

Stormwater Management Plan Highbrook Private Plan Change Request

Final



Document control

Purpose

Purpose	To support the Highbrook Private Plan Change Request application
----------------	--

Document

Document Name	Stormwater Management Plan – Highbrook Private Plan Change Request
----------------------	--

Approval

Author of the Stormwater Management Plan: Suman Khareedi, Jono Ryan & Michael Barker		
Reviewed	Sukhi Singh	Date:22/07/22
Approved	Sukhi Singh	Date: 22/07/22

Table of contents

Executive summary	4
1 Existing site appraisal.....	8
2 Development summary and planning context	21
3 Mana whenua: Te ao Māori and mātauranga.....	24
4 Stakeholder engagement and consultation	27
5 Stormwater management.....	32
6 Departures from regulatory or design codes	39
7 Conclusions and recommendations for future work	40
Appendix A1 – Site Plan	41
Appendix A2 – Site Historical Activities Plan	42
Appendix B – Proposed Development Architectural Plans	43
Appendix C1 – Proposed Stormwater Management.....	44
Appendix C2 – Stormwater Runoff Calculations	45

Executive summary

The overall purpose of the Stormwater Management Plan (SMP) is to provide guidance to the applicant and Auckland Council on how stormwater will be managed based on a developed future land use scenario, and to support the Private Plan Change Request application.

This SMP is consistent with Council's policies and plans. Non-statutory policy and planning documents are also considered.

This Stormwater Management Plan (SMP) has been prepared to support the Highbrook Private Plan Change Request. The Plan Change area is part of the site at 8 Sparky Road, Ōtara, which was the site of the former Ōtāhuhu Power Station.

The purpose of the Plan Change is to enable the change in the use of the site from Light Industry Zone to Terrace House and Apartments Zone (THAB). The residential use of the site enables efficient use of the land resource in a strategic location, that has a high level of visual amenity offered by the Tāmaki Estuary environments.

The scope of the SMP:

The scope of this SMP is to:

- Detail proposed stormwater management for development of the plan change area.
- Demonstrate how stormwater management related expectations under the Auckland Unitary Plan (AUP) and Auckland Council's Stormwater Network Discharge Consent can be met.

Outcomes of the SMP:

The outcomes sought by the SMP are:

- An integrated stormwater management approach.
- A water sensitive treatment framework that manages and mitigates the impact of land use change from industrial to residential use.
- Provide for the enhancement of the Tāmaki Estuary environments.
- Identify flood risk areas and ensure that development is located or appropriately managed within these areas.
- A set of Best Practice Options (BPO) for stormwater that can be applied to the development.

Network Discharge Consent (NDC)

Auckland Council obtained a Region-wide Network Discharge Consent to authorise the diversion and discharge of stormwater. The area covered by the NDC includes all urban zoned land. The preparation of a SMP is a direct requirement of the NDC for any activity seeking to utilise or fall within the parameters of the NDC by having the SMP “adopted” into the NDC framework. In relation to this Private Plan Change Request, the NDC requires that a SMP only be adopted if a SMP has been prepared to support the plan change and the plan change must be consistent with that SMP (condition 13b). This SMP has been prepared to support the Private Plan Change Request for the rezoning of part of the site located at 8 Sparky Road, Ōtara.

The Plan Change Request seeks to rezone the site from Light Industry Zone to THAB Zone. The future development of the site will be required to align with the objectives, policies, and rules framework of the THAB Zone.

The Development Concept Plan to illustrate one option for the future development of the site, aligning with the outcomes envisaged by the THAB Zone. The Development Concept Plan envisages approximately 500 houses on the site, based on an apartment typology.

A new stormwater management system will replace the current stormwater management system on site comprising of table drains, a 300 mm stormwater culvert, and a catchpit. The new stormwater system will be a piped stormwater reticulation system with suitable stormwater treatment devices that comply with the Auckland Council’s Stormwater Code of Practice Version 3 that is effective from January 2022. A detailed design of this stormwater management system will be developed in the future to support the Resource Consent application. Once implemented, this new stormwater management system will service all buildings, impervious areas, and some pervious areas. The remainder of the pervious areas (less than 30% of the total site) viz., the area of the future esplanade reserve, will remain ‘unconnected’ thereby draining directly to the Tāmaki River.

The proposal is to treat stormwater from the entire site using new treatment devices that are designed to comply with GD01/TP10. The existing stormwater pond that treats runoff from a small area (0.9ha) of Highbrook Drive (refer to Figure 1) will need to be decommissioned to enable development within this portion of the site. To enable decommissioning this pond, the proposal is to combine the treatment of runoff from the subject section of Highbrook Drive with that from the site in device(s) to be constructed. Once vested in Auckland Council, this will reduce the operation and maintenance requirements for one treatment pond.

The proposed development plan and the topography of the site allows for the following four options for stormwater treatment:

1. A wetland (or a coastal wetland) constructed in conjunction with the creation of the esplanade reserve along the banks of the Tāmaki estuary.
2. Two stormwater treatment ponds at both ends of the site to treat approximately half the site in each pond.

3. Proprietary treatment devices (viz., Stormfilters) at both ends of the site to treat approximately half the site in each device.
4. Raingardens constructed along the proposed road.

Raingardens (Option 4) are not preferred, owing to operation and maintenance requirements and Auckland Transport's preference to not have them in the road corridor. Therefore, options 1, 2 and 3 are recommended for this site.

This new stormwater system will be a piped stormwater reticulation system that complies with the Auckland Council's Stormwater Code of Practice Version 3 that is effective from January 2022. As such, the network will have adequate capacity to convey 10% AEP event flows. The overland flows will be along the roads to be formed. No secondary flow structures viz., culverts are deemed necessary.

This site or the properties along the banks of Tāmaki Estuary downstream of the site, are neither flood prone nor flood sensitive. Only a small portion of the site in the vicinity of the barge dock (on the western side of the site) and the northern tip of the site that are at RL 2.0 m are expected to get inundated by 0.34 m during a 1% AEP event. The future development of the site will be carefully designed to ensure that habitable floors are not proposed in the section of the site that is flood prone or flood sensitive.

The future road network for this site can be aligned with the existing gravel roads. As such the overland flow paths within the site remain largely unchanged after the development.

The pipe network to service the site will be independent of the existing Auckland Council's stormwater network because of the site's location in relation to existing Auckland Council stormwater network. Stormwater flows from the site will discharge directly into Tāmaki Estuary after treatment. As such, the hydraulic connectivity will be directly to the Tāmaki Estuary flows. The time of concentration (ToC) for the flows from the site will be significantly less than the ToC for the flows in Tāmaki Estuary or the Ōtara Creek in the vicinity of the site.

The proposal is to vest the entire stormwater management system to be developed for this site, in Auckland Council. The future asset ownership will be with Auckland Council.

No bespoke operation and maintenance requirements are envisaged for the stormwater management system proposed for this site. They will be consistent with the operation and maintenance requirements of the wider Auckland Council stormwater network.

The principles outlined for the proposed stormwater management system is consistent with the objectives of the NDC. The proposed stormwater management system meets the connection requirements under Schedule 4 of the Regionwide Network Discharge Consent (NDC) that the Auckland Council holds. There are no departures from the Auckland Council Code of Practice or the connection requirements of the NDC.

Changing the zoning from Light Industry to THAB will have a lesser impact on the environment from the perspective of stormwater management. Under the AUP(OP), the

maximum permissible impervious area in the THAB Zone is less than that in the Light Industry Zone. This will result in reduced stormwater runoff volume and peak flows into the receiving environment. Rezoning the land as proposed will not result in any material difference in water quality, as in both cases, runoff will need to be treated to comply with the guidelines in GD01/TP10 and conditions of the Network Discharge Consent (NDC).

Establishing a combined treatment facility for the site and subject section of Highbrook Drive (currently being treated in a separate pond), will reduce maintenance requirements for Auckland Council. The opportunity to create wetland along the bank of the Tamaki Estuary will result in high level of amenity for the public, similar to the stormwater treatment facilities in the Highbrook Business Park further north along Highbrook Drive.

Rezoning as proposed has the potential for improvements both in the short term (establishment of an Esplanade Reserve area) and the long term (residential amenity). Establishment of an Esplanade Reserve in the future will provide public access and amenity, with ongoing maintenance of the coastal vegetation. In addition, residential development offers greater opportunities for planting, maintenance and enhancement of the main part of the site, as well as the coastal area.

1 Existing site appraisal

1.1 Summary of data sources and dates

Existing site appraisal item	Source and date of data used
Topography	<ul style="list-style-type: none"> Auckland Council GeoMaps
Geotechnical / soil conditions	<ul style="list-style-type: none"> Babbage Geotechnical Appraisal Memo of 17 February 2022 prepared by Jordan Moll
Existing stormwater network	<ul style="list-style-type: none"> Auckland Council GeoMaps and site inspection
Existing hydrological features	<ul style="list-style-type: none"> Auckland Council GeoMaps and site inspection
Stream, river, coastal erosion	<ul style="list-style-type: none"> Site inspection, Geotechnical appraisal
Flooding and flowpaths	<ul style="list-style-type: none"> Auckland Council GeoMaps and site inspection
Coastal Inundation	<ul style="list-style-type: none"> Auckland’s Exposure to Coastal Inundation by storm-tides and Waves Technical Report 2020/024
Ecological / environmental areas	<ul style="list-style-type: none"> Desktop Ecological Assessment Memo by Bioreserches dated 19 July 2022 prepared by Treffery Barnett
Cultural and heritage sites	<ul style="list-style-type: none"> No sites identified in the AUP(OP)
Contaminated land	<ul style="list-style-type: none"> Preliminary Contamination Review by Babbage Consultants Ltd dated 15 July 2022 prepared by Tiago Teixeira.

1.2 Location and general information

The land subject to the Private Plan Change Request (“the site”) is the part of 8 Sparky Road, Ōtara (shown in Figure 1) with a parcel ID 7534518. The site forms part of the former Ōtāhuhu Power Station site (closed in 2015). It is bound by Highbrook Drive to the south-east, Tāmaki Estuary to the north, Ōtara Creek to the Northeast, and State Highway 1 (SH1) to the west.

The site is currently zoned Light Industry. The proposal is to change the zoning to Terrace House and Apartments Zone (THAB). Figure 1, below, shows the area subject to the Plan Change Request. A plan of the existing site is also included in Appendix A1.

