
Developed: A =	3.3400	ha					
Percentage Difference	100%						
Difference: A =	0.0000	ha					
<b>% Impermeable</b>							
Present: A =	81%						
Developed: A =	77%						
			<b>Storm 1</b>	<b>Storm 2</b>	<b>Storm 3</b>	<b>Storm 4</b>	<b>Storm 5</b>
Av Recurrence Int. ARI =	2	10	EDV	WQV	100	yr	
24hr Rainfall Depth P <sub>24</sub> =	87.2	152.8	34.5	29.1	239.4	mm	
<b>2: Peak Flow Rate Summary</b>							
Av Recurrence Int. ARI =	<b>2</b>	<b>10</b>	<b>EDV</b>	<b>WQV</b>	<b>100</b>	yr	
Present Peak Flow q <sub>p</sub> =	0.437	0.800	0.156	0.128	1.285	m <sup>3</sup> /s	
Developed Peak Flow q <sub>p</sub> =	0.428	0.789	0.150	0.123	1.275	m <sup>3</sup> /s	
Percentage Difference	<b>98%</b>	<b>99%</b>	<b>96%</b>	<b>96%</b>	<b>99%</b>		
Peak Flow Difference q =	<b>-0.009</b>	<b>-0.010</b>	<b>-0.005</b>	<b>-0.005</b>	<b>-0.010</b>	m <sup>3</sup> /s	
<b>3: Runoff Volume Summary</b>							
Av Recurrence Int. ARI =	<b>2</b>	<b>10</b>	<b>EDV</b>	<b>WQV</b>	<b>100</b>	yr	
Present Volume V <sub>24</sub> =	2483	4592	861	703	7428	m <sup>3</sup>	
Developed Volume V <sub>24</sub> =	2426	4518	831	677	7342	m <sup>3</sup>	
Percentage Difference	<b>98%</b>	<b>98%</b>	<b>97%</b>	<b>96%</b>	<b>99%</b>		
Volume Difference V =	<b>-57</b>	<b>-74</b>	<b>-30</b>	<b>-26</b>	<b>-86</b>	m <sup>3</sup>	



## RAINGARDEN SIZING SUMMARY TABLE

Project: Bayswater Maritime Precinct  
 Calcs by: A.Watson

No: 12582-01  
 Date: 1/12/2020

Raingarden	Catchment Area (m <sup>2</sup> )	Min. treatment area (m <sup>2</sup> )	Proposed Area (m <sup>2</sup> )
RG-1	2400	48	24
RG-2	1400	28	29
RG-3	875	18	25
RG-4	1040	21	23
RG-5	1425	29	34
RG-6	830	17	17
RG-7	1000	20	22
RG-8	1670	34	45
RG-9	2150	43	46
RG-10	790	16	16
RG-11	700	14	11
<b>TOTAL</b>	<b>14280</b>	<b>288</b>	<b>292</b>

RAINGARDEN CALCULATIONS		RG-1	REFERENCE
<b><u>Treatment Requirements</u></b>			ARC GD01; Section C3
Area to be treated	$A_{(connect)} = \begin{matrix} \boxed{2400.0} & \text{m}^2 \\ \boxed{0.2} & \text{ha} \end{matrix}$		Rational Method Inputs
Coefficient	$C = \boxed{0.95}$		Roofed, paved, imp areas
Time of Concentration	$T_c = \boxed{10.0}$ mins		
Rainfall Intensity	$i = \boxed{10.0}$ mm/hr		
Water Quality Flow	$WQF = \boxed{22.8}$ m <sup>3</sup> /hr		$Q=2.78*C*I*A$
<b><u>Minimum Device Area</u></b>			
Infiltration Rate	$K_{(media)} = \begin{matrix} \boxed{1.0} & \text{m/hr} \\ \boxed{0.5} & \end{matrix}$		
Clogging Safety Factor			
Minimum Area Required	$\boxed{45.64}$ m <sup>2</sup>		>2% of Catchment Area
<b>2% of Catchment Area</b>	<b><math>\boxed{48.00}</math> m<sup>2</sup></b>		<b>Check</b>
<b>Required Device Area</b>	<b><math>\boxed{48.0}</math> m<sup>2</sup></b>		
Ponding Depth	$d_{(pond)} = \boxed{100}$ mm		For Treatment: ≥100mm
Media Depth	$d_{(media)} = \boxed{500}$ mm		≥500mm
Transition Layer	$\boxed{100}$ mm		100mm
Drainage Layer	$d_{(drainage)} = \boxed{250}$ mm		≥200-300mm
<b><u>Void Space Assumptions</u></b>			
Ponding Layer	$\boxed{100\%}$		
Bioretention Layer	$\boxed{30\%}$		
Transition Layer	$\boxed{30\%}$		
Drainage Layer	$\boxed{35\%}$		

RAINGARDEN CALCULATIONS	RG-2	REFERENCE
<b><u>Treatment Requirements</u></b>		ARC GD01; Section C3
Area to be treated	$A_{(connect)} = 1400.0 \text{ m}^2$ $0.1 \text{ ha}$	Rational Method Inputs
Coefficient	$C = 0.95$	Roofed, paved, imp areas
Time of Concentration	$T_c = 10.0 \text{ mins}$	
Rainfall Intensity	$i = 10.0 \text{ mm/hr}$	
Water Quality Flow	$WQF = 13.3 \text{ m}^3/\text{hr}$	$Q=2.78*C*I*A$
<b><u>Minimum Device Area</u></b>		
Infiltration Rate	$K_{(media)} = 1.0 \text{ m/hr}$	
Clogging Safety Factor	$0.5$	
Minimum Area Required	$26.62 \text{ m}^2$	>2% of Catchment Area
<i>2% of Catchment Area</i>	<i>28.00 m<sup>2</sup></i>	<b>Check</b>
<b>Required Device Area</b>	<b>28.0 m<sup>2</sup></b>	
Ponding Depth	$d_{(pond)} = 100 \text{ mm}$	For Treatment: ≥100mm
Media Depth	$d_{(media)} = 500 \text{ mm}$	≥500mm
Transition Layer	$100 \text{ mm}$	100mm
Drainage Layer	$d_{(drainage)} = 250 \text{ mm}$	≥200-300mm
<b><u>Void Space Assumptions</u></b>		
Ponding Layer	<b>100%</b>	
Bioretention Layer	<b>30%</b>	
Transition Layer	<b>30%</b>	
Drainage Layer	<b>35%</b>	

