STORMWATER MANAGEMENT PLAN

AUCKLAND SURF PARK COMMUNITY

AW Holdings 2021 Ltd

MCKENZIE & CO.

DOCUMENT CONTROL RECORD

PROJECT: Auckland Surf Park Community

CLIENT: AW Holdings 2021 Ltd

PROJECT LOCATION: 1350, 1320 Dairy Flat Highway, Dairy Flat, Auckland;

89 & 105 Lascaelles Drive, Dairy Flat;

253 & 237 Postman Road, Dairy Flat

Revision	Date	Originator	Checker	Approver	Description
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Contents

1 Statement of Qualifications and Experience 1

2 Existing Site Appraisal 2

2.1 Stage 1 Stormwater Management Plan 2

2.2 Summary of Data Sources and Dates 2

2.3 Location and General Information 3

2.4 Topography 9

2.5 Geotechnical 10

2.6 Existing Drainage Features and Stormwater Infrastructure 11

2.7 Receiving Environment 12

2.8 Existing Hydrological Features 13

2.9 Flooding and Flow paths 13

2.10 Coastal Erosion 15

2.11 Biodiversity 16

3 Development Summary and Planning Context 19

3.1 Regulatory and Design Requirements 19

4 Mana Whenua: Te Ao Maori And Matauranga 21

5 Stakeholder Engagement and Consultation 22

6 Proposed Development 23

6.1 Proposal of the Development 23

7 Stormwater Management 24

7.1 Principles of Stormwater Management 24

7.1.1 Original Principles 24

7.1.2 Proposed Principles 26

7.2 Proposed Stormwater Management 26

7.2.1 General 26

7.3 Water Quality 33

7.4 Stream Hydrology 34

7.5 Flooding 10% AEP Event (Network Capacity)..35

7.6 Flooding 1% AEP Event (Habitable Floors) 35

7.7 Overland Flow path and Floodplain Management 36

7.8 Development Staging... 36

7.9 Hydraulic Connectivity.. 36

7.10 Asset Ownership... 36

7.11 Ongoing Maintenance Requirements... 36

7.12 Implementation of Stormwater Network...37

7.13 Dependencies...37

7.14 Risks..37

8 Departures from Regulatory or Design Codes.. 38

9 Conclusions and Recommendations... 39

1. Collector Rd Catchment (High Use Road) 39

2. Data Centre Precinct 39

3. Surf Lagoon, Surf Village Centre and Accomodatin Precincts..40

4. Solar Farm Precincts (North, Centre and South) 40

5. Northeast Residential Precincts..40

6. South Residential Precincts 41

7-1. Live/Work and Water and Wastewater Treatment Plant – Road 41

7-2 Live/Work and Water and Wastewater Treatment Plant – West Part 41

7-3. Live/Work and Water and Wastewater Treatment Plant – East Part...............................42

8. Northwest Residential Precinct..42

9. Light Industrial Precinct...42

10. Postman Road Roundabout (High Use Road)...43

1 STATEMENT OF QUALIFICATIONS AND EXPERIENCE

James Kitchen

I am a Director of McKenzie & Co and a Chartered Professional Engineer (CPEng, MIPENZ). I hold a Bachelor of Engineering (Hons) from the University of Canterbury and have worked in civil engineering for more than 20 years across New Zealand, Australia, and the United Kingdom. My experience includes director oversight, senior design and project management roles for land development, infrastructure, and contract administration, with work spanning residential subdivisions, industrial developments, and transport projects.

I have led civil engineering inputs on a wide range of subdivision and infrastructure projects throughout Auckland. My role involves guiding concept design, detailed engineering, procurement, and construction delivery, supported by a strong understanding of local planning and regulatory frameworks. I bring a practical approach to design and project coordination, ensuring that technical decisions are grounded in local conditions and achievable construction practice.

I confirm that, in my capacity as reviewer of the substantive application, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

Scott Lamason

I am a Senior Civil Engineer and Design Lead at McKenzie & Co, with a Bachelor of Engineering from Unitec and more than 20 years of experience in land development and subdivision engineering. My background includes senior roles in both consultancy and local government, where I have led multidisciplinary teams and provided direction on complex development projects across Auckland. My work covers detailed design, regulatory strategy, and project governance from concept through to approval.

My previous experience as Development Engineering Team Leader at Auckland Council has given me a clear understanding of local authority processes and engineering requirements. I have since managed civil inputs for residential, mixed-use, and infrastructure projects, supporting technical design, stakeholder engagement, and coordinated delivery. I bring structured judgement and practical insight to engineering assessment for the Auckland Surf Park project.

I confirm that, in my capacity as author and reviewer of parts of the substantive application, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

Zhongxin Wang

I am a Senior Civil Engineer at McKenzie & Co and a Chartered Professional Engineer (CPEng, CMEngNZ). I hold a Bachelor of Engineering and a Master of Engineering from the University of Auckland. My experience covers civil design, earthworks, infrastructure planning, and flood assessment for land development projects across Auckland. I have worked in both greenfield and brownfield settings, developing practical solutions supported by strong analytical skills and proficiency in 12d modelling.

Before joining McKenzie & Co, I held engineering roles with Woods, Everest/Hollier Greig, and M8 Group, where I contributed to the planning, design, and construction phases of subdivision and infrastructure projects. I focus on clear communication and coordinated delivery, supporting efficient progression of technical work and constructive engagement with clients, contractors, and council officers.

I confirm that, in my capacity as author of parts of the substantive application, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

Romeo Dela Cruz

I am a Senior Engineer at McKenzie & Co and a Chartered Professional Engineer (CPEng, CMEngNZ, IntPE(NZ)). I hold degrees in Civil Engineering and Geodetic Engineering from Feati University. I have extensive experience across land development and infrastructure engineering, with work covering detailed civil design, geometric road layout, three waters infrastructure, erosion and sediment control, and construction support.

Since joining McKenzie & Co in 2019, I have contributed to the delivery of subdivision projects throughout Auckland, providing engineering review and practical guidance on site-based matters. My background enables me to make sound design decisions and support effective coordination during construction, ensuring that engineering requirements are met consistently and efficiently.

I confirm that, in my capacity as author and reviewer of parts of the substantive application, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

2 EXISTING SITE APPRAISAL

2.1 Stage 1 Stormwater Management Plan

A stormwater management plan was developed as part of the Stage 1 Surf Park project in 2023 to assess the existing site, address the stormwater concerns, and propose management options for the development.

The purpose of the updated stormwater management plan is to reflect the design changes that have occurred for Stage 2.

2.2 Summary of Data Sources and Dates

The following data sources have been used in preparing this stormwater management plan:

Table 1 Summary of Data Sources

Existing Site Appraisal Item	Source and Date of Data Used
Topography	LiDAR, Auckland Council, 2016-2018 Retrolens, historic aerial photographs, 2025 Topographic survey, McKenzie and Co, 2023 & 2025
Geotechnical	Auckland Council Geomaps, 2025

	Landcare Research Soil Map Viewer, 2023 Geotechnical Factual Report, May 2023, Initia Geotechnical Specialists. Geotechnical Factual Report, November 2025, Initia Geotechnical Specialists.
Existing Stormwater Network	Auckland Council Geomaps, 2025 Topographic survey, McKenzie and Co 2023 & 2025
Existing Hydrological Features	Auckland Council Geomaps, 2025 Topographic survey, McKenzie and Co 2023 & 2025 Geotechnical Factual Report, November 2025, Initia Geotechnical Specialists.
Stream, River, Coastal Erosion	
Flooding and Flow paths	Auckland Council Geomaps, 2025 Flood Modelling and Flood Plain Mapping, Rangitopuni and Dairy Stream Catchments, DHI, 2009 McKenzie and Co, Flood Plain Mapping, 2023 Woods Flood report 02 Feb.2026
Landslides	Auckland Council Geomaps, 2025
Coastal Inundation	Not Applicable
Ecological / Environmental Areas	Auckland Council Geomaps, 2025 Stage 2 Ecological Impact Assessment, Viridis Environmental Consultants, 2 December 2025
Cultural and Heritage Sites	Auckland Council Geomaps, 2025 Auckland Surf Park, Archaeological Assessment, CFG Heritage, 2025
Contaminated Land	Auckland Council Geomaps, 2025 Auckland Surf Park: Stage 2, Preliminary and Detailed Site Investigation (Ground Contamination) WWLA, 2025

2.3 Location and General Information

Table 2 - Site Location and General Information

Existing Site Element	
Site Address	1320 and 1350 Dairy Flay Highway, 89 and 105 Lascelles Drive, and 237 and 253 Postman Road, Dairy Flat, Auckland Location of the site is shown in Figure 1.
Legal Description	Lots 3 and 4 DP 607404, Lots 1 and 2 DP 151504, Lot 4 DP

	66181 and Lot 1 DP 605825
Current Land Use	The site is currently open pasture and is being used for farming. Refer to Figure 2. There is also a portion of the site that is currently subject to the enabling Stage 1 earthworks. It is zoned Future Urban, Refer to Figure 3.
Current Building Coverage	Existing building coverage on the site includes existing dwellings and several ancillary buildings used for farming. Refer to Figure 6.
Historical Land Use	A review of historic aerial photographs shows that land has been used for farming (grazing) as far back as 1957. Refer to Figure 8.

The proposed site is located at 1320 and 1350 Dairy Flat Highway, 89 and 105 Lascelles Drive, and 237 and 253 Postman Road, Dairy Flat, approximately 23 kms north north-west of Auckland. The site encompasses three legal titles, Lots 3 and 4 DP 607404, Lots 1 and 2 DP 151504, Lot 4 DP 66181 and Lot 1 DP 605825. Refer to Figure 1.

The site is predominantly pasture with dwellings and farm out-buildings. There are also portions of the site that are currently subject to the enabling Stage 1 earthworks. The surrounding properties are predominantly rural properties underlying Future Urban Zone zoning. The site locality, adjacent properties, and existing zoning are illustrated in Figure 2 and Figure 3, while Figure 4 presents the proposed development scheme plan.

Māori occupation of the wider area was concentrated to the coast between Ōrewa and Ōkura, including the Whāngaparāoa Peninsula. Many records note that inland areas remained in mature forest until the historic era. Early plan SO 894 drawn in 1869 includes the project area and shows that there are pre-European Māori walking tracks along the inland flats, and that the current path of Dairy Flat Highway generally follows one of those tracks.

In early European times the area was milled for timber then used for gum digging like most land north of the central Auckland area. The first formal road near the property was what is now Dairy Flat Highway, built in the 1870s. Plan SO 1118 drawn in 1874 shows there are “drains” plotted and annotated around 150 m south of the project area. The land was then prepared and used for farming in the later 19th century, and this remained the main use. Refer to Figure 8 for aerial photo of the site dating from circa 1957, showing the land cleared and being used for framing purposes.

Figure 1 – Site Location (Source: Auckland Council Geo Map, Sept 2025)

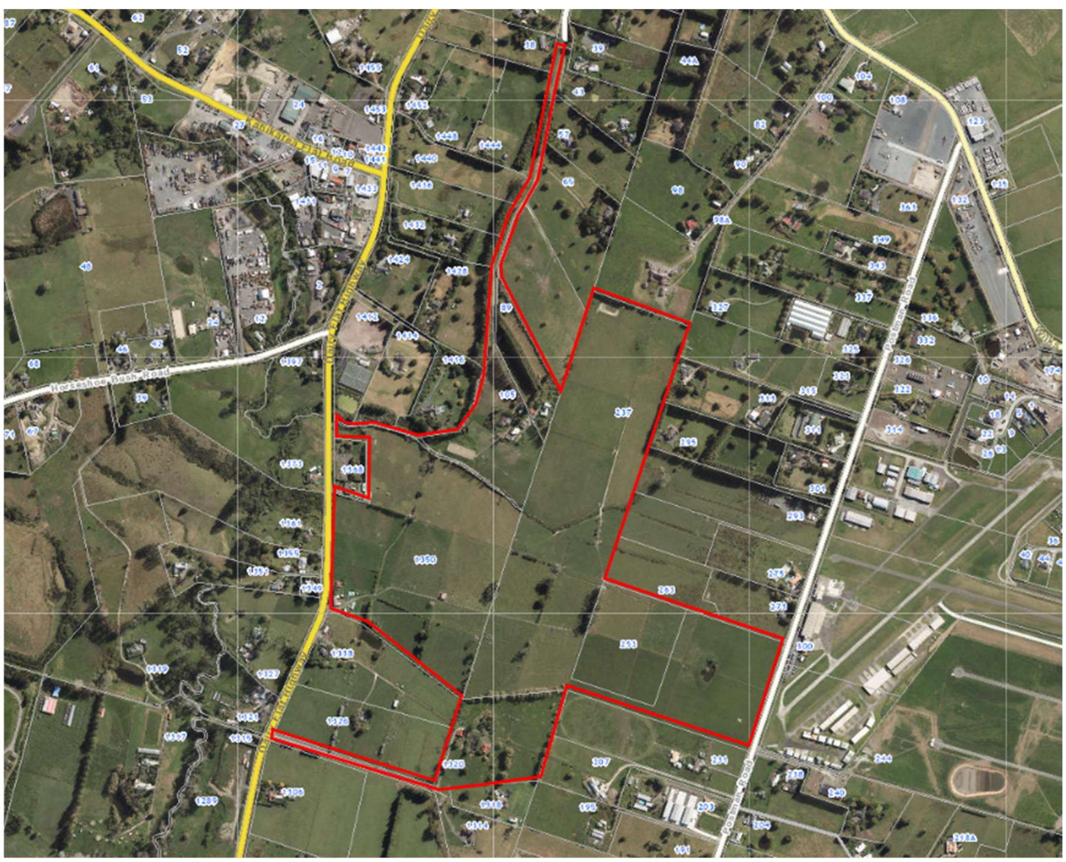


Figure 2 – Current Site Use (Source: Auckland Council GeoMaps, 2024/2025 Aerial Photography)

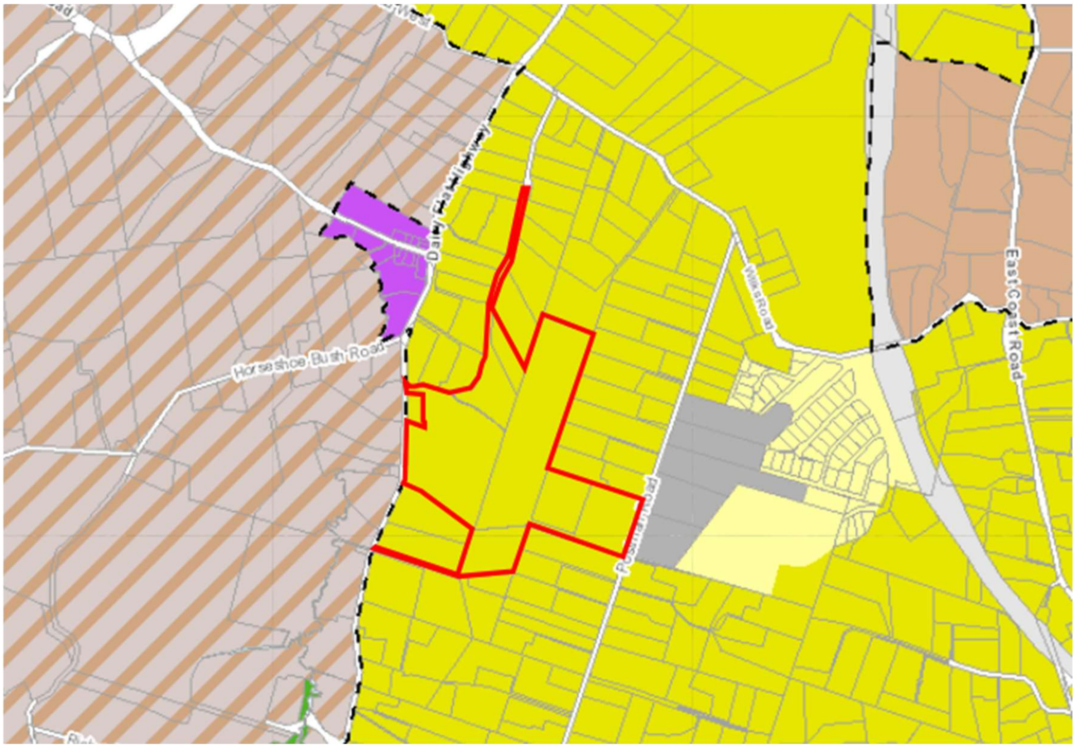


Figure 3 – Existing Land Use (Source: Auckland Unitary Plan Operate in Part Map, Sept 2025)

Figure 4 Proposed Scheme Plan (Source: Proposed Scheme Plan by MCCL)

Figure 5 – Building Coverage 1350 Diary Flat Highway (Source: Auckland Council GeoMaps, Jan. 2026)

Figure 6 – Building Coverage 1320 Dairy Flat Highway (Source: Auckland Council GeoMaps, Jan 2026)

Figure 7 - Building Coverage 89 & 1050 Lascelles Drive (Source: Auckland Council GeoMaps, Feb 2026)

Figure 8 - Historic Land Use – 1957, (Source - retrolens.co.nz)

2.4 Topography

Regionally, the site is situated in a low-gradient drainage basin, which generally constitutes a series of gently dipping slopes (or 'rolling' topography) and a network of surficial drainage tributaries.

The majority of the property area constitutes a near level, low lying plain which extends across the western, central and central-eastern portion of the site. The northern branch of the site comprises a moderate to gently dipping slope, which rises northwards and encompasses an elevation change of approximately 14 m, from 53 to 67 m RL. The gradient of this slope ranges between approximately 2 to 13 degrees and generally decreases towards the northern boundary.

Refer to Figure 9 for site topography and existing site slopes.

The predominant drainage feature at the site, a sub east-west oriented stream, bisects the central site, bounding the alluvial basin and the northern slope. This stream flows west along the northern boundary of the western half of the site. The gradient of the land steepens with proximity to this feature. A low gradient slope also exists within approximately 250 m of the western extent of the site, increasing in elevation from 54 m to 64 m RL at the site boundary.

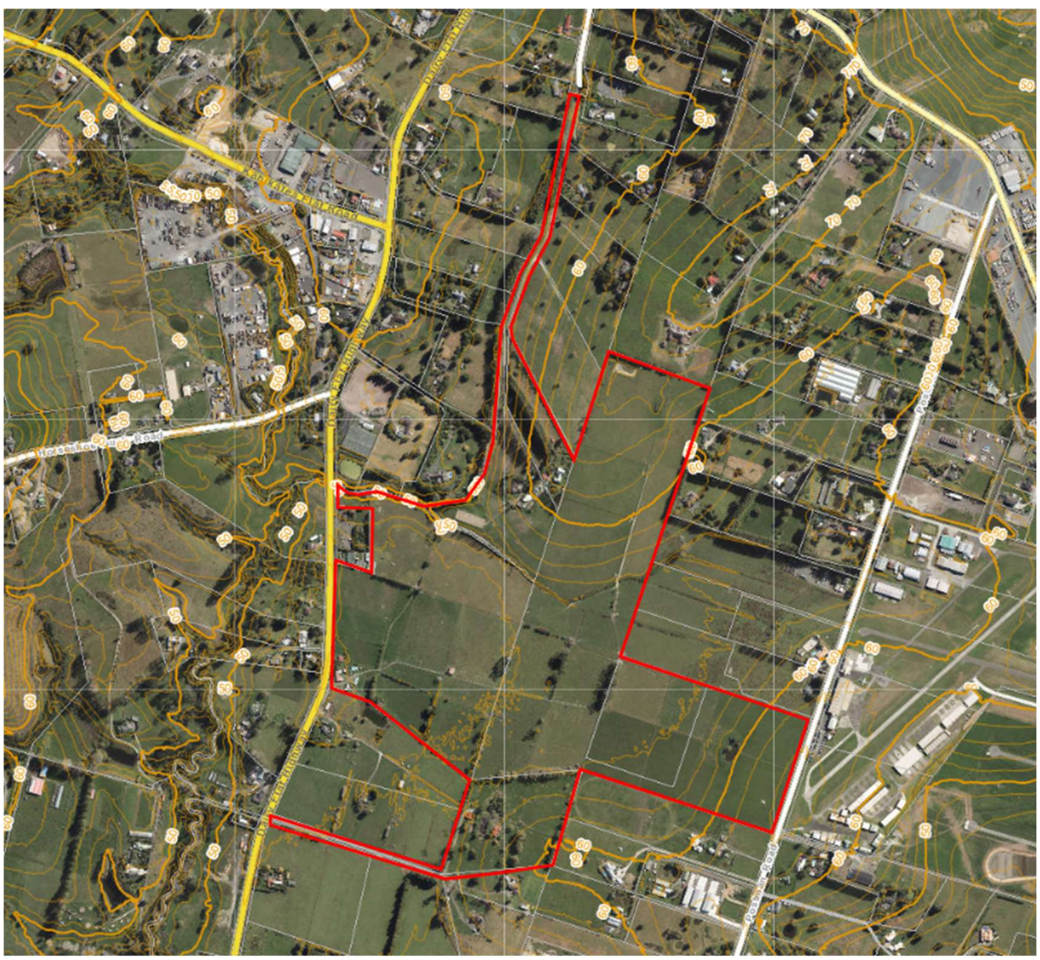


Figure 9 - Site Topography (Source: Auckland Council GeoMaps)

2.5 Geotechnical

Summary of geotechnical conditions from Initia[1]:

"Based on the results of the recent geotechnical investigations carried out by Initia in March and April 2023, and final reporting in June 2023, the site is underlain by the following geological units:

1. Topsoil, over

2. Tauranga Group Alluvium (where present), over

3. Mahurangi Limestone (Motatau Complex) in Northland Allochthon soils and rock

Piezometers have been installed in all five Initia machine boreholes in the Surf Park area for ongoing groundwater monitoring. Perched groundwater depths range from about 0.5m to 1.3m, with levels varying from approximately 52.9mRL to 55.2mRL[2] . Fluctuations are noted to vary significantly depending on weather conditions.

A Static Groundwater layer is inferred at a depth of 3 to 4m below ground.

Location of boreholes, test pits and piezometers are shown in Figure 10Error! Reference source not found..

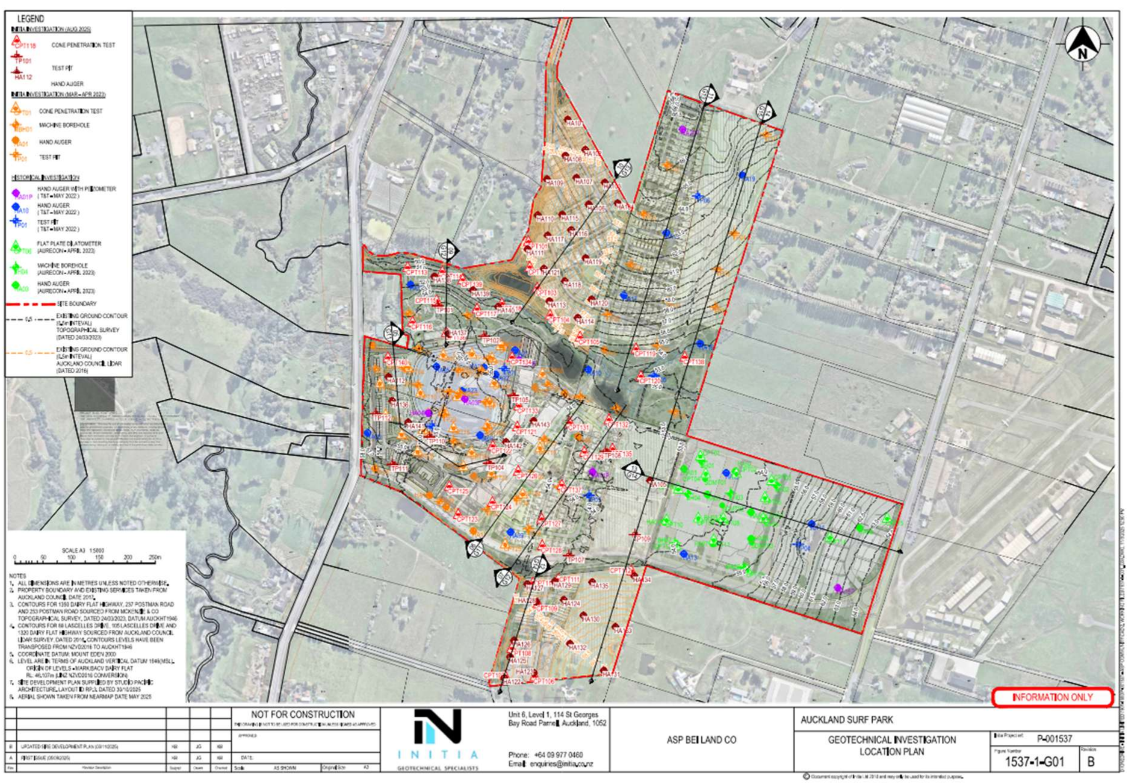


Figure 10 - Location of Geotechnical Boreholes (Source: Geotechnical Factual Report Rev E, Initia, Nov

[1] Initia report P-001537 Rev E

[2] AUK 1946 vertical datum. This is equivalent to 52.6mRL to 54.9mRL in NZVD vertical datum

2025)

2.6 Existing Drainage Features and Stormwater Infrastructure

The site can be broadly divided into two main catchments: the north catchment and the south catchment, both of which drain into the Rangitopuni Stream. Refer to Figure 11.

The South Catchment is smaller, covering an area of 20.57 ha, and it drains southwards towards 1320 Dairy Flat Highway. The catchment is delineated by Dairy Flat Highway to the west and slopes eastward with moderate grades ranging from 5% to 8%. Several farm ponds have been constructed at the base of the road embankment, the largest one just south of the site within 1338 Dairy Flat Highway, with a surface area of approximately 1400m^2 and an estimated storage volume of less than 1500m^3. Additionally, there are two smaller farm ponds within 1350 Dairy Flat Highway, with surface areas of 380m^2 and 120m^2, respectively. These are shown in Figure 12.

The lower part of the South Catchment is characterised by a very flat terrain with grades of 0.5% or less. Farm drains and small culverts have been installed to facilitate drainage across the site. Notably, there is no existing public stormwater infrastructure within this catchment. On the other hand, the northern catchment is significantly larger, covering an area of 216.0 Ha. It is bounded by Dairy Flat Highway to the west, Wilks Road to the north, and North Shore Airport to the east.

The upper parts of the northern catchment, beyond the site boundaries, consist of rolling hills and gullies with moderate grades. Except for culverts located beneath roads, there is no public stormwater infrastructure in this upper section of the catchment. Several farm drains have been constructed to manage water flow in this area. The lower part of the catchment is characterized by a very flat topography, with grades of less than 1%. Numerous farm drains, along with culverts beneath farm tracks, have been established to direct water into the Rangitopuni Stream. Three culverts also facilitate drainage westward beneath Dairy Flat Highway. Artificial farm ponds are located near the northern and western boundaries of the site.