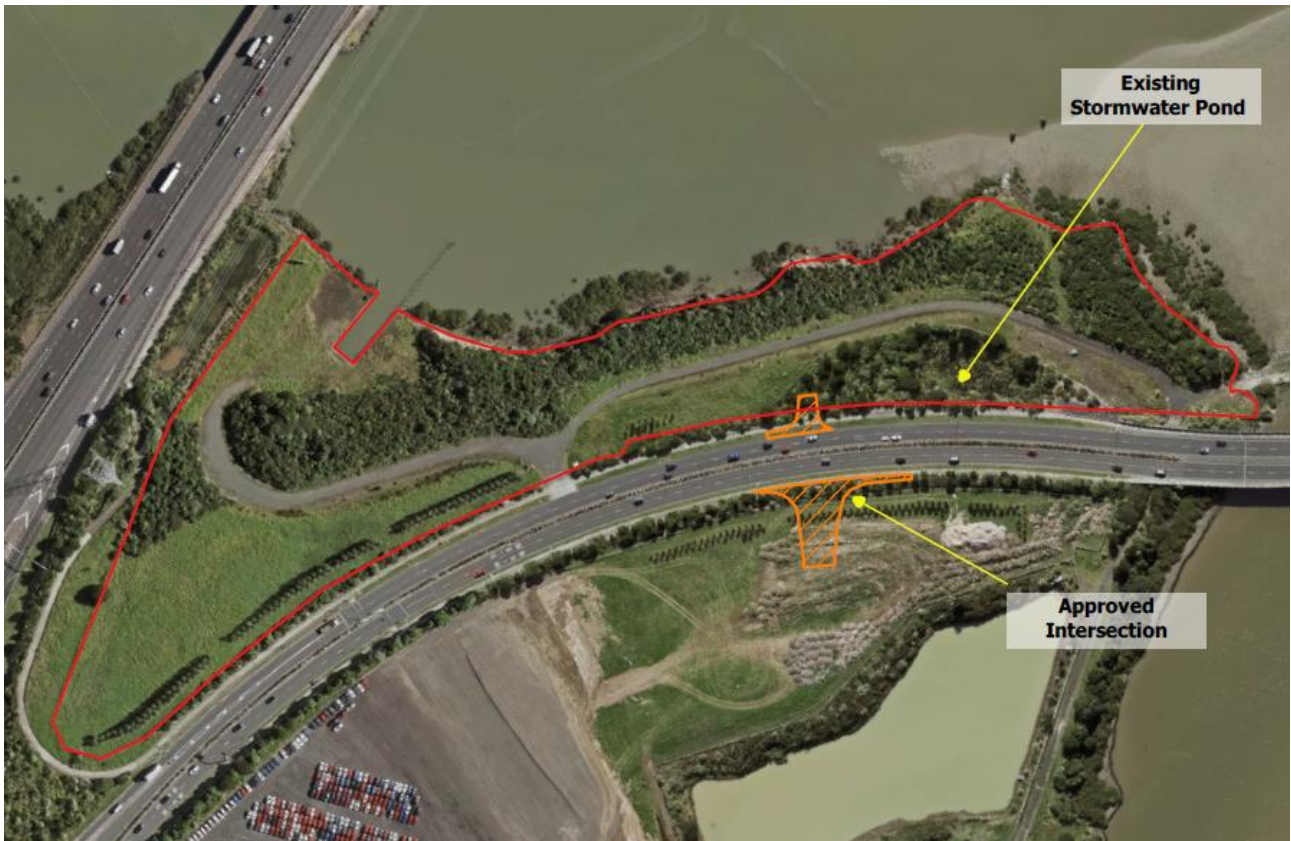


Figure 1: Location of plan change area (the Site)

Existing site element	
Site address	<ul style="list-style-type: none"> 8 Sparky Road, Ōtara
Legal description	<ul style="list-style-type: none"> Lot 2 DP 209362
Current Land Use	<ul style="list-style-type: none"> Vacant. A part of site adjoining Highbrook Drive is occupied by a small stormwater pond.
Current building coverage	<ul style="list-style-type: none"> N/A
Historical Land Use	<ul style="list-style-type: none"> Former Ōtāhuhu Power Station

The site is approximately 4.4ha and comprises vacant land with predominantly bush and grass cover. Some additional features at, and adjacent to, the site include (refer to figure 2, below):

1. Barge dock at the south end of the site. This was used for materials supply to support the construction of the former Ōtāhuhu Power Station.
2. Stormwater treatment pond towards the northern end of the site, adjacent Highbrook Drive. This pond treats stormwater runoff generated by a portion (approximately 0.9ha) of Highbrook Drive.

3. Boat ramp, at the northeast end of the site.
4. Gravel access road along the length of the site, running parallel to Highbrook Drive.
5. Concrete box culvert (4m x 2.4m) below Highbrook Drive at the north end of the site to allow vehicle access between the east and west sides of Highbrook Drive. This access has been blocked off with a fence and gate.
6. A Weir across Ōtara Creek, built as part of the Otahuhu Power Station to dam flows from Ōtara Creek to allow intake of water for cooling of the power station (figure 3).
7. Water cooling pond, where discharge of hot water from the former power station would cool down before discharging to Tamaki River. This pond has partly backfilled. The remainder of the pond is currently being used as a sediment control pond.
8. 1800mm diameter outfall pipeline between the water-cooling pond and Tamaki River. This pipeline runs across the north end of the subject site. This outfall pipe discharges into the Tamaki Estuary via three lines of diffusers identified by the markers.

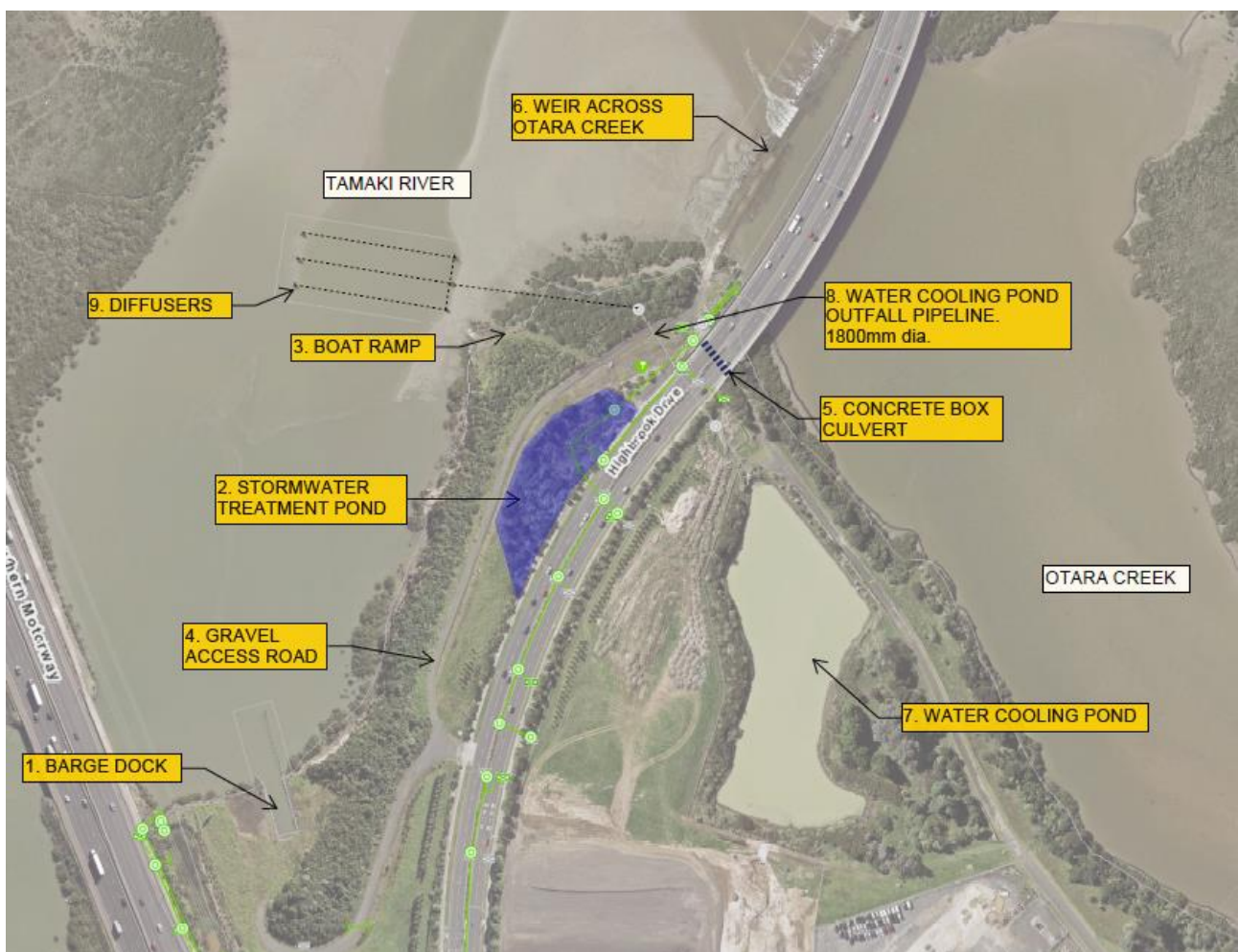


Figure 2: Existing Site Features



Figure 3: Existing Weir across Ōtara Creek



Figure 4: Remainder of the water cooling pond being used as a sediment control pond

1.3 Topography

The site generally falls from Highbrook Drive to the Tāmaki Estuary (north-westward direction) with the north end of the site falling to Ōtara Creek (north-eastward). The highest point of the site (RL 9.5 m) is in the south-eastern corner of the site. The topography of the site comprises of three distinct terraces. The first terrace is along the eastern boundary of the site (RL 8.0-9.5 m). The second terrace is a 25-30 m strip of land along the gravel road at an RL of 7.5-8.0 m. The third terrace is in the south-western corner of the site at an RL of 2.0-3.0 m in the vicinity of the barge dock.

1.4 Geotechnical

The geological map (see figure 5) indicates the south and centre of the site is underlain by pumiceous deposits of the Puketoka Formation (tp), described light-grey to orange-brown, pumiceous mud, sand and gravel, with muddy peat and lignite. The north part of the site is underlain by Lithic tuff of the Auckland Volcanic Field (avt), being thin graded beds of grey, mud- to sand-sized fragments of comminuted, country rock (mainly sandstone, mudstone, alluvium, micaceous sand) together with basalt and basanite fragments.

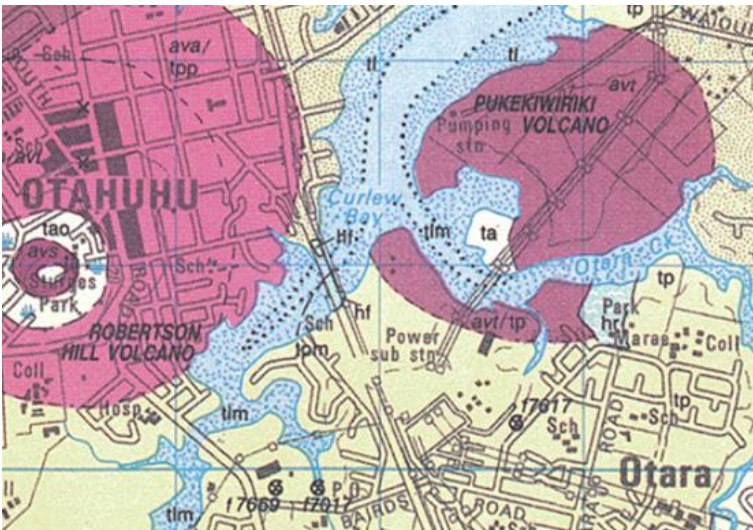


Figure 5: Geological Map

The desk study completed by Babbage, using details of historic investigations carried out close to the site, identifies the ground conditions to comprise of clay, silt, and sand of the Puketoka formation, overlain in part by tuff and other AVF deposits and/or surficial fill. The Puketoka formation is anticipated to comprised mostly stiff to hard silt over the top 8-15m with some loose to dense silty sand lenses. Competent Kaawa Formation sedimentary rock is expected between 15 m and 22 m below ground level.



Figure 6: Slope and condition along the bank of Tamaki River estuary

The northern most part of the site was reclaimed in the 1960s. In the late 1960s and 1970s an area in the southwestern corner of the site, adjacent to Tāmaki Estuary, was reclaimed. The source of the fill is unknown. Nonetheless, it appears to comprise of approximately 1.0m of well compacted aggregate separated from the underlying alluvium by a geotextile.

In the early 2000s significant earthworks were undertaken in the southern and eastern part of the site, and the land to the south and east, for the construction of Highbrook Drive. Large amounts of fill material were stockpiled in this area.

The site slopes gently down to the Tamaki River estuary along the western and northern boundaries with a thick vegetation and mangroves along the coastline. As such, the site is not considered to be susceptible to slope stability issues or coastal erosion.