RAINGARDEN CALCULATIONS	RG-3	REFERENCE
<b><u>Treatment Requirements</u></b>		ARC GD01; Section C3
Area to be treated	$A_{(connect)} = \begin{matrix} \boxed{875.0} & m^2 \\ \boxed{0.1} & ha \end{matrix}$	Rational Method Inputs
Coefficient	$C = \boxed{0.95}$	Roofed, paved, imp areas
Time of Concentration	$T_c = \boxed{10.0}$ mins	
Rainfall Intensity	$i = \boxed{10.0}$ mm/hr	
Water Quality Flow	$WQF = \boxed{8.3}$ m <sup>3</sup> /hr	$Q=2.78*C*I*A$
<b><u>Minimum Device Area</u></b>		
Infiltration Rate	$K_{(media)} = \begin{matrix} \boxed{1.0} & m/hr \\ \boxed{0.5} & \end{matrix}$	
Clogging Safety Factor	$\boxed{0.5}$	
Minimum Area Required	$\boxed{16.64}$ m <sup>2</sup>	>2% of Catchment Area
<b>2% of Catchment Area</b>	<b><math>\boxed{17.50}</math> m<sup>2</sup></b>	<b>Check</b>
<b>Required Device Area</b>	<b><math>\boxed{18.0}</math> m<sup>2</sup></b>	
Ponding Depth	$d_{(pond)} = \boxed{100}$ mm	For Treatment: ≥100mm
Media Depth	$d_{(media)} = \boxed{500}$ mm	≥500mm
Transition Layer	$\boxed{100}$ mm	100mm
Drainage Layer	$d_{(drainage)} = \boxed{250}$ mm	≥200-300mm
<b><u>Void Space Assumptions</u></b>		
Ponding Layer	$\boxed{100\%}$	
Bioretention Layer	$\boxed{30\%}$	
Transition Layer	$\boxed{30\%}$	
Drainage Layer	$\boxed{35\%}$	

RAINGARDEN CALCULATIONS		RG-4	REFERENCE
<b><u>Treatment Requirements</u></b>			ARC GD01; Section C3
Area to be treated	$A_{(connect)} = \begin{matrix} \boxed{1040.0} & \text{m}^2 \\ \boxed{0.1} & \text{ha} \end{matrix}$		Rational Method Inputs
Coefficient	$C = \boxed{0.95}$		Roofed, paved, imp areas
Time of Concentration	$T_c = \boxed{10.0}$ mins		
Rainfall Intensity	$i = \boxed{10.0}$ mm/hr		
Water Quality Flow	$WQF = \boxed{9.9}$ m <sup>3</sup> /hr		$Q=2.78*C*I*A$
<b><u>Minimum Device Area</u></b>			
Infiltration Rate	$K_{(media)} = \begin{matrix} \boxed{1.0} & \text{m/hr} \\ \boxed{0.5} & \end{matrix}$		
Clogging Safety Factor			
Minimum Area Required	$\underline{\underline{\boxed{19.78}}} \text{ m}^2$		>2% of Catchment Area
<b>2% of Catchment Area</b>	<b><math>\boxed{20.80} \text{ m}^2</math></b>		<b>Check</b>
<b>Required Device Area</b>	<b><math>\boxed{21.0} \text{ m}^2</math></b>		
Ponding Depth	$d_{(pond)} = \boxed{100}$ mm		For Treatment: ≥100mm
Media Depth	$d_{(media)} = \boxed{500}$ mm		≥500mm
Transition Layer	$\boxed{100}$ mm		100mm
Drainage Layer	$d_{(drainage)} = \boxed{250}$ mm		≥200-300mm
<b><u>Void Space Assumptions</u></b>			
Ponding Layer	$\boxed{100\%}$		
Bioretention Layer	$\boxed{30\%}$		
Transition Layer	$\boxed{30\%}$		
Drainage Layer	$\boxed{35\%}$		

RAINGARDEN CALCULATIONS	RG-5	REFERENCE
<b><u>Treatment Requirements</u></b>		ARC GD01; Section C3
Area to be treated	$A_{(connect)} = \begin{matrix} \boxed{1425.0} & m^2 \\ \boxed{0.1} & ha \end{matrix}$	Rational Method Inputs
Coefficient	$C = \boxed{0.95}$	Roofed, paved, imp areas
Time of Concentration	$T_c = \boxed{10.0}$ mins	
Rainfall Intensity	$i = \boxed{10.0}$ mm/hr	
Water Quality Flow	$WQF = \boxed{13.5}$ m <sup>3</sup> /hr	$Q=2.78*C*I*A$
<b><u>Minimum Device Area</u></b>		
Infiltration Rate	$K_{(media)} = \begin{matrix} \boxed{1.0} & m/hr \\ \boxed{0.5} & \end{matrix}$	
Clogging Safety Factor		
Minimum Area Required	$\boxed{27.10}$ m <sup>2</sup>	>2% of Catchment Area
<b>2% of Catchment Area</b>	<b><math>\boxed{28.50}</math> m<sup>2</sup></b>	<b>Check</b>
<b>Required Device Area</b>	<b><math>\boxed{29.0}</math> m<sup>2</sup></b>	
Ponding Depth	$d_{(pond)} = \boxed{100}$ mm	For Treatment: ≥100mm
Media Depth	$d_{(media)} = \boxed{500}$ mm	≥500mm
Transition Layer	$\boxed{100}$ mm	100mm
Drainage Layer	$d_{(drainage)} = \boxed{250}$ mm	≥200-300mm
<b><u>Void Space Assumptions</u></b>		
Ponding Layer	$\boxed{100\%}$	
Bioretention Layer	$\boxed{30\%}$	
Transition Layer	$\boxed{30\%}$	
Drainage Layer	$\boxed{35\%}$	