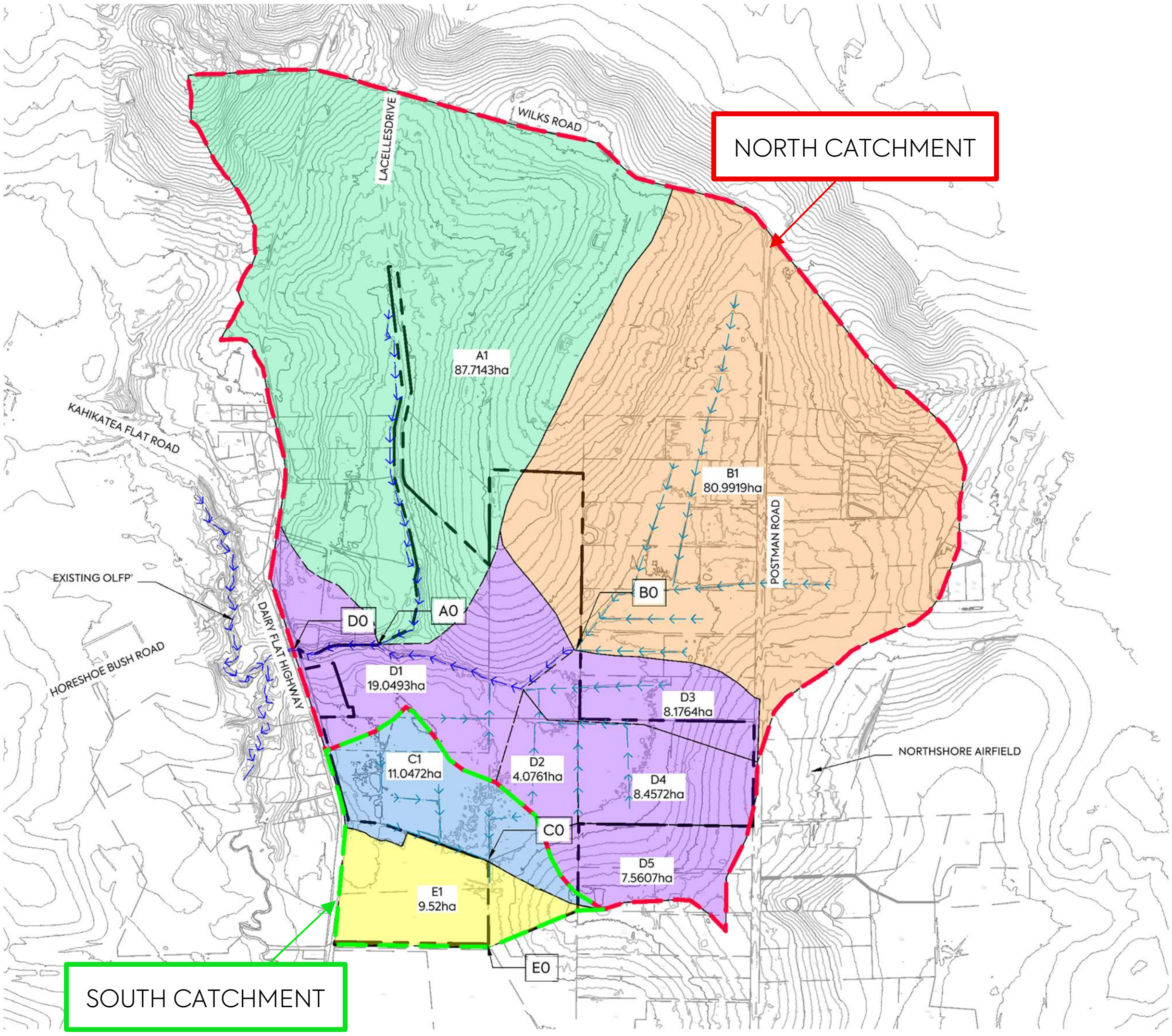


Figure 11 - Existing Drainage Features and Stormwater Infrastructure

2.7 Receiving Environment

The development area comprises two receiving environments that eventually discharge into the Rangitopuni stream, which ultimately flows into the coast.

One of these environments, referred to as "Stream A," runs along the northwestern boundary of the site. Over the years, farming practices have altered the natural alignment of this stream. As part of the development project, efforts will be made to restore the stream to its natural state, including the implementation of riparian planting along its banks. The majority of stormwater runoff from the site will be directed into this stream. To facilitate the flow, the stream passes beneath the Dairy Flat Highway through three 900 culverts, which in turn discharges into the Rangitipuni Stream.

2.8 Existing Hydrological Features

An Ecological report has been prepared by Viridis, which indicates that there are permanent streams through the site, and a number of manmade, highly modified farm drains that have been formed during the decades of farming. Refer to Figure 12 below.

Figure 12 - Freshwater Ecological features (Source: Viridis, January 2026)

2.9 Flooding and Flow paths

Auckland Council Geomaps and Flood Modelling

Auckland Council flood model, shows the extent of the flooding on the project site, including areas of ponding. This model includes 3.8-degree climate change.

Flooding is shown as generally confined to "stream A'. The underlying terrain is based on using LiDAR 2016. Auckland council has also undertaken an overland flow path analysis to identify flow paths of greater than 2,000m^2. These are shown, on top of the flood plain, in Figure 13.

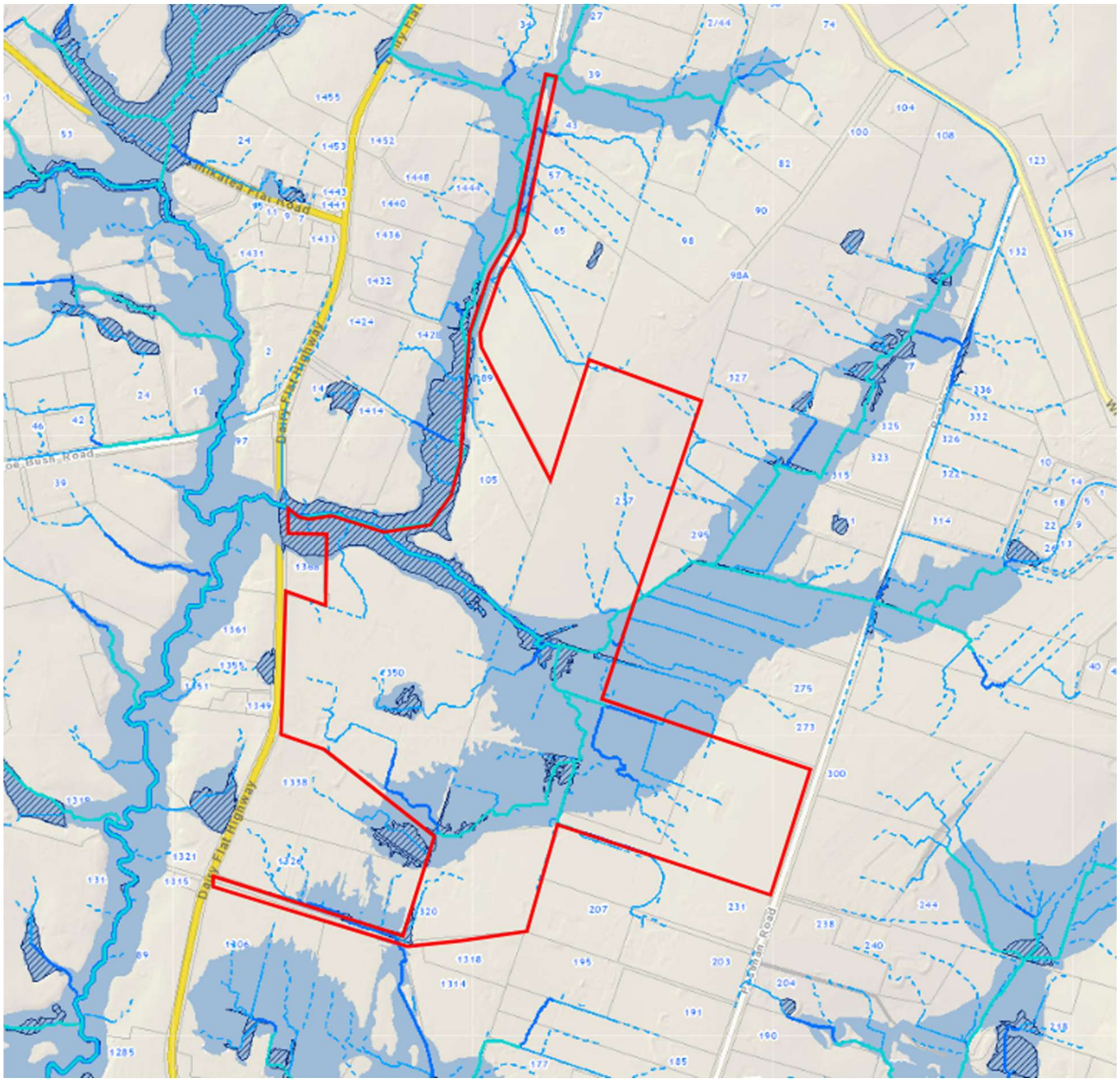


Figure 13 - 1% AEP Flood Extent and Overland Flow paths (assuming maximum probable development and including 3.8-degree climate change) (Auckland Council Geomaps, accessed September 2025)

Flood Modelling

A Flood assessment has been completed by Woods[3]. The flood depth results of the modelling are included below in Figure 14.

With the exception of some minor surface ponding, the floodplain extent is generally limited to the main channel being Stream A. The modelling indicates that there are flood effects to third-party land upstream or downstream of the proposed development site and no additional mitigation measures are required beyond those currently proposed.

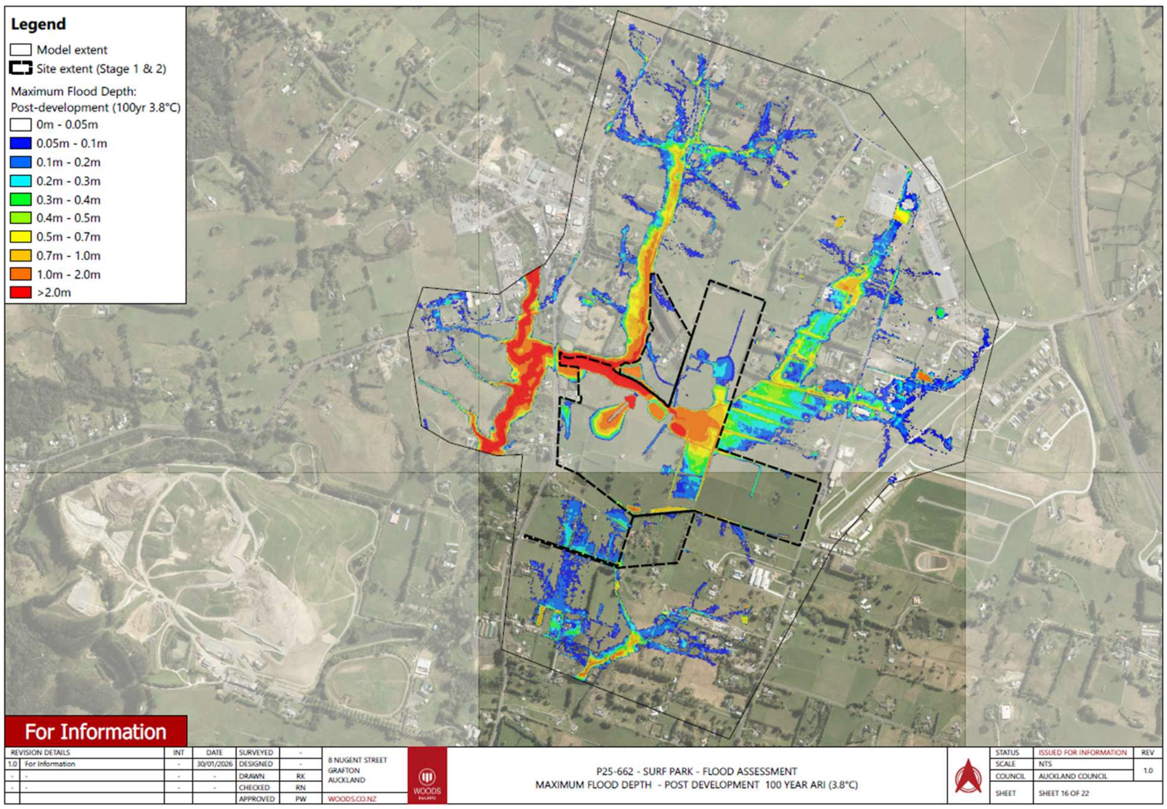


Figure 14 - Pp-Development 1% AEP (3.8-degree climate change) Flood extent, 2026.

(Refer to Woods Flood Report for more details, this figure is for context purposes only and should not be reviewed for technical flood analysis and may be out of date at time of publication.)*

2.10 Coastal Erosion

There is no coastal aspect to this development, and as such no coastal erosion is applicable.

[3] Surf Park Flood Assessment, Woods, 02 February 2026

2.11 Biodiversity

The following is noted from the Ecological Impact Assessment by Viridis Environmental Consultants:

a. Terrestrial Ecology

"Vegetation

Vegetation within the site was assessed during field visits. Both native and exotic species were recorded, and the structure, condition, extent and connectivity of vegetation were described. Particular attention was given to identifying vegetation types that may provide habitat for terrestrial fauna (e.g. lizards, birds and bats), noting features such as ground cover, shrub density, tree canopies and proximity to riparian areas.

This information was used to characterise terrestrial habitats and to inform the targeted fauna surveys described below.

Avifauna

No formal avifauna surveys were undertaken; however, birds seen or heard were recorded opportunistically during multiple site visits. Additional records were collated from nearby eBird.org iNaturalist.org records (accessed November 2025) and observations made by Viridis ecologists in the wider area.

Herpetofauna

Herpetofauna (lizard) values were informed by both desktop and field methods. A desktop review of local lizard records from the Department of Conservation's (DoC) Amphibian and Reptile Distribution (ARDs) database and Bioweb was undertaken to identify species with potential to be present on site.

Lizard surveys associated with the Stage 1 fauna management works were undertaken by Epoch Ecology under Wildlife Act Authority Permit 96260-FAU. An experienced herpetologist worked alongside an excavator to systematically scrape back grass, rank ground cover and farm debris within areas mapped in the approved Lizard Management Plan, exposing the ground surface and potential refugia.

Manual hand-searching and raking were undertaken concurrently to ensure all suitable microhabitats were thoroughly searched. Following initial clearance, a post-vegetation-clearance search of the construction footprint was completed to confirm that no lizards remained undetected. These methods were used to inform the assessment of lizard presence and habitat value."

b. Streams

"During the site assessment, the presence and extent of streams and any wetlands on site were noted, and the quality of freshwater habitat was visually assessed. Watercourses were classified using AUP-OP definitions to determine whether they were ephemeral, intermittent, or permanent. Freshwater habitat was assessed with reference to ecological aspects such as channel modification, hydrological heterogeneity, riparian vegetation extent, substrate type, and any fish or macroinvertebrate habitat observed.

Fish

The NIWA New Zealand Freshwater Fish Database (NZFFD) was reviewed to identify fish species potentially present within the site. Field surveys were then undertaken in the central stream reach using an EFM300 electric fishing machine, following the New Zealand Freshwater Fish Sampling Protocols (Joy et al. 2013). Electric fishing temporarily stuns fish so they can be captured, identified and counted, after which all individuals are returned to their habitat. Fish surveys were carried out alongside a Stream Ecological Valuation assessment in 2023 and a fish salvage in 2025.

An Index of Biotic Integrity (IBI) was calculated for the reach based on the fish community present, altitude, and distance inland (Joy & Henderson 2004). Fish IBI is a multi-metric measure of taxonomic richness that incorporates habitat guilds and factors such as altitude and distance from the coast, using quantile regression scoring. The NPS-FM provides Attribute Bands (A–D) for fish IBI scores to assist interpretation.

Macroinvertebrates

Three macroinvertebrate samples were collected within the site (Figure 4) using a D-net and the quantitative soft-bottomed stream sampling method described in NEMS (2022). All samples were preserved in 70% isopropyl alcohol for subsequent identification and counting. Benthic macroinvertebrates were identified and enumerated to a level appropriate for calculating the Macroinvertebrate Community Index (MCI) and Quantitative MCI (QMCI), following NEMS (2022) protocols. The NPS-FM provides Attribute Bands (A–D) for MCI and QMCI scores to assist interpretation."

c. Wetlands

"Where appropriate, potential wetland areas were assessed in accordance with wetland delineation protocols (MfE 2022, Clarkson 2014), to determine if an area met the regulatory definition of 'natural inland wetland' (NPS-FM 2020). Potential wetland areas were assessed based on the prevalence of certain vegetation species and their indicator status ratings, as defined in Clarkson et al. (2021):

- *Obligate wetland (OBL) vegetation, which almost always is a hydrophyte (a plant which only grows in wet environments), rarely found in uplands (non-wetland areas).*
- *Facultative wetland (FACW) vegetation, which usually is a hydrophyte but can occasionally be found in uplands.*
- *Facultative (FAC) vegetation, which is commonly either a hydrophyte or non-hydrophyte.*
- *Facultative upland (FACU) vegetation, which is occasionally a hydrophyte but is usually found in uplands.*
- *Upland (UPL) vegetation, which is rarely a hydrophyte and is almost always found in uplands.*

Where the dominance or prevalence tests showed unclear results, hydric soils and hydrology tests were undertaken in accordance with methodology outlined in MfE (2022) and Clarkson (2014).

Wetland assessments also included identifying native and exotic vegetation species, examining the structural tiers within wetland areas, and assessing the quality and abundance of aquatic habitats. Signs of wetland degradation such as pugging and grazing from stock access, structures such as culverts impeding hydrological function, and weed infestation were also noted.."

The catchment over the site is a tributary to the Rangitopuni Stream which discharges to the coast approximately 14km downstream east of Riverhead township. The Auckland Unitary Plan identifies Significant Ecological Areas (SEA) over and adjacent to the Rangitopuni Stream.

3 DEVELOPMENT SUMMARY AND PLANNING CONTEXT

This section provides a high-level summary of the proposed development, together with the specific planning and regulatory requirements.

3.1 Regulatory and Design Requirements

Based on the review of Auckland Council's regulatory and stormwater guidelines the site-specific stormwater management requirements have been identified. The relevant regulatory guidelines are listed in Table 3 below, and a summary of the requirements is presented in the sections following.

Table 3 Summary of Regulatory and Design Requirements

Requirement	Relevant Regulatory / Design to Follow
SMAF Hydrology mitigation	Not within SMAF overlay
Stormwater management	Auckland Unitary Plan Chapter E9
Natural Hazards	Auckland Unitary Plan Chapter E36
Natural Resources of the Regional Policy Statement	Auckland Unitary Plan Chapter B7
Stormwater Diversion and Discharge	Auckland Unitary Plan chapter E8
AUP Precinct	Not applicable
Stormwater Management Devices Design	Auckland Council GD01
Application of Principles of Stormwater Management	Auckland Council GD04
Hydrology in the Auckland Region	Guidelines for Stormwater Runoff Modelling in the Auckland Region – Technical Publication 108 (1999). Former Auckland Regional Council.
Stormwater Management Approach	Auckland Unitary Plan stormwater management provisions: technical basis of contaminant and volume management requirements– Technical Report 2013/035 (2013). Auckland Council. Silverdale West Dairy Flat, Business Area Structure Plan. WSP | Opus, November 2018
Design and Construction of Stormwater Infrastructure	Auckland Code of Practice: For Land Development and Subdivision (Chapter 4 - Stormwater) - NZ Building Code, E1 Surface Water.
Detail on Stormwater Management including	NZS4404 – Land development and

WSD, Flood Risk Management, Freeboard allowance etc.	Subdivision infrastructure. NZ Building Code, E1 Surface Water. Auckland Code of Practice: For Land Development and Subdivision (Chapter 4 – Stormwater) – November (2015). Auckland Council.
Auckland Council Regionwide Network Discharge Consent	This area is zoned as Future Urban and is outside of the NDC catchment, as such this SMP cannot be adopted under the NDC, and its own discharge and diversion consent is sought as part of this application.

4 MANA WHENUA: TE AO MAORI AND MATAURANGA

The applicant has engaged with the relevant iwi authorities who have historic and territorial rights in Tāmaki Makaurau.

Te Kawerau ā Maki provided a Cultural Advice memo, and Ngaati Whanaunga Iwi provided a Cultural Impact Assessment (CIA) for the Stage 1 proposal.

The CIA provided by Ngaati Whanaunga identifies diversion and discharge of stormwater as a key issue for concern are comfortable that the issues will be managed in accordance with Best Practice to minimise potential effects on cultural values.

The report provided by Te Kawerau ā Maki provided some recommendations and their significance in the design and implementation of stormwater management strategies is outlined below.

The key principles, relating to stormwater that have been adopted are –

- Protect and enhance the values and function of natural ecosystem
- Incorporate water-sensitive design
- Multi stage treatment train
- Promoting on site stormwater tanks

The recommendations address cultural impacts, land preservation, water quality, and ecological conservation. By incorporating these recommendations, the stormwater management design will promote sustainable practices and cultural stewardship.

Wāhi Tohu:
Te Kawerau ā Maki's ancestral awa, Manga Rangitōpuni, holds cultural significance. The recommendations emphasize supporting kaitiakitanga (active participation) of the iwi to uphold the mauri and wairua of this feature. Water-sensitive design, restoration planting, and embracing mana whenua values, as outlined in the masterplan, are crucial for achieving this. Furthermore, an access covenant should be established to ensure reasonable site access for Te Kawerau ā Maki.

Whenua:
To preserve land integrity, the recommendations suggest minimizing earthworks and achieving cut-fill neutrality whenever possible. Retention of topsoil on site and its incorporation into landscaping activities is encouraged. Robust sediment controls must be implemented to minimize environmental impacts. Moreover, dedicating a portion of the site to farming will support the mauri of the soil and contribute to its overall health.

Wai Māori:
The recommendations emphasize maintaining a development setback from the stream and establishing an esplanade reserve. This setback area should be revegetated to maximize filtration and protect/enhance habitat. A multi-step stormwater system is proposed, including retention/detention tanks, permeable surfaces, tree pits/vegetated swales, ponds, and

wetlands. Direct outfall to waterways should be avoided, and if necessary, designed via wetlands or riprap to prevent scouring. Additionally, promoting the use of water tanks for potable or outdoor use will reduce reliance on water takes from the public supply system. Strict adherence to water takes, ensuring baseline levels, recharge rates, and long-term monitoring, is crucial. The recommendations highlight the compatibility of these measures with the current masterplan.

Rerenga Rauropi:
Preservation of native vegetation is a key concern in the recommendations. Avoiding the removal of native vegetation is recommended, and if removal is necessary, a 1:2 replacement ratio of native eco-sourced species or productive fruit/flower-bearing species is required. However, it is crucial to select species that do not self-seed and become pests. Minimizing harm to native birds, bats, lizards, and aquatic species during vegetation removal and earthworks is essential. This can be achieved through surveys, translocations, management plans, and seasonal considerations.

Incorporating the recommendations provided by Te Kawerau Iwi into the stormwater management design will ensure the mitigation of cultural impacts, preservation of land integrity, improvement of water quality, and conservation of ecological balance. Adhering to these recommendations will foster sustainable practices and cultural stewardship, contributing to the overall success and positive outcomes of the stormwater management project.

5 STAKEHOLDER ENGAGEMENT AND CONSULTATION

The following parties have been consulted during the preparation of the preparation of this SMP;

- Mana Whenua, refer to the Consultation Summary prepared by Barker & Associates. The recommendations have been inserted into this SMP.
- Health Waters, Advice regarding the tailwater conditions, and flood modelling.
- Auckland Transport, regarding the Stormwater Management Approach for the collector road.

6 PROPOSED DEVELOPMENT

6.1 Proposal of the Development

The Stage 2 proposal is for the expansion of the Auckland Surf Park Community to include a surf lagoon, a hyperscale artificial intelligence data centre campus, an integrated residential development including approximately 400 units and subdivision, a village centre, work-live precinct, an industrial precinct and ancillary activities. The proposal also involves variations to Stage 1 of the development including design changes and the expansion of the solar farm.

The existing impervious coverage is extremely low, with limited development on the land to date. The proposed imperviousness of the site is expected to be 67% across the development, the individual sub catchment impervious areas are detailed in Table 5.

The Masterplan is included as Figure 15 below.

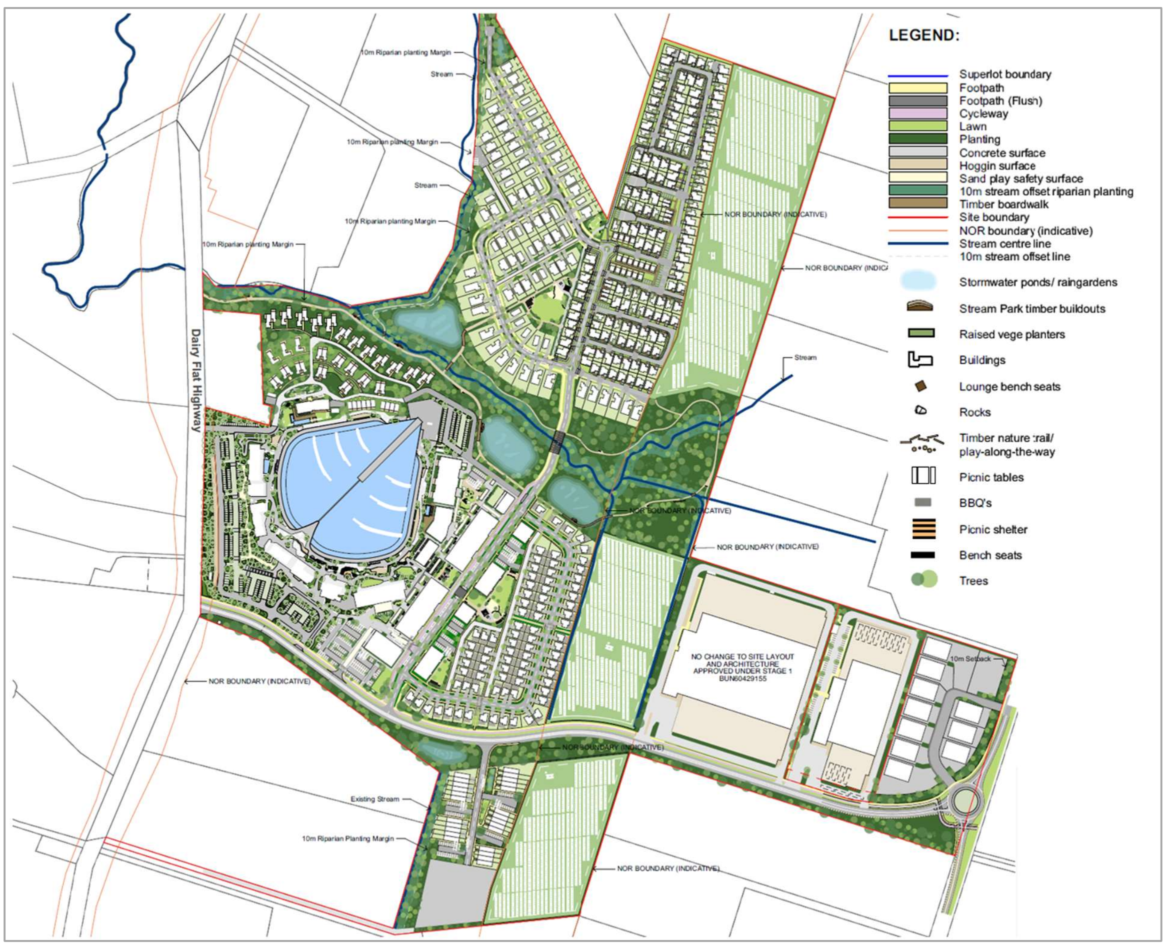


Figure 15 - Proposed Development Masterplan (Source: Studio Pacific Architecture)

7 STORMWATER MANAGEMENT

7.1 Principles of Stormwater Management

7.1.1 Original Principles

This section outlines the stormwater management approach for the post-development proposal for the site. It aligns with the provisions of the AUP. The purpose of this approach is to promote sustainable stormwater management and land development on the site. Additionally, it aims to safeguard, restore, and improve the receiving environment, such as watercourses.

The following standards and guidelines were adopted for the proposed stormwater management approach:

- Stormwater Management Devices in the Auckland Region, Guideline Document 2107/001 Version 1 (GD01) Dec 2017.
- Water Sensitive Design for Stormwater, March 2015, Guideline Document 2015/004 (GD04).
- The Auckland Council Code of Practice for Land Development and Subdivision, Stormwater (SWCoP).
- Guidelines for Stormwater Runoff Modelling in the Auckland Region, ARC Technical Publication No. 108 (ARC TP108), 1999.

The assessment of stormwater runoff volumes and peak flows were determined using Auckland Councils ARC TP108 methods and encompasses the following areas included for stormwater treatment:

- Existing pervious and impervious surfaces,
- Proposed new private roads, carparking and driveway areas,
- All other new impervious areas (e.g., new roof areas and hardstanding areas).

Permanent treatment devices will be designed in accordance with the guideline document *"Stormwater Management Devices in the Auckland Region, Guideline Document 2107/001 Version 1 (GD01) Dec 2017",* using the BPO approach. All the devices proposed in this design will provide water quality treatment to minimum 75% removal of Total Suspended Solids (TSS) efficiency.

The guiding water sensitive design principles as outlined in GD04, and the performance outcomes and standards have been adopted and incorporated in the stormwater management approach for the development of the site. See key points and guiding principles below. Table 4 also shows the expected outcomes and performance standards consistent with the objectives and policies AUP:(OiP).

Table 4 Application of Stormwater Principles

Water Sensitive Design Principles	Applications
Protect and enhance the values and functions of the natural ecosystem	Adoption of the WSD Blue-Green infrastructure, and green corridor network. Riparian stream edge planting, and riprap have been proposed where practicable, to minimise impact of stormwater runoff and overland flow on the receiving downstream environment. Bio-retention devices are proposed for water quality and hydrological mitigation within the site to mitigate effects on receiving environments (streams).
Address stormwater effects as close to the source point as possible	Generation of contaminants will be prevented as far as practicable using ow contaminant generating building materials. Where high concentrations of contaminants are generated, i.e., road and car parks, green infrastructure will be provided to mimic natural physical, biological, and physical treatment processes as close to the source as practicable (e.g., swales, wetland, raingarden etc.). Where green infrastructure is unable to be utilised, filter devices such as the SW360 StormFilter will be used.
Mimic natural systems and processes for stormwater management	Green infrastructure such as vegetated bio-retention devices, filter strips and green outfalls have been proposed for use within the site. Riparian stream edge planting, esplanade revegetation planting, and riprap to protect the stream networks within the site. Discharge of stormwater to the stream environment will be retarded and dispersed to maintain the stream flow regime within the site for frequent events.

