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Stormwater Management Plan

Pukekohekohe Gateway Plan Change

222-250 Manukau Road, Pukekohekohe
Auckland Thoroughbred Racing Incorporated (ATR)
8/04/2025
FINAL FOR ISSUE

Document Control

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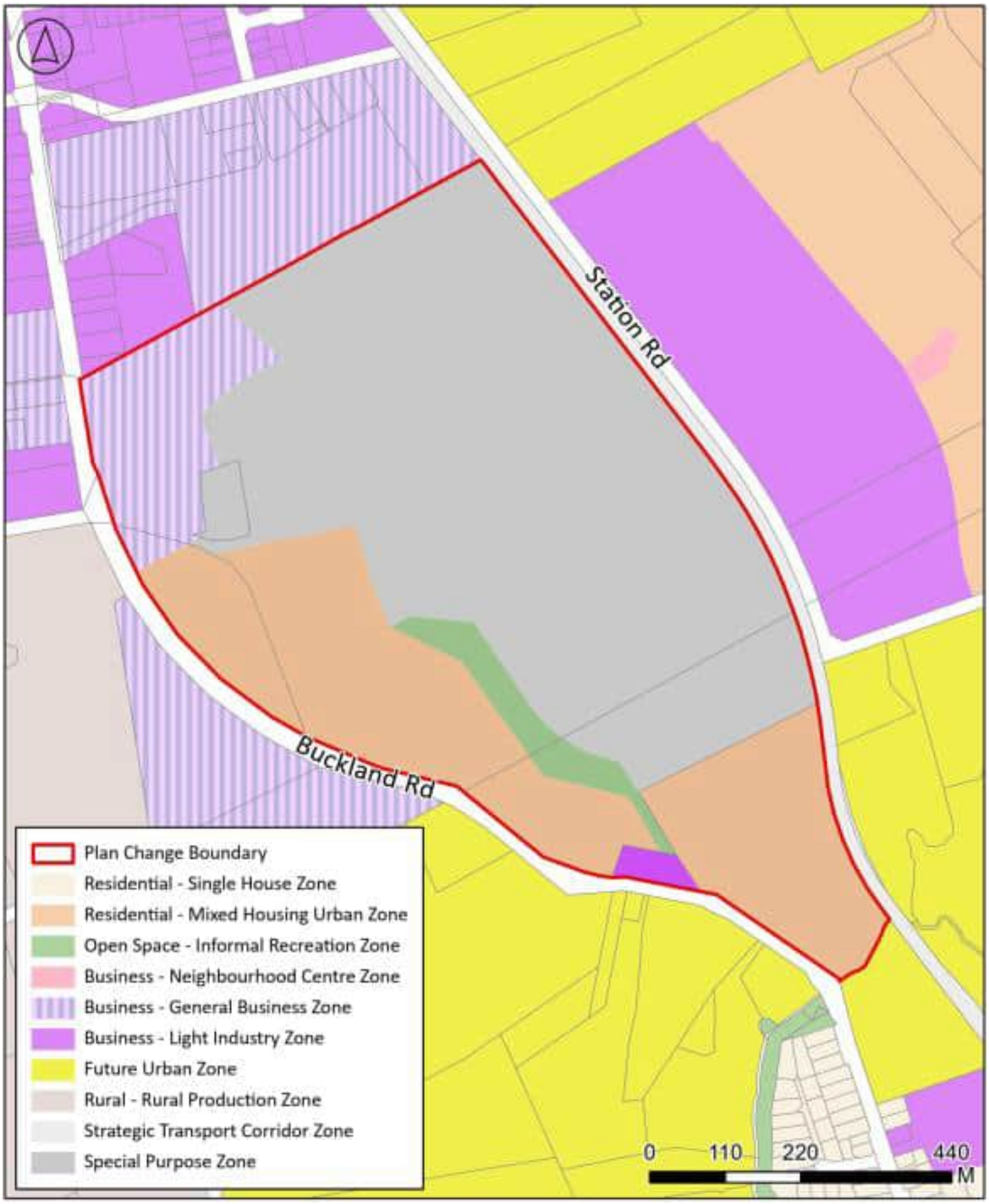
Executive Summary

Auckland Thoroughbred Racing (ATR) are seeking a Private Plan Change (PPC) application for a portion of their racing facilities at 222-250 Manukau Road, Pukekohekohe (Figure E1). The PPC area sits within the ATR landholdings and is currently zoned as 'Special Purpose – Major Recreation Facility Zone' and 'Business – General Business Zone'. The PPC, called the Pukekohekohe Gateway Precinct seeks to rezone 22.96 hectares of land to 'Residential - Mixed Housing Urban' and 'Open Space – Informal Recreation Zone' to enable a residential development which overlooks the racing facilities. Woods has been engaged by to provide a Stormwater Management Plan (SMP) for the PPC.



E1: PPC site location

The purpose of this SMP is to guide Auckland Council and the applicant on how stormwater is to be managed within the PPC area, as well as to seek inclusion under the Auckland Council Regionwide Network Discharge Consent (NDC).

The SMP complies with the requirements set out in Schedule 4 of the NDC for 'Large Brownfields Developments' and proposes the following:[1]

- Water quality treatment
  - Water quality treatment of all new impervious areas is proposed within the PPC area. The preferred option for water quality treatment is via centralised communal wetlands to be constructed. Water quality treatment may alternatively be provided at source in a device designed and sized in accordance with Auckland Council's Stormwater Management Devices in the Auckland Region Guideline Document 2017/001 (GD01).
- Auckland Unitary Plan Stormwater Management Area (SMAF1) hydrology mitigation
  - Retention (volume reduction) of a minimum of 5mm of runoff from all impervious areas.
  - Detention (temporary storage) with a draindown period of 24 hours for the difference between the pre-development (grassed state) and post-development runoff volumes from the 95th percentile, 24-hour rainfall event minus the retention volume for all impervious areas.
  - SMAF1 hydrology mitigation to be met at source or in centralised communal wetlands. The landform modelling undertaken to inform the plan change shows that stormwater can appropriately discharge to the two wetlands and that the wetlands can be incorporated into a design surface for the proposed Pukekohekohe Gateway Precinct.
- Primary network
  - To be designed in accordance with the operative version of the Auckland Council Stormwater Code of Practice at the time of development.
- Secondary Network
  - Overland flow paths to be conveyed via internal roads designed in accordance with standards set out in the operative version of the Auckland Council Stormwater Code of Practice at the time of development and Auckland Transport's Transport Design Manual.
  - The PPC allows for the realignment and daylighting of the existing man-made watercourse and pipework within the Pukekohekohe Gateway Plan Change boundaries. The stream naturalisation works will be undertaken as part of a separate Resource Consent application and aims to improve the watercourse, provide amenity to future residential lots and enhance the flood storage currently available within the Pukekohekohe Gateway Plan Change boundaries.
  - Flood modelling has been undertaken, and the results have demonstrated that there are no upstream or downstream effects resulting from intensification within the PPC area. The PPC seeks to maintain the natural attenuation available within the site resulting from the stream naturalisation works.
- Flood risk assessment
  - Flood hazard risk has been undertaken using the approved Pukekohe South InfoWorks ICM model that has been reviewed and approved by Healthy Waters.
  - This flood model assessed any potential flooding effects from the PPC to ensure no third-party flood effects.
  - Flood modelling undertaken indicates no upstream or downstream effects resulting from the proposed development. Further, the development has been designed to be located outside of the future 1% AEP floodplain (3.8^{o}C climate change scenario).

[1] Auckland Council, Auckland Design Manual, Regionwide Stormwater Network Discharge Consent Schedule 4: Connection Requirements at p. 13.

Woods has also consulted with Healthy Waters with regard to flood modelling undertaken and the overall stormwater management strategy.

In summary, the objectives of AUP and Schedule 4 of the NDC are satisfied by the stormwater approach described within this SMP and as part of the development. Overall, there are no significant impediments with respect to stormwater.

1. Introduction

1.1. Background

ATR is seeking a PPC for a portion of the site at 222-250 Manukau Road, Pukekohekohe (Site). The PPC seeks to rezone part of the Site from 'Special Purpose – Major Recreation Facility' to 'Residential - Mixed Housing Urban' and 'Open Space – Informal Recreation Zone'. The extent of the proposed new Precinct is outlined in red in Figure 1 and will hereon be referred to as the Pukekohekohe Gateway Precinct.

It is noted that the northwestern portion of the Site has previously undergone a separate plan change (PC30) to rezone the land from 'Special Purpose – Recreational Facility' to 'Business – General Business' zone. PC30 became operative in 2021 and is subject to a private covenant to Auckland Transport for infrastructure upgrades as development within PC30 progresses. The Pukekohekohe Precinct Plan Change proposal includes PC30 to incorporate and cohesively manage the transport upgrades required to support future residential development into the AUP. No changes are proposed to the zoning or land use framework within PC30.

The PPC proposes three sub-precincts, sitting within the Pukekohekohe Gateway Precinct boundaries as follows:

- Sub-Precinct A and Sub-Precinct B to be rezoned to MHU and OS-IR zones to provide for and manage future development in accordance with these zones; and
- Sub-Precinct C to the PC30 land to manage the provision of key transport upgrades that are currently required by way of an existing private covenant.

This SMP has been prepared to support the plan change within the Sub-Precincts A and B within the Pukekohekohe Gateway Precinct. The overall purpose of the SMP is summarised as follows:

- Provide guidance to the applicant and inform Auckland Council on how stormwater will be managed for the rezoned area,
- Demonstrate that the rezoned area can meet the requirements of Schedules 2 and 4 of the Regionwide NDC, and
- Identify flood risk areas and provide for development outside of the 1% AEP floodplain without creating adverse flooding effects on properties upstream or downstream of the Pukekohekohe Gateway Precinct area in comparison to the existing scenario.

Figure 1: Pukekohekohe Gateway Precinct Extent

2. Existing site appraisal

The Pukekohekohe Gateway Plan Change extent (herein referred to as the Site) has an approximate area of 72.5 hectares and is accessible from two locations along Buckland Road. The Site is currently used for horse racing and other associated events. The land to the north of the Site is zoned 'General Business' or 'Light Industry'. Land to the south of Buckland Road is zoned 'Future Urban'. Land to the north of Station Road is zoned 'Future Urban' and 'Special Purpose – Major Recreational Facility'.

The PPC encompasses an area of approximately 28.76 hectares; however, it only seeks to rezone an approximate area of 22.96 hectares (sub-precincts A and B), with the remainder of the PPC to retain its current zoning of 'Special Purpose – Major Recreational Facility' within the Pukekohe Gateway Precinct Boundaries.

Figure 2: Pukekohekohe Gateway Sub-Precinct Boundaries

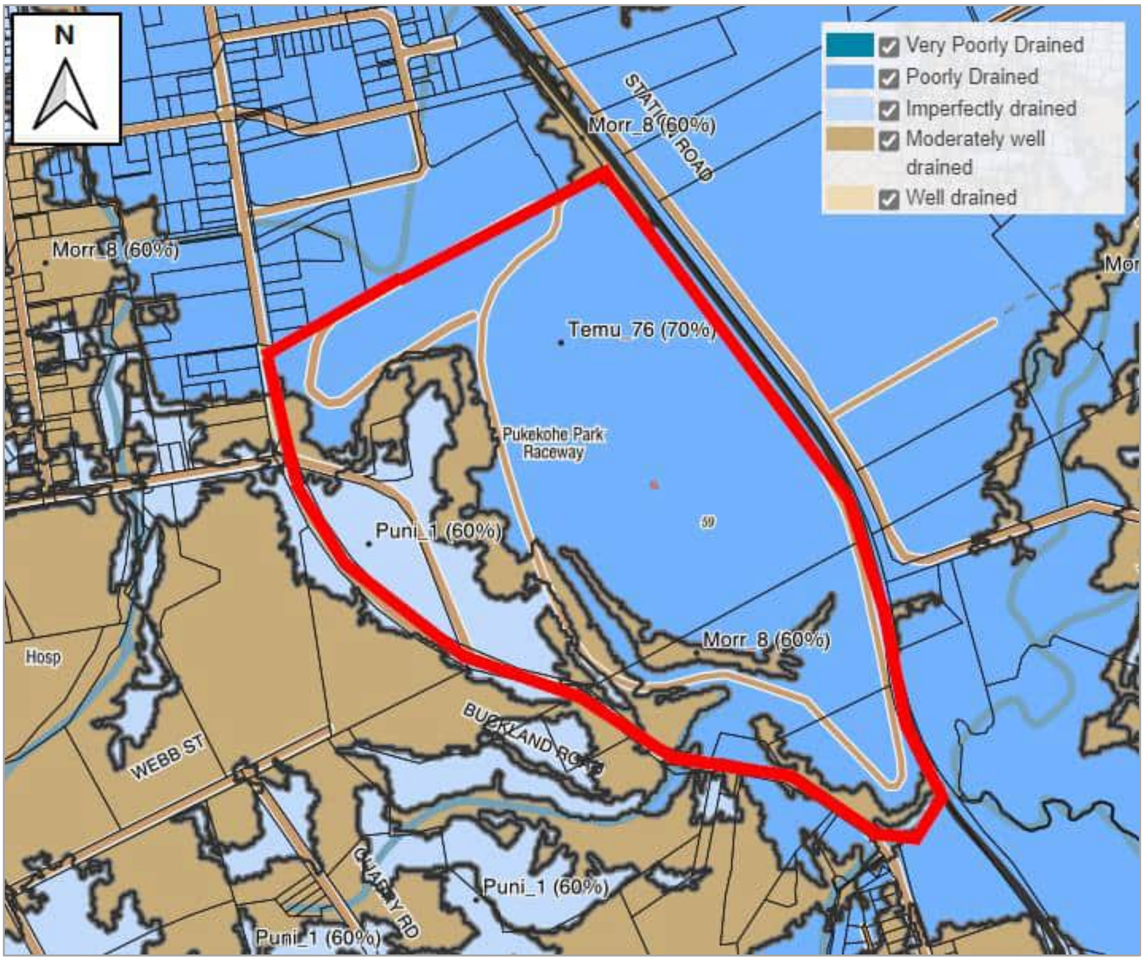
2.1. Topography

The topography within the PPC area falls from west to east, with Buckland Road acting as the high point to convey runoff to the manmade channel that runs within the PPC area. The area within the racecourse to the east of the PPC area is flat and runoff from this area also discharges to the watercourse.

Figure 3: Topography at subject site (Source: Auckland Council GeoMaps)

2.2. Geotechnical

Published geological maps for the area obtained from Auckland Council's soils layer indicate that the underlying soil of the Site is exclusively made up of alluvial soils (soil ID B) and Pukekohekohe Volcanic (soil ID D). Published drainage maps of the Site obtained from S-maps indicate the soils on the Site vary in drainage capabilities, primarily falling within the range of moderate to poor drainage, with poor drainage being the predominant characteristic, as shown in Figure 4.



*note: red boundary denotes the boundary of ATR's landholdings. PPC extent sits within this.

Figure 4: Soil Drainage (Source: S-map)

A geotechnical assessment, undertaken by ENGEO, has been summarised in a memo dated 19/12/2024. The assessment found the following based on the published GNS Science Map 12B:

- That the low-lying eastern portions of the PPC area are anthropogenic engineered ground, with mixed cut and fill deposits. Consequently, the underlying geology in these areas is uncertain due to modification by human activity.
- That the western elevated portion of the PPC area is mapped as basaltic lava. Surface soils that overlay the basaltic lava are a mixture of ash, tephra and tuff.

The geotechnical assessment has split the PPC area into three zones, as shown in Figure 5.

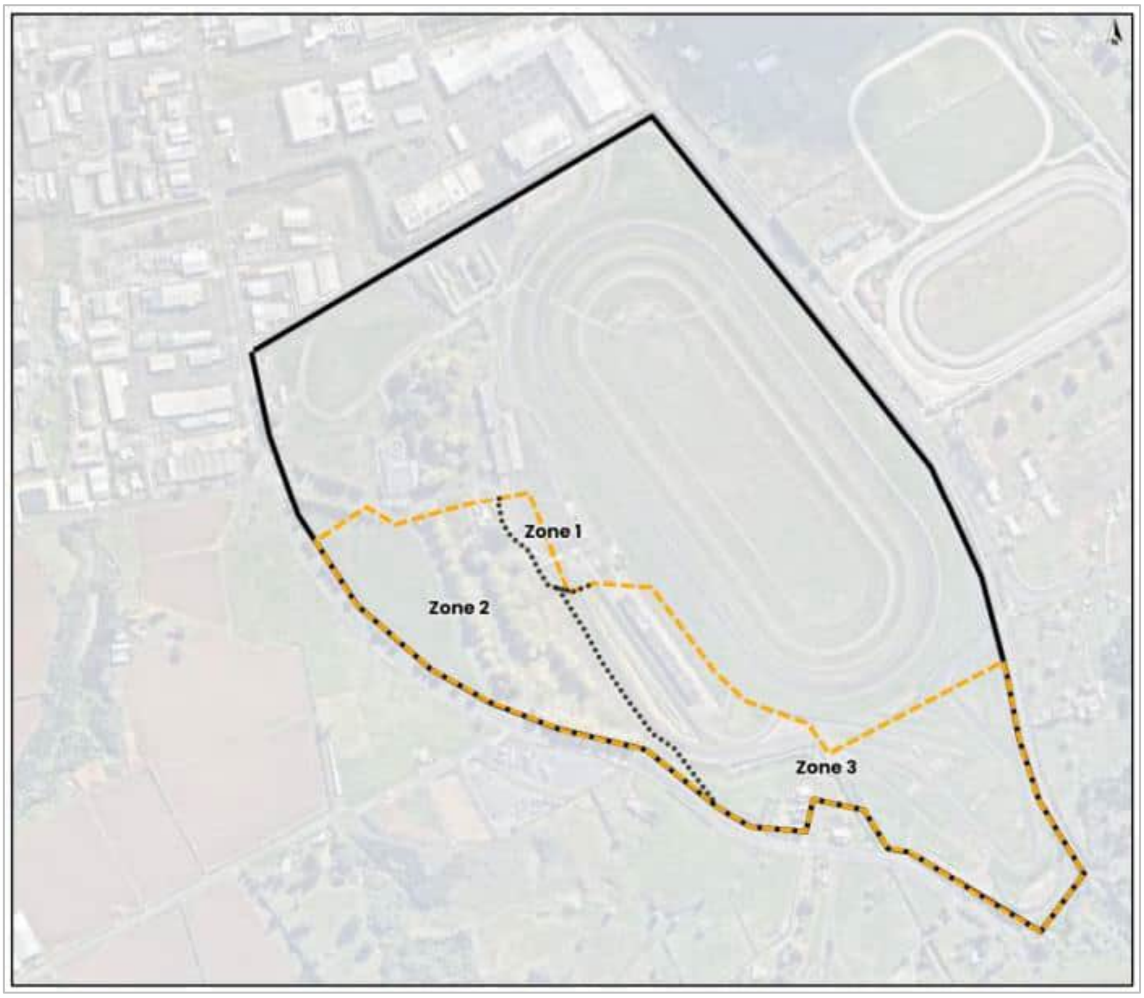


Figure 5: Geotechnical zones (source: ENGEO Report, 21/02/25)

The geotechnical investigation summarised the following:

- Flooding:
    - Within zone 1 – Filling within this zone will induce consolidation settlements, given that zone 1 is in a floodplain.
    - Within zone 2 – N/A
    - Within zone 3 – Filling within this zone will induce consolidation settlements, given that zone 3 is in a floodplain.
- Groundwater levels:
    - Within zone 2 – groundwater levels between 5.0 and 6.0 m below ground level.
    - Within zones 1 & 3 – groundwater levels between 0.5 and 4.5m below ground level, with groundwater shallower towards the northern corner of the PPC area.

The report found that geotechnical risks can be managed through ground improvement, specific engineering and foundation design.

2.3. Existing stormwater features

The primary drainage infrastructure within the PPC area is predominantly via manmade watercourses and culverts. Auckland Council GeoMaps indicates two 2500mm gravity mains traversing the northwestern portion of the Site before discharging into an existing manmade watercourse (Figure 6).

This watercourse travels south, outside of the PPC area, towards the Buckland Road Esplanade Reserve and then outside of the Auckland Region boundary. Beyond the Auckland Region boundary, the Site discharges into the Waikato River.

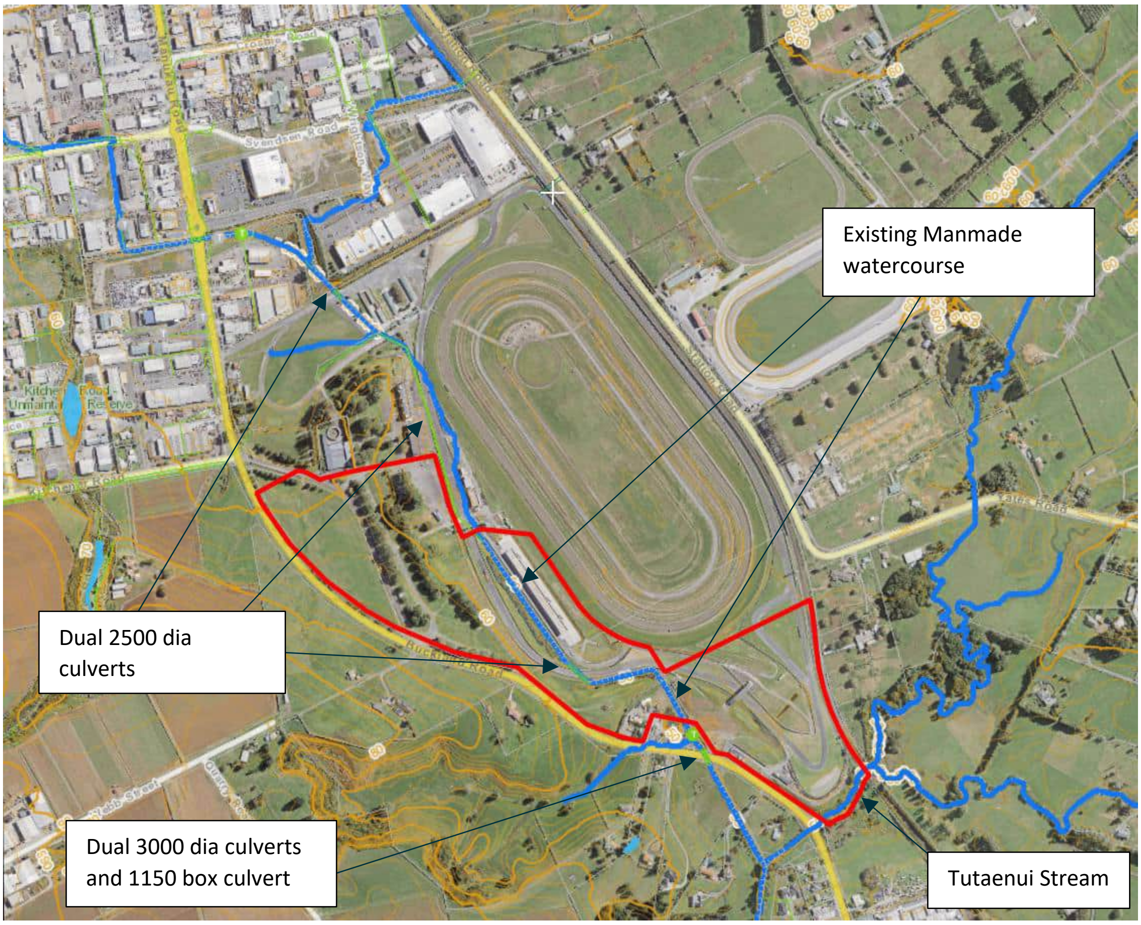


Figure 6: Watercourses and existing infrastructure (Source: Auckland Council Geomaps)

2.3.1. Flood features

Auckland Council GeoMaps shows the PPC area as affected by the following flood features (Figure 7):

- An existing major overland flow path running north to south through the PPC area. The overland flow path is conveyed via a manmade watercourse that is partially piped within the site.
- Extensive floodplains localised to low spots along the northern boundary of the PPC area.
- Several separate flood-prone areas. It is noted that the flood-prone area closest to the outlet from the Site has a spill elevation of 51.93mRL Auckland Vertical Datum 2016 AUK1946) and a volume of approximately 11,921m^3.

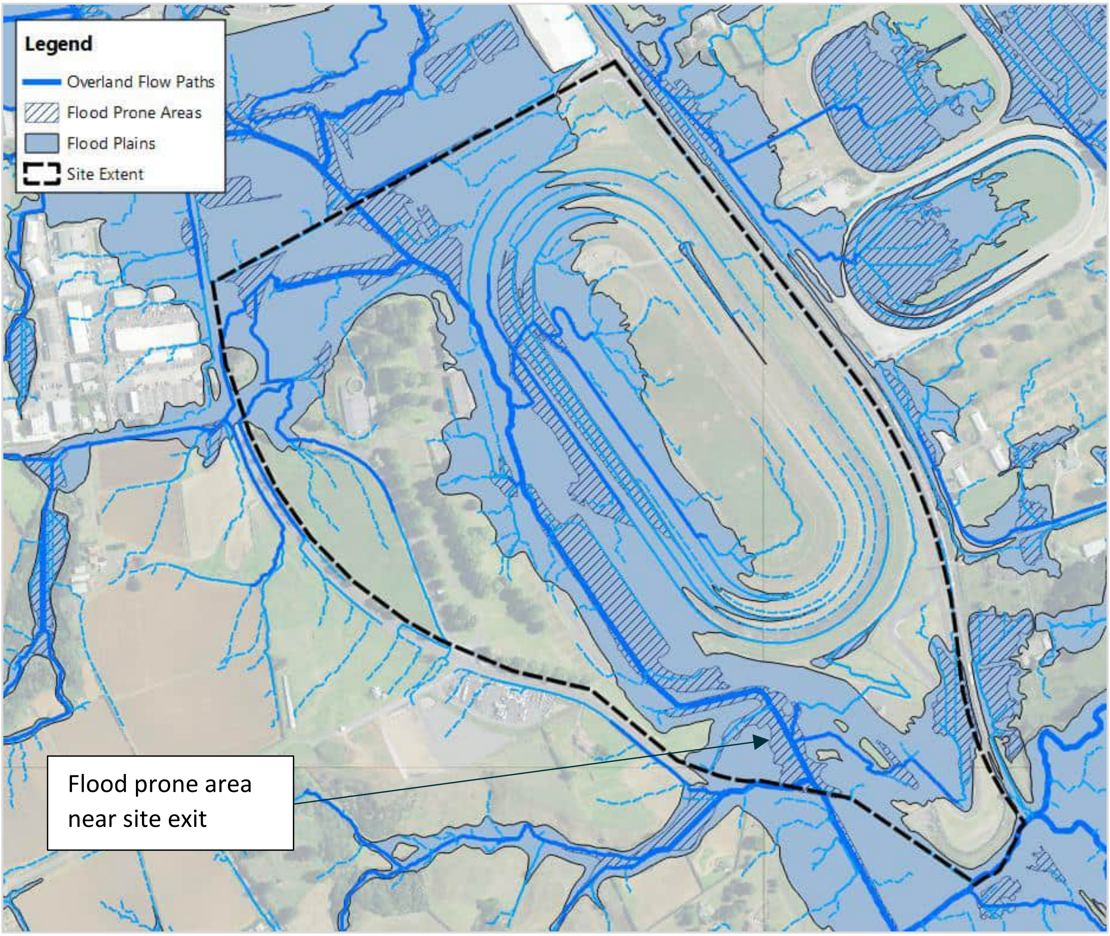


Figure 7: Existing secondary network/flooding (Source: Auckland Council GeoMaps)

2.4. Receiving environment

The Site is located within the lower western reaches of the Pukekohekohe catchment, discharging to the Tutaenui Stream, as seen in Figure 8. It is noted that the PPC area is located close to the border of the Auckland Regional Boundary, and the Tutaenui Stream ultimately discharges to the Waikato River.

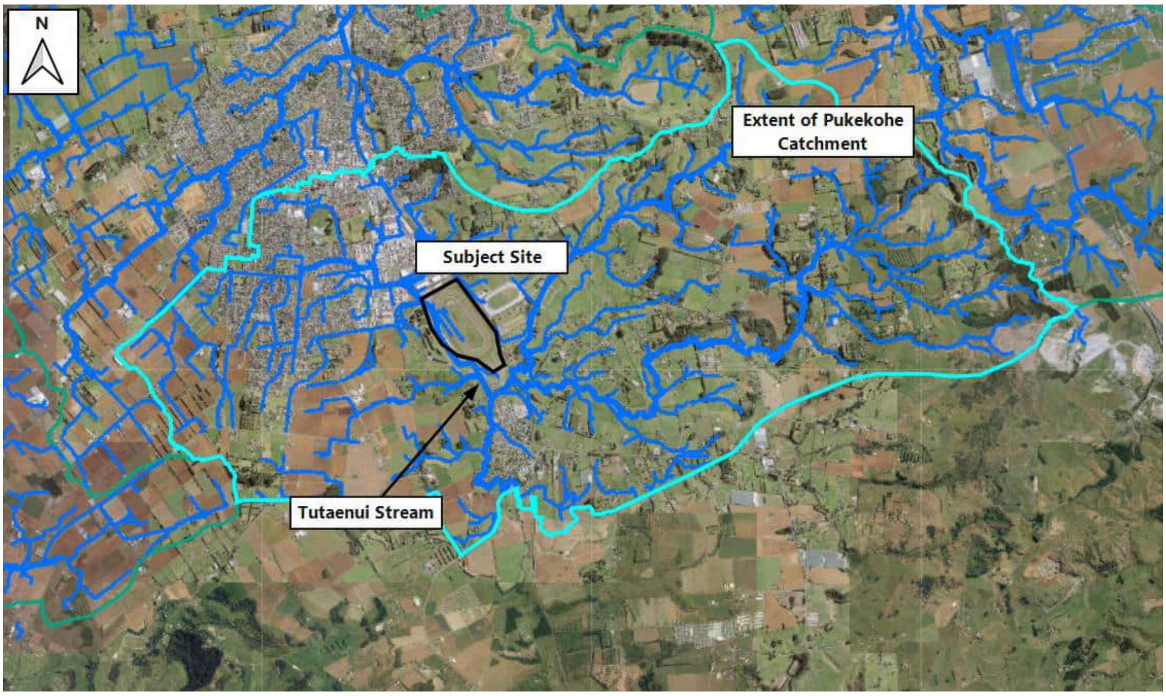


Figure 8: Receiving environment (Source: Auckland Council Geomaps)

Woods have been provided with Auckland Council's Watercourse Assessment Report (WAR) for the Pukekohe Tutaenui Stream Catchment. The WAR states that Auckland Council has identified Pukekohe as an urban expansion area, with development intended to extend to the north and south of the existing township. Development within the catchment will result in rapid changes to the form and functionality of watercourses within the Pukekohe Tutaenui Stream catchment.

The stream surveys conducted as part of the WAR identified that stream channels in the Pukekohe Tutaenui Stream Catchment are highly modified, reflecting the current mixed agricultural and urban nature of the catchment. The streams were identified as poorly shaded and suffering elevated biological contaminant loads.

The WAR identifies that the catchment was split into zones based on existing urban and rural areas and areas where future urban growth is planned to occur. The PPC area is fed by streams that run through Management Zone 3 (Urban Pukekohe). The key management goals and objectives across all management zones within this stream catchment includes encouraging landowners/developers to restore, enhance or protect riparian zones, futureproof stream conveyance capacity by removing unnecessary culverts, addressing inlet/outlet erosion issues as land becomes developed and providing ecological and amenity linkages through the enhancement of esplanade reserves where these are triggered through development.

This is aligned with the stream naturalisation proposed within the bounds of the PPC area, which aims to enhance the current channel and create flood storage within the plan change boundaries. Consent will be sought separately for the stream naturalisation works.

2.5. Freshwater ecological features

An ecological assessment was undertaken by Viridis Environmental Consultants, which assessed the presence and extent of streams and wetlands on the site. The assessment classified the watercourses on Site according to AUP-OP definitions to determine the ephemeral, intermittent, permanent or artificial status of the waterway.

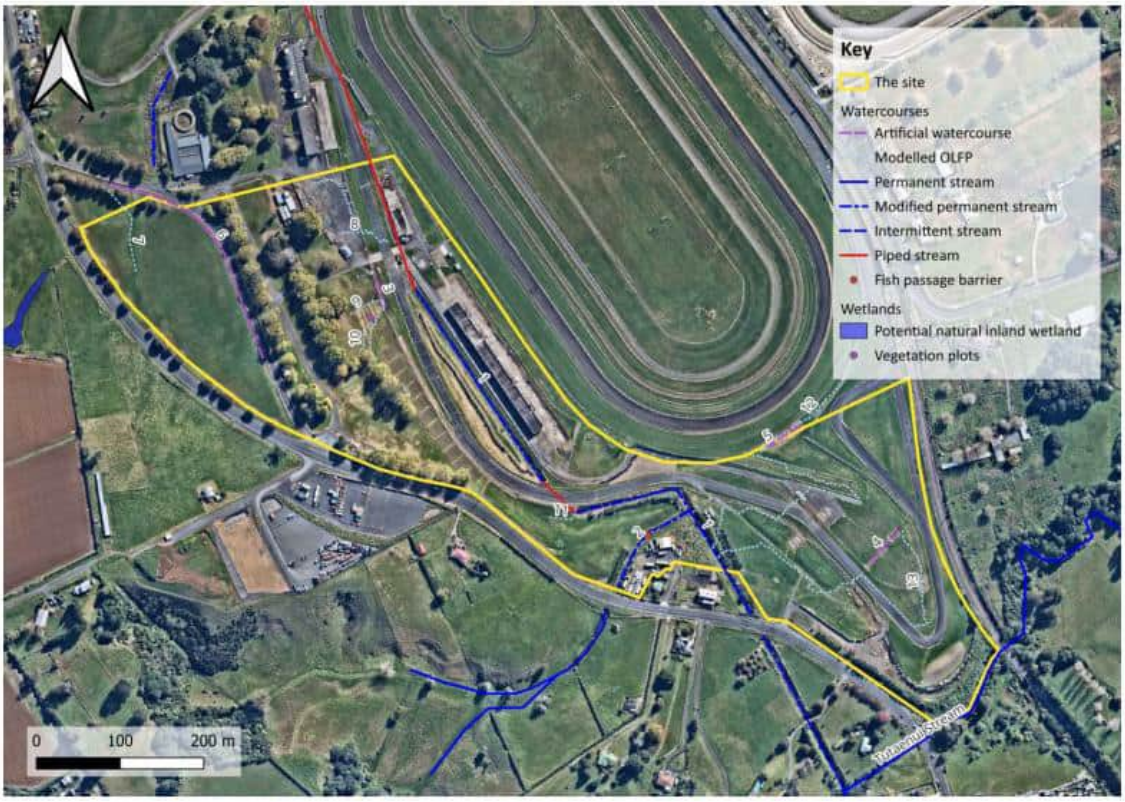


Figure 9: Watercourse classification within Pukekohekohe Gateway Plan Change (source: Viridis Ecology Memo, dated 26/08/2024)

The ecological assessment found the following:

1. The modelled overland paths within the Pukekohekohe Gateway Plan Change (denoted in dotted lines on Auckland Council Geomaps) have no discernible channels, surface water or other defining stream characteristics and therefore do not meet the definition of streams in the AUP-OP.
2. Four artificial watercourses were identified on site, which were constructed for drainage. The assessment notes that artificial watercourses are of low ecological value due to intermittent flows and are excluded from the relevant stream protection rules under the AUP-OP and National Policy Statement for Freshwater Management 2020 (NPS-FM).
3. The Tutaenui Stream runs along the southeastern boundary (close to the southern boundary of Sub-Precinct B). Historic aerial photographs suggest some stream modification (straightening) was done from 1940 to 1961. The ecological value of this main reach of the Tutaenui Stream is considered 'low – moderate' as the stream may contain the at-risk' long-finned eel.
4. A tributary of the Tutaenui Stream runs within the Pukekohekohe Gateway Plan Change and has been referred to as 'Watercourse 1' in the ecological assessment. This tributary has been extensively modified in the following ways:
    a. Parts of the stream have been piped, namely flows upstream of the Site that discharge to the tributary within the Pukekohekohe Gateway Precinct, and
    b. Daylighted parts of the stream have been straightened and deepened, and banks have been reinforced with gabion baskets.
    c. The ecological value of this tributary is considered low because of channel modification and piping; however, the watercourse may contain the at-risk' long-finned eel.
5. A tributary of the Tutaenui Stream runs downstream of the Pukekohekohe Gateway Plan Change and has been referred to as 'Watercourse 2' in the ecological assessment. This tributary has also been extensively modified through straightening and the installation of culverts. This watercourse

features a perched culvert, which acts as a barrier to fish passage. The ecological value of this tributary is considered low because of channel modifications.

6. No natural inland wetlands were identified within the Pukekohekohe Gateway Precinct, according to the definitions in the NPS-FM.

The ecological assessment makes the following conclusions and recommendations:

1. The streams on Site are in a degraded state due to a history of channel and riparian modification. Channel restoration and riparian planting are identified as having the potential to improve ecological values.
2. The proposed approach to stormwater management, outlined in this SMP, will help to protect the streams on Site as well as the Tutaenui Stream.
3. The outcomes of the PPC are consistent with the objectives and policies of the AUP-OP, and future development undertaken in accordance with the proposed zoning and precinct provisions is anticipated to result in the protection and enhancement of biodiversity values on the Site.

2.6. Biodiversity

Auckland Council Geomaps identifies no significant ecological areas within the PPC area. Stormwater runoff from the PPC area will ultimately discharge to the open watercourse that runs under Buckland Road and within the existing Buckland Road Esplanade Reserve.

2.7. Cultural and heritage sites

An archaeological survey was undertaken by Archaeology Solutions Ltd, which found no previously recorded archaeological sites within the bounds of the Pukekohekohe Gateway Precinct. Historical imagery shows that the racecourses are located on a drained swamp. The assessment notes that draining the swamp will have resulted in any wooden artefacts being turned to soil.

Any development is recommended to be undertaken with an Accidental Discovery Protocol in place to mitigate the risk of encountering pre-1900 archaeological features.

2.8. Contaminated land

A contamination assessment was undertaken by ENGEO and summarised in a memo dated 02/12/2024. The assessment found that historical and current land uses on Site have identified several potential activities that are included on the Hazardous Activities and Industries List (HAIL), including storage tanks or drums for fuel, chemicals or liquid waste, motor vehicle workshops and a large bund, which Auckland Council classified as landfill.

The assessment also states that existing and former site buildings may contain asbestos products in building materials.

A Detailed Site Investigation will be required as part of subsequent consent applications. This includes an intrusive environmental investigation to be undertaken prior to any earthworks, subdivision or land use consent applications.

3. Development summary and planning context

The requirements of the AUP-OP and Network Discharge Consent (NDC) are summarised in Table 1 and discussed in detail in relevant subsections.

Table 1: Regulatory and design requirements

Guidance document	Summary	Relevance for SMP
Auckland Council's Regionwide Stormwater Network Discharge Consent	Tool for managing and integrating land use, stormwater discharge and the region's natural water assets to mitigate the impacts of climate change and flooding	Schedules 2 and 4 are relevant to the plan change as new stormwater assets are to be vested in the Council
AUP-OP – Chapters E1, E3, E8, E9, E10 and E36	Covers policies regarding stormwater and stormwater management	Yes
Auckland Council - Stormwater management devices in the Auckland Region – Guidelines Document 2017/001 (GD01)	Technical guidance on design criteria for stormwater management devices	Yes – provides guidance for design of stormwater management devices
Auckland Regional Council - Design Guideline Manual for Stormwater Treatment Devices – Technical Publication 10 (2003)	Legacy document for technical guidance on the design criteria for stormwater management devices	Yes – but superseded by GD01
Auckland Regional Council – Guidelines for Stormwater Runoff Modelling in the Auckland Region – Technical Publication 108 (1999)	Guideline document for hydrology in the Auckland Region	Yes – provides guidance on rainfall depths and the hydrological assessment method
Auckland Council - Auckland Unitary Plan stormwater management provisions: technical basis of contaminant and volume management requirements – Technical Report 2013-035 (2013)	Auckland Council document that outlines the key aspects of the Stormwater Management approach in the AUP	Yes – provides guidance.
Auckland Council – Code of Practice for Land Development and Subdivision (Chapter 3 - Stormwater) – Version 3.0 (January 2022)	The currently operative Code of Practice document. Provides minimum standards for the design and construction of stormwater systems for land development and subdivision	Yes – Guidance to be followed regarding the design of stormwater lines to be vested in the Auckland Council
Auckland Council – Code of Practice for Land Development and Subdivision (Chapter 4 - Stormwater) – Version 4.0 (March 2024) – Not operative	Future code of practice that is currently not operative. Provides guidance on potential future minimum standards for the design and construction of stormwater systems for land development and subdivision	Yes – information only: Guidance to be followed around modelling for climate change-related flood resilience, accounting for a 3.8 °C temperature increase
Auckland Council - Stormwater Flood Specifications (2023)	Technical specification document for stormwater flood modelling	Yes - Provides guidance for the building of stormwater flood models
Auckland Council - Water Sensitive Design for Stormwater –	Guidance document for the application of Water Sensitive Design (WSD)	Yes - outlines the WSD approach for the site. WSD

Guidance document	Summary	Relevance for SMP
Guidance Document 2015/004 (March 2015)		works alongside the urban design solution
National Policy Statement for Freshwater Management 2020 (NPS-FM)	A tool for managing and improving the conditions of Auckland's freshwater and coastal systems	Yes - Outlines strategic objectives to be considered.
NZS4404 – Land development and subdivision infrastructure	Provides detail on stormwater management, including WSD, flood risk management, freeboard allowance, etc.	Yes - Guidance to be followed

3.1. Regionwide stormwater network discharge consent

The regionwide stormwater NDC is a tool for managing and integrating land use, stormwater discharge and the region's natural water assets to mitigate the impacts of climate change and flooding.

3.1.1. Schedule 2

Schedule 2 of the NDC sets out the objectives and outcomes for the discharge of stormwater within the Auckland region. The key objectives of Schedule 2 are:

- Safe Communities – Reduce risk to people, property, and infrastructure.
- Healthy and Connected Waterways that Provide for Te Mauri O Te Wai – Enhance the value of streams, groundwater and coastal water and restore Te Mauri O Te Wai.
- Support Growth – Provide quality stormwater infrastructure through water sensitive design.
- Collaborative Outcomes - Engage stakeholders to achieve best practicable stormwater outcomes.
- Prioritised Investment – maximise benefits by targeting best practicable outcomes.
- Efficient Business – Deliver stormwater systems through robust systems, practices and processes.

The key outcomes of Schedule 2 are:

- Manage erosion effects caused by discharges from the public stormwater infrastructure (Assets O1.2)
- Improve existing assets by taking opportunities from redevelopment where they arise (Assets O1.3)
- Integrate water sensitive design into new and major redevelopment (Growth O2.2)
- Enable effective land use and stormwater management planning and co-operation between developers and infrastructure providers (Growth O2.3)
- Avoid the increase of existing flooding or creation of new flooding of habitable floors because of urban development and intensification (Flooding O3.1)
- Reduce existing flood risk by taking opportunities from redevelopment where they arise (Flooding O3.2)
- Enhance urban streams and waterways by working collaboratively with key stakeholders such as Mana Whenua, Local Boards, Community Groups and the development community to take opportunities where they arise (Stream Health O4.2)
- Collaborate with Council departments and CCOs that have a key role in delivering positive stormwater outcomes (Common to all Issues O8.1)
- Establish effective mechanisms for mana whenua to be appropriately engaged in stormwater management (Common to all Issues O8.2)

3.1.2. Schedule 4

The stormwater management strategy for the Pukekohekohe Gateway Plan Change proposes water quality and SMAF1 hydrology mitigation for all impervious areas within the plan change extent.

Water Quality:

- Treatment of 100% of proposed new impervious areas by a water quality device designed in accordance with GD01 for relevant contaminants.

Stream Hydrology (SMAF):

- Achieve equivalent hydrology (infiltration, runoff volume, peak flow) to pre-development (grassed state) levels:
    - Provide retention (volume reduction) of a minimum of 5mm runoff depth for all impervious areas; and
    - Provide detention (temporary storage) with a draindown period of 24 hours for the difference between the pre-development (grassed state) and post-development runoff volumes from the 95th percentile, 24-hour rainfall event minus the retention volume for all impervious areas.

Flooding - property/ pipe capacity 10% AEP event:

- Ensure that there is sufficient capacity within the pipe network downstream of the connection point to cater for the stormwater runoff associated with the development in a 10% AEP event, including incorporating flows from contributing catchments at maximum probable development.

Pipe network 10% AEP:

- Demonstrating sufficient capacity is available, including flows from the catchment (at maximum probable development) draining to the relevant pipe network in the 10% AEP event);
- Upgrading the relevant pipe network to a size that can cater for the additional flows from the development in the 10% AEP event (taking into account existing flows from the contributing catchment); or
- Upgrading the relevant pipe network to a size that is larger than would otherwise be required to cater for the 10% AEP event for the development, due to the need to cater for flows from the contributing catchment at maximum probable development, subject to a fair and proportionate funding agreement with Healthy Waters.

Flooding - buildings 1% AEP event:

- Manage/mitigate 1% AEP peak flows to that immediately preceding development/redevelopment.

If the above requirements on water quality, stream hydrology and flooding cannot be met, then an alternative level of mitigation will be determined through an SMP that:

Applies an Integrated Stormwater Management Approach

Meets the NDC Objectives and Outcomes in Schedule 2

Is the BPO for the given project.

A summary of the future urban development requirements for Brownfields Large can be seen in Figure 10.

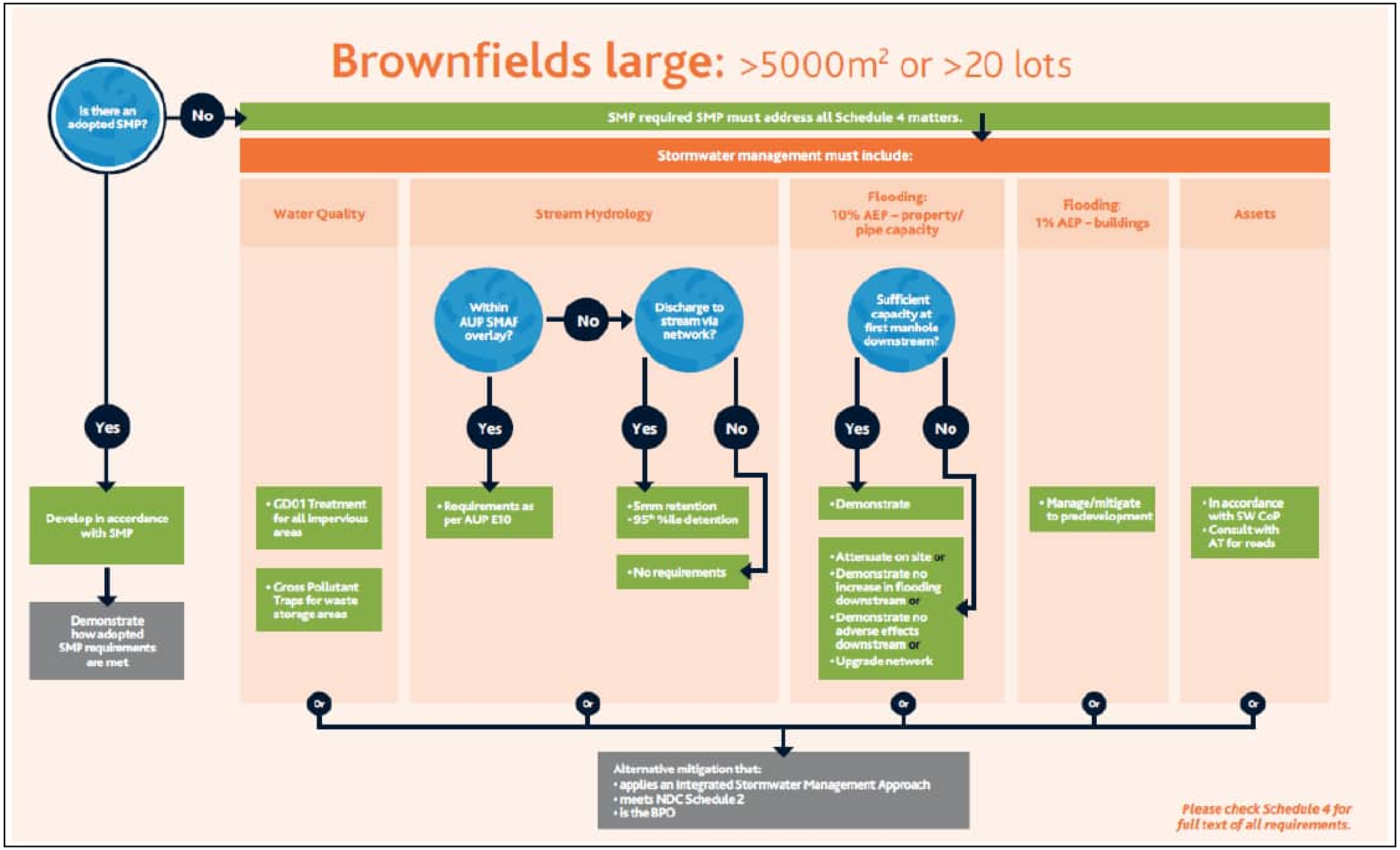


Figure 10: Brownfields Large Connection Requirements (Auckland Council Regionwide stormwater network discharge consent)

3.2. Auckland Unitary Plan

The policies relating to stormwater and flooding are covered in Chapter E of the AUP-OP. The requirements set out in the relevant chapters are as follows:

- E1 – Water quality and integrated management
- E3 – Lakes, rivers, streams and wetlands
- E8 – Diversion and discharge of stormwater
- E9 – Stormwater quality – high contaminant generating car parks and high-use roads
- E10 – Stormwater management area – Flow 1 and 2
- E39 – Natural hazards and flooding

It is noted that the application seeks to be considered under the NDC.

3.3. Water sensitive design (GD04)

GD04 is a guidance document by Auckland Council which introduces principles and objectives for Water Sensitive Design (WSD). These include an interdisciplinary design approach, using on-site stormwater management practices to mimic natural systems and protect the functions of natural ecosystems. WSD approaches focus on reducing or eliminating stormwater runoff generation through source control and utilising natural systems and processes to manage stormwater quantity and quality effects. The objectives include:

- Managing stormwater quality - manage stormwater quality to avoid adverse environmental effects.
- Minimising soil disturbance - minimise sediment in stormwater runoff, especially during construction, and protect site soil resources from modification.
- Promoting ecosystem health - promote the health of regional ecosystems and their associated environmental services through the management of stormwater at the catchment and site scale.
- Delivering best practice - deliver best practice urban design and broader community outcomes as part of stormwater management delivery.
- Maximising return on investment - achieve maximum value from stormwater management through the consideration of a broad range of benefits.

4. Mana whenua engagement

At the time of writing, engagement correspondence has been sent to all iwi groups with registered interest in the PPC area, with responses and ongoing engagement and involvement with two iwi groups - Ngāti te Ata Waiohua and Ngāti Tamaoho. A summary of the Cultural Values Assessment (CVA), as pertaining to stormwater, is included in Table 2.

Further consultation and engagement with Ngāti te Ata Waiohua and Ngāti Tamaoho will continue on an ongoing basis as the PPC progresses.

Table 2: Cultural Values Assessment summary

Iwi	Summary of stormwater-related discussion	Summary of measures within the PPC
Ngāti Te Ata Waiohua	Ngāti Te Ata note that the Pukekohekohe Gateway Plan Change has seen intensification in ecologically sensitive areas, including riverine and coastal zones, which are susceptible to adverse environmental impacts. The mauri of waterways and wetlands is a priority for Ngāti Te Ata Waiohua. The following stormwater-related matters have been raised as needing to be addressed in the PPC: • The PPC must ensure that natural features such as waterways are not visually or physically compromised and that preserving these features maintains the character of the area. • The inclusion and enhancement of existing waterways and wetlands in the master plan. • Aligning the stormwater systems with the Auckland Council Regionwide NDC. • Daylight and naturalise at least 500m of piped waterways, integrating riparian planting. • Include hydrological modelling and an adaptive management plan to address flood risk and stream erosion.	The PPC and proposed stormwater management measures meet Ngāti Te Ata Waiohua's concerns in the following ways: • Waterways and natural features within the site will be preserved and enhanced with planting where possible. This is further discussed in the Landscape and Visual Effects Assessment written by Barkers & Associates. • The stormwater management measures outlined in this Stormwater Management Plan align with the Auckland Council Regionwide Network Discharge Consent. • The extent of the manmade channel within the PPC area is being daylighted and currently being workshopped with Ngāti Te Ata Waiohua. Native riparian planting will be integrated into the stream channel. • Flood modelling has been undertaken to assess any effects on third-party land resulting from the plan change and is included in subsequent sections of this report.

Iwi	Summary of stormwater-related discussion	Summary of measures within the PPC
Ngāti Tamaoho	The following stormwater-related matters have been raised by Ngāti Tamaoho in their Cultural Values Assessment: • That the use of GD01 and GD04 be used in the design of stormwater mitigation devices • A treatment train approach is recommended, with any constructed wetlands providing a final/polishing treatment prior to discharge via green outfalls. • A forebay should be installed to prevent any constructed wetlands from mitigating the risk of sediment resuspension during heavy rainfall events. • Ngāti Tamaoho have an expectation that all catchpits be fitted with a Stormwater360 LittaTrap or Enviropod.	The PPC and proposed stormwater management measures meet Ngāti Tamaoho's concerns in the following ways: • The SMP recommends that any proposed stormwater management devices be sized and designed in accordance with GD01. • A treatment train approach has been • The SMP recommends the separation of clean water from roofs to be captured in tanks and contaminated runoff from patios, driveways and roads be treated in constructed wetlands. • The constructed wetlands will feature forebays in accordance with GD01 to allow for sediment to settle out of the runoff prior to treatment in the body of the wetland. • It is understood that placing catchpit inserts, GPTs such as LittaTraps or Enviropods, on public catchpits may not be accepted by Council or Auckland Transport due to the ongoing maintenance requirements for these devices. These may be implemented on private drainage infrastructure, particularly within lots near waste management areas. It is noted that the sediment load generated within lots is not likely to be as significant as that generated from public roads and may not necessitate the use of catchpit inserts.

5. Stakeholder engagement and consultation

Engagement has been undertaken with various parties, including Mana Whenua and Healthy Waters.

Consultations pertaining to stormwater is detailed in Table 3 with further minutes provided in the Consultation Summary Report appended to the Section 32 Report.

Woods has been engaging with Healthy Waters since May 2023 in relation to the flood modelling required to support the plan change. Woods, on behalf of ATR, has been working collaboratively on converting the legacy Pukekohe base Stormwater DHI model into InfoWorks ICM. The converted model has undergone a peer review by Healthy Waters and has been confirmed as acceptable to be used to assess plan change scenarios.