1.5 Existing drainage features and stormwater infrastructure

The site is vacant land. The drainage/stormwater infrastructure currently present on site comprises the following (refer to figure 7, below):

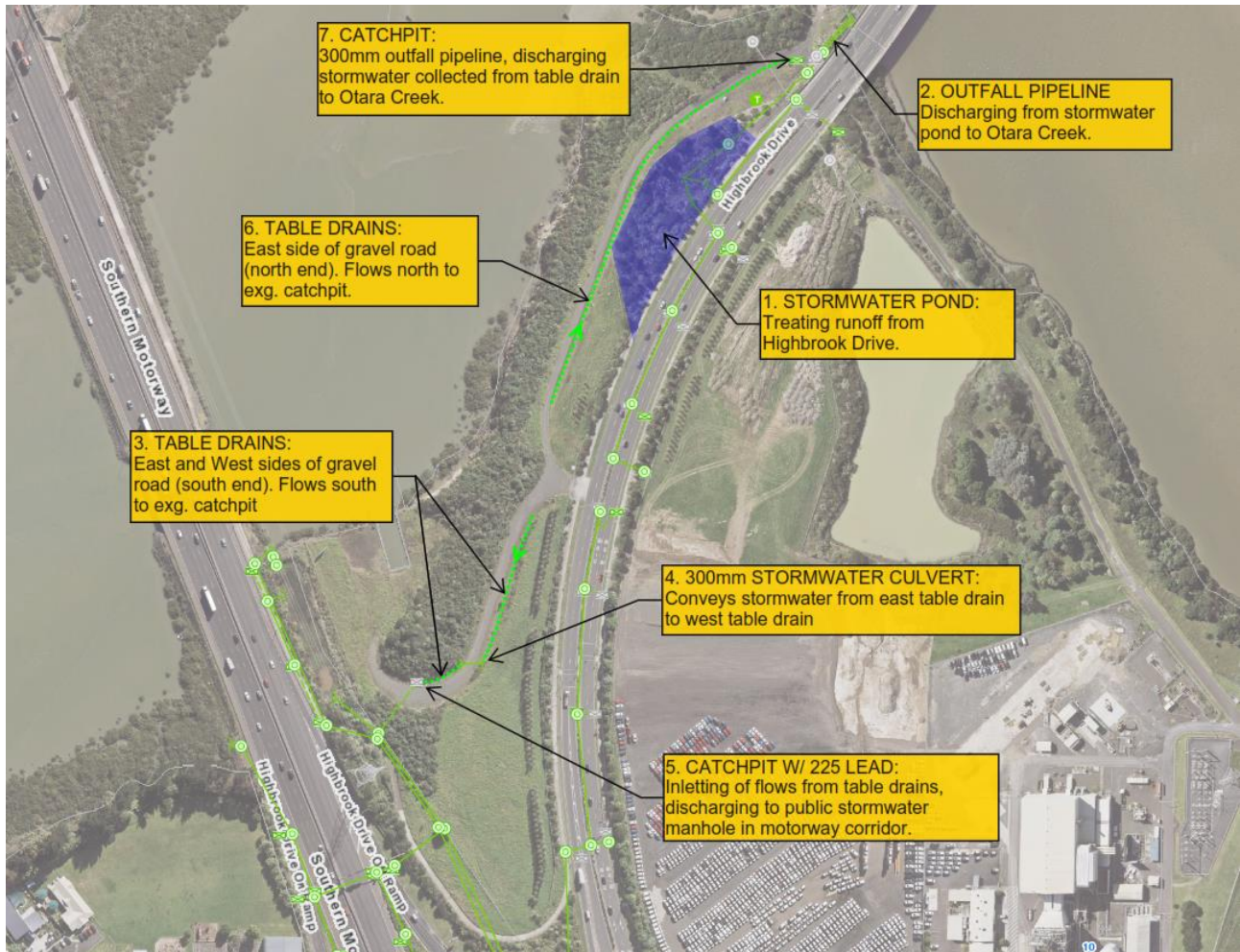


Figure 7: Existing drainage features & stormwater infrastructure

1. A stormwater pond that treats runoff from a 0.9 ha section of Highbrook Drive
2. Outfall pipeline from the stormwater pond that discharges to Ōtara Creek estuary
3. Table drains on either side of the gravel road (south end), flowing south to existing catchpit.
4. A 300 mm stormwater culvert across the gravel road that conveys stormwater from the eastern table drain to the western table drain (figure 8).
5. A catchpit and a 225 mm diameter lead connecting the discharge from the table drain (south end) to the existing manhole 2000058569 in the motorway corridor.
6. Table drains on the east side of the gravel road (north end), flowing north to existing catchpit.
7. A catchpit and 300 mm outfall pipeline, discharging to Ōtara Creek estuary.
8. 1800 mm outfall pipeline from the water cooling pond, traversing northeast across the site (refer to figure 2).



Figure 8: 300mm culvert across the internal gravel road

1.6 Receiving environment

The receiving environment for the site is the Tāmaki Estuary which forms part of the Hauraki Gulf catchment area (refer Figure 8.5.3.1 of the Regional Policy Statement in the AUP(OP)). Figure B7.4.2.1 of the AUP(OP) identifies the Tāmaki Estuary as a marine degraded area in Auckland (Degraded Area 1).

The receiving environment includes the Significant Ecological Areas (SEA) shown in Figure 9 below. The AUP(OP) describes these SEAs as:

- **SEA-M2-45w2** – Wading bird habitat. Extensive areas of feeding habitat for waders along this coastline. The whole of the Tamaki Estuary is a regionally important wildlife habitat and has been selected by the Department of Conservation as an Area of Significant Conservation Value (ASCV).
- **SEA-M2-45c** – Otahuhu Creek. Extensive areas of feeding habitat for waders along this coastline. SEA-M2



Figure 9: Extent of Significant Ecological Area

Both of the SEAs described above are either upstream of the site or located on the far bank of Tāmaki Estuary (opposite side of the subject site). There are no SEA areas delineated in the AUP along the banks of Tāmaki Estuary bordering the site.

There are no Natural Resources overlays applied over the site in the AUP(OP).

1.7 Existing hydrological features

The only hydrological feature on the site is the stormwater treatment pond that treats runoff from approximately 0.9 ha section of Highbrook Drive. It occupies an area of approximately 3,000 m² in the north-eastern corner of the site with an estimated storage volume of approximately 300 m³.

1.8 Flooding and Overland Flow Paths

Auckland Council, based on rapid flood modelling, has identified three overland flow paths through the site. These are shown in in Figure 10. Our site inspection has identified that there are no overland flow paths entering the site from neighbouring land. There are two overland flow paths that start within the site. They are:

1. The overland flow path along the table drains of the gravel road.

2. The overland flow path in the southern part of the site that drains to the NZTA stormwater pond.

The major overland flow path shown to run into the site at the northern end from Highbrook Drive from the water-cooling pond to the east of Highbrook Drive does not flow across the Tamaki Drive into the site as shown in the Auckland Council GeoMaps. The pond outlet structure has a flood gate (Figure 11) that allows discharge of secondary overland flows (or flows in excess pond discharge rate) directly to Tamaki Estuary through the 1800mm outfall pipeline.

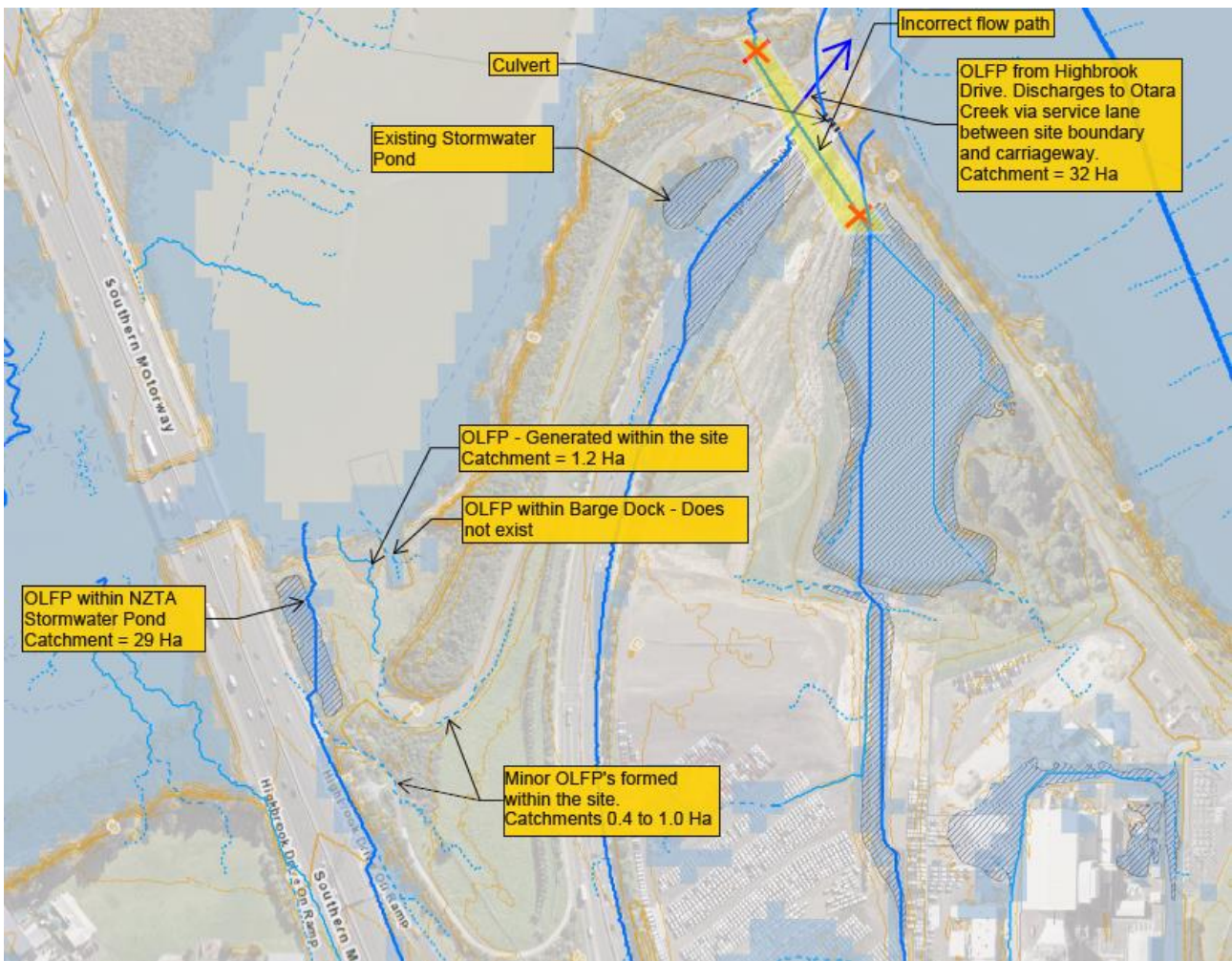


Figure 10: Overland flow paths through the site

Once the pond is fully reclaimed, the overland flows are likely to flow through the box culvert underpass via an access track next to the pond discharging to the Ōtara Creek upstream of the weir (as shown in Figure 10). As such this overland flow path does not enter the site now are in the future.



Figure 11: Floodgate at the water-cooling pond outlet

1.9 Coastal inundation

The west boundary of the site is contiguous with the banks of the Tamaki River. The Auckland Council Technical Report 2020/024: *Auckland’s Exposure to Coastal Inundation by Storm-tides and Waves* has calculated coastal inundation levels at two locations near the site. Table 1, below, summarises these results.

Table 1: Coastal Inundation Levels (*Auckland Council TR 2020/024*)

Site	0.01 AEP storm-tide wave elevations	max. AEP set up plus	0.01 AEP max. storm-tide plus wave setup elevations, with inferred wave setup component subtracted
Tāmaki Estuary at the mouth of Pakuranga Creek (downstream of the site)	RL 2.42m		RL 2.32m
Tāmaki Estuary near Lansdown Avenue (Upstream of the site)	RL 2.46m		RL 2.36m

By linear interpolation, the 1% AEP (0.01 AEP) maximum storm-tide plus wave setup elevation with inferred wave setup component subtracted at the site is estimated to be RL 2.34 m. This results in a small portion of the site in the vicinity of the barge dock and the northern tip of the site that is at RL 2.0 m gets inundated by up to 340 mm (0.34 m) during a 1% AEP event. Therefore, the future habitable floor levels of buildings within this part of the site need to be higher than RL 3.34 m. As per the Development Concept Plan, for the site, the habitable floors are expected to be along the eastern, southern and south-western boundary of the site where the general ground level is substantially above RL 3-8 m. The details pertaining to the finished ground levels of buildings will be refined at the time of applying for Resource Consents.