7.1.2 Proposed Principles

The Stage 1 principles have been reviewed and remain applicable to the Stage 2 proposal.

7.2 Proposed Stormwater Management

7.2.1 General

An evaluation of stormwater management devices appropriates for this site, to produce a Best Practical Option (BPO) Toolbox, was undertaken and is presented in Appendix B.

The site can be split into various catchment categories for determining the Best Practical Option (BPO) for the catchment. Figure 16 and Table 5 below shows the different catchments, and the BPO identified for each, based on the toolbox.

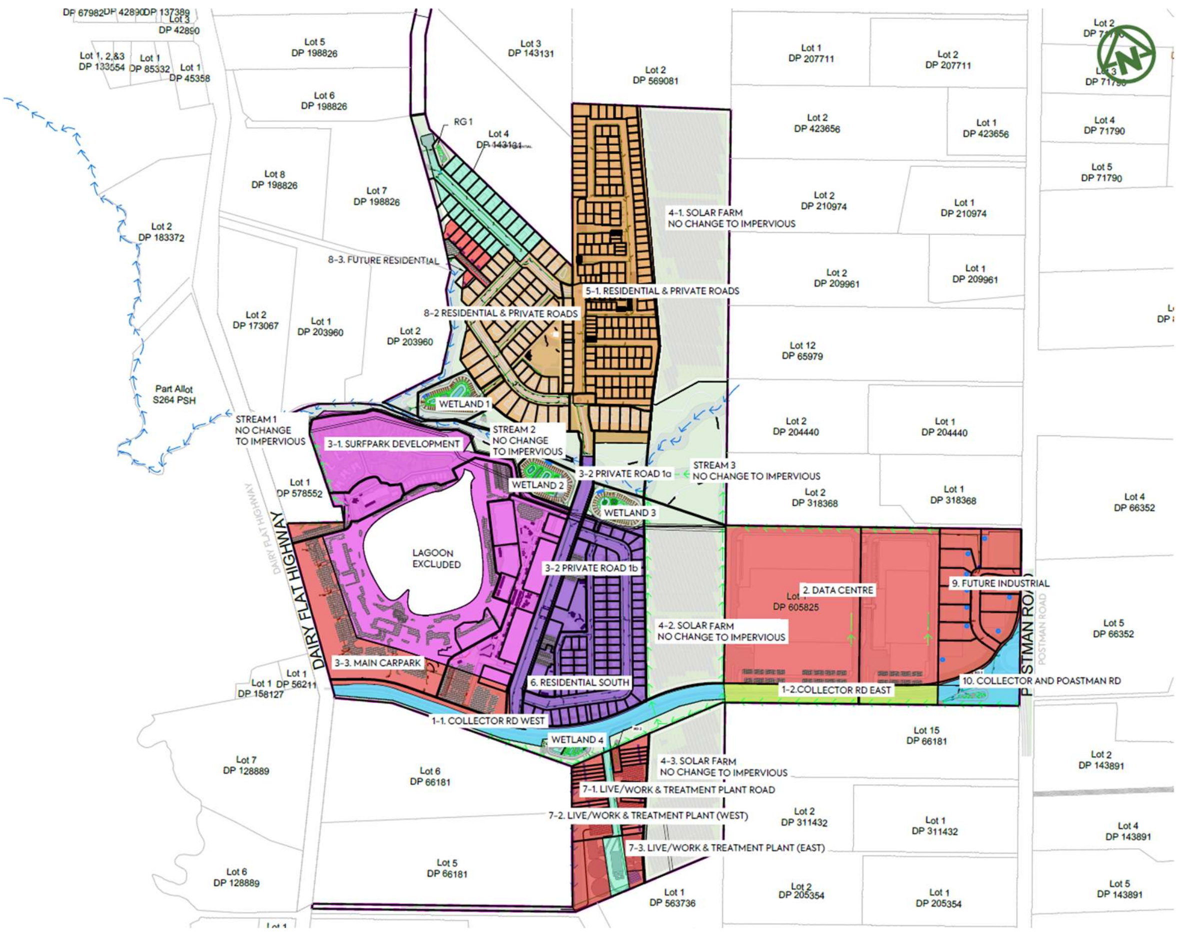


Figure 16 - Stormwater Management Device Catchment Plan (Source: Proposed Catchment Plan by MCCL)

Table 5 Summary of Stormwater Management Device

Sub catchment		BPO			
Catchment Name	Area (ha)	Treatment	Detention	10% Conveyance	Outlet
1 Collector Road (High Use Road)	Impervious (ha) 0.771 Total (ha) 1.835	- Swales - Constructed Wetland - Raingarden	- Constructed Wetland - Raingarden	- Swales	Riprap
2 Data Centre Precinct (Network Utility)	Impervious.(ha) 5.833 Total (ha) 6.333	- Swales - Tree pits - Onsite Proprietary Devices - Permeable pavers	- Tree pit - Rainwater Tanks	- Swales preferred - Pipe Network	Riprap
3-1 Surf Lagoon, Surf Village Centre and Accommodation Precincts	Impervious.(ha) 4.800 Total (ha) 6.700	- Constructed Wetland - Permeable pavers - Tree pit - Rainwater tanks (optional)	- Constructed Wetland, - Raingardens - Planter Box's - Tree pit - Rainwater tanks (optional)	- Swales (preferred) - Pipe Network	Riprap
3-2 Private Road	Impervious.(ha) 0.432 Total (ha) 0.540	- Constructed wetland	- Constructed wetland	- Pipe Network	Riprap
3-3 Main Carpark	Impervious.(ha) 0.400 Total (ha) 2.245	- Onsite raingardens - Pervious pavers	- Onsite raingardens - Pervious pavers	- Pipe Network	Riprap
4 Solar Farm Precinct	The solar farm is considered to be a pervious catchment as grass is expected to grow under the panel array. Any access tracks will be minimal and constructed out of gravel or previous pavement, as such this catchment is considered self-mitigating.				
5 Northeast Residential Precinct	Impervious.(ha) 2.911 Total (ha) 4.410	- Constructed Wetland	- Constructed Wetland	- Pipe Network	Riprap
6 South Residential Precinct	Impervious.(ha) 2.289 Total (ha) 3.690	- Constructed Wetland	- Constructed Wetland	- Pipe Network	Riprap
7 -1 Live/Work & Water and Wastewater Treatment Plant - Road	Impervious.(ha) 0.340 Total (ha) 0.340	- Raingarden	- Raingarden	- Pipe Network	Riprap
7 -2 Live/Work & Water and Wastewater Treatment Plant - West Part (Industrial)	Impervious.(ha) 0.355 Total (ha) 1.005	- Onsite, proprietary devices	- Rainwater Tanks	- Pipe Network	Riprap
7 -3 Live/Work & Water and Wastewater Treatment Plant – East Part (Industrial)	Impervious.(ha) 0.088 Total (ha) 0.640	- Onsite, proprietary devices	- Rainwater Tanks	- Pipe Network	Riprap

8 Northwest Residential Precinct	Impervious.(ha) 3.061 Total (ha) 4.635	- Raingarden - Constructed Wetland - Pervious Pavers	- Rainwater Tanks - Constructed Wetland	- Pipe Network	Riprap
9 Light Industrial Precinct	Impervious.(ha) 1.914 Total (ha) 2.080	- Swales - Tree pits - Permeable pavers - Onsite, proprietary devices	- Rainwater Tanks - Tree pit - Permeable pavers	- Swales - Pipe Network	Riprap
10 Postman Road Roundabout	Impervious.(ha) 0.378 Total (ha) 0.630	- Raingarden	- Raingarden	- Swales - Pipe Network	Swales

1. Collector Road

This catchment covers the collector road, which will be vested to Auckland Transport. Based on discussions with AT, preference for a single large device was selected, with a constructed wetland being the preferred solution for this area. Due to the flat nature of the site, swales are the only conveyance option to minimise earthworks on the site. The wetland will discharge into a new Swale, which conveys the water to the north to the diverted steam. The collector road will convey the 1% AEP event along the carriageway and swale, and discharge to the swale to the north. A drainage easement will be in place to cover the extent.

The proposed wetland has been designed to provide 95% attenuation of stormwater runoff. Additional flood mitigation for the 10% and 1% AEP storm events will be achieved through the creation of supplementary flood storage areas, formed by earthworks within the existing flood extents.

2. Data Centre Precinct

Flows from the data centre and light industry developments will be conveyed via swales to the north of the site and towards a diverted stream.

The proposed treatment swales have been designed with sufficient capacity to convey flows from the 100-year ARI storm event. Flood mitigation for the 10-year and 100-year events will be provided through the creation of additional flood storage areas, achieved by earthworks within the existing flood extents.

Alternative stormwater management devices—such as proprietary treatment systems, permeable paving, tree pits, or water reuse systems—may also be incorporated where appropriate, subject to detailed design.

3. Surf Lagoon, Surf Village Centre and Accommodation Precincts

The Surf Lagoon, Surf Village Centre and Accommodation Precincts are located to the west of Spine Road and north of Collector Road. The Best Practicable Option (BPO) for roof runoff includes the use of optional storage tanks (either aboveground or underground). While the tanks are not mandatory, their incorporation is preferred where there is demand for non-potable water reuse.

The wetland has been sized to provide treatment and detention for runoff from the catchment areas. However, it is recommended that roof water tanks be included in the final design primarily to support onsite water reuse, rather than solely for stormwater management purposes.The proposed wetland has been designed to provide 95% attenuation of stormwater runoff. Additional flood mitigation for the 10% and 1% AEP storm events will be achieved through the creation of supplementary flood storage areas, formed by earthworks within the existing flood extents.

Additional at-source measures are applied across the site, including swales and permeable paving where practicable. While the wetland provides the primary treatment, retention, and detention functions for this development, water-sensitive design approaches closer to the source remain the preferred option where feasible. The 1% AEP overland flow path will be safely conveyed through the site via designed paths and the private road network. No upstream overland flows enter the surf park site.

4. Solar Farm Precincts (North, Centre and South)

The solar farm area is considered a pervious catchment, as grass cover is expected to establish and grow beneath the panel arrays. Access tracks within the site will be minimal and constructed using gravel or permeable pavement. Accordingly, the catchment is regarded as largely self-mitigating, with minimal additional stormwater management required.

5. Northeast Residential Precinct

The Northeast Residential Precinct is proposed for residential development, with the catchment predominantly comprising impervious surfaces such as roads and roofs. Runoff from these areas will be conveyed through the stormwater network and directed into a constructed wetland. The wetland has been designed to provide both water quality treatment and detention storage to ensure stream protection.

The proposed wetland has been designed to provide 95% attenuation of stormwater runoff. Additional flood mitigation for the 10% and 1% AEP storm events will be achieved through the creation of supplementary flood storage areas, formed by earthworks within the existing flood extents.

6. South Residential Precinct

The Southern Residential Precinct is proposed for residential development, with the catchment predominantly comprising impervious surfaces such as roads and rooftops. Runoff from these areas will be conveyed through the stormwater network and directed into a constructed wetland. The wetland has been designed to provide both water quality treatment and detention storage to ensure stream protection.

The proposed wetland has been designed to provide 95% attenuation of stormwater runoff. Additional flood mitigation for the 10% and 1% AEP storm events will be achieved through the creation of supplementary flood storage areas, formed by earthworks within the existing flood extents.

7. Live/Work and Precinct and Treatment Plant

This area is to be developed into a live–work precinct, a water and wastewater treatment plant, and an accessway. The site has been divided into three distinct stormwater catchments—western, road, and eastern—each with tailored management measures to control runoff quantity and quality in accordance with best practice and climate change allowances.

The western catchment comprises part of the live–work units and the wastewater treatment plant. Stormwater runoff from this area will be collected in detention tanks designed to provide storage for rainfall events up to the 1% ARI, incorporating a 3.8-degree climate change factor. The detained runoff will be slowly released through the internal stormwater network before discharging to the existing channel along the western boundary and ultimately conveyed downstream at a controlled rate to avoid increased peak flows.

Runoff generated from the road catchment will be directed to a raingarden, which is designed to provide both water quality treatment and flow attenuation for the 95th percentile rainfall event with 2.1-degree climate change. Treated runoff will then discharge into the proposed stormwater channel, which ultimately outfalls to the diverted stream to the north. This approach ensures the treatment of contaminants from vehicle areas and maintains downstream hydrological conditions.

The eastern catchment includes the remaining live–work units and part of the wastewater treatment plant. Stormwater from this area will also be managed through detention tanks, designed to attenuate flows for storm events up to the 95th percentile rainfall event, incorporating a 2.1-degree climate change allowance. Treated runoff will then discharge into the proposed stormwater channel, which ultimately outfalls to the diverted stream to the north. The detention system will ensure post-development discharge rates are consistent with pre-development levels, mitigating potential flooding or erosion effects on downstream environments.

8. Northwest Residential Precinct

The northwest Residential Precinct catchment is proposed to be developed for residential use, with the catchment predominantly comprising impervious surfaces such as roads, driveways, and rooftops. Stormwater runoff from these areas will be conveyed through a reticulated stormwater network and directed into a combination of raingardens and a constructed wetland. The raingardens will provide water quality treatment, while the wetland will offer both water quality improvement and detention storage, ensuring adequate stream protection and flow control.

Due to the proposed ground levels, the norther-western portion of the catchment will naturally drain towards the existing stream. In this area, the stormwater network will eventually drain into the existing stream. Hence the accessways within this portion are designed using permeable paving, which provides on-site filtration and treatment of surface runoff. Roof runoff from the dwellings will be collected in rainwater tanks, designed to detain flows up to the 95th percentile storm event, incorporating a 2.1-degree climate change allowance.

The northern corner of the catchment will be collected and collected into a proposed raingarden for quality treatment before discharged to the existing stream.

The remainder of the catchment will be serviced by the stormwater network and discharged to the proposed constructed wetland. The wetland has been designed to attenuate approximately 95% of stormwater runoff, providing both quantity and quality control. Additional flood mitigation for the 10% and 1% Annual Exceedance Probability (AEP) storm events will be achieved through the creation of supplementary flood storage areas, formed by earthworks within the existing floodplain extents.

9. Light Industry Precinct

Runoff from the industrial east development roof areas will be directed into downpipes and conveyed to aboveground detention tanks for storage and controlled release. The detention tanks will discharge via outlets connected to the downstream stormwater network, with flows conveyed through swales located on the northern boundary of the site before discharging into the diverted stream.

The proposed detention tanks are designed to provide attenuation for the 2-year, 10-year, and 100-year ARI storm events. Climate change allowances have been incorporated into the design, with a 2.1-degree factor applied for the 2-year and 10-year events, and a 3.8-degree factor applied when sizing the tanks for the 100-year event.

In addition, runoff from the proposed internal roads will be treated using a Stormwater360 StormFilter system prior to discharge, ensuring appropriate water quality treatment is achieved.

10. Postman Road Roundabout

The roundabout is constructed at the junction of Postman Road and the Collector Road, serving a critical function in connecting these two roadways. The catchment area primarily encompasses the roundabout itself and adjacent road surfaces. Stormwater runoff from this area will be captured through kerbs and channel drains and conveyed via an underground piped system to an associated raingarden.

This wetland is specifically designed to manage stormwater runoff from the roundabout and connecting road areas. It will provide treatment through sedimentation, filtration, and biological processes to effectively remove contaminants.

The raingarden will also deliver detention storage to attenuate peak flows. The proposed raingarden has been designed to provide 95% attenuation of stormwater runoff. Additional flood mitigation for the 10% and 1% AEP storm events will be achieved through the creation of supplementary flood storage areas, formed by earthworks within the existing flood extents.

Figure 17 below shows the proposed stormwater management plan.

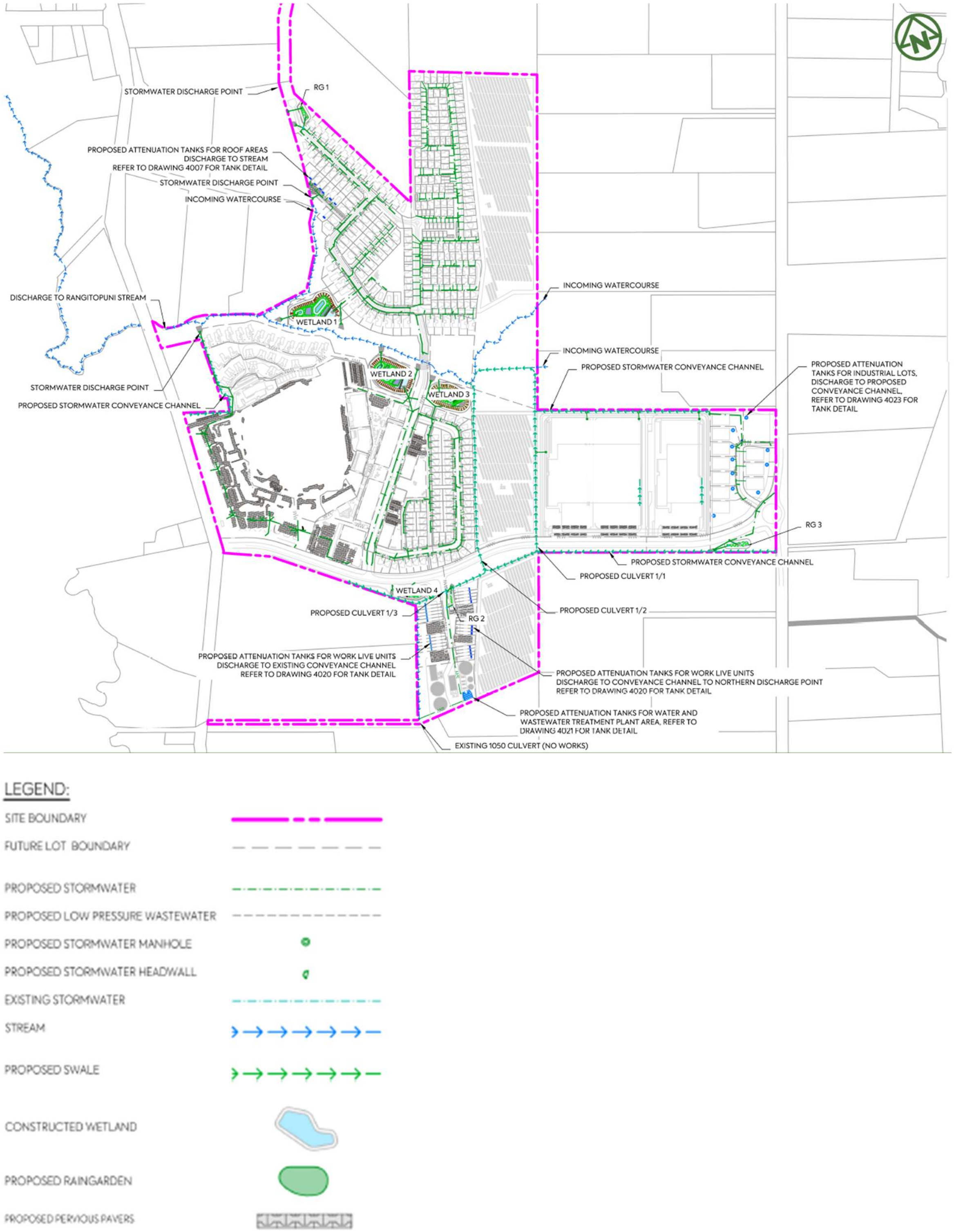


Figure 17 - Concept Stormwater Proposal for the development (Source: Proposed Stormwater by MCCL)

A summary of the BPO for the site, is shown below in Appendix C.

7.3 Water Quality

Water quality objectives are:

- To provide treatment of all impervious surfaces using a device designed in accordance with GD01 for the appropriate contaminants.
- 75% total suspended solid to be treated.
- Eliminate and if not possible minimise the generation and discharge of contaminants.
- Design a stormwater management system that provides a high level of water quality to protect the receiving environment.
- Preserve, protect, and enhance streams and floodplains which can also contain amenity and connectivity with communities.
- Provide at-source water quality treatment of runoff for all contaminant generating impervious surfaces to target sediments, metals, and gross pollutants.

Table 6 below presents shows the targeted contaminants for each type of impervious surface. Note that data centre, whilst industrial, is not listed in Table 33.4.3 of the AUP as a low, medium or high risk industrial activity. In accordance with rule 33.4.1(A3) no specific stormwater management is required if the activity meets the Permitted Activity standards.

Table 6 Contaminants of Concern, and Quality mitigation BPO for Various Impervious Surfaces

Impervious area	Contaminants of concern	BPO
High use roads	Sediments, gross pollutants, metals, oils and grease, hydrocarbons, temperature	swales, wetland.
Carparks HCGA	Sediments, gross pollutants, metals, oils and grease, hydrocarbons, temperature	Permeable pavers, swale, or raingardens.
Local road	Sediments, metals, hydrocarbons	Swales, raingarden, wetland
commercial roofs	Sediments, organics,	No specific design for water quality required, retention and detention are provided in Wetland. low contaminant generating materials.
Hardstanding areas, Paths.	Sediments, organics	No specific design for water quality required if retention and detention are provided.

Bioretention swales, bioretention devices, tree pits, wetlands designed to GD01 can provide the required water quality treatment levels and are appropriate for this development. Proprietary treatment devices, such as Storm filters, may also be used outside of the public realm.

At source treatment preferred.

Flat sites do not have the grade to pipe flow long distances and pass through a treatment device, therefore swales are preferred. These will also provide some treatment.

7.4 Stream Hydrology

This section focuses on mitigating the impacts of smaller, more frequent storm events to counterbalance the effects of development. These events have a significant influence on the geomorphology of receiving streams, and their effects on downstream erosion risk are discussed in Section 6.2.5 below. The hydrological mitigation measures outlined here will be most effective during smaller events, such as those with up to the 10% Annual Exceedance Probability (AEP), but they will also help mitigate runoff in all storm events.

Retention involves storing and retaining stormwater runoff on-site, which facilitates baseflow management in streams and groundwater recharge. The purpose is to reduce the volume of stormwater discharged into the receiving environment. Furthermore, there will be a substantial on-site demand for non-potable water.

Detention refers to temporarily storing and gradually releasing runoff, thereby reducing peak flows and safeguarding the downstream receiving environment against scour and erosion.

While it is crucial to decrease peak flows and manage increased runoff volumes, it should not be done at the expense of existing baseline flows that discharge into the wetlands and streams.

Table 7 presents the design requirements for hydrology mitigation for the site.

Table 7 Retention and Detention Requirements for Hydrology Mitigation

Design Area	Performance Requirements
Retention	Provide retention of at least 5mm runoff depth for the impervious area
Detention	Provide detention, and drain down period of 24 hours for runoff volume from the difference between the pre and post development 95th percentile, 24hour storm, minus the retention volume

Retention and detention requirements can be met with tanks (above ground rainwater tanks or underground detention tanks), green roofs, infiltration trenches, raingardens, bioretention devices. Permeable paving provide retention only, wet ponds, dry ponds and wetlands provide detention only.

7.5 Flooding 10% AEP Event (Network Capacity)

The objective for managing the 10% AEP event is to ensure there is sufficient capacity in the pipes and swale network.

The only existing pipe infrastructure downstream of the site are the three culverts beneath Dairy Flat Highway. No upgrades of these culverts are proposed as part of the development.

As there is no upstream or downstream network, there are no constraints in regards to capacity for servicing for the 10% AEP event.

7.6 Flooding 1% AEP Event (Habitable Floors)

Assessment of flooding, flows generated from 100year storm are provided in the attached Woods Flood assessment Report focus on the external flood flows from the wider upstream catchment. Refer to the Flood Memo by Mckenzieand Co for all internal flow paths and MFL recommendations.

It is proposed that all development is set outside of the flood plain. The Maximum Probable Development flood extent is shown in Figure 18. This shows that apart from some minor surface ponding, the 1% AEP flood plain is largely contained within the Stream A extent. Development is fully located outside of this flood plain and the relevant freeboard should be applied for all structures.

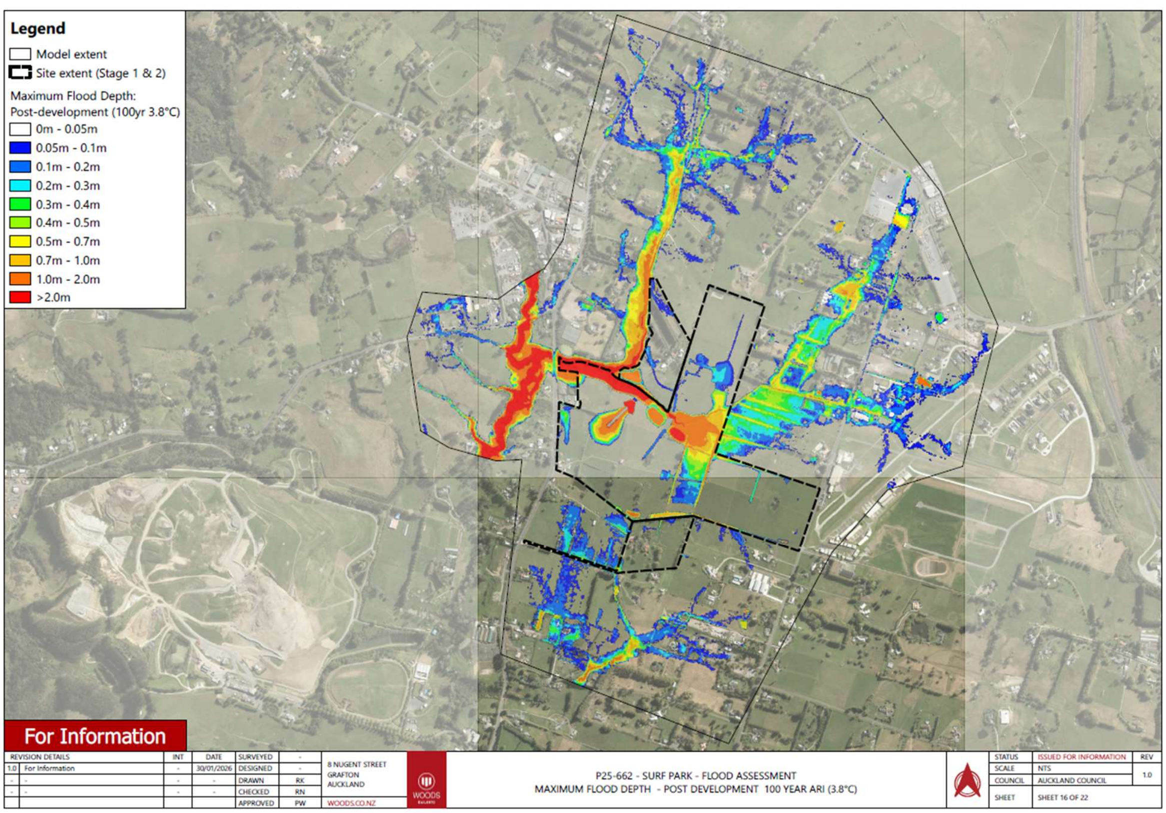


Figure 18 – Post Development Flood extents (Source: Woods Floodings 02 Feb 2026)

7.7 Overland Flow path and Floodplain Management

The existing entry points for overland flowpaths from the upstream catchments will be maintained with the development of the site.

Roads and carparking areas will be used to route the OLFP through site, All buildings will be designed to maintaining the required freeboard above OLFP's and Floodplains.

Exit points for the OLFP's within the site, are to stream A.

7.8 Development Staging

It is proposed that the Collector Road is constructed first, to enable access and facilitate the future construction of the site. The surf park will then construct the private infrastructure as required as the various buildings are constructed.

7.9 Hydraulic Connectivity

Hydraulic connectivity through the site will primarily be provided by the use of Swales where possible. Culverts have been avoided where possible, but where they are need, appropriate fish passage may be provided where grades require.

7.10 Asset Ownership

All stormwater located within the road to vest, will be owned by Auckland Council and maintained by Auckland Transport. This is because is exclusively services the public road reserve.

The remaining stormwater infrastructure will be owned and maintained by the landowner that the infrastructure is located on and will remain private. Building Consent applications will be required for this infrastructure.

7.11 Ongoing Maintenance Requirements

Proposed stormwater management devices for this development are:

- Raingardens
- Vegetated swales
- Constructed Wetlands
- Rainwater tanks

Draft operations and maintenance manuals will be prepared before the devices are completed.

The stormwater infrastructure that serves the collector road will be dedicated solely to servicing the road and will be transferred to Auckland Council. Auckland Transport (AT) will be responsible for the ongoing maintenance of all stormwater assets associated with the collector road. Any stormwater assets located north of the collector road will be privately owned, and the responsibility for their ongoing maintenance will lie with the private asset owner.