Further consultation and engagement with stakeholders will continue on an ongoing basis as the plan change progresses.

Table 3: Summary of engagement and consultation

Date	Parties	Summary of discussion
28/11/2024	ATR (Adam Sadgrove) Barkers & Associates (Nick Robers, Cosette Pearson) Woods (Pranil Wadan, Brian Flood, Thomas McClory, Ajay Desai) Healthy Waters (Jack Thompson)	Nick Roberts outlines the PPC scope to Jack Thompson. Pranil Wadan provided an overview of the existing stormwater infrastructure within the Site, including existing culverts and the man-made watercourse and highlighted that the Tutaenui Stream forms the receiving environment. Pranil also provided an overview of the stormwater management strategy, which includes the naturalisation of the man-made watercourse and daylighting of some piped infrastructure, as well as creating more flood storage as part of the naturalisation. Stormwater management options include a communal wetland as the preferred option but still maintain flexibility to do more at source as part of future resource consent applications. Stream erosion within the site was not identified as an issue. Jack Thompson clarified whether the PPC seeks to come under the NDC, which Pranil confirmed was the intent. Ajay Desai provided an overview of the flood modelling, stating that he worked closely with Larry Shu from Healthy Waters and that Healthy Waters has approved the base model. Ajay has adapted the base model accordingly for the plan change. Modelling includes an assessment at 3.8 °C for flood resilience. The modelling provides a good understanding of the current flood risk in the catchment. Ajay noted that the culverts at the flow path entry and exit points from the site are to be maintained, and no upgrades are proposed. Jack asked how far downstream the model extents reach, and Ajay clarified that the modelling includes the catchment's ultimate discharge point to the Waikato River. Jack requests that the plan show the wider extent downstream of the Site to confirm no worsening of flood effects resulting from the PPC. Jack requested a hydrograph to verify that pre- and post-development flows do not converge upstream of Buckland Road and downstream of the PPC Area. Jack indicated that large communal devices are preferred by Auckland Council and Auckland Transport as opposed to rain gardens in road reserves.

Date	Parties	Summary of discussion
03/12/2024	Ngāti Te Ata Waiohua (Karl Flavell) Ngāti Tamaoho (Edith Tuhimata, Lucie Rutherfurd) ATR (Adam Sadgrove) Woods (Pranil Wadan, Brian Flood) Barker & Associates (Joseph McCready, Cosette Pearson, Nick Roberts)	Lucie Rutherfurd expressed a strong preference for forebays as opposed to Gross Pollutant Traps if wetlands are to be vested with the Auckland Council. Karl Flavell and Lucie Rutherfurd indicated a strong support for correctly referring to the PPC as 'Pukekohekohe Park Plan Change'. Lucie Rutherford notes that the stream enhancement needs to include pools and ripples, root wads and wetland planting species. Pranil Wadan gave an overview of the stormwater management strategy for the PPC, including a treatment train approach for stormwater management. Both Iwi queried whether any natural springs (puna) were located close to the site and requested Pranil to find out more information and to report back. Lucie Rutherfurd expressed a preference for wetlands over ponds as attenuation devices. Both Iwi groups agreed that wetlands are the preferred option. Lucie Rutherfurd and Edith Tuhimata requested water quality testing be done pre- and post-development so that any stream enhancement can be tracked to provide mana whenua with cultural indicators.

Date	Parties	Summary of discussion
19/03/2025	Ngāti Tamaoho (Lucie Rutherford, Edith Tuhimata, Dennis Kirkwood) ATR (Adam Sadgrove) Woods (Pranil Wadan) Barker & Associates (Nick Roberts, Cam Wallace, Joseph McReady, Cosette Pearson)	Nick Roberts provided an overview of the channel enhancement of the current manmade waterway running through the site, as prepared alongside Karl Flavell and Edith Rutherford. Lucie Rutherford queried what zone will be proposed, and Nick Roberts clarified that the Mixed Housing Urban zone will be proposed; however, the dwellings will be a mix of terraced housing and standalone buildings, driven by the market. The discussion around the stream channel alignment centred around opportunities for mahi toi cultural structures both in the development and along the awa, which will be further explored in focused workshops with Ngāti Tamaoho and Ngāti Waiohua. The stream enhancement works will run parallel with the plan change process, with the intention being to have the stream and channel works lodged and approved prior to the plan change being approved. Lucie Rutherford queried the location of stormwater management devices and raised concerns around whether the wetlands might flood and how often. Pranil Wadan confirmed that the wetlands have been located in an area of the site that has previously flooded and clarified that the device locations on the plans are indicative to inform the plan change. Details of the wetland locations will be worked through as part of future consenting stages, with mana whenua involved in the process. Wetland devices will be vested in Healthy Waters. Lucie Rutherford expressed that stormwater wetlands need forebays, which Pranil Wadan confirmed. Edith Tuhimata noted an expectation of baseline testing for water quality. Pranil Wadan confirmed that this work can be undertaken, and information shared with mana whenua.

Date	Parties	Summary of discussion
24/03/2025	ATR (Adam Sadgrove) Barkers & Associates (Nick Robers, Cosette Pearson) Woods (Pranil Wadan, Ajay Desai) Healthy Waters (Jack Thompson)	Cosette Pearson outlined the scope, purpose and content of the proposed plan change. Pranil Wadan and Cosette Pearson provided an overview of the provisions relevant to stormwater, namely the inclusion of the SMAF-1 overlay, stormwater quality and riparian margin provisions. Jack Thompson confirmed that the key matter Healthy Waters is looking for in Plan Change applications is the establishment that the development and stormwater management strategy will work, as opposed to exact details of how it will work. Jack Thompson queried what the plan is for non-potable reuse of water and how this would be implemented. Pranil Wadan confirmed that reuse would be within the property itself, with the intention to plumb back into the dwelling for non-potable reuse. Adam Sadgrove and Pranil Wadan noted that a Resource Consent is being sought separately for the stream naturalisation/enhancement project, to have consent by the time the plan change goes to hearing. Ajay Desai and Pranil Wadan noted that at the recent community engagement event, members of the Buckland Community raised concerns around existing flooding issues as a result of streams not being maintained/cleared of debris to enable conveyance. Jack Thompson noted that this is an existing flooding issue that Auckland Council are aware of and that the ops team have been carrying out maintenance work in the creek adjacent to Buckland. Healthy Waters is also commissioning work to investigate flooding issues/flood mitigation options to address these concerns. Jack Thompson noted that the stream cleaning is a perceived issue and that flood models show that this area will flood regardless. Additionally, flood information was available when residents purchased their properties; therefore, flooding has not been noted on the LIMs. Jack Thompson confirmed that Healthy Waters is looking for confirmation that any flooding effects resulting from the plan change can be contained within the Precinct site.

Date	Parties	Summary of discussion
02/04/2025	ATR (Adam Sadgrove) Barkers & Associates (Nick Robers, Cosette Pearson, Kasey Zhai) CKL (Darryl Hughes) Auckland Transport (Marguerite Pearson) Auckland Council (Tania Richmond, Ben Kildare, Craig Cairncross, Susan Andrews, Jack Thompson)	Nick Roberts provided an overview of the plan change, with sub-precincts A and B of the Pukekohekohe Gateway Precinct being rezoned to Mixed Housing Urban and Open Space – Informal Recreational. Susan Andrews queried the state of existing streams. Cosette Pearson confirmed that no piping is proposed, but the southern portion will be daylighted. Susan Andrews queried the purpose of the riparian margin standard within the new Pukekohekohe Gateway Precinct, stating that a 10m wide margin may not be sufficient for stream erosion/geomorphic stability measures. Cosette Pearson and Nick Roberts confirmed that the presence of streams within the new Precinct will trigger the standard along the southern boundary. Jack Thompson confirmed that design details of the stream will be subject to Resource Consent purposes, and details will be resolved through future consenting processes. Susan Andres identified that the plan change would need to consider the impacts of development on downstream erosion and to confirm whether the SMAF overlay is sufficient for erosion protection. ATR confirmed that ongoing discussions have been held with Healthy Waters in relation to flood modelling, with the Council having reviewed the pre-development model and confirmed that the model is fit to assess post-development effects, with the caveat that the post-development model will require further review. ATR notes that alongside the model review process, ATR has had over 2 years' worth of consultation with Healthy Waters. Susan Andrews requested minutes from all meetings held with Healthy Waters discussing the plan change, as well as ecological assessments undertaken to inform the plan change. All identified that further stormwater-focused sessions may be required following Healthy Waters' receipt and review of flood models. Additional feedback regarding SMAF and stream hydrology/geomorphic matters can be provided at these sessions.

6. Proposed development

The Pukekohekohe Gateway Plan Change seeks to rezone approximately 22.96 hectares of land from the Special Purpose zone to 'Mixed Housing Urban' and 'Open Space – Informal Recreation Zone', as shown in the legend in Figure 11.

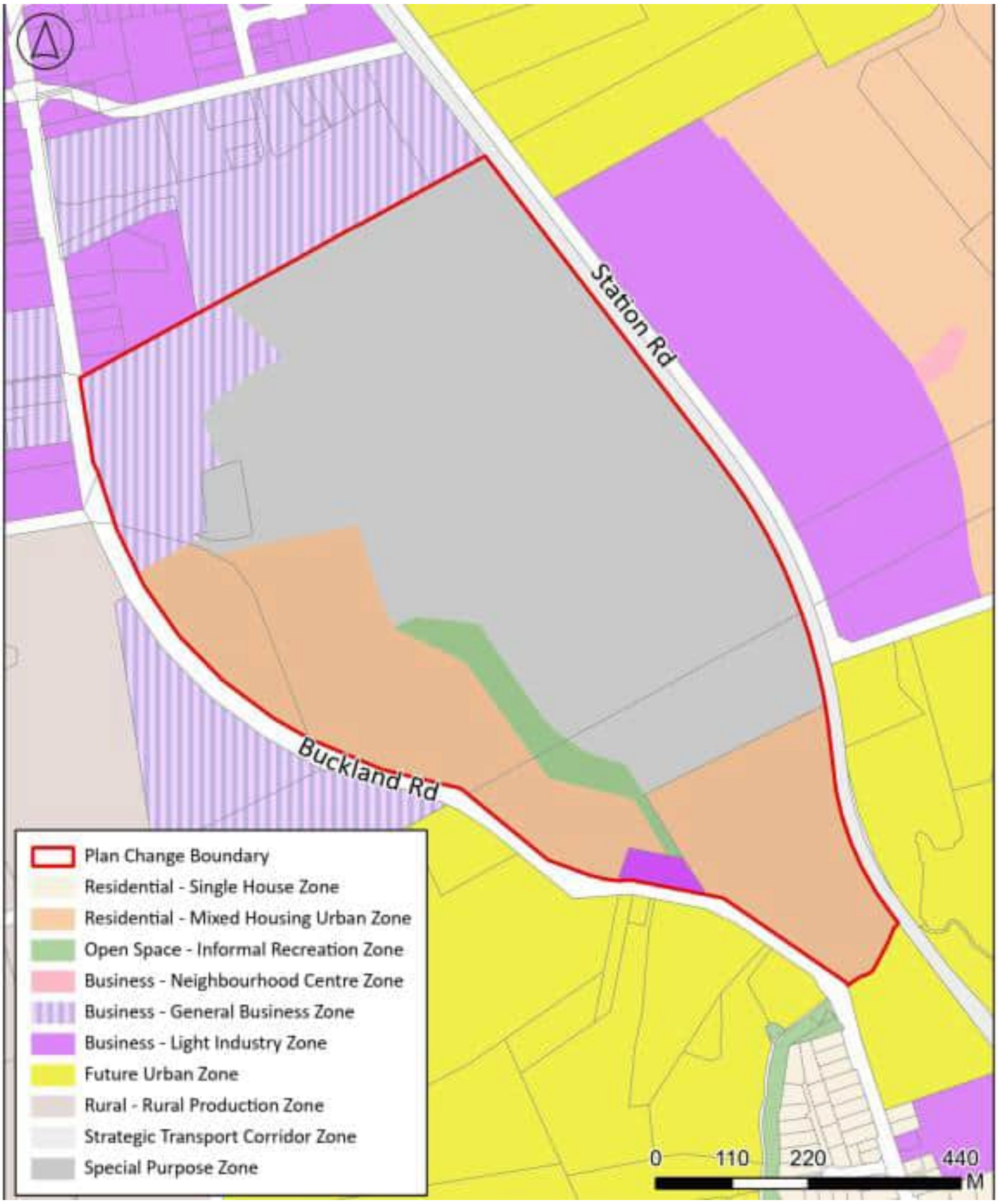


Figure 11: Pukekohekohe Gateway Plan Change area

The PPC intends to rezone land that is not currently being utilised as part of the track facilities and will enable residential development that overlooks the racing facilities.

The proposed rezoning is across land that contains an existing man-made open trapezoidal channel, which receives runoff from the Pukekohekohe catchment to the north of the PPC area. The PPC allows for the realignment and daylighting of the existing man-made watercourse and pipework within the Pukekohekohe Gateway Plan Change boundaries. Flood modelling has been undertaken for the proposed PPC area, which is detailed in Section 8.

7. Stormwater management

This section presents the stormwater management approach for the PPC and seeks to meet the objectives and design requirements set out in Schedule 4 of the Auckland Council Regionwide NDC and the AUP-OP.

This section covers how stormwater discharge will be managed in accordance with the NDC requirements for Large Brownfields sites with respect to water quality and hydrology mitigation. Flood management is covered in Section 8.

7.1. Stormwater management strategy

This section presents details on how the proposed stormwater management approach follows the principles outlined in Section 8.1 and aligns with the requirements set out in Schedule 4 of the NDC.

7.1.1. Water quality

Eliminating and minimising the generation of contaminants for all contaminant-generating impervious surfaces. Runoff from all impervious areas directly connected to the public network will be treated in a device sized and designed in accordance with GD01.

7.1.2. Stream Hydrology

Preserving, protecting, and enhancing streams, wetlands, and floodplains can provide amenities and enhance connectivity with communities. This is in line with consultation with Mana Whenua, as detailed in Section 4 of this SMP.

SMAF1 hydrology mitigation is proposed for all new impervious areas, prioritising retention via reuse or infiltration where possible. SMAF1 detention is also proposed to provide stream erosion mitigation that may result from intensification on-site.

A site walkover was undertaken on 31/08/2024 to view the watercourse upstream of the Site and the manmade channel within the Pukekohekohe Gateway Plan Change boundaries. The watercourse upstream of the Pukekohekohe Gateway Plan Change featured significant armouring and gabion baskets at culvert inlets and outlets.

The walkover identified no areas of stream erosion concern within or upstream of the Pukekohekohe Gateway Precinct. Viridis have verified this in their ecology assessment and in the Auckland Council Watercourse Assessment Report for the Pukekohe and Tutaenui Stream catchment. Consequently, the SMAF1 hydrology mitigation proposed as part of stormwater management is considered adequate to address stream erosion risk resulting from the development.

7.1.3. Conveyance and flooding

All proposed new public stormwater lines are to be designed in accordance with version 4 of the Auckland Council Stormwater Code of Practice.

Flows greater than the pipe capacity (10% AEP event) will be conveyed as overland flow paths along the road corridor or jointly owned access lots (JOALs). Overland flow path alignments will depend on the final superlot layout and will be finalised at the detailed design stage. For the purposes of the PPC, the following design criteria is recommended for overland flow paths:

- Overland flow paths will be designed with sufficient capacity to accommodate the 1% AEP event (inclusive of climate change in accordance with version 4 of the Auckland Council Stormwater Code of Practice) with the PPC area at MPD impervious coverages.
- Overland flow paths will be unobstructed and comply with the depth and velocity criteria outlined in the Auckland Transport - Transport Design Manual.
- Existing overland flow path alignments will not change in a way that affects any external properties.

- Overland flows will meet the design criteria outlined in version 4 of the Auckland Council Stormwater Code of Practice.
- A flood assessment has been undertaken, which has been discussed in Section 8 of this report.
- Finished floor levels for vulnerable activities are to be set in accordance with version 4 of the Auckland Council Stormwater Code of Practice.

The PPC will manage flood effects not to exacerbate any existing flood risk to people and property upstream or downstream of the PPC.

This will be achieved by utilising the flood storage associated with the stream naturalisation works within the Pukekohekohe Gateway Plan Change boundaries and the natural attenuation offered by the existing culvert that discharges to the Tutaenui Stream to the south of Buckland Road.

7.1.4. Stormwater management summary

The stormwater management strategy for the PPC area has been summarised in Table 4.

Table 4: Stormwater management strategy – Pukekohekohe Gateway Precinct

<table>
<tr><th rowspan="3">Area</th><th colspan="5">Stormwater Management</th></tr>
<tr><th rowspan="2">Water Quality</th><th colspan="2">Hydrology Mitigation</th><th rowspan="2">Primary Conveyance</th><th rowspan="2">Secondary Conveyance</th></tr>
<tr><th>Retention</th><th>Detention</th></tr>
<tr><td rowspan="2">Roof area</td><td>Non-contaminant generating roofing and cladding material.</td><td rowspan="2">Retention of at least the first 5mm of runoff via non-potable reuse tanks (limited to roof areas)</td><td rowspan="2">Detention via communal bioretention devices/ raingardens sized and designed in accordance with GD01</td><td rowspan="5">Convey runoff generated from the 10% AEP event (inclusive of climate change factors in accordance with the Stormwater Code of Practice)</td><td rowspan="2">Finished floor levels to be provided as per the Stormwater Code of Practice</td></tr>
<tr><td>Reuse tanks to provide first flush treatment</td></tr>
<tr><td>Public roads</td><td colspan="3" rowspan="3">Water quality and hydrology mitigation to be provided via devices sized and designed in accordance with GD01.

Devices may be placed at the source or in communal devices placed close to the discharge location.</td><td rowspan="3">Convey overland flow paths for the 1% AEP (inclusive of climate change factors) within road reserves and green spaces.</td></tr>
<tr><td>Private JOALS</td></tr>
<tr><td>Driveways/patio areas</td></tr>
</table>

To meet the requirements outlined above, the SMP recommends water quality treatment and SMAF1 hydrology mitigation to be met in wetlands sized and designed in accordance with GD01. Sub-precinct boundaries and indicative wetland locations have been shown in Figure 12.

Figure 12: Sub-precinct boundaries (indicative wetland locations marked by stars)

The indicative wetlands have indicatively been sized for water quality and SMAF1 hydrology mitigation for all impervious areas (including roads) within the sub-precinct boundaries. The calculation methodology is included in Appendix A.

While the SMP recommends wetlands to meet the stormwater management requirements, a Stormwater Management Toolbox (Table 5) has been developed to guide the selection of further stormwater management devices to optimise the area occupied by the wetland. While the communal wetlands remain the preferred approach for water quality treatment and SMAF1 hydrology mitigation, the toolbox intends to accommodate potential changes through the detailed design stage, infrastructure constraints or operational requirements.

The reference to roadside raingardens and detention tanks is intended as an alternative option, only to be used if site-specific constraints emerge during design development. The Auckland Transport Design

Manual (ATDM) permits the use of raingardens within the road corridor, provided they meet the design requirements, including a minimum surface area of $20m^2$. We anticipate that any consultation with AT on the use of proposed raingardens will be subject to ATDM compliance and Auckland Transport approval. Consultation with Auckland Transport will be undertaken at the appropriate consenting stage.

Table 5: Stormwater management toolbox

Activity/Land Use	Outcome	Performance Standard	Device Options	
			At source	**Communal**
On Lot: Roof Area	Water quality	Water quality treatment in a device sized and designed in accordance with GD01	Eliminate contaminant generation at source using inert roofing and cladding materials.	Communal wetland sized and designed in accordance with GD01
	Hydrology mitigation	Equivalent of SMAF1 retention requirement as per AUP Table E10.6.3.1.1	Non potable water reuse through rain tanks sized and designed in accordance with GD01	N/A
		Equivalent of SMAF1 detention requirement as per AUP Table E10.6.3.1.1	Detention tanks sized and designed in accordance with GD01	Communal wetland sized and designed in accordance with GD01
On Lot: Driveways/patio areas	Water quality	Water quality treatment in a device sized and designed in accordance with GD01	Raingardens/Communal raingardens sized and designed in accordance with GD01 Catchpit inserts such as LittaTraps or Enviropods may be implemented near waste management areas on lots	Communal wetland sized and designed in accordance with GD01
	Hydrology mitigation	Equivalent of SMAF1 retention requirement as per AUP Table E10.6.3.1.1	Retention to ground via underground tanks sized and designed in accordance with GD01. This is contingent on whether infiltration rates support this and there are no geotechnical constraints around ground stability. If retention to ground isn't feasible, the retention volume will be included as part of the detention volume.	N/A
		Equivalent of SMAF1 detention requirement as per AUP Table E10.6.3.1.1	Detention tanks sized and designed in accordance with GD01	Communal wetland sized and designed in accordance with GD01
Private JOALs	Water quality	Water quality treatment in a device sized and designed in accordance with GD01	Raingardens/Communal raingardens sized and designed in accordance with GD01	Communal wetland sized and designed in accordance with GD01

Activity/Land Use	Outcome	Performance Standard	Device Options	
			At source	**Communal**
	Hydrology mitigation	Equivalent of SMAF1 retention requirement as per AUP Table E10.6.3.1.1	Retention to ground via underground tanks sized and designed in accordance with GD01, provided infiltration rates support this and there are no geotechnical constraints around ground stability.	N/A
		Equivalent of SMAF1 detention requirement as per AUP Table E10.6.3.1.1	Detention tanks sized and designed in accordance with GD01	Communal wetland sized and designed in accordance with GD01
Public roads	Water quality	Water quality treatment in a device sized and designed in accordance with GD01	Roadside raingardens sized and designed in accordance with GD01. This option is subject to asset owner (Auckland Transport) approval.	Communal wetland sized and designed in accordance with GD01
	Hydrology mitigation	Equivalent of SMAF1 retention requirement as per AUP Table E10.6.3.1.1	N/A - retention to ground next to road carriageways isn't feasible, the retention volume is proposed to be included as part of the detention volume.	Communal wetland sized and designed in accordance with GD01
		Equivalent of SMAF1 detention requirement as per AUP Table E10.6.3.1.1	N/A	Communal wetlands sized and designed in accordance with GD01

7.1.5. Development staging

The Pukekohekohe Gateway Plan Change may be developed in multiple stages, to be decided at subsequent consenting stages, once the PPC application has been approved.

7.2. Hydraulic connectivity

Runoff in the 10% AEP event is to be conveyed in primary drainage and will discharge to an open watercourse within the PPC area. The site will be designed such that flows in excess of the 10% AEP event will flow to the open watercourse via the road corridors or JOALS.

It is noted that the purpose of this SMP is to demonstrate that stormwater from the PPC area can be managed in accordance with the NDC. It is noted that subsequent resource consent applications will dictate the internal layout of the sub-precincts; therefore, hydraulic connectivity is to be assessed at subsequent resource consent applications.

7.2.1. Overland flow path and floodplain management

Secondary flows (events greater than the 10-year ARI storm event and up to a 100-year ARI storm event) will be conveyed along road corridors or conveyance channels. Overland flow path conveyance routes will depend on the built environment, and the plan change proposes to maintain existing overland flow path discharge locations.

The overland flow path management strategy will meet the following design criteria:

- Conveyance routes for overland flow paths will be designed with sufficient capacity to accommodate the 100-year ARI (allowing for future temperature increases due to climate change) storm event with the contributing catchment at MPD impervious coverages,
- Overland flows from any external properties entering the PPC area will be maintained and accommodated within the overland flow path conveyance routes within the PPC area.
- Overland flow paths will remain unobstructed and comply with the velocity and depth values required for pedestrian and vehicular safety within the site, as per Auckland Transport – Transport Design Manual (TDM). AT TDM states that the product of maximum depth and average velocity should be less than $0.3m^2/s$
- Overland flows will meet the design criteria outlined in Auckland Council's Stormwater Code of Practice.

7.3. Asset ownership

The devices that make up the stormwater management strategy for the PPC area, along with the asset owners, is summarised in Table 6.

Table 6: Asset ownership

Asset	Location	Owner
Tanks	Private lots	Lot owner
Communal wetland	Stormwater reserve area	Auckland Council or Council Controlled Organisation
Public stormwater network	Road reserves	Auckland Council

The location of these devices, along with confirmation of the appropriate vesting authority, will be undertaken at subsequent consenting applications.

7.4. Ongoing maintenance requirements

Private stormwater management devices within the lots will be the sole responsibility of future lot owners.

The stormwater line that is being daylighted to an open watercourse is proposed to be maintained privately by ATR.

The primary stormwater network to service the development will be vested in and maintained by Auckland Council. Any communal stormwater management devices will be vested in and maintained by Auckland Council.

Any stormwater management devices that are within the public road corridor will be vested in and maintained by Auckland Transport.

Operation and maintenance manuals are to be provided as part of subsequent consent applications.

7.5. Implementation of stormwater network

Stormwater network implementation is to be addressed at subsequent consenting applications once detailed superlot layouts are finalised.

7.6. Risks

A preliminary risk register relating to the proposed stormwater management strategy within the PPC area is outlined in Table 7. This register can be used and built on at subsequent consenting stages.

Table 7: Risk register

Risk to proposed stormwater management	Risk mitigation/ management measures	Other risk management measures	When does this risk need to be addressed	Resultant risk level (following mitigation measures)
Unknown soil infiltration rates	Design using a minimum regional rate of 2 mm/hr as set out in E10 of the AUP	Site-specific testing at subsequent consenting stages	During subsequent consenting applications, when superlot layouts have been finalised	Low
Contaminants from changed land use entering the watercourse	Water quality treatment devices to be designed and sized in accordance with GD01 to meet water quality treatment requirements	Regular maintenance of water quality treatment devices. Water quality monitoring.	At the plan change and at the resource consent stages	Low
Overland flow paths	High-level assessment of overland flow paths	Reassess during subsequent design stages, when superlot layouts have been finalised.	During subsequent consenting applications, when superlot layouts have been finalised	Low
Floodplains	High-level assessment of floodplains	Reassess during subsequent design stages, when superlot layouts have been finalised.	During subsequent consenting applications, when superlot layouts have been finalised	Low
Communal bioretention devices	Preliminary design	Reassess during subsequent design stages, when superlot layouts have been finalised.	During subsequent consenting applications, when superlot layouts have been finalised	Low
Stream erosion	SMAF1 hydrology mitigation	Erosion study/stream walkover to identify erosion hotspots	During subsequent consenting applications, when superlot layouts have been finalised	Low

8. Flooding

Woods has undertaken flood modelling to inform this stormwater management plan and to:

- Understand existing flood risk within the PPC area and wider catchment,
- To develop and test flood mitigation options with the intent to optimise the site layout, and
- Quantify any changes to flood risk upstream and downstream of the PPC area because of the proposed plan change.

The flood model was based on Auckland Council's existing model of the Pukekohe South stormwater catchment, which was prepared in the Mike by DHI software (v2014, service pack 3). The existing model was converted to InfoWorks ICM Version 2023.2 and updated to capture changes in the stormwater catchment, including imperviousness, topography and infrastructure upgrades. The associated model build report has been included in Appendix B.

This model was used as the pre-development model to assess the existing flood risk within and outside the PPC area. The model was reviewed by Healthy Waters and confirmed as acceptable for undertaking effects assessments in this area (details included in Appendix B).

8.1. Post-Development model

The post-development scenario was developed by incorporating the following changes:

- Proposed land changes as per the design surface developed by Woods
- Realignment of the existing channel within the site
- Daylighting of a section of the existing piped network
- Removal of existing local culverts
- Provision of additional flood storage within the site and
- Proposed treatment wetland

A composite Manning's n value of 0.10 has been adopted for the stream to account for the representative roughness of a low-flow channel ($n \approx 0.04$) and densely vegetated banks/floodplain ($n \approx 0.12$), consistent with the ranges given in Chow (1959) and Auckland Council's Stormwater Code of Practice v4 (2023).

No other changes were made to the model.

8.2. Model Scenarios

An overview of the modelled scenarios has been provided in Table 8.

Table 8: Modelled scenarios

Scenario	AEP	Climate Change	Land use
Pre-development	50%, 10%, 1%	2.1°C	Maximum Probable Development land use inside and outside of the plan change area.
	1%	3.8°C	
	1%	2.1°C	Maximum Probable Development land use outside of the plan change area. Existing Imperviousness for the PPC area.
Post-development	50%, 10%, 1%	2.1°C	Maximum Probable Development land use outside of the plan change area. Proposed imperviousness for the PPC area as per the master plan.
	50%	No climate change	
	1%	3.8°C	

8.3. Model results

The purpose of the flood modelling was to demonstrate that there would be no flood effects resulting from the development enabled by the PPC. The complete set of modelled results, showing flood extents and maximum depth for all modelled scenarios, is provided in Appendix C.

Flood depth maps for the pre-development and post-development for the 1% AEP 2.1 °C are shown in Figure 13 and Figure 14.

Flood depth maps for the pre-development and post-development for the 1% AEP 3.8 °C are shown in Figure 16 and Figure 17.

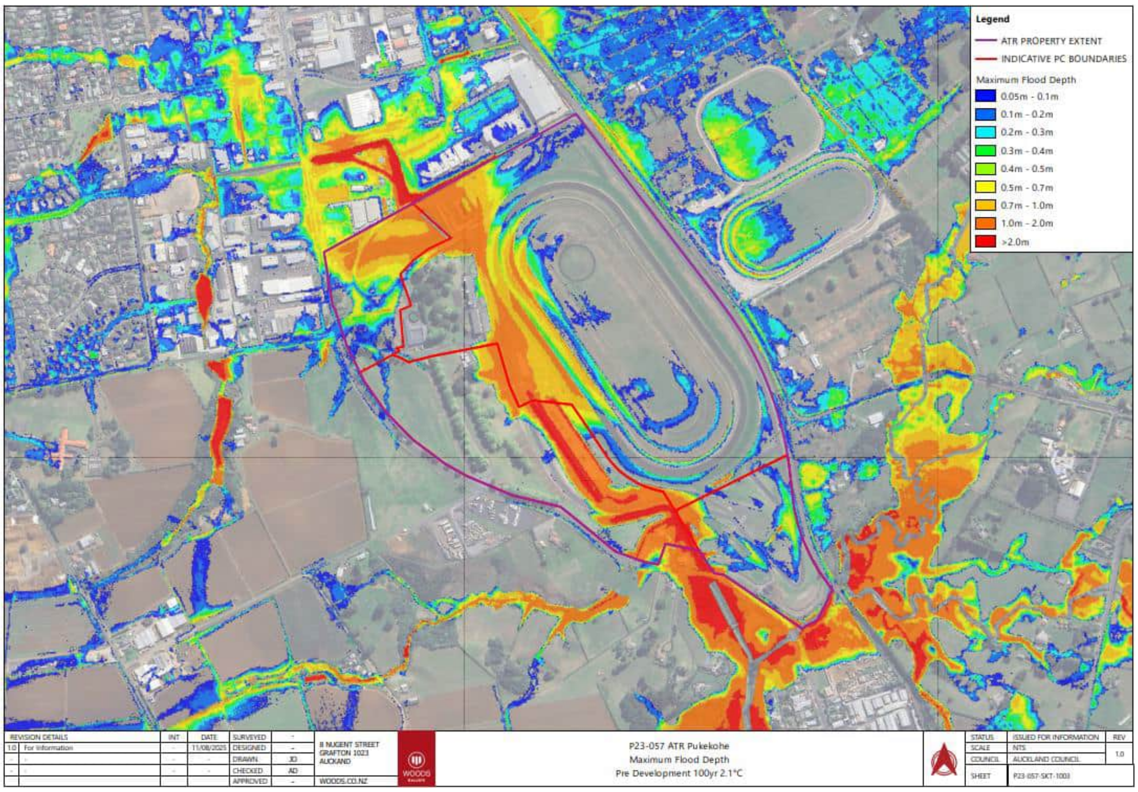


Figure 13: Maximum Depth: Pre-development 1% AEP (inclusive of 2.1 °C climate change)

The 1% AEP 2.1 °C water level difference (afflux) plot is shown in Figure 15. The 1% AEP 3.8 °C water level difference (afflux) plot is shown in Figure 18.

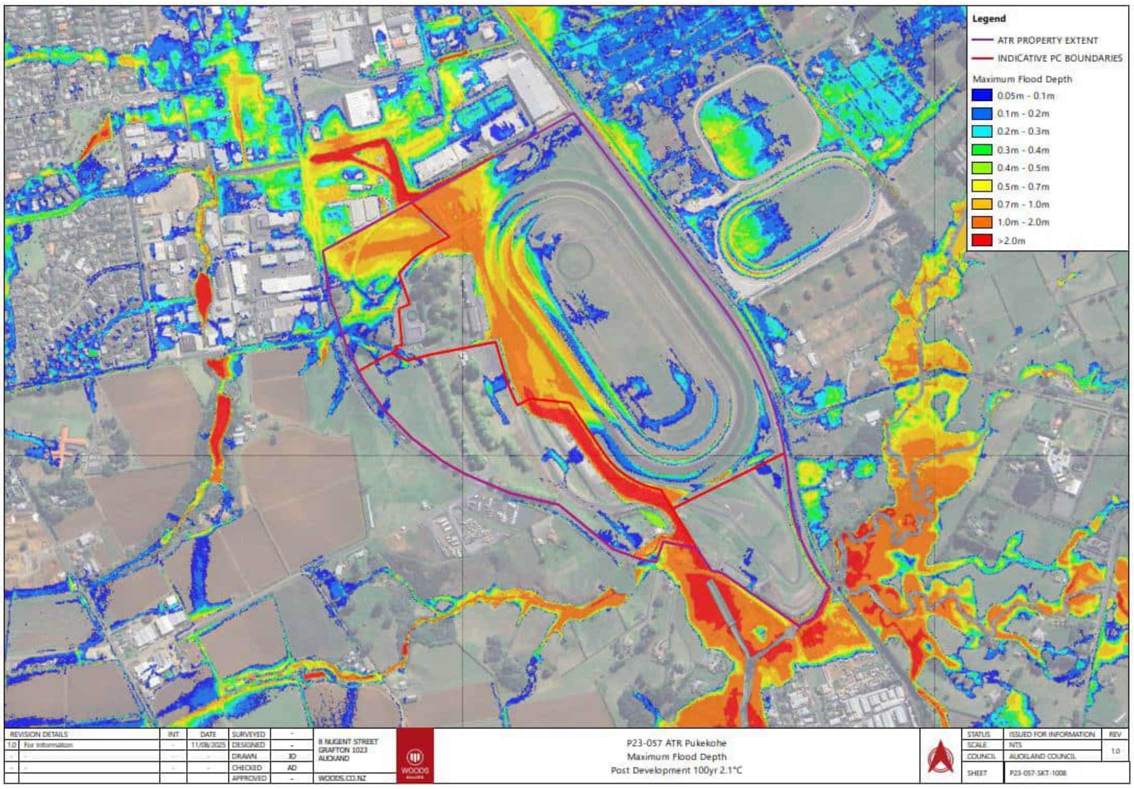


Figure 14: Maximum depth: Post Development 1% AEP (inclusive of 2.1 °C climate change)

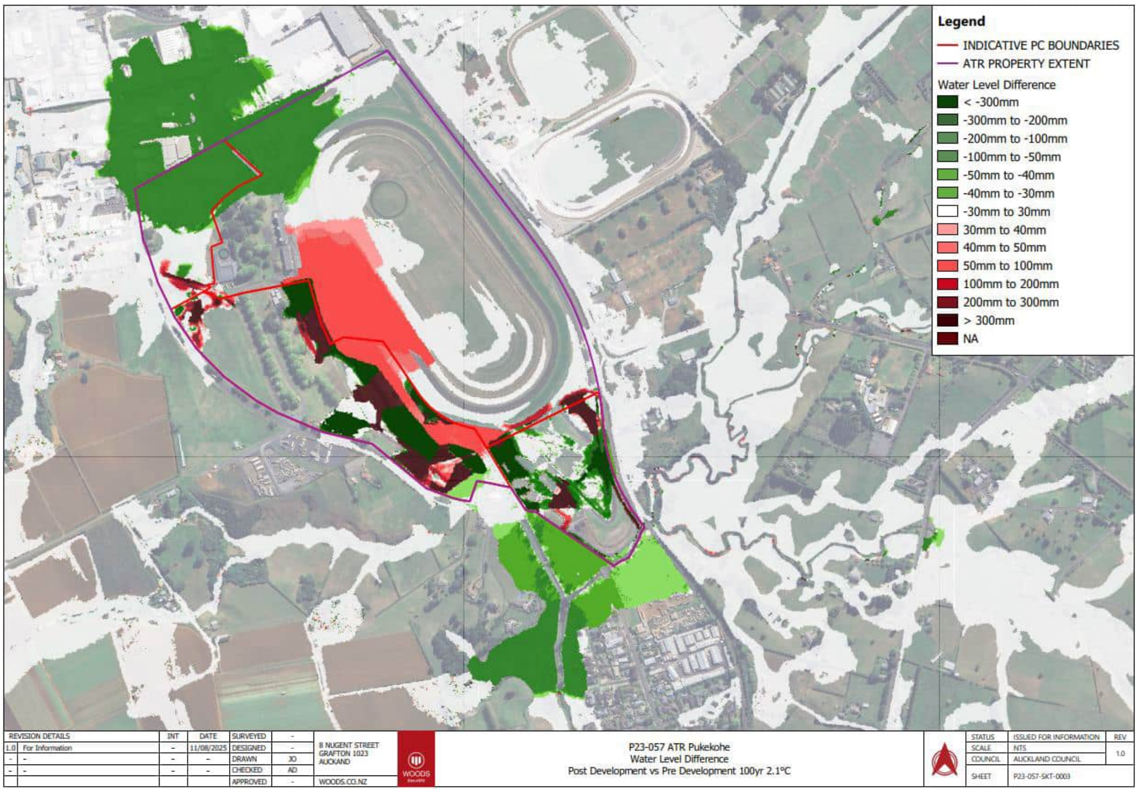


Figure 15: Water level difference plot: 1% AEP (inclusive of 2.1 °C climate change)

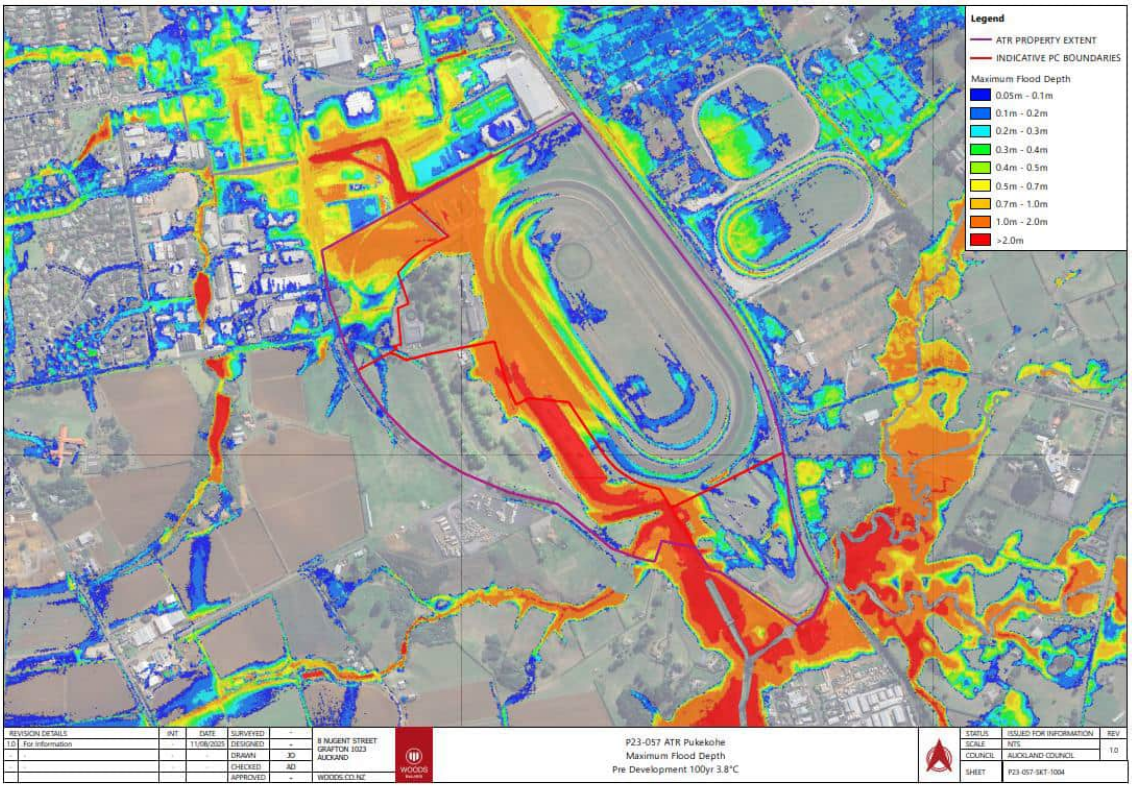


Figure 16: Maximum Depth: Pre-development 1% AEP (inclusive of 3.8 °C climate change)

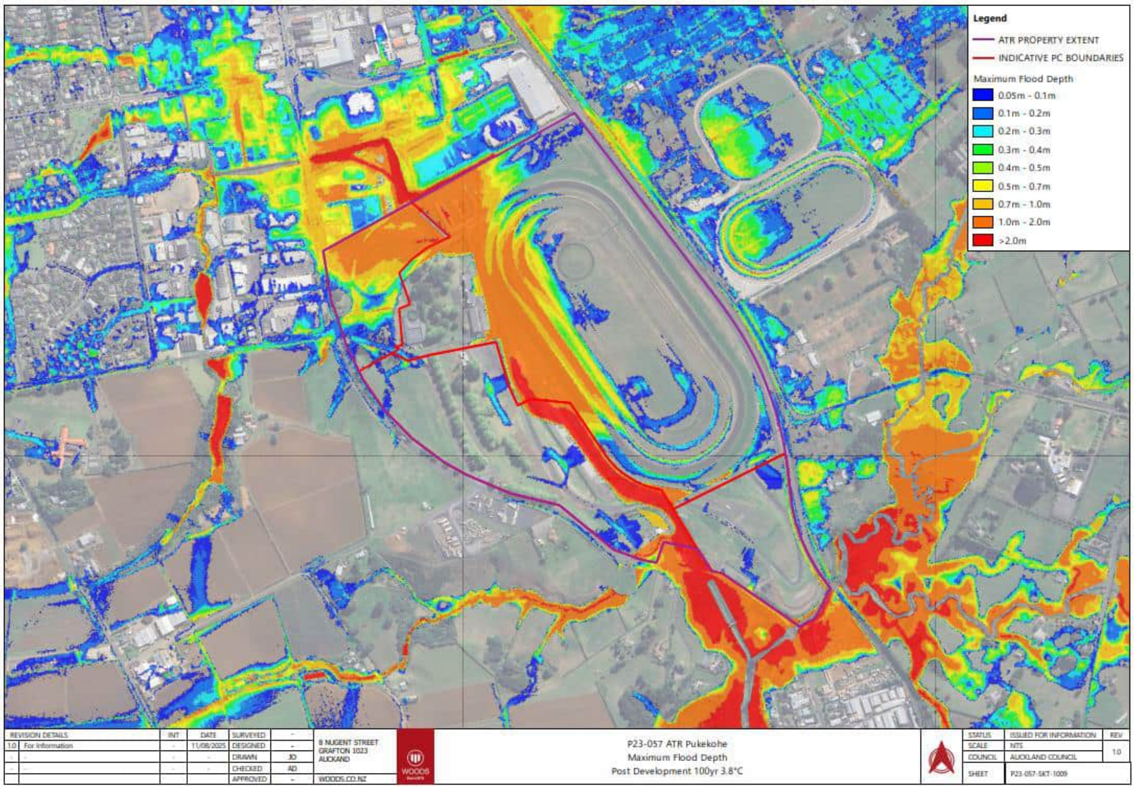


Figure 17: Maximum depth: Post Development 1% AEP (inclusive of 3.8 °C climate change)

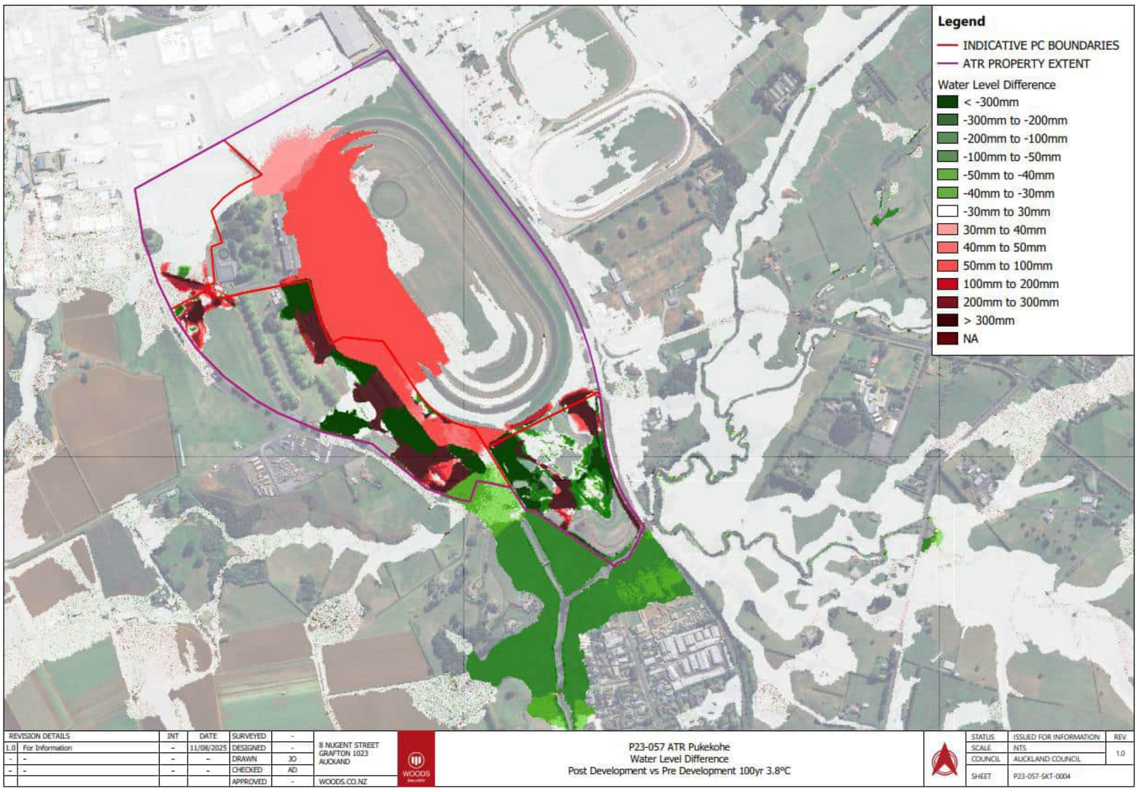


Figure 18: Water level difference plot: 1% AEP (inclusive of 3.8 °C climate change)

The modelled results show no increases upstream or downstream of the PPC area for all the modelled scenarios because of the storage within the site and improved conveyance along the proposed channel.

All future residential lots will be located outside of the future 1% AEP floodplain (inclusive of 3.8 °C climate change). Results from this model run show that the proposed lots sit outside the modelled flood extent, as seen in Appendix C.

9. Departures from regulatory or design codes

The stormwater management approach proposed for the PPC meets the minimum regulatory or design standards and is considered the Best Practicable Option approach.

10. Conclusions

ATR is seeking a PPC for a portion of ATR's landholdings at the Site. The PPC seeks to rezone part of the area from 'Special Purpose – Major Recreation Facility' to 'Residential Mixed Housing Urban' and 'Open Space – Informal Recreation' zones.

This SMP has been drafted for the Pukekohekohe Gateway Plan Change area to provide guidance to the applicant and to Auckland Council regarding how stormwater is to be managed. The SMP complies with the requirements set out in Schedule 4 of Auckland Council's Regionwide NDC.

The SMP complies with the requirements set out in Schedule 4 of the NDC for 'Large Brownfields Developments' and proposes the following:

- Water quality treatment
    - Water quality treatment of all new impervious areas is proposed within the PPC extent. The preferred option for water quality treatment is via constructed centralised communal wetlands. Water quality treatment may alternatively be provided at source in a device designed and sized in accordance with Auckland Council's Stormwater Management Devices in the Auckland Region Guideline Document 2017/001 (GD01)
- SMAF1 hydrology mitigation
    - Retention (volume reduction) of a minimum of 5mm of runoff from all impervious areas; and
    - Detention (temporary storage) with a draindown period of 24 hours for the difference between the pre-development (grassed state) and post-development runoff volumes from the 95th percentile, 24-hour rainfall event minus the retention volume for all impervious areas.
    - SMAF1 hydrology mitigation to be met at source or in centralised communal wetlands.
- Primary network
    - To be designed in accordance with the operative version of the Auckland Council Stormwater Code of Practice at the time of development.
- Secondary Network
    - Overland flow paths to be conveyed via internal roads designed in accordance with standards set out in the operative version of the Auckland Council Stormwater Code of Practice at the time of development and Auckland Transport's Transport Design Manual.
    - The PPC allows for the realignment and daylighting of the existing man-made watercourse and pipework within the Pukekohekohe Gateway Plan Change boundaries. The stream naturalisation works aim to improve the watercourse, provide amenity to future residential lots and enhance the flood storage currently available within the precinct boundaries.
    - Flood modelling has been undertaken, and the results have demonstrated that there are no upstream or downstream effects resulting from intensification within the PPC. The PPC seeks to maintain the natural attenuation available within the site resulting from the stream naturalisation works.

- Flood risk assessment
    - Flood hazard risk assessment has been undertaken using the approved Pukekohe South ICM model reviewed by Healthy Waters for the pre-development/existing scenario.
    - This flood model to assess any potential flooding effects from the proposed plan change to ensure no third-party flood effects.
    - Flood modelling undertaken indicates no upstream or downstream effects resulting from the proposed development. Further, the development has been designed to be located outside of the future 1% AEP floodplain (inclusive of climate change).

Woods has also consulted with Healthy Waters with regard to flood modelling undertaken and the overall stormwater management strategy.

In summary, the objectives of AUP and Schedule 4 of the NDC are satisfied by the stormwater approach described within this SMP and as part of the development. Overall, there are no significant impediments with respect to stormwater.

APPENDIX A

Wetland Sizing Memorandum

To

Auckland Council

From

Woods
Thomas McClory – Civil Engineer

W-REF: P23-057 – ATR Pukekohe Park
24 March 2025
Reviewer: Sakti Gounder – Senior Associate
Rev 1

Pukekohekohe Gateway Precinct – PPC Wetland Memo

1. Introduction

This memorandum has been prepared to provide high-level sizing requirements of wetlands to service the Pukekohekohe Gateway Precinct and is intended to be read in conjunction with the proposed Pukekohekohe Gateway Precinct Stormwater Management Plan (SMP). The SMP has been prepared to support the Pukekohe Park Racecourse Private Plan Change (PPC) on behalf of Auckland Thoroughbred Racing.

The PPC proposes to rezone part of the Pukekohe Park Racecourse to Residential - Mixed Housing Urban and Open Space – Informal Recreation.

For the purpose of this memorandum, a wetland is assumed in each of the two proposed residentially zoned sub-precincts (refer to Figure 1 below). The two wetlands have been sized based on conceptual urban design layouts to meet SMAF1 hydrology mitigation and water quality requirements, as outlined in the SMP.

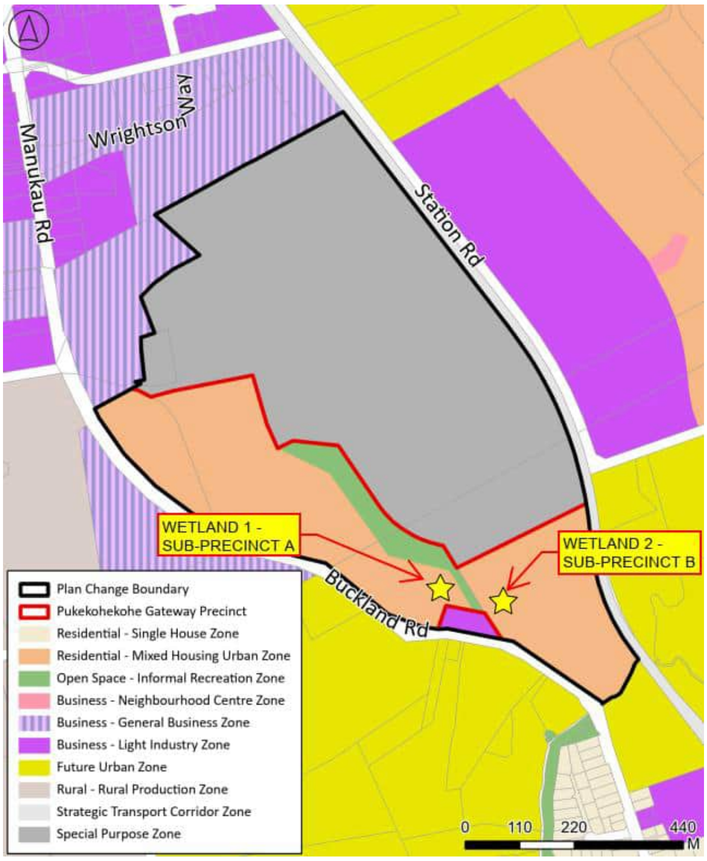


Figure 1: Proposed Zoning and Conceptual Wetland Locations

2. Design Requirements

The volumes calculated to fulfil Water Quality and SMAF1 Hydrology Mitigation requirements for the conceptual development are based on Guideline Document (GD01) published by Auckland Council, December 2017. As per GD01, the requirement for Water Quality and Hydrology Mitigation (SMAF1) are as follows:

1. Water Quality: Provide water quality volume equivalent to runoff volume generated from the catchment for 90^{th} percentile storm.

2. Hydrology Mitigation:

   a) Retention - Provide retention of at least 5mm runoff depth from all impervious areas.

   b) Detention - Provide detention with a drain-down period of 24 hours for the difference between the pre- and post-development runoff volumes from the 95^{th} percentile, 24-hour rainfall event minus the 5mm retention volume.

Table 1 provides the rainfall depth for 95^{th} and 90^{th} percentile storms across the Pukekohe Park Racecourse.

Table 1: Rainfall depths for 95th and 90th percentile storms

95th percentile storm (mm)	90th percentile storm (mm)
35	25

3. Design Details

This memorandum employs the following design approach:

- Wetland sizing requirements have been undertaken based on the guidelines provided in Stormwater Management Devices in GD01.
- Impervious areas have been taken from conceptual urban design layouts and considers public roads and private hardstand. Roofed areas have been excluded from the calculations under the assumption that rain tanks will provide SMAF1 hydrology mitigation.
- As this assessment is a high-level design based on conceptual residential development layouts, geometric design elements of the wetlands use a conical frustum shape to calculate total area and volumetric requirements.
- In lieu of detailed wetland designs, contingencies have been applied in the calculations below.
- Wetland design criteria such as inlet and outlet hydraulics, residence time, bathymetry, etc. will be provided during future consent and engineering approval applications.