Figure 12: Extent of coastal inundation.

1.10 Biodiversity

Historic aerials (Auckland Council GeoMaps, Retrolense) illustrate that the site was cleared of all vegetation for farming except for a small amount of coastal fringe vegetation (1940, 1959, 1960). The site was further modified with the addition (1967) and removal (between 2001 and 2003) of power generation plant and access roads. This was followed by the construction of Highbrook Drive (2006) and subsequent landscape planting.

The vegetation on the site is currently a mix of rank grass, native plantings (flax, five finger, pōhutukawa, cabbage tree, kānuka), exotic trees (macrocarpa, poplar, pine) and exotic weed species (tree privet, pampas, wattle), transitioning to mangroves in the Coastal Marine Area (CMA). Although the area of native plantings near the coast are now well established, they are comprised of common native species, and area strongly influenced by weed species.

1.11 Cultural and heritage sites

The Auckland Council GeoMaps does not identify any cultural and heritage sites being present within the site.

1.12 Contaminated land

The site and surrounding area were pastureland until the part of the site and land to the southeast was developed for the Ōtāhuhu Power Station in the late 1960s. Two large circular tanks, in a large rectangular earth bund, associated with the power station were installed across the southeast boundary in 1967. In the late 1960s and 1970s, an area in the southwestern corner of the site, adjacent to the Tamaki River, was reclaimed. The source of the fill is unknown. A barge dock and long jetty stretching into the Tamaki River were constructed in this reclaimed area by 1979. A rectangular feature was present in the southwestern corner of the site in 1979/1980 but had been removed by 1988. The two circular tanks had been removed by the early 2000s at which time significant earthworks were undertaken in the southern and eastern part of the site and the land to the south and east, for the construction of Highbrook Drive.

The northern part of the site appears to have been used as a construction yard during this time. The road construction works were completed by 2010. There has been no significant changes at the site since 2010. It is possible that contaminated soil may be present in various locations at the site as a result of historical activities at the site and in the surrounding area. A detailed plan showing the historical activities included in Appendix A2.

2 Development summary and planning context

2.1 Proposed Development

The Plan Change Request seeks to rezone the site from Light Industry Zone to THAB Zone. The future development of the site will be required to align with the objectives, policies and rules framework of the THAB Zone.

The applicant has prepared a Development Concept Plan to illustrate one option for the future development of the site, aligning with the outcomes envisaged by the THAB Zone. The Development Concept Plan envisages approximately 500 houses on the site, based on an apartment typology. It is noted that development beyond 200 houses will need to be supported by a future Integrated Transport Assessment.

Future development of the site will require the vesting of esplanade reserve areas adjoining Tāmaki Estuary.



Figure 13: Concept Plan of the proposed development

2.2 Location and area

The site is a 4 ha (inclusive of the stormwater pond) part of 8 Sparky Road, Ōtara (shown in Figure 1) with a parcel ID 7534518. It forms a part of the former Ōtāhuhu power station site bound by Highbrook Drive to the south-east, Tāmaki Estuary to the north, Ōtara Creek Estuary to the Northeast, and the Southern Motorway to the west.

2.3 Earthworks

Detailed development design plans will be confirmed in the future at the time of lodging of the resource consent application, which will include the volume and area of the site to be

earth worked. Development of the site will require a main spine road to be formed and building platforms will be created to compliment the topography of the site.

2.4 Regulatory and design requirements

Requirement	Relevant regulatory / design to follow
Unitary Plan – SMAF hydrology mitigation	<ul style="list-style-type: none"> The site is not subject to the SMAF overlay
High Contaminant Generating Areas	<ul style="list-style-type: none"> Chapter E9 of the AUP(OP) will be relevant at the land development stage, given that residential development generally utilises car parks and manoeuvring areas that are likely to meet the threshold for this activity. The provisions of Chapter E9 and relevant policies of Chapter E1 (Water quality and integrated management) are noted and utilised in BPO for stormwater management.
Natural Hazards	<ul style="list-style-type: none"> Chapter E36 of the AUP(OP) sets out the provisions relating to natural hazards and flooding. Auckland Council’s GeoMaps (Figure 14) indicates overland flow paths, the 1 percent annual exceedance probability (AEP) floodplain, and the coastal storm inundation 1 per cent AEP area are present within the site. The provisions of Chapter E36 are used to inform the BPO for stormwater management.
Auckland Council GeoMaps - Floodplain & overland flow paths (left) and Coastal Inundation Control (right)	
Auckland Unitary Plan Precinct	<ul style="list-style-type: none"> N/A
Existing Management Plan	<p>Catchment</p> <ul style="list-style-type: none"> The Auckland Council’s GeoMaps show the site to be a part of the Ōtara Creek/Flat Bush catchment. At the time of writing this SMP, Healthy Waters

Requirement	Relevant regulatory / design to follow
	confirmed that currently there is no SMP or CMP for this catchment.
Auckland Council Regionwide Network Discharge Consent	<ul style="list-style-type: none"> • The Regionwide Stormwater Network Discharge Consent No. DIS60069613 is applicable. • Developers who wish to have the stormwater diversion and discharge associated with their proposal authorised by the NDC need to demonstrate that connection requirements under Schedule 4 are met. • The connection requirements for Brownfield (large) are applicable to this proposal. • Integrated stormwater management approach in accordance with the policies set out in E1, B7, and B8 of the AUP(OP) to: <ul style="list-style-type: none"> ○ Minimise stormwater related effects ○ Retain/restore natural hydrology as far as practicable ○ Minimise generation and discharge of contaminants and stormwater flows at source ○ Minimise temperature related effects ○ Enhance freshwater systems, including streams and riparian margins ○ Minimise the location of engineered structures in streams ○ Protect the values of SEAs as identified in the AUP(OP) • WATER QUALITY: Where discharge is to degraded or sensitive aquatic environment, treatment of all impervious areas by water quality device designed in accordance with GD01/TP10. Figure B7.4.2.1 identifies the Tāmaki Estuary as a degraded environment (Coastal Degraded 1). • Alternatives to water quality measures may be determined through an SMP that applies an Integrated Stormwater Management approach; meets Schedule 2 of the NDC; and is the best practicable option. • ASSETS: New assets to become part of the public network to meet the required level of service for the life of the asset. Vesting is subject to any required approvals under Stormwater Bylaw, and the Stormwater Code of Practice. Assets in the road corridor require approval from Auckland Transport.

3 Mana whenua: Te ao Māori and mātauranga

3.1 Identification and incorporation of mana whenua values

Four mana whenua groups acknowledged interest in the PC site, these groups were Ngāti Te Ata, Ngāti Tamaoho, Te Ākitai Waiohua and Ngāi Tai Ki Tāmaki. Consultation is ongoing, with all four groups agreeing to provide a Cultural Values Assessment (CVA). A summary of the consultation is in the table below:

Mana Whenua Group	Summary of Consultation
<ul style="list-style-type: none"> Ngāti Maru Rūnanga Ngāti Tamaterā Ngāti Whanaunga Te Ahiwaru – Waiohua Ngāti Pāoa Waikato - Tainui 	<p>Letter provided with an overview of the PC Request, including attachments of maps on 2 November 2021 requesting acknowledgement of potential interest matters for Mana Whenua.</p> <p>No interest was registered.</p>
Te Kawerau ā Maki	<p>Letter provided with an overview of the PC Request, including attachments of maps on 2 November 2021 requesting acknowledgement of potential interest matters for Mana Whenua.</p> <p>Response received on 4 November 2021, confirming that Te Kawerau ā Maki have shared ancestral interests in the PC area and have extremely high cultural sensitivity in relation to the awa and the shoreline. Te Kawerau ā Maki deferred to their whanaunga Kaitiaki to respond to and lead input into the PC Request: Ngāti Pāoa, Te Ākitai Waiohua and Ngāti tai ki Tāmaki.</p>
Ngāti Te Ata	<p>Letter provided with an overview of the PC Request, including attachments of maps on 2 November 2021 requesting acknowledgement of potential interest matters for Mana Whenua.</p> <p>A meeting with Ngāti Te Ata’s representative was held on 13 December 2021, and he confirmed that a Cultural Values Assessment is required. It was agreed that the Cultural Values Assessment would be completed following the lodgement of the PC Request with Auckland Council.</p> <p>The applicant is committed to ongoing consultation with Ngāti Te Ata.</p>
Ngāti Tamaoho	<p>Letter provided with an overview of the PC Request, including attachments of maps on 2 November 2021 requesting acknowledgement of potential interest matters for Mana Whenua.</p>

A meeting with Ngāti Tamaoho's representatives was held on 13 December 21. An overview of the plan change was provided. Ngāti Tamaoho has prepared a Cultural Values Assessment (Technical Report 10 in Appendix 4).

The applicant is committed to ongoing consultation with Ngāti Tamaoho.

Te Ākitai Waiohua

Letter provided with an overview of the PC Request, including attachments of maps on 2 November 2021 requesting acknowledgement of potential interest matters for Mana Whenua.

On 22 March 2022, a site walkover meeting was held with Te Ākitai Waiohua's representative, and he confirmed that a Cultural Values Assessment is required. It was agreed that the Cultural Values Assessment would be completed following the lodgement of the PC Request with Auckland Council.

The applicant is committed to ongoing consultation with Te Ākitai Waiohua.

A CVA has been prepared by Ngāti Tamaoho (Technical Report 10, Appendix 4). The report identifies the following key stormwater management matters:

- GD01 and GD04 stormwater guidelines are supported as appropriate means in stormwater mitigation;
- Use of low impact green stormwater infrastructure, reuse of clean roof water for non-potable reuse, capture for reuse of rainwater;
- Treatment train approach to all accesses and road runoff, including the use of enviro pods or similar within internal cesspits;
- Native riparian planting of 10 meters along waterways; and
- Creating a 'mana o te wai' plan to ensure the health of Te Wai O Taiki and Waitematā is not only maintained but increased.

In terms of addressing the above matters, the SMP has addressed water quality treatment of all impervious areas by recommending water quality device designed in accordance with GD01, along with other methods outlined for the management of stormwater systems to ensure comprehensive Water Sensitive Design (WSD) as outlined in GD04.

Pertaining to those other key matters, the client will meaningfully engage with Ngāti Tamaoho governance and kaitiaki in meeting the recommendations outlined above. Further investigation will be given to those matters forming part of the detailed design phase.

Furthermore, the applicant is committed to ongoing discussions and consultation with all four mana whenua groups in relation to cultural heritage values, and the effects on Wai O Taiki (Tāmaki River).

4 Stakeholder engagement and consultation

The area subject to the Private Plan Change Request is deemed to be brown-field land. The wider consultation undertaken in respect of the Plan Change is set out in the Statutory Assessment Report. The applicant is committed to undertaking further consultation with mana whenua groups and key stakeholders as part of the continued processing of this Plan Change Request. The applicant is also committed to undertaking further consultation with the key stakeholders (including Auckland Council and mana whenua) as part of the detailed design process at the land development stage. Refer to the table below summarising consultation with the key stakeholders.

Key stakeholder/ Organisation	Summary of Consultation
Tāmaki Estuary Protection Society	<p>Letter provided with an overview of the Plan Change Request, including attachments of maps on 25 February 2022.</p> <p>A meeting was held with the representatives of the Tāmaki Estuary Protection Society on 21 March 2022. The following key matters were raised:</p> <ul style="list-style-type: none">• concerns regarding potential contaminants in the Tāmaki River and Ōtara Creek.• Concerns regarding effects of the PC on the roosting of the shorebirds. <p>In response to the concerns raised, the Ecological Assessment Memo was updated to include consideration of effects on the coastal bird species using the weir at the mouth of the Ōtara Creek (where it flows into Tāmaki River) for roosting.</p>

In response to the concerns regarding contamination matters, a Land Contamination Review Report was prepared to identify current or historical potential for contamination sources in the PC area.