RAINGARDEN CALCULATIONS		RG-6	REFERENCE
<b><u>Treatment Requirements</u></b>			ARC GD01; Section C3
Area to be treated	$A_{(connect)} =$ <input type="text" value="830.0"/> m <sup>2</sup> <input type="text" value="0.1"/> ha		Rational Method Inputs
Coefficient	$C =$ <input type="text" value="0.95"/>		Roofed, paved, imp areas
Time of Concentration	$T_c =$ <input type="text" value="10.0"/> mins		
Rainfall Intensity	$i =$ <input type="text" value="10.0"/> mm/hr		
Water Quality Flow	$WQF =$ <input type="text" value="7.9"/> m <sup>3</sup> /hr		$Q=2.78*C*I*A$
<b><u>Minimum Device Area</u></b>			
Infiltration Rate	$K_{(media)} =$ <input type="text" value="1.0"/> m/hr		
Clogging Safety Factor	<input type="text" value="0.5"/>		
Minimum Area Required	<hr/> <input type="text" value="15.78"/> m <sup>2</sup>		>2% of Catchment Area
<b>2% of Catchment Area</b>	<b><input type="text" value="16.60"/> m<sup>2</sup></b>		<b>Check</b>
<b>Required Device Area</b>	<b><input type="text" value="17.0"/> m<sup>2</sup></b>		
Ponding Depth	$d_{(pond)} =$ <input type="text" value="100"/> mm		For Treatment: ≥100mm
Media Depth	$d_{(media)} =$ <input type="text" value="500"/> mm		≥500mm
Transition Layer	<input type="text" value="100"/> mm		100mm
Drainage Layer	$d_{(drainage)} =$ <input type="text" value="250"/> mm		≥200-300mm
<b><u>Void Space Assumptions</u></b>			
Ponding Layer	<input type="text" value="100%"/>		
Bioretention Layer	<input type="text" value="30%"/>		
Transition Layer	<input type="text" value="30%"/>		
Drainage Layer	<input type="text" value="35%"/>		

RAINGARDEN CALCULATIONS	RG-7	REFERENCE
<b><u>Treatment Requirements</u></b>		ARC GD01; Section C3
Area to be treated	$A_{(connect)} = $ <input type="text" value="1000.0"/> m <sup>2</sup> <input type="text" value="0.1"/> ha	Rational Method Inputs
Coefficient	$C = $ <input type="text" value="0.95"/>	Roofed, paved, imp areas
Time of Concentration	$T_c = $ <input type="text" value="10.0"/> mins	
Rainfall Intensity	$i = $ <input type="text" value="10.0"/> mm/hr	
Water Quality Flow	$WQF = $ <input type="text" value="9.5"/> m <sup>3</sup> /hr	$Q=2.78*C*I*A$
<b><u>Minimum Device Area</u></b>		
Infiltration Rate	$K_{(media)} = $ <input type="text" value="1.0"/> m/hr	
Clogging Safety Factor	<input type="text" value="0.5"/>	
Minimum Area Required	<hr/> <input type="text" value="19.02"/> m <sup>2</sup>	>2% of Catchment Area
<b>2% of Catchment Area</b>	<b><input type="text" value="20.00"/> m<sup>2</sup></b>	<b>Check</b>
<b>Required Device Area</b>	<b><input type="text" value="20.0"/> m<sup>2</sup></b>	
Ponding Depth	$d_{(pond)} = $ <input type="text" value="150"/> mm	For Treatment: ≥100mm
Media Depth	$d_{(media)} = $ <input type="text" value="500"/> mm	≥500mm
Transition Layer	<input type="text" value="100"/> mm	100mm
Drainage Layer	$d_{(drainage)} = $ <input type="text" value="250"/> mm	≥200-300mm
<b><u>Void Space Assumptions</u></b>		
Ponding Layer	<input type="text" value="100%"/>	
Bioretention Layer	<input type="text" value="30%"/>	
Transition Layer	<input type="text" value="30%"/>	
Drainage Layer	<input type="text" value="35%"/>	



RAINGARDEN CALCULATIONS	RG-8	REFERENCE
<b><u>Treatment Requirements</u></b>		ARC GD01; Section C3
Area to be treated	$A_{(connect)} = \begin{matrix} 1670.0 \\ 0.2 \end{matrix} \begin{matrix} m^2 \\ ha \end{matrix}$	Rational Method Inputs
Coefficient	$C = \begin{matrix} 0.95 \end{matrix}$	Roofed, paved, imp areas
Time of Concentration	$T_c = \begin{matrix} 10.0 \end{matrix} \text{ mins}$	
Rainfall Intensity	$i = \begin{matrix} 10.0 \end{matrix} \text{ mm/hr}$	
Water Quality Flow	$WQF = \begin{matrix} 15.9 \end{matrix} \text{ m}^3/\text{hr}$	$Q=2.78*C*I*A$
<b><u>Minimum Device Area</u></b>		
Infiltration Rate	$K_{(media)} = \begin{matrix} 1.0 \end{matrix} \text{ m/hr}$	
Clogging Safety Factor	$\begin{matrix} 0.5 \end{matrix}$	
Minimum Area Required	$\begin{matrix} 31.76 \end{matrix} \text{ m}^2$	>2% of Catchment Area
<b>2% of Catchment Area</b>	<b><math>\begin{matrix} 33.40 \end{matrix} \text{ m}^2</math></b>	<b>Check</b>
<b>Required Device Area</b>	<b><math>\begin{matrix} 34.0 \end{matrix} \text{ m}^2</math></b>	
Ponding Depth	$d_{(pond)} = \begin{matrix} 100 \end{matrix} \text{ mm}$	For Treatment: ≥100mm
Media Depth	$d_{(media)} = \begin{matrix} 500 \end{matrix} \text{ mm}$	≥500mm
Transition Layer	$\begin{matrix} 100 \end{matrix} \text{ mm}$	100mm
Drainage Layer	$d_{(drainage)} = \begin{matrix} 250 \end{matrix} \text{ mm}$	≥200-300mm
<b><u>Void Space Assumptions</u></b>		
Ponding Layer	$\begin{matrix} 100\% \end{matrix}$	
Bioretention Layer	$\begin{matrix} 30\% \end{matrix}$	
Transition Layer	$\begin{matrix} 30\% \end{matrix}$	
Drainage Layer	$\begin{matrix} 35\% \end{matrix}$	