3.1. Wetland sizing requirements

Wetlands 1 and 2 have been sized to provide Water Quality and SMAF1 requirements for a conceptual residential development within the proposed Pukekohekohe Gateway Precinct. The final water quality volume has been reduced by half to account for SMAF mitigation, and an additional 15% has been added to allow for forebay volume.

Geological maps for the area indicate the underlying soils are alluvial and Pukekohe volcanic. For the purposes of the contributing catchment calculations, soil classification Group C has been used, with Curve Number (CN) values of 74 and 98 for pervious and impervious surfaces, respectively.

Refer to Appendix 1 of this memorandum for TP108 catchment calculations.

Table 2 provides a summary of the areas proposed to be managed by the wetlands and the associated Water Quality Volume (dead storage) and Hydrology Mitigation (live storage).

Table 2: Summary of areas and volumes required

	Impervious area (ha)	Pervious area (ha)	Total area (ha)	Water Quality volume (m^3)	Final Water Quality volume (reduced by half + 15%) (m^3)	Total Hydrology Mitigation volume (m^3)	Total volume (m^3)
Wetland 1	3.84	3.92	7.76	938	610	880	1489
Wetland 2	2.53	2.58	5.10	617	401	579	981

3.2. Geometric design of Wetlands 1 and 2

As this assessment is a high-level design based on conceptual residential development layouts, a conical frustum shape has been used to calculate the total area and volumetric requirements for the wetlands.

Permanent Water Level (PWL) depths of 0.5m and 1.5m have been tested, with a 25% contingency applied to the PWL area to account for non-vertical side batters and bathymetry to provide required residence time. Refer to Table 3 below.

Table 3: Permanent water area summary

	Permanent water volume (m^3)	Depth (m)	Permanent water area (m^2)	Permanent water area with 25% contingency (m^2)
Wetland 1	377	0.5	1219	1524
		1.5	406	508
Wetland 2	673	0.5	803	1003
		1.5	268	334

Using this information, hydrology mitigation areas and volumes have been calculated assuming a PWL depth of 0.5m. This depth has been chosen as a conservative value to account for alternating shallow and deep marshes. 1 in 3 side batters have been employed above the PWL, and volumes calculated using a conical frustum formula. Refer to Table 4 below.

Table 4: Permanent water area summary

	Permanent Water Area With 25% Contingency (m^2)	Required Hydrology Mitigation volume (m^3)	Design Height of Hydrology Mitigation (m)	Provided Hydrology Mitigation Volume (m^3)	Water Area at Top of Hydrology Mitigation (m^2)
Wetland 1	1524	880	0.6	991	1783
Wetland 2	1003	579	0.6	665	1216

An additional 3.5m has been added to the top of water radius to account for a maintenance track, with a further 25% contingency to allow for an irregular shape that deviates from the conical frustum used in the area and volumetric calculations above. Refer to Table 5 below.

Table 5: Permanent water area summary

	Area With Maintenance Track (m^2)	Area With 25% Contingency (m^2)
Wetland 1	2346	2932
Wetland 2	1687	2108

Refer to Appendix 2 of this memorandum for wetland sizing calculations.

4. Conclusion

Using the information outlined above, Woods have incorporated two wetlands into a 12D surface model based on conceptual urban design layouts. A piped stormwater network has been designed alongside the surface model. The modelling undertaken shows that stormwater can appropriately discharge to the two wetlands, and that the wetlands can be incorporated into a design surface for the proposed Pukekohekohe Gateway Precinct.

APPENDIX 1 – TP108 CATCHMENT CALCULATIONS

Pond Parameters - Pre Development WETLAND 1

Project P23-057 **By** SS **Date** 6/08/2024

Location PUKEKOHE PARK

1.1 Runnoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number [*CN*]*	Area (ha)	Product of CN x area
Group C	Crops, minimal vegetation	74	7.76	574.2
		Totals =	7.76	574.2

* from Appendix B - TP108

Pervious Areas:

$CN_{(pervious)} = \frac{\textit{pervious product}}{\textit{pervious area}} = \frac{574.2}{7.8} =$ **74.0**

$Ia_{(pervious)} =$ **5.00**

Impervious Areas:

$CN_{(impervious)} =$ **98.0**

$Ia_{(impervious)} =$ **0.00**

Overall:

$CN_{(average)} = \frac{\textit{total product}}{\textit{total area}} = \frac{574.2}{7.8} =$ **74.0**

$Ia_{(average)} = \frac{\textit{5 x pervious area}}{\textit{total area}} = \frac{38.80}{7.8} =$ **5.00**

1.3 Pre Development Volume

Rainfall Depth	P_{24} =	35.00	mm
Soil Storage	S =	89.24	mm
Runoff Depth	Q_{24} =	7.55	mm
Runoff Volume	V_{24} =	585.62	m³

Pond Parameters - Post Development WETLAND 1

Project P23-057 **By** SS **Date** 6/08/2024

Location PUKEKOHE PARK

Runnoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number [*CN*]*	Area (ha)	Product of CN x area
Group C	Urban lawns	74	3.92	290.4
Group C	Sealed roads, roofs	98	3.84	375.8
* from Appendix B - TP108		Totals =	7.76	666.2

Pervious Areas:

$CN_{(pervious)} = \frac{\textit{pervious product}}{\textit{pervious area}} = \frac{290.4}{3.92} = 74.0$

$Ia_{(pervious)} = 5.00$

Impervious Areas:

$CN_{(impervious)} = 98.0$

$Ia_{(impervious)} = 0.00$

Overall:

$CN_{(average)} = \frac{\textit{total product}}{\textit{total area}} = \frac{666.2}{7.8} = 85.9$

$Ia_{(average)} = \frac{\textit{5 x pervious area}}{\textit{total area}} = \frac{19.62}{7.8} = 2.53$

Water Quality Volume

		Pervious Component	Impervious Component
90th Percentile Rainfall [P_{24}]		25.0	
Component Area (ha)	[*A*]	3.92	3.84
Curve Number	[*CN*]	74.00	98.00
Initial Abstraction (mm)	[*Ia*]	5.00	0.00
Soil Storage (mm)	[*S* = *25.4(1000/CN - 10)*]	89.24	5.18
Runoff Depth (mm)	[$Q_{24} = (P_{24} - Ia)^2 / (P_{24} - Ia + S)$]	3.66	20.71
Runoff Volume (m³)	[$V_{24} = 1000\, Q_{24}\, A$]	143.68	794.10
Combined Runoff Volume (m³)		938	

938

SMAF Volume

		Pervious Component	Impervious Component
Rainfall Depth (mm)	[P_{24}]	35.0	
Component Area (ha)	[A]	3.92	3.84
Curve Number	[CN]	74.00	98.00
Initial Abstraction (mm)	[Ia]	5.00	0.00
Soil Storage (mm)	[$S = 25.4(1000/CN - 10)$]	89.24	5.18
Runoff Depth (mm)	[$Q_{24} = (P_{24} - Ia)^2 / (P_{24} - Ia + S)$]	7.55	30.49
Runoff Volume (m^3)	[$V_{24} = Q_{24}\ A$]	296.17	1169.10
Combined Runoff Volume (m^3)		1,465	

Pond Parameters - Pre Development WETLAND 2

Project P23-057 **By** SS **Date** 6/08/2024

Location PUKEKOHE PARK

1.1 Runnoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number [*CN*]*	Area (ha)	Product of CN x area
Group C	Crops, minimal vegetation	74	5.10	377.7
		Totals =	5.10	377.7

* from Appendix B - TP108

Pervious Areas:

$CN_{(pervious)} = \frac{\textit{pervious product}}{\textit{pervious area}} = \frac{377.7}{5.1} = 74.0$

$Ia_{(pervious)} = 5.00$

Impervious Areas:

$CN_{(impervious)} = 98.0$

$Ia_{(impervious)} = 0.00$

Overall:

$CN_{(average)} = \frac{\textit{total product}}{\textit{total area}} = \frac{377.7}{5.1} = 74.0$

$Ia_{(average)} = \frac{\textit{5 x pervious area}}{\textit{total area}} = \frac{25.52}{5.1} = 5.00$

1.3 Pre Development Volume

Rainfall Depth	P_{24} =	35.00	mm
Soil Storage	S =	89.24	mm
Runoff Depth	Q_{24} =	7.55	mm
Runoff Volume	V_{24} =	385.19	m³

WOODS EST.1970

Pond Parameters - Post Development WETLAND 2

Project P23-057 **By** SS **Date** 6/08/2024

Location PUKEKOHE PARK

2.1 Runnoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number [*CN*]*	Area (ha)	Product of CN x area
Group C	Urban lawns	74	2.58	190.8
Group C	Sealed roads, roofs	98	2.53	247.5
		Totals =	5.10	438.3

* from Appendix B - TP108

Pervious Areas:

$CN_{(pervious)} = \frac{\textit{pervious product}}{\textit{pervious area}} = \frac{190.8}{2.6} = 74.0$

$Ia_{(pervious)} = 5.00$

Impervious Areas:

$CN_{(impervious)} = 98.0$

$Ia_{(impervious)} = 0.00$

Overall:

$CN_{(average)} = \frac{\textit{total product}}{\textit{total area}} = \frac{438.3}{5.1} = 85.9$

$Ia_{(average)} = \frac{\textit{5 x pervious area}}{\textit{total area}} = \frac{12.89}{5.1} = 2.53$

2.3 Water Quality Volume

		Pervious Component	Impervious Component
90th Percentile Rainfall [P_{24}]		25.0	
Component Area (ha)	[*A*]	2.58	2.53
Curve Number	[*CN*]	74.00	98.00
Initial Abstraction (mm)	[*Ia*]	5.00	0.00
Soil Storage (mm)	[*S* = *25.4(1000/CN - 10)*]	89.24	5.18
Runoff Depth (mm)	[Q_{24} = $(P_{24} - Ia)^2 / (P_{24} - Ia + S)$]	3.66	20.71
Runoff Volume (m³)	[V_{24} = $1000\, Q_{24}\, A$]	94.39	522.94
Combined Runoff Volume (m³)		617	

617

2.4 Extended Detention Volume

		Pervious Component	Impervious Component
Rainfall Depth (mm)	[P_{24}]	35.0	
Component Area (ha)	[A]	2.58	2.53
Curve Number	[CN]	74.00	98.00
Initial Abstraction (mm)	[Ia]	5.00	0.00
Soil Storage (mm)	[$S = 25.4(1000/CN - 10)$]	89.24	5.18
Runoff Depth (mm)	[$Q_{24} = (P_{24} - Ia)^2 / (P_{24} - Ia + S)$]	7.55	30.49
Runoff Volume (m^3)	[$V_{24} = Q_{24} A$]	194.58	769.90
Combined Runoff Volume (m^3)		964	

APPENDIX 2 – WETLAND SIZING CALCULATIONS

PROJECT: PUKEKOHE PARK RACECOURSE
DATE: 13/08/2024
DESIGNED BY: SS
CHECKED BY: SG/TM

PUKEKOHE PARK WETLANDS - ALLOWS FOR HARDSTANDS AND ROADS

SCENARIO	IMP AREA (HA)	PER AREA (HA)	TOTAL AREA (ha)	IMP%	WQV VOLUME (m^3) (PWL)	Forebay (m^3)	FINAL WQV VOLUME (m^3) (PWL) - reduced by half and allows for 15% additional WQV volume	HYDROLOGY MITIGATION VOLUME - PRE DEVELOPMENT (m^3)	HYDROLOGY MITIGATION VOLUME - POST DEVELOPMENT (m^3)	HYDROLOGY MITIGATION VOLUME (DIFFERENCE FROM PRE DEVELOPMENT) - (m^3)	TOTAL VOLUME (m^3)	Assumed Depth for WQV (m)	GD01 minimum wetland surface area (PWL) (m^2)	GD01 minimum wetland surface area (PWL) with 25% contingency (m^2)
WETLAND 1	3.84	3.92	7.76	49%	937.78	140.67	609.55	585.62	1465.27	879.65	1489.20	0.50	1219.11	1523.89
WETLAND 2	2.53	2.58	5.10	49%	617.34	92.60	401.27	385.19	964.48	579.28	980.55	0.50	802.54	1003.18

NOTES:
1. Final WQV allows for 15% forebay volume and 50% reduction (to account for SMAF)
2. The minimum area has been calculated based on GD01 guidelines. Uses a PWL depth of 0.5m.
3. The final PWL area allows for 25% contigency to account for side batters and bathymetry to provide residence time

PROJECT: PUKEKOHE PARK RACECOURSE
DATE: 13/08/2024
DESIGNED BY: TM
CHECKED BY: SG

HIGH-LEVEL SMAF MITIGATION (ABOVE PWL) DESIGN

SCENARIO	Minimum Height Check For Mitigation (assumes vertical side batters) (m)	Radius of PWL Area (base of mitigation) Assuming Circular Wetland (m)	Design Height (m)	Side Batters 1 in ...	Radius of Top of SMAF Mitigation Assuming Circular Wetland (m)	Volume of Conical Frustum (m3)	**Check** Frustum > Required Mitigation?	Area of Top of SMAF Mitigation (m2)	Excess Volume (m3)	Radius with 3.5m maintenance track	Area with 3.5m maintenance track	Area with 25% contingency
WETLAND 1	0.58	22.0	0.60	3.00	23.8	991.1	OK	1783.2	111.4	27.3	2345.6	2932
WETLAND 2	0.58	17.9	0.60	3.00	19.7	664.6	OK	1215.5	85.3	23.2	1686.5	2108

NOTES:
1. The final area allows for 25% contigency to account for sediment drying area and non-conical shaped wetland

APPENDIX B

Pukekohe SW Model Review

Outlook

RE: ATR Pukekohekohe Flood Model & Clause 23 Responses

From Larry Shui <Larry.Shui@aucklandcouncil.govt.nz>
Date Mon 28/07/2025 2:46 PM
To Pranil Wadan <pranil.wadan@woods.co.nz>
Cc Jack Thompson <jack.thompson@aucklandcouncil.govt.nz>; Adam Sadgrove <adams@ellerslie.co.nz>; Cosette Pearson <cosettep@barker.co.nz>; Brian Flood <brian.flood@woods.co.nz>; Kasey Zhai <kaseyz@barker.co.nz>; Nick Roberts <NickR@barker.co.nz>; Ajay Desai <ajay.desai@woods.co.nz>

Hi Pranil,
I am now satisfied with amended model which addressed the issues raised earlier. I recommend that the model is now suitable for assessment the impact of proposed plan change.

Kind Regards
Larry

From: Pranil Wadan <pranil.wadan@woods.co.nz>
Sent: Monday, 21 July 2025 12:00 pm
To: Larry Shui <Larry.Shui@aucklandcouncil.govt.nz>
Cc: Jack Thompson <jack.thompson@aucklandcouncil.govt.nz>; Adam Sadgrove <adams@ellerslie.co.nz>; Cosette Pearson <cosettep@barker.co.nz>; Brian Flood <brian.flood@woods.co.nz>; Kasey Zhai <kaseyz@barker.co.nz>; Nick Roberts <NickR@barker.co.nz>; Ajay Desai <ajay.desai@woods.co.nz>
Subject: ATR Pukekohekohe Flood Model & Clause 23 Responses

Hi Larry,

Hope your well – I have attached our responses to the clause 23 requests that related to the flood modelling undertaken for the Pukekohekohe PPC.

We have also revised the models based on some of the comments – Link to this model is below – note that pleases allow an hour or so for all the models to upload

ATR Pukekohekohe Model

With regard to the clause 23 and model review there is a meeting scheduled next Tuesday 29th July from 2-3pm – would it be possible to have any feedback prior to that session, secondly given the nature of the clause 23 comments and your involvement to date it would be great to have you attend the meeting, if you can confirm your availability I can forward you on the invite.

Pranil Wadan
General Manager - Water Infrastructure and Planning
BE Civil, CPEng, IntPE(NZ), CMEngNZ
pranil.wadan@woods.co.nz
+64 21 385 328
woods.co.nz

Outlook

Review of ATR ICM model

From Larry Shui <larryshui@gmail.com>
Date Fri 4/10/2024 3:36 PM
To Ajay Desai <ajay.desai@woods.co.nz>; Cheryl Bai <cheryl.bai@aucklandcouncil.govt.nz>

Hi Ajay,
We have now completed my review of the latest ICM model delivered post addressing my initial review comments.

I consider that the model is fit for the purpose of assessing the impact of proposed development in the Pukekohe Race Track area on the immediate upstream and downstream area. The existing drainage network and stream channels are well represented in the Race Track area.

Given that there has been significant development involving modification to terrain and construction of new drainage system in the upper catchment area which have not been represented in this model, and the subcatchment boundaries and loading locations require further amendments, we don't recommend that this model should be used for assessment of flood risk in other parts of the Pukekohe South Catchment at this stage.

I have also identified the following two issues with the model which may be addressed when assessing the future development scenario:
The impervious and pervious portions of the subcatchment should be modelled as separate subcatchments with different Tc, this will enable modelling the hydrological impact of a more efficient post-development drainage system.
There are a few links in the model (Tabled below) with exceptionally high velocities which require checking and amendments if needed.

LinkID	US Velocity, m/s	US Head, m	DS Head, m	DS Velocity, m/s
1139172_1139173	-729.033	27154.58398	1939622.25	-6167.765
1145401_dummy_2	61.835	256.795	67.723	11.262
1181287	56.983	254.199	89.181	3.964
1144980	43.851	161.476	64.43	3.858
1145360	22.172	118.282	96.167	9.045
1143400	20.157	85.403	62.124	3.1
100040_Dummy	18.139	143.427	144.65	-18.454
1145401_dummy_1	15.702	73.827	60.881	3.38
100114_Dummy	14.215	108.378	103.225	-9.863
99932_Dummy	13.299	102.006	98.324	10.701
100069_Dummy	13.152	131.389	131.237	-13.123
100075_Dummy	-12.034	127.012	128.208	-12.822
100071_Dummy	11.945	127.922	127.937	-12.029
100193_Dummy	11.578	87.887	87.613	11.346

Kind Regards
Larry

Conversion and Update Report

ATR Pukekohe - Stormwater Model Conversion and Update Report

Auckland Thoroughbred Racing Incorporated (ATR)

Final For Issue

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1. Purpose and Activities

This report documents the process of converting the Pukekohe South stormwater catchment model provided by Healthy Waters (HW) from Mike DHI v2014, Service Pack 3, to InfoWorks ICM Version 2024.5. The model has also been updated with latest information including imperviousness, topography and infrastructure upgrades.

The converted model will be used to assess the existing flood risks associated with the proposed development of the Counties Racing Club located at 222-250 Manukau Road, Pukekohe, which Auckland Thoroughbred Racing Incorporated (ATR) are proposing to redevelop with medium density residential housing.

Following the model update and conversion exercise, the updated model has been used to understand flood risk within the ATR site and wider catchment and develop and test flood mitigation options which optimise the site layout without increasing flood risks to upstream and downstream catchments. The stormwater model runs for the identified options and the results from the model runs are discussed in the sections below.

2. Background Information

The Pukekohe stormwater catchment extent is show in Figure *1* and covers approximately 2,756 hectares. The western end the Pukekohe township includes the areas zoned as industrial, commercial and existing residential under the Auckland Unitary Plan Operative in Part (AUP), while the centre and eastern side of the catchment are largely rural and located within the Waikato district.

ATR need to understand the flood risk to the site under current and future situations. The ATR site is located in the western portion of the Pukekohe South catchment, as indicated in Figure 1 below.

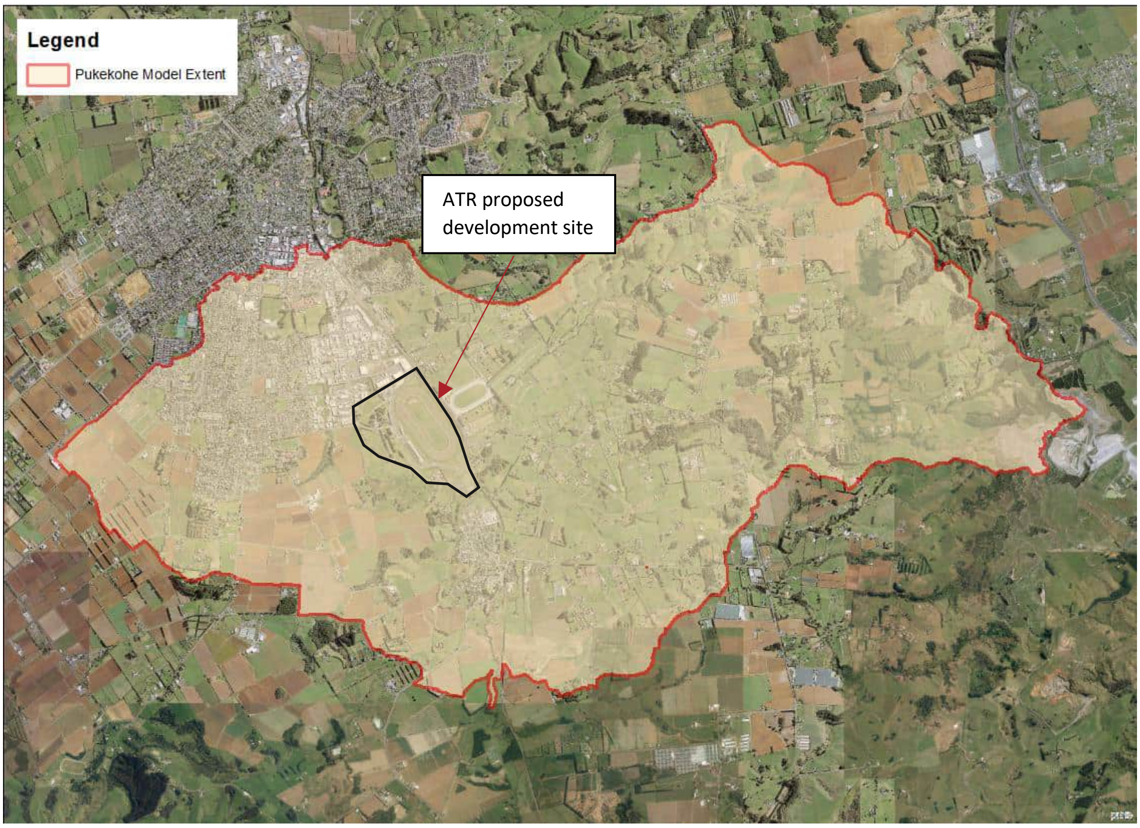


Figure 1 Pukekohe SW catchment boundary used for modelling.

The Pukekohe South stormwater catchment model was provided by HW. This model was developed using the Mike DHI suite (v2014, Service Pack 3). Mike Urban has been used to represent the piped stormwater network, MIKE 21 to represent topography (Flexible mesh) and the MIKE 11 to represent rivers and open channels. This model was developed in accordance with Auckland Council (AC) Stormwater Flood Modelling Specifications (SFMS, November 2011) by Tonkin & Taylor Ltd. The DHI model is limited in its ability to be used for the design of options and has a large computational time, therefore converting the model to the latest InfoWorks ICM will allow the model to be better utilised to assess flood risk and any associated flood mitigation options.

3. Model review and limitations

The DHI model provided by HW has been reviewed to cover the following elements - manholes, conduits, weirs, orifices, 2D boundary, 2D flexible mesh zones, culverts, inlets and outlets, walls, roughness zones, storage areas, subcatchments and q/h tables. Key limitations of the existing DHI model as detailed in the Pukekohe South FHM Model Build and System Performance report (Tokin & Taylor, July 2020) are noted below:

- The ponds, culverts and bridges are based on catchment understanding following survey carried out by Opus between August 2015 and March 2016. Due to the rate of development in the catchment modifications to the ponds, culverts and bridges since this time may not be represented in the model.
- No blockage has been assumed in manholes, pipes, culverts and catchpits in the stormwater system.
- No sedimentation has been allowed for in the pipes i.e., it is assumed that all pipes can perform at full capacity.
- No topographical changes, natural or otherwise have been allowed for in the modelling, including but not exclusive to geomorphological changes, volcanic activity and landslides.
- The potential for change in asset condition over time is not represented.
- Screens, orifice plates, control gates, valves, backflow preventers, choke points and other such obstructions and hydraulic controls are not modelled unless this data has been provided.
- The bathymetry for modelling was developed using ground contours which were derived from LiDAR 2013 survey data. In urban areas the LiDAR is stated to have a vertical accuracy +/- 0.2 m @ 95% confidence, and a horizontal accuracy of +/- 0.6 m @ 95% confidence.
- Inlets did not include Q-H relationships, this was agreed with the model reviewer and catchment planner (refer to model review document in Appendix J).
- No account has been taken of the execution of any operations and maintenance works that may affect system performance (i.e., regular pipe cleaning may indicate a serious deficiency in the network affecting hydraulic conditions).
- The asset data that was not captured or verified in the field as part of this project is assumed to be correct.

4. Model conversion – Mike by DHI to InfoWorks ICM

The process of converting the Pukekohe South model from Mike by DHI to InfoWorks ICM Version 2024.5 is summarised in the sections below.

4.1 Stormwater network

Table *1* summarises the model network information extracted from the DHI Mike Urban model received and imported into InfoWorks ICM:

Table 1 Network model parameters

Asset	Attribute	Comments
Manholes	Invert level	Reviewed against GIS information and updated as required.
	Ground elevation	Reviewed against LiDAR 2016 data and updated as required.
Conduits	Diameter	Reviewed against GIS information and updated as required.
	US invert level	
	DS invert Level	

	Pipes Roughness	Pipe roughness adopted from DHI model with Manning's value of 0.012 and 0.013
Catchments	Total area	Hydrological parameters reviewed and updated based on latest GIS information, including Curve Numbers based on soil types and existing and future imperviousness assumptions.

The process of converting the received Mike Urban network elements model to the InfoWorks ICM model is detailed below.

- Import manholes and pipes spatial information along with attributes listed in Table *1*
- Import subcatchments boundaries along with attributes listed in Table *1*
- Review network connectivity. Where the previous model has weirs or orifice representations, they were reviewed, and some cases replaced with one 1D/2D ICM alternative e.g., ICM bridges. Also, storage areas were added at river confluences in this model.
- Review node storage areas and chamber floor levels.
- Review long sections and pipes with negative gradients.
- Review pipe losses and roughness values assigned.
- Add Q/H relationships for structures.
- Link the stormwater network with the 2D flexible mesh using Gully, 2D and Connect 2D nodes type, and converting outlets to 2D outfalls.

4.2 Boundary conditions

4.2.1 Downstream water level

The downstream water level boundary in the received MIKE 11 model was set to RL 42.9 m. This water level boundary has been retained in the converted ICM model.

4.2.2 Rainfall

The model received included 24-hour rainfall depths for the 2, 10-, 20-, 50- and 100-year Average Recurrence Interval (ARI) design storms from the Auckland Council TP108[1] design rainfall isohyets graphs. The model had assigned rainfall zones based on the TP108 contours for the 2, 5, 10-, 20-, 50- and 100-year ARIs. Those zones were translated into ICM within the subcatchments rainfall profile. For example, for the 100 ARI six (6) rainfall contours were distributed as shown in Figure 2.

[1] Guidelines for stormwater runoff modelling in the Auckland Region TP108. Auckland Regional Council, April 1999

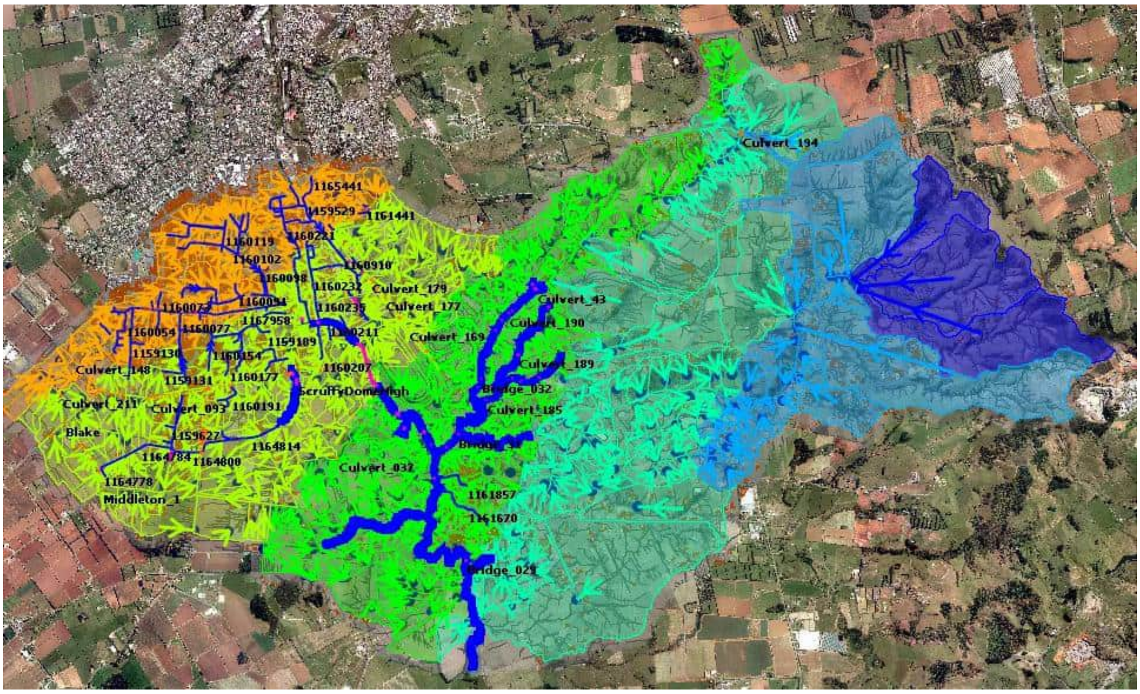


Figure 2: 100 ARI CC, 6 rainfalls TP108 depths (180, 190, 200, 210, 220 and 230mm) for the Pukekohe Catchments

The rainfall in the DHI model received are shown in Table 2. The rainfall included in the model includes a percentage increase in the 24-hour depth due to Climate Change (2.1-degree temperature increase). These percentage increases due to Climate Change (CC) align with the values provided in Table 1 of the Stormwater Code of Practice[2], and therefore have been retained in the InfoWorks ICM model. The 24-hour rainfall depth including percentage increase due to CC associated with a 3.8-degree temperature increase has also been added to the InfoWorks ICM model. These updated 24-hour rainfall depths are included in Table 2.

Table 2: 24-hour rainfall depths

Average Recurrence Interval (ARI)	24-hour rainfall depth (mm)	% increase due to Climate Change 2.1 degrees	24-hour rainfall depth with Climate Change (mm) 2.1 degrees	% increase due to Climate Change 3.8 degrees	24-hour rainfall depth with Climate Change (mm) 3.8 degrees
2 year	70	9.0%	76	27.4%	89
5 year	100, 110, 120	11.3%	111, 122, 133	29.6%	130, 143, 156
10 year	120, 140, 140,	13.2%	136, 147, 158	30.8%	157, 170, 183
20 year	130, 140, 150, 160, 170,	15.1%	149, 161, 172, 184, 195	31.2%	171, 184, 197, 210, 223
50 year	160, 170, 180, 190, 200	16.8%	186, 198, 210, 221, 233	32.7%	211, 225, 238, 251, 264
100 year	180, 190, 200, 210, 220, 230,	16.8%	210, 221, 233, 245, 256, 268	32.7%	239, 253, 266, 279, 292, 304

4.3 Model topography

The 2D Zone was modelled using LiDAR 2016 with 'Normal Condition' boundary type. Vertical Accuracy Specification is +/- 0.2m (95%), Horizontal Accuracy Specification is +/- 0.6m (95%), and Vertical datum is AUK1946.

[2] The Auckland Code of Practice for Land Development and Subdivision Version 3.0, Chapter 4, Stormwater. Auckland Council, January 2022

All manholes were coupled to 2D, and cover types were assigned a "2D Gully" for modelled manholes and "Outfall 2D" for modelled outlets, ensuring that any overland flows are represented in the two-dimensional domain.

Dummy manholes were assigned a "sealed" cover type ensuring no artificial flows are generated.

The mesh was generated using the Terrain Sensitive meshing option, with resolution set to a maximum of $4m^2$ which is considered suitable to represent flow paths and floodplains.

Mesh zones with a minimum mesh size of $5m^2$ were applied to retain uniformity in invert/ground levels between the outfall and 2D mesh elements.

4.4 Hydrology

The DHI model received has 1384 subcatchments delineated based on 2013 LiDAR ranging in size between 0.20 to 138.56 ha. The pervious and impervious subcatchments were represented separately, i.e., 692 pervious subcatchment and 692 impervious subcatchments. The subcatchment total area and delineation has been retained in the converted ICM model, along with the subcatchment connectivity and loading.

The DHI model received followed the soil conservation services (SCS) method to convert rainfall into runoff and this method has been retained in the converted InfoWorks ICM model.

The following hydrological parameters have been reviewed and updated in the converted ICM model:

- Time of concentration (ToC)
- Initial abstraction
- Curve number (CN)
- Land use and impervious assumptions

Refer to section 5.5 for more information on updates to model hydrology.

The subcatchments and loading in the converted InfoWorks ICM model are shown in Figure 3.

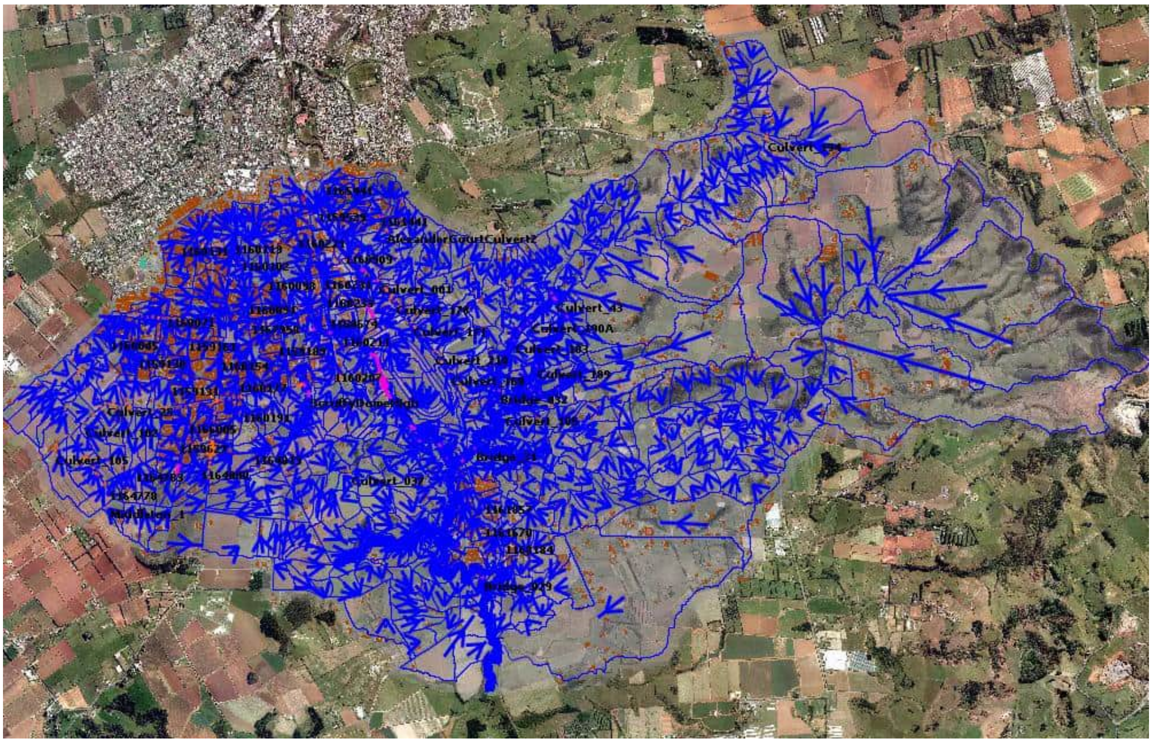


Figure 3: Pukekohe converted to InfoWorks ICM

5. Model Updates

5.1 Topography updates

The topography in InfoWorks ICM model was updated using LiDAR 2016 DEM data with a resolution of 1m. Minor adjustments were undertaken to represent inlet and outlet levels in the topography.

2D Roughness zones were updated as per existing land uses. Building footprints were assigned a Manning's n of 0.5 with impervious surfaces (roads/paved areas) assigned a Manning's roughness value of 0.02 around the catchment. Some upstream streams/major overland flow paths represented in the model received as MIKE 11 river reaches have been represented in InfoWorks ICM as 2D only, as there were multiple utilities alongside and assigned a Manning's roughness value of 0.1. Refer section 5.3 for more information.

5.2 2D source points

The converted InfoWorks ICM model has not retained the original location of the Mike Urban source points. The source points in the Mike Urban model received were imported into InfoWorks ICM and cross checked using the overland flow paths (OLFP) developed using the 2016 LiDAR. Where required, the source points were moved to ensure they are intercepting the OLFPs. This representation is shown in Figure 4.

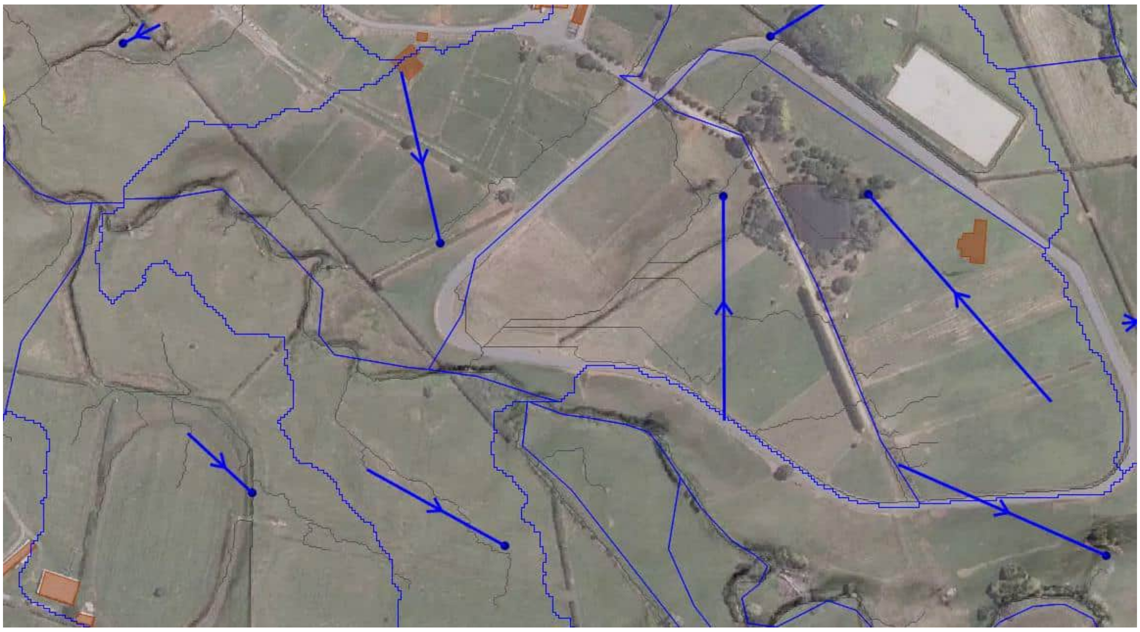


Figure 4: Converted 2D point source ICM v2023.2

5.3 MIKE 11 Rivers to ICM River Reach conversion

River Reaches have been generated for use in the converted InfoWorks ICM model using a combination of survey and LiDAR interpolated cross sections. A cross-section survey of the watercourses and associated structures was undertaken in 2015 and 2016 by Opus and included in the model received, and all surveyed cross sections have been included in the converted model. Some open channels previously represented in MIKE 11 were not converted to 1D river reaches in ICM and instead were modelled as 2D with terrain-sensitive mesh. The 1D river reaches have been connected to the 2D model through lateral and inlet banks and the reaches which have been converted to 2D are shown in the Figure 5.

Manning's n 0.04 was used for the ICM 1D river reaches. The previous MIKE 11 model had an average Manning's n applied of 0.04.

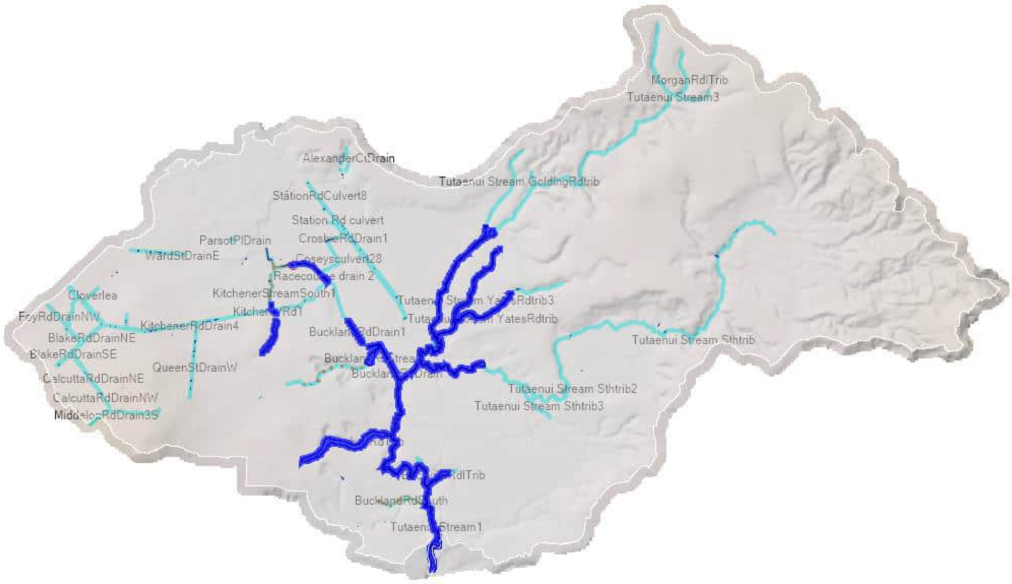


Figure 5: River and open channels modelled as ICM river reach (Dark Blue), and rest modelled directly in the 2D with terrain-sensitive meshing.

5.4 Culvert modelling

Two types of culvert representation have been used in the converted InfoWorks ICM model:

- Conduit type (Culverts) for large culverts within the 1D river reaches. These culverts have been assigned entry and exit losses as US Federal Highway Administration (FHWA). The representation of culverts as a conduit type is available from ICM version 2024.5. An example of this type of culvert representation is shown in Figure 6.

Figure 6: Conduits Type culvert only ICM 2023.2 (Pink colour)

- Conduit type (Culverts) was also used for the small culverts located within small streams and open channels in the 2D extent. An example of this type of culvert representation is shown in shown in Figure 7.

Figure 7: Conduits Type (Conduits (2D)) for small culverts only ICM 2023.2 (Orange colour)

5.5 Hydrology updates

Updates to the hydrological parameters in the InfoWorks ICM model are summarised in Table 3.

Table 3: Updated hydrological parameters

Parameter	Pukekohe South model received (Mike DHI v2014, Service Pack 3)	Pukekohe South converted model (InfoWorks ICM Version 2023)
Subcatchments	1384 subcatchments total. The pervious and impervious subcatchments were represented separately, i.e., 692 pervious subcatchment and 692 impervious subcatchments.	692 subcatchments total. Subcatchments made up of pervious and impervious components.
Time of Concentration	Subcatchment ToC ranges from 6.67 to 36.87 mins.	No changes.
Initial abstraction	Pervious areas Ia= 5mm Impervious areas Ia = 0	No changes.
Curve Number	CN for pervious areas range from 31.95 to 88. CN of 98 applied for impervious areas.	CN for pervious area updated based on soil type – CN of 74 and 61 applied as Runoff Area 2 and Runoff Area 3 in ICM respectively. CN of 98 retained for impervious areas (applied as Runoff Area 1 in ICM model).
Land use	Impervious percentage assumptions for MPD scenarios based on land use provided in the Proposed Auckland Unitary Plan March 2013.	ED scenario: Updated based on latest impervious areas. MPD scenarios: Land use updated based on AUP.

The DHI model received has 1384 subcatchments delineated based on 2013 LiDAR ranging in size between 0.20 to 138.56 ha. The pervious and impervious subcatchments were represented separately, i.e., 692 pervious subcatchment and 692 impervious subcatchments. This has been updated in the ICM model so that the impervious and pervious components are included within a single subcatchments, reducing the total number of subcatchments to 692.

The subcatchment impervious percentages for the maximum probable development (MPD) scenario have been updated based on Land Use as represented in the AUP using the assumed impervious coverage percentages shown in Table 4.

Table 4: AUP Imperviousness

AUP Zoning	Assumed MPD % impervious coverage
Business - Mixed Use Zone	80
Business - Light Industry Zone	90
Business - Neighbourhood Centre	100
Business - Town Centre Zone	100
Coastal - Coastal Transition Zone	10
Coastal - General Coastal Marine Zone	100
Open Space - Community Zone	70
Open Space - Informal Recreation Zone	10
Open Space - Sport and Active Recreation Zone	40
Residential - Mixed Housing Suburban Zone	60
Residential - Mixed Housing Urban Zone	60
Residential - Single House Zone	60
Residential - Terrace Housing and Apartment Building Zone	70
Road	90
Special Purpose - School Zone	70
Strategic Transport Corridor Zone	100
Water	100

6. Model checks

6.1 TP108 flow comparison

The model generated flows have been compared with flows calculated using TP108 guidelines for calculating stormwater runoff for four (4) of the modelled subcatchments. The results are shown in Table 5 below and show a good comparison between the modelled and calculated flows.

Table 5: Comparison of ICM modelled flows with TP108 calculated flows

Subcatchment	Parameters			Rainfall	ICM		TP108		Difference %	
	AREA ha	Imp %	Length (m)	Intensity (mm)	Peak Flow (m3/s)	Volume (m3)	Peak Flow m3/s	Volume (m3)	Peak Flow m3/s	Volume (m3)
PUKE_S_370	2.108	87.8	266	221	0.57	4298.0	0.68	4313.7	16%	0%
PUKE_S_415	4.282	61.8	116.7	221	1.38	8209.0	1.43	8214.4	4%	0%
PUKE_S_440	2.418	62.7	87.7	221	0.83	4652.0	0.82	4652.3	-2%	0%
PUKE_S_467	3.024	63.1	259	210	0.77	5470.0	0.87	5504.3	12%	-1%

6.2 Comparison to previous flood extents

The converted model has been run for the 100-year MPD scenario with CC (2.1 degrees), and the resulting flood extent compared with the flood extent from the DHI model received. The results are shown in the Figures below. Overall, there is very good correlation between the DHI and ICM flood extents, with the most significant difference being in the vicinity of the ATR site (refer Area 2 shown in Figure 7). In this area the InfoWorks ICM results show a slightly larger flood extent extending to the racecourse itself, as well as some differences in flood extent in the commercial area to the north of the racecourse. This is a factor of the differences between the 2013 and 2016 LiDAR and the more detailed meshing used in the InfoWorks ICM model.

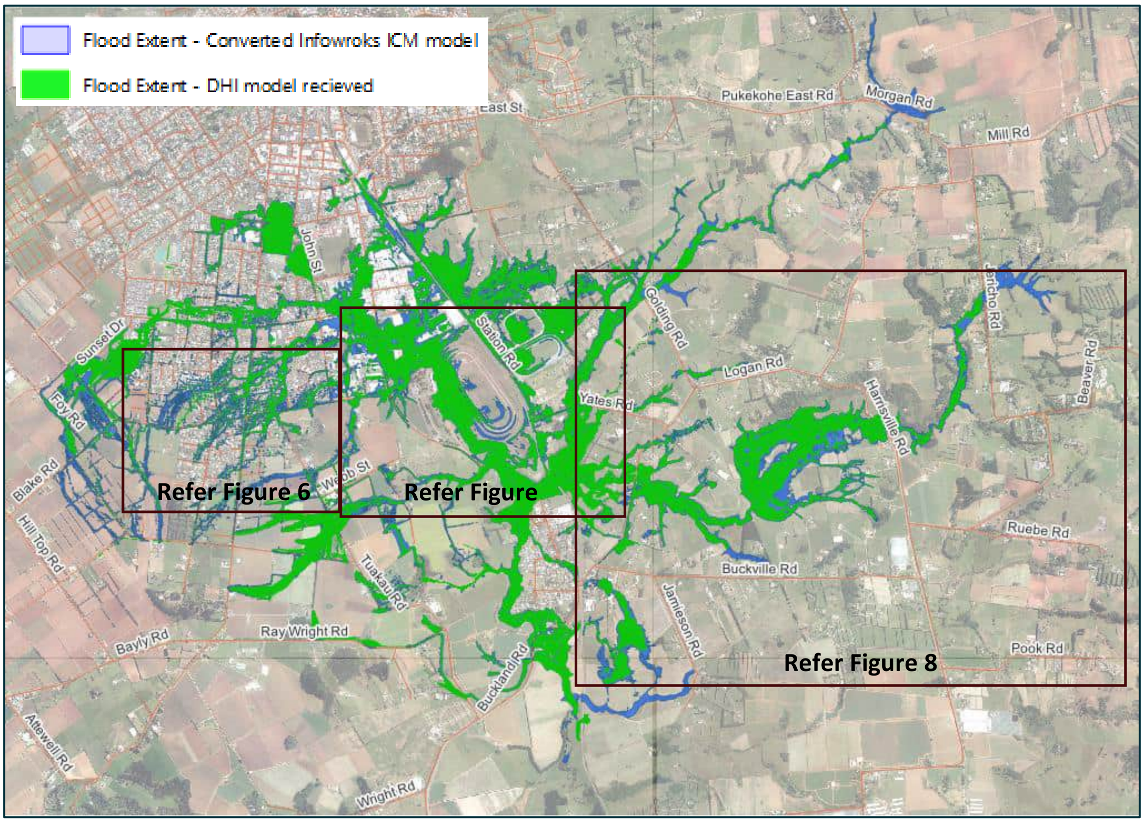


Figure 5: Comparison of flood extent for 100yr ARI MPD+CC scenario, DHI model and InfoWorks ICM model

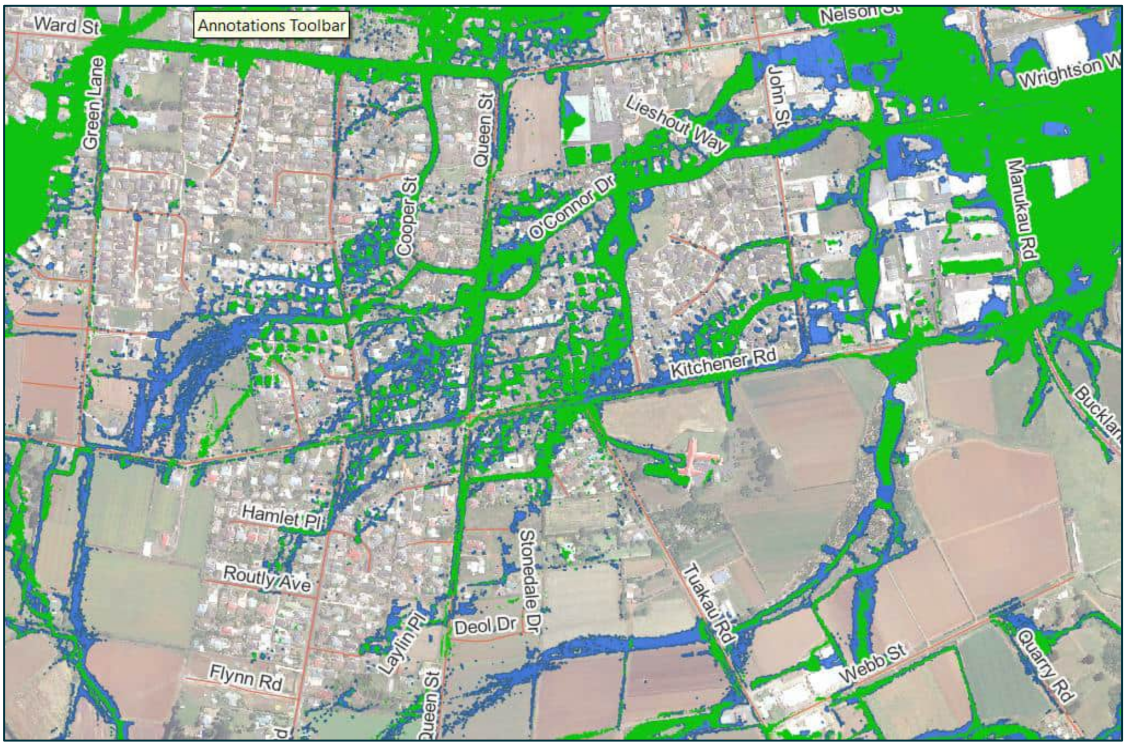


Figure 6: Results comparison Area 1, residential area west of ATR site

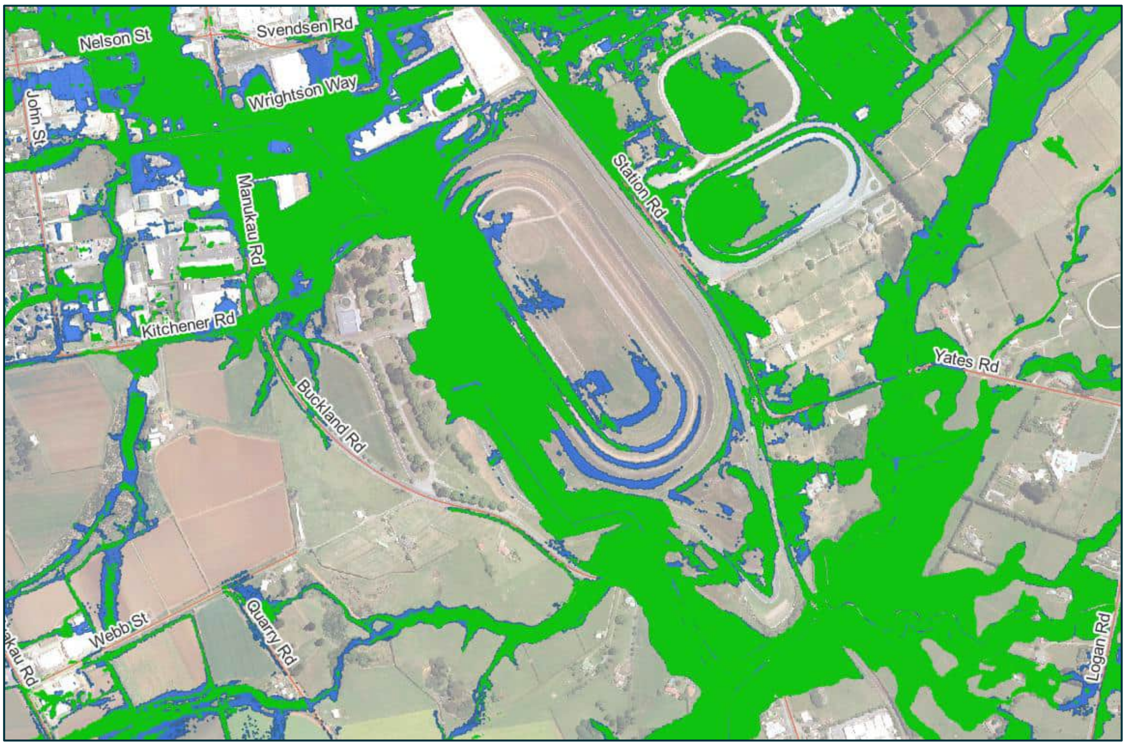


Figure 7: Results comparison Area 2, ATR site

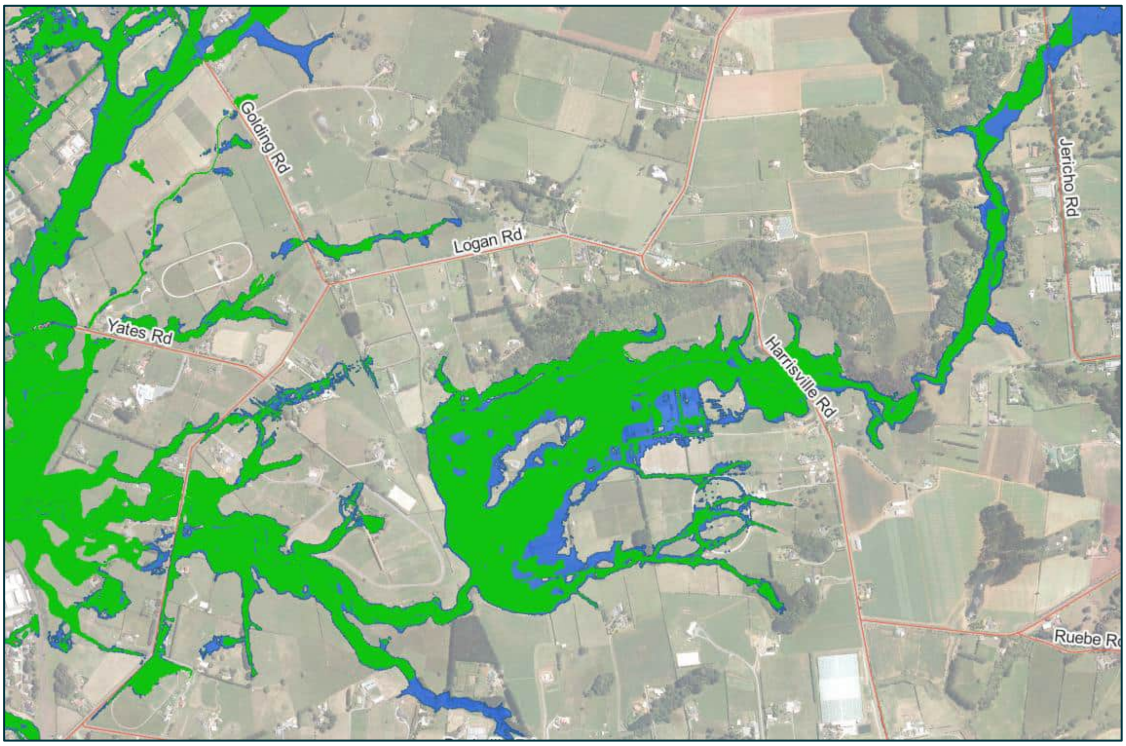


Figure 8: Results comparison Area 3, rural area east of ATR site

6.3 Afflux comparison

The flood depths for the DHI and InfoWorks ICM model for the 100yr ARI MPD (CC) scenario have been compared, together with the peak flows and total runoff volume for the two models. The two models have reported similar peak flow, and total volume, as summarised in Table 6 below.