7.12 Implementation of Stormwater Network

The stormwater network has been conceptually designed to effectively manage both the quantity and quality of stormwater runoff from the development catchments. The design of the stormwater system and devices will adhere to the regulatory standards set by Auckland Council, including SWCoP (Stormwater Code of Practice), GD01, and GD04.

For the northern catchment, all private stormwater conveyance and treatment devices will be approved in accordance with the building Code, through Building Consents.

For the Collector Rd infrastructure, the stormwater and treatment devices will be determined in accordance with the Engineering Approval process.

Once approved the works will be installed and, monitored before being inspected by Council for signoff. As the site amenities is constructed, staged stabilisation of completed areas will occur thus no extra sedimentation of the stormwater network will occur.

Operations, maintenance, and monitoring of the proposed stormwater system will be critical in ensuring that the short and long-term performance of the system is maintained. Maintenance and monitoring will focus on preventing sedimentation entering the system and ultimately the receiving environment.

Monitoring will be carried out during the construction stages and on completion will continue throughout the life cycle of the system. This will be the responsibility of the development owner.

Continual monitoring will identify any need for maintenance requirements as these arise.

7.13 Dependencies

No stormwater infrastructure is proposed outside of the development site.

7.14 Risks

Table 8 Risk Register

Proposed Risk to Stormwater Management	Mitigation / Management	Further mitigation/ management to be used	When do risks need to be addressed	What is the Resultant level of Risk?
Soil Erosion	To reduce the risk of erosion of temporary batter faces due care to overland / stormwater should be made to ensure surface water does not flow over formed batters		During the Resource Consent phase (i.e. earthworks)	Moderate
Slope Stability	Slope stability analyses undertaken		During the Resource Consent phase	Moderate

8 DEPARTURES FROM REGULATORY OR DESIGN CODES

The stormwater management approach for development meets the minimum regulatory or design codes standards and is considered the BPO approach. No departures are proposed.

9 CONCLUSIONS AND RECOMMENDATIONS

A stormwater management plan (SMP) and a Flood risk assessment (FRA) has been prepared to support a Resource Consent Application for a surf lagoon, data centre, an integrated residential development, a village centre, work-live precinct, an industrial precinct, and ancillary activities. The Flood assessment is contained in a separate report. The SMP and is summarized below -

1. **Collector Rd Catchment (High Use Road)**

Stormwater management requirements

- WQ treatment for all impervious area
- Detention for all impervious area
- Avoid the floodplain.

Proposed BPO

- Constructed wetland (water quality treatment and 95th percentile detention with 2.1-degree CC)
- Swales for 10% (with 2.1-degree CC) conveyance
- Road OLFP for conveyance of 1% AEP (with 3.8-degree CC)

2. **Data Centre Precinct**

Stormwater management requirements

- WQ treatment for all contaminant generating areas
- Detention for all impervious area

Proposed BPO

- Low contaminant generating building materials
- Rainwater tanks (optional)
- Proprietary devices.
- Swales for 10% (with 2.1-degree CC) conveyance, where possible
- Pipes for 10% (with 2.1-degree CC) conveyance where swales are not available
- Discharge to conveyance channel of 1% AEP (with 3.8-degree CC)
- Avoid the floodplain, maintain freeboard

3. Surf Lagoon, Surf Village Centre and Accomodatin Precincts

SWM requirements

- WQ treatment for all contaminant generating areas
- Detention for all impervious area

Proposed BPO

- Low contaminant generating building materials
- Rainwater tanks (optional)
- Planter boxes, tree pits
- Permeable pavers
- Constructed Wetland(s)
- Swales for 10% (with 2.1-degree CC) conveyance, where possible
- Pipes for 10% (with 2.1-degree CC) conveyance where swales are not available
- Road and path OLFP for conveyance of 1% AEP (with 3.8-degree CC)
- Avoid the floodplain, maintain freeboard.

4. Solar Farm Precincts (North, Centre and South)

The solar farm area is considered a pervious catchment, as grass cover is expected to establish and grow beneath the panel arrays. Access tracks within the site will be minimal and constructed using gravel or permeable pavement. Accordingly, the catchment is regarded as largely self-mitigating, with minimal additional stormwater management required.

5. Northeast Residential Precincts

Stormwater management requirements

- WQ treatment for all contaminant generating areas
- Detention for all impervious area

Proposed BPO

- Constructed wetland for water quality treatment and 95th percentile detention (with 2.1-degree CC)
- Roads for 1% conveyance (with 3.8-degree CC)
- Avoid the floodplain, maintain freeboard.

6. South Residential Precincts

Stormwater management requirements

- WQ treatment for all contaminant generating areas
- Detention for all impervious area

Proposed BPO

- Constructed wetland for water quality treatment and 95th percentile detention (with 2.1-degree CC)
- Roads for 1% conveyance (with 3.8-degree CC)
- Avoid the floodplain, maintain freeboard.

7-1. Live/Work and Water and Wastewater Treatment Plant – Road

Stormwater management requirements

- WQ treatment for all contaminant generating areas
- Detention for all impervious area

Proposed BPO

- Raingarden (water quality and detention)
- Roads for 1% conveyance (with 3.8-degree CC)
- Avoid the floodplain, maintain freeboard

7-2 Live/Work and Water and Wastewater Treatment Plant – West Part

Stormwater management requirements

- WQ treatment for all contaminant generating areas
- Detention for all impervious area

Proposed BPO

- SW360 StormFilter (water quality)
- Rainwater tanks (1% detention with 3.8-degree CC)
- Avoid the floodplain, maintain freeboard.

7-3. Live/Work and Water and Wastewater Treatment Plant – East Part

Stormwater management requirements

- WQ treatment for all contaminant generating areas
- Detention for all impervious area

Proposed BPO

- SW360 StormFilter (water quality)
- Roads for 1% conveyance (95th percentile detention with 2.1-degree CC)
- Avoid the floodplain, maintain freeboard.

8. Northwest Residential Precinct

Stormwater management requirements

- WQ treatment for all contaminant generating areas
- Detention for all impervious area

Proposed BPO

- Constructed wetland (water quality and detention)
- Roads for 1% conveyance
- Avoid the floodplain, maintain freeboard.

9. Light Industrial Precinct

Stormwater management requirements

- WQ treatment for all contaminant generating areas
- Detention for all impervious area

Proposed BPO

- Low contaminant generating building materials
- Rainwater tanks (1% detention with 3.8-degree CC)
- Proprietary devices
- Swales for 10% (with CC) conveyance, where possible
- Pipes for 10% (with CC) conveyance where swales are not available
- Discharge to Roads for conveyance of 1% AEP with climate change
- Avoid the Floodplain, maintain freeboard.

10. Postman Road Roundabout (High Use Road)

Stormwater management requirements

- WQ treatment for all contaminant generating areas
- Detention for all impervious area
- Avoid the floodplain.

Proposed BPO

- Raingardens
- Road OLFP for conveyance of 1% AEP with climate change

APPENDIX A – PROPOSED DEVELOPMENT PLANS

APPENDIX B – STORMWATER MANAGEMENT SELECTION PROCESS AND ASSESSMENT

CB.1 ISSUES, CONSTRAINTS AND OPPORTUNITIES

The table below outlines issues, effects and potential opportunities for stormwater management within the site. This outline will assist in determining the Best Practicable Option (BPO) for stormwater management for the subject sites.

The Auckland Council GD01 Table 15 provides a list of stormwater management devices which demonstrate compliance with providing the necessary treatment for these generated contaminants such as Total suspended solids (TSS), Hydrocarbons (TPH), Total Zinc (TZn) and Temperature (which are particularly relevant for high contaminant yielding activities/roads).

Table 15: Estimated device effectiveness

	Quantity control					Quality control								
Key • Effective ○ Partially effective - Not effective	1% AEP	Detention of 50% and 10% AEP	90th & 95th percentile detention	Groundwater recharge	Retention	Sediment	Gross pollutants	Heavy metals	Oils and grease	Nutrients	Organics	Hydrocarbons	Indicator bacteria	Temperature
Pervious pavement - unlined	-	-	•	○	•	•	-b	-b	-b	-b	-b	-b	-b	-b
Pervious pavement - lined	-	-	•	-	-	•	-b	-b	-b	-b	-b	-b	-b	-b
Living roof	-	-	•a	-	•	○	NA	○	NA	○	○	NA	○	•
Rainwater tank (no reuse)	-	○	•	-	-	•	NA	○	NA	○	○	NA	○	○
Rainwater tank (with reuse)	-	○	•	-	•	•	NA	○	NA	○	○	NA	○	○
Infiltration device	-	○	•a	•	•	-	-	-	-	-	-	-	-	•
Swale (lined)	-	-	-	-	-	•	○	○	○	○	○	○	○	•
Bioretention swale (unlined)	-	-	•	•	•	•	•	•	•	•	•	•	•	•
Rain garden	-	-	•	•	•	•	•	•	•	•	•	•	•	•
Stormwater tree pitc	-	-	○	○	•	•	•	•	•	•	•	•	•	•
Planter box	-	-	○	○	•	•	•	•	•	•	•	•	•	•
Constructed wetland	-d	•	•	-	○	•	•	•	•	•	•	•	○	○
Wet pond	•	•	•	-	-	•	•	○	○	○	○	○	○	-
Dry pond (detention basin)	•	•	•	-	-	-	-	-	-	-	-	-	-	•

Notes:

NB: Assumes sizing, construction and maintenance are compliant with this guideline's requirements

NA: Not applicable, does not treat this pollutant because it is generally not present in the drainage area

•a: Assumes retention of up to the 90th and 95th percentile events

-b: Assumes limited water quality treatment for active pervious paving systems. Passive pervious paving is assumed to have some treatment effectiveness if maintained correctly

c: Stormwater tree pits are different to street tree pits in that they are specifically designed for stormwater management and must be sized accordingly.

-d Wetlands designs should bypass large storm events to protect vegetation and ensure sediments are not resuspended

[15] Adapted from the International Stormwater Best Management Practice Database, 2014. Sourced from http://www.bmpdatabase.org

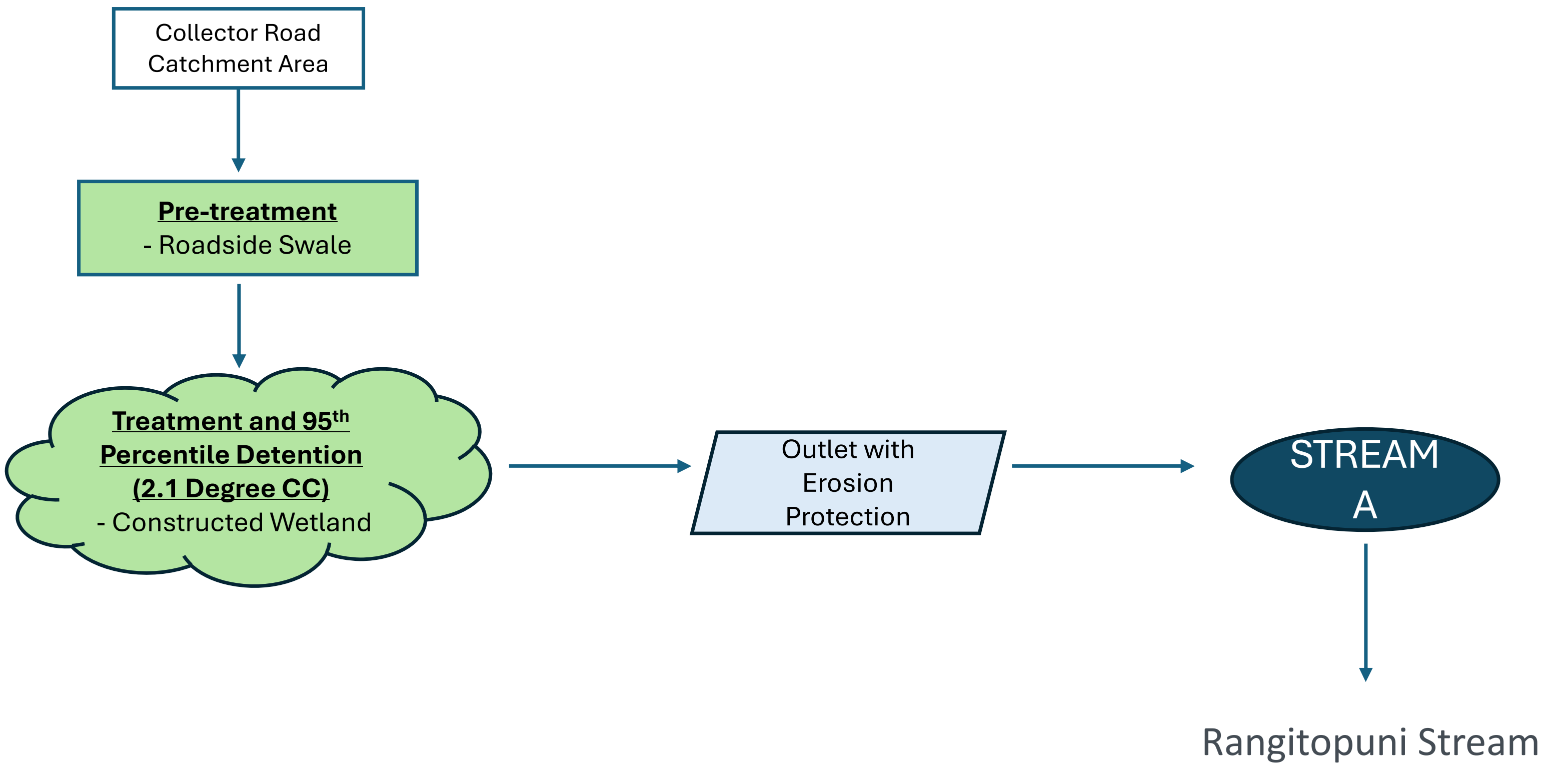
B.2 EVALUATION OF STORMWATER MANAGEMENT OPTIONS

The table below provides an evaluation summary of devices applicable for each development zone/use with a commentary on each device's weakness. This was used to evaluate devices to determine the best practicable option.

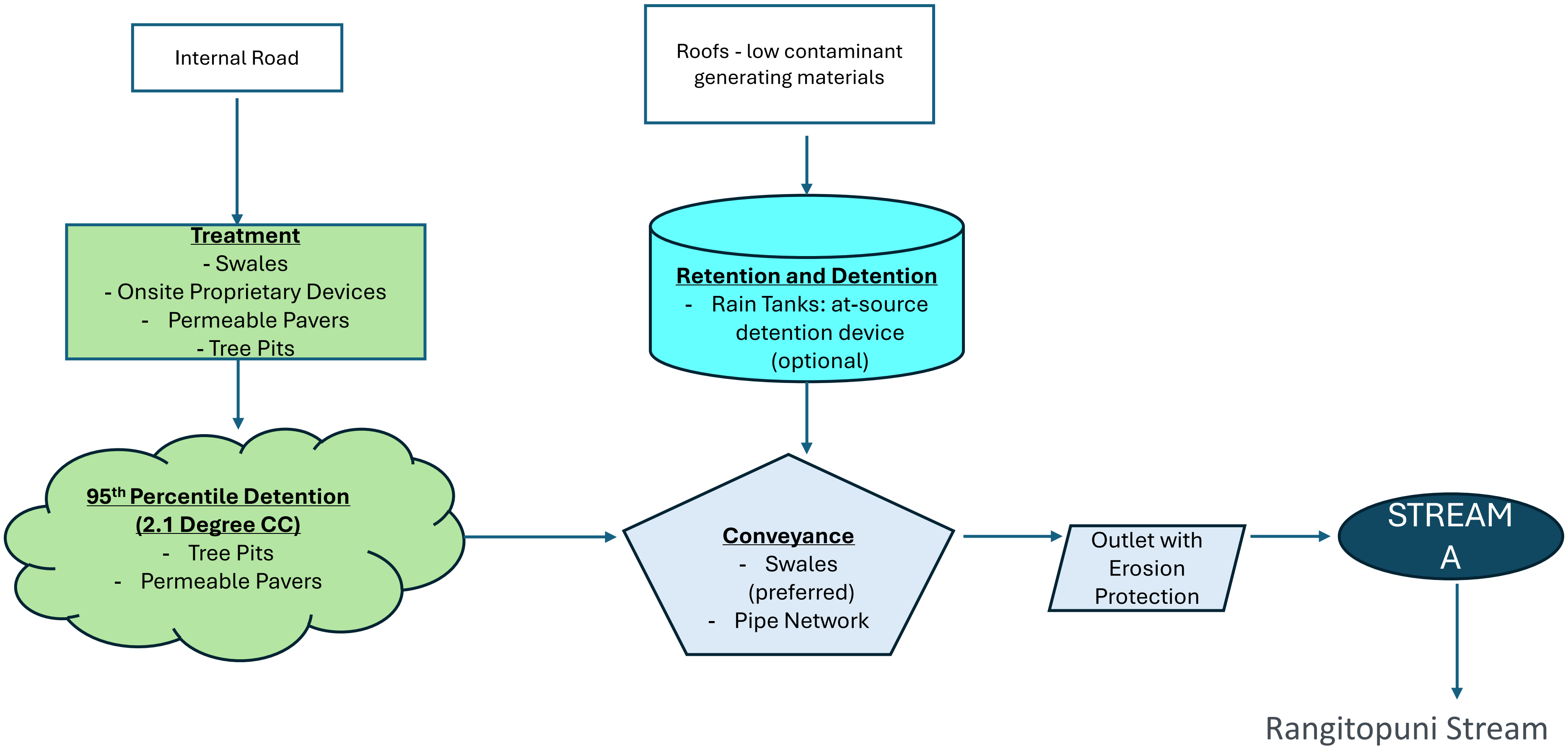
WSD Device	Performance Criteria	Device Location							Strengths	Limitations	Appropriate for Use
		High Use Road	*Local Road*	*Carparks*	*Industrial - not HCGA*	*Hotels/ Entertainment*	*Residential*	*Other*			
Pervious pavement	Water Quality	N/A	N/A	N	Y	Y	Y	Y	Provides recharge for the groundwater	Not compliant with AT TDM for public roads Efficacy degrades long term Retention relies on soil permeability	Yes for pavements excluding roads and HCGA
	5mm Retention			Y	Y	Y	Y	Y			Yes, excluding public roads
	95th percentile Detention			N	Y	Y	Y	Y			Yes, excluding public raods
	100 year Flood mitigation			N	N	N	N	N			No
Living roof	Water Quality	N/A	N/A	N/A	Partial	Partial	Partial	Partial		Cant be used for pavements or hardstanding areas Require specific architectural and structural design for construction and maintenance	Yes, partial removal of sediments
	5mm Retention				Y	Y	Y	Y			Yes, for roof runoff only.
	95th percentile Detention				Y	Y	Y	Y			Yes, for roof runoff only.
	100 year Flood mitigation				N	N	N	N			No
Tank with reuse (either U/G or RWT)	Water Quality	N/A	N/A	N	Y	Y	Y	Y	Opportunity to collect and re-use the water throughout the site for non potable purposes	Not suitable for public roads (proprietary devices not permitted) Underground tanks have risk of flotation in high groundwater areas Cost of tanks for detention of large catchments not economical	Yes, excluding public roads and HCGA
	5mm Retention			Y	Y	Y	Y	Y			Yes, excluding public roads. Rainwater tanks for roofs and underground ranks for pavements
	95th percentile Detention			Y	Y	Y	Y	Y			Yes
	100 year Flood mitigation			Y	Y	Y	Y	Y			Yes
Infiltration trenches	Water Quality	N	N	N	N	N	N	N	Effective on sites with low grades	Not sutiable for low infiltration areas, areas with high ground water Infiltration rate is dependent on the soil permability Unsuitable for steep sites Requries pre-treatment to prevent clogging and prevent contaminants entering the groundwater	No
	5mm Retention	Y	Y	Y	Y	Y	Y	Y			Yes
	95th percentile Detention	Y	Y	Y	Y	Y	Y	Y			Yes
	100 year Flood mitigation	N	N	N	N	N	N	N			No
Lined swale	Water Quality	N	Y	N	Y	Y	Y	Y	Replacement for underground piped network Can be used on shallow grades	Check dams or similar requried for steeper sections Potential for cars to be parked here ilegally if located roadside	Yes, excluding HCGA
	5mm Retention	N	N	N	N	N	N	N			No
	95th percentile Detention	N	N	N	N	N	N	N			No
	100 year Flood mitigation	N	N	N	N	N	N	N			No
Bioretention swale	Water Quality	Y	Y	Y	Y	Y	Y	Y	Replacement for underground piped network Can be used on shallow grades Provides of WQ, retention and detention	Maintenance and excluding vehicles (if roadside) 100 year flow needs to be managed to avoid damaging biomedia. Not the space on lots o get the 30m length required for treatment	Yes
	5mm Retention	Y	Y	Y	Y	Y	Y	Y			Yes
	95th percentile Detention	Y	Y	Y	Y	Y	Y	Y			Yes
	100 year Flood mitigation	N	N	N	N	N	N	N			No
Raingarden	Water Quality	Y	Y	Y	Y	Y	Y	Y	One device that can provide WQ, retention and detention. Low headloss device, suitable for flat sites. High contamination areas can be treated at source and separately	Raingardens to be vested to AT will also need to meet TDM requirements (approvals risk). Retention relies on pemeable soils to be most effective. Ongoing maintenance costs.	Yes
	5mm Retention	Y	Y	Y	Y	Y	Y	Y			Yes
	95th percentile Detention	Y	Y	Y	Y	Y	Y	Y			Yes
	100 year Flood mitigation	N	N	N	N	N	N	N			No
Large Bioretention device	Water Quality	Y	Y	Y	Y	Y	Y	Y	One device that can provide WQ, retention and detention. Low headloss device, suitable for flat sites.	Large space required (5% of catchment area) and located where impervious areas can drain to, and outside of the floodplain	Yes
	5mm Retention	Y	Y	Y	Y	Y	Y	Y			Yes
	95th percentile Detention	Y	Y	Y	Y	Y	Y	Y			Yes
	100 year Flood mitigation	N	N	N	N	N	N	N			No
Tree pit	Water Quality	Y	Y	Y	Y	Y	Y	Y	One device that can provide WQ, retention and detention. Low headloss device, suitable for flat sites.	Tree pits are not AT compliant	Yes, excluding public roads
	5mm Retention	Y	Y	Y	Y	Y	Y	Y			Yes
	95th percentile Detention	Y	Y	Y	Y	Y	Y	Y			Yes
	100 year Flood mitigation	N	N	N	N	N	N	N			No
Planter box	Water Quality	Y	Y	Y	Y	Y	Y	Y	One device that can provide WQ, retention and detention. Low headloss device, suitable for flat sites.	Not sutiable for runoff from pavements and roads	Yes, excluding public roads
	5mm Retention	Y	Y	Y	Y	Y	Y	Y			Yes, excluding public roads
	95th percentile Detention	Y	Y	Y	Y	Y	Y	Y			Yes, excluding public roads
	100 year Flood mitigation	N	N	N	N	N	N	N			No
Wetland	Water Quality	Y	Y	Y	Y	Y	Y	Y	One devices provides WQ and detention (for hydrological mitigation) Suitable for flat areas Can be incorporated into site landscaping as a feature	AT TDM Teir 2 device - will be assessed on case by case basis (where used for road runoff only) 100 year flows need to be routed around the wetland Pre-treatment required	Yes, but not a preferred option for public roads only. Can be used in conjunction with runoff from other sources.
	5mm Retention	N	N	N	N	N	N	N			No
	95th percentile Detention	Y	Y	Y	Y	Y	Y	Y			Yes, not a preferred option for public roads only. Can be used in conjunction with runoff from other sources.
	100 year Flood mitigation	N	N	N	N	N	N	N			No
Wet pond	Water Quality	Partial	Partial	Partial	Y	Y	Y	Y	Can be incorparated into site design (eg recreational areas) Can be used for temporary water storage while surf lagoon is drained	AT TDM Tier 3 device - approval will only be given by exception (where used for road runoff only) H&S risk Emabankement design and effect on groundwater levels	Yes, excluding HCGA. Not a preferred option for public roads only. Can be used in conjunction with runoff from other sources.
	5mm Retention	N	N	N	N	N	N	N			No
	95th percentile Detention	Y	Y	Y	Y	Y	Y	Y			Yes, not a preferred option for road runoff only. Can be used in conjunction with runoff from other sources.
	100 year Flood mitigation	Y	Y	Y	Y	Y	Y	Y			Yes, not a preferred option for road runoff only. Can be used in conjunction with runoff from other sources.
Dry pond	Water Quality	N	N	N	Y	Y	Y	Y	Can be incorparated into site design (eg recreational areas) Can be used for temporary water storage while surf lagoon is drained	AT TDM Teir 2 device - will be assessed on case by case basis (where used for road runoff only) Larger storage device will need to consider dam design criteria H&S Risk No WQ or retention credit	No
	5mm Retention	N	N	N	N	N	N	N			No
	95th percentile Detention	Y	Y	Y	Y	Y	Y	Y			Yes, not a preferred option for road runoff only. Can be used in conjunction with runoff from other sources.
	100 year Flood mitigation	Y	Y	Y	Y	Y	Y	Y			Yes, not a preferred option for road runoff only. Can be used in conjunction with runoff from other sources.
Proprietary device (Stormfilter)	Water Quality	N	N	Y	Y	Y	Y	Y	Small devices that can be located easily	Maintenance and replacement cost Provides water quality treatment only	Yes, private lots only
	5mm Retention	N	N	N	N	N	N	N			No
	95th percentile Detention	N	N	N	N	N	N	N			No
	100 year Flood mitigation	N	N	N	N	N	N	N			No

APPENDIX C – Summary of the Best Practical Option (BPO)

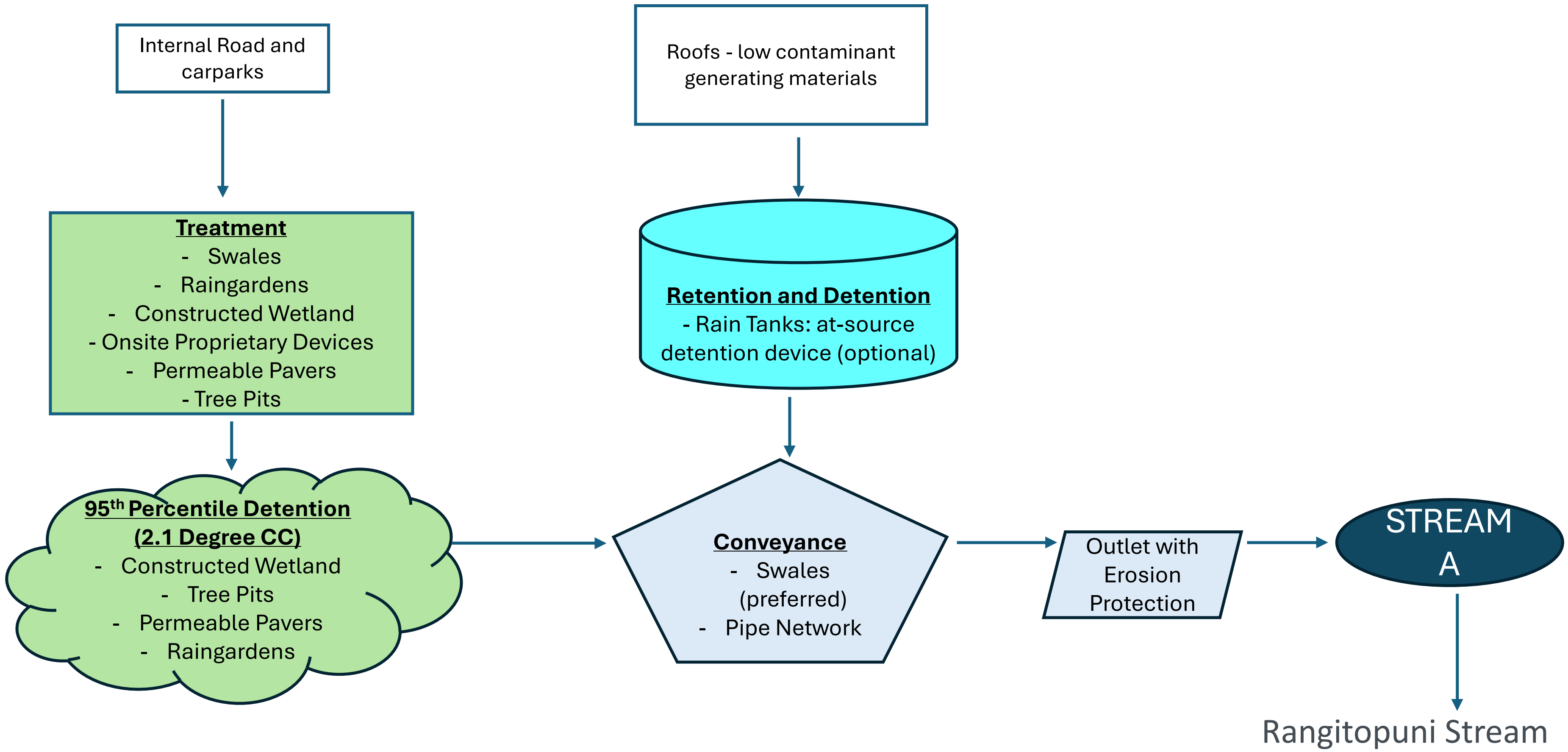
1. COLLETOR ROAD CATCHMENT (HIGH-USE ROAD)