Greater East Tamaki Business Association (GETBA).

Letter provided with an overview of the Plan Change Request, including attachments of maps on 3 March 2022.

A meeting was held with the representatives of the GETBA on 29 March 2022. The following key matters were raised:

- Additional traffic effects arising from the PC Request, noting the existing congestion on Highbrook Drive.
- Requested maps identifying the locations of all the existing crossing in proximity to the PC area.
- Requested that all existing cameras used for crime prevention adjacent to underpass remain.

The information relating to the location of existing crossings was provided on 31 March 2022.

The PC Request is informed by an Integrated Transport Assessment, which includes consideration of traffic effects on Highbrook Drive.

Ōtara Waterways & Lake Trust

Letter provided with an overview of the Plan Change Request, including attachments of maps on 25 February 2022.

A meeting was held with the representatives of the Ōtara Waterways & Lake Trust on 4 April 2022. The following key matters were raised:

- Concerns regarding existing signalised crossings and the new proposed access.
-

-
- Requested maps identifying the locations of all the existing crossing in proximity to the PC area.
 - Concerns regarding the number of car parks and capacity within the development.
 - Requested information on Mana Whenua groups being consulted.

The information requested was provided on 20 April 2022.

The PC Request is informed by an Integrated Transport Assessment, which includes consideration of traffic effects on Highbrook Drive.

Goodman Property Trust (Goodman)

A meeting was held with the representatives of Goodman on 28 March 2022 to provide an overview of the PC Request. The following key matters were raised:

- Additional traffic effects arising from the PC Request, noting the existing congestion on Highbrook Drive.
- Need to ensure that the proposed residential development is of a high quality noting its location at the entrance to Highbrook Business Park, an area of significant investment for Goodman.

The ITA was provided to Goodman on 7 July 2022 for review by their independent specialists.

Ōtara-Papatoetoe Local Board

Letter provided with an overview of the Plan Change Request, including attachments of maps on 2 March 22.

An overview of the PC was provided to the Ōtara - Papatoetoe Local board in their workshop meeting on 26 April 22. The Board as interested it the following key matters:

- The type of housing to be developed.
 - Interested to know whether there would be any social procurement schemes to allow public to participate in landscaping/ design or communal gardens.
-

-
- Requested that the PC incorporate greenways in providing connectivity to the PC area.

Ōtara-Papatoetoe Local Board will review the PC Request when lodged via the statutory process.

Howick Local Board

Letter provided with an overview of the Plan Change Request, including attachments of maps on 02 March 22.

The Howick Local Board declined the request for a meeting, as comments of the Board are to be provided following the lodgement of the PC Request via the statutory process.

Waka Kotahi and AT

Multiple meetings have been held with Waka Kotahi and AT representatives to discuss the various aspects of the PC Request, including:

- Need for future development within the PC area to secure access to Waka Kotahi's stormwater pond adjoining the PC area. The applicant agrees that this will be provided at the land development phase.
 - Noting the proximity to SH1 and Highbrook Drive, the PC should consider potential elevated noise environment and need for noise mitigation. The applicant agrees with this request, and has proposed noise mitigation measures in the PC Request.
 - Need for an ITA to assess traffic effects on the SH1 and Highbrook interchange and the other roads in the proximity of the PC area. The draft ITA was provided to Waka Kotahi and AT for review prior to lodgement. Feedback received was incorporated into ITA submitted with the PC Request. The findings and recommendations of the ITA have been incorporated into the PC Request.
 - Need to illustrate that the current zoning of the site is unable to be utilised for its intended purposes.
-

Transpower New Zealand

A meeting with Transpower's representative was held on 3 September 2021. The key following matters were discussed:

- There are no concerns in relation to the effects of the PC on the Ōtara Substation given the separation distance between the two.
- Ensure that there is no development proposed underneath the National Grid infrastructure.
- Ensure that the proposed development does not restrict access to the National Grid Tower beside the PC area. The applicant agrees that access to the Tower will be provided at the land development stage.

The applicant is committed to consulting with Transpower at the land development phase.

5 Stormwater management

5.1 Principles of stormwater management

Auckland Council GeoMaps show the site to be within the Ōtara catchment. Healthy Waters has confirmed that, currently the Ōtara catchment does not have a Stormwater Management Plan (SMP) or Catchment management Plan (CMP). Therefore, guidance for stormwater management in this site cannot be drawn from a SMP/CMP for the wider catchment this site is in. Notwithstanding that, the stormwater management assets will be vested in Auckland Council following the development of this site. Therefore, stormwater management system designed for this site will need to meet the connection requirements under Schedule 4 of the Regionwide Network Discharge Consent (NDC) that the Auckland Council holds.

The connection requirements outlined in Schedule 4 of the NDC for brownfield developments include:

1. Water Quality: Treatment of all impervious areas by a water quality device designed in accordance with GD01/TP 10 for the relevant contaminants.
2. Stream Hydrology: Where discharge is to a stream via public stormwater outside of SMAF – meet SMAF 1/SMAF 2 requirements.
3. Flooding:
 1. Ensure there is sufficient capacity within the pipe network downstream of the connection point to cater for the additional stormwater runoff associated with the development in a 10% AEP event.
 2. Demonstrate that flows in excess of the pipe capacity in a 10% AEP event within the pipe network downstream of the connection point will not increase adverse effects on any other property.
4. Buildings – 1% AEP event: Manage/mitigate 1% peak flows to that immediately preceding development/redevelopment.

The requirements of stormwater management for this site in the order of priority is as follows:

1. **Provision of quality stormwater infrastructure** – It is vital to provide quality stormwater infrastructure to maintain healthy waterways and to mitigate risks to our communities, people and property. Moreover, quality stormwater infrastructure ensures that the strategic objectives and the connection requirements under the NDC are met.
2. **Water quality management** – The section of Tāmaki Estuary and the Ōtara Creek in the vicinity of the site is within the Hauraki Gulf catchment area. SEA areas are mapped upstream of the site and on the far bank of the Tāmaki Estuary (opposite

side of the subject site). Therefore, maintaining or improving the water quality in the Tāmaki Estuary and Ōtara Creek is a priority of the stormwater system for this site.

3. ***Mitigation of erosion at the outfall and protection and protection/enhancement of the SEA*** – Currently, there is no known coastal erosion along the banks of Tāmaki Estuary in the vicinity of the site. It is important to maintain this condition post development. Therefore, the stormwater system proposed for this site needs to protect and enhance the banks of the Tāmaki Estuary.
4. **Managing flows in excess of the pipe capacity i.e., secondary flows** – Managing flows in excess of pipe capacity protects people, properties and our communities in storm events in excess of 10% AEP. This also mitigates the risk of flooding of habitable floors during major storm events. Therefore, the stormwater management system for this site needs to provide a 10% AEP storm event level of service.
5. ***Mitigating risk of 1% peak flows having adverse impact on development/redevelopment*** – The habitable floors in this site need to be above the coastal inundation level calculated for this site to mitigate the exposure of the development to climate change impacts and flooding during major storms. This measure, in conjunction with managing secondary flows will provide a satisfactory level of protection to habitable floors in future buildings on this site.

The site is located at the bottom of the Ōtara Creek catchment. Stormwater flows from this site discharge to the Tāmaki Estuary. The hydrological benefits of flow attenuation diminish substantially at the bottom of a catchment. In addition, there are no known flooding issues in the Tāmaki Estuary downstream of the site, nor are there any known coastal erosion issues in the vicinity of the site. Therefore, attenuation of flows is deemed unnecessary. Nonetheless, the topography and the nature of the development anticipated in the THAB Zone lends itself to incorporating rainwater harvesting within the site, which offer substantial benefits. This along with other methods outlined for the management of stormwater systems for this site, will result in comprehensive Water Sensitive Design (WSD) which is defined in GD04 as:

“An approach to freshwater management, it is applied to land use planning and development at complementary scales, including region, catchment, development and site. Water sensitive design seeks to protect and enhance natural freshwater systems, sustainably manage water resources, and mimic natural processes to achieve enhanced outcomes for ecosystems and or communities”.

Integrated approaches such as WSD minimise the adverse effects of growth and development on freshwater systems and coastal waters. It is Auckland Council’s preferred stormwater management approach. Therefore, the future development of the site should explore options to harvest rainwater on this site.

The strategic objectives of the NDC applicable for this site include:

1. *Healthy and connected waterways that provide for te mauri o te wai: Stream, groundwater and coastal water values are maintained and enhanced and communities are connected with them.*
2. *Support growth through water sensitive development and provision of quality stormwater infrastructure is enabled.*
3. *Risk to our communities, including people, property and infrastructure is reduced.*

The principles of stormwater management outlined in this section will assist the future development to comply with the strategic objectives mentioned above.

5.2 Proposed stormwater management

The objective of this Stormwater Management Plan is to outline the principles to ensure that the connection requirements and the strategic objectives of the NDC are met. A detailed design of the future stormwater management system will be developed at the time of applying for Resource Consents.

5.2.1 General

A new stormwater management system will replace the current stormwater management system on site comprising of table drains, a 300 mm stormwater culvert across the gravel road and a catchpit. The new stormwater system will be a piped stormwater reticulation system with suitable stormwater treatment devices that comply with the Auckland Council's Stormwater Code of Practice Version 3 that is effective from January 2022. A detailed design of this stormwater management system will be developed in the future to support the Resource Consent application. Once implemented, this new stormwater management system will service all buildings, impervious areas, and some permeable areas i.e., these areas will be 'connected'. The remainder of the pervious areas (less than 30% of the total site) viz., including the area of the future esplanade reserve, will remain 'unconnected' thereby draining directly to the Tāmaki River.

5.2.2 Water quality

The proposal is to treat stormwater from the entire site using new treatment devices that are designed to comply with GD01/TP10. The existing stormwater pond that treats runoff from a small area (0.9ha) of Highbrook Drive (refer to Figure 1) will need to be decommissioned to enable development within this portion of the site. To enable decommissioning this pond, the proposal is to combine the treatment of runoff from the subject section of Highbrook Drive with that from the site in device(s) to be constructed. Once vested in Auckland Council, this will reduce the operation and maintenance requirements for one treatment pond.

The water quality volumes that we have calculated for the maximum probable development (MPD) within the site is included in Appendix C2.

While the detailed design of the water quality pond is to be undertaken at the time of the Resource Consent application, we have completed a preliminary, high-level assessment of the stormwater treatment volumes. Based on this assessment, a total of 765 m³ of runoff

will need to be treated, comprising 157 m³ generated by the Highbrook Drive catchment and 608 m³ from the site itself.

The proposed development plan and the topography of the site allows for the following four options for stormwater treatment:

1. A wetland (or a coastal wetland) constructed in conjunction with the creation of the esplanade reserve along the banks of the Tāmaki estuary.
2. Two stormwater treatment ponds or proprietary treatment devices (viz., Stormfilters) at both ends of the site to treat approximately half the site in each device.
3. Raingardens constructed along the proposed road.

Raingardens (Option 3) are not preferred, owing to operation and maintenance requirements and Auckland Transport's preference to not have them in the road corridor. Therefore, options 1 or 2 are recommended for this site. A concept plan of stormwater treatment options is set out in Appendix C1.

5.2.3 Flooding 10 percent AEP event (Network Capacity)

A detailed design of this stormwater management system will be confirmed in the future at the land development stage to support the Resource Consent application. This new stormwater system will be a piped stormwater reticulation system that complies with the Auckland Council's Stormwater Code of Practice Version 3 that is effective from January 2022. As such, the network will have adequate capacity to convey 10% AEP event flows. The overland flows will be along the roads to be formed. No secondary flow structures viz., culverts are deemed necessary.

Our review of the Auckland Council's GeoMaps has confirmed that there are no flood prone/flood sensitive areas along the Tāmaki Estuary downstream of the site during 10% AEP or 100% AEP events. The only flood prone location in the vicinity of the site is a localised depression along Highbrook Drive next to the treatment pond. Based on our site inspection, should the flood waters overtop the kerbs, this area will drain to Ōtara Creek via the service road bypassing the site.