Table 6: Comparison of peak flows and runoff volume for the 100yr MPD (CC) scenario

Model	Peak flow (m^3/s)	Cumulative Volume between 12:00 am and 5:20pm (m^3)
DHI model received	157	2,904,740
Converted InfoWorks ICM model	157	2,898,457
Difference	0%	0%

For the majority of the catchment, the afflux results show no significant difference in peak depths, however there are some differences between the two model results observed in the vicinity of the racecourse, where the ICM modelled depths south of the racecourse are noticeably lower than the DHI results, and to the north modelled depths are higher. Investigation into the model results revealed a significant instability in the Mike 11 model which is triggering this observed difference in the maximum depths, despite both models having similar peak flow and volume. The area affected by this instability is shown in the blue polygon in Figure 9 below.

The observed difference in maximum depths for the area to the west of the racecourse can be attributed to the model update process including:

- Updated terrain and meshing based on 2016 LiDAR (higher definition in the InfoWorks ICM model).
- Hydrology updates (refer section 5.5 for more information) and updated 2D roughness.
- Updates to the ICM 1D river reaches to include bridge survey data.

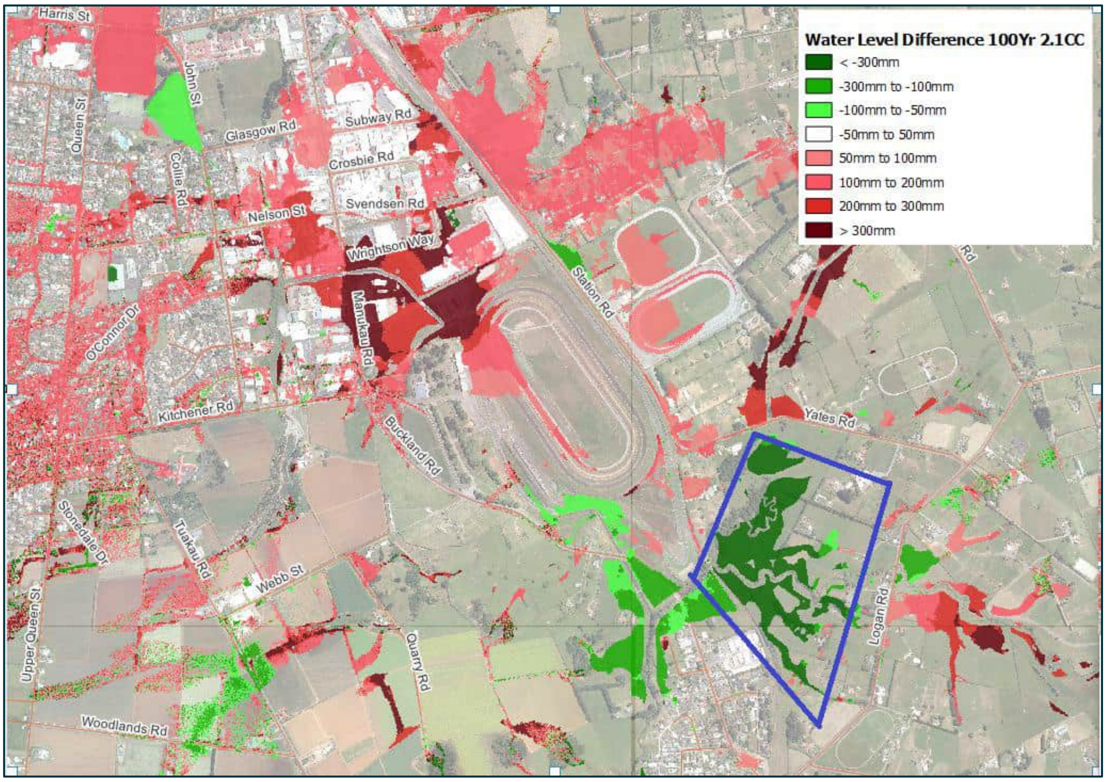


Figure 9: Water level comparison for 100yr ARI MPD+CC scenario, DHI model received and InfoWorks ICM model

7. Flood mitigation options

The updated model, the model has been run for the 100-year ARI MPD event (3.8° CC) to understand flood risk within the ATR site. The model results indicate that the site is widely impacted by flood depths up to 0.7-1.0m deep, with peak depths exceeding 2m for some portions of the site.

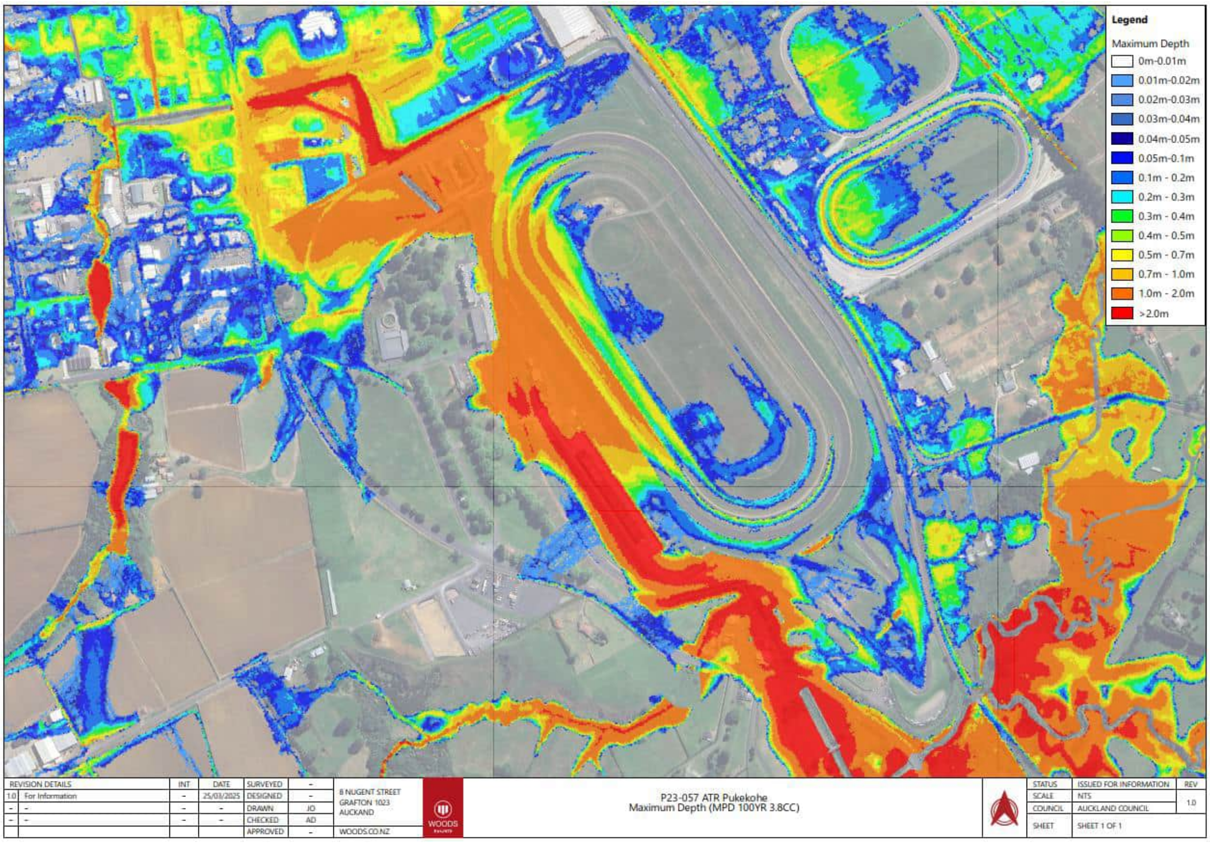


Figure 10: 100-year MPD (3.8 ° CC) flood depths within the development site

A number of flood mitigation options for the development site have been investigated and modelled. The exploration of flood mitigation options involved making incremental modifications to the existing ground levels, exploring different stormwater channel geometry, alignments, and depths in order to achieve a greater developable area and result in no increased flooding on the upstream and downstream catchments. In the development of the options and assessment of the model results SMAF 1 (Stormwater Management Areas Flow 1) control has been considered as this is likely be applied to proposed new Superlot areas. Options explored the most optimal locations for the stormwater mitigation devices required for the proposed superlots.

Five (5) option scenarios have been modelled. The results of these mode runs are summarised in Table 7 below and concept schematics are included in Appendix B.

Table 7: Options to mitigate the new development flood impact for the 100yr ARI MPD (CC 3.8°) scenario.

Option	Modifications	Results	Outcomes
1	• Raise PC30 ground level 500mm above existing floodplain. • Assumes a stables extent and raise ground level 500mm above existing floodplain.	• Flood depth increased 100-200mm in the surrounding industrial areas north of the site. • Flood depths south of the site increase 50-100mm	• Built up areas are restricting existing OLFP from entering the site – resulting in increase in flooding downstream. • Hydrology of existing open channel needs to be improved to allow more water to flow through the site.

Option	Modifications	Results	Outcomes
			• Storage areas need to be created to offset raised ground levels in the floodplain areas.
2	• Reduce the built-up extent within PC30 to allow better overland flow path passage. • Extend the stables extent to test impact. • Realigned the existing open channels near the pit garages to improve hydrology. • Kept existing channels as potential storage/stormwater treatment areas.	• Improvement in flood impact on upstream as shown by smaller extents of flood depth increase compared to Run 1. • Flood depth increase 50-100mm in the surrounding industrial areas north of the site.	• Increase conveyance downstream may help divert and push water through the site. • Removing raised ground areas in the PC30 areas will increase flood storage and allow for better flow conveyance. • Widening up the channel will create more storage and flow conveyance. • Keep the existing float road level as a control for the inflow into the site.
3	• Create storage in PC30 Area. • Remove elevated ground in PC30 Area surround existing building along Manukau Road. • Extended stables area to maximum buildable area • Elevate areas in prime buildable areas above the flood plain level of approx. RL54.4 • Create a stormwater mitigation ponding area. • Create a shallow overland flow path areas alongside the existing channel to direct flow and increase flow conveyance downstream	• Improvement from flood impact on upstream as shown by smaller extents of flood depth increase compared to Run 2 results. • Flood depth increase limited to 50mm-100mm. • Little to no flood depth increase in the downstream catchment. • The shallow swale helped with the flood levels along the racecourse but not for the upstream catchment.	• The location and the setback of PC30 raised area and stables area is the main control for the flooding impact on the upstream catchment. • Raising the ground level near the grandstand area does not critically raise the flood levels within the site.
4	• Shift PC30 raised platform areas closer to the Buckland Road frontage. • Extend the stables areas to maximise stables extent. • Cut down the float road where is it raised for better hydraulic conveyance. • Realign the stormwater open channel as long to the wastewater infrastructure as possible and widen the channel. • Backfill existing channel and raise above flood plain to generate more developable area.	• Increase in flood impact extent compared to Run 3 results due to shifting PC30 raised platform closer to Bucklands Road frontage. • Flood depth increase limited to 50mm-100mm. • Little to no flood depth increase in the downstream catchment. • Backfilling the existing channel and building up the areas has little to no impact on the flood level around the racetracks.	• Shifting the PC30 raised platform increased the flood depth across a wider upstream catchment area. • Require better conveyance of flow from nearby catchment around PC30 raised platform area. • Increased conveyance can be achieved through having a greater set back to the float road or building a large stormwater channel in front of PC30 platform to divert the flow.
5	• Shift PC30 building platform south to provide an approx. 50m set back from the northern boundary. • Reduce the stables area extents to not constrict flows from the existing stormwater inlet discharging water from the KiwiRail corridor.	• Improvement from flood impact on upstream as shown by smaller extents of flood depth increase compared to Run 4 results and similar to Run 2 results.	• PC30 raised platform areas need to be refined and investigated at further stages. • Increase in flow width at the float road will help to reduce the flood impacts to the upstream catchments.

8. Limitations

The following key limitations in relation to the Pukekohe South catchment model are noted below:

- This model has been prepared to provide guidance on flood levels and depths within the modelled catchment area for the modelled scenario. The modelling process relies on a range of assumptions and simplifications and may be subject to errors and inaccuracies. The compounding effects of the uncertainties in the TP108 rainfall model (ARC, 1999), the uncertainties in the LiDAR data and the uncertainties in hydraulic parameters such as roughness could result in the water level varying from the mapped levels.

- The LiDAR data has an absolute vertical accuracy of +/- 0.10m. Deviations in vertical accuracy can occur in areas of dense vegetation. Below water ground levels are not reliably represented in the LiDAR data.
- No additional survey was carried out as a part of this model conversion and update exercise.
- There is no measured flow data in the catchment; therefore, it was only possible to check the model against measured peak water levels, anecdotal evidence and previous modelling.
- Due to the rate of development in the catchment, recently installed stormwater infrastructure, and modifications to the ponds, culverts and bridges may not be captured in latest Council GIS data or available survey, and therefore may not be represented in the model.
- Some SW reticulation =>300 mm was found to be excluded from the model when it is compared with the Auckland Council Geomaps information. These assets have not been included in the InfoWorks ICM model.

9. Recommendations and Next Steps

- The converted InfoWorks ICM model should be validated against the latest January 27, 2023, rainfall event to gain confidence in the model results.
- Following model validation, the ICM model can be used to develop flood plains and understand the flood risk within the proposed ATR development site. Once the flood risk within the site is understood, the model can then be used as a tool to undertake flood effects assessment for flood mitigation and reduction options.

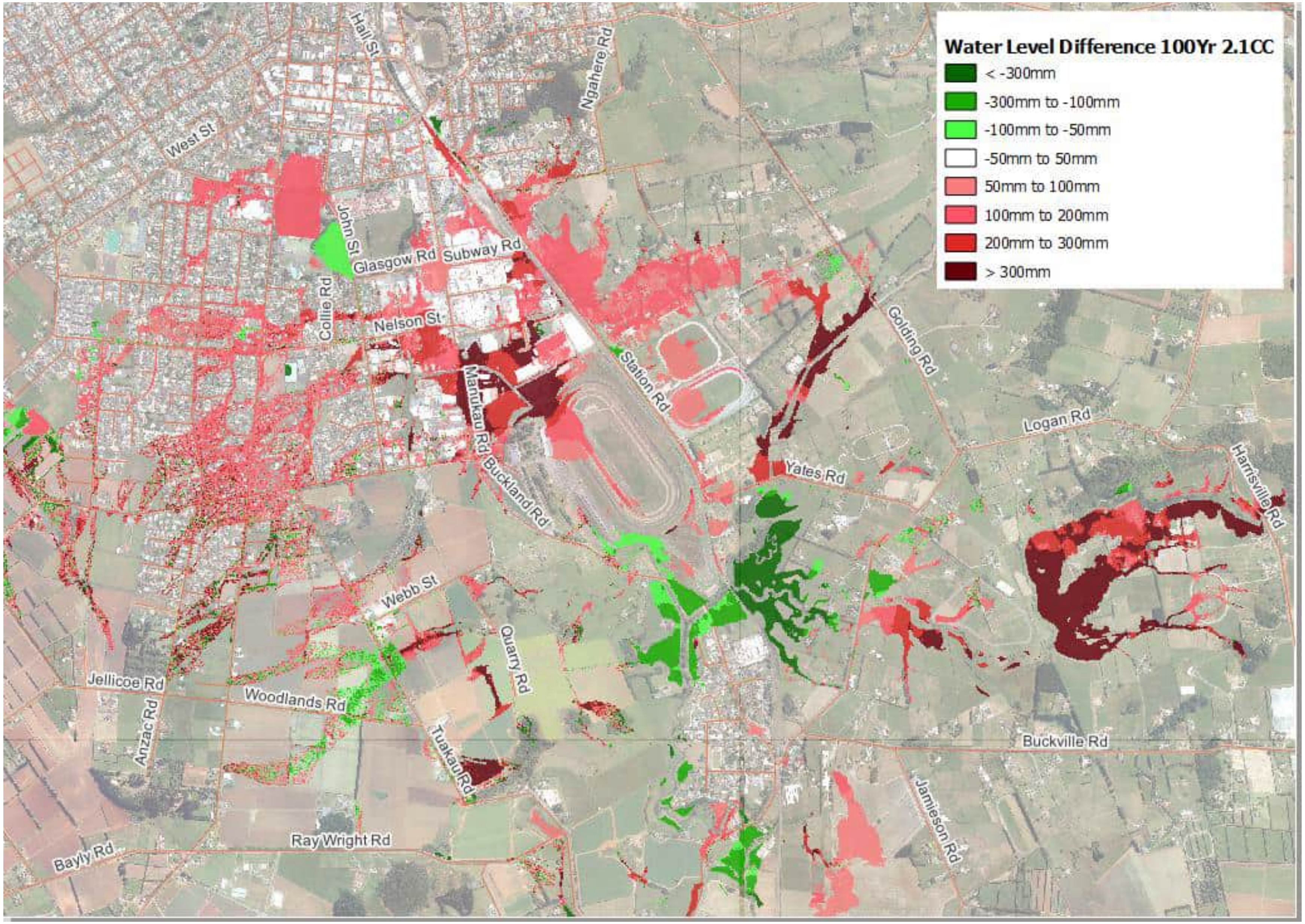
APPENDIX A: Model Update Summary

<table>
<tr><th>Item</th><th>Pukekohe South mode received (Mike DHI v2014, Service Pack 3)</th><th>Pukekohe South converted model (InfoWorks ICM Version 2024.5)</th></tr>
<tr><td colspan="3">Hydrology Updates</td></tr>
<tr><td>Subcatchments</td><td>• Total number subcatchments: 1384.
• Pervious and impervious subcatchments are represented separately, i.e., 692 pervious subcatchment and 692 impervious subcatchments.</td><td>• ICM has 692 Subcatchments with 3 land uses. 1 Impervious and 2 Pervious CN 61 and CN74</td></tr>
<tr><td>Impervious</td><td>• MPD scenario: Impervious percentage assumptions based on land use provided in the Proposed Auckland Unitary Plan March 2013.</td><td>• MPD scenarios: Land use updated based on Auckland Unitary Plan operative in part. Impervious percentage updated based on values presented in Table 2 of this report.</td></tr>
<tr><td>Curve numbers</td><td>• CN for pervious areas range from 31.95 to 88.
• CN of 98 applied for impervious areas</td><td>• CN recalculated based on soil type – CN of 74, 61 and 39 applied as Runoff Area 2, Runoff Area 3 and Runoff Area 4 in ICM respectively.
• CN of 98 retained for impervious areas (applied as Runoff Area 1 in ICM model)</td></tr>
<tr><td>Initial abstraction</td><td>• Pervious areas Ia= 5mm
• Impervious areas Ia = 0</td><td>• No changes</td></tr>
<tr><td>Time of Concentration</td><td>• Subcatchment ToC ranges from 6.67 to 36.87mins</td><td>• No changes, original ToC have been retained in the ICM model</td></tr>
<tr><td colspan="3">Topography</td></tr>
<tr><td>Terrain model</td><td>• The terrain model was developed from 2013 LiDAR.</td><td>• Terrain model updated with the LiDAR 2016.
• Mesh triangles generated using Terrain Sensitive meshing with a maximum size of 6m^2.
• Mesh zones with a minimum areas of 5m2 were applied to retain uniformity in invert/ground levels between the outfall and 2D mesh elements.</td></tr>
<tr><td>Roughness zones</td><td><table>
<tr><th>Land use</th><th>Manning's n used</th></tr>
<tr><td>Building footprints</td><td>0.200</td></tr>
<tr><td>Road</td><td>0.020</td></tr>
<tr><td>Orchard, vineyard, or other crop</td><td>0.167</td></tr>
<tr><td>Forest</td><td>0.150</td></tr>
<tr><td>Surface mine or dump</td><td>0.125</td></tr>
<tr><td>Short rotation cropland</td><td>0.035</td></tr>
<tr><td>Rest of catchment</td><td>0.030</td></tr>
</table></td><td>• 0.02, 0.5, and 0.1 Manning's n applied to Impervious surfaces, building footprints, and remaining parcel / pervious areas respectively
• Manning's n from the original DHI model was used for the ICM</td></tr>
<tr><td colspan="3">Stormwater Network</td></tr>
<tr><td>Pipes and links</td><td>• The model has 476 pipes (Mike Urban), 168 culverts (Mike11), 1 bridge (Mike11) and 124 open channels (Mike11)
• Manning's n of 0.013 used for all pipes.</td><td>• Pipes asset data as original Mike Flood model based on Council GIS.
• The final model has 470 pipes, 456 Manholes, 165Culverts and 5 Bridges.
• Manning's n of 0.012 and 0.013 used for conduits
• Culverts represented as either Conduit type (Culverts).</td></tr>
<tr><td>Nodes</td><td>• The Mike Urban model has a total of 1036 nodes, which includes 459 manholes and 39 inlets/outlets. The model also includes dummy manholes and source points for</td><td>• Manhole asset data as original Mike Flood model based on Council GIS.</td></tr>
</table>

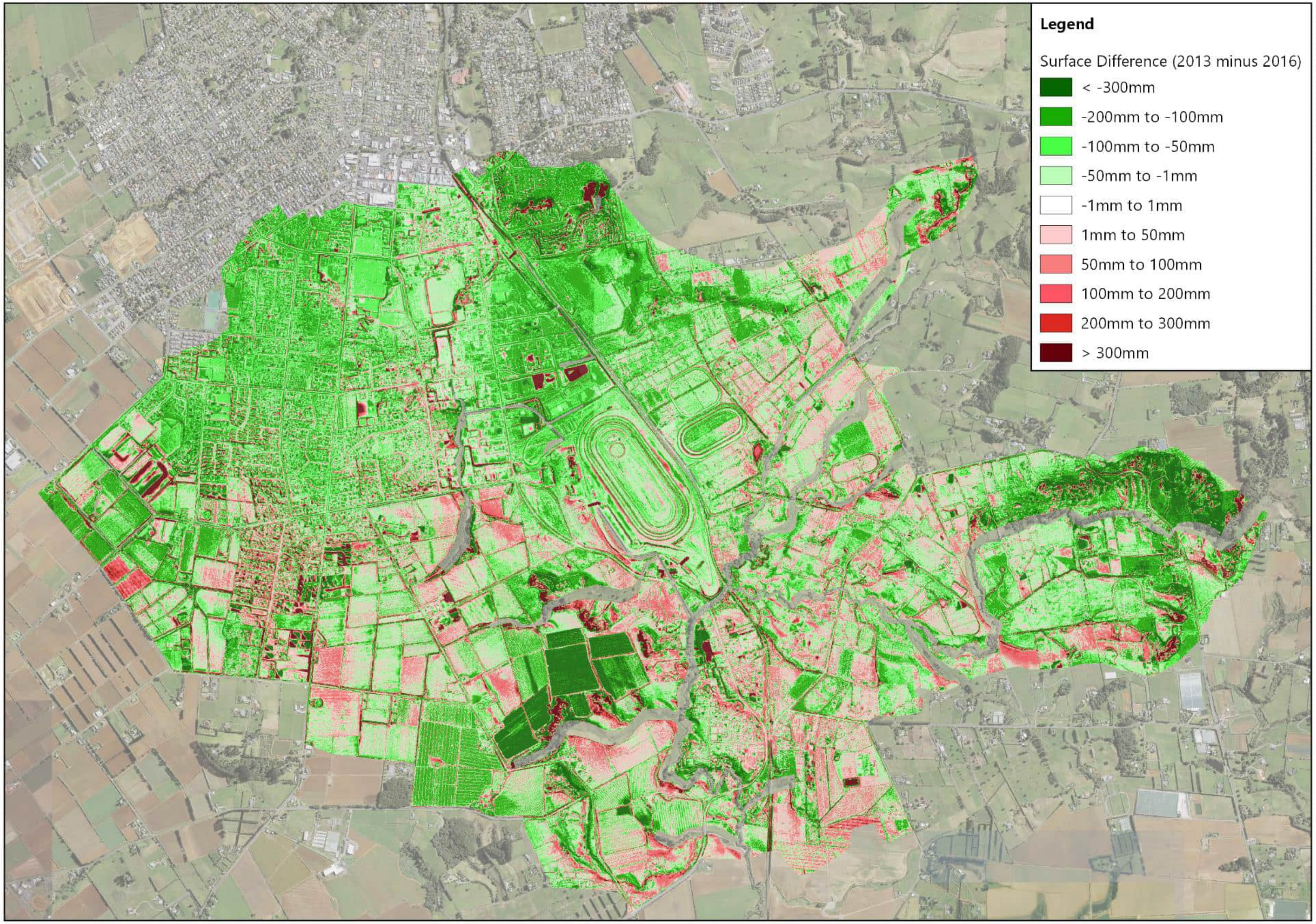
<table>
<tr><td></td><td>distributing flows onto the Mike 21 grid or Mike 11 channels.</td><td>All manholes were coupled to 2D, and cover types were assigned a "2D Gully" for modelled manholes and "Outfall 2D"
Dummy manholes were assigned a "sealed" cover type ensuring no artificial flows are generated.
No changes were made to source points.</td></tr>
<tr><td>River Reaches and open channels</td><td>124 open channels are represented in Mike11.
Mike11 model uses an average Manning's n applied of 0.04.</td><td>A number of open channels previously represented in Mike11 were not converted to 1D river reaches in ICM and instead were modelled as 2D using terrain-sensitive meshing, with a Manning's n of 0.1.
40 River Reaches have been generated for use in the converted ICM model using a combination of survey cross sections and LiDAR interpolated cross sections.
Manning's n 0.04 was used for the ICM 1D river reaches.
Bridge structures within 1D river reaches updated based on survey data undertaken by Opus 2015/2016.</td></tr>
<tr><td colspan="3">Boundary Conditions</td></tr>
<tr><td>Water Levels</td><td>Downstream water level boundary in the MIKE 11 branch Tutaenui Stream1 at chainage 1181 = 42.9m</td><td>No changes</td></tr>
<tr><td>Rain Events</td><td>Rainfall zones assigned based on the TP108 contours for the 2, 5, 10-, 20-, 50- and 100-Years Average Recurrence Interval (ARI).
24-hour rainfall depth obtained from TP108 guidelines and % increase in climate change as shown below:
<table>
<tr><th>Average Recurrence Interval (ARI)</th><th>24-hour rainfall depth (mm)</th><th>Percentage increase due to Climate Change</th></tr>
<tr><td>2 year</td><td>70</td><td>9.0%</td></tr>
<tr><td>5 year</td><td>100, 110, 120</td><td>11.3%</td></tr>
<tr><td>10 year</td><td>120, 130, 140</td><td>13.2%</td></tr>
<tr><td>20 year</td><td>130, 140, 150, 160, 170</td><td>15.1%</td></tr>
<tr><td>50 year</td><td>160, 170, 180, 190, 200</td><td>16.8%</td></tr>
<tr><td>100 year</td><td>180, 190, 200, 210, 220, 230</td><td>16.8%</td></tr>
</table></td><td>Existing 24-hour rainfall depths with and without percentage increase for Climate change 2.1 degrees retained in InfoWorks ICM model.</td></tr>
<tr><td colspan="3">Modelled Scenarios</td></tr>
<tr><td>Scenarios to simulate</td><td>
<table>
<tr><th>Land Use</th><th>Design Storm Event</th><th>Rainfall</th></tr>
<tr><td>ED</td><td>2 year ARI</td><td>Existing 2 year</td></tr>
<tr><td>ED</td><td>5 year ARI</td><td>Existing 5 year</td></tr>
<tr><td>ED</td><td>10 year ARI</td><td>Existing 10 year</td></tr>
<tr><td>ED</td><td>20 year ARI</td><td>Existing 20 year</td></tr>
<tr><td>ED</td><td>50 year ARI</td><td>Existing 50 year</td></tr>
<tr><td>ED</td><td>100 year ARI</td><td>Existing 100 year</td></tr>
<tr><td>MPD</td><td>2 year ARI</td><td>Future 2 year</td></tr>
<tr><td>MPD</td><td>5 year ARI</td><td>Future 5 year</td></tr>
<tr><td>MPD</td><td>10 year ARI</td><td>Future 10 year</td></tr>
<tr><td>MPD</td><td>20 year ARI</td><td>Future 20 year</td></tr>
<tr><td>MPD</td><td>50 year ARI</td><td>Future 50 year</td></tr>
<tr><td>MPD</td><td>100 year ARI</td><td>Future 100 year</td></tr>
</table></td><td>Only MPD scenario modelled</td></tr>
</table>

APPENDIX B: Model Comparison Maps

1. Afflux map - DHI vs ICM (100yr MPD + CC)
2. Terrain difference – 2013 vs. 2016 LiDAR



Water Level Difference 100Yr 2.1CC
< -300mm
-300mm to -100mm
-100mm to -50mm
-50mm to 50mm
50mm to 100mm
100mm to 200mm
200mm to 300mm
> 300mm
West St
Hall St
Ngahere Rd
John St
Glasgow Rd
Subway Rd
Collie Rd
Nelson St
Manukau Rd
Station Rd
Golding Rd
Logan Rd
Yates Rd
Buckland Rd
Harrisville Rd
Webb St
Quarry Rd
Jellicoe Rd
Woodlands Rd
Anzac Rd
Tuakau Rd
Buckville Rd
Jamieson Rd
Ray Wright Rd
Bayly Rd


Legend
Surface Difference (2013 minus 2016)
< -300mm
-200mm to -100mm
-100mm to -50mm
-50mm to -1mm
-1mm to 1mm
1mm to 50mm
50mm to 100mm
100mm to 200mm
200mm to 300mm
> 300mm

Appendix C: Stormwater Manhole Asset Data

Node ID	Node type	System type	Ground level (m AD)	Chamber floor level (m AD)	Flood type	Benching method	Head discharge table
1146237	Manhole	storm	71.186	69.16	Gully 2D	Half Benching	manhole 1000L/s
MH-C1	Manhole	storm	71.147	70.29	Gully 2D	Half Benching	manhole 1000L/s
1142144	Manhole	storm	86.592	85.912	Gully 2D	Half Benching	manhole 6250L/s
1146230	Manhole	storm	68.644	68.43	Gully 2D	Half Benching	manhole 9930 L/s
MH-A11	Manhole	storm	60.738	58.94	Gully 2D	Half Benching	manhole 9930 L/s
1141645	Manhole	storm	55.168	54.583	Gully 2D	Half Benching	Manholes 100 L/s AC
1141654	Manhole	storm	56.169	54.01	Gully 2D	Half Benching	Manholes 100 L/s AC
1142055	Manhole	storm	63.879	61.276	Gully 2D	Half Benching	Manholes 100 L/s AC
1142058	Manhole	storm	61.851	60.27	Gully 2D	Half Benching	Manholes 100 L/s AC
1142059	Manhole	storm	61.098	59.594	Gully 2D	Half Benching	Manholes 100 L/s AC
1142060	Manhole	storm	61.468	59.053	Gully 2D	Half Benching	Manholes 100 L/s AC
1142132	Manhole	storm	75.481	71.853	Gully 2D	Half Benching	Manholes 100 L/s AC
1142134	Manhole	storm	89.315	87.147	Gully 2D	Half Benching	Manholes 100 L/s AC
1142135	Manhole	storm	89.597	87.67	Gully 2D	Half Benching	Manholes 100 L/s AC
1142140	Manhole	storm	90.142	88.154	Gully 2D	Half Benching	Manholes 100 L/s AC
1142143	Manhole	storm	90.054	86.949	Gully 2D	Half Benching	Manholes 100 L/s AC
1142145	Manhole	storm	89.76	85.557	Gully 2D	Half Benching	Manholes 100 L/s AC
1142146	Manhole	storm	89.064	85.288	Gully 2D	Half Benching	Manholes 100 L/s AC
1142147	Manhole	storm	88.903	85.24	Gully 2D	Half Benching	Manholes 100 L/s AC
1142148	Manhole	storm	88.579	85.113	Gully 2D	Half Benching	Manholes 100 L/s AC
1142149	Manhole	storm	87.891	85.006	Gully 2D	Half Benching	Manholes 100 L/s AC
1142150	Manhole	storm	87.825	84.931	Gully 2D	Half Benching	Manholes 100 L/s AC
1142151	Manhole	storm	87.915	84.822	Gully 2D	Half Benching	Manholes 100 L/s AC
1142152	Manhole	storm	86.941	84.415	Gully 2D	Half Benching	Manholes 100 L/s AC
1142154	Manhole	storm	89.337	86.348	Gully 2D	Half Benching	Manholes 100 L/s AC
1142155	Manhole	storm	89.504	87.237	Gully 2D	Half Benching	Manholes 100 L/s AC
1142158	Manhole	storm	90.439	86.39	Gully 2D	Half Benching	Manholes 100 L/s AC
1142159	Manhole	storm	90.321	86.62	Gully 2D	Half Benching	Manholes 100 L/s AC
1142160	Manhole	storm	90.428	88.546	Gully 2D	Half Benching	Manholes 100 L/s AC
1142165	Manhole	storm	83.669	80.938	Gully 2D	Half Benching	Manholes 100 L/s AC
1142166	Manhole	storm	81.508	78.892	Gully 2D	Half Benching	Manholes 100 L/s AC
1142167	Manhole	storm	82.042	80.594	Gully 2D	Half Benching	Manholes 100 L/s AC
1142168	Manhole	storm	81.741	80.594	Gully 2D	Half Benching	Manholes 100 L/s AC
1142170	Manhole	storm	81.269	80.594	Gully 2D	Half Benching	Manholes 100 L/s AC
1142171	Manhole	storm	81.612	80.594	Gully 2D	Half Benching	Manholes 100 L/s AC
1142174	Manhole	storm	74.493	72.762	Gully 2D	Half Benching	Manholes 100 L/s AC
1142175	Manhole	storm	77.969	76.776	Gully 2D	Half Benching	Manholes 100 L/s AC
1142179	Manhole	storm	72.688	70.572	Gully 2D	Half Benching	Manholes 100 L/s AC
1142180	Manhole	storm	71.926	70.439	Gully 2D	Half Benching	Manholes 100 L/s AC
1142181	Manhole	storm	76.885	74.837	Gully 2D	Half Benching	Manholes 100 L/s AC
1142182	Manhole	storm	77.201	75.863	Gully 2D	Half Benching	Manholes 100 L/s AC
1142183	Manhole	storm	77.336	75.863	Gully 2D	Half Benching	Manholes 100 L/s AC
1142184	Manhole	storm	77.444	76.41	Gully 2D	Half Benching	Manholes 100 L/s AC
1142190	Manhole	storm	65.396	63.165	Gully 2D	Half Benching	Manholes 100 L/s AC
1142193	Manhole	storm	65.42	63.896	Gully 2D	Half Benching	Manholes 100 L/s AC
1142194	Manhole	storm	66.221	64.454	Gully 2D	Half Benching	Manholes 100 L/s AC
1142195	Manhole	storm	67.821	65.33	Gully 2D	Half Benching	Manholes 100 L/s AC
1142198	Manhole	storm	60.374	57.4	Gully 2D	Half Benching	Manholes 100 L/s AC
1142199	Manhole	storm	65.4	61.637	Gully 2D	Half Benching	Manholes 100 L/s AC
1142200	Manhole	storm	64.693	62.85	Gully 2D	Half Benching	Manholes 100 L/s AC
1142202	Manhole	storm	65.356	63.294	Gully 2D	Half Benching	Manholes 100 L/s AC
1142203	Manhole	storm	66.189	63.591	Gully 2D	Half Benching	Manholes 100 L/s AC
1142204	Manhole	storm	65.512	63.725	Gully 2D	Half Benching	Manholes 100 L/s AC
1142205	Manhole	storm	66.569	65.672	Gully 2D	Half Benching	Manholes 100 L/s AC
1142206	Manhole	storm	66.831	66.466	Gully 2D	Half Benching	Manholes 100 L/s AC
1142207	Manhole	storm	71.071	69.098	Gully 2D	Half Benching	Manholes 100 L/s AC
1142208	Manhole	storm	72.215	69.462	Gully 2D	Half Benching	Manholes 100 L/s AC
1142209	Manhole	storm	72.607	70.969	Gully 2D	Half Benching	Manholes 100 L/s AC
1142210	Manhole	storm	73.721	72.523	Gully 2D	Half Benching	Manholes 100 L/s AC
1142211	Manhole	storm	74.777	73.395	Gully 2D	Half Benching	Manholes 100 L/s AC
1142216	Manhole	storm	66.601	64.168	Gully 2D	Half Benching	Manholes 100 L/s AC
1142217	Manhole	storm	66.803	64.17	Gully 2D	Half Benching	Manholes 100 L/s AC
1142220	Manhole	storm	65.587	64.152	Gully 2D	Half Benching	Manholes 100 L/s AC
1142221	Manhole	storm	66.007	63.869	Gully 2D	Half Benching	Manholes 100 L/s AC
1142222	Manhole	storm	65.937	64.537	Gully 2D	Half Benching	Manholes 100 L/s AC
1142223	Manhole	storm	65.904	65.188	Gully 2D	Half Benching	Manholes 100 L/s AC

Node ID	Node type	System type	Ground level (m AD)	Chamber floor level (m AD)	Flood type	Benching method	Head discharge table
1142224	Manhole	storm	68.261	65.672	Gully 2D	Half Benching	Manholes 100 L/s AC
1142225	Manhole	storm	69.502	67.138	Gully 2D	Half Benching	Manholes 100 L/s AC
1142226	Manhole	storm	70.201	68.601	Gully 2D	Half Benching	Manholes 100 L/s AC
1142227	Manhole	storm	70.379	68.89	Gully 2D	Half Benching	Manholes 100 L/s AC
1142228	Manhole	storm	70.976	69.209	Gully 2D	Half Benching	Manholes 100 L/s AC
1142229	Manhole	storm	70.589	69.469	Gully 2D	Half Benching	Manholes 100 L/s AC
1142231	Manhole	storm	74.354	72.31	Gully 2D	Half Benching	Manholes 100 L/s AC
1142232	Manhole	storm	70.169	68.73	Gully 2D	Half Benching	Manholes 100 L/s AC
1142233	Manhole	storm	68.38	66.106	Gully 2D	Half Benching	Manholes 100 L/s AC
1142234	Manhole	storm	65.773	64.986	Gully 2D	Half Benching	Manholes 100 L/s AC
1142236	Manhole	storm	65.589	64.353	Gully 2D	Half Benching	Manholes 100 L/s AC
1142237	Manhole	storm	65.794	64.977	Gully 2D	Half Benching	Manholes 100 L/s AC
1142238	Manhole	storm	65.947	63.057	Gully 2D	Half Benching	Manholes 100 L/s AC
1142241	Manhole	storm	68.106	66.222	Gully 2D	Half Benching	Manholes 100 L/s AC
1142242	Manhole	storm	68.337	66.58	Gully 2D	Half Benching	Manholes 100 L/s AC
1142244	Manhole	storm	71.161	69.056	Gully 2D	Half Benching	Manholes 100 L/s AC
1142245	Manhole	storm	68.667	66.366	Gully 2D	Half Benching	Manholes 100 L/s AC
1142246	Manhole	storm	68.769	67.236	Gully 2D	Half Benching	Manholes 100 L/s AC
1142247	Manhole	storm	68.713	67.649	Gully 2D	Half Benching	Manholes 100 L/s AC
1142249	Manhole	storm	70.497	68.56	Gully 2D	Half Benching	Manholes 100 L/s AC
1142253	Manhole	storm	72.332	70.453	Gully 2D	Half Benching	Manholes 100 L/s AC
1142254	Manhole	storm	73.889	71.098	Gully 2D	Half Benching	Manholes 100 L/s AC
1142255	Manhole	storm	75.227	72.219	Gully 2D	Half Benching	Manholes 100 L/s AC
1142256	Manhole	storm	74.371	72.657	Gully 2D	Half Benching	Manholes 100 L/s AC
1142257	Manhole	storm	76.572	74.109	Gully 2D	Half Benching	Manholes 100 L/s AC
1142260	Manhole	storm	76.554	74.363	Gully 2D	Half Benching	Manholes 100 L/s AC
1142262	Manhole	storm	78.78	76.409	Gully 2D	Half Benching	Manholes 100 L/s AC
1142263	Manhole	storm	80.085	78.184	Gully 2D	Half Benching	Manholes 100 L/s AC
1142266	Manhole	storm	81.054	79.288	Gully 2D	Half Benching	Manholes 100 L/s AC
1142267	Manhole	storm	85.028	83.403	Gully 2D	Half Benching	Manholes 100 L/s AC
1142268	Manhole	storm	87.144	85.15	Gully 2D	Half Benching	Manholes 100 L/s AC
1142270	Manhole	storm	87.897	85.517	Gully 2D	Half Benching	Manholes 100 L/s AC
1142272	Manhole	storm	78.899	76.95	Gully 2D	Half Benching	Manholes 100 L/s AC
1142273	Manhole	storm	79.054	77.383	Gully 2D	Half Benching	Manholes 100 L/s AC
1142276	Manhole	storm	81.944	80.794	Gully 2D	Half Benching	Manholes 100 L/s AC
1142278	Manhole	storm	73.633	71.96	Gully 2D	Half Benching	Manholes 100 L/s AC
1142279	Manhole	storm	77.167	75.347	Gully 2D	Half Benching	Manholes 100 L/s AC
1142280	Manhole	storm	78.024	76.7	Gully 2D	Half Benching	Manholes 100 L/s AC
1142283	Manhole	storm	80.259	77.699	Gully 2D	Half Benching	Manholes 100 L/s AC
1142287	Manhole	storm	92.934	91.621	Gully 2D	Half Benching	Manholes 100 L/s AC
1142288	Manhole	storm	93.597	91.873	Gully 2D	Half Benching	Manholes 100 L/s AC
1142294	Manhole	storm	91.371	89.997	Gully 2D	Half Benching	Manholes 100 L/s AC
1142298	Manhole	storm	90.494	89.088	Gully 2D	Half Benching	Manholes 100 L/s AC
1142300	Manhole	storm	82.973	82.177	Gully 2D	Half Benching	Manholes 100 L/s AC
1142301	Manhole	storm	87.145	84.835	Gully 2D	Half Benching	Manholes 100 L/s AC
1142302	Manhole	storm	88.143	86.766	Gully 2D	Half Benching	Manholes 100 L/s AC
1142312	Manhole	storm	131.577	129.833	Gully 2D	Half Benching	Manholes 100 L/s AC
1142315	Manhole	storm	113.502	112.56	Gully 2D	Half Benching	Manholes 100 L/s AC
1142317	Manhole	storm	112.508	111.318	Gully 2D	Half Benching	Manholes 100 L/s AC
1142318	Manhole	storm	116.368	115.28	Gully 2D	Half Benching	Manholes 100 L/s AC
1142323	Manhole	storm	55.804	54.15	Gully 2D	Half Benching	Manholes 100 L/s AC
1142324	Manhole	storm	57.067	54.789	Gully 2D	Half Benching	Manholes 100 L/s AC
1142329	Manhole	storm	53.784	51.773	Gully 2D	Half Benching	Manholes 100 L/s AC
1142331	Manhole	storm	53.466	51.717	Gully 2D	Half Benching	Manholes 100 L/s AC
1142332	Manhole	storm	54.094	52.03	Gully 2D	Half Benching	Manholes 100 L/s AC
1142333	Manhole	storm	54.138	52.319	Gully 2D	Half Benching	Manholes 100 L/s AC
1142334	Manhole	storm	59.071	56.448	Gully 2D	Half Benching	Manholes 100 L/s AC
1142337	Manhole	storm	54.808	53.48	Gully 2D	Half Benching	Manholes 100 L/s AC
1142345	Manhole	storm	65.501	59.372	Gully 2D	Half Benching	Manholes 100 L/s AC
1142346	Manhole	storm	65.106	63.282	Gully 2D	Half Benching	Manholes 100 L/s AC
1142347	Manhole	storm	64.542	63.48	Gully 2D	Half Benching	Manholes 100 L/s AC
1142348	Manhole	storm	65.478	64.15	Gully 2D	Half Benching	Manholes 100 L/s AC
1142349	Manhole	storm	65.578	64.36	Gully 2D	Half Benching	Manholes 100 L/s AC
1142350	Manhole	storm	67	65.079	Gully 2D	Half Benching	Manholes 100 L/s AC
1142354	Manhole	storm	64.594	63.007	Gully 2D	Half Benching	Manholes 100 L/s AC
1142356	Manhole	storm	55.724	54.354	Gully 2D	Half Benching	Manholes 100 L/s AC
1142357	Manhole	storm	55.923	53.465	Gully 2D	Half Benching	Manholes 100 L/s AC
1142358	Manhole	storm	55.463	52.906	Gully 2D	Half Benching	Manholes 100 L/s AC

Node ID	Node type	System type	Ground level (m AD)	Chamber floor level (m AD)	Flood type	Benching method	Head discharge table
1142368	Manhole	storm	61.083	59.031	Gully 2D	Half Benching	Manholes 100 L/s AC
1142370	Manhole	storm	58.415	55.807	Gully 2D	Half Benching	Manholes 100 L/s AC
1142380	Manhole	storm	64.444	62.942	Gully 2D	Half Benching	Manholes 100 L/s AC
1142382	Manhole	storm	65.323	64.31	Gully 2D	Half Benching	Manholes 100 L/s AC
1142431	Manhole	storm	86.724	84.142	Gully 2D	Half Benching	Manholes 100 L/s AC
1142432	Manhole	storm	88.621	85.089	Gully 2D	Half Benching	Manholes 100 L/s AC
1142433	Manhole	storm	89.719	86.551	Gully 2D	Half Benching	Manholes 100 L/s AC
1142434	Manhole	storm	90.434	87.987	Gully 2D	Half Benching	Manholes 100 L/s AC
1142455	Manhole	storm	65.894	62.604	Gully 2D	Half Benching	Manholes 100 L/s AC
1142482	Manhole	storm	77.965	76.495	Gully 2D	Half Benching	Manholes 100 L/s AC
1142490	Manhole	storm	75.938	72.601	Gully 2D	Half Benching	Manholes 100 L/s AC
1142498	Manhole	storm	94.361	92.142	Gully 2D	Half Benching	Manholes 100 L/s AC
1142499	Manhole	storm	95.508	92.702	Gully 2D	Half Benching	Manholes 100 L/s AC
1142516	Manhole	storm	93.006	91.065	Gully 2D	Half Benching	Manholes 100 L/s AC
1142517	Manhole	storm	91.569	89.632	Gully 2D	Half Benching	Manholes 100 L/s AC
1142521	Manhole	storm	95.317	92.977	Gully 2D	Half Benching	Manholes 100 L/s AC
1142522	Manhole	storm	100.501	97.853	Gully 2D	Half Benching	Manholes 100 L/s AC
1142528	Manhole	storm	101.918	101.047	Gully 2D	Half Benching	Manholes 100 L/s AC
1142529	Manhole	storm	90.865	88.765	Gully 2D	Half Benching	Manholes 100 L/s AC
1142541	Manhole	storm	81.502	79.861	Gully 2D	Half Benching	Manholes 100 L/s AC
1142543	Manhole	storm	79.309	77.475	Gully 2D	Half Benching	Manholes 100 L/s AC
1142553	Manhole	storm	60.977	59.185	Gully 2D	Half Benching	Manholes 100 L/s AC
1142558	Manhole	storm	66.241	62.902	Gully 2D	Half Benching	Manholes 100 L/s AC
1142559	Manhole	storm	65.795	64.76	Gully 2D	Half Benching	Manholes 100 L/s AC
1142560	Manhole	storm	67.584	64.073	Gully 2D	Half Benching	Manholes 100 L/s AC
1142595	Manhole	storm	70.88	69.535	Gully 2D	Half Benching	Manholes 100 L/s AC
1142596	Manhole	storm	70.422	69.055	Gully 2D	Half Benching	Manholes 100 L/s AC
1143400	Manhole	storm	66.515	64.548	Gully 2D	Half Benching	Manholes 100 L/s AC
1143426	Manhole	storm	58.268	57.356	Gully 2D	Half Benching	Manholes 100 L/s AC
1143472	Manhole	storm	55.962	52.44	Gully 2D	Half Benching	Manholes 100 L/s AC
1143473	Manhole	storm	55.077	52.404	Gully 2D	Half Benching	Manholes 100 L/s AC
1143474	Manhole	storm	55.762	53.422	Gully 2D	Half Benching	Manholes 100 L/s AC
1143475	Manhole	storm	55.798	52.466	Gully 2D	Half Benching	Manholes 100 L/s AC
1143476	Manhole	storm	56.082	53.036	Gully 2D	Half Benching	Manholes 100 L/s AC
1143477	Manhole	storm	56.396	53.07	Gully 2D	Half Benching	Manholes 100 L/s AC
1143478	Manhole	storm	56.456	53.224	Gully 2D	Half Benching	Manholes 100 L/s AC
1143479	Manhole	storm	56.389	53.406	Gully 2D	Half Benching	Manholes 100 L/s AC
1143480	Manhole	storm	56.546	53.782	Gully 2D	Half Benching	Manholes 100 L/s AC
1143481	Manhole	storm	57.642	53.715	Gully 2D	Half Benching	Manholes 100 L/s AC
1143482	Manhole	storm	57.753	54.264	Gully 2D	Half Benching	Manholes 100 L/s AC
1143483	Manhole	storm	60.956	56.717	Gully 2D	Half Benching	Manholes 100 L/s AC
1143484	Manhole	storm	61.548	58.618	Gully 2D	Half Benching	Manholes 100 L/s AC
1143485	Manhole	storm	64.776	59.58	Gully 2D	Half Benching	Manholes 100 L/s AC
1143486	Manhole	storm	64.753	59.757	Gully 2D	Half Benching	Manholes 100 L/s AC
1143487	Manhole	storm	64.919	59.783	Gully 2D	Half Benching	Manholes 100 L/s AC
1143488	Manhole	storm	65.377	60.684	Gully 2D	Half Benching	Manholes 100 L/s AC
1143489	Manhole	storm	66.205	61.273	Gully 2D	Half Benching	Manholes 100 L/s AC
1143490	Manhole	storm	65.341	61.59	Gully 2D	Half Benching	Manholes 100 L/s AC
1143491	Manhole	storm	64.727	62.16	Gully 2D	Half Benching	Manholes 100 L/s AC
1143492	Manhole	storm	65.645	63.031	Gully 2D	Half Benching	Manholes 100 L/s AC
1143493	Manhole	storm	67.285	65.243	Gully 2D	Half Benching	Manholes 100 L/s AC
1143494	Manhole	storm	65.201	63.464	Gully 2D	Half Benching	Manholes 100 L/s AC
1143495	Manhole	storm	56.231	53.331	Gully 2D	Half Benching	Manholes 100 L/s AC
1143496	Manhole	storm	65.583	62.922	Gully 2D	Half Benching	Manholes 100 L/s AC
1143497	Manhole	storm	55.732	54.107	Gully 2D	Half Benching	Manholes 100 L/s AC
1143554	Manhole	storm	99.999	99.495	Gully 2D	Half Benching	Manholes 100 L/s AC
1143643	Manhole	storm	83.052	80.417	Gully 2D	Half Benching	Manholes 100 L/s AC
1143644	Manhole	storm	82.787	80.782	Gully 2D	Half Benching	Manholes 100 L/s AC
1143645	Manhole	storm	82.568	80.993	Gully 2D	Half Benching	Manholes 100 L/s AC
1143650	Manhole	storm	54.134	51.273	Gully 2D	Half Benching	Manholes 100 L/s AC
1143651	Manhole	storm	54.464	51.27	Gully 2D	Half Benching	Manholes 100 L/s AC
1143652	Manhole	storm	54.2	51.531	Gully 2D	Half Benching	Manholes 100 L/s AC
1143653	Manhole	storm	54.402	51.727	Gully 2D	Half Benching	Manholes 100 L/s AC
1143654	Manhole	storm	54.354	52.351	Gully 2D	Half Benching	Manholes 100 L/s AC
1143655	Manhole	storm	54.673	52.519	Gully 2D	Half Benching	Manholes 100 L/s AC
1143656	Manhole	storm	55.075	52.853	Gully 2D	Half Benching	Manholes 100 L/s AC
1143657	Manhole	storm	55.549	53.368	Gully 2D	Half Benching	Manholes 100 L/s AC
1143658	Manhole	storm	56.111	53.476	Gully 2D	Half Benching	Manholes 100 L/s AC