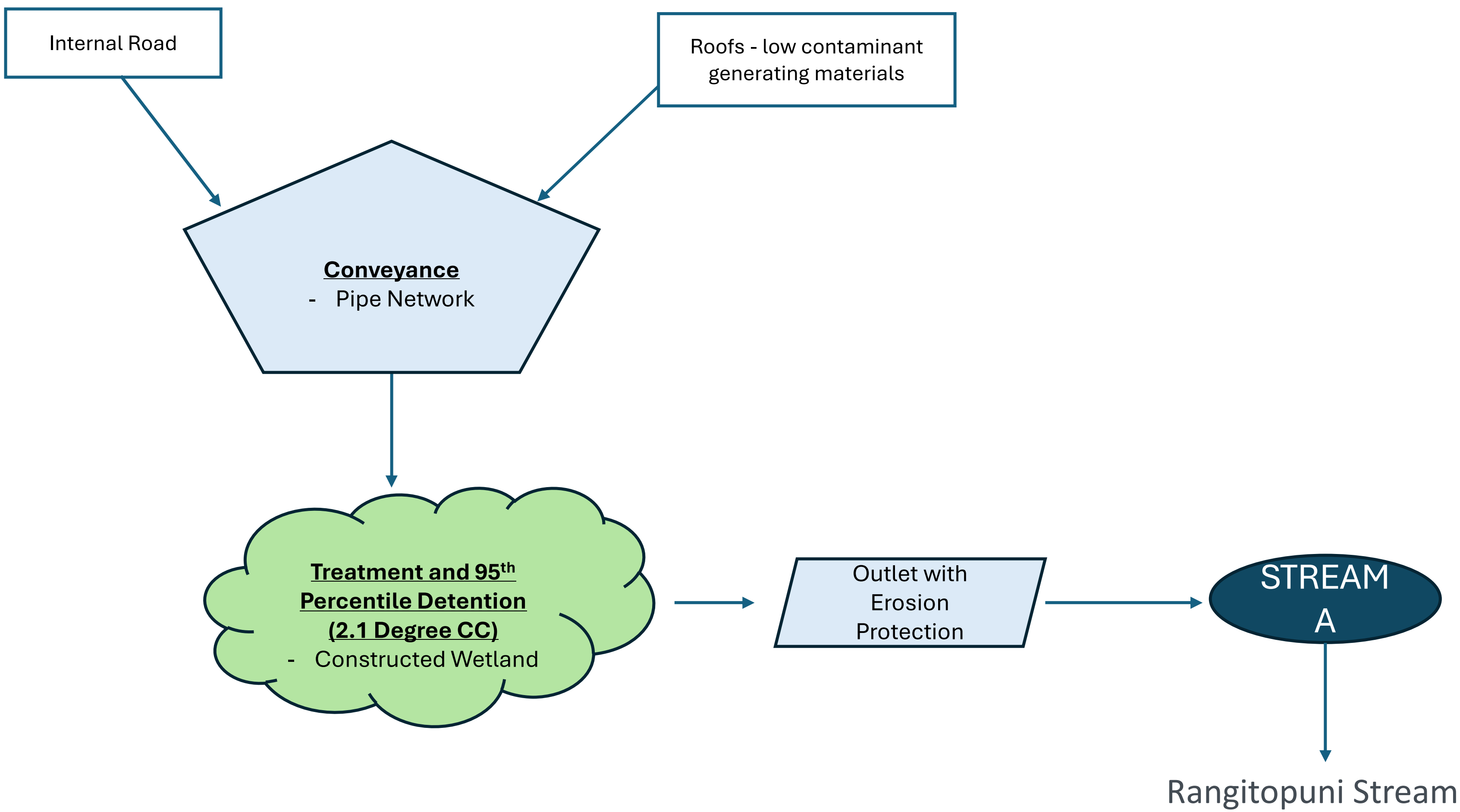
2. DATA CENTRE PRECINCT CATCHMENT (INDUSTRIAL)



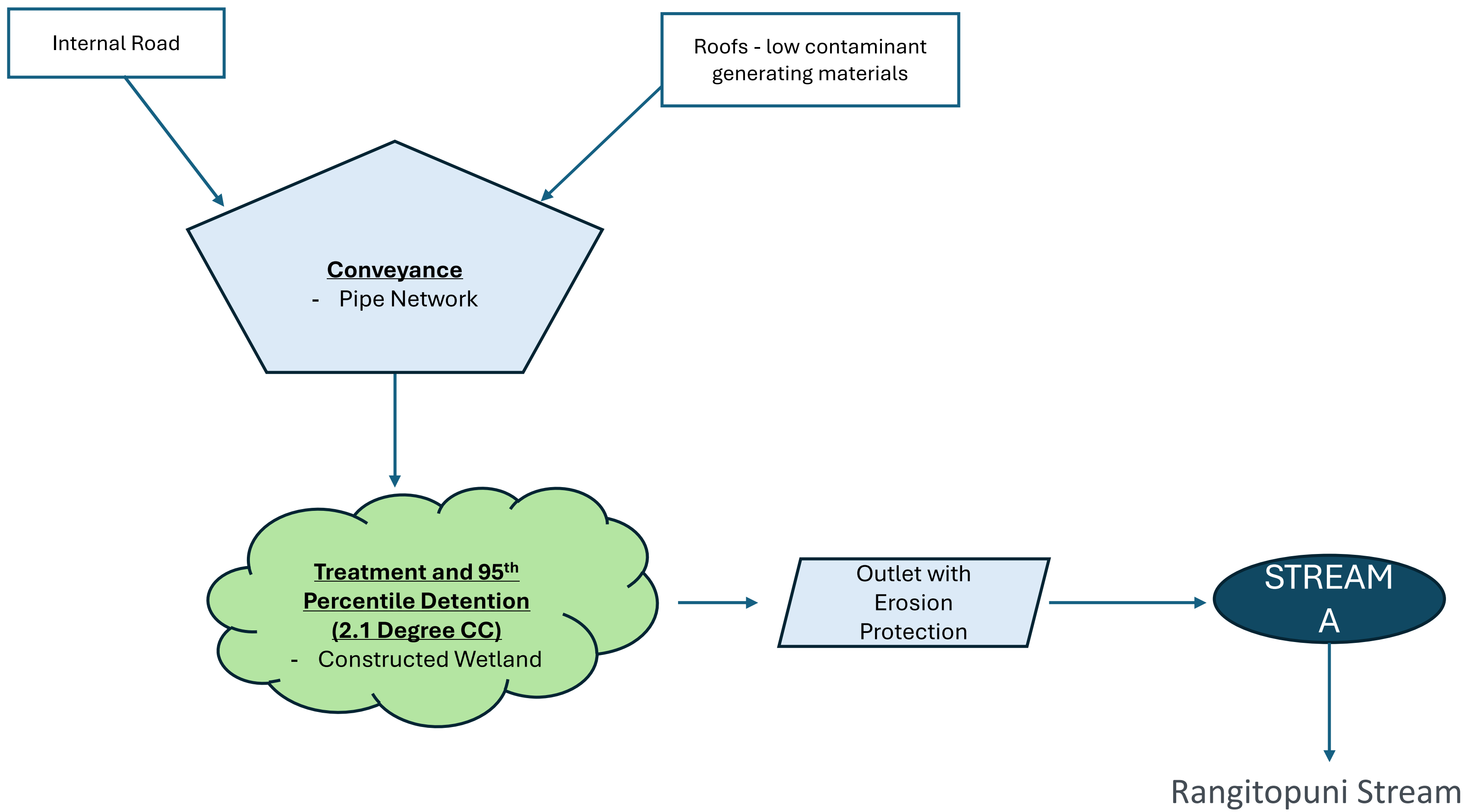
3. Surf Lagoon, Surf Village Centre and Accommodation PRECINCTS CATCHMENT



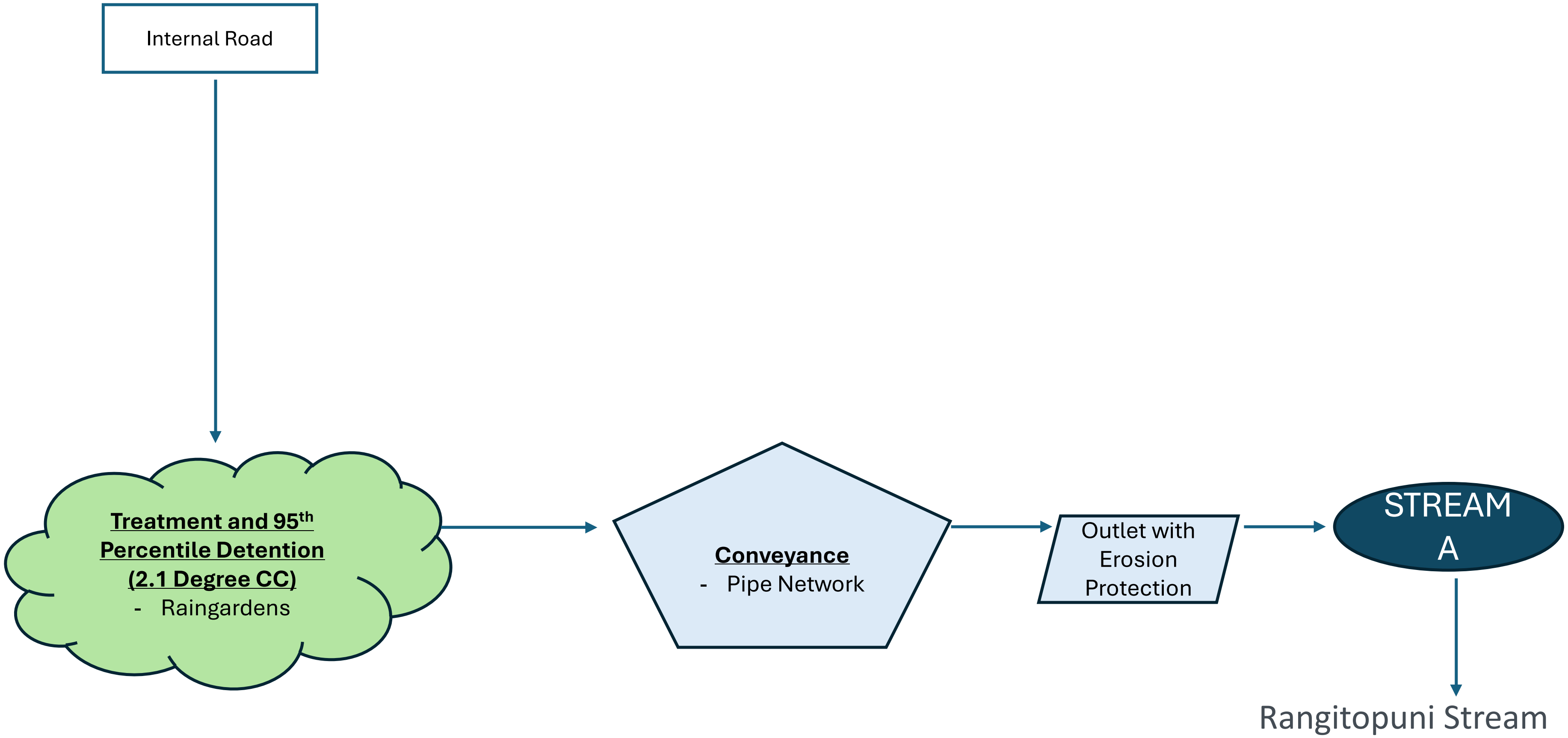
5. NORTHEAST RESIDENTIAL PRECINCT (RESIDENTIAL)



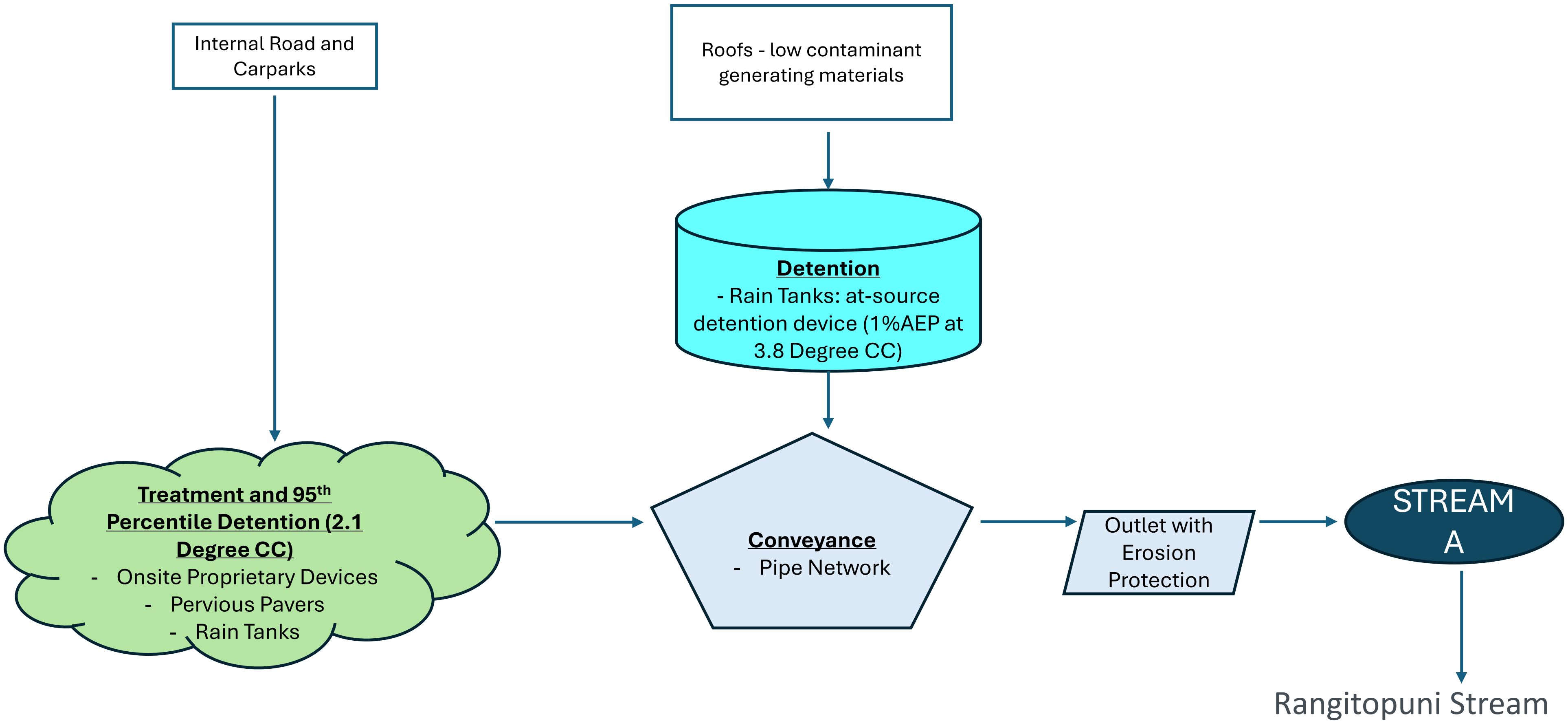
6. SOUTH RESIDENTIAL PRECINCT (RESIDENTIAL)



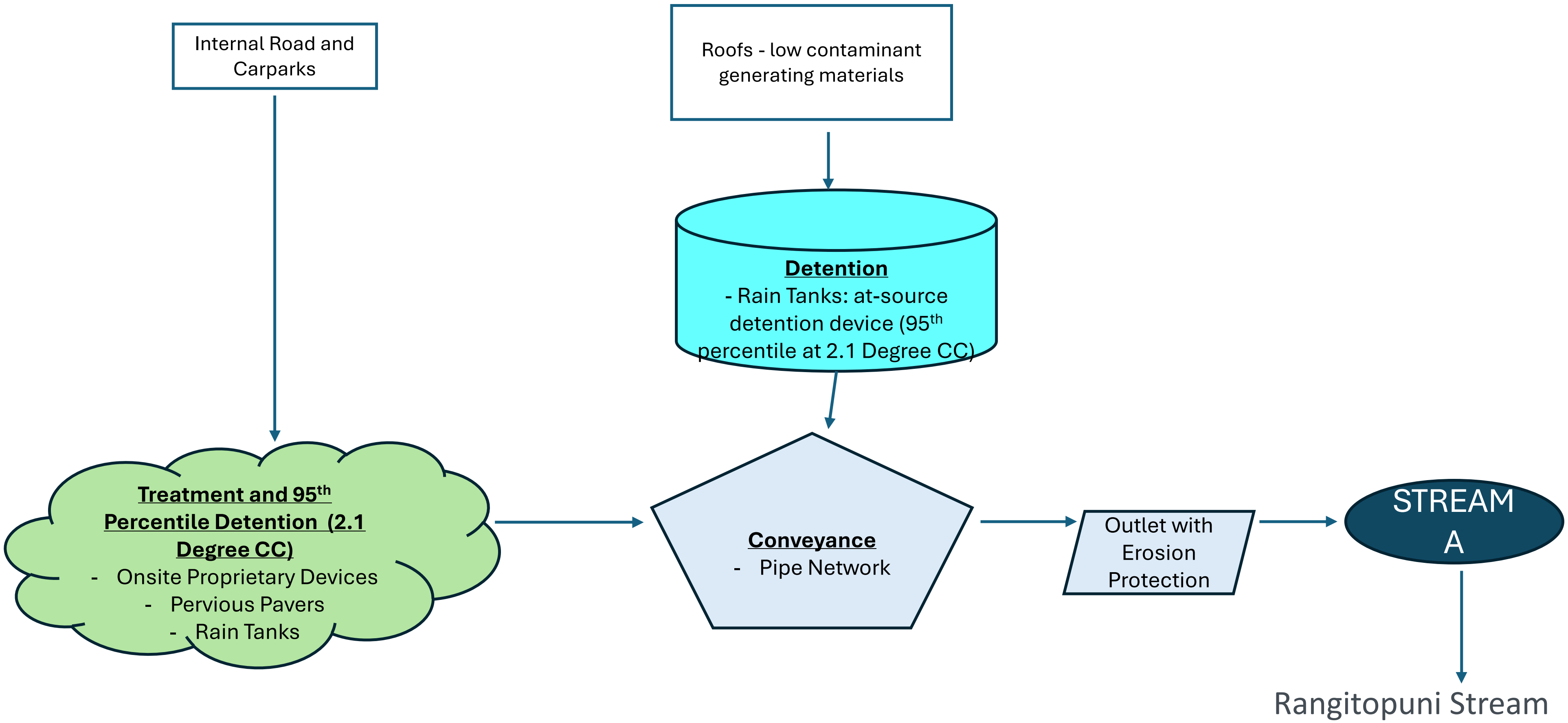
7-1. LIVE/WORK & WATER AND WASTEWATER TREATMENT PLANT – ROAD (INDUSTRIAL)



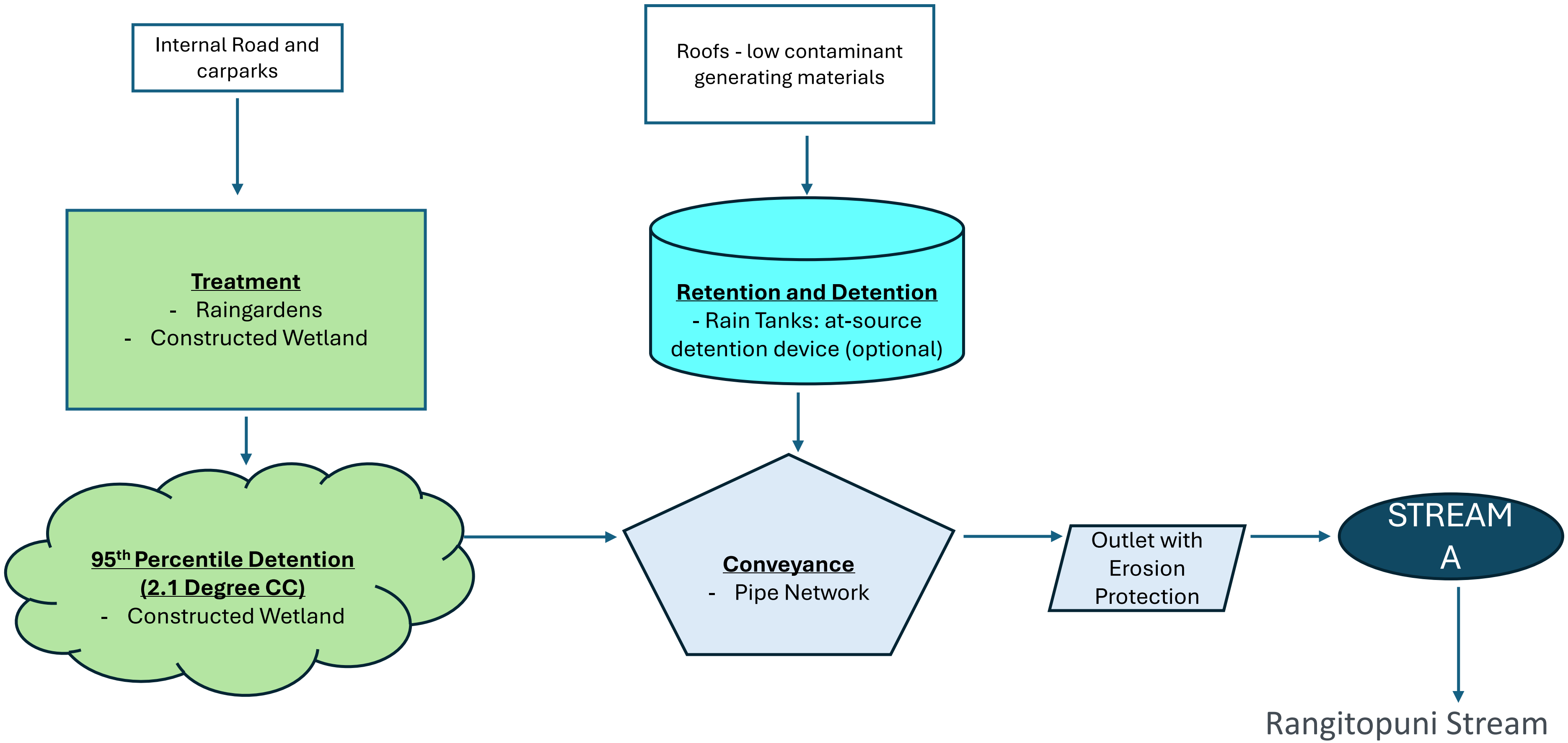
7-2. LIVE/WORK & WATER AND WASTEWATER TREATMENT PLANT – WEST PART (INDUSTRIAL)



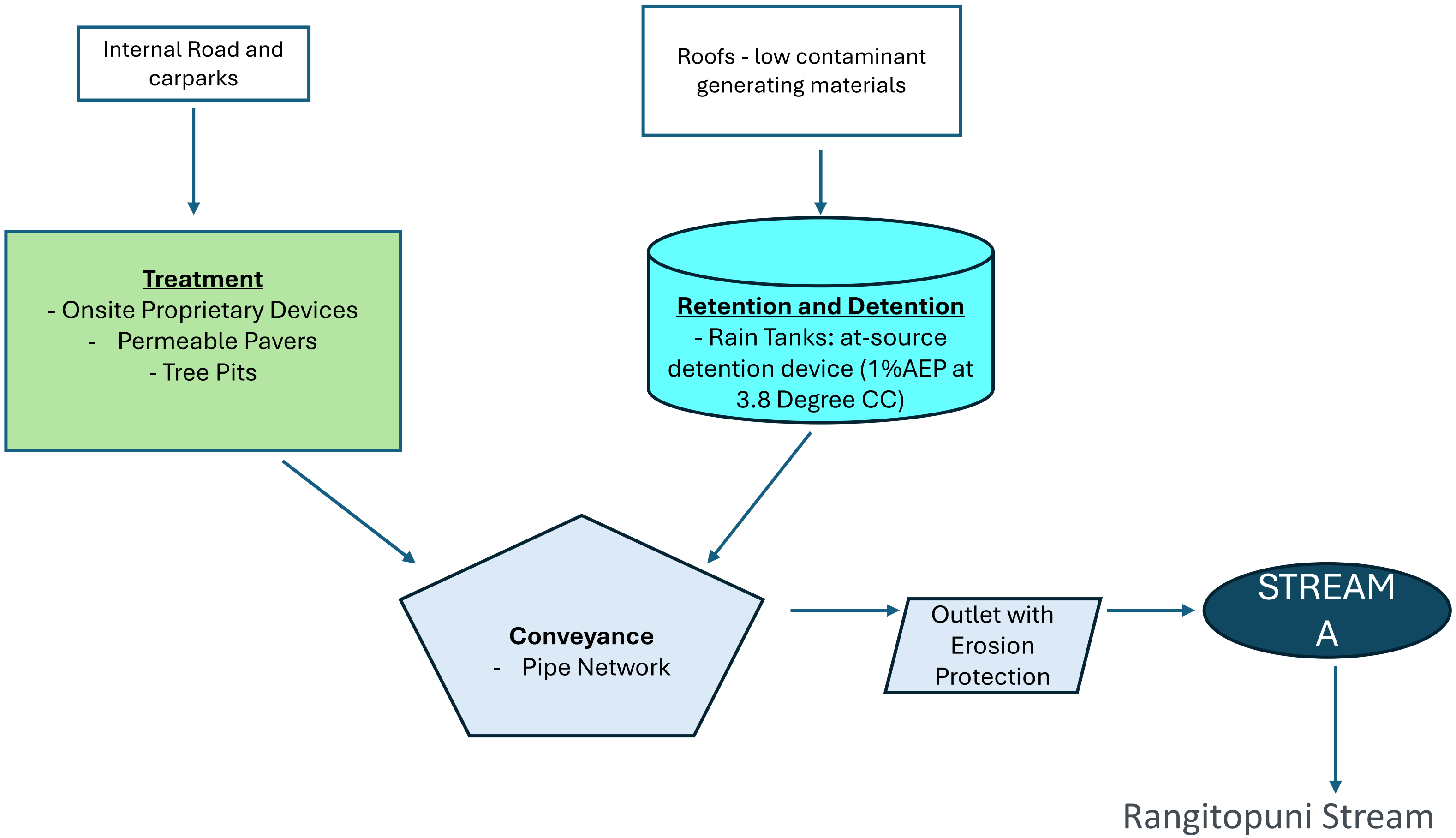
7-3. LIVE/WORK & WATER AND WASTEWATER TREATMENT PLANT – EAST PART (INDUSTRIAL)



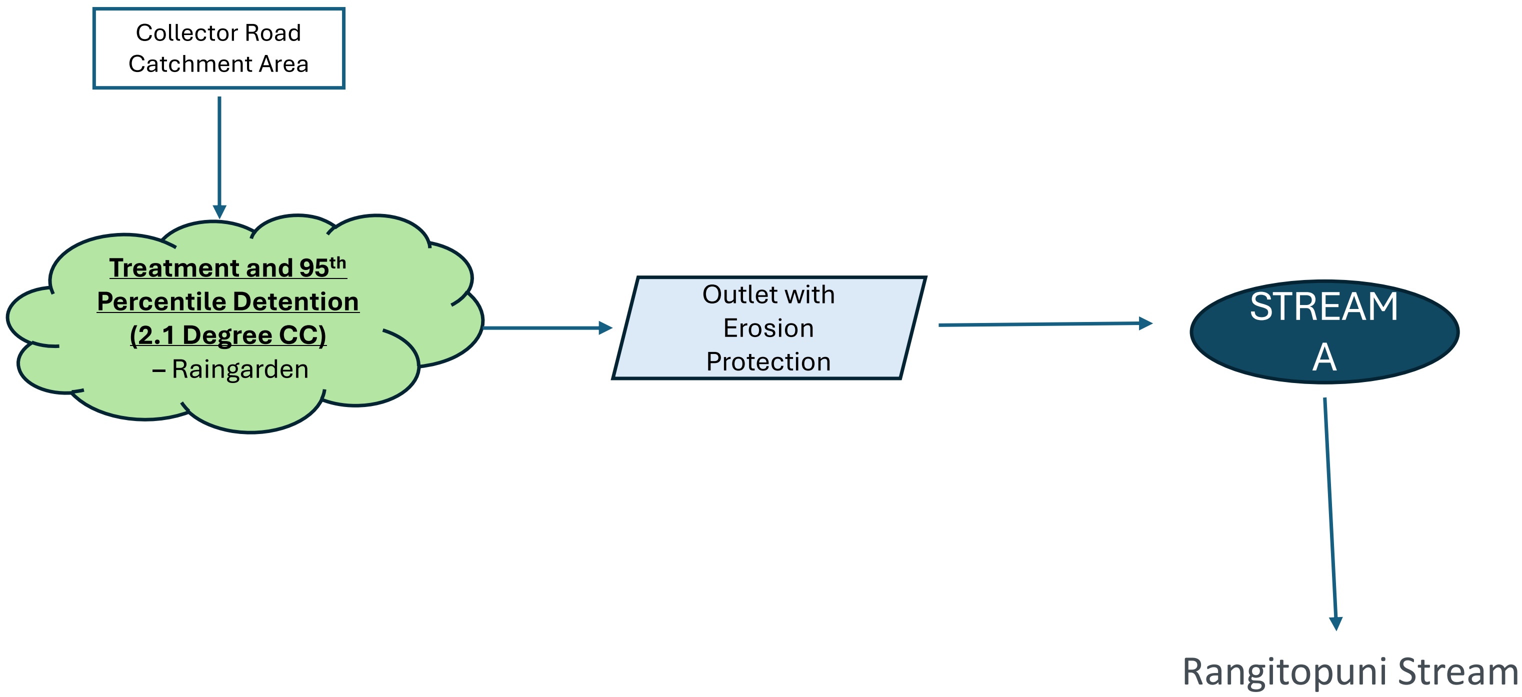
8. NORTHWEST RESIDENTIAL PRECINCT CATCHMENT (RESIDENITAL)