5.2.4 Flooding 1 percent AEP event (Habitable floors)

As discussed in the previous section of this report, this site or the properties along the banks of Tāmaki Estuary downstream of the site, are not flood prone nor flood sensitive. Only a small portion of the site in the vicinity of the barge dock (on the western side of the site) and the northern tip of the site that are at RL 2.0 m are expected to get inundated by 0.34 m during a 1% AEP event. The future development of the site will be carefully designed to ensure that habitable floors are not proposed in the section of the site that is prone to inundation.

5.2.5 Overland flowpath and floodplain management

As discussed in section 1.8 of this report, there are no overland paths entering the site from neighbouring properties. The two overland flow paths in the site coincide with the table

drains along the existing gravel roads. The future road network for this site is able to be aligned with the existing gravel roads. As such the overland flow paths within the site can remain largely unchanged after the development. Moreover, future development on the site is not expected to affect downstream properties by way of new or altered overland flow paths as the stormwater runoff discharges directly to the Tāmaki Estuary.

5.3 Hydraulic connectivity

The post-development stormwater management system proposed for this site comprises of a pipe network and treatment devices. The pipe network to service the site will be independent of the existing Auckland Council's stormwater network because of the site's location in relation to existing Auckland Council stormwater network. Stormwater flows from the site will discharge directly into Tāmaki Estuary after treatment. As such, the hydraulic connectivity will be directly to the Tāmaki Estuary flows.

The time of concentration (ToC) for the flows from the site will be significantly less than the ToC for the flows in Tāmaki Estuary or the Ōtara Creek in the vicinity of the site.

5.4 Asset ownership

The proposal is to vest the entire stormwater management system to be developed for this site, in Auckland Council. The future asset ownership will be with Auckland Council.

5.5 Ongoing maintenance requirements

The stormwater management system for the site will be designed in the future at the land development phase. Details of ongoing maintenance requirements will be outlined in the Resource Consent stage. Notwithstanding that, the stormwater management proposed for the site will comprise of a pipe network and stormwater treatment device(s) that comply with the requirements of GD01 and the Stormwater Code of Practice Version 3. As such, no bespoke operation and maintenance requirements are envisaged. They will be consistent with the operation and maintenance requirements of the wider Auckland Council stormwater network.

5.6 Implementation of stormwater network

The stormwater network to service the site will be implemented in the future at land development stage.

5.7 Dependencies

As discussed earlier, the pipe network to service the site will be independent of the existing Auckland Council's stormwater network due of the site's location in relation to the existing Auckland Council stormwater network. Stormwater flows from the site discharge directly into Tāmaki Estuary after treatment. As such, it is not dependent on the implementation or upgrade of the Auckland Council's current stormwater network.

It is proposed to decommission the existing stormwater treatment pond that services 0.9ha of a section of Highbrook Drive. This can be decommissioned only after a suitable device to

treat the stormwater flows from the site and the subject section of Highbrook Drive is constructed. This is the only dependency that is envisaged.

5.8 Risks

No risks to the wider Auckland Council stormwater management system is envisaged from the proposed plan change or the future development of the site.

6 Departures from regulatory or design codes

There are no departures proposed as part of this Stormwater Management Plan.

7 Conclusions and recommendations for future work

[insert chapter introduction statement here]

7.1 Conclusions

The principles outlined for the proposed stormwater management system is consistent with the objectives of the NDC. The proposed stormwater management system meets the connection requirements under Schedule 4 of the Regionwide Network Discharge Consent (NDC) that the Auckland Council holds. There are no departures from the Auckland Council Code of Practice or the connection requirements of the NDC.

Changing the zoning from Light Industry to THAB will have a lesser impact on the environment from the perspective of stormwater management. Under the AUP(OP), the maximum permissible impervious area in the THAB Zone is less than that in the Light Industry Zone. This will result in reduced stormwater runoff volume and peak flows into the receiving environment. Rezoning the land as proposed will not result in any material difference in water quality, as in both cases, runoff will need to be treated to comply with the guidelines in GD01/TP10 and conditions of the Network Discharge Consent (NDC).

Establishing a combined treatment facility for the site and subject section of Highbrook Drive (currently being treated in a separate pond), will reduce maintenance requirements for Auckland Council. The opportunity to create wetland along the bank of the Tamaki Estuary will result in high level of amenity for the public, similar to the stormwater treatment facilities in the Highbrook Business Park further north along Highbrook Drive.

Rezoning as proposed has the potential for improvements both in the short term (establishment of an Esplanade Reserve area) and the long term (residential amenity). Establishment of an Esplanade Reserve in the future will provide public access and amenity, with ongoing maintenance of the coastal vegetation. In addition, residential development offers greater opportunities for planting, maintenance and enhancement of the main part of the site, as well as the coastal area.

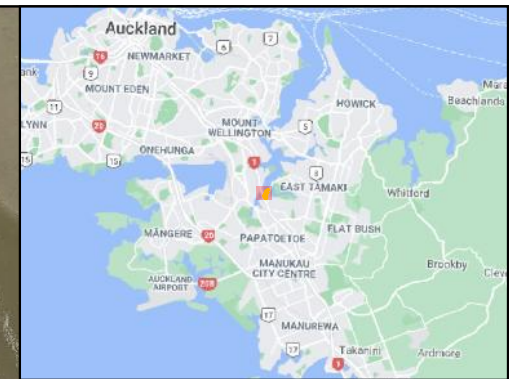
7.2 Recommendations

Our recommendation is that the subject site, being part of 8 Sparky Road, Ōtara with a parcel ID 7534518, be rezoned for residential development. We also recommend disestablishing the current stormwater pond that treats 0.9ha of Highbrook Drive in favour of a combined treatment facility.

Appendix A1 – Site Plan



TAMAKI RIVER



Legend

- Highbrook Site Boundary
- Contours Line (RL)
 0.5

NOTES
 Aerial Images - LINZ Basemap

DISCLAIMER:
 This map/plan is not an engineering draft.
 This map/plan is illustrative only and all information
 should be independently verified on site before
 taking any action.

SCALE
1:3,000 @ A3

MAP NO.
64872#BEE02 01

6. WEIR ACROSS OTARA CREEK

9. DIFFUSERS

8. WATER COOLING POND
 OUTFALL PIPELINE.
 1800mm dia.

5. CONCRETE BOX
 CULVERT

3. BOAT RAMP

2. STORMWATER
 TREATMENT POND

OTARA CREEK

4. GRAVEL
 ACCESS ROAD

7. WATER COOLING POND

1. BARGE DOCK

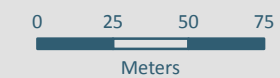
**Appendix A - Sheet 1
 Site Plan**





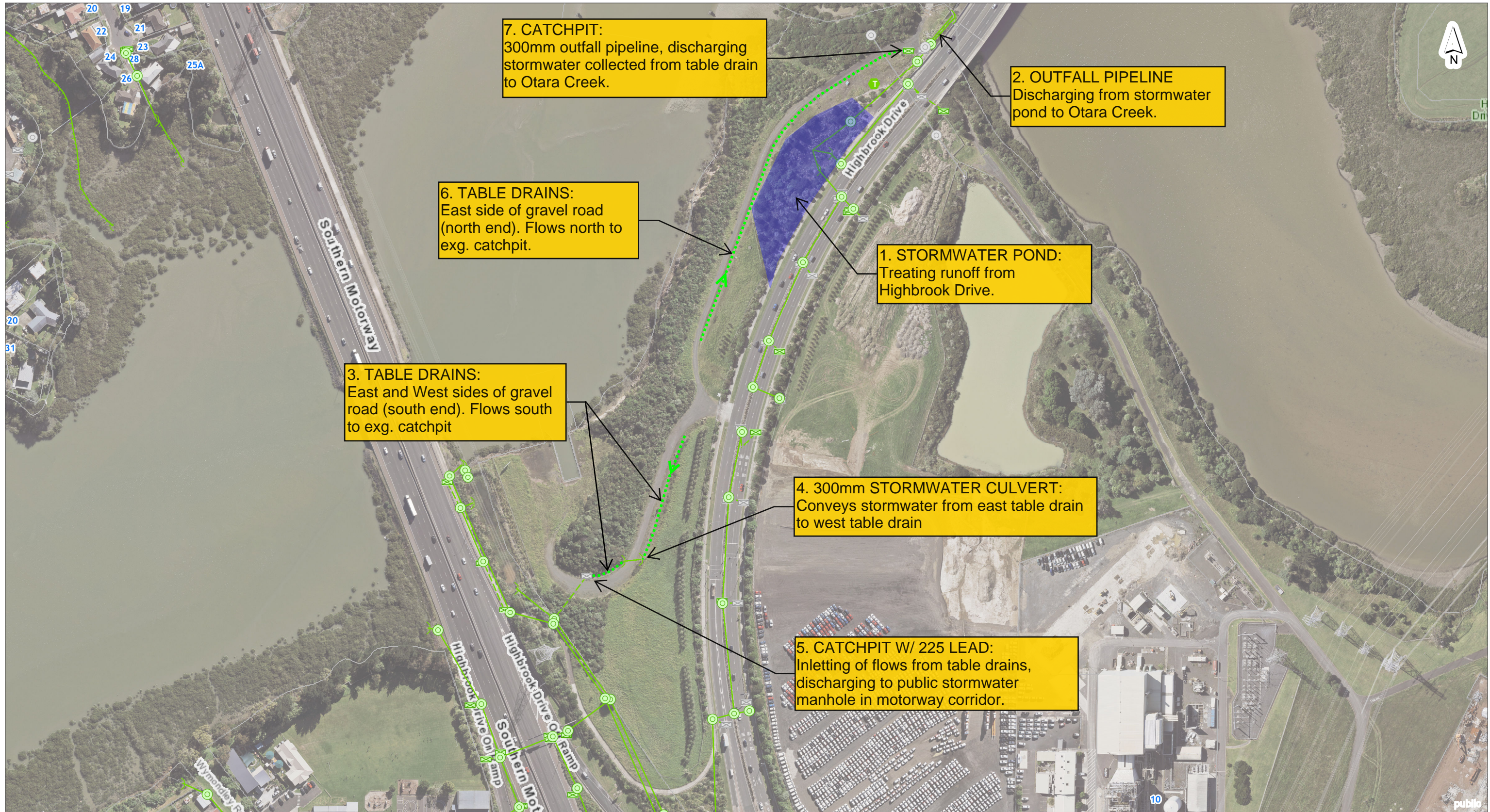
DISCLAIMER:
 This map/plan is illustrative only and all information should be independently verified on site before taking any action. Copyright Auckland Council. Land Parcel Boundary information from LINZ (Crown Copyright Reserved). Whilst due care has been taken, Auckland Council gives no warranty as to the accuracy and plan completeness of any information on this map/plan and accepts no liability for any error, omission or use of the information. Height datum: Auckland 1946.