Node ID	Node type	System type	Ground level (m AD)	Chamber floor level (m AD)	Flood type	Benching method	Head discharge table
1143659	Manhole	storm	56.142	53.737	Gully 2D	Half Benching	Manholes 100 L/s AC
1143660	Manhole	storm	56.181	53.961	Gully 2D	Half Benching	Manholes 100 L/s AC
1143661	Manhole	storm	56.22	54.027	Gully 2D	Half Benching	Manholes 100 L/s AC
1143662	Manhole	storm	55.163	54.339	Gully 2D	Half Benching	Manholes 100 L/s AC
1143663	Manhole	storm	56.375	54.684	Gully 2D	Half Benching	Manholes 100 L/s AC
1143664	Manhole	storm	57.631	55.259	Gully 2D	Half Benching	Manholes 100 L/s AC
1143665	Manhole	storm	54.23	52.03	Gully 2D	Half Benching	Manholes 100 L/s AC
1143669	Manhole	storm	67.248	67.061	Gully 2D	Half Benching	Manholes 100 L/s AC
1143670	Manhole	storm	65.477	63.538	Gully 2D	Half Benching	Manholes 100 L/s AC
1143671	Manhole	storm	65.005	62.974	Gully 2D	Half Benching	Manholes 100 L/s AC
1143672	Manhole	storm	64.401	62.754	Gully 2D	Half Benching	Manholes 100 L/s AC
1143678	Manhole	storm	65.108	64.012	Gully 2D	Half Benching	Manholes 100 L/s AC
1143679	Manhole	storm	65.074	64.033	Gully 2D	Half Benching	Manholes 100 L/s AC
1143682	Manhole	storm	67.391	66.284	Gully 2D	Half Benching	Manholes 100 L/s AC
1143684	Manhole	storm	65.8	64.867	Gully 2D	Half Benching	Manholes 100 L/s AC
1143713	Manhole	storm	61.036	60.05	Gully 2D	Half Benching	Manholes 100 L/s AC
1143714	Manhole	storm	64.714	63.127	Gully 2D	Half Benching	Manholes 100 L/s AC
1143715	Manhole	storm	88.289	86.024	Gully 2D	Half Benching	Manholes 100 L/s AC
1143716	Manhole	storm	89.568	87.933	Gully 2D	Half Benching	Manholes 100 L/s AC
1143769	Manhole	storm	57.213	55.523	Gully 2D	Half Benching	Manholes 100 L/s AC
1143794	Manhole	storm	54.637	52.92	Gully 2D	Half Benching	Manholes 100 L/s AC
1143795	Manhole	storm	54.786	53.224	Gully 2D	Half Benching	Manholes 100 L/s AC
1143842	Manhole	storm	52.042	51.347	Gully 2D	Half Benching	Manholes 100 L/s AC
1143843	Manhole	storm	57.358	53.522	Gully 2D	Half Benching	Manholes 100 L/s AC
1143844	Manhole	storm	58.334	54.402	Gully 2D	Half Benching	Manholes 100 L/s AC
1143845	Manhole	storm	58.923	54.61	Gully 2D	Half Benching	Manholes 100 L/s AC
1143846	Manhole	storm	59.1	54.827	Gully 2D	Half Benching	Manholes 100 L/s AC
1143847	Manhole	storm	58.641	55.009	Gully 2D	Half Benching	Manholes 100 L/s AC
1143848	Manhole	storm	57.813	55.197	Gully 2D	Half Benching	Manholes 100 L/s AC
1143853	Manhole	storm	58.017	55.7	Gully 2D	Half Benching	Manholes 100 L/s AC
1144016	Manhole	storm	88.573	86.578	Gully 2D	Half Benching	Manholes 100 L/s AC
1144026	Manhole	storm	71.239	69.986	Gully 2D	Half Benching	Manholes 100 L/s AC
1144028	Manhole	storm	72.762	70.797	Gully 2D	Half Benching	Manholes 100 L/s AC
1144092	Manhole	storm	67.328	65.492	Gully 2D	Half Benching	Manholes 100 L/s AC
1144093	Manhole	storm	67.522	65.813	Gully 2D	Half Benching	Manholes 100 L/s AC
1144094	Manhole	storm	67.756	66.059	Gully 2D	Half Benching	Manholes 100 L/s AC
1144095	Manhole	storm	68.488	67.028	Gully 2D	Half Benching	Manholes 100 L/s AC
1144096	Manhole	storm	69.014	67.536	Gully 2D	Half Benching	Manholes 100 L/s AC
1144107	Manhole	storm	67.649	65.926	Gully 2D	Half Benching	Manholes 100 L/s AC
1144112	Manhole	storm	67.842	66.097	Gully 2D	Half Benching	Manholes 100 L/s AC
1144113	Manhole	storm	69.338	67.544	Gully 2D	Half Benching	Manholes 100 L/s AC
1144417	Manhole	storm	75.816	73.618	Gully 2D	Half Benching	Manholes 100 L/s AC
1144420	Manhole	storm	74.22	72.4	Gully 2D	Half Benching	Manholes 100 L/s AC
1144421	Manhole	storm	73.264	71.88	Gully 2D	Half Benching	Manholes 100 L/s AC
1144422	Manhole	storm	72.824	71.39	Gully 2D	Half Benching	Manholes 100 L/s AC
1144423	Manhole	storm	73.379	70.982	Gully 2D	Half Benching	Manholes 100 L/s AC
1144427	Manhole	storm	73.335	71.662	Gully 2D	Half Benching	Manholes 100 L/s AC
1144428	Manhole	storm	71.801	70.285	Gully 2D	Half Benching	Manholes 100 L/s AC
1144429	Manhole	storm	71.533	69.772	Gully 2D	Half Benching	Manholes 100 L/s AC
1144434	Manhole	storm	71.788	70.153	Gully 2D	Half Benching	Manholes 100 L/s AC
1144435	Manhole	storm	71.234	69.349	Gully 2D	Half Benching	Manholes 100 L/s AC
1144516	Manhole	storm	56.974	55.254	Gully 2D	Half Benching	Manholes 100 L/s AC
1144517	Manhole	storm	56.171	54.809	Gully 2D	Half Benching	Manholes 100 L/s AC
1144518	Manhole	storm	57.218	55.699	Gully 2D	Half Benching	Manholes 100 L/s AC
1144519	Manhole	storm	56.927	55.749	Gully 2D	Half Benching	Manholes 100 L/s AC
1144576	Manhole	storm	53.712	52.008	Gully 2D	Half Benching	Manholes 100 L/s AC
1144579	Manhole	storm	53.711	52.004	Gully 2D	Half Benching	Manholes 100 L/s AC
1144586	Manhole	storm	54.084	52.457	Gully 2D	Half Benching	Manholes 100 L/s AC
1144587	Manhole	storm	53.678	51.903	Gully 2D	Half Benching	Manholes 100 L/s AC
1144701	Manhole	storm	66.287	63.624	Gully 2D	Half Benching	Manholes 100 L/s AC
1144705	Manhole	storm	53.47	48.765	Gully 2D	Half Benching	Manholes 100 L/s AC
1144707	Manhole	storm	53.45	49.308	Gully 2D	Half Benching	Manholes 100 L/s AC
1144710	Manhole	storm	54.48	49.859	Gully 2D	Half Benching	Manholes 100 L/s AC
1144711	Manhole	storm	54.149	50.21	Gully 2D	Half Benching	Manholes 100 L/s AC
1144712	Manhole	storm	54.548	50.543	Gully 2D	Half Benching	Manholes 100 L/s AC
1144714	Manhole	storm	54.888	51.168	Gully 2D	Half Benching	Manholes 100 L/s AC
1144715	Manhole	storm	54.639	51.283	Gully 2D	Half Benching	Manholes 100 L/s AC
1144721	Manhole	storm	72.473	70.201	Gully 2D	Half Benching	Manholes 100 L/s AC

Node ID	Node type	System type	Ground level (m AD)	Chamber floor level (m AD)	Flood type	Benching method	Head discharge table
1144725	Manhole	storm	70.38	68.253	Gully 2D	Half Benching	Manholes 100 L/s AC
1144726	Manhole	storm	69.84	67.656	Gully 2D	Half Benching	Manholes 100 L/s AC
1144727	Manhole	storm	69.363	67.366	Gully 2D	Half Benching	Manholes 100 L/s AC
1144729	Manhole	storm	70.018	68.094	Gully 2D	Half Benching	Manholes 100 L/s AC
1144731	Manhole	storm	70.726	69.066	Gully 2D	Half Benching	Manholes 100 L/s AC
1144732	Manhole	storm	70.654	68.451	Gully 2D	Half Benching	Manholes 100 L/s AC
1144734	Manhole	storm	71.938	69.745	Gully 2D	Half Benching	Manholes 100 L/s AC
1144793	Manhole	storm	93.544	91.709	Gully 2D	Half Benching	Manholes 100 L/s AC
1144798	Manhole	storm	94.789	92.224	Gully 2D	Half Benching	Manholes 100 L/s AC
1144802	Manhole	storm	104.162	101.538	Gully 2D	Half Benching	Manholes 100 L/s AC
1144803	Manhole	storm	98.231	95.523	Gully 2D	Half Benching	Manholes 100 L/s AC
1144804	Manhole	storm	94.829	92.699	Gully 2D	Half Benching	Manholes 100 L/s AC
1144853	Manhole	storm	81.836	79.173	Gully 2D	Half Benching	Manholes 100 L/s AC
1144923	Manhole	storm	83.759	81.891	Gully 2D	Half Benching	Manholes 100 L/s AC
1144924	Manhole	storm	87.152	85.561	Gully 2D	Half Benching	Manholes 100 L/s AC
1144925	Manhole	storm	89.111	86.63	Gully 2D	Half Benching	Manholes 100 L/s AC
1144933	Manhole	storm	80.807	78.143	Gully 2D	Half Benching	Manholes 100 L/s AC
1144980	Manhole	storm	64.946	63.353	Gully 2D	Half Benching	Manholes 100 L/s AC
1144981	Manhole	storm	65.093	62.322	Gully 2D	Half Benching	Manholes 100 L/s AC
1145056	Manhole	storm	91.01	88.946	Gully 2D	Half Benching	Manholes 100 L/s AC
1145285	Manhole	storm	65.244	63.111	Gully 2D	Half Benching	Manholes 100 L/s AC
1145286	Manhole	storm	64.899	63.102	Gully 2D	Half Benching	Manholes 100 L/s AC
1145287	Manhole	storm	65.328	63.997	Gully 2D	Half Benching	Manholes 100 L/s AC
1145302	Manhole	storm	53.97	51.509	Gully 2D	Half Benching	Manholes 100 L/s AC
1145313	Manhole	storm	61.639	57.107	Gully 2D	Half Benching	Manholes 100 L/s AC
1145314	Manhole	storm	54.23	52.51	Gully 2D	Half Benching	Manholes 100 L/s AC
1145330	Manhole	storm	59.453	58.176	Gully 2D	Half Benching	Manholes 100 L/s AC
1145334	Manhole	storm	58.126	56.72	Gully 2D	Half Benching	Manholes 100 L/s AC
1145356	Manhole	storm	88.282	87.187	Gully 2D	Half Benching	Manholes 100 L/s AC
1145357	Manhole	storm	93.884	89.356	Gully 2D	Half Benching	Manholes 100 L/s AC
1145359	Manhole	storm	94.756	90.296	Gully 2D	Half Benching	Manholes 100 L/s AC
1145360	Manhole	storm	93.725	93.128	Gully 2D	Half Benching	Manholes 100 L/s AC
1145361	Manhole	storm	101.151	97.683	Gully 2D	Half Benching	Manholes 100 L/s AC
1145362	Manhole	storm	108.143	105.36	Gully 2D	Half Benching	Manholes 100 L/s AC
1145363	Manhole	storm	117.475	112.983	Gully 2D	Half Benching	Manholes 100 L/s AC
1145364	Manhole	storm	121.547	119.14	Gully 2D	Half Benching	Manholes 100 L/s AC
1145365	Manhole	storm	124.134	121.495	Gully 2D	Half Benching	Manholes 100 L/s AC
1145366	Manhole	storm	138.622	134.456	Gully 2D	Half Benching	Manholes 100 L/s AC
1145367	Manhole	storm	150.614	146.896	Gully 2D	Half Benching	Manholes 100 L/s AC
1145368	Manhole	storm	158.059	156.201	Gully 2D	Half Benching	Manholes 100 L/s AC
1145369	Manhole	storm	153.607	151.08	Gully 2D	Half Benching	Manholes 100 L/s AC
1145370	Manhole	storm	165.924	162.46	Gully 2D	Half Benching	Manholes 100 L/s AC
1145371	Manhole	storm	167.048	163.412	Gully 2D	Half Benching	Manholes 100 L/s AC
1145372	Manhole	storm	169.259	165.457	Gully 2D	Half Benching	Manholes 100 L/s AC
1145373	Manhole	storm	171.815	167.16	Gully 2D	Half Benching	Manholes 100 L/s AC
1145374	Manhole	storm	176.588	171.927	Gully 2D	Half Benching	Manholes 100 L/s AC
1145375	Manhole	storm	176.332	174.142	Gully 2D	Half Benching	Manholes 100 L/s AC
1145376	Manhole	storm	184.419	182.145	Gully 2D	Half Benching	Manholes 100 L/s AC
1145379	Manhole	storm	65.059	60.926	Gully 2D	Half Benching	Manholes 100 L/s AC
1145380	Manhole	storm	62.96	60.223	Gully 2D	Half Benching	Manholes 100 L/s AC
1145401	Manhole	storm	61.797	60.085	Gully 2D	Half Benching	Manholes 100 L/s AC
1145468	Manhole	storm	77.414	75.9	Gully 2D	Half Benching	Manholes 100 L/s AC
1145489	Manhole	storm	58.26	56.96	Gully 2D	Half Benching	Manholes 100 L/s AC
1145491	Manhole	storm	88.846	85.83	Gully 2D	Half Benching	Manholes 100 L/s AC
1145672	Manhole	storm	56.032	53.574	Gully 2D	Half Benching	Manholes 100 L/s AC
1145683	Manhole	storm	73.675	71.981	Gully 2D	Half Benching	Manholes 100 L/s AC
1145684	Manhole	storm	73.048	71.429	Gully 2D	Half Benching	Manholes 100 L/s AC
1145717	Manhole	storm	105.331	101.882	Gully 2D	Half Benching	Manholes 100 L/s AC
1145718	Manhole	storm	108.825	105.823	Gully 2D	Half Benching	Manholes 100 L/s AC
1145720	Manhole	storm	115.202	113.063	Gully 2D	Half Benching	Manholes 100 L/s AC
1145721	Manhole	storm	115.251	114.2	Gully 2D	Half Benching	Manholes 100 L/s AC
1145759	Manhole	storm	64.969	61.749	Gully 2D	Half Benching	Manholes 100 L/s AC
1145760	Manhole	storm	65.116	63.068	Gully 2D	Half Benching	Manholes 100 L/s AC
1145761	Manhole	storm	65.589	63.815	Gully 2D	Half Benching	Manholes 100 L/s AC
1145762	Manhole	storm	65.698	64.008	Gully 2D	Half Benching	Manholes 100 L/s AC
1145763	Manhole	storm	65.374	63.36	Gully 2D	Half Benching	Manholes 100 L/s AC
1145764	Manhole	storm	66.052	64.575	Gully 2D	Half Benching	Manholes 100 L/s AC
1145964	Manhole	storm	160.812	159.9	Gully 2D	Half Benching	Manholes 100 L/s AC

Node ID	Node type	System type	Ground level (m AD)	Chamber floor level (m AD)	Flood type	Benching method	Head discharge table
1145966	Manhole	storm	150.875	149.456	Gully 2D	Half Benching	Manholes 100 L/s AC
1145967	Manhole	storm	150.404	149.141	Gully 2D	Half Benching	Manholes 100 L/s AC
1145968	Manhole	storm	140.456	138.888	Gully 2D	Half Benching	Manholes 100 L/s AC
1145969	Manhole	storm	130.671	129.581	Gully 2D	Half Benching	Manholes 100 L/s AC
1145970	Manhole	storm	129.169	127.818	Gully 2D	Half Benching	Manholes 100 L/s AC
1145972	Manhole	storm	109.33	108.35	Gully 2D	Half Benching	Manholes 100 L/s AC
1145977	Manhole	storm	87.7	86.371	Gully 2D	Half Benching	Manholes 100 L/s AC
1145978	Manhole	storm	87.819	86.653	Gully 2D	Half Benching	Manholes 100 L/s AC
1145979	Manhole	storm	88.136	86.848	Gully 2D	Half Benching	Manholes 100 L/s AC
1145980	Manhole	storm	87.867	86.859	Gully 2D	Half Benching	Manholes 100 L/s AC
1145981	Manhole	storm	88.474	87.026	Gully 2D	Half Benching	Manholes 100 L/s AC
1146038	Manhole	storm	70.046	68.813	Gully 2D	Half Benching	Manholes 100 L/s AC
1146039	Manhole	storm	70.105	68.645	Gully 2D	Half Benching	Manholes 100 L/s AC
1146040	Manhole	storm	69.582	68.036	Gully 2D	Half Benching	Manholes 100 L/s AC
1146041	Manhole	storm	69.612	67.883	Gully 2D	Half Benching	Manholes 100 L/s AC
1146042	Manhole	storm	69.442	67.451	Gully 2D	Half Benching	Manholes 100 L/s AC
1146043	Manhole	storm	70.306	68.935	Gully 2D	Half Benching	Manholes 100 L/s AC
1146044	Manhole	storm	70.167	68.871	Gully 2D	Half Benching	Manholes 100 L/s AC
1146050	Manhole	storm	59.098	55.937	Gully 2D	Half Benching	Manholes 100 L/s AC
1146051	Manhole	storm	57.796	55.61	Gully 2D	Half Benching	Manholes 100 L/s AC
1146052	Manhole	storm	57.284	55.417	Gully 2D	Half Benching	Manholes 100 L/s AC
1146055	Manhole	storm	64.198	62.56	Gully 2D	Half Benching	Manholes 100 L/s AC
1146059	Manhole	storm	65.067	62.726	Gully 2D	Half Benching	Manholes 100 L/s AC
1146106	Manhole	storm	56.18	53.677	Gully 2D	Half Benching	Manholes 100 L/s AC
1146177	Manhole	storm	71.351	68.877	Gully 2D	Half Benching	Manholes 100 L/s AC
1146178	Manhole	storm	66.617	63.86	Gully 2D	Half Benching	Manholes 100 L/s AC
1146179	Manhole	storm	65.103	62.509	Gully 2D	Half Benching	Manholes 100 L/s AC
1146180	Manhole	storm	63.909	61.026	Gully 2D	Half Benching	Manholes 100 L/s AC
1146181	Manhole	storm	62.962	60.687	Gully 2D	Half Benching	Manholes 100 L/s AC
1146182	Manhole	storm	61.83	60.335	Gully 2D	Half Benching	Manholes 100 L/s AC
1146195	Manhole	storm	56.179	54.576	Gully 2D	Half Benching	Manholes 100 L/s AC
1146196	Manhole	storm	56.719	54.554	Gully 2D	Half Benching	Manholes 100 L/s AC
1146231	Manhole	storm	71.086	68.34	Gully 2D	Half Benching	Manholes 100 L/s AC
1146232	Manhole	storm	70.041	67.489	Gully 2D	Half Benching	Manholes 100 L/s AC
1146233	Manhole	storm	68.42	65.894	Gully 2D	Half Benching	Manholes 100 L/s AC
1146234	Manhole	storm	66.225	63.252	Gully 2D	Half Benching	Manholes 100 L/s AC
1146235	Manhole	storm	62.541	58.6	Gully 2D	Half Benching	Manholes 100 L/s AC
1146238	Manhole	storm	71.188	68.77	Gully 2D	Half Benching	Manholes 100 L/s AC
1146241	Manhole	storm	60.276	56.65	Gully 2D	Half Benching	Manholes 100 L/s AC
1146242	Manhole	storm	60.846	59.133	Gully 2D	Half Benching	Manholes 100 L/s AC
1146243	Manhole	storm	57.328	54.4	Gully 2D	Half Benching	Manholes 100 L/s AC
1146244	Manhole	storm	55.948	54.06	Gully 2D	Half Benching	Manholes 100 L/s AC
1146252	Manhole	storm	58.631	56.34	Gully 2D	Half Benching	Manholes 100 L/s AC
1146254	Manhole	storm	58.124	55.411	Gully 2D	Half Benching	Manholes 100 L/s AC
1146298	Manhole	storm	146.512	144.991	Gully 2D	Half Benching	Manholes 100 L/s AC
1146299	Manhole	storm	155.908	155.08	Gully 2D	Half Benching	Manholes 100 L/s AC
1146302	Manhole	storm	152.105	151.137	Gully 2D	Half Benching	Manholes 100 L/s AC
1146372	Manhole	storm	57.936	56.309	Gully 2D	Half Benching	Manholes 100 L/s AC
1146373	Manhole	storm	58.114	56.131	Gully 2D	Half Benching	Manholes 100 L/s AC
1146374	Manhole	storm	58.797	55.802	Gully 2D	Half Benching	Manholes 100 L/s AC
1146375	Manhole	storm	56.985	55.47	Gully 2D	Half Benching	Manholes 100 L/s AC
1146376	Manhole	storm	56.387	54.953	Gully 2D	Half Benching	Manholes 100 L/s AC
1146377	Manhole	storm	57.084	55.214	Gully 2D	Half Benching	Manholes 100 L/s AC
1146378	Manhole	storm	55.867	53.723	Gully 2D	Half Benching	Manholes 100 L/s AC
1146379	Manhole	storm	55.563	53.14	Gully 2D	Half Benching	Manholes 100 L/s AC
1146380	Manhole	storm	56.505	52.616	Gully 2D	Half Benching	Manholes 100 L/s AC
1146390	Manhole	storm	69.849	68.139	Gully 2D	Half Benching	Manholes 100 L/s AC
1146392	Manhole	storm	54.733	52.559	Gully 2D	Half Benching	Manholes 100 L/s AC
1146393	Manhole	storm	53.799	51.021	Gully 2D	Half Benching	Manholes 100 L/s AC
1146398	Manhole	storm	53.907	51.674	Gully 2D	Half Benching	Manholes 100 L/s AC
1146399	Manhole	storm	53.93	51.057	Gully 2D	Half Benching	Manholes 100 L/s AC
1146400	Manhole	storm	53.804	50.766	Gully 2D	Half Benching	Manholes 100 L/s AC
1146401	Manhole	storm	53.954	50.542	Gully 2D	Half Benching	Manholes 100 L/s AC
1146403	Manhole	storm	53.658	50.351	Gully 2D	Half Benching	Manholes 100 L/s AC
1181287	Manhole	storm	91.758	88.61	Gully 2D	Half Benching	Manholes 100 L/s AC
1181288	Manhole	storm	93.011	90.8	Gully 2D	Half Benching	Manholes 100 L/s AC
1181289	Manhole	storm	93.066	91.19	Gully 2D	Half Benching	Manholes 100 L/s AC
1181552	Manhole	storm	104.993	101.68	Gully 2D	Half Benching	Manholes 100 L/s AC

Node ID	Node type	System type	Ground level (m AD)	Chamber floor level (m AD)	Flood type	Benching method	Head discharge table
1181599	Manhole	storm	106.406	105.18	Gully 2D	Half Benching	Manholes 100 L/s AC
1139361_1139388_Dummy	Manhole	storm	53.717	52.423	Gully 2D	Half Benching	Manholes 100 L/s AC
1142058_dummy	Manhole	storm	60.883	60.11	Gully 2D	Half Benching	Manholes 100 L/s AC
1142060_dummy	Manhole	storm	60.698	58.781	Gully 2D	Half Benching	Manholes 100 L/s AC
1142231_dummy	Manhole	storm	71.909	70.673	Gully 2D	Half Benching	Manholes 100 L/s AC
1142236_dummy	Manhole	storm	65.596	64.55	Gully 2D	Half Benching	Manholes 100 L/s AC
1142238_dummy	Manhole	storm	65.916	61.184	Gully 2D	Half Benching	Manholes 100 L/s AC
1142244_dummy	Manhole	storm	68.92	67.5	Gully 2D	Half Benching	Manholes 100 L/s AC
1142312_dummy_1	Manhole	storm	128.455	127.505	Gully 2D	Half Benching	Manholes 100 L/s AC
1142315_dummy	Manhole	storm	114.982	111.85	Gully 2D	Half Benching	Manholes 100 L/s AC
1142349_dummy	Manhole	storm	64.605	62.38	Gully 2D	Half Benching	Manholes 100 L/s AC
1142357_dummy	Manhole	storm	55.689	53.132	Gully 2D	Half Benching	Manholes 100 L/s AC
1142553_dummy	Manhole	storm	66.474	59.43	Gully 2D	Half Benching	Manholes 100 L/s AC
1143332_dummy_1	Manhole	storm	100.021	97.245	Gully 2D	Half Benching	Manholes 100 L/s AC
1143332_dummy_2	Manhole	storm	101.24	100.64	Gully 2D	Half Benching	Manholes 100 L/s AC
1143474_Dummy	Manhole	storm	56.043	52.43	Gully 2D	Half Benching	Manholes 100 L/s AC
1143678_dummy	Manhole	storm	65.238	63.898	Gully 2D	Half Benching	Manholes 100 L/s AC
1143682_dummy	Manhole	storm	66.67	65.787	Gully 2D	Half Benching	Manholes 100 L/s AC
1143794_dummy	Manhole	storm	54.644	52.879	Gully 2D	Half Benching	Manholes 100 L/s AC
1144727_dummy_1	Manhole	storm	69.47	66.936	Gully 2D	Half Benching	Manholes 100 L/s AC
1144727_dummy_2	Manhole	storm	66.79	63.896	Gully 2D	Half Benching	Manholes 100 L/s AC
1144923_dummy	Manhole	storm	82.153	79.828	Gully 2D	Half Benching	Manholes 100 L/s AC
1144933_dummy	Manhole	storm	77.917	76.6	Gully 2D	Half Benching	Manholes 100 L/s AC
1144981_dummy	Manhole	storm	62.288	58.827	Gully 2D	Half Benching	Manholes 100 L/s AC
1145357_dummy_1	Manhole	storm	90.646	85.3	Gully 2D	Half Benching	Manholes 100 L/s AC
1145357_dummy_2	Manhole	storm	84.628	81.31	Gully 2D	Half Benching	Manholes 100 L/s AC
1145357_dummy_3	Manhole	storm	82.893	79.72	Gully 2D	Half Benching	Manholes 100 L/s AC
1145361_dummy_1	Manhole	storm	100.083	96.35	Gully 2D	Half Benching	Manholes 100 L/s AC
1145361_dummy_2	Manhole	storm	97.083	92.432	Gully 2D	Half Benching	Manholes 100 L/s AC
1145366_dummy_1	Manhole	storm	128.444	125.891	Gully 2D	Half Benching	Manholes 100 L/s AC
1145366_dummy_2	Manhole	storm	127.203	124.641	Gully 2D	Half Benching	Manholes 100 L/s AC
1145366_dummy_3	Manhole	storm	123.752	121.324	Gully 2D	Half Benching	Manholes 100 L/s AC
1145369_dummy	Manhole	storm	151.713	150.392	Gully 2D	Half Benching	Manholes 100 L/s AC
1145372_dummy	Manhole	storm	166.903	163.548	Gully 2D	Half Benching	Manholes 100 L/s AC
1145374_dummy	Manhole	storm	172.572	167.812	Gully 2D	Half Benching	Manholes 100 L/s AC
1145401_dummy	Manhole	storm	60.708	58.929	Gully 2D	Half Benching	Manholes 100 L/s AC
1145401_dummy_1	Manhole	storm	62.898	61.11	Gully 2D	Half Benching	Manholes 100 L/s AC
1145401_dummy_2	Manhole	storm	62.428	61.744	Gully 2D	Half Benching	Manholes 100 L/s AC
1145672_dummy	Manhole	storm	56.055	53.522	Gully 2D	Half Benching	Manholes 100 L/s AC
1145968_dummy_1	Manhole	storm	132.766	131.8	Gully 2D	Half Benching	Manholes 100 L/s AC
1145968_dummy_2	Manhole	storm	132.527	131.09	Gully 2D	Half Benching	Manholes 100 L/s AC
1145968_dummy_3	Manhole	storm	138.466	137.42	Gully 2D	Half Benching	Manholes 100 L/s AC
1146232_dummy	Manhole	storm	69.447	66.851	Gully 2D	Half Benching	Manholes 100 L/s AC
1146233_dummy	Manhole	storm	66.487	63.585	Gully 2D	Half Benching	Manholes 100 L/s AC
1146235_dummy_1	Manhole	storm	56.874	54.8	Gully 2D	Half Benching	Manholes 100 L/s AC
1146380_dummy	Manhole	storm	55.423	52.019	Gully 2D	Half Benching	Manholes 100 L/s AC
1181599_dummy	Manhole	storm	107.265	103.81	Gully 2D	Half Benching	Manholes 100 L/s AC
1145965	Manhole	storm	159.807	158.172	Gully 2D	Half Benching	scruffy dome 1050mm diameter
100160A_Dummy	Manhole	storm	52.971	50.471	Sealed		
1142317_Dummy	Manhole	storm	111.8	111.49	Sealed		
1139486	Outfall 2D	storm	64.023	64.023			
1144721_dummy	Outfall 2D	storm	70.73	70.732			
ACC_Dummy	Outfall 2D	storm	64.135	64.135			
Culvert_203_US	Outfall 2D	storm	54.61	54.324			
1139120	Outfall 2D	storm	60.964	60.964			
1139171	Outfall 2D	storm	52.148	52.148			
1139323	Outfall 2D	storm	52.57	52.57			
1139324	Outfall 2D	storm	52.619	52.619			
1139335	Outfall 2D	storm	86.511	86.512			
1139361	Outfall 2D	storm	52.252	52.252			
1139388	Outfall 2D	storm	52.884	52.884			
1139472	Outfall 2D	storm	50.636	50.636			
1139491	Outfall 2D	storm	65.332	65.332			
1139492	Outfall 2D	storm	62.56	62.56			
1139529	Outfall 2D	storm	55.567	55.567			
1139625	Outfall 2D	storm	52.87	52.87			
1139700	Outfall 2D	storm	50.223	50.223			
1140481	Outfall 2D	storm	48.458	48.458			

Node ID	Node type	System type	Ground level (m AD)	Chamber floor level (m AD)	Flood type	Benching method	Head discharge table
1141018	Outfall 2D	storm	78.463	78.463			
1141020	Outfall 2D	storm	58.69	58.69			
1141021	Outfall 2D	storm	59.91	59.91			
1141098	Outfall 2D	storm	76.329	76.329			
1141349	Outfall 2D	storm	56.683	56.683			
1141494	Outfall 2D	storm	160.232	160.232			
1141495	Outfall 2D	storm	159.503	159.503			
1141499	Outfall 2D	storm	86.352	86.352			
1141511	Outfall 2D	storm	86.051	86.051			
1141561	Outfall 2D	storm	56.274	56.274			
1141648	Outfall 2D	storm	54.35	54.35			
1141774	Outfall 2D	storm	50.265	50.265			
1142330	Outfall 2D	storm	51.717	51.717			
1143331	Outfall 2D	storm	100.01	100.01			
1143332	Outfall 2D	storm	97.245	97.245			
1146394	Outfall 2D	storm	50.931	50.931			
100000_Dummy	Outfall 2D	storm	80.74	80.74			
100001_Dummy	Outfall 2D	storm	80.608	80.608			
100002_Dummy	Outfall 2D	storm	81.356	81.356			
100003_Dummy	Outfall 2D	storm	81.1	81.1			
100004_Dummy	Outfall 2D	storm	81.77	81.77			
100005_Dummy	Outfall 2D	storm	81.578	81.578			
100006_Dummy	Outfall 2D	storm	82.1	82.1			
100007_Dummy	Outfall 2D	storm	81.986	81.986			
100008_Dummy	Outfall 2D	storm	83.056	83.056			
100009_Dummy	Outfall 2D	storm	82.641	82.641			
100010_Dummy	Outfall 2D	storm	83.864	83.864			
100011_Dummy	Outfall 2D	storm	83.695	83.695			
100012_Dummy	Outfall 2D	storm	84.268	84.268			
100013_Dummy	Outfall 2D	storm	84.044	84.044			
100014_Dummy	Outfall 2D	storm	84.826	84.826			
100015_Dummy	Outfall 2D	storm	84.752	84.752			
100016_Dummy	Outfall 2D	storm	85.731	85.731			
100017_Dummy	Outfall 2D	storm	85.605	85.605			
100018_Dummy	Outfall 2D	storm	118.431	118.431			
100019_Dummy	Outfall 2D	storm	118.261	118.261			
100020_Dummy	Outfall 2D	storm	120.767	120.767			
100021_Dummy	Outfall 2D	storm	120.762	120.762			
100022_Dummy	Outfall 2D	storm	122.034	122.034			
100023_Dummy	Outfall 2D	storm	121.59	121.59			
100024_Dummy	Outfall 2D	storm	121.522	121.522			
100025_Dummy	Outfall 2D	storm	120.884	120.884			
100026_Dummy	Outfall 2D	storm	91.372	91.372			
100027_Dummy	Outfall 2D	storm	91.311	91.311			
100028_Dummy	Outfall 2D	storm	106.688	106.688			
100029_Dummy	Outfall 2D	storm	106.649	106.649			
100030_Dummy	Outfall 2D	storm	133.807	133.807			
100031_Dummy	Outfall 2D	storm	132.629	132.629			
100033_Dummy	Outfall 2D	storm	133.966	133.966			
100034_Dummy	Outfall 2D	storm	134.512	134.512			
100035_Dummy	Outfall 2D	storm	134.611	134.611			
100036_Dummy	Outfall 2D	storm	135.102	135.102			
100037_Dummy	Outfall 2D	storm	135.717	135.717			
100038_Dummy	Outfall 2D	storm	136.401	136.401			
100039_Dummy	Outfall 2D	storm	126.175	126.175			
100040_Dummy	Outfall 2D	storm	126.321	126.321			
100041_Dummy	Outfall 2D	storm	123.762	123.762			
100042_Dummy	Outfall 2D	storm	123.64	123.64			
100043_Dummy	Outfall 2D	storm	123.6	123.6			
100044_Dummy	Outfall 2D	storm	146.896	146.896			
100045_Dummy	Outfall 2D	storm	147.008	147.008			
100046_Dummy	Outfall 2D	storm	147.154	147.154			
100047_Dummy	Outfall 2D	storm	147.917	147.917			
100048_Dummy	Outfall 2D	storm	151.048	151.048			
100049_Dummy	Outfall 2D	storm	152.189	152.189			
100050_Dummy	Outfall 2D	storm	158.061	158.061			
100051_Dummy	Outfall 2D	storm	158.708	158.708			
100052_Dummy	Outfall 2D	storm	164.515	164.515			

Node ID	Node type	System type	Ground level (m AD)	Chamber floor level (m AD)	Flood type	Benching method	Head discharge table
100053_Dummy	Outfall 2D	storm	165.666	165.666			
100054_Dummy	Outfall 2D	storm	188.55	188.55			
100055_Dummy	Outfall 2D	storm	176.538	176.538			
100056_Dummy	Outfall 2D	storm	188.65	188.65			
100057_Dummy	Outfall 2D	storm	177.718	177.718			
100058_Dummy	Outfall 2D	storm	174.336	174.336			
100059_Dummy	Outfall 2D	storm	176.09	176.09			
100060_Dummy	Outfall 2D	storm	174.948	174.948			
100061_Dummy	Outfall 2D	storm	176.098	176.098			
100062_Dummy	Outfall 2D	storm	166.146	166.146			
100063_Dummy	Outfall 2D	storm	166.849	166.849			
100064_Dummy	Outfall 2D	storm	159.203	159.203			
100065_Dummy	Outfall 2D	storm	160.607	160.607			
100066_Dummy	Outfall 2D	storm	147.95	147.95			
100067_Dummy	Outfall 2D	storm	148.838	148.838			
100068_Dummy	Outfall 2D	storm	121.263	121.263			
100069_Dummy	Outfall 2D	storm	121.334	121.334			
100070_Dummy	Outfall 2D	storm	119.438	119.438			
100071_Dummy	Outfall 2D	storm	119.541	119.541			
100072_Dummy	Outfall 2D	storm	119.056	119.056			
100073_Dummy	Outfall 2D	storm	119.063	119.063			
100074_Dummy	Outfall 2D	storm	118.404	118.404			
100075_Dummy	Outfall 2D	storm	118.472	118.472			
100076_Dummy	Outfall 2D	storm	117.384	117.384			
100077_Dummy	Outfall 2D	storm	117.578	117.578			
100078_Dummy	Outfall 2D	storm	120.6	120.6			
100079_Dummy	Outfall 2D	storm	121.9	121.9			
100080_Dummy	Outfall 2D	storm	123.866	123.866			
100081_Dummy	Outfall 2D	storm	124.201	124.201			
100082_Dummy	Outfall 2D	storm	100.78	100.78			
100083_Dummy	Outfall 2D	storm	125.07	125.07			
100084_Dummy	Outfall 2D	storm	101.75	101.75			
100085_Dummy	Outfall 2D	storm	124.837	124.837			
100086_Dummy	Outfall 2D	storm	125.645	125.645			
100087_Dummy	Outfall 2D	storm	125.569	125.569			
100088_Dummy	Outfall 2D	storm	123.899	123.899			
100089_Dummy	Outfall 2D	storm	123.828	123.828			
100092_Dummy	Outfall 2D	storm	123.577	123.577			
100093_Dummy	Outfall 2D	storm	121.6	121.6			
100094_Dummy	Outfall 2D	storm	121.419	121.419			
100095_Dummy	Outfall 2D	storm	120.766	120.766			
100096_Dummy	Outfall 2D	storm	120.354	120.354			
100097_Dummy	Outfall 2D	storm	119.194	119.194			
100098_Dummy	Outfall 2D	storm	118.833	118.833			
100099_Dummy	Outfall 2D	storm	117.595	117.595			
100100_Dummy	Outfall 2D	storm	116.804	116.804			
100101_Dummy	Outfall 2D	storm	114.5	114.5			
100102_Dummy	Outfall 2D	storm	113.687	113.687			
100103_Dummy	Outfall 2D	storm	111.066	111.066			
100104_Dummy	Outfall 2D	storm	110.631	110.631			
100105_Dummy	Outfall 2D	storm	109.829	109.829			
100106_Dummy	Outfall 2D	storm	109.3	109.3			
100107_Dummy	Outfall 2D	storm	109.005	109.005			
100108_Dummy	Outfall 2D	storm	108.639	108.639			
100109_Dummy	Outfall 2D	storm	106.971	106.971			
100110_Dummy	Outfall 2D	storm	106.591	106.591			
100112_Dummy	Outfall 2D	storm	103.763	103.763			
100113_Dummy	Outfall 2D	storm	103.283	103.283			
100114_Dummy	Outfall 2D	storm	97.94	97.94			
100115_Dummy	Outfall 2D	storm	96.9	96.9			
100116_Dummy	Outfall 2D	storm	97.002	97.002			
100117_Dummy	Outfall 2D	storm	96.707	96.707			
100118_Dummy	Outfall 2D	storm	95.488	95.488			
100119_Dummy	Outfall 2D	storm	95.17	95.17			
100120_Dummy	Outfall 2D	storm	95.488	95.488			
100121_Dummy	Outfall 2D	storm	95.17	95.17			
100122_Dummy	Outfall 2D	storm	94.264	94.264			
100123_Dummy	Outfall 2D	storm	93.773	93.773			

Node ID	Node type	System type	Ground level (m AD)	Chamber floor level (m AD)	Flood type	Benching method	Head discharge table
100124_Dummy	Outfall 2D	storm	93.408	93.408			
100125_Dummy	Outfall 2D	storm	93.156	93.156			
100126_Dummy	Outfall 2D	storm	91.253	91.253			
100127_Dummy	Outfall 2D	storm	90.042	90.042			
100128_Dummy	Outfall 2D	storm	89.469	89.469			
100129_Dummy	Outfall 2D	storm	88.257	88.257			
100130_Dummy	Outfall 2D	storm	88.532	88.532			
100131_Dummy	Outfall 2D	storm	88.383	88.383			
100132_Dummy	Outfall 2D	storm	88.264	88.264			
100133_Dummy	Outfall 2D	storm	88.008	88.008			
100134_Dummy	Outfall 2D	storm	87.84	87.84			
100135_Dummy	Outfall 2D	storm	87.74	87.74			
100136_Dummy	Outfall 2D	storm	89.039	89.039			
100137_Dummy	Outfall 2D	storm	88.903	88.903			
100138_Dummy	Outfall 2D	storm	90.927	90.927			
100139_Dummy	Outfall 2D	storm	90.925	90.925			
100140_Dummy	Outfall 2D	storm	92.812	92.812			
100141_Dummy	Outfall 2D	storm	91.882	91.882			
100142_Dummy	Outfall 2D	storm	98.088	98.088			
100143_Dummy	Outfall 2D	storm	97.203	97.203			
100144_Dummy	Outfall 2D	storm	101.039	101.039			
100145_Dummy	Outfall 2D	storm	100.519	100.519			
100146_Dummy	Outfall 2D	storm	104.224	104.224			
100147_Dummy	Outfall 2D	storm	102.849	102.849			
100148_Dummy	Outfall 2D	storm	106.582	106.582			
100149_Dummy	Outfall 2D	storm	106.152	106.152			
100150_Dummy	Outfall 2D	storm	109.094	109.094			
100151_Dummy	Outfall 2D	storm	108.66	108.66			
100152_Dummy	Outfall 2D	storm	110.321	110.321			
100153_Dummy	Outfall 2D	storm	109.989	109.989			
100154_Dummy	Outfall 2D	storm	111.565	111.565			
100155_Dummy	Outfall 2D	storm	111.385	111.385			
100157_Dummy	Outfall 2D	storm	112.256	112.256			
100159_Dummy	Outfall 2D	storm	112.032	112.032			
100161_Dummy	Outfall 2D	storm	117.94	117.94			
100162_Dummy	Outfall 2D	storm	111.972	111.972			
100163_Dummy	Outfall 2D	storm	121.183	121.183			
100164_Dummy	Outfall 2D	storm	121.18	121.18			
100165_Dummy	Outfall 2D	storm	123.524	123.524			
100166_Dummy	Outfall 2D	storm	122.571	122.571			
100167_Dummy	Outfall 2D	storm	130.709	130.709			
100168_Dummy	Outfall 2D	storm	130.039	130.039			
100169_Dummy	Outfall 2D	storm	77.61	77.61			
100170_Dummy	Outfall 2D	storm	131.816	131.816			
100171_Dummy	Outfall 2D	storm	77.31	77.31			
100172_Dummy	Outfall 2D	storm	131.54	131.54			
100173_Dummy	Outfall 2D	storm	87.58	87.58			
100174_Dummy	Outfall 2D	storm	86.006	86.006			
100175_Dummy	Outfall 2D	storm	85.351	85.351			
100176_Dummy	Outfall 2D	storm	85.237	85.237			
100177_Dummy	Outfall 2D	storm	84.557	84.557			
100179_Dummy	Outfall 2D	storm	84.148	84.148			
100181_Dummy	Outfall 2D	storm	82.49	82.49			
100182_Dummy	Outfall 2D	storm	82.338	82.338			
100183_Dummy	Outfall 2D	storm	82.008	82.008			
100184_Dummy	Outfall 2D	storm	81.894	81.894			
100185_Dummy	Outfall 2D	storm	81.462	81.462			
100187_Dummy	Outfall 2D	storm	81.407	81.407			
100189_Dummy	Outfall 2D	storm	81.106	81.106			
100191_Dummy	Outfall 2D	storm	81.007	81.007			
100193_Dummy	Outfall 2D	storm	80.65	80.65			
100195_Dummy	Outfall 2D	storm	80.582	80.582			
100196_Dummy	Outfall 2D	storm	70.11	70.11			
100197_Dummy	Outfall 2D	storm	60.97	60.97			
100198_Dummy	Outfall 2D	storm	80.333	80.333			
100200_Dummy	Outfall 2D	storm	80.272	80.272			
100201_Dummy	Outfall 2D	storm	79.785	79.785			
100202_Dummy	Outfall 2D	storm	79.097	79.097			

Node ID	Node type	System type	Ground level (m AD)	Chamber floor level (m AD)	Flood type	Benching method	Head discharge table
100203_Dummy	Outfall 2D	storm	74.309	74.309			
100204_Dummy	Outfall 2D	storm	74.283	74.283			
100205_Dummy	Outfall 2D	storm	74.027	74.027			
100206_Dummy	Outfall 2D	storm	73.861	73.861			
100207_Dummy	Outfall 2D	storm	63.943	63.943			
100208_Dummy	Outfall 2D	storm	63.864	63.864			
100209_Dummy	Outfall 2D	storm	63.557	63.557			
100210_Dummy	Outfall 2D	storm	63.415	63.415			
100211_Dummy	Outfall 2D	storm	57.28	57.28			
100212_Dummy	Outfall 2D	storm	57.116	57.116			
100213_Dummy	Outfall 2D	storm	54.1	54.1			
100214_Dummy	Outfall 2D	storm	55.51	55.51			
100216_Dummy	Outfall 2D	storm	51.26	51.26			
100220_Dummy	Outfall 2D	storm	49	49			
100221_Dummy	Outfall 2D	storm	48.61	48.61			
1139172_1139173	Outfall 2D	storm	54.77	54.77			
1142300_dummy	Outfall 2D	storm	79.789	79.789			
1142312_dummy_2	Outfall 2D	storm	127.1	127.1			
1143331_dummy	Outfall 2D	storm	100.2	100.2			
1145286_dummy	Outfall 2D	storm	62.828	62.828			
1145972_dummy	Outfall 2D	storm	107.9	107.9			
1146235_dummy_2	Outfall 2D	storm	53.8	53.8			
1146244_dummy	Outfall 2D	storm	53.8	53.8			
99934_Dummy	Outfall 2D	storm	52.71	52.71			
99935_Dummy	Outfall 2D	storm	51.963	51.963			
99936_Dummy	Outfall 2D	storm	54.659	54.659			
99937_Dummy	Outfall 2D	storm	54.394	54.394			
99938_Dummy	Outfall 2D	storm	55.237	55.237			
99939_Dummy	Outfall 2D	storm	54.934	54.934			
99940_Dummy	Outfall 2D	storm	55.626	55.626			
99941_Dummy	Outfall 2D	storm	55.526	55.526			
99942_Dummy	Outfall 2D	storm	55.87	55.87			
99943_Dummy	Outfall 2D	storm	55.764	55.764			
99944_Dummy	Outfall 2D	storm	55.998	55.998			
99945_Dummy	Outfall 2D	storm	55.818	55.818			
99946_Dummy	Outfall 2D	storm	56.593	56.593			
99947_Dummy	Outfall 2D	storm	56.678	56.678			
99948_Dummy	Outfall 2D	storm	56.85	56.85			
99949_Dummy	Outfall 2D	storm	56.8	56.8			
99950_Dummy	Outfall 2D	storm	57.4	57.4			
99951_Dummy	Outfall 2D	storm	57.3	57.3			
99952_Dummy	Outfall 2D	storm	56.911	56.911			
99953_Dummy	Outfall 2D	storm	56.703	56.703			
99954_Dummy	Outfall 2D	storm	56.673	56.673			
99955_Dummy	Outfall 2D	storm	56.419	56.419			
99956_Dummy	Outfall 2D	storm	55.942	55.942			
99957_Dummy	Outfall 2D	storm	55.989	55.989			
99958_Dummy	Outfall 2D	storm	56.203	56.203			
99959_Dummy	Outfall 2D	storm	56.136	56.136			
99960_Dummy	Outfall 2D	storm	56.808	56.808			
99961_Dummy	Outfall 2D	storm	56.773	56.773			
99962_Dummy	Outfall 2D	storm	56.41	56.41			
99963_Dummy	Outfall 2D	storm	56.329	56.329			
99964_Dummy	Outfall 2D	storm	56.342	56.342			
99965_Dummy	Outfall 2D	storm	56.383	56.383			
99966_Dummy	Outfall 2D	storm	56.126	56.126			
99967_Dummy	Outfall 2D	storm	56.081	56.081			
99968_Dummy	Outfall 2D	storm	55.6	55.6			
99969_Dummy	Outfall 2D	storm	55.5	55.5			
99970_Dummy	Outfall 2D	storm	55.273	55.273			
99971_Dummy	Outfall 2D	storm	55.25	55.25			
99972_Dummy	Outfall 2D	storm	54.94	54.94			
99973_Dummy	Outfall 2D	storm	54.938	54.938			
99974_Dummy	Outfall 2D	storm	55.273	55.273			
99975_Dummy	Outfall 2D	storm	55.25	55.25			
99976_Dummy	Outfall 2D	storm	54.731	54.731			
99977_Dummy	Outfall 2D	storm	54.488	54.488			
99978_Dummy	Outfall 2D	storm	55.923	55.923			

Node ID	Node type	System type	Ground level (m AD)	Chamber floor level (m AD)	Flood type	Benching method	Head discharge table
99979_Dummy	Outfall 2D	storm	55.535	55.535			
99980_Dummy	Outfall 2D	storm	73.657	73.657			
99981_Dummy	Outfall 2D	storm	73.216	73.216			
99982_Dummy	Outfall 2D	storm	77.186	77.186			
99983_Dummy	Outfall 2D	storm	76.334	76.334			
99984_Dummy	Outfall 2D	storm	77.886	77.886			
99985_Dummy	Outfall 2D	storm	77.679	77.679			
99986_Dummy	Outfall 2D	storm	78.043	78.043			
99987_Dummy	Outfall 2D	storm	77.947	77.947			
99988_Dummy	Outfall 2D	storm	78.493	78.493			
99989_Dummy	Outfall 2D	storm	78.383	78.383			
99990_Dummy	Outfall 2D	storm	78.93	78.93			
99991_Dummy	Outfall 2D	storm	78.768	78.768			
99992_Dummy	Outfall 2D	storm	79.024	79.024			
99993_Dummy	Outfall 2D	storm	78.954	78.954			
99994_Dummy	Outfall 2D	storm	79.84	79.84			
99995_Dummy	Outfall 2D	storm	79.534	79.534			
99996_Dummy	Outfall 2D	storm	80.066	80.066			
99997_Dummy	Outfall 2D	storm	79.949	79.949			
99998_Dummy	Outfall 2D	storm	80.625	80.625			
99999_Dummy	Outfall 2D	storm	80.503	80.503			
ACC_Inlet	Outfall 2D	storm	64.27	64.27			

APPENDIX D: Stormwater Pipe Asset Data

US node ID	Link suffix	DS node ID	Conduit type	System type	Asset ID	Length (m)	Shape ID	Width (mm)	Height (mm)	US invert (m AD)	DS invert (m AD)
1142324	1	1142323	Conduit	storm	1160207	25.9	CIRC	150	150	54.79	54.15
1142183	1	1142182	Conduit	storm	1160084	5	CIRC	225	225	75.86	75.86
1145968_dummy_1	1	1145968_dummy_2	Conduit	storm	Link_15	5	CIRC	225	225	131.80	131.09
1142312_dummy_1	1	1142312_dummy_2	Conduit	storm	1163174	6.9	CIRC	225	225	127.51	127.10
1142312	1	1142312_dummy_1	Conduit	storm	1160199	39.6	CIRC	225	225	129.83	127.51
1142182	1	1142181	Conduit	storm	1160082	45.6	CIRC	225	225	75.86	74.84
1142184	1	1142183	Conduit	storm	1160085	51.4	CIRC	225	225	76.41	75.86
1142171	1	1142170	Conduit	storm	1160074	51.8	CIRC	225	225	80.59	80.59
1142143	1	1145978	Conduit	storm	1160762	56.1	CIRC	225	225	86.95	86.68
1142283	1	1142280	Conduit	storm	1160179	67.6	CIRC	225	225	77.70	76.70
1142132	1	1143671	Conduit	storm	1166349	91	CIRC	225	225	71.85	62.97
1146299	1	1146298	Conduit	storm	1168063	91.5	CIRC	225	225	155.08	144.99
1145968_dummy_3	1	1145968_dummy_1	Conduit	storm	1159627	93.2	CIRC	225	225	137.42	131.80
1142272	1	1142255	Conduit	storm	1160154	161.8	CIRC	225	225	76.95	73.32
1142350	1	1142349	Conduit	storm	1160224	41.4	CIRC	250	250	65.08	64.41
1142349	2	1142349_dummy	Conduit	storm	1160226	57.2	CIRC	250	250	64.36	62.38
1143493	1	1142350	Conduit	storm	1160225	83.4	CIRC	250	250	65.24	65.08
1145966	1	1145967	Conduit	storm	1165998	13.9	CIRC	275	275	149.46	149.14
1142348	1	1142347	Conduit	storm	1160641	59.6	CIRC	275	275	64.15	63.53
1145334	2	1141349	Conduit	storm	1165611	5	CIRC	300	300	56.72	56.68
1181289	1	1181288	Conduit	storm	1181308	5	CIRC	300	300	91.19	90.80
1142217	1	1142216	Conduit	storm	1160116	6.4	CIRC	300	300	64.18	64.17
1142349_dummy	1	1143491	Conduit	storm	1160227	6.5	CIRC	300	300	62.38	62.16
1145762	1	1145761	Conduit	storm	1165621	8.8	CIRC	300	300	64.01	63.82
1142337	1	1139324	Conduit	storm	1160698	9.5	CIRC	300	300	53.48	52.62
1145763	1	1145760	Conduit	storm	1165623	10.3	CIRC	300	300	63.36	63.07
1143669	1	1139491	Conduit	storm	1161442	10.6	CIRC	300	300	67.06	65.33
1145964	1	1145965	Conduit	storm	1165992	11.4	CIRC	300	300	159.90	158.86
1145468	2	1141098	Conduit	storm	1165020	12.1	CIRC	300	300	76.51	76.33
1146377	1	1146376	Conduit	storm	1168189	13.8	CIRC	300	300	55.21	55.04
1146398	1	1146399	Conduit	storm	1168218	14	CIRC	300	300	51.67	51.06
1142273	1	1142272	Conduit	storm	1160172	14.9	CIRC	300	300	77.38	76.95
1142288	1	1142287	Conduit	storm	1160184_1159611	14.9	CIRC	300	300	91.88	91.63
1145489	1	1145334	Conduit	storm	1164742	15.3	CIRC	300	300	56.96	56.72
1143853	1	1143848	Conduit	storm	1161857	15.5	CIRC	300	300	55.70	55.54
1145764	1	1145762	Conduit	storm	1165620	15.5	CIRC	300	300	64.58	64.01
1142223	1	1142222	Conduit	storm	1160123	18.2	CIRC	300	300	65.19	64.54
1144586	1	1142329	Conduit	storm	1163323	19	CIRC	300	300	52.46	51.96
1143426	1	1145334	Conduit	storm	1165608	19.4	CIRC	300	300	57.36	56.72
1142315_dummy	1	1142317_Dummy	Conduit	storm	1160203	20.6	CIRC	300	300	111.85	111.50
1145761	1	1145763	Conduit	storm	1165622	20.7	CIRC	300	300	63.82	63.36
1142354	2	1146059	Conduit	storm	1166158	22.2	CIRC	300	300	63.01	62.73
1142482	1	1142490	Conduit	storm	1166359	23.9	CIRC	300	300	76.50	72.60
1142349	1	1142348	Conduit	storm	1160223	24.4	CIRC	300	300	64.36	64.15
1142280	1	1142279	Conduit	storm	1160177	25.9	CIRC	300	300	76.70	75.39
1142175	1	1144933_dummy	Conduit	storm	1160255	26	CIRC	300	300	76.78	76.60
1144519	2	1144518	Conduit	storm	1163201	26.8	CIRC	300	300	55.75	55.70
1181287	1	1145491	Conduit	storm	1181310	26.8	CIRC	300	300	88.61	85.83
1144420	1	1144421	Conduit	storm	1162976	28.5	CIRC	300	300	72.40	71.88
1143645	1	1143644	Conduit	storm	1161368	29	CIRC	300	300	80.99	80.78
1142490	1	1143669	Conduit	storm	1161441	34.1	CIRC	300	300	72.60	67.06
1142155	1	1142154	Conduit	storm	1160060	35.4	CIRC	300	300	87.24	86.35
1145760	1	1145759	Conduit	storm	1165624	36	CIRC	300	300	63.07	61.75
1143769	1	1146377	Conduit	storm	1168198	37.8	CIRC	300	300	55.52	55.27
1144729	1	1144726	Conduit	storm	1163615	38.1	CIRC	300	300	68.09	67.85
1145491	1	1142301	Conduit	storm	1165075	38.3	CIRC	300	300	85.83	85.16
1142315	1	1142315_dummy	Conduit	storm	1160202	41.1	CIRC	300	300	112.56	111.85
1144925	1	1144924	Conduit	storm	1163936	43.3	CIRC	300	300	86.63	85.56
1181288	1	1181287	Conduit	storm	1181309	43.6	CIRC	300	300	90.80	88.61
1146059	2	1143491	Conduit	storm	1160229	44.8	CIRC	300	300	62.73	62.16
1143644	1	1143643	Conduit	storm	1161367	46.8	CIRC	300	300	80.78	80.50
1143714	1	1143713	Conduit	storm	1161535	47.9	CIRC	300	300	63.13	60.05
1144026	1	1146043	Conduit	storm	1166128	48.1	CIRC	300	300	69.99	68.94
1144518	2	1146051	Conduit	storm	1163212	48.2	CIRC	300	300	55.70	55.66

