BIRZULIS ASSOCIATES Pty Ltd
Consulting Structural + Civil Engineers
ACN 003 797 911 ABN 99 003 797 911

SYDNEY OFFICE
583 Darling Street, Rozelle NSW 2039
Telephone: (02) 95557230
Email: office@birzulisassociates.com
NEWCASTLE OFFICE
2/163 King Street, Newcastle NSW 2300
Telephone: (02) 40494855
Email: office@birzulisassociates.com

OPAL BAYVIEW

INTEGRATED WATER MANAGEMENT PLAN

Prepared For: ***Principal Healthcare Finance Pty Limited*** ***(Opal Healthcare)***	*Prepared by:* ***Birzulis Associates*** ***583 Darling Street*** ***ROZELLE NSW 2039***

Document Control

Project Title	Opal Bayview
Document Title	Integrated Water Management Plan
Project No.	9449
Description	Integrated Water Management Report

	Name	Signature
Prepared by	Grishmi Khanal	……..
Reviewed by	Christopher Mundy	……..

DOCUMENT HISTORY

Date	Revision	Reason for Issue	No. copies
29.08.2025	P1	Draft SSDA Submission	PDF Only
01.10.2025	P2	SSDA Submission	PDF Only
29.01.2026	P3	Revised SSDA Submission	PDF Only

Contents

1 Executive Summary

This Integrated Water Management (IWM) Report is submitted to the Department of Planning, Housing and Infrastructure (DPHI) on behalf of Principal Healthcare Finance Pty Limited (Opal Healthcare) in support of a State Significant Development Application (SSDA) (SSD-77240466) for a 177-bed residential aged care facility (RACF) at 36–42 Cabbage Tree Road, Bayview (the site). It addresses the Secretary's Environmental Assessment Requirements (SEARs) Item 11 – Water Management by detailing the proposed drainage design, stormwater and wastewater servicing, compliance with Northern Beaches Council requirements, and the stormwater quality management measures proposed for the development.

The IWM strategy integrates potable water efficiency, rainwater reuse, stormwater quantity management via on-site detention (OSD), pollutant load reduction using best-practice treatment devices, and flood and overland flow management consistent with Australian Rainfall and Runoff (ARR 2019).

Key outcomes of the IWM strategy are summarised below:

- Stormwater quality improvements (MUSIC results) against Council targets:
  - Gross Pollutants: 100% reduction
  - Total Suspended Solids (TSS): 85.3% reduction
  - Total Phosphorus (TP): 75.7% reduction
  - Total Nitrogen (TN): 59.9% reduction

- On-site detention sized via DRAINS to maintain post-development discharges at or below pre-development up to the 1% AEP event. On-site detention volume of 200 m^3 has been provided.

- Rainwater reuse/storage capacity: 56 kL supplying toilet flushing and landscape irrigation.

- Flood risk management: site located outside mapped High/Medium/Low flood risk precincts; finished floor levels set above the 1% AEP flood planning level plus freeboard; overland flow safely conveyed via the existing grass-lined swale to Cahill Creek and ultimately to Pittwater; no adverse downstream impact.

Compliance:

- SEARs Item 11 is addressed within this report.
- Northern Beaches Council Planning Controls, Pittwater 2021 DCP, and Water Management for Development Policy (2021) Region 1
- ARR 2019 design guidelines adopted for modelling and design.

This report is to be read in conjunction with the civil and hydraulic design documentation submitted as part of the State Significant Development Application. Supporting modelling files, design drawings and Council correspondence are included in the appendices.

2 Introduction

This Integrated Water Management (IWM) Report is submitted to the Department of Planning, Housing and Infrastructure (DPHI) on behalf of Principal Healthcare Finance Pty Limited (Opal Healthcare) in support of a State Significant Development Application (SSDA) (SSD-77240466) for a 177-bed residential aged care facility (RACF) at 36-42 Cabbage Tree Road, Bayview (the site).

The proposed development will comprise the following:

- Demolition of the existing aged care building and driveway on the site.
- Construction of a three-storey residential aged care facility, accommodating:
  - 177 beds,
  - Basement parking,
  - Ground floor ancillary facilities.
- Construction of a community room, to be located on the Aveo Bayview Gardens Retirement Living (Aveo BGRL) site.
- Construction of a new driveway, to be located on the Aveo BGRL site.
- Torrens Title subdivision of the Opal Healthcare Bayview site from Aveo BGRL.
- Associated amenities and landscaping works.
- Augmentation of, and connection to, existing utilities as required.

For a detailed project description, refer to the Environmental Impact Statement prepared by Beam Planning.

2.1 Relevant SEARS

This Integrated Water Management Report addresses the following relevant Secretary's Environmental Assessment Requirements (SEARs) set out in the table below.

Table 2.1.1– Summary of Relevant SEARs and Response

SEAR	Requirement	Response	Report Section
11	Integrated Water Management Plan	This report documents the relevant information in response to SEAR 11.	This report.

2.2 Project Site Description

The Opal HealthCare Bayview site comprises a ~6,000sqm portion of the current Aveo BGRL site at 36-42 Cabbage Tree Road, legally described at Lot 121 in DP 789400. The site in irregular is shape, bound by Annam Road to the east, and the Aveo BGRL site to the north, west, and south.

A site aerial is provided below.

Figure 2.2.1 Context of site within the broader Aveo site

Figure 2.2.2 Subdivision site

2.3 Scope and purpose of the IWM report

This Integrated Water Management (IWM) report has been prepared to accompany the state SSDA and demonstrate that stormwater, potable water, wastewater, and groundwater are managed in an integrated and sustainable manner.