Appendix A - Sheet 2 Existing Site Features Plan



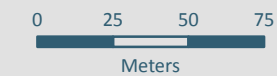
Scale @ A3
 = 1:2,500

Date Printed:
 22/11/2021



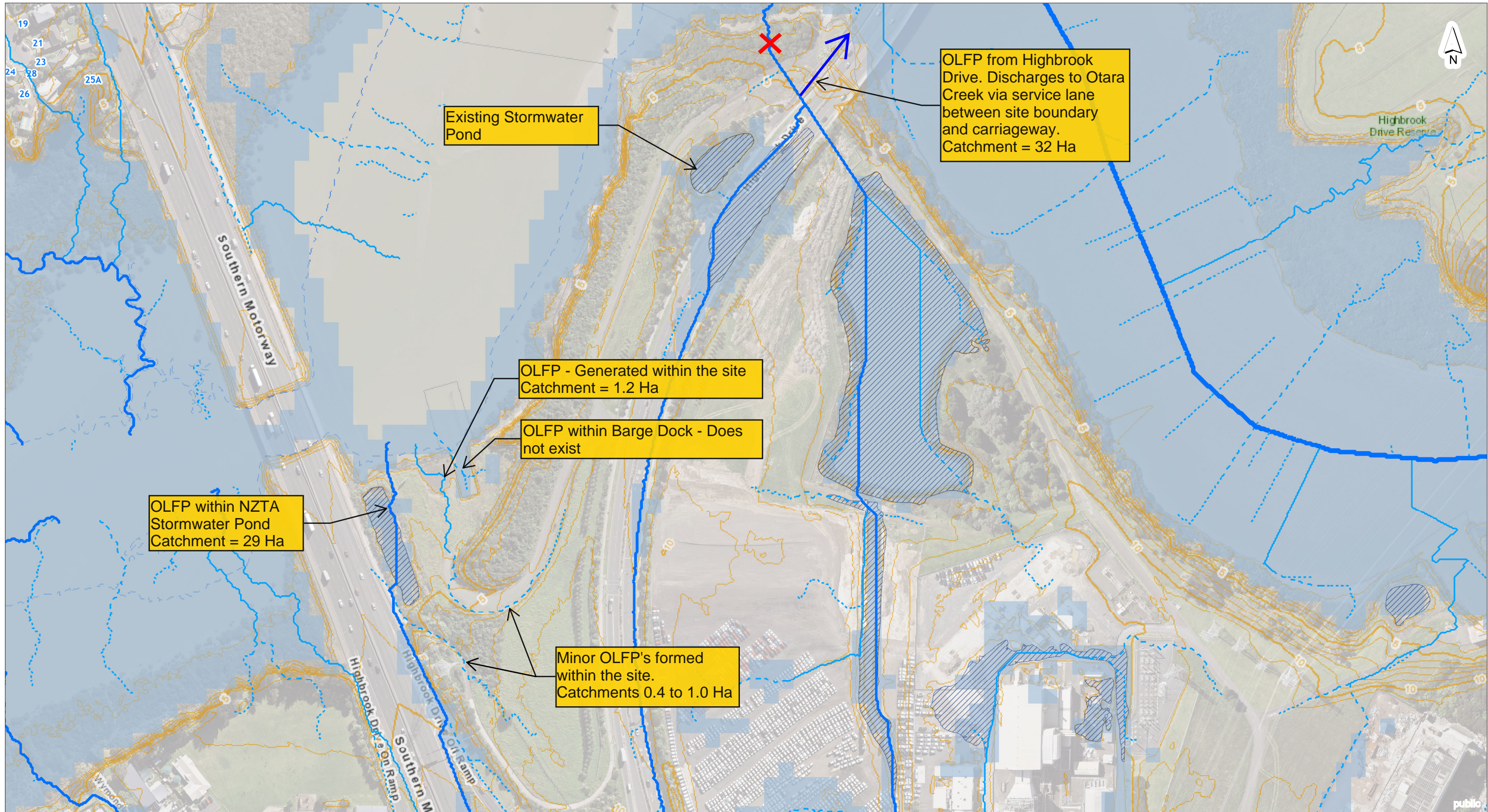
DISCLAIMER:
This map/plan is illustrative only and all information should be independently verified on site before taking any action. Copyright Auckland Council. Land Parcel Boundary information from LINZ (Crown Copyright Reserved). Whilst due care has been taken, Auckland Council gives no warranty as to the accuracy and plan completeness of any information on this map/plan and accepts no liability for any error, omission or use of the information. Height datum: Auckland 1946.

Appendix A - Sheet 3 Existing Drainage Features Plan



Scale @ A3
= 1:2,500

Date Printed:
16/11/2021



DISCLAIMER:
This map/plan is illustrative only and all information should be independently verified on site before taking any action. Copyright Auckland Council. Land Parcel Boundary information from LINZ (Crown Copyright Reserved). Whilst due care has been taken, Auckland Council gives no warranty as to the accuracy and plan completeness of any information on this map/plan and accepts no liability for any error, omission or use of the information. Height datum: Auckland 1946.

Appendix A - Sheet 4 Flood Hazards Plan

0 25 50 75
Meters

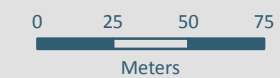
Scale @ A3
= 1:2,500

Date Printed:
23/11/2021



DISCLAIMER:
This map/plan is illustrative only and all information should be independently verified on site before taking any action. Copyright Auckland Council. Land Parcel Boundary information from LINZ (Crown Copyright Reserved). Whilst due care has been taken, Auckland Council gives no warranty as to the accuracy and plan completeness of any information on this map/plan and accepts no liability for any error, omission or use of the information. Height datum: Auckland 1946.

Appendix A - Sheet 5 1%AEP Coastal Inundation Plan



Scale @ A3
= 1:2,500

Date Printed:
24/11/2021

Appendix A2 – Site Historical Activities Plan



Appendix A2 - Sheet 1 Site Historical Activities Plan

COPYRIGHT BABBAGE CONSULTANTS LIMITED
UNAUTHORISED COPYING PROHIBITED
DO NOT SCALE THIS MAP
PLEASE REFER ALL QUERIES TO
BABBAGE CONSULTANTS LIMITED

CLIENT / PROJECT
Stonehill Trustees

Highbrook Private Plan Change

MAP TITLE
**Map No 2. Former Investigations
and Soil Disturbed Areas -
Potential Contaminated Land**

MAP REVISIONS
06/04/2022 Initial version by TT.

Legend

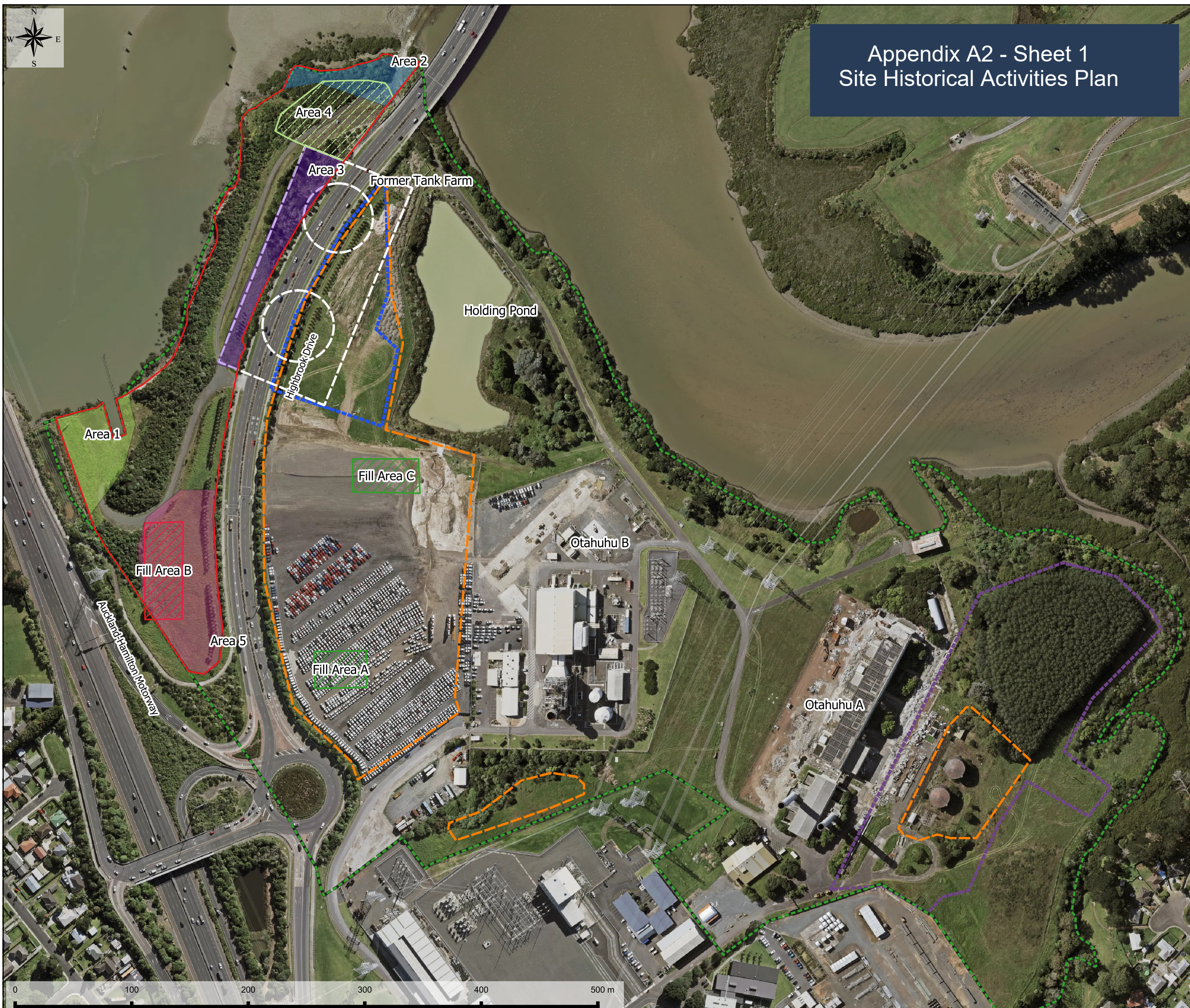
- 8 Sparky Road Site
- Highbrook Site Boundaries
- Potential Contaminated Land Areas - Highbrook Site**
 - Area 1 - Reclamation (1969 - 1979)
 - Area 2 - Reclamation (1967)
 - Area 3 - Former Tank Farm (1967 - 2003)
 - Area 5 - Former Construction Yard Area (2006)
 - Area 4 - Soil/Fill Material Stockpiled (2006)
- Former Intrusive Investigations**
 - Areas of T&T 2011 Investigation
 - T&T 2011
 - T&T 2011
 - Not Investigated
 - Area of GSL2018 DSI Investigation
 - Area of GSL2019 Investigation

NOTES
Aerial Images - LINZ Basemap
Land Parcels - Auckland Council Geomaps

DISCLAIMER:
This map/plan is not an engineering draft.
This map/plan is illustrative only and all information
should be independently verified on site before
taking any action.

SCALE
1:3,000 @ A3

MAP NO.
64872#BEE02 01



Appendix B – Proposed Development Architectural Plans

HIGHBROOK LIVING DEVELOPMENT CONCEPT PLAN



Key:

- A Dairy
- B Shared Office Facility
- C Cafe
- D Apartment Blocks -predominantly five storeys
- E Terrace Houses
- F Stand alone houses / Duplexes

Appendix C1 – Proposed Stormwater Management

CLIENT / PROJECT

Stormwater Management Plan
 Highbrook Living

Terraced/Town housing Planning






MAP TITLE

**Terraced/Town housing Planning
 in Highbrook**

MAP REVISIONS

28/10/2021 Initial version by v1.

Legend

-  Area-1 : 70% Impervious surface area
-  Area-2 : 90% Impervious surface area
-  Option 1- Wetland
-  Option 2- Ponds
-  Option 3- Proprietary SW treatment devices

NOTES

Mapped 21/10/2021 by Sundra Tatiparthi

SOURCES

1. Aerial photograph: LINZ Basemap, 2020
2. Road and boundary information: LINZ Data

DISCLAIMER:

This map/plan is not an engineering draft.
 This map/plan is illustrative only and all information
 should be independently verified on site before
 taking any action.