US node ID	Link suffix	DS node ID	Conduit type	System type	Asset ID	Length (m)	Shape ID	Width (mm)	Height (mm)	US invert (m AD)	DS invert (m AD)
1142347	1	1142346	Conduit	storm	1160222	51.5	CIRC	300	300	63.48	63.28
1144417	1	1144420	Conduit	storm	1162975	54	CIRC	300	300	73.62	72.42
1145330	1	1145489	Conduit	storm	1165064	56.9	CIRC	300	300	58.18	56.96
1142232	1	1146390	Conduit	storm	1160133	57.2	CIRC	300	300	68.73	68.14
1142298	1	1145979	Conduit	storm	1160710	59.2	CIRC	300	300	89.09	86.85
1142541	1	1142543	Conduit	storm	1159161	59.6	CIRC	300	300	79.86	77.48
1144924	1	1144923	Conduit	storm	1163937	63.1	CIRC	300	300	85.56	81.89
1142249	1	1142247	Conduit	storm	1160145	66.1	CIRC	300	300	68.56	67.69
1142231_dummy	1	1142229	Conduit	storm	1160130	67.5	CIRC	300	300	70.67	69.47
1144113	1	1144112	Conduit	storm	1162408	69.7	CIRC	300	300	67.54	66.10
1142195	1	1142194	Conduit	storm	1160092	71.7	CIRC	300	300	65.33	64.53
1143489	1	1142345	Conduit	storm	1160221	77.3	CIRC	300	300	61.27	59.37
1142234	1	1142222	Conduit	storm	1160124	78.5	CIRC	300	300	64.99	64.65
1142543	1	1142175	Conduit	storm	1160077	79.6	CIRC	300	300	77.48	76.78
1144731	1	1144732	Conduit	storm	1163602	81.8	CIRC	300	300	69.07	68.45
1142559	1	1142560	Conduit	storm	1159189	87.1	CIRC	300	300	64.76	64.07
1142231	1	1142231_dummy	Conduit	storm	1160131	91.7	CIRC	300	300	72.31	70.67
1142233	1	1142222	Conduit	storm	1160122	104.1	CIRC	300	300	66.11	64.54
1146390	1	1142233	Conduit	storm	1168211	135	CIRC	300	300	68.14	66.11
1142382	1	1142380	Conduit	storm	1160258	139	CIRC	300	300	64.31	62.94
1142276	1	1142272	Conduit	storm	1160171	139.9	CIRC	300	300	80.79	77.63
1142181	1	1144026	Conduit	storm	1162242	174.5	CIRC	300	300	74.84	70.05
1142287	1	1142268	Conduit	storm	1160168	319.5	CIRC	300	300	91.62	85.15
1142216	1	1142204	Conduit	storm	1160103	57.8	CIRC	325	325	64.17	64.03
1142237	1	1142236	Conduit	storm	1160134	129.6	CIRC	350	350	64.98	64.39
1142236_dummy	1	1142236	Conduit	storm	1167649	166	CIRC	350	350	64.55	64.35
1142222	1	1142221	Conduit	storm	1160120	5	CIRC	375	375	64.54	64.51
1145683	1	1145684	Conduit	storm	1165441	5.8	CIRC	375	375	71.98	71.43
1142209	1	1144028	Conduit	storm	1162247	6.9	CIRC	375	375	70.97	70.80
1142278	1	1144427	Conduit	storm	1160261	8.6	CIRC	375	375	71.96	71.72
1141645	1	1146195	Conduit	storm	1167891	8.8	CIRC	375	375	54.58	54.58
1145287	1	1142193	Conduit	storm	1164672	12.5	CIRC	375	375	64.00	63.90
1142558	1	1142455	Conduit	storm	1161014	12.8	CIRC	375	375	62.90	62.60
1146043	1	1146044	Conduit	storm	1166129	14.1	CIRC	375	375	68.94	68.87
1142247	1	1142246	Conduit	storm	1160144	16.5	CIRC	375	375	67.65	67.28
1145684	1	1146177	Conduit	storm	1167825	16.8	CIRC	375	375	71.43	69.87
1142208	1	1142207	Conduit	storm	1160108	18	CIRC	375	375	69.46	69.10
1143713	1	1139529	Conduit	storm	1161536	22.1	CIRC	375	375	60.05	55.57
1142455	1	1142238_dummy	Conduit	storm	1161013	22.5	CIRC	375	375	62.60	61.18
1144422	1	1144423	Conduit	storm	1162986	22.7	CIRC	375	375	71.39	71.06
1142180	1	1144734	Conduit	storm	1160787	23.2	CIRC	375	375	70.44	69.75
1144923_dummy	1	1144853	Conduit	storm	1163818	23.7	CIRC	375	375	79.83	79.17
1144112	1	1144107	Conduit	storm	1162407	25.5	CIRC	375	375	66.10	65.93
1145356	1	1145357_dummy_3	Conduit	storm	1164825	25.6	CIRC	375	375	87.19	79.72
1142193	1	1145286	Conduit	storm	1164652	26	CIRC	375	375	63.90	63.10
1144421	1	1144422	Conduit	storm	1162985	27.1	CIRC	375	375	71.88	71.39
1146195	1	1146196	Conduit	storm	1167893	30	CIRC	375	375	54.58	54.55
1146044	1	1146038	Conduit	storm	1166130	32.1	CIRC	375	375	68.87	68.81
1142194	1	1145287	Conduit	storm	1160091	34.6	CIRC	375	375	64.45	64.00
1142246	1	1142245	Conduit	storm	1160142	37.1	CIRC	375	375	67.24	66.47
1142206	1	1142205	Conduit	storm	1160106	39.4	CIRC	375	375	66.47	65.67
1146177	1	1146178	Conduit	storm	1167863	44.5	CIRC	375	375	68.88	63.86
1142179	1	1142180	Conduit	storm	1160081	46.4	CIRC	375	375	70.57	70.44
1145981	1	1145980	Conduit	storm	1166019	48.4	CIRC	375	375	87.03	86.86
1142210	1	1142209	Conduit	storm	1160111	49.3	CIRC	375	375	72.52	70.97
1142294	1	1145981	Conduit	storm	1160701	50.5	CIRC	375	375	90.00	87.03
1143682	1	1143682_dummy	Conduit	storm	1161479	50.7	CIRC	375	375	66.28	65.79
1142560	1	1142558	Conduit	storm	1161015	50.9	CIRC	375	375	64.07	62.90
1144732	1	1144726	Conduit	storm	1163603	61.2	CIRC	375	375	68.45	67.87
1144427	1	1144428	Conduit	storm	1163006	62	CIRC	375	375	71.66	70.29
1144028	1	1142208	Conduit	storm	1160109	66.2	CIRC	375	375	70.80	69.46
1142221	1	1142220	Conduit	storm	1160119	71.2	CIRC	375	375	64.51	64.15
1144923	1	1144923_dummy	Conduit	storm	1163942	74.7	CIRC	375	375	81.89	79.83
1144519	1	1144516	Conduit	storm	1163200	80.7	CIRC	375	375	55.75	55.25
1142211	1	1142210	Conduit	storm	1160112	89.8	CIRC	375	375	73.40	72.52
1142279	1	1142278	Conduit	storm	1160176	111.4	CIRC	375	375	75.35	71.96
1142207	1	1142206	Conduit	storm	1160107	130.5	CIRC	375	375	69.10	66.47
1146196	1	1141648	Conduit	storm	1167894	134.5	CIRC	375	375	54.55	54.35
1145970	1	1142317	Conduit	storm	1160723	146.4	CIRC	375	375	127.82	111.32

US node ID	Link suffix	DS node ID	Conduit type	System type	Asset ID	Length (m)	Shape ID	Width (mm)	Height (mm)	US invert (m AD)	DS invert (m AD)
1142346	1	1143490	Conduit	storm	1160895	10.7	CIRC	400	400	63.28	63.14
1142140	1	1142135	Conduit	storm	1166025	21	CIRC	400	400	88.15	87.70
1142170	1	1142168	Conduit	storm	1160073	23.1	CIRC	400	400	80.59	80.59
1142205	1	1142204	Conduit	storm	1160104	39.9	CIRC	400	400	65.67	63.84
1145967	1	1146298	Conduit	storm	1165995	42.1	CIRC	400	400	149.14	145.14
1142380	1	1142055	Conduit	storm	1159878	56.6	CIRC	400	400	62.94	61.62
1146298	1	1145968	Conduit	storm	1168055	58	CIRC	400	400	144.99	138.89
1143493	2	1143492	Conduit	storm	1160890	75.1	CIRC	400	400	65.24	63.21
1142204	1	1142203	Conduit	storm	1160102	162.7	CIRC	400	400	63.73	63.59
1143554	1	1143332_dummy_1	Conduit	storm	1161068	5	CIRC	450	450	99.50	99.09
1144701	1	1142203	Conduit	storm	1163552	5	CIRC	450	450	63.62	63.59
1145717	1	1144802	Conduit	storm	1165541	5	CIRC	450	450	101.88	101.54
1142232	2	1142226	Conduit	storm	1160132	10	CIRC	450	450	68.76	68.75
1143332_dummy_1	1	1143332	Conduit	storm	1161069	11.5	CIRC	450	450	97.25	97.25
1145972	1	1145972_dummy	Conduit	storm	1166006	13.4	CIRC	450	450	108.35	107.90
1144853	1	1142166	Conduit	storm	1163816	14.7	CIRC	450	450	79.17	78.89
1143332_dummy_2	1	1143332_dummy_1	Conduit	storm	1161067	15.5	CIRC	450	450	100.65	97.25
1145968_dummy_2	1	1145969	Conduit	storm	1165996	15.8	CIRC	450	450	131.09	129.90
1144428	1	1144429	Conduit	storm	1163007	19.8	CIRC	450	450	70.29	69.84
1142596	1	1142226	Conduit	storm	1166367	22.9	CIRC	450	450	69.06	68.89
1144798	1	1142498	Conduit	storm	1163751	24.1	CIRC	450	450	92.22	92.14
1143679	1	1143678	Conduit	storm	1161472	27.6	CIRC	450	450	64.24	64.08
1142553	1	1142368	Conduit	storm	1160239	27.8	CIRC	450	450	59.19	59.03
1144434	1	1144435	Conduit	storm	1163029	29.1	CIRC	450	450	70.15	69.52
1146178	1	1146179	Conduit	storm	1167864	38.7	CIRC	450	450	63.86	62.51
1144096	1	1144095	Conduit	storm	1162388	39.5	CIRC	450	450	67.54	67.03
1144980	1	1144981	Conduit	storm	1164056	42.9	CIRC	450	450	63.35	62.32
1143684	1	1143679	Conduit	storm	1161473	44.2	CIRC	450	450	64.87	64.03
1142368	1	1142060_dummy	Conduit	storm	1159986	44.9	CIRC	450	450	59.03	58.78
1142553_dummy	1	1142553	Conduit	storm	1160639	45	CIRC	450	450	59.43	59.19
1142160	1	1142158	Conduit	storm	1160065	46.3	CIRC	450	450	88.55	86.39
1142499	1	1144798	Conduit	storm	1161116	48.9	CIRC	450	450	92.70	92.22
1144516	1	1144517	Conduit	storm	1163194	51.4	CIRC	450	450	55.25	54.84
1181599	1	1181599_dummy	Conduit	storm	1181639	51.6	CIRC	450	450	105.18	103.81
1144725	1	1144726	Conduit	storm	1163619	54.5	CIRC	450	450	68.25	67.77
1142498	1	1142516	Conduit	storm	1161090	55.6	CIRC	450	450	92.14	91.07
1144981_dummy	1	1142198	Conduit	storm	1160097	59.4	CIRC	450	450	58.83	57.40
1142354	1	1146055	Conduit	storm	1166159	60.7	CIRC	450	450	63.01	62.56
1144107	1	1143400	Conduit	storm	1162402	61.5	CIRC	450	450	65.93	64.55
1144423	1	1144434	Conduit	storm	1163023	64.8	CIRC	450	450	70.98	70.15
1143494	1	1143492	Conduit	storm	1160891	65.7	CIRC	450	450	63.46	63.22
1142595	1	1142596	Conduit	storm	1166365	67.9	CIRC	450	450	69.54	69.09
1142318	1	1145972	Conduit	storm	1166005	71.1	CIRC	450	450	115.28	108.35
1145968	1	1145968_dummy_2	Conduit	storm	1165996_1	81.4	CIRC	450	450	138.89	131.09
1144802	1	1144803	Conduit	storm	1163722	83.8	CIRC	450	450	101.54	95.52
1143682_dummy	1	1143684	Conduit	storm	1161480	93.9	CIRC	450	450	65.79	64.87
1145969	1	1142318	Conduit	storm	1166004	120.4	CIRC	450	450	129.58	115.28
1142317	1	1143554	Conduit	storm	1160718	123	CIRC	450	450	111.32	99.50
1143678_dummy	1	1144701	Conduit	storm	1163551	145.2	CIRC	450	450	63.90	64.22
1144981	1	1144981_dummy	Conduit	storm	1164057	145.4	CIRC	450	450	62.32	58.83
1142236	1	1143678	Conduit	storm	1161493	28.1	CIRC	475	475	64.35	64.13
1142135	1	1142134	Conduit	storm	1160045	36.3	CIRC	475	475	87.67	87.17
1142227	1	1142226	Conduit	storm	1160127	22.4	CIRC	500	500	68.89	68.81
1142203	1	1142202	Conduit	storm	1160101	45.6	CIRC	500	500	63.59	63.29
1143678	1	1143678_dummy	Conduit	storm	1161494	60.1	CIRC	500	500	64.01	63.90
1142202	1	1142200	Conduit	storm	1160099	64.5	CIRC	500	500	63.29	62.85
1145980	1	1145979	Conduit	storm	1166020	5	CIRC	525	525	86.86	86.85
1146302	2	1145369_dummy	Conduit	storm	1168075	5.4	CIRC	525	525	151.14	150.39
1143672	1	1139492	Conduit	storm	1161451	13.7	CIRC	525	525	62.75	62.56
1146372	1	1146373	Conduit	storm	1168184	18	CIRC	525	525	56.31	56.13
1144793	1	1142516	Conduit	storm	1159130	18.1	CIRC	525	525	91.71	91.07
1144804	1	1144793	Conduit	storm	1163727	23.4	CIRC	525	525	92.70	91.79
1142167	1	1142166	Conduit	storm	1160070	28.8	CIRC	525	525	80.59	78.89
1142528	1	1142522	Conduit	storm	1159131	28.9	CIRC	525	525	101.05	97.85
1144429	1	1144435	Conduit	storm	1163030	32	CIRC	525	525	69.77	69.40
1142159	1	1142158	Conduit	storm	1160064	33.3	CIRC	525	525	86.62	86.39

US node ID	Link suffix	DS node ID	Conduit type	System type	Asset ID	Length (m)	Shape ID	Width (mm)	Height (mm)	US invert (m AD)	DS invert (m AD)
1139361_1139388_Dummy	2	1139361	Conduit	storm	Link_55	35.2	CIRC	525	525	52.42	52.25
1142158	1	1142154	Conduit	storm	1160061	48.3	CIRC	525	525	86.39	86.35
1145978	1	1145977	Conduit	storm	1166022	53.3	CIRC	525	525	86.65	86.37
1145979	1	1145978	Conduit	storm	1166021	57	CIRC	525	525	86.85	86.65
1144803	1	1144804	Conduit	storm	1163726	60.4	CIRC	525	525	95.52	92.70
1142522	1	1142521	Conduit	storm	1159132	80.2	CIRC	525	525	97.85	92.98
1144095	1	1144094	Conduit	storm	1162386	81.2	CIRC	525	525	67.03	66.06
1181599_dummy	1	1181552	Conduit	storm	1181642	81.7	CIRC	525	525	103.81	101.68
1142225	1	1142224	Conduit	storm	1160125	84.8	CIRC	525	525	67.15	65.67
1142168	1	1142167	Conduit	storm	1160071	86.1	CIRC	525	525	80.59	80.59
1142134	1	1139335	Conduit	storm	1160648	86.9	CIRC	525	525	87.15	86.51
1142224	1	1142221	Conduit	storm	1160121	104.3	CIRC	525	525	65.67	63.87
1142226	1	1142225	Conduit	storm	1160126	109.4	CIRC	525	525	68.60	67.14
1142517	1	1142529	Conduit	storm	1159134	5.6	CIRC	550	550	89.63	89.03
1146055	1	1142055	Conduit	storm	1166160	34	CIRC	550	550	62.56	62.31
1142521	1	1142517	Conduit	storm	1159133	76.5	CIRC	550	550	92.98	89.63
1142220	1	1142204	Conduit	storm	1160105	76.6	CIRC	550	550	64.15	63.78
1145360	1	1145359	Conduit	storm	1164818	5	CIRC	600	600	93.13	91.78
1145977	1	1141499	Conduit	storm	1166023	5.3	CIRC	600	600	86.37	86.35
1146182	1	1142058	Conduit	storm	1159982	5.9	CIRC	600	600	60.34	60.27
1142331	1	1142330	Conduit	storm	1160211	6.4	CIRC	600	600	51.77	51.72
1145721	1	1145720	Conduit	storm	1165524	10.7	CIRC	600	600	114.20	113.06
1145672	1	1145672_dummy	Conduit	storm	1165439	11.4	CIRC	600	600	53.57	53.52
1145672_dummy	1	1142357	Conduit	storm	1165440	12.4	CIRC	600	600	53.52	53.47
1143670	1	1143671	Conduit	storm	1161446	14.5	CIRC	600	600	63.54	62.97
1143671	1	1143672	Conduit	storm	1161447	15.5	CIRC	600	600	62.97	62.75
1146181	1	1146182	Conduit	storm	1167867	16.6	CIRC	600	600	60.69	60.42
1144094	1	1144093	Conduit	storm	1162397	18.1	CIRC	600	600	66.06	65.81
1145965	1	1145368	Conduit	storm	1165993	21.7	CIRC	600	600	158.17	156.20
1142242	1	1142241	Conduit	storm	1160138	22.1	CIRC	600	600	66.58	66.22
1144435	1	1142244	Conduit	storm	1163031	22.6	CIRC	600	600	69.35	69.07
1145314	1	1144576	Conduit	storm	1164737_711	27.2	CIRC	600	600	52.51	52.01
1146051	1	1146052	Conduit	storm	1166150	28.3	CIRC	600	600	55.61	55.42
1146106	1	1145672	Conduit	storm	1160233	28.7	CIRC	600	600	53.68	53.57
1142058	1	1142058_dummy	Conduit	storm	1160259	28.8	CIRC	600	600	60.27	60.11
1146378	1	1146379	Conduit	storm	1168192	29.7	CIRC	600	600	53.72	53.14
1146242	1	1146241	Conduit	storm	1167975	30	CIRC	600	600	59.13	57.41
1146375	1	1146376	Conduit	storm	1168188	30.3	CIRC	600	600	55.47	54.95
1146180	1	1146181	Conduit	storm	1167866	30.5	CIRC	600	600	61.03	60.69
1146050	2	1146051	Conduit	storm	1166149	32.4	CIRC	600	600	55.94	55.82
1146393	1	1146394	Conduit	storm	1168214	33.4	CIRC	600	600	51.02	50.93
1144726	1	1144727	Conduit	storm	1163620	34.3	CIRC	600	600	67.66	67.37
1142229	1	1142228	Conduit	storm	1160129	35	CIRC	600	600	69.47	69.39
1143848	1	1143847	Conduit	storm	1161858	38.2	CIRC	600	600	55.20	55.01
1144093	1	1144092	Conduit	storm	1162398	39.6	CIRC	600	600	65.81	65.49
1144092	1	1143400	Conduit	storm	1162401	49.1	CIRC	600	600	65.49	64.55
1142154	1	1142150	Conduit	storm	1160058	50	CIRC	600	600	86.35	84.93
1146373	1	1146374	Conduit	storm	1168186	50.2	CIRC	600	600	56.13	55.85
1146374	1	1146375	Conduit	storm	1168187	51.8	CIRC	600	600	55.80	55.47
1143795	1	1143794	Conduit	storm	1161750	52.1	CIRC	600	600	53.22	52.92
1142244_dummy	1	1142242	Conduit	storm	1160140	54.9	CIRC	600	600	67.50	66.58
1145718	1	1145717	Conduit	storm	1165539	55.1	CIRC	600	600	105.82	101.88
1142529	1	1143716	Conduit	storm	1161538	56.4	CIRC	600	600	88.77	87.93
1146179	1	1146180	Conduit	storm	1167865	56.6	CIRC	600	600	62.53	61.09
1142055	1	1142059	Conduit	storm	1159983	58.7	CIRC	600	600	61.28	59.59
1142357	1	1142357_dummy	Conduit	storm	1160234	62.6	CIRC	600	600	53.47	53.13
1144517	1	1142356	Conduit	storm	1160673	63.6	CIRC	600	600	54.81	54.35
1145720	1	1145718	Conduit	storm	1165525	65.8	CIRC	600	600	113.06	105.85
1142323	1	1145314	Conduit	storm	1160210	72.8	CIRC	600	600	54.15	52.51
1146376	1	1146378	Conduit	storm	1168190	74.4	CIRC	600	600	54.95	53.85
1145368	1	1145367	Conduit	storm	1164795_1164796	75.5	CIRC	600	600	156.20	146.90
1142058_dummy	1	1142059	Conduit	storm	1159529	75.8	CIRC	600	600	60.11	59.59
1142332	1	1142331	Conduit	storm	1160212	75.8	CIRC	600	600	52.03	51.77
1146392	1	1146393	Conduit	storm	1168213	79.8	CIRC	600	600	52.60	52.04
1142333	1	1142332	Conduit	storm	1160213	84.5	CIRC	600	600	52.32	52.03
1146052	1	1144517	Conduit	storm	1166151	84.8	CIRC	600	600	55.42	54.83
1142244	1	1142244_dummy	Conduit	storm	1160141	93.8	CIRC	600	600	69.06	67.50
1142199	1	1146242	Conduit	storm	1160678	160.4	CIRC	600	600	61.64	59.13

US node ID	Link suffix	DS node ID	Conduit type	System type	Asset ID	Length (m)	Shape ID	Width (mm)	Height (mm)	US invert (m AD)	DS invert (m AD)
1142345	1	1143664	Conduit	storm	1160658	167.2	CIRC	600	600	59.37	55.26
1142200	1	1142199	Conduit	storm	1160098	175.8	CIRC	600	600	62.85	61.64
1142357_dummy	1	1142358	Conduit	storm	1160235	42.3	CIRC	650	650	53.13	52.92
1142358	1	1146392	Conduit	storm	1160674	73.9	CIRC	650	650	52.91	52.56
1143794_dummy	1	1139625	Conduit	storm	1161755	6.6	CIRC	675	675	52.88	52.87
1146038	1	1146039	Conduit	storm	1166133	12.3	CIRC	675	675	68.81	68.65
1146040	1	1146041	Conduit	storm	1166136	13.2	CIRC	675	675	68.04	67.91
1144727	1	1144727_dummy_1	Conduit	storm	1163631	15.3	CIRC	675	675	67.37	66.94
1146379	1	1146380	Conduit	storm	1168194	23.7	CIRC	675	675	53.14	52.62
1143794	1	1143794_dummy	Conduit	storm	1161754	27.8	CIRC	675	675	52.92	52.88
1145056	1	1142434	Conduit	storm	1164240	29.7	CIRC	675	675	88.95	87.99
1143842	1	1139700	Conduit	storm	1161864	32.7	CIRC	675	675	51.35	50.22
1141561	1	1146050	Conduit	storm	1166148	32.9	CIRC	675	675	56.27	55.94
1144016	1	1143715	Conduit	storm	1162230	33.8	CIRC	675	675	86.58	86.02
1143716	1	1144016	Conduit	storm	1162231	62.9	CIRC	675	675	87.93	86.61
1146039	1	1146040	Conduit	storm	1166134	63.7	CIRC	675	675	68.65	68.04
1143843	1	1143842	Conduit	storm	1161863	66.4	CIRC	675	675	53.52	51.35
1142302	1	1142301	Conduit	storm	1160192	81.8	CIRC	675	675	86.78	84.99
1142516	1	1145056	Conduit	storm	1160933	84.2	CIRC	675	675	91.07	88.97
1142300	1	1142300_dummy	Conduit	storm	Link_16	90.2	CIRC	675	675	82.18	79.79
1142301	1	1142300	Conduit	storm	1160191	100.7	CIRC	675	675	84.84	82.18
1142267	1	1142266	Conduit	storm	1160166	103.1	CIRC	675	675	83.40	79.36
1146042	1	1144727_dummy_1	Conduit	storm	1166139	7.9	CIRC	700	700	67.45	67.42
1145759	1	1143490	Conduit	storm	1165625	21.5	CIRC	700	700	61.75	61.59
1143492	1	1143496	Conduit	storm	1160892	22.4	CIRC	700	700	63.03	62.92
1143490	1	1143489	Conduit	storm	1160931	47.6	CIRC	700	700	61.59	61.36
1146041	1	1146042	Conduit	storm	1166138	54.2	CIRC	700	700	67.88	67.45
1143491	2	1145759	Conduit	storm	1160930	55.6	CIRC	700	700	62.16	61.75
1143496	1	1143491	Conduit	storm	1160893	84	CIRC	700	700	62.92	62.20
1146403	1	1141774	Conduit	storm	1168260	5.1	CIRC	750	750	50.35	50.27
MH-C1	1	1146238	Conduit	storm	Line_C	9.6	CIRC	750	750	70.29	68.77
1144715	1	1144714	Conduit	storm	1163561	12	CIRC	750	750	51.28	51.17
1145302	1	1144715	Conduit	storm	1163560	17.6	CIRC	750	750	51.51	51.33
1146400	1	1146401	Conduit	storm	1168223	26.7	CIRC	750	750	50.77	50.54
1142060_dummy	1	1143484	Conduit	storm	1160937	29.5	CIRC	750	750	58.78	58.70
1144579	1	1144587	Conduit	storm	1163338	30.7	CIRC	750	750	52.01	51.93
1144576	1	1144579	Conduit	storm	1163337	33.4	CIRC	750	750	52.01	52.03
1142270	1	1142268	Conduit	storm	1161540	34.2	CIRC	750	750	85.52	85.18
1142060	1	1142060_dummy	Conduit	storm	1159985	35.4	CIRC	750	750	59.05	58.82
1144587	1	1142329	Conduit	storm	1163339	36.2	CIRC	750	750	51.90	51.77
1142266	1	1142263	Conduit	storm	1160164	38.5	CIRC	750	750	79.29	78.18
1142268	1	1142267	Conduit	storm	1160167	43.8	CIRC	750	750	85.15	83.40
1142434	1	1142433	Conduit	storm	1160929	44.5	CIRC	750	750	87.99	86.55
1143715	1	1142270	Conduit	storm	1161539	47.2	CIRC	750	750	86.02	85.52
1146399	1	1146400	Conduit	storm	1168222	50.4	CIRC	750	750	51.06	50.77
1146380_dummy	1	1145302	Conduit	storm	1161671	53.9	CIRC	750	750	52.02	51.51
1142433	1	1142432	Conduit	storm	1160918	55.8	CIRC	750	750	86.55	85.09
1146401	1	1146403	Conduit	storm	1168224	59.3	CIRC	750	750	50.54	50.40
1146380	1	1146380_dummy	Conduit	storm	1161670	63.2	CIRC	750	750	52.62	52.02
1142059	1	1142060	Conduit	storm	1159984	80.4	CIRC	750	750	59.59	59.05
1142228	1	1142227	Conduit	storm	1160128	86	CIRC	750	750	69.21	68.89
1142432	1	1142431	Conduit	storm	1160907	93.9	CIRC	750	750	85.09	84.40
1142245	1	1142241	Conduit	storm	1160139	30.5	CIRC	800	800	66.37	66.22
1144714	1	1144712	Conduit	storm	1163563	36.3	CIRC	800	800	51.17	50.61
1143847	1	1143846	Conduit	storm	1161859	36.9	CIRC	800	800	55.01	54.85
1142254	1	1142253	Conduit	storm	1160152	64.5	CIRC	800	800	71.10	70.45
1143846	1	1143845	Conduit	storm	1161860	66.6	CIRC	800	800	54.83	54.61
1142255	1	1142254	Conduit	storm	1160153	80.5	CIRC	800	800	72.22	71.10
1142253	1	1142245	Conduit	storm	1160143	98	CIRC	800	800	70.45	66.45
1143486	1	1143485	Conduit	storm	1160902	15.7	CIRC	825	825	59.76	59.58
1142260	1	1142257	Conduit	storm	1160158	16	CIRC	825	825	74.36	74.11
1143487	1	1143486	Conduit	storm	1160901	21	CIRC	825	825	59.78	59.80
1143488	1	1143487	Conduit	storm	1160898	50.8	CIRC	825	825	60.68	60.12
1142263	1	1142262	Conduit	storm	1160162	62	CIRC	825	825	78.18	76.41
1142262	1	1142260	Conduit	storm	1160161	71.4	CIRC	825	825	76.41	74.36
1143489	2	1143488	Conduit	storm	1160897	83.9	CIRC	825	825	61.27	60.68
1142329	1	100160A_Dummy	Conduit	storm	1160700	101.8	CIRC	825	825	51.77	51.44
1144711	1	1144710	Conduit	storm	1163568	28.1	CIRC	850	850	50.21	49.87

US node ID	Link suffix	DS node ID	Conduit type	System type	Asset ID	Length (m)	Shape ID	Width (mm)	Height (mm)	US invert (m AD)	DS invert (m AD)
1142165	1	1143643	Conduit	storm	1161379	33.3	CIRC	850	850	80.94	80.45
1142256	1	1142255	Conduit	storm	1160155	40.1	CIRC	850	850	72.66	72.35
1144710	1	1144707	Conduit	storm	1163569	44.9	CIRC	850	850	49.86	49.31
1143643	1	1142166	Conduit	storm	1161380	72.5	CIRC	850	850	80.42	78.89
1142257	1	1142256	Conduit	storm	1160156	91.1	CIRC	850	850	74.11	72.89
1143661	1	1143660	Conduit	storm	1161391	11	CIRC	900	900	54.03	54.01
1144933_dummy	1	1145468	Conduit	storm	1162714	13.4	CIRC	900	900	76.60	75.90
1145380	1	1141021	Conduit	storm	1164829	13.4	CIRC	900	900	60.22	59.91
A_DUMMY	1	100216_Dummy	Conduit	storm	Culvert_35	17.1	CIRC	900	900	51.55	51.26
1143659	1	1143658	Conduit	storm	1161393	18.9	CIRC	900	900	53.74	53.48
1141654	1	1143474	Conduit	storm	1160932	20.5	CIRC	900	900	54.01	53.42
1145401_dummy_2	1	1145401_dummy_1	Conduit	storm	1160733	20.8	CIRC	900	900	61.74	61.11
1143474	1	1143474_Dummy	Conduit	storm	1160922	30.2	CIRC	900	900	53.42	52.43
1143495	1	1143478	Conduit	storm	1160925	31.3	CIRC	900	900	53.33	53.22
1142166	1	1144933	Conduit	storm	Link_5	33.9	CIRC	900	900	78.89	78.14
1144705	1	1140481	Conduit	storm	1163579	41.4	CIRC	900	900	48.77	48.46
1143477	1	1143475	Conduit	storm	1160915	43.5	CIRC	900	900	53.07	52.47
1143664	1	1143663	Conduit	storm	1161388	44.5	CIRC	900	900	55.26	54.68
1143479	1	1143495	Conduit	storm	1160917	48.8	CIRC	900	900	53.41	53.33
1144707	1	1144705	Conduit	storm	1163578	51.3	CIRC	900	900	49.31	48.87
1143662	1	1143661	Conduit	storm	1161390	51.5	CIRC	900	900	54.34	54.03
1145468	1	1142174	Conduit	storm	1160076	59.2	CIRC	900	900	75.90	72.76
1143663	1	1143662	Conduit	storm	1161389	59.7	CIRC	900	900	54.68	54.34
1142174	1	1144721	Conduit	storm	1160786	65.1	CIRC	900	900	72.76	70.51
1143480	1	1143479	Conduit	storm	1160920	71.5	CIRC	900	900	53.78	53.41
1143478	1	1143477	Conduit	storm	1160914	74	CIRC	900	900	53.22	53.14
1143660	1	1143659	Conduit	storm	1161392	76.8	CIRC	900	900	53.96	53.76
1143485	1	1143484	Conduit	storm	1160904	94.9	CIRC	900	900	59.58	58.83
1145376	1	1145375	Conduit	storm	1164778	97.5	CIRC	900	900	182.15	174.19
1143400	1	1139120	Conduit	storm	1160669	110.4	CIRC	900	900	64.55	60.96
1142431	1	1142165	Conduit	storm	1160069	139.2	CIRC	900	900	84.14	81.08
1144933	1	1144933_dummy	Conduit	storm	1162713	143.9	CIRC	900	900	78.14	76.60
1143497	2	1143480	Conduit	storm	1160919	71.5	CIRC	925	925	54.19	53.78
1144712	1	1144711	Conduit	storm	1163565	45.2	CIRC	1000	1000	50.54	50.21
1142152	1	1142431	Conduit	storm	1160896	12	CIRC	1050	1050	84.42	84.23
1142149	1	1142150	Conduit	storm	1160057	12.1	CIRC	1050	1050	85.01	84.93
1142146	1	1142147	Conduit	storm	1160054	12.2	CIRC	1050	1050	85.29	85.28
1142150	1	1142151	Conduit	storm	1160059	16.3	CIRC	1050	1050	84.93	84.87
1143484	1	1143483	Conduit	storm	1160906	27.6	CIRC	1050	1050	58.62	56.72
1145313	1	1142334	Conduit	storm	1160688_1	31.8	CIRC	1050	1050	57.11	56.45
1142148	1	1142149	Conduit	storm	1160056	35.4	CIRC	1050	1050	85.11	85.01
1144721	1	1144734	Conduit	storm	1163596	35.5	CIRC	1050	1050	70.20	69.75
1142147	1	1142148	Conduit	storm	1160055	42	CIRC	1050	1050	85.24	85.11
1141020	1	1145313	Conduit	storm	1160688	47.8	CIRC	1050	1050	58.69	57.11
1142151	1	1142152	Conduit	storm	1162715	55.3	CIRC	1050	1050	84.82	84.60
1142144	1	1142145	Conduit	storm	1160051	65	CIRC	1050	1050	85.91	85.56
1142145	1	1142146	Conduit	storm	1160053	68.8	CIRC	1050	1050	85.56	85.29
1144734	1	1146237	Conduit	storm	1163598_1167945	98.8	CIRC	1050	1050	69.75	69.16
1145365	1	1145366_dummy_3	Conduit	storm	1164803	7.6	CIRC	1200	1200	121.50	121.32
1145374_dummy	1	1145373	Conduit	storm	1164782	11	CIRC	1200	1200	167.81	167.16
1146237	1	1146238	Conduit	storm	1167946	11.4	CIRC	1200	1200	69.16	68.77
1145366_dummy_1	1	1145366_dummy_2	Conduit	storm	1164801	12.8	CIRC	1200	1200	125.89	124.64
1142190	1	1145285	Conduit	storm	1164659	14.4	CIRC	1200	1200	63.17	63.12
1146244	1	1146244_dummy	Conduit	storm	1167987	15.9	CIRC	1200	1200	54.07	53.80
1146252	1	1142370	Conduit	storm	1160240	19.1	CIRC	1200	1200	56.34	55.81
1142198	1	1146241	Conduit	storm	1160096	20	CIRC	1200	1200	57.40	56.69
1145366_dummy_3	1	1145364	Conduit	storm	1164804_1164805	23.7	CIRC	1200	1200	121.32	119.14
1145369_dummy	1	1145367	Conduit	storm	1164792_1164793	25.3	CIRC	1200	1200	150.39	146.90
1143844	1	1143843	Conduit	storm	1161862	26.8	CIRC	1200	1200	54.40	53.52
1145369	1	1145369_dummy	Conduit	storm	Link_3	27.8	CIRC	1200	1200	151.08	150.39
1145285	1	1145286	Conduit	storm	1164667	29.8	CIRC	1200	1200	63.11	63.10
1142370	1	1146254	Conduit	storm	1160095	30	CIRC	1200	1200	55.81	55.43
1145366_dummy_2	1	1145365	Conduit	storm	1164802	31.3	CIRC	1200	1200	124.64	121.50
1146254	1	1146243	Conduit	storm	1167942	33.1	CIRC	1200	1200	55.41	54.52
1145286	1	1145286_dummy	Conduit	storm	1164668	48	CIRC	1200	1200	63.10	62.83

US node ID	Link suffix	DS node ID	Conduit type	System type	Asset ID	Length (m)	Shape ID	Width (mm)	Height (mm)	US invert (m AD)	DS invert (m AD)
1146241	1	1146252	Conduit	storm	1167978	48.7	CIRC	1200	1200	56.65	56.34
1146243	1	1146244	Conduit	storm	1167984	53.5	CIRC	1200	1200	54.40	54.06
1143658	1	1143657	Conduit	storm	1161394	55.2	CIRC	1200	1200	53.48	53.37
1143845	1	1143844	Conduit	storm	1161861	64.1	CIRC	1200	1200	54.61	54.40
1143656	1	1143655	Conduit	storm	1161396	67.9	CIRC	1200	1200	52.85	52.52
1145374	1	1145374_dummy	Conduit	storm	1164781	69.4	CIRC	1200	1200	171.93	167.81
1144727_dummy_2	1	1142190	Conduit	storm	1164656	70	CIRC	1200	1200	63.90	63.17
1145364	1	1145363	Conduit	storm	1164806	70.2	CIRC	1200	1200	119.14	113.05
1143657	1	1143656	Conduit	storm	1161395	79.5	CIRC	1200	1200	53.37	52.85
1145366	1	1145366_dummy_1	Conduit	storm	1164800	87.7	CIRC	1200	1200	134.46	125.89
1145373	1	1145372	Conduit	storm	1164783	88	CIRC	1200	1200	167.16	165.46
1144727_dummy_1	1	1144727_dummy_2	Conduit	storm	1160734	104.2	CIRC	1200	1200	66.94	63.90
1145367	1	1145366	Conduit	storm	1164827_1164797_1164798_1164799	104.6	CIRC	1200	1200	146.90	134.46
1142334	1	1139323	Conduit	storm	1160697	137.7	CIRC	1200	1200	56.45	52.57
1145375	1	1145374	Conduit	storm	1164779	148.9	CIRC	1200	1200	174.14	171.93
1145372	1	1145372_dummy	Conduit	storm	1164784	150.3	CIRC	1200	1200	165.46	163.55
1145401	1	1145401_dummy	Conduit	storm	1164888	32.8	CIRC	1250	1250	60.09	58.93
1145401_dummy_1	1	1145401	Conduit	storm	1160683	34.3	CIRC	1250	1250	61.11	60.11
1145401_dummy	1	1142198	Conduit	storm	1164889	43.3	CIRC	1250	1250	58.93	57.40
1145372_dummy	1	1145371	Conduit	storm	1164785	10.7	CIRC	1350	1350	163.55	163.42
1146238	1	1146230	Conduit	storm	1167949	17.9	CIRC	1350	1350	68.77	68.43
1145359	1	1145357	Conduit	storm	1164819_1164820	22	CIRC	1350	1350	90.30	89.41
1143655	1	1143654	Conduit	storm	1161397	22.8	CIRC	1350	1350	52.52	52.39
1145357_dummy_3	1	1141018	Conduit	storm	1164826	22.8	CIRC	1350	1350	79.72	78.46
1145361	1	1145361_dummy_1	Conduit	storm	1164813	28.3	CIRC	1350	1350	97.68	96.35
1145357_dummy_2	1	1145357_dummy_3	Conduit	storm	1164824	28.6	CIRC	1350	1350	81.31	79.72
1143476	1	1143475	Conduit	storm	1160913	38.1	CIRC	1350	1350	53.04	52.47
1145361_dummy_2	1	1145359	Conduit	storm	1164815_816_817	45.4	CIRC	1350	1350	92.43	90.30
1143665	1	1143653	Conduit	storm	1161399	49.4	CIRC	1350	1350	52.03	51.73
1145371	1	1145370	Conduit	storm	1164787	51	CIRC	1350	1350	163.41	162.46
1143654	1	1143665	Conduit	storm	1161398	52.4	CIRC	1350	1350	52.35	52.03
1145357_dummy_1	1	1145357_dummy_2	Conduit	storm	1164823	71.7	CIRC	1350	1350	85.30	81.31
1145357	1	1145357_dummy_1	Conduit	storm	1164822	73.4	CIRC	1350	1350	89.36	85.30
1145362	1	1181552	Conduit	storm	1181640	73.9	CIRC	1350	1350	105.36	101.68
1145361_dummy_1	1	1145361_dummy_2	Conduit	storm	1164814	83.3	CIRC	1350	1350	96.35	92.43
1181552	1	1145361	Conduit	storm	1164812	95.1	CIRC	1350	1350	101.68	97.68
1143482	1	1143481	Conduit	storm	1160909	133.9	CIRC	1350	1350	54.26	53.72
1145370	1	1145369	Conduit	storm	1164789_1164788	134.9	CIRC	1350	1350	162.46	151.08
1145363	1	1145362	Conduit	storm	1164811	153.1	CIRC	1350	1350	112.98	105.36
1143481	1	1143476	Conduit	storm	1160910	163.6	CIRC	1350	1350	53.72	53.06
1143483	1	1143482	Conduit	storm	1160908	173	CIRC	1350	1350	56.72	54.58
1142238	1	1142238_dummy	Conduit	storm	Link_4	65.2	CIRC	1400	1400	63.12	61.18
1142241	1	1142238	Conduit	storm	1160136	77.5	CIRC	1400	1400	66.23	63.12
1142238_dummy	1	1145379	Conduit	storm	1160735	6.8	CIRC	1580	1580	61.18	60.93
1145379	1	1145380	Conduit	storm	1164828	12.6	CIRC	1580	1580	60.93	60.22
1146230	1	1146231	Conduit	storm	1167954	17.6	CIRC	1580	1580	68.43	68.34
1146233_dummy	1	1146234	Conduit	storm	Link_8	9.2	CIRC	1600	1600	63.59	63.25
1143472	1	1143474_Dummy	Conduit	storm	1160921_1	23.5	CIRC	1600	1600	52.44	52.43
1143651	1	1143650	Conduit	storm	1161403	26.8	CIRC	1600	1600	51.27	51.27
1146235_dummy_1	1	1146235_dummy_2	Conduit	storm	Link_21	30.4	CIRC	1600	1600	54.80	53.80
1143650	1	1139472	Conduit	storm	1161402	36.2	CIRC	1600	1600	51.27	50.64
1143653	1	1143652	Conduit	storm	1161400	38.3	CIRC	1600	1600	51.73	51.53
MH-A11	1	1146235	Conduit	storm	A11-A7	41.6	CIRC	1600	1600	58.94	58.71
1143473	1	1139171	Conduit	storm	1160923	51.3	CIRC	1600	1600	52.40	52.15
1146233	1	1146233_dummy	Conduit	storm	1167963	63.5	CIRC	1600	1600	65.89	63.59
1146232	1	1146232_dummy	Conduit	storm	Link_7	64.6	CIRC	1600	1600	67.49	66.85
1143475	1	1143472	Conduit	storm	1160916	88.2	CIRC	1600	1600	52.47	52.44
1143652	1	1143651	Conduit	storm	1161401	91.1	CIRC	1600	1600	51.53	51.34
1146232_dummy	1	1146233	Conduit	storm	1167958	92.1	CIRC	1600	1600	66.85	65.89

US node ID	Link suffix	DS node ID	Conduit type	System type	Asset ID	Length (m)	Shape ID	Width (mm)	Height (mm)	US invert (m AD)	DS invert (m AD)
1146231	1	1146232	Conduit	storm	1167955	101.9	CIRC	1600	1600	68.34	67.71
1143474_Dummy	1	1143473	Conduit	storm	1160921	107.9	CIRC	1600	1600	52.43	52.40
1146234	1	1146235	Conduit	storm	1167967	117.8	CIRC	1600	1600	63.25	59.86
1146235	1	1146235_dummy_1	Conduit	storm	1167973	137.2	CIRC	1600	1600	58.60	54.80
100160A_Dummy	1	100160_Dummy	Conduit	storm	Culvert_16_17	20.8	CIRC	2500	2500	50.47	50.28
A2	1	100220_Dummy	Conduit	storm	Racecourse drain 236	66.2	CIRC	2540	2540	49.03	49.00
A5	1	A2	Conduit	storm	Racecourse drain 236	319.3	CIRC	2540	2540	49.48	49.03
1142356	1	1143497	Conduit	storm	1160231	34.5	RECT	590	760	54.35	54.11
1143497	1	1146106	Conduit	storm	1160232	120.5	RECT	590	760	54.11	53.68
99933_Dummy	1	99935_Dummy	Conduit	storm	COSEYSCULVERT28	128.2	RECT	2510	1500	52.20	51.96
100259_Dummy	1	100258_Dummy	Conduit	storm	Culvert_214	11	RECT	8000	1000	48.28	48.19
99962_Dummy	1	99963_Dummy	Culvert	storm	Culvert_175	7	CIRC	225	225	56.41	56.33
99960_Dummy	1	99961_Dummy	Culvert	storm	Culvert_172	12.6	CIRC	225	225	56.81	56.77
1141494	1	1145964	Culvert	storm	1165992	1.9	CIRC	300	300	160.23	159.90
100020_Dummy	1	100021_Dummy	Culvert	storm	Kitchener_2	7	CIRC	300	300	120.77	120.76
99958_Dummy	1	99959_Dummy	Culvert	storm	Culvert_171	7	CIRC	300	300	56.20	56.14
99956_Dummy	1	99957_Dummy	Culvert	storm	Culvert_170	7	CIRC	300	300	55.94	55.99
100056_Dummy	1	100054_Dummy	Culvert	storm	Middleton_1	7	CIRC	300	300	188.65	188.55
100022_Dummy	1	100023_Dummy	Culvert	storm	Kitchener_3	8.6	CIRC	300	300	122.03	121.59
100024_Dummy	1	100025_Dummy	Culvert	storm	Culvert_098	12	CIRC	300	300	121.52	120.88
99978_Dummy	1	99979_Dummy	Culvert	storm	Culvert_004	12	CIRC	300	300	55.92	55.54
99944_Dummy	1	99945_Dummy	Culvert	storm	Culvert_199	13.4	CIRC	300	300	56.00	55.82
100275_Dummy	1	100274_Dummy	Culvert	storm	Culvert_42	22.1	CIRC	300	300	60.24	59.84
99972_Dummy	1	99973_Dummy	Culvert	storm	Culvert_180	30	CIRC	300	300	54.94	54.94
1139172_1139173	1	1143476	Culvert	storm	1160911	43.5	CIRC	300	300	54.77	54.60
100214_Dummy	1	100213_Dummy	Culvert	storm		67.1	CIRC	300	300	55.51	54.10
99950_Dummy	1	99951_Dummy	Culvert	storm	StationRdDrain1CH879.5	7	CIRC	350	350	57.40	57.30
99948_Dummy	1	99949_Dummy	Culvert	storm	StationRdDrain1CH974	7	CIRC	350	350	56.85	56.80
99946_Dummy	1	99947_Dummy	Culvert	storm	Culvert_168	7	CIRC	350	350	56.59	56.68
100170_Dummy	1	100172_Dummy	Culvert	storm	UpperQueen_2	7	CIRC	375	375	131.82	131.54
99968_Dummy	1	99969_Dummy	Culvert	storm	Culvert_178	7	CIRC	375	375	55.60	55.50
99964_Dummy	1	99965_Dummy	Culvert	storm	Culvert_176	7	CIRC	375	375	56.34	56.38
99954_Dummy	1	99955_Dummy	Culvert	storm	Culvert_169	7	CIRC	375	375	56.67	56.42
99952_Dummy	1	99953_Dummy	Culvert	storm	Culvert_210	9.8	CIRC	375	375	56.91	56.70
100030_Dummy	1	100031_Dummy	Culvert	storm	Culvert_103	19.7	CIRC	375	375	133.81	132.63
99966_Dummy	1	99967_Dummy	Culvert	storm	Culvert_177	7	CIRC	400	400	56.13	56.08
100018_Dummy	1	100019_Dummy	Culvert	storm	Kitchener_1	7	CIRC	450	450	118.43	118.26
1143331_dummy	1	1143331	Culvert	storm		8.6	CIRC	450	450	100.20	100.01
99936_Dummy	1	99937_Dummy	Culvert	storm	Culvert_202	10.2	CIRC	450	450	54.66	54.39
99938_Dummy	1	99939_Dummy	Culvert	storm	Culvert_213	10.5	CIRC	450	450	55.24	54.93
99974_Dummy	1	99975_Dummy	Culvert	storm	Culvert_179	10.7	CIRC	450	450	55.27	55.25
99970_Dummy	1	99971_Dummy	Culvert	storm	Culvert_179	10.7	CIRC	450	450	55.27	55.25
99942_Dummy	1	99943_Dummy	Culvert	storm	Culvert_002	12	CIRC	450	450	55.87	55.76
99976_Dummy	1	99977_Dummy	Culvert	storm	Culvert_001	14.3	CIRC	450	450	54.73	54.49
100086_Dummy	1	100087_Dummy	Culvert	storm	Culvert_216	32	CIRC	450	450	125.65	125.57
99940_Dummy	1	99941_Dummy	Culvert	storm	Culvert_200	11	CIRC	525	525	55.63	55.53
1139388	1	1139361_1139388_Dummy	Culvert	storm	Link_54	30.6	CIRC	525	525	52.88	52.42
1141495	1	1146302	Culvert	storm	1165994	93.5	CIRC	525	525	159.50	151.14
100041_Dummy	1	100042_Dummy	Culvert	storm	Culvert_094	7	CIRC	600	600	123.76	123.64
100088_Dummy	1	100089_Dummy	Culvert	storm	Culvert_095	7	CIRC	600	600	123.90	123.83
ACC_Inlet	1	ACC_Dummy	Culvert	storm	AlexanderCourtCulvert2	10.2	CIRC	600	600	64.27	64.14
100265_Dummy	1	100264_Dummy	Culvert	storm	Culvert_186	11.7	CIRC	600	600	55.08	54.48
1139486	1	1143670	Culvert	storm	1161445	12.5	CIRC	600	600	64.02	63.54
100273_Dummy	1	100271_Dummy	Culvert	storm	Culvert_189	15.1	CIRC	600	600	55.35	55.27
100186_Dummy	1	100192_Dummy	Culvert	storm	Culvert_40	41.9	CIRC	600	600	61.53	60.89
100084_Dummy	1	100082_Dummy	Culvert	storm	Culvert_194	53.6	CIRC	600	600	101.75	100.78
100229_Dummy	1	100228_Dummy	Culvert	storm		22.9	CIRC	650	650	57.33	57.30
100161_Dummy	1	100162_Dummy	Culvert	storm	Culvert_60	160	CIRC	675	675	117.94	111.97
100169_Dummy	1	100171_Dummy	Culvert	storm	Culvert_037	7	CIRC	700	700	77.61	77.31
100167_Dummy	1	100168_Dummy	Culvert	storm	UpperQueen_4	7	CIRC	750	750	130.71	130.04
100163_Dummy	1	100164_Dummy	Culvert	storm	UpperQueen_5	7	CIRC	750	750	121.18	121.18
100083_Dummy	1	100085_Dummy	Culvert	storm	Culvert_096	7	CIRC	750	750	125.07	124.84
100081_Dummy	1	100080_Dummy	Culvert	storm	Culvert_097	7	CIRC	750	750	124.20	123.87
100165_Dummy	1	100166_Dummy	Culvert	storm	Culvert_65	10	CIRC	750	750	123.52	122.57