The report addresses the pre- and post-development water cycle impacts and outlines proposed measures to meet Northern Beaches Council Planning Controls, Pittwater 2021 DCP, and Water Management for Development Policy (2021) Region 1. This includes provision of on-site detention, achievement of pollutant load reduction targets, and protection of downstream drainage infrastructure and receiving environments. The purpose of this report is to confirm that the development achieves compliance through practical, site-responsive water management solutions.

3 Site Context and Existing Conditions

3.1 Site location, topography, existing land use

The subject site is located at 36–42 Cabbage Tree Road, Bayview, within the Northern Beaches Local Government Area. It forms part of the Aveo Bayview Gardens Retirement Living precinct and comprises approximately 6,000 m^2 of land proposed to be subdivided from the larger Aveo site.
The site is irregular in shape and is bounded by Annam Road to the east and the remainder of the Aveo Bayview Gardens site to the north, west and south. Existing land use comprises an aged care facility and associated driveway and landscaping, which will be demolished as part of the proposed development.
Topography across the site is steeply sloping, with a crossfall of approximately 9 metres from west to east. Drainage from the site generally flows downslope towards the south-east into the existing stormwater network.

3.2 Existing Geotechnical and Groundwater Conditions

The geotechnical investigation undertaken by WSP (PS223670-WSP-NSW-SYD-GEO-REP-001 Rev0, August 2025) identified the subsurface conditions as comprising fill overlying residual silty clays, with interbedded sandstone and siltstone encountered at depths of approximately 1.7–3.0 m. The residual clays are stiff to hard with moderate to high shrink–swell potential, and soil chemistry is generally non-aggressive to mildly aggressive to buried infrastructure. The site is classified as Class H1 under AS2870-2011 due to the deep clay profile, with potential for reclassification to Class A following basement excavation.

Laboratory testing included California Bearing Ratio (CBR) tests on near-surface fill materials:

- BH03 (0.2–0.7 m, gravelly sand fill): 4.5% (MDD 1.86 t/m^3)
- BH08 (0.2–0.6 m, gravelly sand fill): 1.5% (MDD 1.79 t/m^3)

These results indicate very poor to poor quality subgrade. For design purposes, a conservative CBR of 3% has been adopted for pavement design of the internal roads and car park areas. Groundwater was not encountered in shallow boreholes during drilling but is inferred to be present within the sandstone bedrock at depths greater than 5 m below ground level.

Groundwater flow is expected to be directed downslope towards the south, consistent with the topography. Monitoring wells have been installed to allow further assessment, and a separate groundwater monitoring program is underway.

3.3 Existing stormwater infrastructure and catchments

Based on the site survey, existing stormwater infrastructure within and adjacent to the site comprises a mix of formal and informal elements. A grass-lined drainage swale is located within the broader Aveo site off Annam Road, which conveys flows from Council's pit and pipe system in Aveo Road down through the site and ultimately discharges to Cahill Creek to the south. An additional drainage easement/creek exists to the south-west of the site, also providing a pathway for overland and minor system flows.
Within the subject site itself, there are several grated pits and pipes that provide conveyance of local stormwater runoff towards the broader drainage network. No records of existing on-site detention (OSD) facilities were identified in Council's records or through the site survey.

The site drainage ultimately discharges into Cahill Creek, which flows southwards before connecting to Pittwater. Pittwater is a tidal estuary, forming part of the larger Broken Bay system

on Sydney's Northern Beaches. It represents a drowned river valley connected to Broken Bay and the Tasman Sea, and functions as an estuarine receiving environment for upstream waterways.

3.4 Known flooding or overland flow characteristics.

Northern Beaches Council's flood hazard mapping has been reviewed for the site and surrounding catchment. The mapping identifies Cahill Creek, located to the south of the site, as subject to both High Flood Risk (hydraulic hazard) and Medium Flood Risk (1% AEP plus freeboard) precincts. An additional drainage easement/creek is located to the south-west of the site and is also mapped as flood affected.

The subject site itself is situated at a higher elevation and is not within the mapped High, Medium or Low Flood Risk precincts. The existing building platform is several metres above the 1% AEP flood extent for Cahill Creek.

Overland flow paths are present within the broader Aveo Bayview Gardens site, draining to the grass-lined swale that conveys runoff southwards to Cahill Creek. These flow paths do not pose a direct flood hazard to the RACF site; however, they are relevant for ensuring safe conveyance of major flows towards the receiving environment.

The ultimate receiving environment is Pittwater, a tidal estuary forming part of Broken Bay on Sydney's Northern Beaches. Pittwater is a drowned river valley connected to Broken Bay and the Tasman Sea, and functions as an estuarine receiving environment for upstream waterways such as Cahill Creek.

4 Water Management Objectives

The water management objectives for this project are to deliver sustainable, resilient outcomes across the full water cycle in accordance with the Northern Beaches Council Planning Controls, Pittwater 2021 DCP, and Water Management for Development Policy (2021) Region 1, and ARR 2019. Specifically, the development will minimise potable water demand through rainwater harvesting and efficient end-uses; manage stormwater quantity so that post-development discharges do not adversely affect downstream systems; improve stormwater quality via WSUD measures and at-source treatment; provide safe conveyance of major overland flows; protect groundwater through appropriate basement waterproofing and subsoil drainage; and ensure long-term performance and maintainability of all water assets through clear operations and maintenance provisions.