RAINGARDEN CALCULATIONS		RG-9	REFERENCE
<b><u>Treatment Requirements</u></b>			ARC GD01; Section C3
Area to be treated	$A_{(connect)} = \begin{matrix} \boxed{2150.0} & m^2 \\ \boxed{0.2} & ha \end{matrix}$		Rational Method Inputs
Coefficient	$C = \boxed{0.95}$		Roofed, paved, imp areas
Time of Concentration	$T_c = \boxed{10.0}$ mins		
Rainfall Intensity	$i = \boxed{10.0}$ mm/hr		
Water Quality Flow	$WQF = \boxed{20.4}$ m <sup>3</sup> /hr		$Q=2.78*C*I*A$
<b><u>Minimum Device Area</u></b>			
Infiltration Rate	$K_{(media)} = \begin{matrix} \boxed{1.0} & m/hr \\ \boxed{0.5} & \end{matrix}$		
Clogging Safety Factor			
Minimum Area Required	$\boxed{40.88}$ m <sup>2</sup>		>2% of Catchment Area
<b>2% of Catchment Area</b>	<b><math>\boxed{43.00}</math> m<sup>2</sup></b>		<b>Check</b>
<b>Required Device Area</b>	<b><math>\boxed{43.0}</math> m<sup>2</sup></b>		
Ponding Depth	$d_{(pond)} = \boxed{100}$ mm		For Treatment: ≥100mm
Media Depth	$d_{(media)} = \boxed{500}$ mm		≥500mm
Transition Layer	$\boxed{100}$ mm		100mm
Drainage Layer	$d_{(drainage)} = \boxed{250}$ mm		≥200-300mm
<b><u>Void Space Assumptions</u></b>			
Ponding Layer	$\boxed{100\%}$		
Bioretention Layer	$\boxed{30\%}$		
Transition Layer	$\boxed{30\%}$		
Drainage Layer	$\boxed{35\%}$		

RAINGARDEN CALCULATIONS		RG-10	REFERENCE
<b><u>Treatment Requirements</u></b>			ARC GD01; Section C3
Area to be treated	$A_{(connect)} =$ <input type="text" value="790.0"/> m <sup>2</sup> <input type="text" value="0.1"/> ha		Rational Method Inputs
Coefficient	$C =$ <input type="text" value="0.95"/>		Roofed, paved, imp areas
Time of Concentration	$T_c =$ <input type="text" value="10.0"/> mins		
Rainfall Intensity	$i =$ <input type="text" value="10.0"/> mm/hr		
Water Quality Flow	$WQF =$ <input type="text" value="7.5"/> m <sup>3</sup> /hr		$Q=2.78*C*I*A$
<b><u>Minimum Device Area</u></b>			
Infiltration Rate	$K_{(media)} =$ <input type="text" value="1.0"/> m/hr		
Clogging Safety Factor	<input type="text" value="0.5"/>		
Minimum Area Required	<hr/> <input type="text" value="15.02"/> m <sup>2</sup>		>2% of Catchment Area
<b>2% of Catchment Area</b>	<b><input type="text" value="15.80"/> m<sup>2</sup></b>		<b>Check</b>
<b>Required Device Area</b>	<b><input type="text" value="16.0"/> m<sup>2</sup></b>		
Ponding Depth	$d_{(pond)} =$ <input type="text" value="100"/> mm		For Treatment: ≥100mm
Media Depth	$d_{(media)} =$ <input type="text" value="500"/> mm		≥500mm
Transition Layer	<input type="text" value="100"/> mm		100mm
Drainage Layer	$d_{(drainage)} =$ <input type="text" value="250"/> mm		≥200-300mm
<b><u>Void Space Assumptions</u></b>			
Ponding Layer	<input type="text" value="100%"/>		
Bioretention Layer	<input type="text" value="30%"/>		
Transition Layer	<input type="text" value="30%"/>		
Drainage Layer	<input type="text" value="35%"/>		