9. LIGHT INDUSTRY PRECINCT CATCHMENT (INDUSTRIAL)



10. POSTMAN ROAD ROUNDABOUT CATCHMENT (HIGH-USE ROAD)



APPENDIX D – Stormwater Calculation

- Catchment Delineation
- Adopted Rainfall Data with Climate Change
- Water Quality Treatment and Detention Device Sizing

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Stormwater Rainfall Claculation (TP108)

Rainfall Intensity Calculation Sheet - With Climate Change

PROJECT NUMBER: 3325-2
ADDRESS: SURFPARK STAGE2 DEVELOPMENT
BY: AL
DATE: 7/11/2025

Input

Percentage Increase in 24-hour Design Rainfall Depth

Sourced from Section 4.2.10 Cimate Change in Code of Practice for Land Development and Subdivision Chapter 4 - Stormwater, **Version 4.0-July 2025**

Annual Exceedance Probability (AEP)	ARI	Percentage Increase in 24-Hour Design Rainfall Depth Due to Future Climate Change (2.1 degree)*	Percentage Increase in 24-Hour Design Rainfall Depth Due to Future Climate Change (3.8 drgree)*
50%	2 year	15.1%	27.4%
20%	5 year	16.4%	29.6%
10%	10 year	17.0%	30.8%
5%	20 year	17.2%	31.2%
2%	50 year	17.6%	31.9%
1%	100 year	18.1%	32.7%

* Assuming 2.1 degree increase in temperature

Rainfall depth with climate change

ARI	Rainfall Depth (mm) - From TP108	Rainfall Depth + Climate Change Allowance (2.1 degree)* (mm)	Rainfall Depth + Climate Change Allowance (3.8 drgree) (mm)
90th	26.0	29.9	33.1
95th	36.5	42.5	47.3
2 year	85.0	97.8	108.3
5 year	115.0	133.9	105.0
10 year	128.0	149.8	167.4
20 year	155.0	181.7	203.4
50 year	175.0	205.8	230.8
100 year	190.0	224.4	252.1

STAGE 2 POST DEVELOPMENT STORMWATER CATCHMENT SUMMARY - TREATMENT AND DETENTION DEVICES

Input

PROJECT NAME Surfpark Stage 2 Development
PROJECT No: 3325-2

Created By AL
Checked By ZW

Date 7/11/2025
Date

	Historical	With 2.1 cc	With 3.8 cc		
95th PERCENTILE 24hr RAINFALL	36.5	42.5	47.3	mm	*From TP108 Rainall Map + Climate Change*
90th PERCENTILE 24hr RAINFALL	26.0	29.9	33.1	mm	*From TP108 Rainall Map + Climate Change*
2-YR ARI	85.0	97.8	108.3	mm	
10-YR ARI	128.0	149.8	167.4	mm	
100-YR ARI	190.0	224.4	252.1	mm	

** From TP108 Rainall Map + 2.1degree and 3.8 degree climate change*

	Catchment Description	Catchment Area (m2)	Imperviousness (%)	Impervious Area (m2)	Perv Area (m2)	*Water Quality Volume* PWV (m3)	*Detention for Stream Protection* Detention Vol. (m3)
1. SELF-MANAGING AREAS	**SELF MANAGING AREAS**						
	DATA CENTRES	63,330	92%	58,330	5,000		
	FUTURE INDUSTRIAL EAST	20,800	92%	19,136	1,664		
	LIVE WORK PRECINCT & WWTP	19,850	39%	7,830	12,020		
		2,400	80%	1,920	480		
	SURF VILLAGE MAIN CARPARKS	22,450	18%	4,000	18,450		
	NORTHWEST Future Residential (SELF)	2,700	83%	2,230	470		
	Total	**131,530**		**93,446**	**38,084**	-	-
2. Wetland (Water Quality and Detention)	**WETLAND 1**						
	NORTHWEST AND NORTHEASRT	77,500	66%	50,947	26,553		
	NORTHWEST FUTURE RESIDENTIAL (SELF)	2,600	74%	1,932	668	Detention ONLY	
	NORTHWEST FUTURE RESIDENTIAL (RG1)	10,500	64%	6,760	3,740	Detention ONLY	
	Total	90,600	66%	**59,639**	**30,961**		
	Total (Water Quality Treatment Area)	**77,500**	66%	**50,947**	**26,553**	694	2,208
	WETLAND 2						
	SURF LAGOON BUILDINGS	6,759	100%	6,759	-		
	SURF LAGOON OPEN SPACE	28,151	30%	8,445	19,706		
	SURF LAGOON RAODS	11,340	100%	11,340	-		
	SURF VILLAGE BUILDINGS	11,957	100%	11,957	-		
	SURF VILLAGE OPEN SPACE	8,866	15%	1,330	7,536		
	ACCO PRECINCT UNITS+DECKS	5,980	100%	5,980	-		
	ACCO PRECINT OPEN SPACE	13,879	0%	-	13,879		
	ACCO PRECINT ROADS	2,138	100%	2,138	-		
	Surf Lagoon	22,050	100%	-	22,050		
	Total	**67,020.0**	72%	**47,949**	**19,071**	**643**	**1,950**
	WETLAND 3						
	NEIGHBOURHOOD SOUTH - OPEN SPACE	3,580	15%	537	3,043		
	NEIGHBOURHOOD SOUTH - LOTS	20,800	60%	12,480	8,320		
	NEIGHBOURHOOD SOUTH -ROADS	12,520	80%	10,016	2,504		
	Total	36,900	62%	23,033	13,867	317	970
	WETLAND 4						
	COLLECTOR ROAD	19,708	42%	8,249	11,459		
	Total	**19,708**		**8,249**	**11,459**		
	Total (Excluding East)	**19,708**		**8,249**	**11,459**	**124.2**	**392.9**
3. RAINGARDEN (Water Quality Only)	**RG 1**						
	NORTHWEST LOT	8,200	60%	4,920	3,280		
	NORTHWEST ROAD	2,300	80%	1,840	460		
	Total	10,500		**6,760**	**3,740**	-	-
	RG 2						
	WORK & LIVE ROAD	2,830	100%	2,830	-		
	Total	2,830		**2,830**	-	-	-
	RG 3						
	Postman Rd Roundabout	6,300	60%	3,780	2,520		
	Total	6,300		**3,780**	**2,520**	-	-

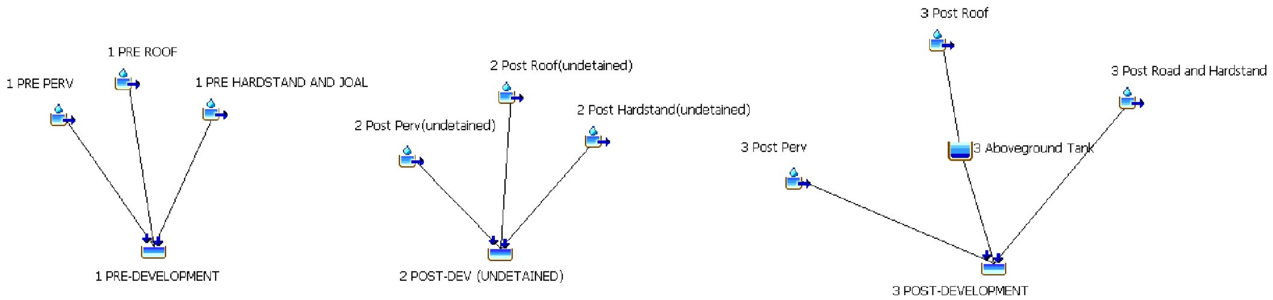
	Aboveground Tanks				
	1. INDUSTRIAL EAST	**Catchment Area (m2)**	**Imperviousness (%)**	**Impervious Area - ROOF (m2)**	**Perv Area (m2)**
	Pre-development				
	Oveall	20299.0	0%	0	20299
	Post-development				
	GXP	3639.0	100%	3639	0
	SUBSTATION	2394.0	100%	2394	0
	LOT 1	1081.0	95%	1027	54
	LOT 2	1048.0	95%	996	52
	LOT 3	1048.0	95%	996	52
	LOT 4	1142.0	95%	1085	57
	LOT 5	3192.0	95%	3032	160
	LOT 6	1258.0	95%	1195	63
	LOT 7	1218.0	95%	1157	61
	LOT 8	1354.0	95%	1286	68
	Total	**17374.0**		**16807**	**567**
	ROAD 1	2925.0	80%	2340	585.0
4. TANKS (2 10 100 yr Detention for Roof area)	**Total**	**2925.0**		**2340**	**585**
	Overall	**20299**		**19147**	**1152**
	4.2.1 Work & Live (WEST PART) - 100 YR ATTENUATION	**Catchment Area (m2)**	**Imperviousness (%)**	**Impervious Area (m2)**	**Perv Area (m2)**
	Pre-development (West)				
	TREATMENT PLANT	2450.0	0%	0	2450
	11 x UNIT ROOF	1100.0	0%	0	1100
	EXISTING PERV TO REMAIN	1285.0	0%	0	1285
	Total	**4835.0**		**0**	**4835**
	Post-development (West)				
	TREATMENT PLANT	2450.0	100%	2450	0
	11 x UNIT ROOF	1100.0	100%	1100	0
	EXISTING PERV TO REMAIN	6500.0	0%	0	6500
	Total	**10050.0**	**35%**	**3550**	**6500**
	4.2.2 Work & Live (EAST PART) - 95 TH ATTENUATION	**Catchment Area (m2)**	**Imperviousness (%)**	**Impervious Area (m2)**	**Perv Area (m2)**
	Post-development (East WWTP)				
	14 x UNIT ROOF	1400.0	100%	1400	0
	TREATMENT PLANT	880.0	100%	880	0
	EXISTING PERV TO REMAIN	5520.0	0%	0	5520
	TOTAL CATCHMENT	**6400.0**	**36%**	**2280**	**5520**
	1. INDUSTRIAL EAST	Catchment Area (m2)	Imperviousness (%)	Impervious Area (m2)	Perv Area (m2)
5. SW 360 (Water Quality for Road)	Road	2925.0	80%	2340	585
	2. Work & Live	Catchment Area (m2)	Imperviousness (%)	Impervious Area (m2)	Perv Area (m2)
	Road	6500.0	0%	0	6500

MCKENZIE & CO.

HEC-HMS MODEL FOR PRE VS POST DEVELOPMENT CATCHMENT

Project Name:	SURFPARK STAGE 2 – INDUSTRIAL EAST	Modelling:	HEC-HMS v 4.12				
Project No:	3325-2	Product Name:	ROSSTANK				
Local Authority:	Auckland City Council	Tank No:	INDUSTRIAL EAST				
Design Storm:	2YR, 10 YR, AND 100 YR	Designed By:	AL	Date:	7/11/25	Rev:	A
Rainfall Information:	TP108 24H Design Storm with Climate Change	Checked By:	SL	Date:	7/11/25		

HEC-HMS PRE & POST DIAGRAM



HEC-HMS PRE & POST DIAGRAM

Global Summary Results for Run "2 yr"

Project: INDUSTRIAL EAST Simulation Run: 2 yr

Start of Run: 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS
End of Run: 12Dec2003, 00:00 Meteorologic Model: 1 in 2 YR
Compute Time: 24Oct2025, 13:39:30 Control Specifications: Control 1

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Alphabetic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
1 PRE HARDSTAND ...	0.00000	0.00000	11 December 2003, ...	0.00001
1 PRE PERV	0.02030	0.15527	11 December 2003, ...	0.76480
1 PRE ROOF	0.00000	0.00002	11 December 2003, ...	0.00008
1 PRE-DEVELOPMENT	0.02030	0.15529	11 December 2003, ...	0.76489
2 Post Hardstand(u...	0.00234	0.03614	11 December 2003, ...	0.19845
2 Post Perv(undetai...	0.00115	0.01779	11 December 2003, ...	0.09771
2 Post Roof(undetai...	0.01681	0.25957	11 December 2003, ...	1.42536
2 POST-DEV (UNDE...	0.02030	0.31350	11 December 2003, ...	1.72152
3 Aboveground Tank	0.01681	0.11997	11 December 2003, ...	1.42484
3 Post Perv	0.00115	0.00881	11 December 2003, ...	0.04341
3 Post Road and Ha...	0.00234	0.03614	11 December 2003, ...	0.19845
3 Post Roof	0.01681	0.25957	11 December 2003, ...	1.42536
3 POST-DEVELOPM...	0.02030	0.15222	11 December 2003, ...	1.66669

Pre-Development Q2 155.29 l/sec

Post-Development Q2 155.22 l/sec

HEC-HMS MODEL FOR PRE VS POST DEVELOPMENT CATCHMENT

Project Name:	SURFPARK STAGE 2 - INDUSTRIAL EAST	Modelling:	HEC-HMS v 4.12				
Project No:	3325-2	Product Name:	ROSSTANK				
Local Authority:	Auckland City Council	Tank No:	INDUSTRIAL EAST				
Design Storm:	2YR, 10 YR, AND 100 YR	Designed By:	AL	Date:	7/11/25	Rev:	A
Rainfall Information:	TP108 24H Design Storm with Climate Change	Checked By:	SL	Date:	7/11/25		

Global Summary Results for Run "10 yr"

Project: INDUSTRIAL EAST Simulation Run: 10 yr

Start of Run: 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS
End of Run: 12Dec2003, 00:00 Meteorologic Model: 1 in 10 YR
Compute Time: 24Oct2025, 13:39:24 Control Specifications: Control 1

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Alphabetic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
1 PRE HARDSTAND ...	0.00000	0.00000	11 December 2003, ...	0.00001
1 PRE PERV	0.02030	0.29665	11 December 2003, ...	1.44209
1 PRE ROOF	0.00000	0.00002	11 December 2003, ...	0.00013
1 PRE-DEVELOPMENT	0.02030	0.29667	11 December 2003, ...	1.44223
2 Post Hardstand(u...	0.00234	0.05442	11 December 2003, ...	0.29884
2 Post Perv(undetai...	0.00115	0.02679	11 December 2003, ...	0.14713
2 Post Roof(undetai...	0.01681	0.39088	11 December 2003, ...	2.14642
2 POST-DEV (UNDE...	0.02030	0.47210	11 December 2003, ...	2.59239
3 Aboveground Tank	0.01681	0.21679	11 December 2003, ...	2.14535
3 Post Perv	0.00115	0.01684	11 December 2003, ...	0.08185
3 Post Road and Ha...	0.00234	0.05442	11 December 2003, ...	0.29884
3 Post Roof	0.01681	0.39088	11 December 2003, ...	2.14642
3 POST-DEVELOPM...	0.02030	0.26610	11 December 2003, ...	2.52604

Pre-Development Q10 296.67 l/sec

Post-Development Q10 266.10 l/sec

Global Summary Results for Run "100 yr"

Project: INDUSTRIAL EAST Simulation Run: 100 yr

Start of Run: 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS
End of Run: 12Dec2003, 00:00 Meteorologic Model: 1 in 100 YR
Compute Time: 24Oct2025, 13:39:18 Control Specifications: Control 1

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Alphabetic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
1 PRE HARDSTAND ...	0.00000	0.00000	11 December 2003, ...	0.00002
1 PRE PERV	0.02030	0.54749	11 December 2003, ...	2.52809
1 PRE ROOF	0.00000	0.00004	11 December 2003, ...	0.00019
1 PRE-DEVELOPMENT	0.02030	0.54753	11 December 2003, ...	2.52829
2 Post Hardstand(u...	0.00234	0.08489	11 December 2003, ...	0.44393
2 Post Perv(undetai...	0.00115	0.04179	11 December 2003, ...	0.21857
2 Post Roof(undetai...	0.01681	0.60969	11 December 2003, ...	3.18852
2 POST-DEV (UNDE...	0.02030	0.73636	11 December 2003, ...	3.85102
3 Aboveground Tank	0.01681	0.42703	11 December 2003, ...	3.18637
3 Post Perv	0.00115	0.03107	11 December 2003, ...	0.14349
3 Post Road and Ha...	0.00234	0.08489	11 December 2003, ...	0.44393
3 Post Roof	0.01681	0.60969	11 December 2003, ...	3.18852
3 POST-DEVELOPM...	0.02030	0.51788	11 December 2003, ...	3.77378

Pre-Development Q100 547.53 l/sec

Post-Development Q100 517.88 l/sec

PRELIMINARY ASSESSMENT SUMMARY

As per Auckland City Council design requirements, stormwater mitigation is required to reduce the post development peak flow rate from the site to less than or equal to pre-development levels for the 2Yr, 10 Yr, And 100 Yr Storm Event. The proposed mitigation provided by the development has been calculated using HEC-HMS v 4.12. Refer to the following detention tank design requirements to achieve the desired mitigation scenario.

MCKENZIE & CO.

DETENTION TANK CALCULATIONS FOR INDUSTRIAL EAST - ROSSTANK

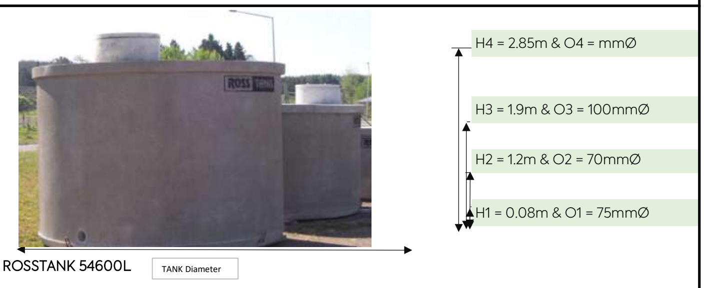
Project Name:	SURFPARK STAGE 2 - INDUSTRIAL EAST	Modelling:	HEC-HMS v 4.12				
Project No:	3325-2	Product Name:	ROSSTANK				
Local Authority:	Auckland City Council	Tank No:	INDUSTRIAL EAST				
Design Storm:	2-YR, 10-YR, 100-YR	Designed By:	AL	Date:	7/11/25	Rev:	A
Rainfall Information:	HIRDS NIWA, OR REGIONAL CODE OF PRACTICE	Checked By:	SL	Date:	7/11/25		

INDUSTRIAL EAST - DETENTION TANK DIMENSIONS FOR THE 2-YR, 10-YR, 100-YR DESIGN STORM

Tank Inflow/Outflow Geometry

Tank Diameter	5.1	m				
Tank Heigth	2.85	m				
O1 (Orifice Diameter)	75.00	mm	A1 (Orifice	0.04418	No. Barrels	1
O2 (Orifice Diameter)	70.00	mm	A2 (Orifice	0.03848	No. Barrels	1
O3 (Orifice Diameter)	100.00	mm	A3 (Orifice	0.07854	No. Barrels	1
H1 (Orifice Height)	0.08	m				
H2 (Orifice Height)	1.20	m				
H3 (Orifice Height)	1.90	m				
Min Tank Volume Require	54,600	L				

Tank Specifications



ROSSTANK 54600L

Dimensions = 5.1Ø x 2.85H

TANK OUTFLOW RESULTS FOR ROSSTANK

PROPOSED OUTFLOW RESULTS FOR A SINGLE TANK — INDUSTRIAL EAST

Elevation	Volume Storage	Total Storage
0	0.00000	0.00000
0.1	0.00192	0.01916
0.2	0.00383	0.03832
0.3	0.00575	0.05747
0.4	0.00766	0.07663
0.5	0.00958	0.09579
0.6	0.01149	0.11495
0.7	0.01341	0.13411
0.8	0.01533	0.15326
0.9	0.01724	0.17242
1	0.01916	0.19158
1.1	0.02107	0.21074
1.2	0.02299	0.22989
1.3	0.02491	0.24905
1.4	0.02682	0.26821
1.5	0.02874	0.28737
1.6	0.03065	0.30653
1.7	0.03257	0.32568
1.8	0.03448	0.34484
1.9	0.03640	0.36400
2	0.03832	0.38316
2.1	0.04023	0.40232
2.2	0.04215	0.42147
2.3	0.04406	0.44063
2.4	0.04598	0.45979
2.5	0.04789	0.47895
2.6	0.04981	0.49811
2.7	0.05173	0.51726
2.85	0.05460	0.54600

DETENTION TANK CALCULATIONS FOR INDUSTRIAL EAST – ROSSTANK

Project Name:	SURFPARK STAGE 2 – INDUSTRIAL EAST	Modelling:	HEC-HMS v 4.12				
Project No:	3325-2	Product Name:	ROSSTANK				
Local Authority:	Auckland City Council	Tank No:	INDUSTRIAL EAST				
Design Storm:	2-YR, 10-YR, 100-YR	Designed By:	AL	Date:	7/11/25	Rev:	A
Rainfall Information:	HIRDS NIWA, OR REGIONAL CODE OF PRACTICE	Checked By:	SL	Date:	7/11/25		

INDUSTRIAL EAST – HEC-HMS MODEL RESULTS

Summary of 2yr Storm (2.1 degree climate change)

Summary Results for Reservoir "3 Aboveground Tank"

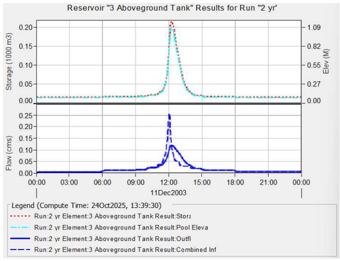
Project: INDUSTRIAL EAST Simulation Run: 2 yr
Reservoir: 3 Aboveground Tank

Start of Run: 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS
End of Run: 12Dec2003, 00:00 Meteorologic Model: 1 in 2 YR
Compute Time: 24Oct2025, 13:39:30 Control Specifications: Control 1

Volume Units: MM 1000 M3

Computed Results

Peak Inflow: 0.25957 (M3/S) Date/Time of Peak Inflow: 11Dec2003, 12:02
Peak Discharge: 0.11997 (M3/S) Date/Time of Peak Discharge: 11Dec2003, 12:15
Inflow Volume: 1.42536 (1000 M3) Peak Storage: 0.21648 (1000 M3)
Discharge Volume: 1.42484 (1000 M3) Peak Elevation: 1.09 (M)



Summary of 10yr Storm (2.1 degree climate change)

Summary Results for Reservoir "3 Aboveground Tank"

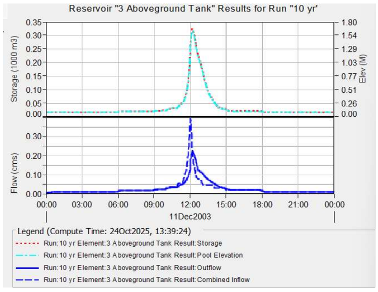
Project: INDUSTRIAL EAST Simulation Run: 10 yr
Reservoir: 3 Aboveground Tank

Start of Run: 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS
End of Run: 12Dec2003, 00:00 Meteorologic Model: 1 in 10 YR
Compute Time: 24Oct2025, 13:39:24 Control Specifications: Control 1

Volume Units: MM 1000 M3

Computed Results

Peak Inflow: 0.39088 (M3/S) Date/Time of Peak Inflow: 11Dec2003, 12:02
Peak Discharge: 0.21679 (M3/S) Date/Time of Peak Discharge: 11Dec2003, 12:12
Inflow Volume: 2.14642 (1000 M3) Peak Storage: 0.32367 (1000 M3)
Discharge Volume: 2.14535 (1000 M3) Peak Elevation: 1.63 (M)



Summary of 100yr Storm (3.8-degree climate change)

Summary Results for Reservoir "3 Aboveground Tank"

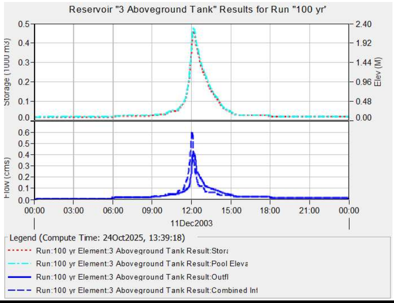
Project: INDUSTRIAL EAST Simulation Run: 100 yr
Reservoir: 3 Aboveground Tank

Start of Run: 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS
End of Run: 12Dec2003, 00:00 Meteorologic Model: 1 in 100 YR
Compute Time: 24Oct2025, 13:39:18 Control Specifications: Control 1

Volume Units: MM 1000 M3

Computed Results

Peak Inflow: 0.60969 (M3/S) Date/Time of Peak Inflow: 11Dec2003, 12:02
Peak Discharge: 0.42703 (M3/S) Date/Time of Peak Discharge: 11Dec2003, 12:09
Inflow Volume: 3.18852 (1000 M3) Peak Storage: 0.46132 (1000 M3)
Discharge Volume: 3.18637 (1000 M3) Peak Elevation: 2.32 (M)



Results output from HEC-HMS v 4.12

Summary of 2yr Storm (2.1 degree climate change)

Results per tank		Tank Volume =	54600L	Peak Volume =	21.60 m^3	Peak Inflow =	25.90 l/s	Peak discharge =	11.99 l/s
Total Lots	10	Tot. Tank Volume =	546000L	Tot. Peak Volume =	216.00 m^3	Tot. Peak Inflow =	259.00 l/s	Tot. Peak discharge =	119.90 l/s

Summary of 10yr Storm (2.1 degree climate change)

Results per tank		Tank Volume =	54600L	Peak Volume =	32.30 m^3	Peak Inflow =	39.00 l/s	Peak discharge =	21.67 l/s
Total Lots	10	Tot. Tank Volume =	546000L	Tot. Peak Volume =	323.00 m^3	Tot. Peak Inflow =	390.00 l/s	Tot. Peak discharge =	216.70 l/s

Summary of 100yr Storm (3.8-degree climate change)

Results per tank		Tank Volume =	54600L	Peak Volume =	46.10 m^3	Peak Inflow =	60.90 l/s	Peak discharge =	42.70 l/s
Total Lots	10	Tot. Tank Volume =	546000L	Tot. Peak Volume =	461.00 m^3	Tot. Peak Inflow =	609.00 l/s	Tot. Peak discharge =	427.00 l/s

INDUSTRIAL EAST – DETENTION TANK ASSESSMENT SUMMARY

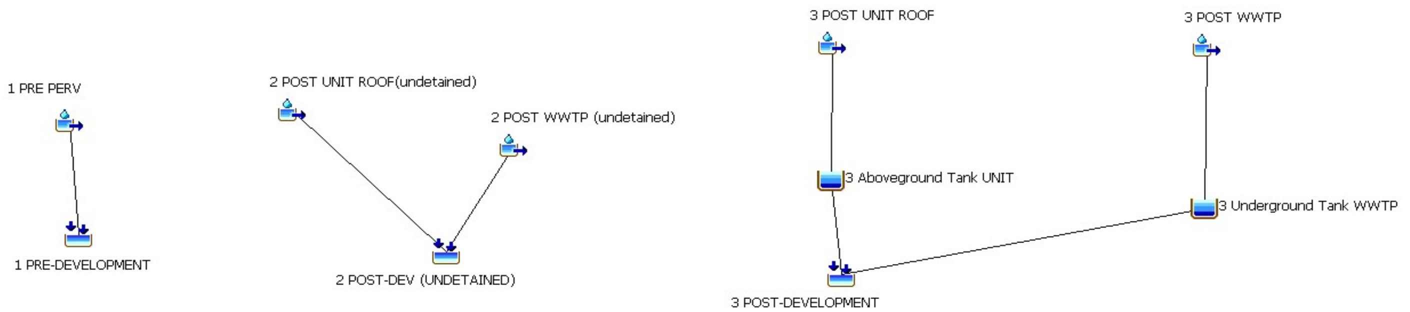
The preliminary assessment indicates that in order to mitigate peak flow runoff for the 2-YR, 10-YR, 100-YR design storm. 10X 54600L above ground tank with 1 x 75 mm, 1 x70 mm, 1x 100 mmØ orifice control on the outlet is required. The proposed mitigation concept will reduce post development peak flow rate from 609l/s to 427l/s for 2yr storms, 390l/s to 216.7l/s for 10 yr storms, 259l/s to 119.9l/s for 100 yr stoems which is less than the pre-development levels previously seen during the 2-YR, 10-YR, 100-YR storm event.