4.1 Potable and Non-Potable Water Efficiency – DCP Targets and Requirements

Under the Northern Beaches Council Planning Controls, Pittwater 2021 DCP, and Water Management for Development Policy (2021) Region 1, developments are required to reduce reliance on potable water by incorporating rainwater harvesting and WSUD measures. The DCP does not prescribe a fixed percentage reduction for non-residential uses; instead, it requires a fit-for-purpose system sized to materially substitute potable demand and demonstrably service non-potable end uses. For this project the targets and requirements are:

- Provide rainwater harvesting sized via a simple water balance to reliably supply non-potable demands (toilet flushing and landscape irrigation) using available roof catchment, with overflow directed to the lawful discharge via the OSD system.
- Connect designated non-potable end uses (toilets and irrigation) to the rainwater system, with automatic potable top-up, backflow prevention and cross-connection controls in accordance with NSW codes.
- Integrate WSUD by prioritising reuse, reducing runoff from roof areas, and supporting landscape outcomes (permeable and vegetated areas).
- Incorporate first-flush diversion and screening; ensure mosquito proofing, safe access and isolation for maintenance.
- Design pumps and controls to meet noise requirements of the Protection of the Environment Operations Act 1997 and to prioritise reuse before potable top-up.
- Prepare an operations and maintenance plan that specifies routine inspections, cleaning, and component replacement; secure ongoing performance through appropriate title instruments where required by Council.

4.2 Runoff volume and pollutant reduction goals

The stormwater strategy will meet the Northern Beaches Council Planning Controls, Pittwater 2021 DCP, and Water Management for Development Policy (2021) Region 1 by achieving the following targets and goals:

Hydrology / Quantity (runoff and flooding):

- Post-development peak discharges must not exceed pre-development peak discharges up to the 1% AEP storm.

- The minor drainage system (pits and pipes) is to convey at least the 1 in 5-year event without unacceptable surcharge.
- The major system (overland flow) is to safely convey at least the 1% AEP event to the lawful point of discharge with no adverse impact on adjoining properties.
- Discharges to the downstream system (grass-lined swale → Cahill Creek → Pittwater) are to avoid increased flood levels, velocities, erosion or scour.
- Where practicable, reduce runoff volumes through reuse, permeable/landscaped areas, and WSUD measures.

Water Quality (annual load reduction):

Table 4.2.2 Council's Pollution Reduction Target

Pollutants	Council's Reduction Target
Gross Pollutants (GP)	90%
Total Suspended Solids (TSS)	85%
Total Phosphorus (TP)	65%
Total Nitrogen (TN)	45%

WSUD and Maintenance:

- Integrate WSUD measures (e.g., rainwater harvesting, GPTs, proprietary filtration, permeable paving, landscaping, and the existing grass-lined swale as the major conveyance path).
- Prepare an Operations & Maintenance Plan and register a positive covenant / restriction on use to secure ongoing performance of OSD and treatment devices.

Standards and Verification:

- Apply ARR 2019 design rainfall and methods.
- Demonstrate compliance by modelling (DRAINS for hydrology/hydraulics; MUSIC/MUSICX for water quality) — results are presented in later sections of this report.

4.3 Flood mitigation and groundwater protection

Flood mitigation – targets and requirements in accordance with the Northern Beaches Council's Water Management Policy and Pit Water DCP 2021.

- Post-development peak discharges must not exceed pre-development peak discharges up to the 1% AEP storm (verified by hydrologic/hydraulic modelling).
- Minor drainage (pits and pipes) to safely convey at least the 1 in 5-year event with limited surcharge.
- Major drainage (overland flow) to safely convey at least the 1% AEP event to the lawful point of discharge without adverse impacts to adjoining properties.
- Finished floor levels, basement access and critical services to be set at or above the adopted flood planning level (1% AEP + freeboard) for the local catchment context.
- Maintain and formalise overland flow paths; no buildings, walls or fences are to obstruct major flow routes.
- Provide lawful discharge with energy dissipation and scour protection sized for design flows; check outlet performance under conservative tailwater conditions.
- Apply ARR 2019 methods, including climate-sensitivity allowances as appropriate, to confirm freeboard and system robustness.
- During construction, implement temporary erosion and sediment controls to protect downstream waterways and maintain capacity of the receiving system.

Groundwater protection – targets and requirements

- Prevent adverse groundwater impacts through drained basement construction and perimeter subsoil drainage designed to relieve hydrostatic pressure without inducing drawdown beyond the site.
- Avoid sustained dewatering; if temporary dewatering is unavoidable, manage in accordance with regulatory requirements to prevent off-site drawdown or discharge of turbid water.
- Keep subsoil/groundwater drainage separate from stormwater treatment trains unless water quality is suitable; otherwise bypass to lawful discharge via approved pathways.
- Waterproofing, drainage and backflow controls to comply with relevant Australian Standards and NSW plumbing codes.
- Prepare and implement an operations and maintenance plan; register a positive covenant/restriction on use (as required) to secure ongoing performance of flood and groundwater management measures.

4.4 Urban Heat Island Reduction and WSUD alignment – DCP Targets and Requirements

Urban Heat Island (UHI) – targets and requirements

- Maximise tree canopy cover across the site, prioritising shade to hardstand, pathways and building façades.
- Provide deep soil zones and soil volumes adequate for long-term tree growth; retain soil moisture through mulching and water-efficient planting design.
- Use permeable and/or high-albedo surface finishes to reduce heat absorption on hardstand where practicable.
- Integrate irrigated landscaping (preferably supplied by harvested rainwater) to support evapotranspiration and microclimate benefits.
- Coordinate landscape and civil design so WSUD elements (swales, permeable paving, rainwater reuse) also contribute to UHI mitigation.