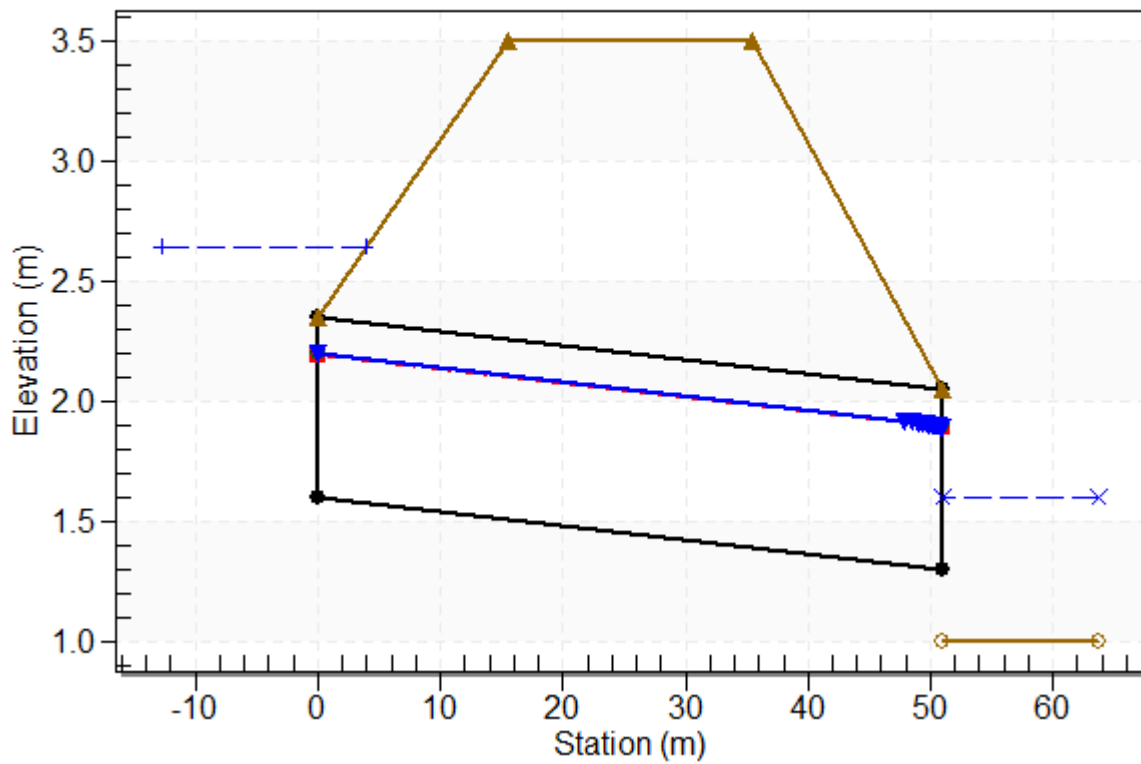
RAINGARDEN CALCULATIONS	RG-11	REFERENCE
<b><u>Treatment Requirements</u></b>		ARC GD01; Section C3
Area to be treated	$A_{(connect)} = \begin{matrix} \boxed{700.0} & \text{m}^2 \\ \boxed{0.1} & \text{ha} \end{matrix}$	Rational Method Inputs
Coefficient	$C = \boxed{0.95}$	Roofed, paved, imp areas
Time of Concentration	$T_c = \boxed{10.0}$ mins	
Rainfall Intensity	$i = \boxed{10.0}$ mm/hr	
Water Quality Flow	$WQF = \boxed{6.7}$ m <sup>3</sup> /hr	$Q=2.78*C*I*A$
<b><u>Minimum Device Area</u></b>		
Infiltration Rate	$K_{(media)} = \begin{matrix} \boxed{1.0} & \text{m/hr} \\ \boxed{0.5} & \end{matrix}$	
Clogging Safety Factor		
Minimum Area Required	$\underline{\underline{13.31}} \text{ m}^2$	>2% of Catchment Area
<b>2% of Catchment Area</b>	<b>14.00 m<sup>2</sup></b>	<b>Check</b>
<b>Required Device Area</b>	<b><span style="border: 2px solid black; padding: 2px;">14.0</span> m<sup>2</sup></b>	
Ponding Depth	$d_{(pond)} = \boxed{100}$ mm	For Treatment: ≥100mm
Media Depth	$d_{(media)} = \boxed{500}$ mm	≥500mm
Transition Layer	$\boxed{100}$ mm	100mm
Drainage Layer	$d_{(drainage)} = \boxed{250}$ mm	≥200-300mm
<b><u>Void Space Assumptions</u></b>		
Ponding Layer	$\boxed{100\%}$	
Bioretention Layer	$\boxed{30\%}$	
Transition Layer	$\boxed{30\%}$	
Drainage Layer	$\boxed{35\%}$	

# HY-8 Culvert Analysis Report

### Water Surface Profile Plot for Culvert: South 1.6m MHWS

Crossing - South 1.6m MHWS, Design Discharge - 0.90 cms

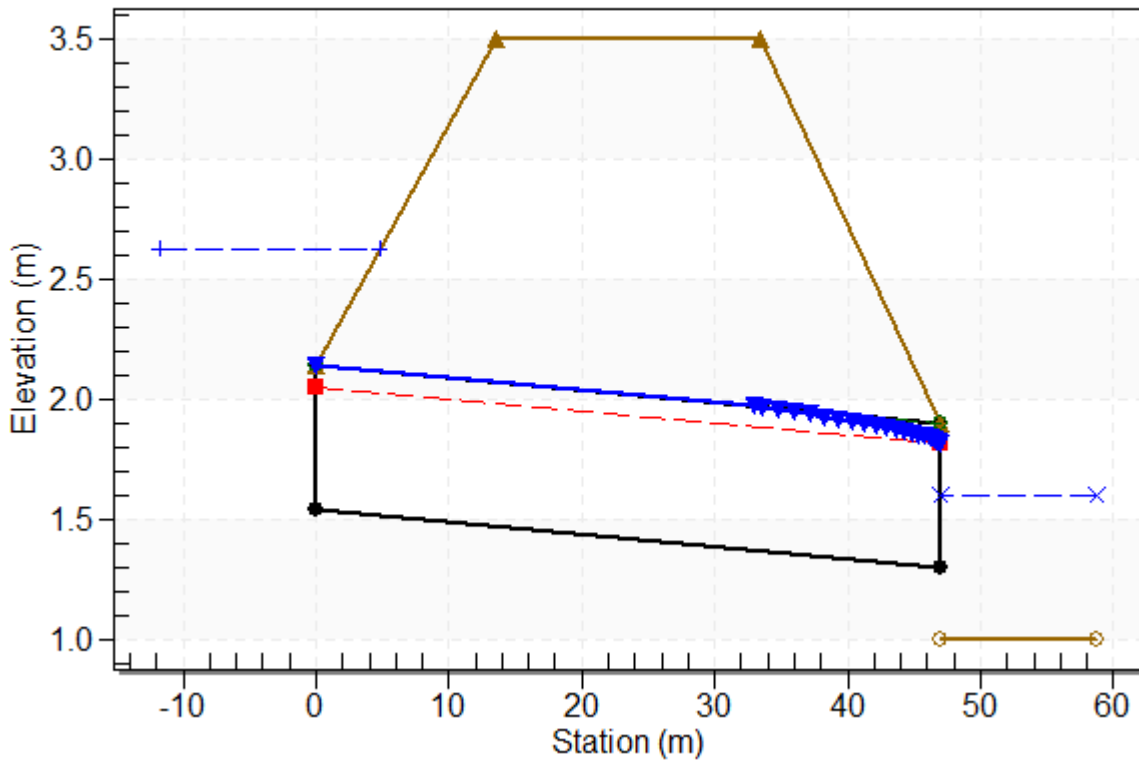
Culvert - South 1.6m MHWS, Culvert Discharge - 0.90 cms