US node ID	Link suffix	DS node ID	Conduit type	System type	Asset ID	Length (m)	Shape ID	Width (mm)	Height (mm)	US invert (m AD)	DS invert (m AD)
Culvert_203_US	1	1141654	Culvert	storm	Culvert_203	13.4	CIRC	750	750	54.61	54.01
100079_Dummy	1	100078_Dummy	Culvert	storm	Culvert_097A	30	CIRC	750	750	121.90	120.60
100227_Dummy	1	100231_Dummy	Culvert	storm		28.6	CIRC	800	800	57.11	57.02
1141511	1	1142144	Culvert	storm	1166018	5	CIRC	900	900	86.05	85.91
100217_Dummy	1	A_DUMMY	Culvert	storm	Culvert_35	8.5	CIRC	900	900	51.69	51.55
100059_Dummy	1	100058_Dummy	Culvert	storm	Calcutta_crossing	8.5	CIRC	900	900	176.09	174.34
100034_Dummy	1	100033_Dummy	Culvert	storm	Culvert_107	9	CIRC	900	900	134.51	133.97
100036_Dummy	1	100035_Dummy	Culvert	storm	Culvert_106	12.1	CIRC	900	900	135.10	134.61
100057_Dummy	1	100055_Dummy	Culvert	storm	Calcutta_1	12.5	CIRC	900	900	177.72	176.54
100053_Dummy	1	100052_Dummy	Culvert	storm	Calcutta_2	12.5	CIRC	900	900	165.67	164.52
100178_Dummy	1	100188_Dummy	Culvert	storm	ScruffyDomeHigh	59.5	CIRC	900	900	62.70	61.75
100196_Dummy	1	100197_Dummy	Culvert	storm	Culvert_39	71	CIRC	900	900	70.11	60.97
100114_Dummy	1	100115_Dummy	Culvert	storm	KitchenerRdDrain3CH482.5	16	CIRC	1050	1050	97.94	96.90
1144721_dummy	1	1144721	Culvert	storm	1168370	16.2	CIRC	1050	1050	70.73	70.61
100205_Dummy	1	100206_Dummy	Culvert	storm	KitchenerRd1CH275	7	CIRC	1150	1150	74.03	73.86
100038_Dummy	1	100037_Dummy	Culvert	storm	Culvert_105	7	CIRC	1200	1200	136.40	135.72
100047_Dummy	1	100046_Dummy	Culvert	storm	Calcutta_5	7.5	CIRC	1200	1200	147.92	147.15
100045_Dummy	1	100044_Dummy	Culvert	storm	Calcutta_6	7.5	CIRC	1200	1200	147.01	146.90
100063_Dummy	1	100062_Dummy	Culvert	storm	Culvert_109	8	CIRC	1200	1200	166.85	166.15
100269_Dummy	1	100268_Dummy	Culvert	storm	Culvert_187	8.1	CIRC	1200	1200	56.19	55.97
100065_Dummy	1	100064_Dummy	Culvert	storm	Culvert_111	8.8	CIRC	1200	1200	160.61	159.20
100067_Dummy	1	100066_Dummy	Culvert	storm	Culvert_122	9	CIRC	1200	1200	148.84	147.95
100061_Dummy	1	100060_Dummy	Culvert	storm	Culvert_112	11	CIRC	1200	1200	176.10	174.95
100051_Dummy	1	100050_Dummy	Culvert	storm	Calcutta_3	12.1	CIRC	1200	1200	158.71	158.06
100203_Dummy	1	100204_Dummy	Culvert	storm	Culvert_166	12.6	CIRC	1200	1200	74.31	74.28
100049_Dummy	1	100048_Dummy	Culvert	storm	Calcutta_4	14.6	CIRC	1200	1200	152.19	151.05
100071_Dummy	1	100070_Dummy	Culvert	storm	Culvert_101	9	CIRC	1350	1350	119.54	119.44
100069_Dummy	1	100068_Dummy	Culvert	storm	Culvert_102	9	CIRC	1350	1350	121.33	121.26
100075_Dummy	1	100074_Dummy	Culvert	storm	Culvert_099	10	CIRC	1350	1350	118.47	118.40
100073_Dummy	1	100072_Dummy	Culvert	storm	Culvert_100	10	CIRC	1350	1350	119.06	119.06
100255_Dummy	1	100254_Dummy	Culvert	storm	Culvert_190	13.3	CIRC	1800	1800	55.75	55.66
100253_Dummy	1	100252_Dummy	Culvert	storm	Culvert_182	13.7	CIRC	1800	1800	55.48	55.23
100284_Dummy	1	100272_Dummy	Culvert	storm	Culvert_190A	14.5	CIRC	1800	1800	55.74	55.78
100251_Dummy	1	100250_Dummy	Culvert	storm	Culvert_183	11.4	CIRC	1860	1860	54.79	54.75
100232_Dummy	1	100231_Dummy	Culvert	storm	Culvert_43	17.8	CIRC	2100	2100	57.35	57.41
100158_Dummy	1	100156_Dummy	Culvert	storm	2001089948	29.9	CIRC	2420	2420	49.29	49.31
100158_Dummy	2	100156_Dummy	Culvert	storm	CUL_FLOAT ROAD	32.3	CIRC	2420	2420	49.29	49.22
100199_Dummy	1	100160A_Dummy	Culvert	storm	Culvert_16_17	7.5	CIRC	2500	2500	50.54	50.47
100281_Dummy	1	100280_Dummy	Culvert	storm		10.5	CIRC	2500	2500	52.11	52.09
A6	1	A5	Culvert	storm	Racecourse drain 236	63.6	CIRC	2540	2540	49.55	49.48
100154_Dummy	1	100155_Dummy	Culvert	storm	UpperQueen_439	7	RECT	600	700	111.57	111.39
100150_Dummy	1	100151_Dummy	Culvert	storm	UpperQueen_467	7	RECT	650	300	109.09	108.66
100148_Dummy	1	100149_Dummy	Culvert	storm	Culvert_056	7	RECT	650	270	106.58	106.15
100144_Dummy	1	100145_Dummy	Culvert	storm	UpperQueen_543	7	RECT	650	300	101.04	100.52
100142_Dummy	1	100143_Dummy	Culvert	storm	Culvert_054	7	RECT	650	300	98.09	97.20
100138_Dummy	1	100139_Dummy	Culvert	storm	UpperQueen_663	7	RECT	650	300	90.93	90.93
100140_Dummy	1	100141_Dummy	Culvert	storm	UpperQueen_630	15.8	RECT	650	300	92.81	91.88
100157_Dummy	1	100159_Dummy	Culvert	storm	Culvert_058	7	RECT	700	330	112.26	112.03
100152_Dummy	1	100153_Dummy	Culvert	storm	UpperQueen_454	7	RECT	700	330	110.32	109.99
100146_Dummy	1	100147_Dummy	Culvert	storm	Culvert_050	7	RECT	700	330	104.22	102.85
100136_Dummy	1	100137_Dummy	Culvert	storm	UpperQueen_706	7	RECT	700	400	89.04	88.90
100134_Dummy	1	100135_Dummy	Culvert	storm	QueenSt_CH698	10	RECT	700	300	87.84	87.74
99980_Dummy	1	99981_Dummy	Culvert	storm	Ward_503	9	RECT	720	380	73.66	73.22
100043_Dummy	1	100092_Dummy	Culvert	storm	Culvert_093	7	RECT	770	500	123.60	123.58
99998_Dummy	1	99999_Dummy	Culvert	storm	Culvert_158	7	RECT	880	350	80.63	80.50
100132_Dummy	1	100133_Dummy	Culvert	storm	Culvert_074	7	RECT	900	320	88.26	88.01
100130_Dummy	1	100131_Dummy	Culvert	storm	Culvert_075	7	RECT	900	320	88.53	88.38
100128_Dummy	1	100129_Dummy	Culvert	storm	Culvert_076	7	RECT	900	320	89.47	88.26
100126_Dummy	1	100127_Dummy	Culvert	storm	Culvert_077	7	RECT	900	340	91.25	90.04
100124_Dummy	1	100125_Dummy	Culvert	storm	Culvert_079	7	RECT	900	330	93.41	93.16

US node ID	Link suffix	DS node ID	Conduit type	System type	Asset ID	Length (m)	Shape ID	Width (mm)	Height (mm)	US invert (m AD)	DS invert (m AD)
100122_Dummy	1	100123_Dummy	Culvert	storm	Culvert_080	7	RECT	900	320	94.26	93.77
100120_Dummy	1	100121_Dummy	Culvert	storm	Culvert_081	7	RECT	900	320	95.49	95.17
100118_Dummy	1	100119_Dummy	Culvert	storm	Culvert_081	7	RECT	900	320	95.49	95.17
100116_Dummy	1	100117_Dummy	Culvert	storm	Culvert_082	7	RECT	900	330	97.00	96.71
100109_Dummy	1	100110_Dummy	Culvert	storm	Culvert_084	7	RECT	900	240	106.97	106.59
100107_Dummy	1	100108_Dummy	Culvert	storm	Culvert_085	7	RECT	900	220	109.01	108.64
100105_Dummy	1	100106_Dummy	Culvert	storm	Culvert_086	7	RECT	900	300	109.83	109.30
100103_Dummy	1	100104_Dummy	Culvert	storm	Culvert_087	7	RECT	900	240	111.07	110.63
100101_Dummy	1	100102_Dummy	Culvert	storm	Culvert_088	7	RECT	900	300	114.50	113.69
100099_Dummy	1	100100_Dummy	Culvert	storm	Culvert_089	7	RECT	900	280	117.60	116.80
100097_Dummy	1	100098_Dummy	Culvert	storm	Culvert_090	7	RECT	900	170	119.19	118.83
100095_Dummy	1	100096_Dummy	Culvert	storm	Culvert_091	7	RECT	900	240	120.77	120.35
100093_Dummy	1	100094_Dummy	Culvert	storm	Culvert_092	7	RECT	900	300	121.60	121.42
100016_Dummy	1	100017_Dummy	Culvert	storm	Ward_16	8.5	RECT	900	420	85.73	85.61
99994_Dummy	1	99995_Dummy	Culvert	storm	Culvert_160	12	RECT	900	330	79.84	79.53
100173_Dummy	1	100174_Dummy	Culvert	storm	Culvert_48	30	RECT	900	310	87.58	86.01
99996_Dummy	1	99997_Dummy	Culvert	storm	Culvert_159	7	RECT	930	510	80.07	79.95
100112_Dummy	1	100113_Dummy	Culvert	storm	Culvert_083	7	RECT	950	200	103.76	103.28
100008_Dummy	1	100009_Dummy	Culvert	storm	Ward_152	17	RECT	950	390	83.06	82.64
100183_Dummy	1	100184_Dummy	Culvert	storm	Culvert_070	7	RECT	1000	420	82.01	81.89
100181_Dummy	1	100182_Dummy	Culvert	storm	Culvert_071	7	RECT	1000	440	82.49	82.34
100177_Dummy	1	100179_Dummy	Culvert	storm	Culvert_072	7	RECT	1000	370	84.56	84.15
100175_Dummy	1	100176_Dummy	Culvert	storm	Culvert_073	7	RECT	1000	380	85.35	85.24
100014_Dummy	1	100015_Dummy	Culvert	storm	Ward_69	7	RECT	1000	450	84.83	84.75
100000_Dummy	1	100001_Dummy	Culvert	storm	Culvert_157	7	RECT	1020	340	80.74	80.61
99992_Dummy	1	99993_Dummy	Culvert	storm	Culvert_161	7	RECT	1020	360	79.02	78.95
99990_Dummy	1	99991_Dummy	Culvert	storm	Culvert_162	7.4	RECT	1040	370	78.93	78.77
100006_Dummy	1	100007_Dummy	Culvert	storm	Culvert_154	7	RECT	1050	280	82.10	81.99
100004_Dummy	1	100005_Dummy	Culvert	storm	Culvert_155	7	RECT	1050	360	81.77	81.58
100201_Dummy	1	100202_Dummy	Culvert	storm	KitchenerRdDrain5 CH210.5	20	RECT	1050	630	79.79	79.10
100010_Dummy	1	100011_Dummy	Culvert	storm	Ward_117	7	RECT	1070	270	83.86	83.70
99988_Dummy	1	99989_Dummy	Culvert	storm	Culvert_163	7	RECT	1070	380	78.49	78.38
99986_Dummy	1	99987_Dummy	Culvert	storm	Culvert_164	7	RECT	1090	370	78.04	77.95
100012_Dummy	1	100013_Dummy	Culvert	storm	Ward_101	7	RECT	1100	370	84.27	84.04
99984_Dummy	1	99985_Dummy	Culvert	storm	Culvert_165	7	RECT	1200	380	77.89	77.68
99982_Dummy	1	99983_Dummy	Culvert	storm	Ward_446	31.5	RECT	1200	560	77.19	76.33
100198_Dummy	1	100200_Dummy	Culvert	storm	Culvert_066	5.9	RECT	1300	380	80.33	80.27
100193_Dummy	1	100195_Dummy	Culvert	storm	Culvert_067	7	RECT	1300	400	80.65	80.58
100189_Dummy	1	100191_Dummy	Culvert	storm	Culvert_068	7	RECT	1300	400	81.11	81.01
100002_Dummy	1	100003_Dummy	Culvert	storm	Culvert_156	11	RECT	1300	400	81.36	81.10
100185_Dummy	1	100187_Dummy	Culvert	storm	Culvert_069	7	RECT	1500	600	81.46	81.41
100028_Dummy	1	100029_Dummy	Culvert	storm	Culvert_211	7.6	RECT	1500	1500	106.69	106.65
100026_Dummy	1	100027_Dummy	Culvert	storm	Culvert_148	12	RECT	1500	2000	91.37	91.31
100040_Dummy	1	100039_Dummy	Culvert	storm	Blake	16	RECT	1500	1500	126.32	126.18
100263_Dummy	1	100262_Dummy	Culvert	storm	Culvert_185	6.6	RECT	1700	1200	52.52	52.51
100077_Dummy	1	100076_Dummy	Culvert	storm	Culvert_25	14	RECT	2000	1500	117.58	117.38
100211_Dummy	1	100212_Dummy	Culvert	storm	Kitchener2_CH212.5	7	RECT	2400	350	57.28	57.12
100209_Dummy	1	100210_Dummy	Culvert	storm	Kitchener2_CH47	7	RECT	2400	400	63.56	63.42
100207_Dummy	1	100208_Dummy	Culvert	storm	Kitchener2_CH18	7	RECT	2400	500	63.94	63.86
100221_Dummy	1	100222_Dummy	Culvert	storm	Culvert_9_10_11	36.7	RECT	2400	2000	48.61	48.58
99934_Dummy	1	99933_Dummy	Culvert	storm	COSEYSCULVERT28	120.4	RECT	2510	1500	52.71	52.49
100267_Dummy	1	100266_Dummy	Culvert	storm	Bridge_188	10.1	RECT	4000	1500	55.01	54.95

APPENDIX E: Stormwater Sub catchment Data

Subcatchment ID	Drains to	System type	Node ID	2D point ID	Total area (ha)	Rainfall profile	Tc (min)	Impervious_ %	Pervious %
PUKE_S_100	2D point source	storm	M21_PUKE_S_100	M21_PUKE_S_100	2.988	100yr_245mm	12.53	10.26	89.74
PUKE_S_1002	Node	storm	1145366	1145366	1.139	100yr_221mm	10	15.60	84.40
PUKE_S_1006	2D point source	storm	M21_PUKE_S_1006	M21_PUKE_S_1006	1.277	100yr_233mm	10	70.00	30.00
PUKE_S_1008	2D point source	storm	M11_PUKE_S_1008	M11_PUKE_S_1008	12.541	100yr_245mm	19.13	20.16	79.84
PUKE_S_1009	2D point source	storm	M21_PUKE_S_1009	M21_PUKE_S_1009	4.685	100yr_245mm	10.09	10.00	90.00
PUKE_S_1010	2D point source	storm	M21_PUKE_S_1010	M21_PUKE_S_1010	3.499	100yr_245mm	10	10.00	90.00
PUKE_S_1011	2D point source	storm	M21_PUKE_S_1011	M21_PUKE_S_1011	10.793	100yr_221mm	12.51	23.77	76.23
PUKE_S_1012	2D point source	storm	M21_PUKE_S_1012	M21_PUKE_S_1012	0.947	100yr_233mm	10	67.02	32.98
PUKE_S_1013	Node	storm	1145362	1145362	3.915	100yr_221mm	10	25.41	74.59
PUKE_S_1014	Node	storm	1142301	1142301	2.070	100yr_221mm	10.17	36.94	63.06
PUKE_S_1015	Node	storm	1181289	1181289	2.751	100yr_221mm	10	61.31	38.69
PUKE_S_1016	Node	storm	1145360	1145360	1.755	100yr_221mm	13.56	10.69	89.31
PUKE_S_1017	Node	storm	1181599	1181599	2.247	100yr_221mm	10	60.58	39.42
PUKE_S_103	2D point source	storm	M21_PUKE_S_103	M21_PUKE_S_103	2.992	100yr_245mm	24.3	42.23	57.77
PUKE_S_104	2D point source	storm	M21_PUKE_S_104	M21_PUKE_S_104	3.272	100yr_245mm	36.05	63.38	36.62
PUKE_S_105	2D point source	storm	M21_PUKE_S_105	M21_PUKE_S_105	3.283	100yr_245mm	10	49.27	50.73
PUKE_S_106	2D point source	storm	M21_PUKE_S_106	M21_PUKE_S_106	3.884	100yr_233mm	11.77	70.19	29.81
PUKE_S_107	2D point source	storm	M11_PUKE_S_107	M11_PUKE_S_107	9.012	100yr_221mm	19.61	14.63	85.37
PUKE_S_108	2D point source	storm	M11_PUKE_S_108	M11_PUKE_S_108	4.009	100yr_221mm	11.5	12.11	87.89
PUKE_S_111	2D point source	storm	M21_PUKE_S_111	M21_PUKE_S_111	3.476	100yr_221mm	13.45	43.78	56.22
PUKE_S_112	Node	storm	1142234	1142234	0.826	100yr_210mm	13.07	78.54	21.46
PUKE_S_115	2D point source	storm	M21_PUKE_S_115	M21_PUKE_S_115	0.896	100yr_221mm	10	86.46	13.54
PUKE_S_116	Node	storm	1142237	1142237	2.027	100yr_210mm	17.14	78.91	21.09
PUKE_S_117	Node	storm	1145683	1145683	1.817	100yr_210mm	11.55	70.67	29.34
PUKE_S_118b	Node	storm	1142231	1142231	2.244	100yr_210mm	10.03	50.93	49.07
PUKE_S_12	Node	storm	1142382	1142382	2.532	100yr_210mm	18.99	86.48	13.52
PUKE_S_120	2D point source	storm	M21_PUKE_S_120	M21_PUKE_S_120	1.799	100yr_210mm	10	70.76	29.24
PUKE_S_121	Node	storm	1143682	1143682	1.211	100yr_210mm	10.84	86.63	13.37
PUKE_S_122	2D point source	storm	M21_PUKE_S_122	M21_PUKE_S_122	3.140	100yr_210mm	12.73	19.28	80.72
PUKE_S_123	2D point source	storm	M21_PUKE_S_123	M21_PUKE_S_123	2.784	100yr_210mm	19.52	33.40	66.60
PUKE_S_124	2D point source	storm	M21_PUKE_S_124	M21_PUKE_S_124	1.291	100yr_221mm	10	72.15	27.85
PUKE_S_125	2D point source	storm	M21_PUKE_S_125	M21_PUKE_S_125	2.371	100yr_210mm	10	45.99	54.01
PUKE_S_126	Node	storm	1142596	1142596	2.300	100yr_210mm	22.67	62.36	37.64
PUKE_S_127	Node	storm	1146182	1146182	1.612	100yr_210mm	10.82	74.01	26.00
PUKE_S_128	Node	storm	1143494	1143494	0.992	100yr_210mm	10	86.96	13.04
PUKE_S_129	2D point source	storm	M21_PUKE_S_129	M21_PUKE_S_129	2.249	100yr_221mm	10	61.87	38.13
PUKE_S_13	2D point source	storm	M11_PUKE_S_13	M11_PUKE_S_13	16.652	100yr_233mm	29.49	15.68	84.32
PUKE_S_132	2D point source	storm	M21_PUKE_S_132	M21_PUKE_S_132	2.631	100yr_221mm	10	55.25	44.75
PUKE_S_134	Node	storm	1145334	1145334	1.141	100yr_221mm	10	90.70	9.30
PUKE_S_135	Node	storm	1146390	1146390	1.235	100yr_210mm	10	63.84	36.16
PUKE_S_136	Node	storm	1144113	1144113	0.852	100yr_221mm	10	63.27	36.73
PUKE_S_137	Node	storm	1142160	1142160	0.802	100yr_210mm	25.91	72.47	27.54
PUKE_S_139	2D point source	storm	M21_PUKE_S_139	M21_PUKE_S_139	4.037	100yr_210mm	10	19.55	80.45
PUKE_S_14	2D point source	storm	M11_PUKE_S_14	M11_PUKE_S_14	4.625	100yr_233mm	11.52	20.00	80.00
PUKE_S_140	2D point source	storm	M21_PUKE_S_140	M21_PUKE_S_140	1.471	100yr_221mm	10	62.46	37.55
PUKE_S_142	2D point source	storm	M21_PUKE_S_142	M21_PUKE_S_142	3.117	100yr_210mm	12.68	65.11	34.89
PUKE_S_143	2D point source	storm	M21_PUKE_S_143	M21_PUKE_S_143	3.301	100yr_221mm	10	35.66	64.34
PUKE_S_144	Node	storm	1142276	1142276	3.503	100yr_221mm	12.82	59.89	40.11
PUKE_S_145	Node	storm	1142317	1142317	2.150	100yr_221mm	14.84	78.57	21.43
PUKE_S_147	2D point source	storm	M21_PUKE_S_147	M21_PUKE_S_147	2.218	100yr_221mm	10	60.39	39.61
PUKE_S_149	Node	storm	1142431	1142431	2.053	100yr_210mm	11.01	70.18	29.82
PUKE_S_15	2D point source	storm	M11_PUKE_S_15	M11_PUKE_S_15	15.409	100yr_245mm	15.38	20.35	79.65
PUKE_S_150	2D point source	storm	M21_PUKE_S_150	M21_PUKE_S_150	4.473	100yr_210mm	19.17	15.19	84.81
PUKE_S_151	2D point source	storm	M21_PUKE_S_151	M21_PUKE_S_151	3.120	100yr_221mm	14.73	10.09	89.91
PUKE_S_153	2D point source	storm	M21_PUKE_S_153	M21_PUKE_S_153	3.946	100yr_221mm	12.63	10.81	89.19
PUKE_S_154	Node	storm	1142482	1142482	1.987	100yr_210mm	10	61.02	38.98
PUKE_S_155	Node	storm	1143671	1143671	2.295	100yr_221mm	12.45	61.43	38.58
PUKE_S_156	2D point source	storm	M21_PUKE_S_156	M21_PUKE_S_156	1.139	100yr_210mm	10	55.20	44.80
PUKE_S_157	2D point source	storm	M21_PUKE_S_157	M21_PUKE_S_157	2.645	100yr_221mm	10	16.65	83.35
PUKE_S_158	2D point source	storm	M21_PUKE_S_158	M21_PUKE_S_158	3.178	100yr_221mm	14.56	13.29	86.71
PUKE_S_159	2D point source	storm	M21_PUKE_S_159	M21_PUKE_S_159	2.316	100yr_210mm	10	13.14	86.86
PUKE_S_16	2D point source	storm	M11_PUKE_S_16	M11_PUKE_S_16	2.281	100yr_233mm	10	21.50	78.50
PUKE_S_161	Node	storm	1142312	1142312	3.065	100yr_221mm	10	59.60	40.40
PUKE_S_162	2D point source	storm	M21_PUKE_S_162	M21_PUKE_S_162	3.492	100yr_221mm	13.73	60.01	39.99
PUKE_S_163	2D point source	storm	M21_PUKE_S_163	M21_PUKE_S_163	2.589	100yr_221mm	10	71.13	28.87
PUKE_S_166	Node	storm	1142333	1142333	3.958	100yr_221mm	21.54	81.49	18.51
PUKE_S_168	2D point source	storm	M21_PUKE_S_168	M21_PUKE_S_168	2.639	100yr_221mm	10	10.80	89.20
PUKE_S_169	2D point source	storm	M21_PUKE_S_169	M21_PUKE_S_169	1.955	100yr_221mm	10	30.40	69.61

PUKE_S_170	2D point source	storm	M21_PUKE_S_170	M21_PUKE_S_170	3.547	100yr_221mm	12.53	63.52	36.48
PUKE_S_173	2D point source	storm	M11_PUKE_S_173	M11_PUKE_S_173	1.934	100yr_245mm	10	20.57	79.43
PUKE_S_179	2D point source	storm	M11_PUKE_S_179	M11_PUKE_S_179	4.132	100yr_245mm	12.55	10.38	89.62
PUKE_S_18	2D point source	storm	M11_PUKE_S_18	M11_PUKE_S_18	17.502	100yr_245mm	30.12	20.64	79.36
PUKE_S_180	2D point source	storm	M11_PUKE_S_180	M11_PUKE_S_180	6.183	100yr_245mm	14.25	10.00	90.00
PUKE_S_181	2D point source	storm	M11_PUKE_S_181	M11_PUKE_S_181	4.574	100yr_245mm	13.12	10.00	90.00
PUKE_S_182	2D point source	storm	M11_PUKE_S_182	M11_PUKE_S_182	35.332	100yr_245mm	40.38	10.00	90.00
PUKE_S_183	2D point source	storm	M11_PUKE_S_183	M11_PUKE_S_183	9.755	100yr_245mm	20.89	10.00	90.00
PUKE_S_184	2D point source	storm	M11_PUKE_S_184	M11_PUKE_S_184	1.592	100yr_233mm	10	10.00	90.00
PUKE_S_185	2D point source	storm	M11_PUKE_S_185	M11_PUKE_S_185	10.617	100yr_245mm	15.52	10.00	90.00
PUKE_S_186	2D point source	storm	M11_PUKE_S_186	M11_PUKE_S_186	18.195	100yr_256mm	20.46	10.00	90.00
PUKE_S_187	2D point source	storm	M11_PUKE_S_187	M11_PUKE_S_187	3.329	100yr_245mm	16.96	10.00	90.00
PUKE_S_188	2D point source	storm	M11_PUKE_S_188	M11_PUKE_S_188	5.642	100yr_233mm	13.93	10.00	90.00
PUKE_S_189	2D point source	storm	M11_PUKE_S_189	M11_PUKE_S_189	4.333	100yr_233mm	10	10.00	90.00
PUKE_S_19	2D point source	storm	M11_PUKE_S_19	M11_PUKE_S_19	4.897	100yr_245mm	19.93	36.42	63.58
PUKE_S_190	2D point source	storm	M11_PUKE_S_190	M11_PUKE_S_190	2.659	100yr_233mm	10	10.00	90.00
PUKE_S_191	2D point source	storm	M11_PUKE_S_191	M11_PUKE_S_191	2.296	100yr_233mm	10	10.00	90.00
PUKE_S_192	2D point source	storm	M11_PUKE_S_192	M11_PUKE_S_192	5.071	100yr_233mm	10	10.00	90.00
PUKE_S_193	2D point source	storm	M11_PUKE_S_193	M11_PUKE_S_193	34.357	100yr_245mm	32.48	10.00	90.00
PUKE_S_194	2D point source	storm	M21_PUKE_S_194	M21_PUKE_S_194	3.979	100yr_221mm	10	70.00	30.00
PUKE_S_198	2D point source	storm	M21_PUKE_S_198	M21_PUKE_S_198	4.005	100yr_221mm	16.13	70.00	30.00
PUKE_S_20	2D point source	storm	M11_PUKE_S_20	M11_PUKE_S_20	6.345	100yr_233mm	15.89	18.35	81.65
PUKE_S_200	2D point source	storm	M21_PUKE_S_200	M21_PUKE_S_200	2.482	100yr_221mm	14.16	70.56	29.44
PUKE_S_201	Node	storm	1143481	1143481	1.091	100yr_221mm	13.48	91.30	8.70
PUKE_S_202	Node	storm	1143476	1143476	2.126	100yr_221mm	18.71	88.15	11.86
PUKE_S_203	Node	storm	1146179	1146179	2.213	100yr_210mm	11.26	65.89	34.11
PUKE_S_206	2D point source	storm	M11_PUKE_S_206	M11_PUKE_S_206	2.018	100yr_233mm	10	13.53	86.47
PUKE_S_207	2D point source	storm	M21_PUKE_S_207	M21_PUKE_S_207	3.142	100yr_233mm	10	68.95	31.05
PUKE_S_208	2D point source	storm	M11_PUKE_S_208	M11_PUKE_S_208	4.296	100yr_233mm	19.64	10.04	89.96
PUKE_S_209	2D point source	storm	M11_PUKE_S_209	M11_PUKE_S_209	1.206	100yr_233mm	10	10.19	89.82
PUKE_S_21	2D point source	storm	M11_PUKE_S_21	M11_PUKE_S_21	22.495	100yr_256mm	36.08	25.78	74.22
PUKE_S_210	2D point source	storm	M21_PUKE_S_210	M21_PUKE_S_210	0.937	100yr_221mm	14.94	90.68	9.32
PUKE_S_211	2D point source	storm	M21_PUKE_S_211	M21_PUKE_S_211	4.407	100yr_221mm	30.4	70.01	29.99
PUKE_S_212	2D point source	storm	M21_PUKE_S_212	M21_PUKE_S_212	2.039	100yr_221mm	16.37	80.21	19.79
PUKE_S_213	2D point source	storm	M11_PUKE_S_213	M11_PUKE_S_213	10.464	100yr_256mm	25.23	10.00	90.00
PUKE_S_219	2D point source	storm	M21_PUKE_S_219	M21_PUKE_S_219	1.856	100yr_233mm	10	70.00	30.00
PUKE_S_221	2D point source	storm	M21_PUKE_S_221	M21_PUKE_S_221	1.114	100yr_233mm	10	70.00	30.00
PUKE_S_222	2D point source	storm	M21_PUKE_S_222	M21_PUKE_S_222	4.275	100yr_233mm	12.75	70.00	30.00
PUKE_S_224	2D point source	storm	M21_PUKE_S_224	M21_PUKE_S_224	2.168	100yr_233mm	10	70.00	30.00
PUKE_S_225	2D point source	storm	M21_PUKE_S_225	M21_PUKE_S_225	2.623	100yr_233mm	10	70.03	29.97
PUKE_S_226	2D point source	storm	M21_PUKE_S_226	M21_PUKE_S_226	2.820	100yr_221mm	18.13	82.13	17.87
PUKE_S_227	Node	storm	1143473	1143473	2.071	100yr_221mm	12.18	90.35	9.65
PUKE_S_228	2D point source	storm	M21_PUKE_S_228	M21_PUKE_S_228	3.497	100yr_233mm	23.25	70.00	30.00
PUKE_S_229	2D point source	storm	M21_PUKE_S_229	M21_PUKE_S_229	3.474	100yr_221mm	16.68	70.00	30.00
PUKE_S_230	2D point source	storm	M21_PUKE_S_230	M21_PUKE_S_230	1.501	100yr_221mm	10	70.00	30.00
PUKE_S_234	2D point source	storm	M21_PUKE_S_234	M21_PUKE_S_234	2.666	100yr_233mm	16.31	70.00	30.00
PUKE_S_235	2D point source	storm	M21_PUKE_S_235	M21_PUKE_S_235	3.684	100yr_233mm	23.09	70.76	29.24
PUKE_S_236	2D point source	storm	M21_PUKE_S_236	M21_PUKE_S_236	2.338	100yr_221mm	23.15	87.53	12.47
PUKE_S_237	2D point source	storm	M21_PUKE_S_237	M21_PUKE_S_237	3.271	100yr_233mm	12.42	70.00	30.00
PUKE_S_238	2D point source	storm	M21_PUKE_S_238	M21_PUKE_S_238	2.403	100yr_233mm	10	70.65	29.35
PUKE_S_239	2D point source	storm	M21_PUKE_S_239	M21_PUKE_S_239	3.106	100yr_233mm	10	70.02	29.98
PUKE_S_24	2D point source	storm	M11_PUKE_S_24	M11_PUKE_S_24	2.245	100yr_233mm	10.44	20.00	80.00
PUKE_S_240	2D point source	storm	M21_PUKE_S_240	M21_PUKE_S_240	1.401	100yr_233mm	10	70.64	29.36
PUKE_S_242	2D point source	storm	M21_PUKE_S_242	M21_PUKE_S_242	3.151	100yr_233mm	17.49	70.00	30.00
PUKE_S_243	2D point source	storm	M21_PUKE_S_243	M21_PUKE_S_243	3.501	100yr_233mm	19.93	70.00	30.00
PUKE_S_245	2D point source	storm	M21_PUKE_S_245	M21_PUKE_S_245	0.684	100yr_233mm	10	71.02	28.98
PUKE_S_248	2D point source	storm	M21_PUKE_S_248	M21_PUKE_S_248	1.270	100yr_233mm	10	71.15	28.85
PUKE_S_249	2D point source	storm	M21_PUKE_S_249	M21_PUKE_S_249	2.449	100yr_233mm	16.64	70.00	30.00
PUKE_S_25	2D point source	storm	M11_PUKE_S_25	M11_PUKE_S_25	3.933	100yr_233mm	10	10.00	90.00
PUKE_S_250	2D point source	storm	M21_PUKE_S_250	M21_PUKE_S_250	2.632	100yr_233mm	10	70.66	29.35
PUKE_S_252	2D point source	storm	M21_PUKE_S_252	M21_PUKE_S_252	3.125	100yr_221mm	16.78	70.00	30.00
PUKE_S_257	2D point source	storm	M21_PUKE_S_257	M21_PUKE_S_257	3.824	100yr_221mm	10	70.00	30.00
PUKE_S_258	2D point source	storm	M21_PUKE_S_258	M21_PUKE_S_258	3.358	100yr_221mm	24.35	70.60	29.40
PUKE_S_259	2D point source	storm	M21_PUKE_S_259	M21_PUKE_S_259	2.691	100yr_221mm	13.46	70.00	30.00
PUKE_S_26	2D point source	storm	M11_PUKE_S_26	M11_PUKE_S_26	85.416	100yr_256mm	41.67	10.00	90.00
PUKE_S_260	Node	storm	1146403	1146403	2.221	100yr_221mm	14.7	80.92	19.08
PUKE_S_261	2D point source	storm	M21_PUKE_S_261	M21_PUKE_S_261	3.434	100yr_245mm	15.83	10.00	90.00
PUKE_S_262	2D point source	storm	M21_PUKE_S_262	M21_PUKE_S_262	3.321	100yr_233mm	13.28	69.77	30.23
PUKE_S_264	Node	storm	1142329	1142329	0.196	100yr_221mm	11.27	80.51	19.49
PUKE_S_265	2D point source	storm	M21_PUKE_S_265	M21_PUKE_S_265	4.323	100yr_221mm	11.12	70.28	29.72
PUKE_S_268	Node	storm	1142324	1142324	2.038	100yr_221mm	14.21	89.98	10.02
PUKE_S_269	Node	storm	1143472	1143472	1.303	100yr_221mm	13.06	90.63	9.37

PUKE_S_27	2D point source	storm	M11_PUKE_S_27	M11_PUKE_S_27	13.700	100yr_233mm	20.49	16.28	83.72
PUKE_S_270	Node	storm	1146393	1146393	1.639	100yr_221mm	17.51	84.32	15.68
PUKE_S_271	2D point source	storm	M21_PUKE_S_271	M21_PUKE_S_271	1.931	100yr_221mm	10	72.08	27.92
PUKE_S_275	2D point source	storm	M21_PUKE_S_275	M21_PUKE_S_275	3.914	100yr_221mm	16.5	70.55	29.45
PUKE_S_276	2D point source	storm	M21_PUKE_S_276	M21_PUKE_S_276	3.028	100yr_233mm	10	70.77	29.20
PUKE_S_277	2D point source	storm	M21_PUKE_S_277	M21_PUKE_S_277	3.325	100yr_233mm	32.68	72.97	27.03
PUKE_S_279	2D point source	storm	M21_PUKE_S_279	M21_PUKE_S_279	3.689	100yr_245mm	10	10.00	90.00
PUKE_S_28	2D point source	storm	M11_PUKE_S_28	M11_PUKE_S_28	3.613	100yr_233mm	10	20.00	80.00
PUKE_S_281	2D point source	storm	M21_PUKE_S_281	M21_PUKE_S_281	3.242	100yr_221mm	12.98	70.65	29.35
PUKE_S_282	2D point source	storm	M21_PUKE_S_282	M21_PUKE_S_282	3.475	100yr_221mm	10	70.03	29.98
PUKE_S_283	2D point source	storm	M21_PUKE_S_283	M21_PUKE_S_283	2.915	100yr_233mm	10	70.11	29.89
PUKE_S_284	2D point source	storm	M21_PUKE_S_284	M21_PUKE_S_284	2.477	100yr_233mm	10	71.14	28.86
PUKE_S_285	2D point source	storm	M21_PUKE_S_285	M21_PUKE_S_285	2.618	100yr_221mm	10	70.59	29.41
PUKE_S_287	2D point source	storm	M21_PUKE_S_287	M21_PUKE_S_287	2.814	100yr_221mm	10	11.69	88.31
PUKE_S_288	2D point source	storm	M21_PUKE_S_288	M21_PUKE_S_288	0.884	100yr_233mm	10	71.14	28.83
PUKE_S_289	2D point source	storm	M21_PUKE_S_289	M21_PUKE_S_289	3.537	100yr_233mm	10	70.00	30.00
PUKE_S_290	2D point source	storm	M21_PUKE_S_290	M21_PUKE_S_290	9.825	100yr_245mm	12.37	10.00	89.91
PUKE_S_291	2D point source	storm	M21_PUKE_S_291	M21_PUKE_S_291	4.226	100yr_221mm	15.73	49.80	50.20
PUKE_S_292	2D point source	storm	M21_PUKE_S_292	M21_PUKE_S_292	4.395	100yr_245mm	10.2	10.00	90.00
PUKE_S_293	2D point source	storm	M21_PUKE_S_293	M21_PUKE_S_293	3.873	100yr_245mm	11	10.00	90.00
PUKE_S_295	2D point source	storm	M21_PUKE_S_295	M21_PUKE_S_295	0.690	100yr_233mm	14.29	71.61	28.39
PUKE_S_297	2D point source	storm	M21_PUKE_S_297	M21_PUKE_S_297	2.098	100yr_233mm	12.15	74.88	25.12
PUKE_S_299	2D point source	storm	M21_PUKE_S_299	M21_PUKE_S_299	1.202	100yr_233mm	10	76.34	23.66
PUKE_S_30	2D point source	storm	M11_PUKE_S_30	M11_PUKE_S_30	38.504	100yr_268mm	57.29	10.80	89.20
PUKE_S_300	2D point source	storm	M21_PUKE_S_300	M21_PUKE_S_300	1.549	100yr_233mm	10	70.00	30.00
PUKE_S_301	2D point source	storm	M21_PUKE_S_301	M21_PUKE_S_301	3.337	100yr_233mm	10.41	70.00	30.00
PUKE_S_302	2D point source	storm	M21_PUKE_S_302	M21_PUKE_S_302	1.668	100yr_233mm	16.53	58.39	41.61
PUKE_S_305	2D point source	storm	M21_PUKE_S_305	M21_PUKE_S_305	3.689	100yr_245mm	10	10.00	90.00
PUKE_S_306	2D point source	storm	M21_PUKE_S_306	M21_PUKE_S_306	3.910	100yr_233mm	10	70.00	30.00
PUKE_S_308	2D point source	storm	M21_PUKE_S_308	M21_PUKE_S_308	2.893	100yr_233mm	13.72	70.33	29.68
PUKE_S_309	2D point source	storm	M21_PUKE_S_309	M21_PUKE_S_309	3.780	100yr_233mm	19.73	80.24	19.76
PUKE_S_310	2D point source	storm	M21_PUKE_S_310	M21_PUKE_S_310	2.356	100yr_233mm	10	70.08	29.92
PUKE_S_311	2D point source	storm	M21_PUKE_S_311	M21_PUKE_S_311	1.890	100yr_233mm	10	70.00	30.00
PUKE_S_312	2D point source	storm	M21_PUKE_S_312	M21_PUKE_S_312	1.203	100yr_233mm	10	70.00	30.00
PUKE_S_313	2D point source	storm	M21_PUKE_S_313	M21_PUKE_S_313	3.594	100yr_233mm	15.13	70.08	29.92
PUKE_S_314	2D point source	storm	M21_PUKE_S_314	M21_PUKE_S_314	2.926	100yr_233mm	11.8	76.93	23.07
PUKE_S_315	Node	storm	1145359	1145359	4.301	100yr_221mm	16.27	10.16	89.84
PUKE_S_319	Node	storm	1142300	1142300	4.156	100yr_221mm	12.55	21.48	78.52
PUKE_S_32	2D point source	storm	M21_PUKE_S_32	M21_PUKE_S_32	2.917	100yr_233mm	10	67.93	32.07
PUKE_S_320	2D point source	storm	M11_PUKE_S_320	M11_PUKE_S_320	2.704	100yr_221mm	10.98	18.29	81.71
PUKE_S_321	2D point source	storm	M21_PUKE_S_321	M21_PUKE_S_321	2.788	100yr_221mm	10	11.10	88.90
PUKE_S_322	2D point source	storm	M21_PUKE_S_322	M21_PUKE_S_322	6.155	100yr_245mm	19.27	10.00	90.00
PUKE_S_323	2D point source	storm	M21_PUKE_S_323	M21_PUKE_S_323	3.660	100yr_233mm	11.9	70.00	30.00
PUKE_S_324	2D point source	storm	M21_PUKE_S_324	M21_PUKE_S_324	3.305	100yr_233mm	20.04	76.23	23.77
PUKE_S_325	Node	storm	1143844	1143844	0.983	100yr_233mm	30.06	69.73	30.27
PUKE_S_326	2D point source	storm	M21_PUKE_S_326	M21_PUKE_S_326	2.739	100yr_233mm	10	70.74	29.26
PUKE_S_329	2D point source	storm	M21_PUKE_S_329	M21_PUKE_S_329	1.170	100yr_233mm	10	60.01	39.99
PUKE_S_33	2D point source	storm	M21_PUKE_S_33	M21_PUKE_S_33	2.430	100yr_221mm	10	70.00	30.00
PUKE_S_330	2D point source	storm	M21_PUKE_S_330	M21_PUKE_S_330	2.661	100yr_233mm	10	70.23	29.77
PUKE_S_332	Node	storm	1146376	1146376	1.323	100yr_233mm	12.32	87.60	12.40
PUKE_S_334	2D point source	storm	M21_PUKE_S_334	M21_PUKE_S_334	1.996	100yr_233mm	10	70.03	29.97
PUKE_S_335	Node	storm	1143769	1143769	1.819	100yr_233mm	25.36	70.56	29.45
PUKE_S_337	2D point source	storm	M21_PUKE_S_337	M21_PUKE_S_337	3.455	100yr_233mm	12.79	70.13	29.87
PUKE_S_338	Node	storm	1144705	1144705	1.098	100yr_233mm	11.51	59.99	40.02
PUKE_S_339	Node	storm	1145302	1145302	2.776	100yr_233mm	14.91	60.07	39.93
PUKE_S_34	2D point source	storm	M11_PUKE_S_34	M11_PUKE_S_34	2.501	100yr_245mm	11.18	10.15	89.85
PUKE_S_340	Node	storm	1144707	1144707	1.318	100yr_233mm	10	64.94	35.06
PUKE_S_341	Node	storm	1144710	1144710	1.568	100yr_233mm	17.43	65.18	34.82
PUKE_S_342	Node	storm	1143848	1143848	3.450	100yr_233mm	10	67.20	32.80
PUKE_S_343	2D point source	storm	M21_PUKE_S_343	M21_PUKE_S_343	2.698	100yr_233mm	13.08	62.71	37.29
PUKE_S_344	2D point source	storm	M21_PUKE_S_344	M21_PUKE_S_344	2.244	100yr_233mm	12.2	70.00	30.00
PUKE_S_345	2D point source	storm	M21_PUKE_S_345	M21_PUKE_S_345	3.065	100yr_233mm	12.72	70.04	29.96
PUKE_S_346	2D point source	storm	M21_PUKE_S_346	M21_PUKE_S_346	4.392	100yr_233mm	10.16	62.08	37.92
PUKE_S_347	2D point source	storm	M21_PUKE_S_347	M21_PUKE_S_347	2.596	100yr_245mm	12.45	70.00	30.00
PUKE_S_348	2D point source	storm	M21_PUKE_S_348	M21_PUKE_S_348	1.184	100yr_245mm	10	75.90	24.10
PUKE_S_349	2D point source	storm	M21_PUKE_S_349	M21_PUKE_S_349	1.314	100yr_245mm	10	61.35	38.65
PUKE_S_35	2D point source	storm	M21_PUKE_S_35	M21_PUKE_S_35	4.191	100yr_221mm	10.19	70.00	30.00
PUKE_S_351	Node	storm	1146377	1146377	2.693	100yr_233mm	10	66.21	33.79
PUKE_S_352	Node	storm	1146372	1146372	1.971	100yr_233mm	12.06	64.29	35.71
PUKE_S_354	2D point source	storm	M11_PUKE_S_354	M11_PUKE_S_354	3.632	100yr_245mm	23.44	29.14	70.86
PUKE_S_357	2D point source	storm	M21_PUKE_S_357	M21_PUKE_S_357	2.440	100yr_221mm	10	86.25	13.75
PUKE_S_358	Node	storm	1144107	1144107	2.577	100yr_221mm	15.97	63.12	36.89

PUKE_S_359	Node	storm	1142559	1142559	1.219	100yr_221mm	26.19	80.03	19.97
PUKE_S_360	2D point source	storm	M21_PUKE_S_360	M21_PUKE_S_360	1.696	100yr_221mm	23.86	89.99	10.01
PUKE_S_361	2D point source	storm	M21_PUKE_S_361	M21_PUKE_S_361	1.108	100yr_221mm	10	82.57	17.43
PUKE_S_362	Node	storm	1143426	1143426	2.924	100yr_221mm	18.18	63.76	36.24
PUKE_S_363	Node	storm	1146180	1146180	1.340	100yr_210mm	10	80.42	19.58
PUKE_S_364	Node	storm	1144586	1144586	2.861	100yr_221mm	19.68	82.88	17.12
PUKE_S_365	Node	storm	1143490	1143490	2.611	100yr_210mm	17.13	82.34	17.66
PUKE_S_366	Node	storm	1142132	1142132	1.062	100yr_210mm	10	60.03	39.97
PUKE_S_367	Node	storm	1142058	1142058	0.757	100yr_210mm	10	86.31	13.69
PUKE_S_368	Node	storm	1142358	1142358	2.974	100yr_221mm	25.47	90.94	9.06
PUKE_S_369	Node	storm	1143651	1143651	2.027	100yr_221mm	25.32	87.49	12.51
PUKE_S_370	Node	storm	1143497	1143497	2.108	100yr_221mm	23.54	87.78	12.22
PUKE_S_371	Node	storm	1142356	1142356	2.737	100yr_221mm	28.33	84.44	15.56
PUKE_S_372	2D point source	storm	M21_PUKE_S_372	M21_PUKE_S_372	1.789	100yr_221mm	22.24	89.23	10.77
PUKE_S_373	Node	storm	1142553_dummy	1142553_dummy	1.444	100yr_210mm	10.01	66.71	33.29
PUKE_S_374	Node	storm	1143482	1143482	1.348	100yr_210mm	14.73	96.63	3.38
PUKE_S_375	Node	storm	1142227	1142227	2.362	100yr_210mm	14.77	60.65	39.35
PUKE_S_379	Node	storm	1142220	1142220	0.910	100yr_210mm	14.01	50.28	49.72
PUKE_S_38	2D point source	storm	M11_PUKE_S_38	M11_PUKE_S_38	3.693	100yr_233mm	15.33	13.71	86.29
PUKE_S_380	Node	storm	1142236	1142236	1.209	100yr_210mm	11.37	70.89	29.12
PUKE_S_381	Node	storm	1144417	1144417	1.576	100yr_221mm	10	61.07	38.93
PUKE_S_382	2D point source	storm	M21_PUKE_S_382	M21_PUKE_S_382	2.558	100yr_210mm	11.92	60.04	39.96
PUKE_S_383	Node	storm	1142205	1142205	1.326	100yr_210mm	10	76.93	23.07
PUKE_S_384	2D point source	storm	M21_PUKE_S_384	M21_PUKE_S_384	2.318	100yr_210mm	10.74	42.16	57.84
PUKE_S_385	Node	storm	1144026	1144026	3.144	100yr_210mm	15.24	63.01	36.99
PUKE_S_386	Node	storm	1143678	1143678	2.647	100yr_210mm	10	43.74	56.26
PUKE_S_387	Node	storm	1145764	1145764	2.017	100yr_210mm	13.59	73.86	26.14
PUKE_S_388	Node	storm	1143684	1143684	1.216	100yr_210mm	16.87	75.77	24.23
PUKE_S_390	Node	storm	1142211	1142211	3.322	100yr_210mm	15.84	63.58	36.42
PUKE_S_392	Node	storm	1145330	1145330	2.375	100yr_210mm	10	73.76	26.24
PUKE_S_393	Node	storm	1142354	1142354	2.625	100yr_210mm	13.14	89.89	10.11
PUKE_S_394	Node	storm	1143483	1143483	2.167	100yr_210mm	13.51	93.91	6.09
PUKE_S_395	2D point source	storm	M21_PUKE_S_395	M21_PUKE_S_395	2.320	100yr_210mm	10	65.24	34.76
PUKE_S_396	Node	storm	1144423	1144423	1.222	100yr_221mm	12.29	68.77	31.23
PUKE_S_397	Node	storm	1142283	1142283	1.887	100yr_221mm	10.52	61.73	38.27
PUKE_S_398	Node	storm	1144096	1144096	2.707	100yr_221mm	14.8	61.99	38.01
PUKE_S_399	Node	storm	1142255	1142255	3.361	100yr_221mm	10.57	66.17	33.83
PUKE_S_40	2D point source	storm	M11_PUKE_S_40	M11_PUKE_S_40	7.500	100yr_256mm	10.22	10.00	90.00
PUKE_S_400	Node	storm	1142560	1142560	1.773	100yr_221mm	12.79	64.23	35.77
PUKE_S_401	Node	storm	1144092	1144092	2.118	100yr_221mm	14.63	62.15	37.85
PUKE_S_402	Node	storm	1142193	1142193	1.693	100yr_210mm	12.02	59.61	40.39
PUKE_S_403	Node	storm	1145313	1145313	1.935	100yr_221mm	12.92	45.08	54.92
PUKE_S_404	Node	storm	1146235	1146235	0.700	100yr_221mm	11.35	79.92	20.08
PUKE_S_405	2D point source	storm	M21_PUKE_S_405	M21_PUKE_S_405	2.413	100yr_221mm	13.24	89.99	10.01
PUKE_S_406	Node	storm	1146399	1146399	2.485	100yr_221mm	10.37	81.10	18.90
PUKE_S_407	Node	storm	1142181	1142181	3.234	100yr_210mm	13.99	64.43	35.57
PUKE_S_408	Node	storm	1142171	1142171	2.450	100yr_210mm	21.81	60.68	39.33
PUKE_S_410	Node	storm	1142268	1142268	2.112	100yr_221mm	11.04	66.91	33.10
PUKE_S_412	Node	storm	1142228	1142228	1.874	100yr_210mm	10	63.27	36.73
PUKE_S_413	Node	storm	1142221	1142221	1.979	100yr_210mm	18.51	85.83	14.18
PUKE_S_414	Node	storm	1142217	1142217	2.308	100yr_210mm	10.56	64.60	35.41
PUKE_S_415	Node	storm	1142273	1142273	4.282	100yr_221mm	12.76	61.79	38.21
PUKE_S_416	Node	storm	1142165	1142165	2.588	100yr_210mm	12.05	70.71	29.29
PUKE_S_417	Node	storm	1142159	1142159	0.732	100yr_210mm	10	63.03	36.97
PUKE_S_418	2D point source	storm	M21_PUKE_S_418	M21_PUKE_S_418	2.382	100yr_210mm	10	52.67	47.33
PUKE_S_419	Node	storm	1144793	1144793	2.939	100yr_210mm	11.74	64.15	35.85
PUKE_S_42	2D point source	storm	M11_PUKE_S_42	M11_PUKE_S_42	89.298	100yr_268mm	63.5	11.51	88.49
PUKE_S_421	2D point source	storm	M21_PUKE_S_421	M21_PUKE_S_421	1.892	100yr_210mm	13.39	13.21	86.79
PUKE_S_422	2D point source	storm	M21_PUKE_S_422	M21_PUKE_S_422	1.885	100yr_210mm	10	61.09	38.91
PUKE_S_423	2D point source	storm	M21_PUKE_S_423	M21_PUKE_S_423	3.779	100yr_210mm	10	59.19	40.81
PUKE_S_424	Node	storm	1142279	1142279	1.038	100yr_221mm	10	60.10	39.90
PUKE_S_425	Node	storm	1144016	1144016	3.587	100yr_221mm	13.97	60.94	39.06
PUKE_S_426	Node	storm	1142260	1142260	2.592	100yr_210mm	12.11	63.02	36.98
PUKE_S_429	Node	storm	1142184	1142184	2.026	100yr_210mm	12.67	61.80	38.20
PUKE_S_43	2D point source	storm	M21_PUKE_S_43	M21_PUKE_S_43	3.359	100yr_221mm	16.23	71.58	28.42
PUKE_S_430	Node	storm	1144721	1144721	1.085	100yr_210mm	10	69.48	30.52
PUKE_S_431	Node	storm	1142179	1142179	2.256	100yr_210mm	11.06	64.60	35.40
PUKE_S_432	Node	storm	1143645	1143645	1.503	100yr_210mm	10	62.24	37.76
PUKE_S_433	Node	storm	1144933	1144933	1.489	100yr_210mm	12.7	60.73	39.27
PUKE_S_434	Node	storm	1142175	1142175	1.908	100yr_210mm	11.56	62.92	37.08
PUKE_S_435	Node	storm	1144853	1144853	1.198	100yr_210mm	13.12	68.20	31.80
PUKE_S_436	Node	storm	1143643	1143643	0.921	100yr_210mm	10.28	65.32	34.68