WSUD – targets and requirements

- Incorporate WSUD measures to reduce runoff and improve water quality: rainwater harvesting, gross pollutant trapping, proprietary filtration, permeable paving, landscaped/vegetated areas, and the existing grass-lined swale as the primary major-flow conveyance.
- Meet Council's water quality performance targets: GP ≥90%, TSS ≥85%, TP ≥65%, TN ≥45%, with discharge pH 6.5–8.5 (verification by MUSIC/MUSICX).
- Provide first-flush diversion, screening, mosquito-proofing and safe maintenance access for all WSUD assets.
- Ensure WSUD elements are hydraulically integrated with the stormwater system and do not obstruct overland flow paths or reduce conveyance capacity.
- Prepare an Operations & Maintenance Plan detailing inspection frequencies, cleaning/replacement of media and device-specific procedures; secure ongoing performance via positive covenant/restriction on use where required by Council. Operation & Maintenance will be provided during the OC stage of the project.

5 Integrated Water Cycle Strategy

The integrated water cycle strategy manages potable demand, stormwater quality and quantity, flood conveyance and groundwater in a coordinated scheme consistent with Northern Beaches Council Planning Controls, Pittwater 2021 DCP, and Water Management for Development Policy (2021) Region 1 and ARR 2019.

Potable demand is reduced via a 56-kL rainwater harvesting system supplying toilet flushing and landscape irrigation. Stormwater quality is addressed through at-source WSUD measures—rainwater reuse, a gross pollutant trap, proprietary filtration within the detention system, permeable/landscaped areas and the existing grass-lined swale—achieving MUSIC outcomes of 100% GP, 85.3% TSS, 75.7% TP and 59.9% TN reduction.

Quantity management is provided by an on-site detention system modelled in DRAINS to maintain post-development peaks at or below pre-development up to the 1% AEP event (post-development peaks: 20% AEP 0.092 m^3/s, 10% AEP 0.104 m^3/s, 5% AEP 0.116 m^3/s, 1% AEP 0.145 m^3/s); the minor pit-and-pipe network is designed to the 1 in 20-year event, with major overland flows conveyed via the retained swale to Cahill Creek and ultimately to Pittwater.

Groundwater interaction is managed by drained basement construction with subsoil drainage; no sustained dewatering is proposed. Ongoing performance is secured through an operations and maintenance plan and positive covenant covering the OSD, treatment devices and swale.

5.1 Potable and Non-Potable Water Reduction Strategy

The development will reduce reliance on potable water in accordance with Northern Beaches Council Planning Controls, Pittwater 2021 DCP, and Water Management for Development Policy (2021) Region 1 by integrating a fit-for-purpose rainwater reuse system and water-efficient end uses.

A 56-kL rainwater tank will capture runoff from the RACF roof. Harvested water will be reused for non-potable demands, prioritising toilet flushing and landscape irrigation. The strategy is to maximise substitution of potable demand while maintaining simple, reliable operation:

Collection and routing

- Connect designated roof catchments to the rainwater tank via screened downpipes and first-flush diversion.
- Provide overflow from the tank to the on-site detention system and then to the lawful point of discharge.

Non-potable end uses.

- Plumb rainwater to WC cisterns and the irrigation network, with automatic potable top-up to ensure continuity of service during dry periods.
- Include backflow prevention and cross-connection controls in accordance with AS/NZS 3500 and NSW plumbing codes.

Systems and controls

- Provide pump set sized for peak non-potable demand with duty/standby or service bypass as appropriate.
- Ensure pump and control equipment meets the noise requirements of the Protection of the Environment Operations Act 1997.
- Install level sensing, run-dry protection, and isolation for maintenance.

Water quality and public health

- Incorporate leaf guards, screens, first-flush and mosquito-proof ventilation; provide safe access for inspection and cleaning.
- Separate any subsoil/groundwater drainage from the rainwater system.

Integration with WSUD and drainage

- Coordinate storage and overflows with the OSD system so reuse is prioritised before discharge.
- Use irrigated landscaping (preferably via harvested rainwater) to support WSUD and urban heat island objectives.

Operations and maintenance

- Prepare an O&M plan covering routine inspection, cleaning of screens/first-flush devices, pump service, and periodic validation of cross-connection controls.
- Where required by Council, secure ongoing performance through a positive covenant and restriction on use.

Detailed end-use connection schedules, hydraulic schematics and confirmatory water-balance calculations will be provided by the project hydraulic consultant to demonstrate that the 56-kL storage reliably services the nominated non-potable demands and aligns with Council policy.

5.2 Wastewater Management

Wastewater servicing requirements—including the Sydney Water connection (gravity or pumped), design flows, pipe sizes and invert levels, backflow protection, and any trade-waste or pump station provisions—are being addressed by the project's hydraulic consultant. A summary of their design is provided below, with full details available in the consultant's drawing.

The site sewer will discharge via a gravity system, connecting to the existing 150 mm Sydney Water sewer asset located along Annam Road at a manhole 2.2 m deep (surface RL 19.5 m, invert RL 17.3 m). A Terminal Maintenance Shaft (TMS) will be constructed at the site boundary to facilitate the connection, with major works for extending the sewer from the Sydney Water asset to the TMS to be carried out by the appointed Sydney Water Coordinator working directly with Bloompark.