MCKENZIE & CO.

HEC-HMS MODEL FOR PRE VS POST DEVELOPMENT CATCHMENT

Project Name:	SURFPARK STAGE 2 - LIVE WORK	Modelling:	HEC-HMS v 4.12				
Project No:	3325-2	Product Name:	Tanksalot®: Slimline corrugated Raintank & Hynds Concrete Retention Tank with Mul-T-Level™ Outlet				
Local Authority:	Auckland City Council	Tank No:	LIVE WORK PRECINCT				
Design Storm:	2yr, 10yr & 100yr	Designed By:	AL	Date:	7/11/25	Rev:	A
Rainfall Information:	TP108 24H Design Storm with Climate Change	Checked By:	SL	Date:	1/01/00		

HEC-HMS PRE & POST DIAGRAM



HEC-HMS PRE & POST DIAGRAM

2 - YEAR HEC-HMS RESULTS SUMMARY

Global Summary Results for Run "2 YR"

Project: LIVEWORK WWTP Simulation Run: 2 YR

Start of Run: 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS - WEST
End of Run: 12Dec2003, 00:00 Meteorologic Model: 2 YR 2.1 CC
Compute Time: 06Nov2025, 14:25:40 Control Specifications: Control 1

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Alphabetic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
1 PRE PERV	0.00355	0.01581	11 December 2003, ...	0.09330
1 PRE-DEVELOPMENT	0.00355	0.01581	11 December 2003, ...	0.09330
2 POST UNIT ROO...	0.00110	0.01253	11 December 2003, ...	0.09289
2 POST WWTP (un...	0.00245	0.02792	11 December 2003, ...	0.20689
2 POST-DEV (UNDE...	0.00355	0.04045	11 December 2003, ...	0.29979
3 Aboveground Tan...	0.00110	0.00996	11 December 2003, ...	0.09292
3 POST UNIT ROOF	0.00110	0.01253	11 December 2003, ...	0.09289
3 POST WWTP	0.00245	0.02792	11 December 2003, ...	0.20689
3 POST-DEVELOPM...	0.00355	0.01538	11 December 2003, ...	0.29913
3 Underground Tank...	0.00245	0.00584	11 December 2003, ...	0.20621

Pre-Development Q_2 15.81 L/s

Post-Development Q_2 15.38 L/s

HEC-HMS MODEL FOR PRE VS POST DEVELOPMENT CATCHMENT

Project Name:	SURFPARK STAGE 2 - LIVE WORK	Modelling:	HEC-HMS v 4.12				
Project No:	3325-2	Product Name:	Tanksalot®: Slimline corrugated Raintank & Hynds Concrete Retention Tank with Mul-T-Level™ Outlet				
Local Authority:	Auckland City Council	Tank No:	LIVE WORK PRECINCT				
Design Storm:	2yr, 10yr & 100yr	Designed By:	AL	Date:	7/11/25	Rev:	A
Rainfall Information:	TP108 24H Design Storm with Climate Change	Checked By:	SL	Date:	1/01/00		

10 - YEAR HEC-HMS RESULTS SUMMARY

Global Summary Results for Run "10 YR"

Project: LIVEWORK WWTP   Simulation Run: 10 YR

Start of Run: 11Dec2003, 00:00   Basin Model: STORMWATER ANALYSIS - WEST
End of Run: 12Dec2003, 00:00   Meteorologic Model: 10 YR 2.1 CC
Compute Time: 06Nov2025, 14:25:50   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: ○ MM ● 1000 M3   Sorting: Alphabetic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
1 PRE PERV	0.00355	0.03266	11 December 2003, ...	0.18740
1 PRE-DEVELOPMENT	0.00355	0.03266	11 December 2003, ...	0.18740
2 POST UNIT ROO...	0.00110	0.01888	11 December 2003, ...	0.14001
2 POST WWTP (un...	0.00245	0.04206	11 December 2003, ...	0.31185
2 POST-DEV (UNDE...	0.00355	0.06094	11 December 2003, ...	0.45186
3 Aboveground Tan...	0.00110	0.01402	11 December 2003, ...	0.13974
3 POST UNIT ROOF	0.00110	0.01888	11 December 2003, ...	0.14001
3 POST WWTP	0.00245	0.04206	11 December 2003, ...	0.31185
3 POST-DEVELOPM...	0.00355	0.02981	11 December 2003, ...	0.45014
3 Underground Tank..	0.00245	0.01690	11 December 2003, ...	0.31040

Pre-Development Q_{10} 32.66 L/s

Post-Development Q_{10} 29.81 L/s

100 - YEAR HEC-HMS RESULTS SUMMARY

Global Summary Results for Run "100 YR"

Project: LIVEWORK WWTP   Simulation Run: 100 YR

Start of Run: 11Dec2003, 00:00   Basin Model: STORMWATER ANALYSIS - WEST
End of Run: 12Dec2003, 00:00   Meteorologic Model: 100 YR 3.8 CC
Compute Time: 06Nov2025, 14:25:45   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: ○ MM ● 1000 M3   Sorting: Alphabetic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
1 PRE PERV	0.00355	0.06513	11 December 2003, ...	0.34886
1 PRE-DEVELOPMENT	0.00355	0.06513	11 December 2003, ...	0.34886
2 POST UNIT ROO...	0.00110	0.02946	11 December 2003, ...	0.20816
2 POST WWTP (un...	0.00245	0.06561	11 December 2003, ...	0.46363
2 POST-DEV (UNDE...	0.00355	0.09506	11 December 2003, ...	0.67180
3 Aboveground Tan...	0.00110	0.02084	11 December 2003, ...	0.20820
3 POST UNIT ROOF	0.00110	0.02946	11 December 2003, ...	0.20816
3 POST WWTP	0.00245	0.06561	11 December 2003, ...	0.46363
3 POST-DEVELOPM...	0.00355	0.06305	11 December 2003, ...	0.66210
3 Underground Tank..	0.00245	0.04222	11 December 2003, ...	0.45390

Pre-Development Q_{100} 65.13 L/s

Post-Development Q_{100} 63.05 L/s

PRELIMINARY ASSESSMENT SUMMARY

As per Auckland City Council design requirements, stormwater mitigation is required to reduce the post development peak flow rate from the site to less than or equal to pre-development levels for the 2Yr, 10Yr & 100Yr Storm Event. The proposed mitigation provided by the development has been calculated using HEC-HMS v 4.12. Refer to the following detention tank design requirements to achieve the desired mitigation scenario.

MCKENZIE & CO.

DETENTION TANK CALCULATIONS FOR LIVE WORK PRECINCT - 11 X UNIT - TANKSALOT®: SLIMLINE CORRUGATED RAINTANK

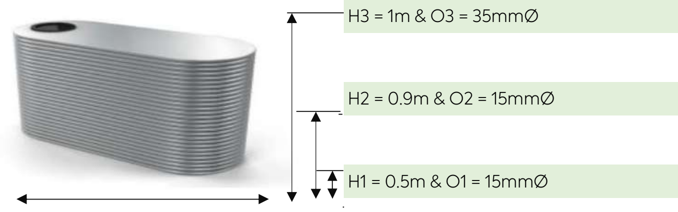
Project Name:	SURFPARK STAGE 2 - LIVE WORK	Modelling:	HEC-HMS v 4.12
Project No:	3325-2	Product Name:	Tanksalot®: Slimline corrugated Raintank
Local Authority:	Auckland City Council	Tank No:	Live Work Precinct - 11 X unit
Design Storm:	2-YR & 10-YR &100 YR	Designed By:	AL Date: 7/11/25 Rev: A
Rainfall Information:	HIRDS NIWA, OR REGIONAL CODE OF PRACTICE	Checked By:	SL Date: 7/11/25 PAGE NO: 1

LIVE WORK PRECINCT - 11 X UNIT - DETENTION TANK DIMENSIONS FOR THE 2-YR & 10-YR &100 YR DESIGN STORM

Tank Inflow/Outflow Geometry

	Tank Length	3.7	m	Tank Heigh	1.02	m
	Tank Width	1.15	m			
2yr	O1 (Orifice Diameter)	0.015	m	A1 m2	0.00194	
10yr	O2 (Orifice Diameter)	0.015	m	A2 m2	0.00194	
	O3 (Orifice Diameter)	0.035	m	A3 m2	0.01059	
	H1 (Orifice Height)	0.50	m		0.02139	
	H2 (Orifice Height)	0.90	m		0.02139	
	H3 (Orifice Height)	1.00	m		0.1165	
	Min Tank Volume Required	4,000	L			

Tank Specifications



Tanksalot®: Slimline corrugated Raintank 4000L

Dimensions = 3.7L x 1.15W x 1.02H

TANK OUTFLOW RESULTS FOR TANKSALOT®: SLIMLINE CORRUGATED RAINTANK

PROPOSED OUTFLOW RESULTS FOR A SINGLE TANK — **Live Work Precinct - 11 X unit**

H1 (m) Elevation	Volume Storage	Total Storage
0	0.00000	0.00000
0.1	0.00043	0.00468
0.2	0.00085	0.00936
0.3	0.00128	0.01404
0.4	0.00170	0.01872
0.5	0.00213	0.02340
0.6	0.00255	0.02808
0.7	0.00298	0.03276
0.8	0.00340	0.03744
0.9	0.00383	0.04212
1	0.00426	0.04681
1.1	0.00468	0.05149

DETENTION TANK CALCULATIONS FOR LIVE WORK PRECINCT – 11 X UNIT – TANKSALOT®: SLIMLINE CORRUGATED RAINTANK

Project Name:	SURFPARK STAGE 2 – LIVE WORK	Modelling:	HEC-HMS v 4.12				
Project No:	3325-2	Product Name:	Tanksalot®: Slimline corrugated Raintank				
Local Authority:	Auckland City Council	Tank No:	Live Work Precinct – 11 X unit				
Design Storm:	2-YR & 10-YR &100 YR	Designed By:	AL	Date:	7/11/25	Rev:	A
Rainfall Information:	HIRDS NIWA, OR REGIONAL CODE OF PRACTICE	Checked By:	SL	Date:	7/11/25	PAGE NO:	1

LIVE WORK PRECINCT – 11 X UNIT – HEC-HMS MODEL RESULTS

Summary of 2yr Storm

Summary Results for Reservoir "3 Aboveground Tank UNIT"

Project: LIVEWORK WWTP Simulation Run: 2 YR
Reservoir: 3 Aboveground Tank UNIT

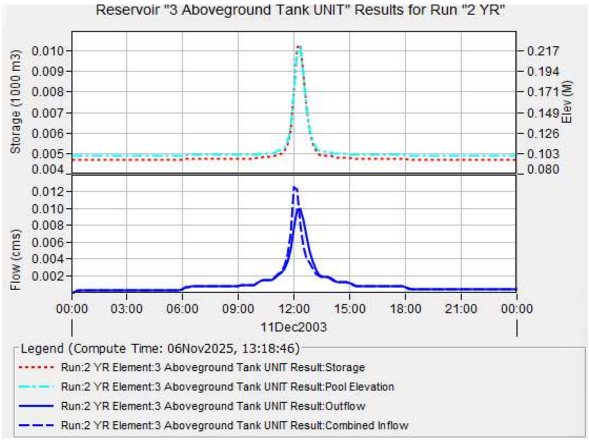
Start of ... 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS - WE!
End of ... 12Dec2003, 00:00 Meteorologic Model: 2 YR 2.1 CC
Compute ... 06Nov2025, 13:18:46 Control Specifications: Control 1

Volume Units: MM 1000 M3

Computed Results

Peak Inflow:	0.01253 (M3/S)	Date/Time of Peak Inflow:	11Dec2003, 12:00
Peak Discharge:	0.00996 (M3/S)	Date/Time of Peak Discharge:	11Dec2003, 12:20
Inflow Volume:	0.09289 (1000 M3)	Peak Storage:	0.01034 (1000 M3)
Discharge Volume:	0.09292 (1000 M3)	Peak Elevation:	0.22 (M)

Graph Output of 2yr Storm



Results per tank	Tank Volume =	1.15m	Peak Volume =	0.94 m^3	Peak Inflow =	1.14 l/s	Peak discharge =	0.91 l/s
Total Lots 11	Tot. Tank Volume =	12.65L	Tot. Peak Volume =	10.34 m^3	Tot. Peak Inflow =	12.53 l/s	Tot. Peak discharge =	9.96 l/s

Summary of 10yr Storm

Summary Results for Reservoir "3 Aboveground Tank UNIT"

Project: LIVEWORK WWTP Simulation Run: 10 YR
Reservoir: 3 Aboveground Tank UNIT

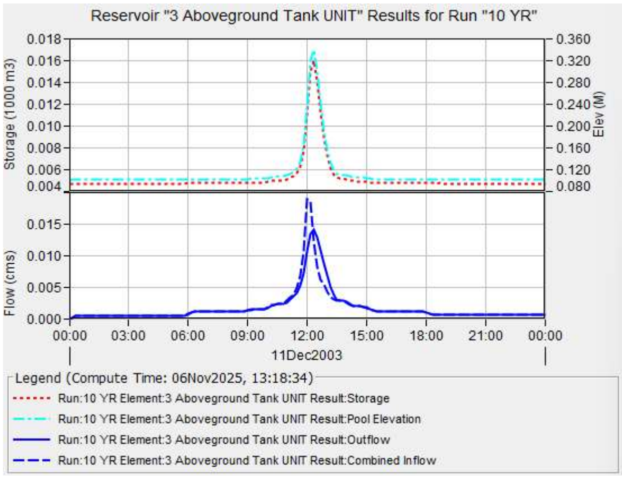
Start of ... 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS - WE!
End of ... 12Dec2003, 00:00 Meteorologic Model: 10 YR 2.1 CC
Compute ... 06Nov2025, 13:18:34 Control Specifications: Control 1

Volume Units: MM 1000 M3

Computed Results

Peak Inflow:	0.01888 (M3/S)	Date/Time of Peak Inflow:	11Dec2003, 12:00
Peak Discharge:	0.01402 (M3/S)	Date/Time of Peak Discharge:	11Dec2003, 12:20
Inflow Volume:	0.14001 (1000 M3)	Peak Storage:	0.01590 (1000 M3)
Discharge Volume:	0.13974 (1000 M3)	Peak Elevation:	0.34 (M)

Graph Output of 10yr Storm

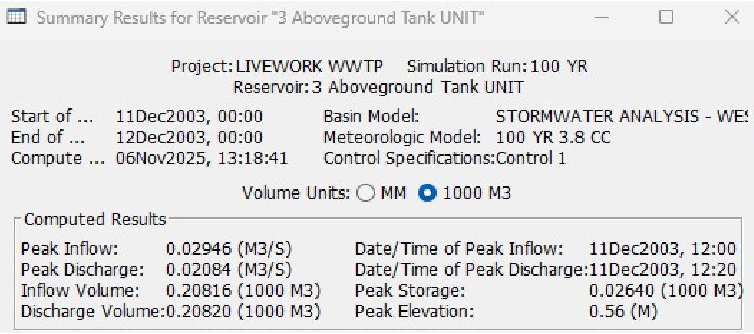


Results per tank	Tank Volume =	0.015m	Peak Volume =	1.45 m^3	Peak Inflow =	1.72 l/s	Peak discharge =	1.27 l/s
Total Lots 11	Tot. Tank Volume =	0.165L	Tot. Peak Volume =	15.90 m^3	Tot. Peak Inflow =	18.88 l/s	Tot. Peak discharge =	14.02 l/s

DETENTION TANK CALCULATIONS FOR LIVE WORK PRECINCT – 11 X UNIT – TANKSALOT®: SLIMLINE CORRUGATED RAINTANK

Project Name:	SURFPARK STAGE 2 – LIVE WORK	Modelling:	HEC-HMS v 4.12				
Project No:	3325-2	Product Name:	Tanksalot®: Slimline corrugated Raintank				
Local Authority:	Auckland City Council	Tank No:	Live Work Precinct – 11 X unit				
Design Storm:	2-YR & 10-YR &100 YR	Designed By:	AL	Date:	7/11/25	Rev:	A
Rainfall Information:	HIRDS NIWA, OR REGIONAL CODE OF PRACTICE	Checked By:	SL	Date:	7/11/25	PAGE NO:	1

Summary of 100yr Storm


Summary Results for Reservoir "3 Aboveground Tank UNIT"

Project: LIVEWORK WWTP Simulation Run: 100 YR
Reservoir: 3 Aboveground Tank UNIT

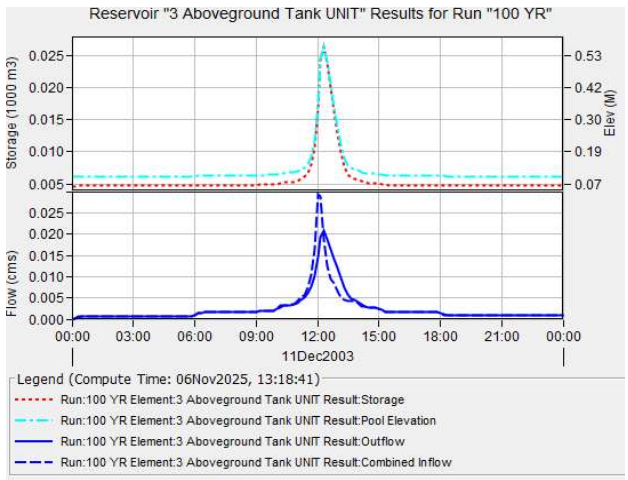
Start of ... 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS - WE!
End of ... 12Dec2003, 00:00 Meteorologic Model: 100 YR 3.8 CC
Compute ... 06Nov2025, 13:18:41 Control Specifications: Control 1

Volume Units: MM 1000 M3

Computed Results

Peak Inflow: 0.02946 (M3/S) Date/Time of Peak Inflow: 11Dec2003, 12:00
Peak Discharge: 0.02084 (M3/S) Date/Time of Peak Discharge: 11Dec2003, 12:20
Inflow Volume: 0.20816 (1000 M3) Peak Storage: 0.02640 (1000 M3)
Discharge Volume: 0.20820 (1000 M3) Peak Elevation: 0.56 (M)

Graph Output of 100yr Storm



Results output from HEC-HMS v 4.12

Results per tank		Tank Volume =	4000L	Peak Volume =	2.40 m³	Peak Inflow =	2.68 l/s	Peak discharge =	1.89 l/s
Total Lots	11	Tot. Tank Volume =	44000L	Tot. Peak Volume =	26.40 m³	Tot. Peak Inflow =	29.46 l/s	Tot. Peak discharge =	20.84 l/s

LIVE WORK PRECINCT – 11 X UNIT – DETENTION TANK ASSESSMENT SUMMARY

The preliminary assessment indicates that in order to mitigate peak flow runoff for the 2-YR & 10-YR &100 YR design storm. A 4000L above ground tank with a 15mmØ orifice control on the outlet is required. The proposed mitigation concept will reduce post development peak flow rate from 29.46l/s to 20.84l/s which is less than the pre-development levels previously seen during the 2-YR & 10-YR &100 YR storm event.

MCKENZIE & CO.

DETENTION TANK CALCULATIONS FOR LIVE WORK PRECINCT - WWTP - HYNDS CONCRETE RETENTION TANK WITH MUL-T-LEVEL™ OUTLET

Project Name:	SURFPARK STAGE 2 - LIVE WORK	Modelling:	HEC-HMS v 4.12				
Project No:	3325-2	Product Name:	Hynds Concrete Retention Tank with Mul-T-Level™ Outlet				
Local Authority:	Auckland City Council	Tank No:	Live Work Precinct - WWTP				
Design Storm:	2yr, 10yr & 100yr	Designed By:	AL	Date:	7/11/25	Rev:	A
Rainfall Information:	TP108 Rainfall Graph with Climate Change Adjustment	Checked By:		Date:			

LIVE WORK PRECINCT - WWTP - DETENTION TANK DIMENSIONS FOR THE 2YR, 10YR & 100YR DESIGN STORM

Tank Inflow/Outflow Geometry

Tank Diameter (Internal)	1.65	m		
No. Barrels	6			
Barrel Effetive Length	2.49	m		
Tank Length	14.952	m		
O1 (Orifice Diameter)	55.00	mm	A1 m2	0.00238
O2 (Orifice Diameter)	100.00	mm	A2 m2	0.00786
O3 (Orifice Diameter)	120.00	mm	A3 m2	0.01131
H1 (Orifice Height)	0.05	m	(2YR)	
H2 (Orifice Height)	0.90	m	(10YR)	
H3 (Orifice Height)	1.15	m	(100YR)	
Min Tank Volume Required	31,971	L		

Tank Specifications

Volume Factor: 1.00

H3 = 1.15m & O3 = 120mmØ

H2 = 0.9m & O2 = 100mmØ

H1 = 0.05m & O1 = 55mmØ

Hynds Cor ROSSTANK

Dimensions = 4.30Ø x 1.82H

TANK OUTFLOW RESULTS FOR HYNDS CONCRETE RETENTION TANK WITH MUL-T-LEVEL™ OUTLET

PROPOSED OUTFLOW RESULTS FOR A SINGLE TANK

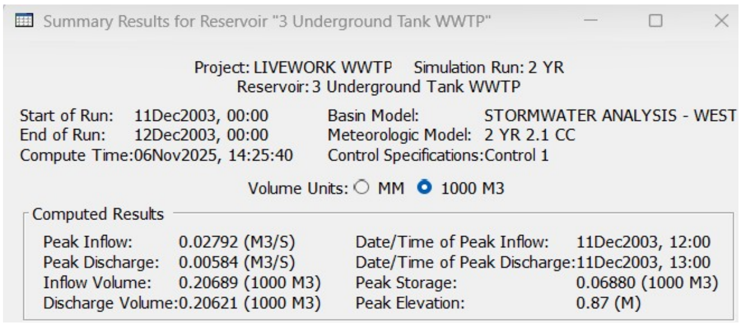
Elevation H1 (m)	Volume Storage (1000 m^3)	Live Work Precinct - WWTP Total Storage (1000 m3)
0	0.00000	0.00000
0.1	0.00079	0.00318
0.2	0.00221	0.00882
0.3	0.00397	0.01588
0.4	0.00598	0.02394
0.5	0.00818	0.03272
0.6	0.01050	0.04202
0.7	0.01291	0.05165
0.8	0.01537	0.06148
0.9	0.01783	0.07133
1	0.02027	0.08108
1.1	0.02264	0.09057
1.2	0.02491	0.09963
1.3	0.02702	0.10808
1.4	0.02892	0.11568
1.5	0.03052	0.12210
1.6	0.03169	0.12675
1.65	0.03197	0.12788

DETENTION TANK CALCULATIONS FOR LIVE WORK PRECINCT – WWTP – HYNDS CONCRETE RETENTION TANK WITH MUL-T-LEVEL™ OUTLET

Project Name:	SURFPARK STAGE 2 – LIVE WORK	Modelling:	HEC-HMS v 4.12				
Project No:	3325-2	Product Name:	Hynds Concrete Retention Tank with Mul-T-Level™ Outlet				
Local Authority:	Auckland City Council	Tank No:	Live Work Precinct – WWTP				
Design Storm:	2yr, 10yr & 100yr	Designed By:	AL	Date:	7/11/25	Rev:	A
Rainfall Information:	TP108 Rainfall Graph with Climate Change Adjustment	Checked By:		Date:			

LIVE WORK PRECINCT – WWTP – HEC-HMS MODEL RESULTS

Summary of 2yr Storm


Summary Results for Reservoir "3 Underground Tank WWTP"

Project: LIVEWORK WWTP Simulation Run: 2 YR
Reservoir: 3 Underground Tank WWTP

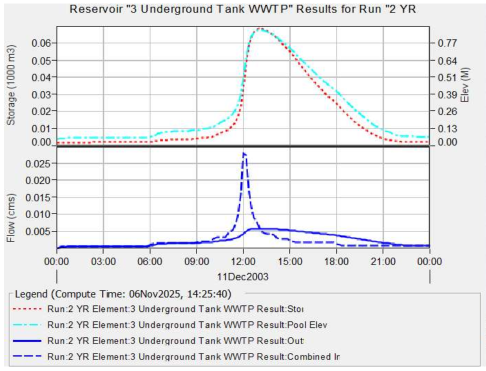
Start of Run: 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS - WEST
End of Run: 12Dec2003, 00:00 Meteorologic Model: 2 YR 2.1 CC
Compute Time: 06Nov2025, 14:25:40 Control Specifications: Control 1

Volume Units: MM 1000 M3

Computed Results

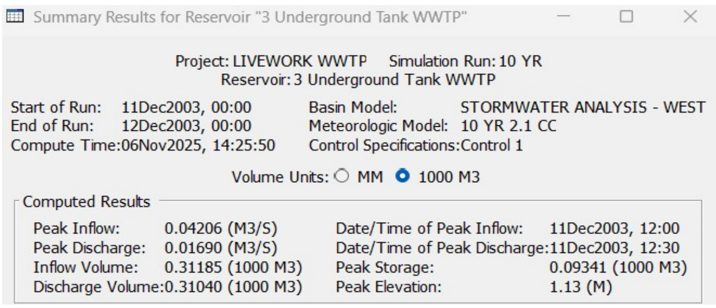
Peak Inflow:	0.02792 (M3/S)	Date/Time of Peak Inflow:	11Dec2003, 12:00
Peak Discharge:	0.00584 (M3/S)	Date/Time of Peak Discharge:	11Dec2003, 13:00
Inflow Volume:	0.20689 (1000 M3)	Peak Storage:	0.06880 (1000 M3)
Discharge Volume:	0.20621 (1000 M3)	Peak Elevation:	0.87 (M)

Graph Output of 2yr Storm



Results per tank		Tank Volume =	31,971	Peak Volume =	17.20 m³	Peak Inflow =	6.975 l/s	Peak discharge =	1.45 l/s
No. of Tanks	4	Tot. Tank Volume =	127,884	Tot. Peak Volume =	68.80 m³	Tot. Peak Inflow =	27.90 l/s	Tot. Peak discharge =	5.80 l/s

Summary of 10yr Storm


Summary Results for Reservoir "3 Underground Tank WWTP"

Project: LIVEWORK WWTP Simulation Run: 10 YR
Reservoir: 3 Underground Tank WWTP

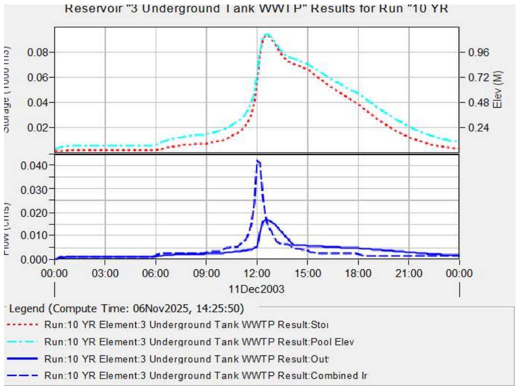
Start of Run: 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS - WEST
End of Run: 12Dec2003, 00:00 Meteorologic Model: 10 YR 2.1 CC
Compute Time: 06Nov2025, 14:25:50 Control Specifications: Control 1

Volume Units: MM 1000 M3

Computed Results

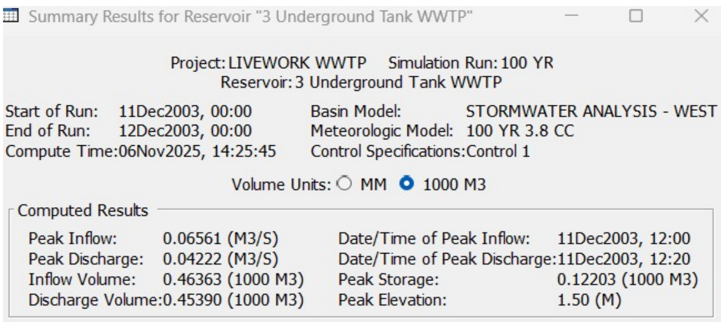
Peak Inflow:	0.04206 (M3/S)	Date/Time of Peak Inflow:	11Dec2003, 12:00
Peak Discharge:	0.01690 (M3/S)	Date/Time of Peak Discharge:	11Dec2003, 12:30
Inflow Volume:	0.31185 (1000 M3)	Peak Storage:	0.09341 (1000 M3)
Discharge Volume:	0.31040 (1000 M3)	Peak Elevation:	1.13 (M)

Graph Output of 10yr Storm



Results per tank		Tank Volume =	31,971	Peak Volume =	23.35 m³	Peak Inflow =	10.52 l/s	Peak discharge =	4.23 l/s
No. of Tanks	4	Tot. Tank Volume =	127,884	Tot. Peak Volume =	93.41 m³	Tot. Peak Inflow =	42.06 l/s	Tot. Peak discharge =	16.90 l/s

Summary of 100yr Storm


Summary Results for Reservoir "3 Underground Tank WWTP"

Project: LIVEWORK WWTP Simulation Run: 100 YR
Reservoir: 3 Underground Tank WWTP

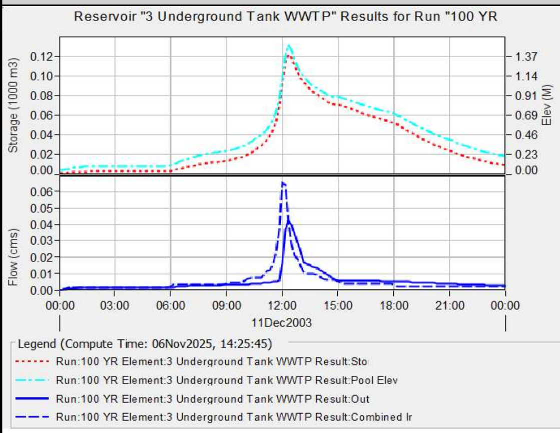
Start of Run: 11Dec2003, 00:00 Basin Model: STORMWATER ANALYSIS - WEST
End of Run: 12Dec2003, 00:00 Meteorologic Model: 100 YR 3.8 CC
Compute Time: 06Nov2025, 14:25:45 Control Specifications: Control 1

Volume Units: MM 1000 M3

Computed Results

Peak Inflow:	0.06561 (M3/S)	Date/Time of Peak Inflow:	11Dec2003, 12:00
Peak Discharge:	0.04222 (M3/S)	Date/Time of Peak Discharge:	11Dec2003, 12:20
Inflow Volume:	0.46363 (1000 M3)	Peak Storage:	0.12203 (1000 M3)
Discharge Volume:	0.45390 (1000 M3)	Peak Elevation:	1.50 (M)

Graph Output of 100yr Storm



Results per tank		Tank Volume =	31,971.1	Peak Volume =	30.51 m³	Peak Inflow =	16.40 l/s	Peak discharge =	10.56 l/s
No. of Tanks	4	Tot. Tank Volume =	127,884	Tot. Peak Volume =	122.03 m³	Tot. Peak Inflow =	65.60 l/s	Tot. Peak discharge =	42.22 l/s

LIVE WORK PRECINCT – WWTP – DETENTION TANK ASSESSMENT SUMMARY

The preliminary assessment indicates that in order to mitigate peak flow runoff for the 2yr, 10yr & 100yr design storm. A 31971.0616657505L above ground tank with a 55mmØ orifice control on the outlet is required. The proposed mitigation concept will reduce post development peak flow rate from 27.9l/s to 5.8l/s which is less than the pre-development levels previously seen during the 2yr, 10yr & 100yr storm event.