### Water Surface Profile Plot for Culvert: North 1.6m MHWS

Crossing - North 1.6m MHWS, Design Discharge - 0.62 cms

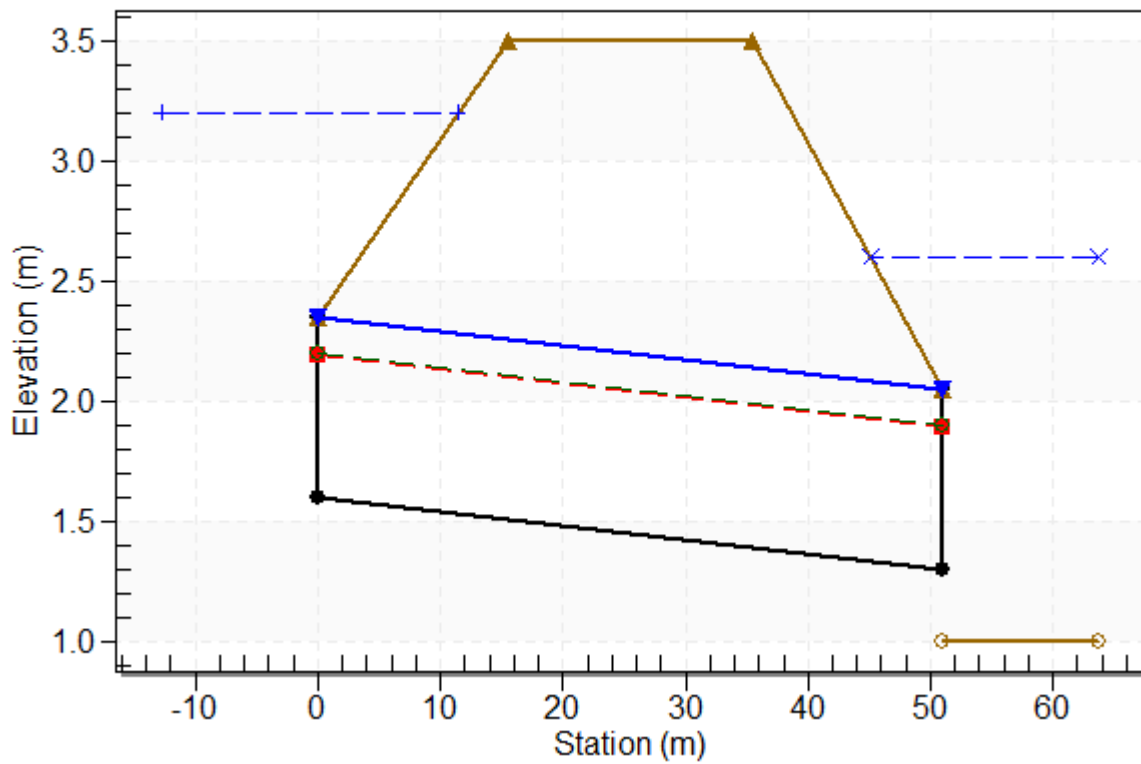
Culvert - North 1.6m MHWS, Culvert Discharge - 0.62 cms



### Water Surface Profile Plot for Culvert: South 2.6m MHWS

Crossing - South 2.6m MHWS , Design Discharge - 0.90 cms

Culvert - South 2.6m MHWS, Culvert Discharge - 0.90 cms

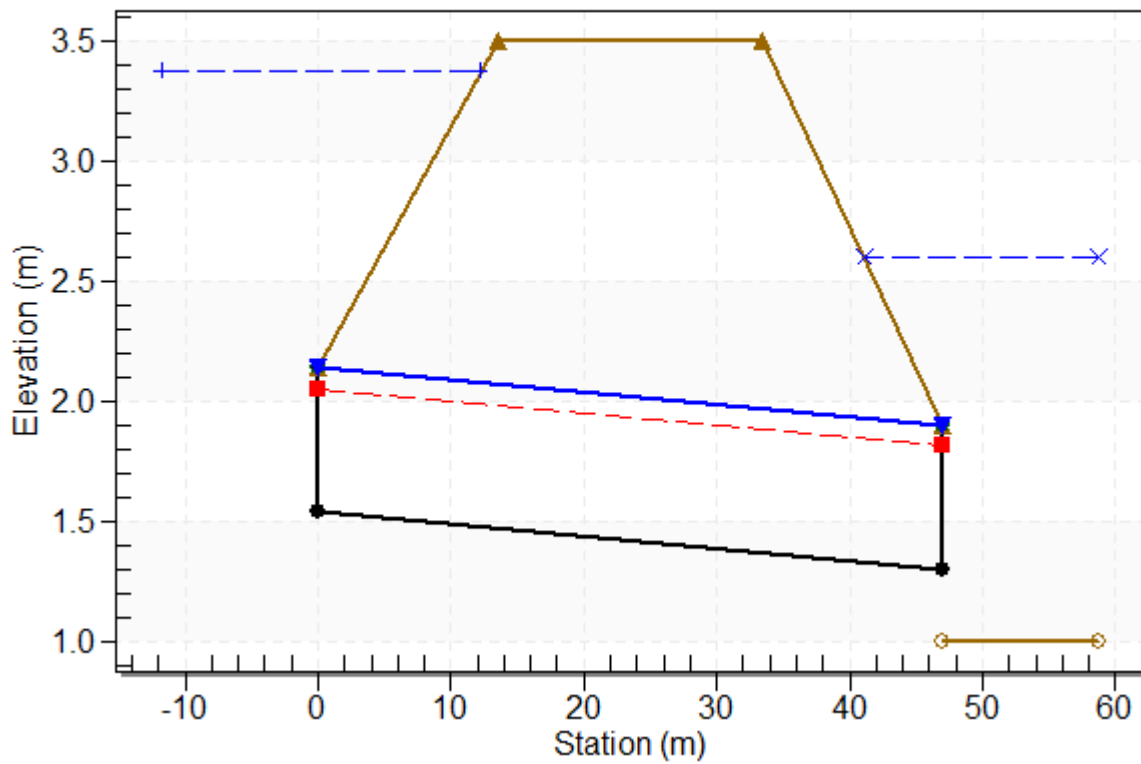




### Water Surface Profile Plot for Culvert: North 2.6m MHWS

Crossing - North 2.6m MHWS, Design Discharge - 0.62 cms

Culvert - North 2.6m MHWS, Culvert Discharge - 0.62 cms



# Appendix C

## Water Supply Flow & Pressure Testing

**Jeremie Hooi**  
Civil Engineer  
Airey Consultants Ltd  
Level 8  
19 Como Street  
Takapuna  
27th July 2018

## RESULTS OF A FIRE FLOW TEST AT BAYSWATER MARINA BAYSWATER

Wednesday 25<sup>th</sup> July 2018  
Tim a'Beckett Con Iftimie David Iftimie

### Background

The proposed residential development at Bayswater Marina, requires adequate fire protection that meets the Fire Service Code of Practice.