A Servicing Advice Notice or Notice of Requirement (NOR) will be obtained and issued by the appointed Sydney Water Coordinator (OPAL WSC) on behalf of the developer, and the reference number will be provided once available.

The site sewer system has been designed by JHA in accordance with AS3500.2, using two 150 mm PVC pipes each with a separate boundary trap and junctions to the TMS (as designed by others). The total calculated load for the system is approximately 1,400 fixture units, which equates to a peak design flow of 14.5 L/s. The system is gravity-based and therefore does not require any pumped configuration or pump duty/backup arrangements.

5.3 Stormwater Management

The stormwater system has been designed to meet Northern Beaches Council Planning Controls, Pittwater 2021 DCP, and Water Management for Development Policy (2021) Region 1,

and to comply with AS/NZS 3500.3 for stormwater drainage. The strategy provides minor-system pit and pipe drainage, safe major-flow conveyance, rainwater reuse, on-site detention (OSD), and a lawful connection to Council's network.

Roof drainage
Roof runoff will be managed by the hydraulic engineer via eaves gutters and downpipes to a 56-kL rainwater tank. Tank overflow is routed to the OSD.

Basement pump-out (lower ground)
A basement pump-out tank is provided at the lower ground basement to manage subgrade and hardstand drainage that cannot drain by gravity. The pump-out system is sized and configured in accordance with AS/NZS 3500.3 (including duty/standby pumps, non-return valves and high-level alarm) and discharges to the downstream stormwater system via the approved connection.

Rear catchment overflow route through basement
Portions of the rear catchment that cannot drain around the site perimeter are conveyed through the basement via a dedicated gravity pipe/culvert route and floor drainage, with local bunding/threshold protection to prevent ingress to occupied areas. This internal bypass provides a controlled major-flow path consistent with the site grading and connects to the OSD/outlet system.

OSD (ground-level basement)
An on-site detention tank is located within the ground-level basement to attenuate post-development flows to pre-development rates up to the 1% AEP event. The OSD receives tank overflow and designated hardstand/roof sub catchments and discharges to the lawful point with energy dissipation and scour protection.

Minor/major surface drainage and thresholds
Grated trench drains and threshold drains are provided at doorways and critical interfaces. The site pit-and-pipe network conveys at least the 1 in 20-year event (minor system), with surface grading and the existing grass-lined swale within the broader Aveo precinct providing a safe bypass path for major events toward Cahill Creek.

Lawful point of discharge
The development connects via a new pit-and-pipe line down Annam Road to an existing Council kerb inlet pit (subject to Council's approval). Flap valves/non-return devices and tailwater allowances are included as required to prevent backflow from the Council system. Outlet pipe from the proposed OSD tank connects to a network of sealed pits with pipes connecting to the existing KIP on Annam Road. Sealed pits has been placed on the road maintaining a minimum distance of 700 mm from the existing utilities.

Water quality and WSUD
At-source pollutant controls are integrated with the drainage system, including rainwater harvesting, a gross pollutant capture device (GPT) and proprietary filtration within or upstream of the OSD. These WSUD elements, together with permeable/landscaped areas and the grass-lined swale, are configured to meet Council's pollutant reduction targets (verification by MUSIC/MUSICX provided elsewhere in this report).

Standards and verification

Design adopts ARR 2019 rainfall and temporal patterns, AS/NZS 3500.3 for pipework, sumps and pump-out, and Pittwater DCP 2021/Policy hydrology criteria. Compliance is demonstrated by DRAINS (quantity) and MUSIC/MUSICX (quality) modelling, with model files and drawings referenced in the appendices.

5.4 Flood and Overland Flow Management

A detailed review of Northern Beaches Council flood hazard mapping confirms that the subject site is not flood-affected and sits outside the mapped High, Medium and Low Flood Risk precincts. The proposed RACF buildings and basements are therefore located above the flood planning level (1% AEP + 500 mm). No flood report is required under Council's DCP as the site is not mapped as flood prone land.
Although the site itself is not flood-affected, surrounding creeks (Cahill Creek and the south-west easement) form part of the downstream drainage system. The stormwater strategy has been designed to ensure that flows from the development do not exacerbate flood behaviour in these waterways. Key measures include:

On-site detention (OSD)
The OSD system has been designed so that post-development discharges are at or below pre-development flows up to the 1% AEP storm, consistent with Council's Water Management for Development Policy (2021). This mitigates any potential downstream flood impacts in Cahill Creek. Overflow chamber has been provided within the OSD tank to serve as a redundancy in the event that the internal orifice is blocked.
The outlet pipe from the OSD tank has been designed to convey the total flow rate for the 1% AEP event from the site to ensure continued function in the event of failure of the designed system. The design is proposed to limit risk of inundation so far as is reasonably practicable.

Finished Floor Levels (FFL)
Habitable floor levels and the basement entry will be set above the 1% AEP flood planning level plus freeboard. This provides resilience against any unforeseen localised flooding.
Overland Flow Conveyance: Overland flow paths across the site and within the broader Aveo precinct have been maintained in the design. Stormwater pipework connects to the existing swale, ensuring that major storm flows can bypass the development and safely discharge into Cahill Creek.

No Obstruction of Major Flows
The development footprint has been designed so that major storm events, including the PMF, can be conveyed through the catchment without obstruction or redirection onto neighbouring properties.