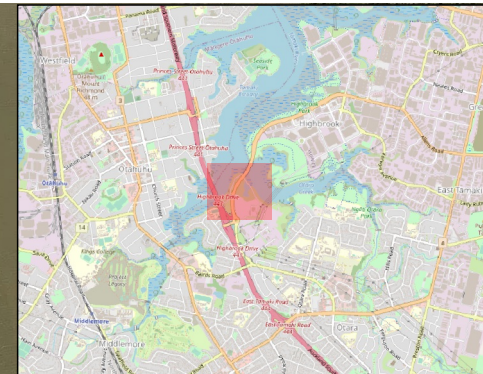
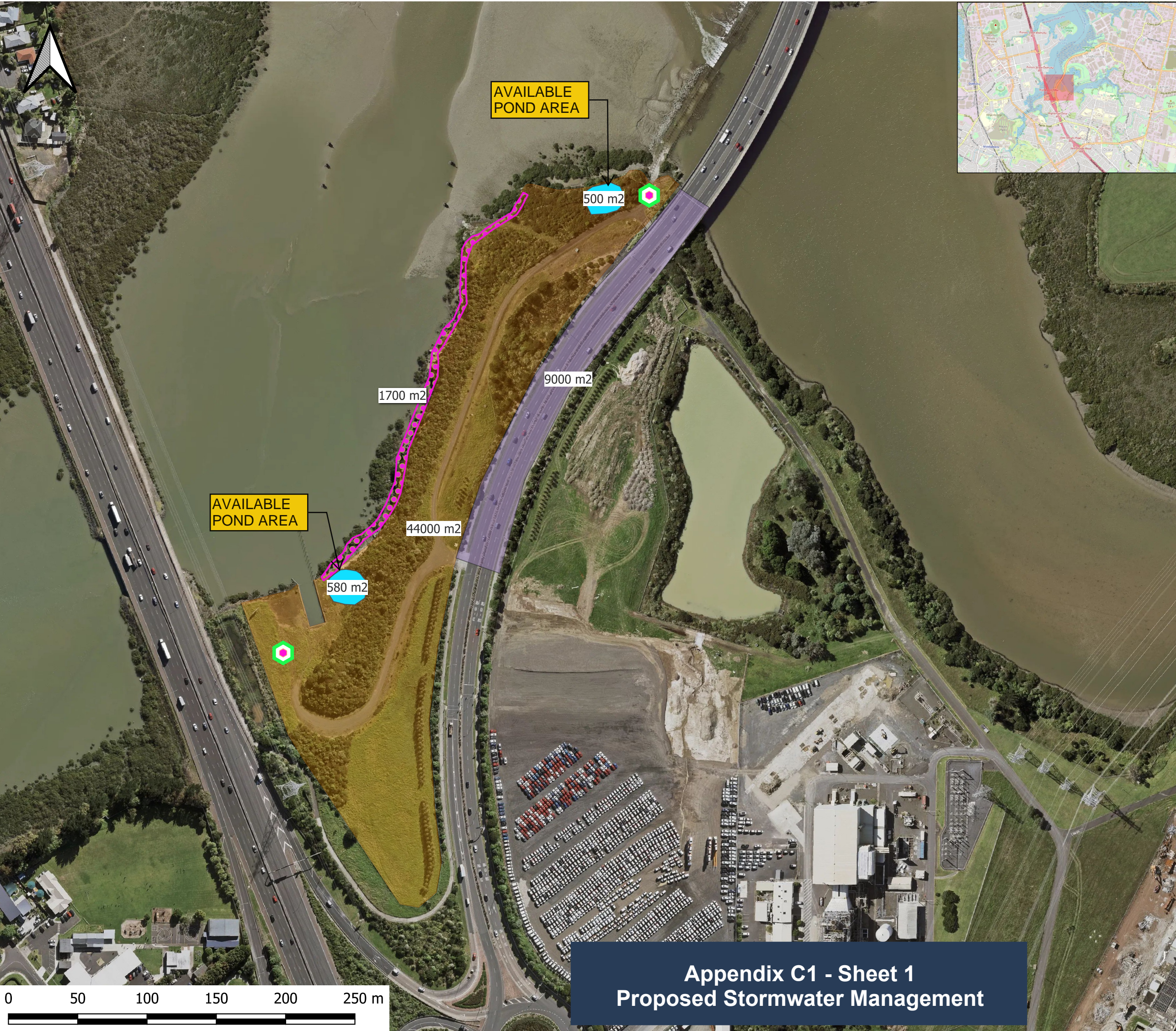
SCALE

@ A3


MAP NO.

Project No. Map No. Rev No.

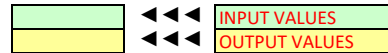
64872 1 v1



Appendix C2 – Stormwater Runoff Calculations

JOB NAME: Highbrook Living	DATE: 20.04.2022	Babbage partners in excellence 
JOB NO: 64872	DES BY: MB	
SUBJECT: SW Runoff Calculation - Highbrook Drive	CHKD BY: SK	

TP108 RUNOFF CALCULATIONS



1. PRE-DEVELOPMENT CATCHMENT:

Impervious Area	ha	0.7700
SCS Curve Number (CN)		98
Pervious Area	ha	0.1400
Hydrological Soil Group		Group C
SCS Curve Number (CN)		74
total area	ha	0.9100
% Impervious		85%

Land use	Group A Soil (volcanic granular loam)	Group B Soil (alluvial)	Group C Soil (mudstone/sandstone)
Bush, humid-climate, not-grazed	30	55	70
Pasture, lightly grazed, good grass cover	39	61	74
Urban lawns	39	61	74
Crops, straight rows, minimal vegetative cover	72	81	88
Sealed roads, roofs	98	98	98

Catchment Slope (S _c)	m/m	0.01
Catchment Length (l)	m	350
Channelisation Factor (C)		0.6
Weighted Curve Number		94.3
Initial Abstraction (I _a) weighted	mm	0.769
t _c (For q* - TP108 Fig. 5.1)	hours	0.18
t _p (SCS Lag for HEC-HMS)	hours	0.12
Storage (S) Total	mm	15.3
Pervious	mm	89.2
Impervious	mm	5.2

Apply Climate Change to Pre-development Scenario? Yes No Select Yes or No

Select appropriate design storm	90th Perc	2 yr ARI	10 yr ARI	100 yr ARI
24-Hour Rainfall Depth (P ₂₄)	24	115	140	220
24-hour rainfall depths with climate change allowances (P ₂₄)	24	125	158	257
c*=(P24-2Ia)/(P24-2Ia+2S)	0.423	0.802	0.837	0.893
q* (from Fig. 5.1)	0.109	0.158	0.158	0.158
Peak Flowrate (q _p)	23.8	180.0	227.6	369.0
24 hour rainfall depth (Q ₂₄) Pervious	3	69	97	186
24 hour rainfall depth (Q ₂₄) Impervious	20	120	153	252
24 hour runoff volume (V24) Pervious	4.7	96.7	135.9	260.5
24 hour runoff volume (V24) Impervious	152.0	926.9	1181.6	1939.5
24 hour runoff volume (V24) Total	156.6	1023.6	1317.5	2199.9


← Refer TP108 - App A - Design Rainfall Maps
← Refer Stormwater Code of Practice - Table 4.1

Auckland Council - Stormwater Code of Practice - Climate Change

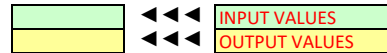
Table 4.1: Percentage Increase in 24-hour Design Rainfall Depth

AEP	50%	20%	10%	5%	2%	1%
ARI	2 yr	5 yr	10 yr	20 yr	50 yr	100 yr
% Increase *	9.0%	11.3%	13.2%	15.1%	16.8%	16.8%

* in 24-Hour Design Rainfall Depth Due to Future Climate Change assuming 2.1°C increase in temperature

JOB NAME: Highbrook Living	DATE: 20.04.2022	Babbage partners in excellence 
JOB NO: 64872	DES BY: MB	
SUBJECT: SW Runoff Calculation - Site Only	CHKD BY: SK	

TP108 RUNOFF CALCULATIONS



1. PRE-DEVELOPMENT CATCHMENT:

Impervious Area	ha	0.0000
SCS Curve Number (CN)		98
Pervious Area	ha	4.4000
Hydrological Soil Group		Group C
SCS Curve Number (CN)		74
total area	ha	4.4000
% Impervious		0%

Land use	Group A Soil (volcanic granular loam)	Group B Soil (alluvial)	Group C Soil (mudstone/sandstone)
Bush, humid-climate, not-grazed	30	55	70
Pasture, lightly grazed, good grass cover	39	61	74
Urban lawns	39	61	74
Crops, straight rows, minimal vegetative cover	72	81	88
Sealed roads, roofs	98	98	98

Catchment Slope (S _c)	m/m	0.03
Catchment Length (l)	m	350
Channelisation Factor (C)		1
Weighted Curve Number		74.0
Initial Abstraction (I _a) weighted	mm	5.000
t _c (For q* - TP108 Fig. 5.1)	hours	0.27
t _p (SCS Lag for HEC-HMS)	hours	0.18
Storage (S) Total	mm	89.2
Pervious	mm	89.2
Impervious	mm	5.2

Apply Climate Change to Pre-development Scenario? No Select Yes or No

Select appropriate design storm		90th Perc	2 yr ARI	10 yr ARI	100 yr ARI
24-Hour Rainfall Depth (P ₂₄)	mm	24	115	140	220
24-hour rainfall depths with climate change allowances (P ₂₄)	mm	24	N/A	N/A	N/A
c*=(P24-2Ia)/(P24-2Ia+2S)		0.073	0.370	0.421	0.541
q* (from Fig. 5.1)		0.020	0.088	0.097	0.116
Peak Flowrate (q _p)	l/s	21.2	445.4	599.3	1120.1
24 hour rainfall depth (Q ₂₄) Pervious	mm	3	61	81	152
24 hour rainfall depth (Q ₂₄) Impervious	mm	20	110	135	215
24 hour runoff volume (V24) Pervious	m ³	146.7	2672.1	3576.0	6685.1
24 hour runoff volume (V24) Impervious	m ³	0.0	0.0	0.0	0.0
24 hour runoff volume (V24) Total	m ³	146.7	2672.1	3576.0	6685.1

← Refer TP108 - App A - Design Rainfall Maps
← Refer Stormwater Code of Practice - Table 4.1

2. POST-DEVELOPMENT CATCHMENT:

Impervious Area	ha	3.0800
SCS Curve Number (CN)		98
Pervious Area	ha	1.3200
Hydrological Soil Group		Group C
SCS Curve Number (CN)		74
total area	ha	4.4000
% Impervious		70%

Auckland Council - Stormwater Code of Practice - Climate Change

Table 4.1: Percentage Increase in 24-hour Design Rainfall Depth

AEP	50%	20%	10%	5%	2%	1%
ARI	2 yr	5 yr	10 yr	20 yr	50 yr	100 yr
% Increase *	9.0%	11.3%	13.2%	15.1%	16.8%	16.8%

* in 24-Hour Design Rainfall Depth Due to Future Climate Change assuming 2.1°C increase in temperature

Catchment Slope (S _c)	m/m	0.03
Catchment Length (l)	m	350
Channelisation Factor (C)		0.6
Weighted Curve Number		90.8
Initial Abstraction (I _a) weighted	mm	1.500
t _c (For q* - TP108 Fig. 5.1)	hours	0.17
t _p (SCS Lag for HEC-HMS)	hours	0.11
Storage (S) Total	mm	25.7
Pervious	mm	89.2
Impervious	mm	5.2

Select appropriate design storm		90th Perc	2 yr ARI	10 yr ARI	100 yr ARI
24-Hour Rainfall Depth (P ₂₄)	mm	24	115	140	220
24-hour rainfall depths with climate change allowances (P ₂₄)	mm	24	125	158	257
c*=(P24-2Ia)/(P24-2Ia+2S)		0.669	0.922	0.937	0.961
q* (from Fig. 5.1)		0.148	0.162	0.163	0.164
Peak Flowrate (q _p)	l/s	156.2	891.8	1135.2	1859.4
24 hour rainfall depth (Q ₂₄) Pervious	mm	3	69	97	186
24 hour rainfall depth (Q ₂₄) Impervious	mm	20	120	153	252
24 hour runoff volume (V24) Pervious	m ³	44.0	912.2	1281.1	2456.0
24 hour runoff volume (V24) Impervious	m ³	607.9	3707.5	4726.6	7757.9
24 hour runoff volume (V24) Total	m ³	651.9	4619.7	6007.6	10213.8

← Refer TP108 - App A - Design Rainfall Maps
← Refer Stormwater Code of Practice - Table 4.1