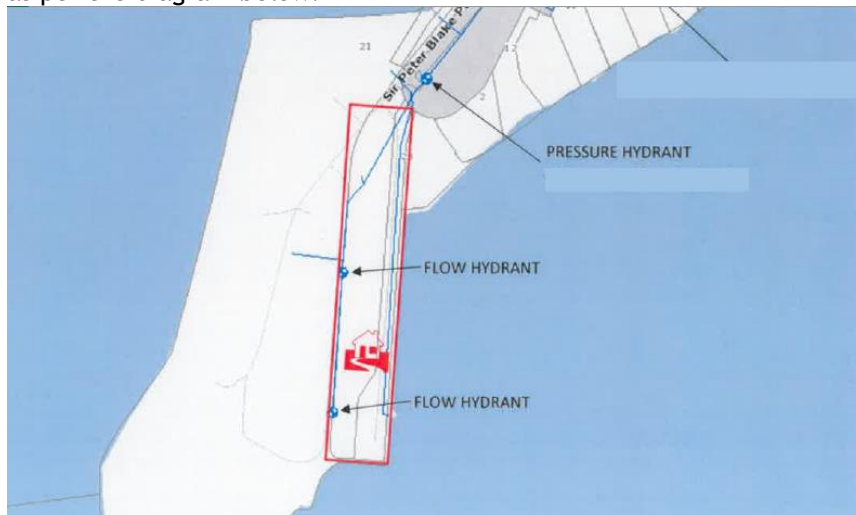
Prior to commencement of the Project, Airey Consultants Ltd requested Detection Services to test the mains surrounding the property to evaluate the potential to provide sufficient water to satisfy the fire requirements for the development. Airey Consultants advised that this development is classified FW3.

The firefighting code of practice stipulates that the minimum requirement for a FW3 Development is a flow of 25l/s from a hydrant within 135m of the development, and a further flow of 25l/s from an additional hydrant within a distance of 270m. WaterCare require a minimum residual pressure of 200 kPa, measured at the next nearest FH.

Detection Services are competent to undertake such testing.

### Procedure

Three fire hydrants were identified as suitable for undertaking the flow test on Sir Peter Blake Parade as per the diagram below.



A pressure logger was installed on the indicated hydrant to record the pressure for a 24hr period during which time the flow test was done from the other two hydrants indicated.

Flow from:	Test Start time	Test End Time	Test Flow rate ℓ/sec	Static pressure (before flow test)	Residual Pressure (during flow test)
Sir Peter Blake Pd	11hr12	11hr15	50 combined	77m	23m

The hydrants were each opened to achieve a flow rate of 25l/s and were not at full capacity.

The flow achieved met the requirements of the Fire Service Code of Practice for the Development.

Figure 1. Graph showing the network pressure for a minimum of 24 hrs with the arrow pointing to the drop caused by the flow test.