5.5 Groundwater Management Strategy

To manage potential groundwater interaction, the proposed basement construction will adopt a drained basement construction. Subsoil drainage will be incorporated where required to relieve hydrostatic pressure and protect the basement structure. These measures will ensure that groundwater does not adversely affect the development and that compliance is achieved with Northern Beaches Council's Water Management for Development Policy (2021).

The adoption of a conservative CBR of 3% for pavement design ensures that the car park and internal road pavements are designed with sufficient structural capacity to account for the poor subgrade strength identified in testing.

Excavation of fill and clay can be undertaken with conventional plant, while excavation of sandstone will require heavy ripping or mechanical rock breaking. Retention systems such as soldier pile walls with shotcrete infill panels and ground anchors or props are recommended, consistent with WSP's geotechnical design advice.

5.6 Modelling and Calculations

Hydrologic and hydraulic modelling has been undertaken to inform the design of stormwater detention and treatment systems for the development. Modelling parameters include ARR 2019 design rainfall, site catchment imperviousness, Northern Beaches Council hydrology criteria (post-development ≤ pre-development up to the 1% AEP event), and Council water-quality performance targets.

Hydraulic modelling (DRAINS)
DRAINS was used to model pre- and post-development flows and to check the adequacy of the proposed on-site detention (OSD) and minor/major drainage systems.
The OSD is sized so that post-development peak discharges do not exceed pre-development discharges up to the 1% AEP event, consistent with Council policy.
The minor pit-and-pipe network is designed to at least the 1 in 20-year event in accordance with the DCP.
The modelling confirms post-development discharges are at or below pre-development for all relevant storms (up to 1% AEP), ensuring no adverse downstream flooding in Cahill Creek or Pittwater.

Table 5.6.1 Result from analysis using DRAINS.

Runoff Value	Maximum Permissible Site Discharge (Pre-development flow)	Achieved Runoff (Post-development flow)
20%	198L/s	92L/s
10%	259L/s	104L/s
5%	304L/s	116L/s
1%	417L/s	145L/s

Water quality modelling (MUSICX)
MUSICX was used to verify that the treatment train (rainwater harvesting, gross pollutant capture, proprietary filtration and landscape/WSUD integration) meets Council's pollutant reduction targets.

Table 5.6.2 Result of analysis using MUSIC.

Pollutants	Council's Reduction Target	Reduction Achieved
Gross Pollutants (GP)	90%	100%
Total Suspended Solids (TSS)	85%	85.3%
Total Phosphorus (TP)	65%	75.7%
Total Nitrogen (TN)	45%	59.9%

Documentation
MUSICX and DRAINS model files will be submitted with the SSDA package. Appendix B includes screenshots of the model setups and output summaries. Catchment delineation and system configuration are documented in civil drawings C.0200, C.0210, C.0220, C.0230 and C.0500.

6 DESIGN INTEGRATION AND WSUD

Water Sensitive Urban Design (WSUD) principles have been incorporated into the overall site layout in accordance with the Northern Beaches Development Control Plan and the Water Management for Development Policy (2021). The WSUD measures are designed to support stormwater quality improvement, landscape integration, and long-term maintainability.
The following elements have been included in the civil and landscape design:

Landscaping and Vegetation
Retention and integration of landscaped areas to promote infiltration, reduce heat island effect, and soften site runoff characteristics.

Permeable Paving
Use of permeable pavements in nominated areas to reduce imperviousness, enhance infiltration, and minimise surface runoff volumes.

Grass-Lined Swale
The main drainage line through the Aveo site is retained as a grass-lined swale, which provides a natural conveyance path to Cahill Creek, assists in flow attenuation, and promotes settlement of coarse sediments.

At-Source Water Quality Devices
Gross pollutant traps, filter systems and rainwater harvesting are included to remove litter, sediments, and nutrients from runoff prior to discharge, ensuring compliance with Council's water quality performance targets.

Prepared civil drawings include a WSUD layout plan and typical construction detail, illustrating how these measures are integrated with both the stormwater drainage design and the site landscaping. Maintenance access and operational considerations have been incorporated into the design, and the operational and maintenance schedule for all proprietary treatment devices is included in Appendix E of this report.

7 CONSTRUCTION AND STAGING CONSIDERATIONS

During construction, temporary stormwater runoff and erosion risks will be managed in accordance with the Landcom Blue Book and Northern Beaches Council requirements. A concept erosion and sediment control plan (ESCP) has been prepared for the works, and detailed ESCP documentation will be provided as part of the civil construction package.
Erosion and sediment controls will be implemented progressively to ensure all disturbed areas are protected, with measures such as sediment fencing, stabilised site access, diversion bunds and pit inlet protection to minimise sediment transport. The primary objective of these measures is to protect downstream waterways, maintain soil stability on site, and reduce pollutant loads entering Council's and private stormwater infrastructure.
The on-site detention (OSD) system will be constructed as part of the lower ground level works to provide attenuation early in the construction program. This will ensure that site runoff during construction is effectively managed and that downstream flows to Cahill Creek and Pittwater are not adversely impacted.

8 COMPLIANCE AND REFERENCE MATRIX

8.1 SEARs Compliance

This report has been prepared in response to Item 11 of the Secretary's Environmental Assessment Requirements (SEARs) and addresses the following requirements relevant to water management.

Table 8.1.1 SEARs requirement and Response.