NDC - WORK & LIVE AREA 95TH PERCENTILE DETENTION TANK

SMAF 1 Rainfall Calculations (95th percentile)	Revsied by		Revision	1
	Prepared by	AL	Date	7/11/2025
	Reviewed by	SL	Date	7/11/2025

Pre/Post Development Area Assessment

	Existing	Proposed
Pervious (m²)	6400.0	5520.0
Impervious (m²)	0.0	1400.0
Total (m²)	6400.0	6400.0
Percentage Impervious	0.0%	21.9%

SMAF mitigation required for total site impervious area

	SMAF Area	
New Impervious (m²)	1400.0	*SMAF considers all new and redeveloped area

TP108 Analysis for Runoff Depth

	Existing	Proposed	
Curve Number	61.0	98.0	
Initial Abstraction, Ia (mm)	5	0	
Catchment Storage, S (mm)	162.39	5.18	
SMAF 1 (95th) , 24hr Rainfall Depth (mm)	**36.5**	**42.5**	(2.1-degree CC)
Runoff Depth, Q24 (mm)	5.12	37.87	

Retention Volume Requirement

Retention Depth (mm)	5.0
Retention Volume for New Impervious area(m^3)	**7.00**

Detention Volume Requirement

Pre development Runoff Volume (m^3)	7.16			
Post- Development Runoff Volume (m^3)	53.01			
Post- Pre Development Runoff Volume (m^3)	45.85			
Detention Volume Total (m^3)	**38.85**	m3	**2775**	L/ Lot
No. of Lot	14.0			

Detention Tank Dimensions

Tank Type	1	X TanksALot 3,000L
Tank Size (m^3)		3.0
Tank length (m)		2.10
Tank Width (m)		1.10
Tank Height (m)		1.48

Detention Parameters

Detention Volume Height(m)	1.201	(measured from tank top)

Detention Tank Outlet Sizing

Average 24 Hour Release Rate (L/s)	0.45
Peak 24 Hour Release Rate (L/s)	0.90
Tank Outlet Head (m)	1.201
Peak Outflow Velocity Formula	$0.62(2gH)^{1/2}$
Peak Outflow Velocity (m/s)	3.01
Orifice Area (mm^2)	298.76
Orifice Diameter (mm)	**19.50**
Orifice Diameter (mm)*	**20.00**

Notes:

* Minimum orifice diameter for tank outlet is 10mm or round up to nearest mm

NDC - WORK & LIVE AREA 95TH PERCENTILE DETENTION TANK

SMAF 1 Rainfall Calculations (95th percentile)

Revsied by		Revision	1
Prepared by	AL	Date	7/11/2025
Reviewed by	SL	Date	7/11/2025

Pre/Post Development Area Assessment

	Existing	Proposed
Pervious (m²)	6400.0	5520.0
Impervious (m²)	0.0	880.0
Total (m²)	6400.0	6400.0
Percentage Impervious	0.0%	13.8%

SMAF mitigation required for total site impervious area

	SMAF Area	
New Impervious (m²)	880.0	*SMAF considers all new and redeveloped area

TP108 Analysis for Runoff Depth

	Existing	Proposed	
Curve Number	61.0	98.0	
Initial Abstraction, Ia (mm)	5	0	
Catchment Storage, S (mm)	162.39	5.18	
SMAF 1 (95th) , 24hr Rainfall Depth (mm)	**36.5**	**42.5**	(2.1-degree CC)
Runoff Depth, Q24 (mm)	5.12	37.87	

Retention Volume Requirement

Retention Depth (mm)	5.0
Retention Volume for New Impervious area(m^3)	**4.40**

Detention Volume Requirement

Pre development Runoff Volume (m^3)	4.50			
Post- Development Runoff Volume (m^3)	33.32			
Post- Pre Development Runoff Volume (m^3)	28.82			
Detention Volume Total (m^3)	**24.42**	m3	**24419**	L/ Lot
No. of Lot	1.0			

Detention Tank Dimensions

Tank Type	1	X Promax 30,000L
Tank Size (m^3)	30.0	
Tank Diameter (m)	1.90	
Tank Height (m)	1.90	

Detention Parameters

Detention Volume Height(m)	1.400	(measured from tank top)

Detention Tank Outlet Sizing

Average 24 Hour Release Rate (L/s)	0.28
Peak 24 Hour Release Rate (L/s)	0.57
Tank Outlet Head (m)	1.400
Peak Outflow Velocity Formula	$0.62(2gH)^{1/2}$
Peak Outflow Velocity (m/s)	3.25
Orifice Area (mm^2)	173.95
Orifice Diameter (mm)	**14.88**
Orifice Diameter (mm)*	**15.00**

Notes:

* Minimum orifice diameter for tank outlet is 10mm or round up to nearest mm

GD01 & TP 108 GRAPHICAL RUNOFF CALCULATION - Wetland 1

PROJECT NAME	Surfpark Stage 2	Created By	AL	Date	7/11/2025
PROJECT Nos:	3325-2	Checked By	SL	Date	7/11/2025

Input

Rainfall Summary

ARI(yr)	90th percentile	95th percentile (From TP108 Cal)
Design rainfall (mm)	29.9	42.5

2.1cc

Total Area- For Detention

	A (m2)		CN	Ia (mm)
Total Catchment	90600			
Pervious	0.44	39653	61	5
Impervious	0.56	50947	98	0

Area Excluding North Future Residential- Treatment

	A (m2)		CN	Ia (mm)
Total Catchment	77500			
Pervious	0.34	26553	61	5
Impervious	0.66	50947	98	0

Total Runoff Volume

$$Q = \frac{(P - Ia)2}{(P - Ia) + S}$$

Q = runoff depth (mm)
P = rainfall depth (mm)
S = potential maximum retention after runoff begins

S = (1000 / CN - 10) 25.4

Output

$Q_{perv.}$	3.32	7.03
$Q_{imperv.}$	25.5	37.9

PWV = 694 m^3 *(Reduced by 50% as stream protection is provided)*

Detention Volume for Stream Protection = 2208 m^3

12D Modeling Output

PWL @	**51.83**	RL	*Manual input from 12d*
95th Percentile Peak Water Level	**52.82**	RL	*Manual input from Hec Hms*
Q 95th	**2503**	m^3	*Manual input from Hec Hms*

Catchment Flow Summary - From HEC-HMS

Global Summary Results for Run "WETLAND 1 95 CC"

Project: HEC HMS Auckland   Simulation Run: WETLAND 1 95 CC

Start of Run: 01Jan2024, 00:00   Basin Model: Wetland 1
End of Run: 02Jan2024, 00:00   Meteorologic Model: 95TH PERCENTILE 2.1D CC
Compute Time: DATA CHANGED, RECOMPUTE   Control Specifications: Control - 24 Hour

Show Elements: All Elements   Volume Units: MM / 1000 M3   Sorting: Alphabetic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
CATCHMENT W1	0.09060	0.55323	1 January 202...	2.98012
POST-DEVELOPMENT SITE W1	0.09060	0.03038	1 January 202...	1.62360
WETLAND 1	0.09060	0.03038	1 January 202...	1.62360

Summary Results for Reservoir "WETLAND 1"

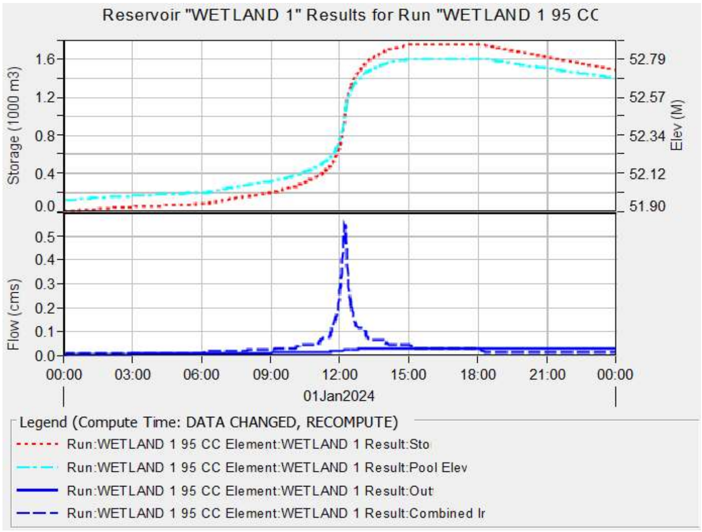
Project: HEC HMS Auckland   Simulation Run: WETLAND 1 95 CC
Reservoir: WETLAND 1

Start o... 01Jan2024, 00:00   Basin Model: Wetland 1
End o... 02Jan2024, 00:00   Meteorologic Model: 95TH PERCENTILE 2.1D
Compute ...DATA CHANGED, RECOMPUTE   Control Specifications: Control - 24 Hour

Volume Units: MM / 1000 M3

Computed Results

Peak Inflow:	0.55323 (M3/S)	Date/Time of Peak Inflow:	01Jan2024, 12:12
Peak Discharge:	0.03038 (M3/S)	Date/Time of Peak Discharge:	01Jan2024, 15:12
Inflow Volume:	2.98012 (1000 M3)	Peak Storage:	2.50266 (1000 M3)
Discharge Volume:	1.62360 (1000 M3)	Peak Elevation:	52.82 (M)



GD01 & TP 108 GRAPHICAL RUNOFF CALCULATION - Wetland 2

PROJECT NAME Surfpark Stage 2 Created By AL Date 7/11/2025
PROJECT Nos: 3325-2 Checked By SL Date 7/11/2025

Input

Rainfall Summary

	90th percentile	95th percentile (From TP108 Cal)	
ARI(yr)			
Design rainfall (mm)	29.9	42.5	2.1cc

Catchment Area

Total Area- For Detention

	A (m2)		CN	Ia (mm)
Total Catchment	67020			
Pervious	0.28	19071	61	5
Impervious	0.72	47949	98	0

Area Excluding Main Car Park- Treatment

	A (m2)		CN	Ia (mm)
Total Catchment	67020			
Pervious	0.28	19071	61	5
Impervious	0.72	47949	98	0

Total Runoff Volume

$$Q = \frac{(P - Ia)2}{(P - Ia) + S}$$

Q = runoff depth (mm)
P = rainfall depth (mm)
S = potential maximum retention after runoff begins

S = (1000 / CN - 10) 25.4

Output

$Q_{perv.}$	3.32	7.03
$Q_{imperv.}$	25.5	37.9

PWV = 643 m^3 *(Reduced by 50% as stream protection is provided)*
Detention Volume for Stream Protection = 1950 m^3

12D Modeling Output

PWL @	**52.10**	RL	*Manual input from 12d*
95th Percentile Peak Water Level	**52.84**	RL	*Manual input from Hec Hms*
Q 95th	**1696**	m^3	*Manual input from Hec Hms*

Catchment Flow Summary - From HEC-HMS

Global Summary Results for Run "WETLAND 2 95 CC"

Project: HEC HMS Auckland   Simulation Run: WETLAND 2 95 CC

Start of Run: 01Jan2024, 00:00   Basin Model: Wetland 2
End of Run: 02Jan2024, 00:00   Meteorologic Model: 95TH PERCENTILE 2.1D CC
Compute Time: DATA CHANGED, RECOMPUTE   Control Specifications: Control - 24 Hour

Show Elements: All Elements   Volume Units: ○ MM ● 1000 M3   Sorting: Alphabetic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
AP OPENSPACE	0.01388	0.01848	1 January 2024, 12:13	0.09720
AP ROADS	0.00214	0.01659	1 January 2024, 12:12	0.09066
AP UNITS	0.00598	0.04640	1 January 2024, 12:12	0.25359
POST-DEVELOPMENT SITE W2	0.08907	0.01167	1 January 2024, 18:16	0.63909
SURF LAGOON BULIDING	0.00676	0.05245	1 January 2024, 12:12	0.28662
SURF LAGOON OPENSPACE	0.02815	0.09159	1 January 2024, 12:13	0.49613
SURF LAGOON ROADS	0.01134	0.08800	1 January 2024, 12:12	0.48089
SURF VILLAGE BUILDINGS	0.01196	0.09278	1 January 2024, 12:12	0.50705
SURF VILLAGE OPEN SPACE	0.00887	0.02033	1 January 2024, 12:13	0.10917
WETLAND 2	0.08907	0.01167	1 January 2024, 18:16	0.63909

Summary Results for Reservoir "WETLAND 2"

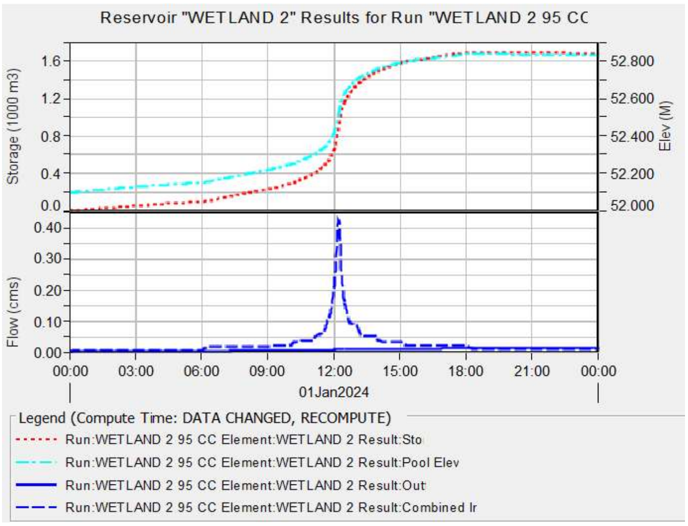
Project: HEC HMS Auckland   Simulation Run: WETLAND 2 95 CC
Reservoir: WETLAND 2

Start of Run: 01Jan2024, 00:00   Basin Model: Wetland 2
End of Run: 02Jan2024, 00:00   Meteorologic Model: 95TH PERCENTILE 2.1D CC
Compute Time: DATA CHANGED, RECOMPUTE   Control Specifications: Control - 24 Hour

Volume Units: ○ MM ● 1000 M3

Computed Results

Peak Inflow:	0.42590 (M3/S)	Date/Time of Peak Inflow:	01Jan2024, 12:12
Peak Discharge:	0.01167 (M3/S)	Date/Time of Peak Discharge:	01Jan2024, 18:16
Inflow Volume:	2.32131 (1000 M3)	Peak Storage:	1.69694 (1000 M3)
Discharge Volume:	0.63909 (1000 M3)	Peak Elevation:	52.84 (M)



GD01 & TP 108 GRAPHICAL RUNOFF CALCULATION - Wetland 3

PROJECT NAME Surfpark Stage 2 Created By AL Date 7/11/2025
PROJECT Nos: 3325-2 Checked By SL Date 7/11/2025

Input

Rainfall Summary

	90th percentile	95th percentile (From TP108 Cal)	
ARI(yr)			
Design rainfall (mm)	29.9	42.5	2.1cc

Catchment Area

Total Area- For Detention

	A (m2)		CN	Ia (mm)
Total Catchment	36900			
Pervious	0.38	13867	61	5
Impervious	0.62	23033	98	0

Area- Treatment

	A (m2)		CN	Ia (mm)
Total Catchment	36900			
Pervious	0.38	13867	61	5
Impervious	0.62	23033	98	0

Total Runoff Volume

$$Q = \frac{(P - Ia)2}{(P - Ia) + S}$$

Q = runoff depth (mm)
P = rainfall depth (mm)
S = potential maximum retention after runoff begins

S = (1000 / CN - 10) 25.4

Output

$Q_{perv.}$	3.32	7.03
$Q_{imperv.}$	25.5	37.9

PWV = 317 m^3 *(Reduced by 50% as stream protection is provided)*
Detention Volume for Stream Protection = 970 m^3

12D Modeling Output

PWL @	**51.37**	RL	*Manual input from 12d*
95th Percentile Peak Water Level	**51.81**	RL	*Manual input from Hec Hms*
Q 95th	**664**	m^3	*Manual input from Hec Hms*

Catchment Flow Summary - From HEC-HMS

Global Summary Results for Run "WETLAND 3 95 CC"

Project: HEC HMS Auckland   Simulation Run: WETLAND 3 95 CC

Start of Run: 01Jan2024, 00:00   Basin Model: Wetland 3
End of Run: 02Jan2024, 00:00   Meteorologic Model: 95TH PERCENTILE 2.1D CC
Compute Time: 06Nov2025, 17:53:25   Control Specifications: Control - 24 Hour

Show Elements: All Elements   Volume Units: MM 1000 M3   Sorting: Watershed Explorer

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
LOT W3	0.02080	0.12100	1 January 2024, 12:...	0.64926
ROAD Area W3	0.01252	0.09593	1 January 2024, 12:...	0.50700
Open Space W3	0.00358	0.00821	1 January 2024, 12:...	0.04408
WETLAND 3	0.03690	0.01353	1 January 2024, 15:...	0.70715
POST-DEVELOPME...	0.03690	0.01353	1 January 2024, 15:...	0.70715

Summary Results for Reservoir "WETLAND 3"

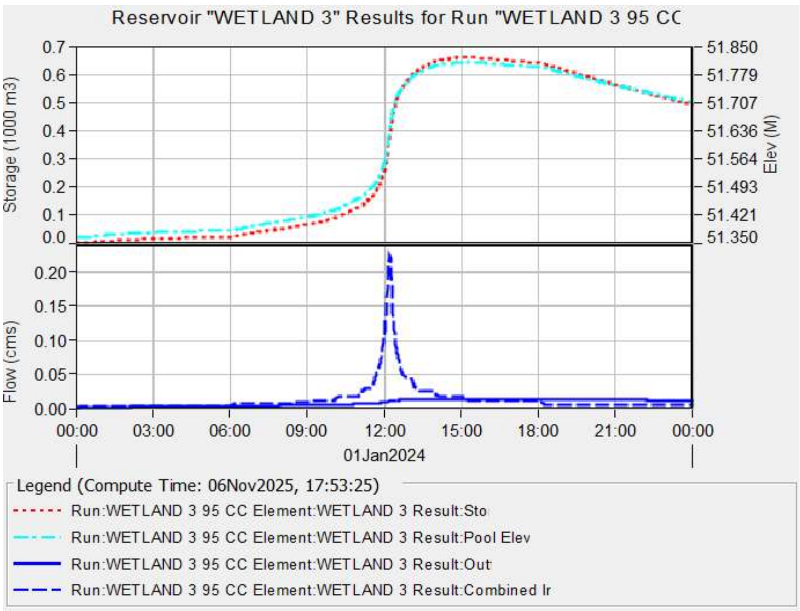
Project: HEC HMS Auckland   Simulation Run: WETLAND 3 95 CC
Reservoir: WETLAND 3

Start of Run: 01Jan2024, 00:00   Basin Model: Wetland 3
End of Run: 02Jan2024, 00:00   Meteorologic Model: 95TH PERCENTILE 2.1D CC
Compute Time: 06Nov2025, 17:53:25   Control Specifications: Control - 24 Hour

Volume Units: MM 1000 M3

Computed Results

Peak Inflow:	0.22502 (M3/S)	Date/Time of Peak Inflow:	01Jan2024, 12:12
Peak Discharge:	0.01353 (M3/S)	Date/Time of Peak Discharge:	01Jan2024, 15:09
Inflow Volume:	1.20035 (1000 M3)	Peak Storage:	0.66465 (1000 M3)
Discharge Volume:	0.70715 (1000 M3)	Peak Elevation:	51.81 (M)



GD01 & TP 108 GRAPHICAL RUNOFF CALCULATION - RG 1 (WATER QUALITY TREATMENT ONLY)

PROJECT NAME	Surfpark Stage 2	Created By	AL	Date	7/11/2025
PROJECT Nos:	3325-2	Checked By	SL	Date	7/11/2025

Input

Rainfall Summary

ARI(yr)	Retention Depth	90th percentile	95th percentile (From TP108 Cal)
Design rainfall (mm)	5.0	29.9	42.5

2.1cc

Catchment Area

Total Area- For Detention

	A (m2)		CN	Ia (mm)
Total Catchment	10500			
Pervious	0.36	3740	61	5
Impervious	0.64	6760	98	0

RAIN GARDEN SIZING - Water Quality Treatment and Detention

Rain Garden	Construction	Material	Depth (m)	Void Ratio	Volume (m3)
1	Storage	Rock	0	35%	0.0
2	Drainage Layer	Rock	0.3	35%	14.3
3	Transition	Coarse Sand	0.1	30%	4.1
4	Media	Bio Media	0.60	30%	24.5
5	Ponding Layer	None	0	100%	0.0
	Total		1		

DEVICE NAME	Catchment Area m2	% Impervious	Impervious Area m2	Minimum Raingarden size required (2% of imperv.) m2	WQF m3/hr	K (media) m/hr	Safety factor for clogging	Calculated Bioretention Area m2	Design RG Area (from 12d) m2
RG1	10500	64%	6760	135.2	**64.2**	**1**	**0.5**	128	136.0
									OK

Raingarden Detail

Q total 43 m^3

LAYER	**RL**
TOP OF BANK	53.975
TOP WATER LEVEL	53.725
Ponding Layer	53.725
Media	53.125
Transition	53.025
Drainage Layer	52.725
Storage	-

200mm Freeboard

GD01 & TP 108 GRAPHICAL RUNOFF CALCULATION - RG 2

PROJECT NAME Surfpark Stage 2 — Created By AL — Date 7/11/2025
PROJECT Nos: 3325-2 — Checked By SL — Date 7/11/2025

Input

Rainfall Summary

ARI(yr)	Retention Depth	90th percentile	95th percentile (From TP108 Cal)
Design rainfall (mm)	5.0	29.9	42.5

2.1cc

Catchment Area

Total Area- For Detention

	A (m2)		CN	Ia (mm)
Total Catchment	2830			
Pervious	0.00	0	61	5
Impervious	1.00	2830	98	0

Total Runoff Volume

$$Q = \frac{(P - Ia)2}{(P - Ia) + S}$$

Q = runoff depth (mm)
P = rainfall depth (mm)
S = potential maximum retention after runoff begins

S = (1000 / CN - 10) 25.4

Output

$Q_{perv.}$	3.32	7.03
$Q_{imperv.}$	25.5	37.9

Retention Volume = 14 m^3
Detention Volume for Stream Protection = 73 m^3

RAIN GARDEN SIZING - Water Quality Treatment and Detention

Rain Garden	Construction	Material	Depth (m)	Void Ratio	Volume (m3)
1	Storage	Rock	0.45	35%	20.2
2	Drainage Layer	Rock	0.3	35%	13.4
3	Transition	Coarse Sand	0.05	30%	1.9
4	Media	Bio Media	0.60	30%	23.0
5	Ponding Layer	None	0.15	100%	19.2
	Total		**1.55**		

DEVICE NAME	Catchment Area m2	% Impervious	Impervious Area m2	Minimum Raingarden size required (3.5% of imperv.) m2	WQF m3/hr	K (media) m/hr	Safety factor for clogging	Calculated Bioretention Area m2	Avaliable Retention volumes (m3)	Avaliable Detention volumes (m3)	Design Raingarden Area m2
RG2	2830	100%	2830	99.1	**26.9**	**1**	**0.5**	54	**20** OK	**78** OK	128.0

12D Modeling Output

Q total 78 m^3 *Manual input from 12d*

LAYER	RL
TOP OF BANK	55.090
TOP WATER LEVEL	54.790
Ponding Layer	54.640
Media	54.040
Transition	53.99
Drainage Layer	53.69
Storage	53.24

300 mm Freeboard

GD01 & TP 108 GRAPHICAL RUNOFF CALCULATION - RG 3

PROJECT NAME	Surfpark Stage 2	Created By	AL	Date	7/11/2025
PROJECT Nos:	3325-2	Checked By	SL	Date	7/11/2025

Input

Rainfall Summary

ARI(yr)	Retention Depth	90th percentile	95th percentile (From TP108 Cal)
Design rainfall (mm)	5.0	29.9	42.5

2.1cc

Catchment Area

Total Area- For Detention

	A (m2)		CN	Ia (mm)
Total Catchment	6300			
Pervious	0.40	2520	61	5
Impervious	0.60	3780	98	0

Total Runoff Volume

$$Q = \frac{(P - Ia)2}{(P - Ia) + S}$$

Q = runoff depth (mm)
P = rainfall depth (mm)
S = potential maximum retention after runoff begins

S = (1000 / CN - 10) 25.4

Output

$Q_{perv.}$	3.32	7.03
$Q_{imperv.}$	25.5	37.9

Retention Volume = 19 m^3
Detention Volume for Stream Protection = 98 m^3

RAIN GARDEN SIZING - Water Quality Treatment and Detention

Rain Garden	Construction	Material	Depth (m)	Void Ratio	Volume (m3)
1	Storage	Rock	0.5	35%	23.2
2	Drainage Layer	Rock	0.5	35%	23.2
3	Transition	Coarse Sand	0.1	30%	4.0
4	Media	Bio Media	0.50	30%	19.8
5	Ponding Layer	None	0.4	100%	52.9
	Total		2		

DEVICE NAME	Catchment Area m2	% Impervious	Impervious Area m2	Minimum Raingarden size required (3.5% of imperv.) m2	WQF m3/hr	K (media) m/hr	Safety factor for clogging	Calculated Bioretention Area m2	Avaliable Retention volumes (m3)	Avaliable Detention volumes (m3)	Design Raingarden Area m2
RG3	6300	60%	3780	132.3	35.9	1	0.5	72	20	123	132.3
									OK	OK	

12D Modeling Output

Q total 123 m^3 *Manual input from 12d*

LAYER	RL	
Ponding Layer	61.65	TOP WATER LEVEL
Media	61.25	
Transition	61.15	
Drainage Layer	60.65	
Storage	60.15	