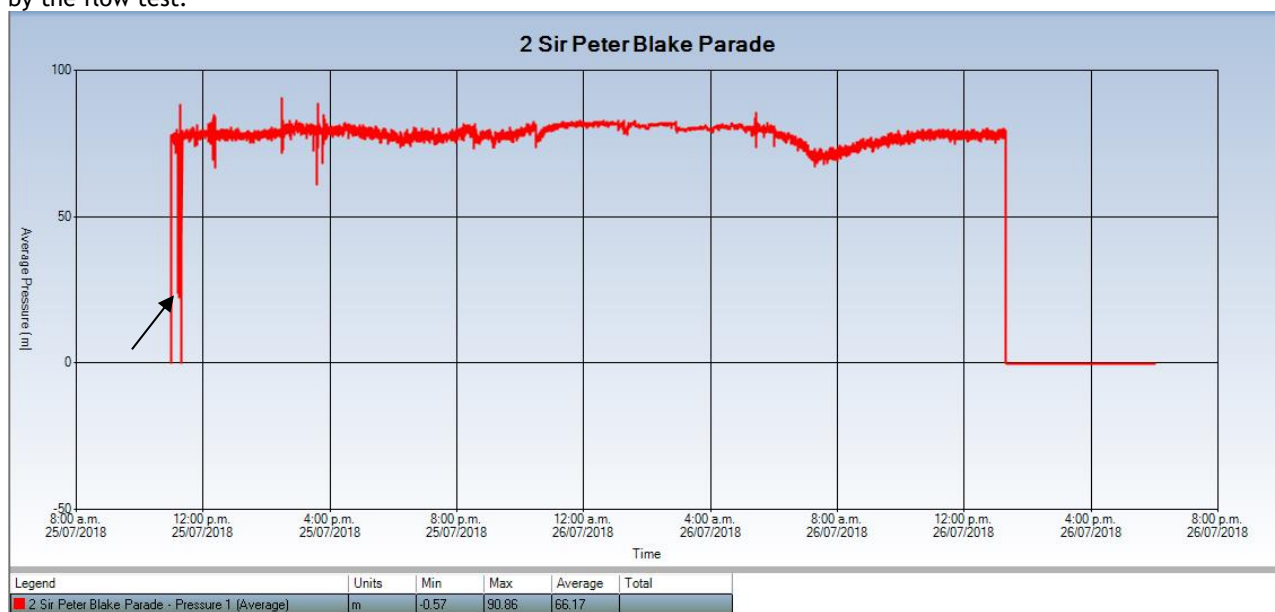
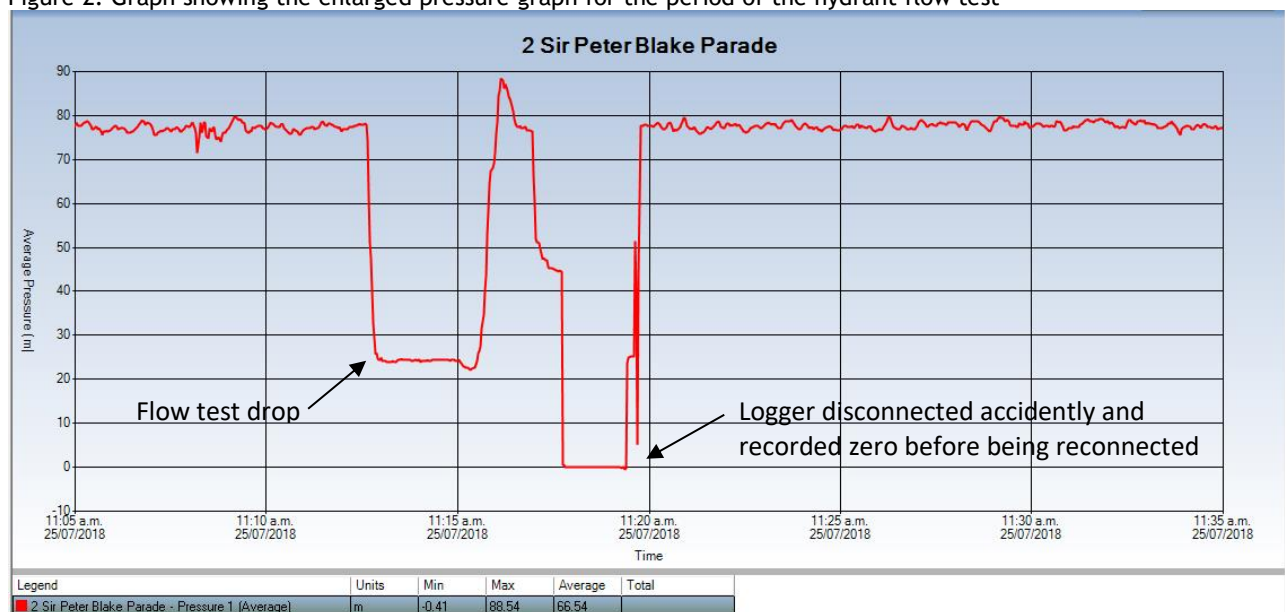


Figure 2. Graph showing the enlarged pressure graph for the period of the hydrant flow test



The test was successful.

**Acknowledgement**

Detection Services appreciates the opportunity to undertake these tests on behalf of Airey Consultants.

Tim a'Beckett (mob 027 5518133)  
Detection Services  
P O Box 58951  
The Hub, Botany  
Auckland.

# Appendix D

## Water Supply/Wastewater Planning Assessment

## Development Application Form – Water Supply/Wastewater Planning Assessment

<b>Date of Application</b>	15/01/2021	
<b>Address of Development</b>	21 Sir Peter Blake Parade, Bayswater	
<b>Layout Plan of Proposed Development clearly showing:</b>	INCLUDED IN REPORT	
<ul style="list-style-type: none"> <li>• Aerial photograph</li> <li>• Road names</li> <li>• Boundary of development</li> <li>• Preferred point of connection to existing water supply and wastewater asset</li> </ul>		
	<b>Description</b>	<b>Comment</b>
<b>Current Land Use</b>	Marina, including offices and liveaboard facilities	
<b>Proposed Land Use</b>	Residential with minor commercial and wet retail	
<b>Total Development Area (Ha.)</b>	3.2 Ha	
<b>Number of Residential Households (Consent &amp; Ultimate)</b>	121	Three apartment buildings with 9 apartments each, plus 94 terrace houses

Refer to Water and Wastewater Code of Practice for Land Development and Subdivision Section 6 Water Supply

Water Supply Development Assessment		
<b>Average and Peak Residential Demand (L/s)</b>	0.91 l/s average 2.26 l/s peak	
<b>Average and Peak Non-Residential Demand (L/s)</b>	0.02 l/s average 0.05 l/s peak	
<b>Non Residential Demand Typical Daily Consumption Profile / Trend</b>	N/A	This is not considered necessary due to the very small areas/demands involved
<b>Fire- fighting Classification required by the proposed site</b>	FW2	Refer to New Zealand Standard SNZ PAS 4509:2008
<b>Hydrant Flow Test Results</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Attach hydrant flow test layout plan and results showing test date & time; location of hydrants tested and pressure logged; static pressure; flow; residual pressure
<b>Sprinkler System in building?</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No (in apartment buildings)	Sprinkler design should consider Watercare Level of Service: minimum pressure at 200kPa and minimum flow at 25 l/min. The building owner shall conduct periodic review of sprinkler design.
<b>Further Water Supply comments</b>		

Refer to Water and Wastewater Code of Practice for Land Development and Subdivision Section 5 Wastewater

<b>Wastewater Development Assessment</b>		
<b>Peak DWF and WWF Residential Design Flows (L/s)</b>	PDWF = 0.76 l/s PWWF = 5.07 l/s	• <i>Calculations included in report</i>
<b>Peak DWF and WWF Non-Residential Design Flows (L/s)</b>	PDWF = 0.02 l/s PWWF = 0.02 l/s	
<b>Non-Residential Discharge Profile / Trend (i.e. Operations)</b>	N/A	
<b>New Assets Required for Development</b>	New pump station	Existing pump station replaced with new pump station
<b>Sewer Capacity Check</b>	Passed	• <i>Calculations included in report</i>
<b>Further Wastewater comments</b>		

For internal Watercare use only

<b>Date Application Received</b>	
<b>Application Ref No.</b>	
<b>Assigned Connections Engineer</b>	
<b>Prior Developer Correspondence with Watercare</b>	
<b>Neighbouring developments to consider in capacity assessment</b>	