SEARs Requirement / Description	Response	Relevant Section of Report
Consultation with the local council		Appendix A
Water-related servicing infrastructure required by the development, and equivalent opportunities to reduce water demand	56 kL of Rainwater Tank (RWT) has been proposed to collect the roof water. Water collected in the RWT serves for irrigation purpose, this provides an opportunity to reduce water demand.	
Proposed drainage design (stormwater and wastewater), including on-site treatment, reuse, detention, water quality management, and discharge points	A preliminary drainage strategy has been developed addressing detention, conveyance, and water quality measures.	Section 5
Compliance with Council or authority requirements, and avoidance of adverse downstream impacts	The strategy aligns with Council policy and mitigates downstream impacts.	Sections 2, 8 and 4
Water and drainage infrastructure to be handed over to Council or authority, including full hydraulic details and compliance with relevant standards	Works to be handed over will be designed in accordance with Council standards. Documentation will be provided with detailed plans and specifications.	Section 2, 4, 5, 8 and Appendix C

8.2 DCP Compliance

This report addresses the applicable provisions of the Northern Beaches Council Development Control Plan (DCP), with respect to stormwater quantity, water quality, flood protection, and infrastructure design.

Table 8.2.1 Design Aspects and Requirements from council.

Design Aspect	Document Reference	Requirement
Stormwater Overflow Routes (Major System)	Northern Beaches Council – Water Management for Development Policy (2021)	1% AEP (100-year ARI)
Stormwater Pits and Pipe Design (Minor System)	Northern Beaches Council – Water Management for Development Policy (2021)	5% AEP (20-year ARI)

8.3 ARR 2019 Compliance

The stormwater design and associated modelling presented in this report have been developed in accordance with the principles and methodologies outlined in Australian Rainfall and Runoff (ARR 2019).

8.4 Other Referenced Documentation

Table 8.4.1 Documents Reviewed

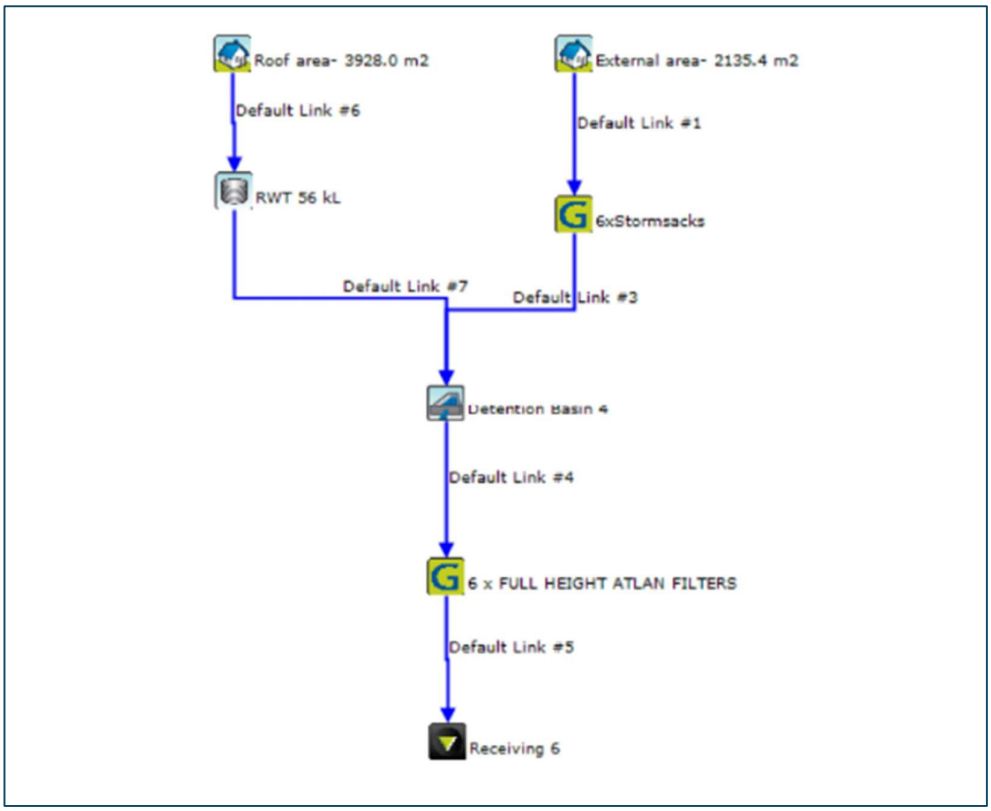
Document	Version / Reference	Date Received
Site Survey Drawing	Rev-7	March 2024
Geotechnical Investigation Report by WSP	Rev-A	August 2025

9 APPENDICES

9.1 APPENDIX A - EVIDENCE OF CONSULTATION WITH COUNCIL

9.2 APPENDIX B - SUPPORTING MODELLING (MUSIC, DRAINS OUTPUTS)

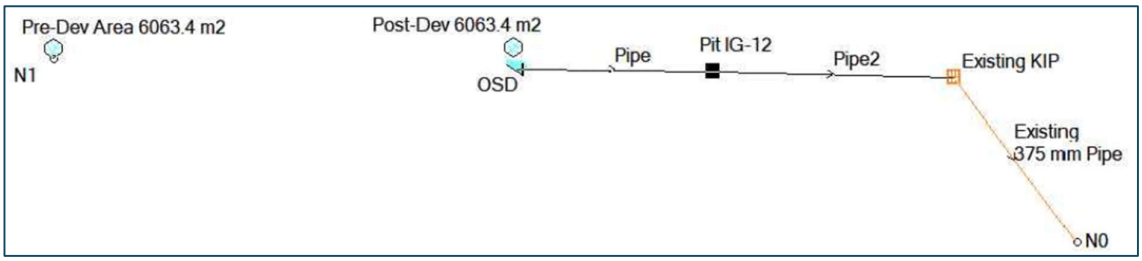
MUSIC MODEL:



MUSIC ANALYSIS RESULT:

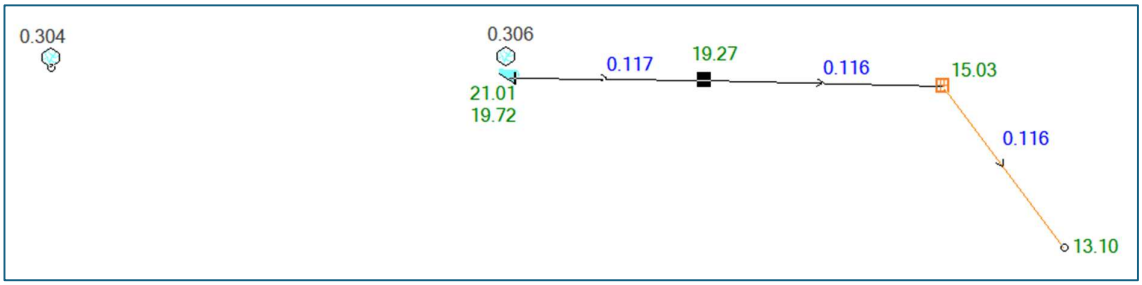
	Sources	Residual Load	% Reduction
Flow (ML/yr)	6.395	6.394	0.01014
Total Suspended Solids (kg/yr)	446.7	65.65	85.3
Total Phosphorus (kg/yr)	1.405	0.3416	75.69
Total Nitrogen (kg/yr)	15.14	6.073	59.88
Gross Pollutants (kg/yr)	142	0	100

DRAINS MODEL:

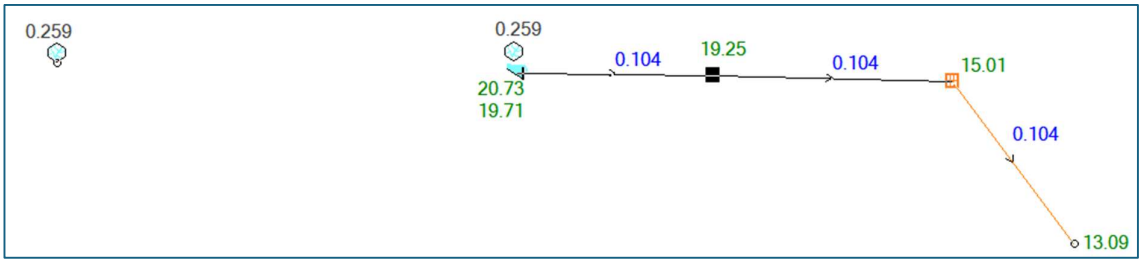


DRAINS RESULT

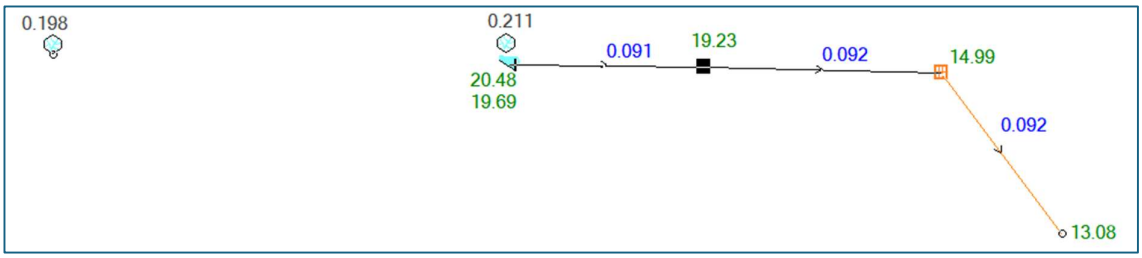
5% AEP



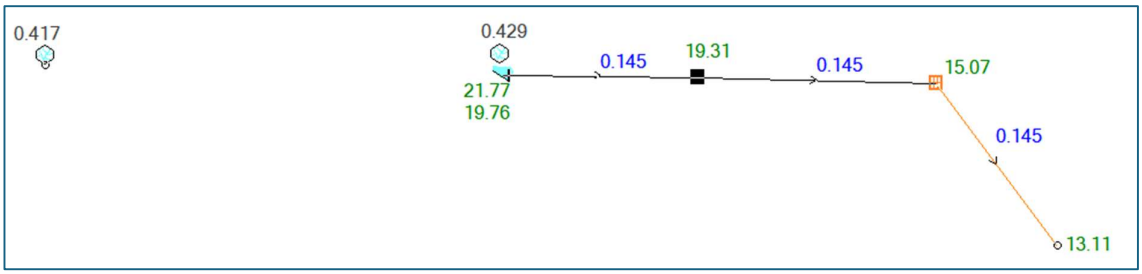
10% AEP



20% AEP



1% AEP (ANALYSED FOR THE MAXIMUM PSD AT PRE-DEVELOPMENT STATE)



9.3 APPENDIX C - ENGINEERING DRAWINGS (PLANS, SECTIONS, OSD)

9.4 APPENDIX D - FLOOD OR GROUNDWATER TECHNICAL REPORTS

Refer to Appendix V of the Environment Impact Statement (EIS).

9.5 APPENDIX E - MANUFACTURER DATA SHEETS FOR TREATMENT SYSTEMS