PUKE_S_437	Node	storm	1142150	1142150	2.924	100yr_210mm	16.5	61.42	38.58
PUKE_S_438	2D point source	storm	M21_PUKE_S_438	M21_PUKE_S_438	3.001	100yr_221mm	14.65	37.26	62.75
PUKE_S_439	Node	storm	1142528	1142528	3.431	100yr_221mm	10	61.01	38.99
PUKE_S_44	2D point source	storm	M21_PUKE_S_44	M21_PUKE_S_44	2.456	100yr_233mm	11.45	51.34	48.66
PUKE_S_440	2D point source	storm	M21_PUKE_S_440	M21_PUKE_S_440	2.418	100yr_221mm	10	62.66	37.35
PUKE_S_441	Node	storm	1145718	1145718	3.057	100yr_221mm	10	61.99	38.01
PUKE_S_444	Node	storm	1145369	1145369	2.446	100yr_221mm	10	22.56	77.44
PUKE_S_446	Node	storm	1145365	1145365	2.884	100yr_221mm	11.11	14.80	85.20
PUKE_S_447	Node	storm	1142499	1142499	1.604	100yr_210mm	10.28	64.34	35.66
PUKE_S_448	Node	storm	1145056	1145056	1.697	100yr_210mm	10	64.73	35.27
PUKE_S_449	Node	storm	1142294	1142294	1.097	100yr_210mm	10	64.84	35.16
PUKE_S_45	2D point source	storm	M21_PUKE_S_45	M21_PUKE_S_45	4.172	100yr_233mm	11.29	70.09	29.91
PUKE_S_450	Node	storm	1145977	1145977	1.912	100yr_210mm	15.47	30.00	70.00
PUKE_S_451	Node	storm	1142298	1142298	1.358	100yr_210mm	10	61.99	38.01
PUKE_S_452	Node	storm	1142143	1142143	0.583	100yr_210mm	10	61.68	38.32
PUKE_S_453	Node	storm	1144925	1144925	1.461	100yr_210mm	10	61.35	38.65
PUKE_S_454	Node	storm	1142517	1142517	2.063	100yr_221mm	10	64.48	35.52
PUKE_S_455	Node	storm	1142225	1142225	1.810	100yr_210mm	17.14	80.00	20.00
PUKE_S_456	Node	storm	1142207	1142207	1.153	100yr_210mm	10	69.88	30.12
PUKE_S_457	Node	storm	1142209	1142209	1.284	100yr_210mm	12.52	63.99	36.01
PUKE_S_458	Node	storm	1146238	1146238	1.515	100yr_210mm	10	66.80	33.20
PUKE_S_459	Node	storm	1142249	1142249	2.989	100yr_221mm	14.5	64.60	35.40
PUKE_S_46	Node	storm	1142059	1142059	1.354	100yr_210mm	14.5	90.54	9.46
PUKE_S_460	Node	storm	1142253	1142253	0.692	100yr_221mm	10	63.29	36.71
PUKE_S_461	Node	storm	1144429	1144429	1.735	100yr_221mm	12.49	60.02	39.98
PUKE_S_462	Node	storm	1142246	1142246	1.643	100yr_221mm	10	51.59	48.41
PUKE_S_463	Node	storm	1146042	1146042	0.379	100yr_210mm	15.6	80.00	20.00
PUKE_S_464	Node	storm	1142203	1142203	1.756	100yr_210mm	21.76	57.43	42.57
PUKE_S_465	2D point source	storm	M21_PUKE_S_465	M21_PUKE_S_465	2.135	100yr_210mm	17.17	84.48	15.52
PUKE_S_466	Node	storm	1142195	1142195	1.169	100yr_210mm	10.48	65.23	34.78
PUKE_S_467	Node	storm	1146039	1146039	3.024	100yr_210mm	22.18	63.09	36.92
PUKE_S_468	Node	storm	1144980	1144980	2.002	100yr_210mm	20.83	62.48	37.52
PUKE_S_469	Node	storm	1142200	1142200	2.827	100yr_210mm	10.67	40.01	59.99
PUKE_S_47	2D point source	storm	M11_PUKE_S_47	M11_PUKE_S_47	7.921	100yr_245mm	19.81	10.00	90.00
PUKE_S_470	2D point source	storm	M21_PUKE_S_470	M21_PUKE_S_470	1.226	100yr_221mm	10	90.00	10.00
PUKE_S_471	Node	storm	1143655	1143655	2.838	100yr_221mm	22.42	90.00	10.01
PUKE_S_472	Node	storm	1143489	1143489	0.831	100yr_210mm	16.1	86.72	13.28
PUKE_S_473	Node	storm	1143795	1143795	1.595	100yr_221mm	21.71	85.67	14.33
PUKE_S_474	Node	storm	1145314	1145314	1.986	100yr_221mm	20.32	80.00	20.00
PUKE_S_475	Node	storm	1143714	1143714	3.668	100yr_221mm	10	90.00	10.00
PUKE_S_476	Node	storm	1144715	1144715	1.223	100yr_233mm	18.66	73.68	26.33
PUKE_S_477	Node	storm	1143650	1143650	1.889	100yr_221mm	22.2	89.96	10.04
PUKE_S_478	Node	storm	1143853	1143853	1.251	100yr_233mm	15.58	59.98	40.02
PUKE_S_481	2D point source	storm	M21_PUKE_S_481	M21_PUKE_S_481	3.930	100yr_221mm	10.88	44.42	55.58
PUKE_S_482	Node	storm	1142302	1142302	1.517	100yr_221mm	10	63.35	36.65
PUKE_S_484	Node	storm	1142334	1142334	2.385	100yr_221mm	10.41	89.99	10.01
PUKE_S_485	2D point source	storm	M11_PUKE_S_485	M11_PUKE_S_485	3.242	100yr_221mm	10	17.02	82.98
PUKE_S_486	Node	storm	1142140	1142140	1.165	100yr_210mm	10	62.18	37.82
PUKE_S_487	Node	storm	1142134	1142134	1.272	100yr_210mm	10	36.95	63.05
PUKE_S_488	2D point source	storm	M11_PUKE_S_488	M11_PUKE_S_488	2.377	100yr_221mm	11.1	13.90	86.10
PUKE_S_492	Node	storm	1142288	1142288	1.686	100yr_221mm	10	62.54	37.46
PUKE_S_493	2D point source	storm	M11_PUKE_S_493	M11_PUKE_S_493	2.668	100yr_221mm	10	13.91	86.10
PUKE_S_494	2D point source	storm	M21_PUKE_S_494	M21_PUKE_S_494	4.370	100yr_210mm	13.05	70.00	30.00
PUKE_S_495	Node	storm	1143664	1143664	2.703	100yr_210mm	14.09	73.51	26.49
PUKE_S_496	2D point source	storm	M21_PUKE_S_496	M21_PUKE_S_496	1.767	100yr_210mm	14.05	70.02	29.98
PUKE_S_497	Node	storm	1146050	1146050	2.060	100yr_210mm	12.41	79.16	20.84
PUKE_S_498	Node	storm	1144517	1144517	2.986	100yr_221mm	13.79	91.66	8.34
PUKE_S_499	Node	storm	1145285	1145285	2.554	100yr_210mm	13.46	63.18	36.82
PUKE_S_500	Node	storm	1145286	1145286	1.520	100yr_210mm	10	58.92	41.08
PUKE_S_501	2D point source	storm	M21_PUKE_S_501	M21_PUKE_S_501	0.784	100yr_221mm	10	60.09	39.91
PUKE_S_502	Node	storm	1145379	1145379	1.624	100yr_221mm	10.72	59.84	40.16
PUKE_S_503	2D point source	storm	M21_PUKE_S_503	M21_PUKE_S_503	1.304	100yr_221mm	10	68.16	31.84
PUKE_S_504	Node	storm	1142238	1142238	1.855	100yr_221mm	10	52.80	47.20
PUKE_S_505	Node	storm	1144729	1144729	1.834	100yr_210mm	13.68	66.47	33.53
PUKE_S_506	Node	storm	1144725	1144725	1.383	100yr_210mm	14.18	65.11	34.89
PUKE_S_507	Node	storm	1144731	1144731	1.875	100yr_210mm	12.74	67.97	32.03
PUKE_S_508	Node	storm	1142198	1142198	2.723	100yr_210mm	10.39	63.54	36.46
PUKE_S_509	Node	storm	1142194	1142194	1.792	100yr_210mm	11.77	60.06	39.94
PUKE_S_51	2D point source	storm	M21_PUKE_S_51	M21_PUKE_S_51	2.368	100yr_221mm	10	70.64	29.36
PUKE_S_510	Node	storm	1142541	1142541	1.831	100yr_210mm	12.64	64.73	35.27
PUKE_S_511	Node	storm	1144726	1144726	1.019	100yr_210mm	10	63.72	36.29
PUKE_S_513	Node	storm	1146233	1146233	0.540	100yr_210mm	10	79.81	20.19

PUKE_S_514	Node	storm	1143662	1143662	1.542	100yr_221mm	10	85.39	14.61
PUKE_S_515	Node	storm	1146254	1146254	2.387	100yr_221mm	13.54	67.66	32.34
PUKE_S_516	2D point source	storm	M21_PUKE_S_516	M21_PUKE_S_516	1.850	100yr_221mm	10	89.99	10.01
PUKE_S_517	2D point source	storm	M21_PUKE_S_517	M21_PUKE_S_517	1.078	100yr_221mm	19.67	89.97	10.04
PUKE_S_518	Node	storm	1143654	1143654	1.015	100yr_221mm	14.66	90.00	10.00
PUKE_S_519	Node	storm	1143658	1143658	0.615	100yr_221mm	10	79.98	20.04
PUKE_S_52	2D point source	storm	M21_PUKE_S_52	M21_PUKE_S_52	3.580	100yr_233mm	10.56	70.00	30.00
PUKE_S_520	Node	storm	1142204	1142204	0.959	100yr_210mm	10	40.00	60.00
PUKE_S_521	Node	storm	1142337	1142337	1.032	100yr_221mm	12.65	89.98	10.02
PUKE_S_522	2D point source	storm	M21_PUKE_S_522	M21_PUKE_S_522	2.181	100yr_210mm	10	70.02	29.98
PUKE_S_523	Node	storm	1143659	1143659	2.165	100yr_210mm	12.77	70.00	30.00
PUKE_S_524	Node	storm	1146241	1146241	1.315	100yr_210mm	13.18	68.82	31.18
PUKE_S_525	Node	storm	1142134	1142134	0.882	100yr_210mm	10	63.67	36.33
PUKE_S_526	Node	storm	1142155	1142155	0.886	100yr_210mm	11.36	68.33	31.67
PUKE_S_527	Node	storm	1145968_dummy_3	1145968_dummy_3	2.995	100yr_221mm	10	62.77	37.23
PUKE_S_528	Node	storm	1146299	1146299	0.922	100yr_221mm	10	60.00	40.00
PUKE_S_53	2D point source	storm	M21_PUKE_S_53	M21_PUKE_S_53	2.491	100yr_221mm	11.93	70.02	29.98
PUKE_S_538	2D point source	storm	M21_PUKE_S_538	M21_PUKE_S_538	1.788	100yr_210mm	10	17.08	82.92
PUKE_S_54	2D point source	storm	M11_PUKE_S_54	M11_PUKE_S_54	4.736	100yr_233mm	11.8	10.00	90.00
PUKE_S_541	2D point source	storm	M21_PUKE_S_541	M21_PUKE_S_541	2.639	100yr_210mm	10	61.44	38.56
PUKE_S_547	2D point source	storm	M21_PUKE_S_547	M21_PUKE_S_547	2.626	100yr_210mm	10	17.97	82.03
PUKE_S_548	2D point source	storm	M21_PUKE_S_548	M21_PUKE_S_548	3.375	100yr_221mm	10	17.60	82.40
PUKE_S_549	2D point source	storm	M21_PUKE_S_549	M21_PUKE_S_549	3.902	100yr_210mm	16.5	13.81	86.19
PUKE_S_55	2D point source	storm	M21_PUKE_S_55	M21_PUKE_S_55	1.260	100yr_210mm	11.74	10.08	89.92
PUKE_S_557	2D point source	storm	M11_PUKE_S_557	M11_PUKE_S_557	6.735	100yr_221mm	14.54	15.77	84.23
PUKE_S_56	2D point source	storm	M11_PUKE_S_56	M11_PUKE_S_56	24.152	100yr_256mm	34.14	10.00	90.00
PUKE_S_564	2D point source	storm	M11_PUKE_S_564	M11_PUKE_S_564	2.386	100yr_221mm	10	19.09	80.91
PUKE_S_574	2D point source	storm	M11_PUKE_S_574	M11_PUKE_S_574	2.879	100yr_221mm	11.63	22.40	77.60
PUKE_S_58	2D point source	storm	M11_PUKE_S_58	M11_PUKE_S_58	11.805	100yr_256mm	17.26	10.00	90.00
PUKE_S_585	Node	storm	1145376	1145376	1.486	100yr_221mm	10	17.14	82.86
PUKE_S_586	2D point source	storm	M11_PUKE_S_586	M11_PUKE_S_586	4.345	100yr_221mm	14.27	13.84	86.16
PUKE_S_587	2D point source	storm	M11_PUKE_S_587	M11_PUKE_S_587	4.176	100yr_221mm	14.59	14.81	85.19
PUKE_S_588	2D point source	storm	M21_PUKE_S_588	M21_PUKE_S_588	2.943	100yr_221mm	10	60.05	39.95
PUKE_S_589	2D point source	storm	M21_PUKE_S_589	M21_PUKE_S_589	1.435	100yr_221mm	10	65.25	34.75
PUKE_S_59	2D point source	storm	M21_PUKE_S_59	M21_PUKE_S_59	2.281	100yr_233mm	10	70.32	29.68
PUKE_S_590	Node	storm	1142315	1142315	1.423	100yr_221mm	10	63.24	36.76
PUKE_S_598	2D point source	storm	M21_PUKE_S_598	M21_PUKE_S_598	0.607	100yr_221mm	10	70.00	30.00
PUKE_S_599	2D point source	storm	M21_PUKE_S_599	M21_PUKE_S_599	0.510	100yr_221mm	10	70.00	30.03
PUKE_S_6	Node	storm	1143493	1143493	1.836	100yr_210mm	11.7	90.81	9.19
PUKE_S_60	2D point source	storm	M11_PUKE_S_60	M11_PUKE_S_60	78.112	100yr_268mm	84.32	19.60	80.40
PUKE_S_600	2D point source	storm	M21_PUKE_S_600	M21_PUKE_S_600	1.686	100yr_221mm	11.8	70.00	30.00
PUKE_S_602	2D point source	storm	M21_PUKE_S_602	M21_PUKE_S_602	3.567	100yr_221mm	12.11	70.00	30.00
PUKE_S_605	2D point source	storm	M21_PUKE_S_605	M21_PUKE_S_605	1.107	100yr_233mm	11.88	70.06	29.94
PUKE_S_61	2D point source	storm	M11_PUKE_S_61	M11_PUKE_S_61	122.963	100yr_256mm	85.31	10.13	89.87
PUKE_S_610	2D point source	storm	M21_PUKE_S_610	M21_PUKE_S_610	1.327	100yr_233mm	10	70.17	29.83
PUKE_S_611	2D point source	storm	M21_PUKE_S_611	M21_PUKE_S_611	0.577	100yr_233mm	10	73.92	26.08
PUKE_S_616	2D point source	storm	M21_PUKE_S_616	M21_PUKE_S_616	2.517	100yr_233mm	10	70.00	30.00
PUKE_S_617	2D point source	storm	M21_PUKE_S_617	M21_PUKE_S_617	0.984	100yr_233mm	10	71.03	28.97
PUKE_S_619	2D point source	storm	M21_PUKE_S_619	M21_PUKE_S_619	1.113	100yr_233mm	10	71.56	28.44
PUKE_S_62	2D point source	storm	M11_PUKE_S_62	M11_PUKE_S_62	12.435	100yr_245mm	19.85	11.00	89.01
PUKE_S_622	2D point source	storm	M21_PUKE_S_622	M21_PUKE_S_622	0.738	100yr_233mm	10	70.00	30.03
PUKE_S_624	2D point source	storm	M21_PUKE_S_624	M21_PUKE_S_624	0.742	100yr_233mm	10	71.77	28.23
PUKE_S_625	2D point source	storm	M21_PUKE_S_625	M21_PUKE_S_625	1.087	100yr_233mm	10	70.64	29.37
PUKE_S_626	2D point source	storm	M21_PUKE_S_626	M21_PUKE_S_626	0.811	100yr_233mm	10	48.80	51.20
PUKE_S_629	2D point source	storm	M21_PUKE_S_629	M21_PUKE_S_629	1.558	100yr_233mm	10	45.90	54.10
PUKE_S_63	2D point source	storm	M11_PUKE_S_63	M11_PUKE_S_63	13.636	100yr_256mm	17.11	10.00	90.00
PUKE_S_64	2D point source	storm	M11_PUKE_S_64	M11_PUKE_S_64	34.693	100yr_245mm	28.95	10.00	90.00
PUKE_S_645	2D point source	storm	M21_PUKE_S_645	M21_PUKE_S_645	3.338	100yr_245mm	10	10.00	90.00
PUKE_S_647	2D point source	storm	M11_PUKE_S_647	M11_PUKE_S_647	5.523	100yr_245mm	10	10.07	89.93
PUKE_S_648	2D point source	storm	M11_PUKE_S_648	M11_PUKE_S_648	4.492	100yr_245mm	10	10.50	89.50
PUKE_S_649	2D point source	storm	M21_PUKE_S_649	M21_PUKE_S_649	3.871	100yr_233mm	10	71.48	28.52
PUKE_S_65	2D point source	storm	M11_PUKE_S_65	M11_PUKE_S_65	4.737	100yr_245mm	11.76	10.00	90.00
PUKE_S_650	2D point source	storm	M21_PUKE_S_650	M21_PUKE_S_650	1.846	100yr_233mm	10	70.51	29.50
PUKE_S_654	2D point source	storm	M11_PUKE_S_654	M11_PUKE_S_654	5.719	100yr_256mm	10.08	10.00	90.00
PUKE_S_657	Node	storm	1145374	1145374	0.950	100yr_221mm	10	10.20	89.80
PUKE_S_658	2D point source	storm	M21_PUKE_S_658	M21_PUKE_S_658	2.599	100yr_233mm	16.76	76.94	23.07
PUKE_S_659	2D point source	storm	M21_PUKE_S_659	M21_PUKE_S_659	0.986	100yr_233mm	10	70.99	29.01
PUKE_S_66	2D point source	storm	M21_PUKE_S_66	M21_PUKE_S_66	4.303	100yr_245mm	10	10.00	90.00
PUKE_S_660	2D point source	storm	M21_PUKE_S_660	M21_PUKE_S_660	2.939	100yr_233mm	10	51.86	48.14
PUKE_S_663	2D point source	storm	M11_PUKE_S_663	M11_PUKE_S_663	3.179	100yr_245mm	10	10.80	89.20
PUKE_S_664	2D point source	storm	M11_PUKE_S_664	M11_PUKE_S_664	1.518	100yr_233mm	13.99	10.39	89.61
PUKE_S_665	2D point source	storm	M21_PUKE_S_665	M21_PUKE_S_665	3.958	100yr_233mm	14.18	70.00	30.00

PUKE_S_666	2D point source	storm	M21_PUKE_S_666	M21_PUKE_S_666	3.734	100yr_233mm	15.85	70.13	29.87
PUKE_S_667	2D point source	storm	M21_PUKE_S_667	M21_PUKE_S_667	0.839	100yr_245mm	10	75.60	24.40
PUKE_S_669	Node	storm	1145373	1145373	2.835	100yr_221mm	11.06	10.96	89.04
PUKE_S_67	2D point source	storm	M11_PUKE_S_67	M11_PUKE_S_67	30.204	100yr_245mm	46.35	10.00	90.00
PUKE_S_670	2D point source	storm	M21_PUKE_S_670	M21_PUKE_S_670	3.578	100yr_221mm	10	11.06	88.94
PUKE_S_673	2D point source	storm	M21_PUKE_S_673	M21_PUKE_S_673	1.327	100yr_221mm	10	70.72	29.28
PUKE_S_674	2D point source	storm	M21_PUKE_S_674	M21_PUKE_S_674	1.465	100yr_221mm	12.73	71.94	28.06
PUKE_S_675	2D point source	storm	M21_PUKE_S_675	M21_PUKE_S_675	4.160	100yr_221mm	10	70.04	29.96
PUKE_S_676	2D point source	storm	M21_PUKE_S_676	M21_PUKE_S_676	1.741	100yr_221mm	10	70.01	30.00
PUKE_S_678	2D point source	storm	M21_PUKE_S_678	M21_PUKE_S_678	2.584	100yr_221mm	10	70.30	29.70
PUKE_S_679	2D point source	storm	M21_PUKE_S_679	M21_PUKE_S_679	4.302	100yr_221mm	15.1	71.74	28.29
PUKE_S_68	2D point source	storm	M21_PUKE_S_68	M21_PUKE_S_68	3.306	100yr_256mm	13.02	10.00	90.00
PUKE_S_680	2D point source	storm	M21_PUKE_S_680	M21_PUKE_S_680	3.898	100yr_221mm	11.29	70.08	29.93
PUKE_S_681	2D point source	storm	M21_PUKE_S_681	M21_PUKE_S_681	2.602	100yr_221mm	10	70.00	30.00
PUKE_S_682	2D point source	storm	M21_PUKE_S_682	M21_PUKE_S_682	3.709	100yr_221mm	12.97	70.00	30.00
PUKE_S_683	2D point source	storm	M21_PUKE_S_683	M21_PUKE_S_683	2.581	100yr_233mm	13.66	70.00	30.00
PUKE_S_684	2D point source	storm	M21_PUKE_S_684	M21_PUKE_S_684	2.582	100yr_233mm	10	70.00	30.00
PUKE_S_685	2D point source	storm	M21_PUKE_S_685	M21_PUKE_S_685	1.008	100yr_221mm	10	70.00	30.00
PUKE_S_688	2D point source	storm	M21_PUKE_S_688	M21_PUKE_S_688	1.708	100yr_233mm	10	70.00	30.00
PUKE_S_689	2D point source	storm	M21_PUKE_S_689	M21_PUKE_S_689	1.785	100yr_221mm	10.9	70.08	29.92
PUKE_S_691	2D point source	storm	M21_PUKE_S_691	M21_PUKE_S_691	3.077	100yr_221mm	18.41	70.04	29.96
PUKE_S_692	2D point source	storm	M21_PUKE_S_692	M21_PUKE_S_692	4.054	100yr_233mm	13.81	70.00	30.00
PUKE_S_693	2D point source	storm	M21_PUKE_S_693	M21_PUKE_S_693	2.043	100yr_221mm	14.04	70.02	29.98
PUKE_S_694	2D point source	storm	M21_PUKE_S_694	M21_PUKE_S_694	1.154	100yr_233mm	10	70.00	30.00
PUKE_S_695	2D point source	storm	M21_PUKE_S_695	M21_PUKE_S_695	2.235	100yr_221mm	13.44	70.82	29.18
PUKE_S_696	2D point source	storm	M21_PUKE_S_696	M21_PUKE_S_696	1.434	100yr_233mm	10	71.81	28.19
PUKE_S_697	2D point source	storm	M21_PUKE_S_697	M21_PUKE_S_697	1.104	100yr_233mm	10	70.01	30.03
PUKE_S_698	2D point source	storm	M21_PUKE_S_698	M21_PUKE_S_698	1.220	100yr_233mm	11.18	70.00	30.00
PUKE_S_699	2D point source	storm	M21_PUKE_S_699	M21_PUKE_S_699	1.877	100yr_233mm	10	70.00	30.00
PUKE_S_70	2D point source	storm	M21_PUKE_S_70	M21_PUKE_S_70	3.049	100yr_245mm	10	10.00	90.00
PUKE_S_700	2D point source	storm	M21_PUKE_S_700	M21_PUKE_S_700	2.880	100yr_233mm	10.3	58.15	41.85
PUKE_S_702	2D point source	storm	M21_PUKE_S_702	M21_PUKE_S_702	4.788	100yr_233mm	11.49	33.79	66.21
PUKE_S_703	2D point source	storm	M21_PUKE_S_703	M21_PUKE_S_703	4.101	100yr_233mm	10	54.41	45.60
PUKE_S_708	2D point source	storm	M21_PUKE_S_708	M21_PUKE_S_708	2.250	100yr_233mm	10	63.00	37.00
PUKE_S_709	2D point source	storm	M21_PUKE_S_709	M21_PUKE_S_709	2.467	100yr_233mm	10	70.00	30.00
PUKE_S_71	2D point source	storm	M11_PUKE_S_71	M11_PUKE_S_71	40.292	100yr_245mm	41.55	10.00	90.00
PUKE_S_710	2D point source	storm	M21_PUKE_S_710	M21_PUKE_S_710	2.316	100yr_233mm	10	70.00	30.00
PUKE_S_714	2D point source	storm	M21_PUKE_S_714	M21_PUKE_S_714	1.292	100yr_233mm	10	70.00	30.00
PUKE_S_719	2D point source	storm	M21_PUKE_S_719	M21_PUKE_S_719	3.094	100yr_233mm	10	27.50	72.50
PUKE_S_72	2D point source	storm	M11_PUKE_S_72	M11_PUKE_S_72	138.556	100yr_245mm	83.3	10.00	90.00
PUKE_S_720	2D point source	storm	M11_PUKE_S_720	M11_PUKE_S_720	1.807	100yr_233mm	14.49	10.00	90.00
PUKE_S_721	2D point source	storm	M21_PUKE_S_721	M21_PUKE_S_721	1.495	100yr_221mm	31.41	70.00	30.00
PUKE_S_722	2D point source	storm	M21_PUKE_S_722	M21_PUKE_S_722	1.370	100yr_221mm	10	70.00	30.00
PUKE_S_723	2D point source	storm	M21_PUKE_S_723	M21_PUKE_S_723	3.297	100yr_221mm	41.04	70.00	30.00
PUKE_S_724	2D point source	storm	M21_PUKE_S_724	M21_PUKE_S_724	2.248	100yr_233mm	10	70.04	29.96
PUKE_S_725	2D point source	storm	M21_PUKE_S_725	M21_PUKE_S_725	2.488	100yr_233mm	21.2	70.02	29.99
PUKE_S_726	2D point source	storm	M21_PUKE_S_726	M21_PUKE_S_726	0.936	100yr_233mm	10	70.08	29.92
PUKE_S_727	2D point source	storm	M21_PUKE_S_727	M21_PUKE_S_727	1.275	100yr_233mm	10.34	86.62	13.38
PUKE_S_729	2D point source	storm	M21_PUKE_S_729	M21_PUKE_S_729	2.257	100yr_233mm	10	71.62	28.38
PUKE_S_73	2D point source	storm	M21_PUKE_S_73	M21_PUKE_S_73	4.528	100yr_233mm	13.18	68.58	31.43
PUKE_S_730	2D point source	storm	M21_PUKE_S_730	M21_PUKE_S_730	0.743	100yr_233mm	10	70.36	29.65
PUKE_S_731	2D point source	storm	M21_PUKE_S_731	M21_PUKE_S_731	2.048	100yr_233mm	15.8	70.00	30.00
PUKE_S_732	2D point source	storm	M21_PUKE_S_732	M21_PUKE_S_732	2.174	100yr_233mm	10	70.00	30.00
PUKE_S_733	2D point source	storm	M21_PUKE_S_733	M21_PUKE_S_733	2.235	100yr_233mm	20.05	70.00	30.00
PUKE_S_734	2D point source	storm	M21_PUKE_S_734	M21_PUKE_S_734	1.383	100yr_233mm	10	70.00	30.00
PUKE_S_735	2D point source	storm	M21_PUKE_S_735	M21_PUKE_S_735	0.944	100yr_233mm	15.74	72.56	27.41
PUKE_S_737	2D point source	storm	M21_PUKE_S_737	M21_PUKE_S_737	2.274	100yr_233mm	25.56	70.00	30.00
PUKE_S_738	2D point source	storm	M21_PUKE_S_738	M21_PUKE_S_738	2.643	100yr_233mm	10	70.15	29.86
PUKE_S_739	2D point source	storm	M21_PUKE_S_739	M21_PUKE_S_739	1.848	100yr_233mm	14.05	70.00	30.00
PUKE_S_74	2D point source	storm	M21_PUKE_S_74	M21_PUKE_S_74	3.222	100yr_221mm	10	70.10	29.90
PUKE_S_740	2D point source	storm	M21_PUKE_S_740	M21_PUKE_S_740	2.849	100yr_233mm	15.44	70.00	30.00
PUKE_S_743	2D point source	storm	M21_PUKE_S_743	M21_PUKE_S_743	5.695	100yr_233mm	23.63	34.77	65.23
PUKE_S_744	2D point source	storm	M21_PUKE_S_744	M21_PUKE_S_744	1.310	100yr_233mm	10	70.28	29.72
PUKE_S_745	2D point source	storm	M21_PUKE_S_745	M21_PUKE_S_745	14.639	100yr_245mm	29.39	19.88	80.12
PUKE_S_746	2D point source	storm	M21_PUKE_S_746	M21_PUKE_S_746	1.130	100yr_233mm	10	69.80	30.20
PUKE_S_747	2D point source	storm	M21_PUKE_S_747	M21_PUKE_S_747	3.142	100yr_245mm	10	10.00	90.00
PUKE_S_748	2D point source	storm	M21_PUKE_S_748	M21_PUKE_S_748	2.907	100yr_233mm	10	70.00	30.00
PUKE_S_75	2D point source	storm	M21_PUKE_S_75	M21_PUKE_S_75	2.734	100yr_233mm	13.94	70.00	30.00
PUKE_S_755	2D point source	storm	M21_PUKE_S_755	M21_PUKE_S_755	0.607	100yr_233mm	10	71.59	28.42
PUKE_S_756	2D point source	storm	M21_PUKE_S_756	M21_PUKE_S_756	1.890	100yr_233mm	12.09	74.27	25.74
PUKE_S_758	2D point source	storm	M21_PUKE_S_758	M21_PUKE_S_758	3.182	100yr_245mm	25.43	10.25	89.75
PUKE_S_759	2D point source	storm	M21_PUKE_S_759	M21_PUKE_S_759	2.458	100yr_245mm	17.75	56.93	43.07

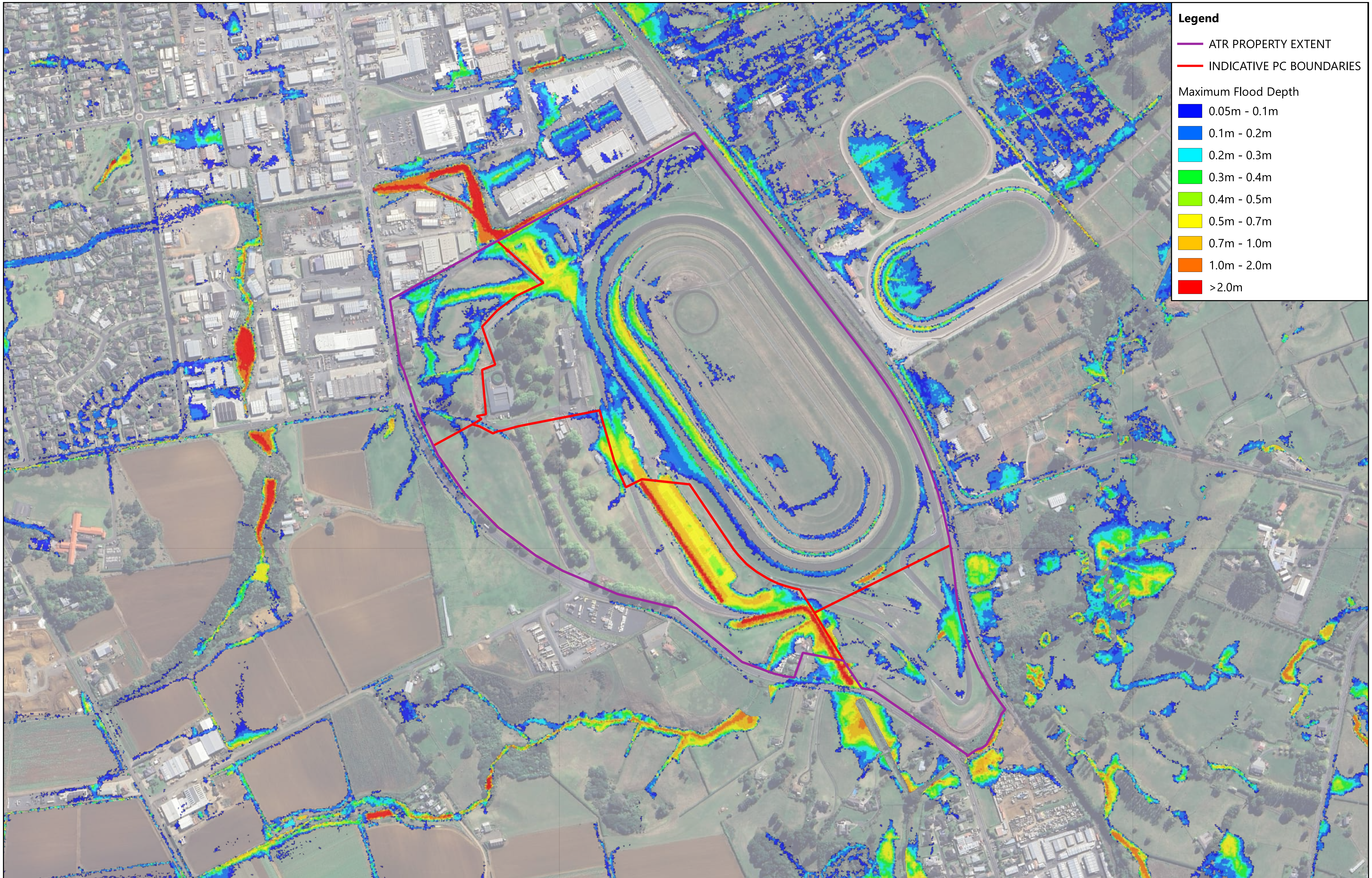
PUKE_S_76	2D point source	storm	M11_PUKE_S_76	M11_PUKE_S_76	15.621	100yr_245mm	32.72	10.00	90.00
PUKE_S_760	2D point source	storm	M21_PUKE_S_760	M21_PUKE_S_760	1.182	100yr_233mm	10	70.00	30.00
PUKE_S_761	2D point source	storm	M21_PUKE_S_761	M21_PUKE_S_761	2.252	100yr_233mm	10	70.00	30.00
PUKE_S_762	2D point source	storm	M21_PUKE_S_762	M21_PUKE_S_762	2.878	100yr_245mm	10	70.70	29.30
PUKE_S_763	2D point source	storm	M21_PUKE_S_763	M21_PUKE_S_763	4.373	100yr_245mm	34.25	15.61	84.39
PUKE_S_764	2D point source	storm	M21_PUKE_S_764	M21_PUKE_S_764	3.479	100yr_245mm	26.93	47.95	52.05
PUKE_S_765	2D point source	storm	M21_PUKE_S_765	M21_PUKE_S_765	2.232	100yr_245mm	10	69.08	30.92
PUKE_S_766	2D point source	storm	M21_PUKE_S_766	M21_PUKE_S_766	2.698	100yr_245mm	10	69.79	30.21
PUKE_S_767	2D point source	storm	M21_PUKE_S_767	M21_PUKE_S_767	1.044	100yr_245mm	10	70.00	30.00
PUKE_S_768	2D point source	storm	M21_PUKE_S_768	M21_PUKE_S_768	2.484	100yr_245mm	12.68	31.49	68.52
PUKE_S_769	2D point source	storm	M21_PUKE_S_769	M21_PUKE_S_769	1.626	100yr_233mm	13.37	67.23	32.77
PUKE_S_77	2D point source	storm	M21_PUKE_S_77	M21_PUKE_S_77	6.385	100yr_245mm	10	10.00	90.00
PUKE_S_770	2D point source	storm	M21_PUKE_S_770	M21_PUKE_S_770	1.837	100yr_233mm	10	48.87	51.13
PUKE_S_771	2D point source	storm	M21_PUKE_S_771	M21_PUKE_S_771	0.916	100yr_233mm	10	71.33	28.67
PUKE_S_773	2D point source	storm	M21_PUKE_S_773	M21_PUKE_S_773	2.045	100yr_233mm	12.23	70.08	29.92
PUKE_S_774	2D point source	storm	M21_PUKE_S_774	M21_PUKE_S_774	3.220	100yr_233mm	15.83	70.20	29.81
PUKE_S_775	2D point source	storm	M21_PUKE_S_775	M21_PUKE_S_775	2.270	100yr_233mm	11.43	70.70	29.30
PUKE_S_777	2D point source	storm	M21_PUKE_S_777	M21_PUKE_S_777	2.643	100yr_221mm	11.13	71.30	28.71
PUKE_S_778	2D point source	storm	M21_PUKE_S_778	M21_PUKE_S_778	0.831	100yr_221mm	10	74.03	25.97
PUKE_S_78	2D point source	storm	M21_PUKE_S_78	M21_PUKE_S_78	3.248	100yr_233mm	10	70.00	30.00
PUKE_S_780	2D point source	storm	M21_PUKE_S_780	M21_PUKE_S_780	2.764	100yr_221mm	11.75	66.85	33.15
PUKE_S_781	2D point source	storm	M21_PUKE_S_781	M21_PUKE_S_781	1.990	100yr_221mm	10	70.25	29.75
PUKE_S_782	2D point source	storm	M21_PUKE_S_782	M21_PUKE_S_782	2.052	100yr_221mm	10	70.00	30.00
PUKE_S_783	2D point source	storm	M21_PUKE_S_783	M21_PUKE_S_783	0.906	100yr_221mm	10	24.57	75.43
PUKE_S_784	Node	storm	1145356	1145356	3.043	100yr_221mm	10.45	42.12	57.88
PUKE_S_79	2D point source	storm	M21_PUKE_S_79	M21_PUKE_S_79	3.767	100yr_233mm	10.44	70.02	29.98
PUKE_S_797	2D point source	storm	M21_PUKE_S_797	M21_PUKE_S_797	1.333	100yr_221mm	11.57	61.00	39.00
PUKE_S_798	2D point source	storm	M21_PUKE_S_798	M21_PUKE_S_798	3.062	100yr_221mm	10	62.34	37.66
PUKE_S_799	2D point source	storm	M21_PUKE_S_799	M21_PUKE_S_799	2.422	100yr_221mm	10	62.00	38.00
PUKE_S_8	2D point source	storm	M11_PUKE_S_8	M11_PUKE_S_8	3.434	100yr_233mm	10	20.00	80.00
PUKE_S_80	2D point source	storm	M21_PUKE_S_80	M21_PUKE_S_80	3.066	100yr_233mm	10	70.00	30.00
PUKE_S_800	2D point source	storm	M21_PUKE_S_800	M21_PUKE_S_800	1.760	100yr_210mm	10	61.72	38.28
PUKE_S_801	2D point source	storm	M21_PUKE_S_801	M21_PUKE_S_801	0.966	100yr_210mm	12.25	22.63	77.37
PUKE_S_802	2D point source	storm	M21_PUKE_S_802	M21_PUKE_S_802	2.111	100yr_221mm	10.04	60.12	39.88
PUKE_S_803	2D point source	storm	M21_PUKE_S_803	M21_PUKE_S_803	2.106	100yr_221mm	10	15.60	84.40
PUKE_S_804	2D point source	storm	M21_PUKE_S_804	M21_PUKE_S_804	2.913	100yr_221mm	10	10.32	89.68
PUKE_S_805	2D point source	storm	M21_PUKE_S_805	M21_PUKE_S_805	2.741	100yr_221mm	10	42.09	57.92
PUKE_S_806	2D point source	storm	M21_PUKE_S_806	M21_PUKE_S_806	2.930	100yr_221mm	10	41.32	58.68
PUKE_S_807	2D point source	storm	M21_PUKE_S_807	M21_PUKE_S_807	1.942	100yr_221mm	10	24.66	75.34
PUKE_S_808	Node	storm	1145372	1145372	1.684	100yr_221mm	11.89	11.08	88.92
PUKE_S_809	2D point source	storm	M21_PUKE_S_809	M21_PUKE_S_809	2.338	100yr_221mm	10.44	14.61	85.39
PUKE_S_81	2D point source	storm	M21_PUKE_S_81	M21_PUKE_S_81	3.797	100yr_233mm	10	70.00	30.00
PUKE_S_810	2D point source	storm	M21_PUKE_S_810	M21_PUKE_S_810	4.487	100yr_221mm	10	70.60	29.40
PUKE_S_811	2D point source	storm	M21_PUKE_S_811	M21_PUKE_S_811	4.273	100yr_233mm	10	70.05	29.95
PUKE_S_812	2D point source	storm	M21_PUKE_S_812	M21_PUKE_S_812	2.602	100yr_233mm	10	70.00	30.00
PUKE_S_813	2D point source	storm	M21_PUKE_S_813	M21_PUKE_S_813	2.711	100yr_221mm	11.46	72.06	27.94
PUKE_S_814	2D point source	storm	M21_PUKE_S_814	M21_PUKE_S_814	3.257	100yr_221mm	10	70.46	29.54
PUKE_S_815	2D point source	storm	M21_PUKE_S_815	M21_PUKE_S_815	4.088	100yr_221mm	11.56	26.21	73.79
PUKE_S_816	2D point source	storm	M21_PUKE_S_816	M21_PUKE_S_816	2.845	100yr_221mm	10	70.18	29.83
PUKE_S_82	2D point source	storm	M21_PUKE_S_82	M21_PUKE_S_82	1.502	100yr_233mm	10.08	70.00	30.00
PUKE_S_820	2D point source	storm	M21_PUKE_S_820	M21_PUKE_S_820	3.896	100yr_233mm	13.96	70.00	30.00
PUKE_S_821	2D point source	storm	M21_PUKE_S_821	M21_PUKE_S_821	3.006	100yr_221mm	15.62	70.32	29.68
PUKE_S_824	2D point source	storm	M21_PUKE_S_824	M21_PUKE_S_824	1.861	100yr_221mm	10	71.21	28.79
PUKE_S_825	2D point source	storm	M21_PUKE_S_825	M21_PUKE_S_825	2.563	100yr_233mm	10	71.40	28.60
PUKE_S_826	2D point source	storm	M21_PUKE_S_826	M21_PUKE_S_826	2.642	100yr_221mm	10	71.76	28.24
PUKE_S_827	2D point source	storm	M21_PUKE_S_827	M21_PUKE_S_827	1.750	100yr_221mm	10	70.56	29.44
PUKE_S_828	2D point source	storm	M21_PUKE_S_828	M21_PUKE_S_828	1.347	100yr_221mm	10	71.08	28.92
PUKE_S_829	2D point source	storm	M21_PUKE_S_829	M21_PUKE_S_829	3.144	100yr_221mm	14.1	70.29	29.71
PUKE_S_83	2D point source	storm	M21_PUKE_S_83	M21_PUKE_S_83	16.547	100yr_221mm	10.32	23.89	76.11
PUKE_S_830	2D point source	storm	M21_PUKE_S_830	M21_PUKE_S_830	2.355	100yr_233mm	16.62	70.36	29.64
PUKE_S_831	2D point source	storm	M21_PUKE_S_831	M21_PUKE_S_831	2.833	100yr_233mm	12.02	70.33	29.67
PUKE_S_832	2D point source	storm	M21_PUKE_S_832	M21_PUKE_S_832	1.828	100yr_233mm	10	70.00	30.00
PUKE_S_833	2D point source	storm	M21_PUKE_S_833	M21_PUKE_S_833	1.492	100yr_233mm	10	70.00	30.00
PUKE_S_835	2D point source	storm	M21_PUKE_S_835	M21_PUKE_S_835	1.838	100yr_233mm	10	70.00	30.00
PUKE_S_836	2D point source	storm	M21_PUKE_S_836	M21_PUKE_S_836	2.357	100yr_233mm	10	70.00	30.00
PUKE_S_837	2D point source	storm	M21_PUKE_S_837	M21_PUKE_S_837	15.161	100yr_233mm	13.03	11.07	88.93
PUKE_S_838	2D point source	storm	M21_PUKE_S_838	M21_PUKE_S_838	3.341	100yr_233mm	10	70.01	29.99
PUKE_S_839	2D point source	storm	M21_PUKE_S_839	M21_PUKE_S_839	2.554	100yr_233mm	10	69.27	30.73
PUKE_S_84	Node	storm	1142223	1142223	2.440	100yr_210mm	20.03	62.09	37.91
PUKE_S_840	2D point source	storm	M21_PUKE_S_840	M21_PUKE_S_840	4.100	100yr_233mm	13.23	70.43	29.57
PUKE_S_841	2D point source	storm	M21_PUKE_S_841	M21_PUKE_S_841	1.894	100yr_233mm	10	71.19	28.81
PUKE_S_844	2D point source	storm	M21_PUKE_S_844	M21_PUKE_S_844	2.966	100yr_233mm	12.2	70.65	29.35

PUKE_S_845	2D point source	storm	M21_PUKE_S_845	M21_PUKE_S_845	2.490	100yr_233mm	10.66	70.05	29.95
PUKE_S_846	2D point source	storm	M21_PUKE_S_846	M21_PUKE_S_846	1.849	100yr_233mm	10	70.25	29.75
PUKE_S_847	2D point source	storm	M21_PUKE_S_847	M21_PUKE_S_847	2.066	100yr_233mm	11.25	72.91	27.09
PUKE_S_848	2D point source	storm	M21_PUKE_S_848	M21_PUKE_S_848	3.062	100yr_233mm	10.75	69.91	30.09
PUKE_S_849	2D point source	storm	M21_PUKE_S_849	M21_PUKE_S_849	2.555	100yr_233mm	12.83	70.67	29.33
PUKE_S_85	2D point source	storm	M21_PUKE_S_85	M21_PUKE_S_85	1.259	100yr_210mm	10	71.01	29.00
PUKE_S_850	2D point source	storm	M21_PUKE_S_850	M21_PUKE_S_850	2.388	100yr_221mm	10.51	70.00	30.00
PUKE_S_851	2D point source	storm	M21_PUKE_S_851	M21_PUKE_S_851	3.295	100yr_221mm	10	70.43	29.57
PUKE_S_852	2D point source	storm	M21_PUKE_S_852	M21_PUKE_S_852	2.841	100yr_221mm	11.56	70.37	29.64
PUKE_S_853	2D point source	storm	M21_PUKE_S_853	M21_PUKE_S_853	2.141	100yr_233mm	14.58	71.21	28.79
PUKE_S_854	2D point source	storm	M21_PUKE_S_854	M21_PUKE_S_854	3.418	100yr_221mm	10	71.39	28.61
PUKE_S_855	2D point source	storm	M21_PUKE_S_855	M21_PUKE_S_855	3.926	100yr_221mm	10	70.09	29.91
PUKE_S_856	2D point source	storm	M21_PUKE_S_856	M21_PUKE_S_856	2.933	100yr_221mm	10	70.08	29.92
PUKE_S_858	2D point source	storm	M21_PUKE_S_858	M21_PUKE_S_858	3.581	100yr_221mm	12.07	70.00	30.00
PUKE_S_859	2D point source	storm	M21_PUKE_S_859	M21_PUKE_S_859	2.285	100yr_221mm	10	73.19	26.82
PUKE_S_86	2D point source	storm	M21_PUKE_S_86	M21_PUKE_S_86	3.112	100yr_221mm	11.05	70.01	29.99
PUKE_S_860	2D point source	storm	M21_PUKE_S_860	M21_PUKE_S_860	1.843	100yr_221mm	10	70.82	29.18
PUKE_S_862	2D point source	storm	M21_PUKE_S_862	M21_PUKE_S_862	3.554	100yr_233mm	10	70.00	30.00
PUKE_S_863	2D point source	storm	M21_PUKE_S_863	M21_PUKE_S_863	3.695	100yr_233mm	10	70.00	30.00
PUKE_S_864	2D point source	storm	M21_PUKE_S_864	M21_PUKE_S_864	3.284	100yr_233mm	16.17	70.84	29.16
PUKE_S_865	2D point source	storm	M21_PUKE_S_865	M21_PUKE_S_865	2.007	100yr_233mm	10	71.11	28.89
PUKE_S_866	2D point source	storm	M21_PUKE_S_866	M21_PUKE_S_866	2.129	100yr_233mm	10	70.61	29.39
PUKE_S_867	2D point source	storm	M21_PUKE_S_867	M21_PUKE_S_867	3.034	100yr_233mm	10	70.00	30.00
PUKE_S_868	2D point source	storm	M21_PUKE_S_868	M21_PUKE_S_868	1.638	100yr_233mm	10	70.00	30.00
PUKE_S_869	2D point source	storm	M21_PUKE_S_869	M21_PUKE_S_869	3.930	100yr_233mm	15.86	70.40	29.60
PUKE_S_87	2D point source	storm	M21_PUKE_S_87	M21_PUKE_S_87	4.155	100yr_233mm	11.75	70.24	29.76
PUKE_S_871	2D point source	storm	M21_PUKE_S_871	M21_PUKE_S_871	3.974	100yr_233mm	13.88	70.09	29.91
PUKE_S_872	2D point source	storm	M21_PUKE_S_872	M21_PUKE_S_872	3.673	100yr_233mm	11.95	68.66	31.34
PUKE_S_873	2D point source	storm	M21_PUKE_S_873	M21_PUKE_S_873	3.424	100yr_233mm	11.8	70.19	29.81
PUKE_S_874	2D point source	storm	M21_PUKE_S_874	M21_PUKE_S_874	3.156	100yr_233mm	10.26	70.33	29.67
PUKE_S_876	2D point source	storm	M21_PUKE_S_876	M21_PUKE_S_876	2.028	100yr_233mm	10.87	70.00	30.00
PUKE_S_877	2D point source	storm	M21_PUKE_S_877	M21_PUKE_S_877	2.332	100yr_233mm	10	70.00	30.00
PUKE_S_879	2D point source	storm	M21_PUKE_S_879	M21_PUKE_S_879	3.546	100yr_221mm	37	71.22	28.78
PUKE_S_88	2D point source	storm	M21_PUKE_S_88	M21_PUKE_S_88	2.746	100yr_233mm	18.82	73.30	26.71
PUKE_S_880	2D point source	storm	M21_PUKE_S_880	M21_PUKE_S_880	3.282	100yr_221mm	33.86	70.00	30.00
PUKE_S_881	2D point source	storm	M21_PUKE_S_881	M21_PUKE_S_881	4.599	100yr_233mm	49.94	70.23	29.77
PUKE_S_883	2D point source	storm	M21_PUKE_S_883	M21_PUKE_S_883	3.839	100yr_233mm	41.51	70.00	30.00
PUKE_S_884	2D point source	storm	M21_PUKE_S_884	M21_PUKE_S_884	1.967	100yr_233mm	32.89	70.00	30.00
PUKE_S_885	2D point source	storm	M21_PUKE_S_885	M21_PUKE_S_885	2.798	100yr_233mm	27.38	70.00	30.00
PUKE_S_886	2D point source	storm	M21_PUKE_S_886	M21_PUKE_S_886	2.917	100yr_221mm	23.51	70.00	30.00
PUKE_S_887	2D point source	storm	M21_PUKE_S_887	M21_PUKE_S_887	0.790	100yr_221mm	10	70.00	30.00
PUKE_S_888	2D point source	storm	M21_PUKE_S_888	M21_PUKE_S_888	2.977	100yr_233mm	14.32	70.00	30.00
PUKE_S_889	2D point source	storm	M21_PUKE_S_889	M21_PUKE_S_889	2.045	100yr_233mm	17.05	70.00	30.00
PUKE_S_89	2D point source	storm	M21_PUKE_S_89	M21_PUKE_S_89	1.821	100yr_221mm	26.24	73.85	26.15
PUKE_S_890	2D point source	storm	M21_PUKE_S_890	M21_PUKE_S_890	2.307	100yr_221mm	10	70.79	29.21
PUKE_S_892	Node	storm	1144576	1144576	0.490	100yr_221mm	20.59	80.00	20.00
PUKE_S_894	2D point source	storm	M11_PUKE_S_894	M11_PUKE_S_894	2.172	100yr_233mm	10.27	18.08	81.92
PUKE_S_895	2D point source	storm	M21_PUKE_S_895	M21_PUKE_S_895	2.199	100yr_233mm	10.99	48.64	51.36
PUKE_S_896	2D point source	storm	M21_PUKE_S_896	M21_PUKE_S_896	0.698	100yr_233mm	10	71.61	28.39
PUKE_S_897	2D point source	storm	M21_PUKE_S_897	M21_PUKE_S_897	0.773	100yr_233mm	10	69.54	30.46
PUKE_S_899	2D point source	storm	M21_PUKE_S_899	M21_PUKE_S_899	0.445	100yr_233mm	10	70.00	30.00
PUKE_S_90	2D point source	storm	M21_PUKE_S_90	M21_PUKE_S_90	4.286	100yr_221mm	32.09	70.00	30.00
PUKE_S_905	2D point source	storm	M21_PUKE_S_905	M21_PUKE_S_905	1.731	100yr_233mm	10	70.41	29.59
PUKE_S_906	2D point source	storm	M21_PUKE_S_906	M21_PUKE_S_906	0.950	100yr_233mm	10	70.00	30.00
PUKE_S_907	2D point source	storm	M21_PUKE_S_907	M21_PUKE_S_907	0.450	100yr_233mm	10	70.00	30.00
PUKE_S_908	2D point source	storm	M21_PUKE_S_908	M21_PUKE_S_908	0.678	100yr_233mm	10	70.00	30.00
PUKE_S_91	2D point source	storm	M21_PUKE_S_91	M21_PUKE_S_91	3.592	100yr_221mm	17.96	21.49	78.51
PUKE_S_914	2D point source	storm	M21_PUKE_S_914	M21_PUKE_S_914	0.718	100yr_221mm	32.84	79.58	20.42
PUKE_S_918	2D point source	storm	M21_PUKE_S_918	M21_PUKE_S_918	1.171	100yr_221mm	32.09	91.44	8.56
PUKE_S_92	2D point source	storm	M21_PUKE_S_92	M21_PUKE_S_92	3.174	100yr_221mm	16.3	72.19	27.81
PUKE_S_923	2D point source	storm	M21_PUKE_S_923	M21_PUKE_S_923	0.330	100yr_221mm	29.35	80.00	20.00
PUKE_S_929	2D point source	storm	M21_PUKE_S_929	M21_PUKE_S_929	1.040	100yr_233mm	12.14	70.00	30.00
PUKE_S_93	2D point source	storm	M21_PUKE_S_93	M21_PUKE_S_93	4.350	100yr_233mm	12.5	70.41	29.60
PUKE_S_930	2D point source	storm	M21_PUKE_S_930	M21_PUKE_S_930	1.309	100yr_233mm	10	70.00	30.00
PUKE_S_933	2D point source	storm	M21_PUKE_S_933	M21_PUKE_S_933	0.940	100yr_233mm	11.25	70.00	30.00
PUKE_S_934	2D point source	storm	M21_PUKE_S_934	M21_PUKE_S_934	0.833	100yr_221mm	10	69.68	30.32
PUKE_S_936	2D point source	storm	M21_PUKE_S_936	M21_PUKE_S_936	3.791	100yr_245mm	10.62	11.08	88.92
PUKE_S_937	2D point source	storm	M21_PUKE_S_937	M21_PUKE_S_937	0.782	100yr_245mm	10	10.00	90.00
PUKE_S_938	2D point source	storm	M21_PUKE_S_938	M21_PUKE_S_938	1.996	100yr_233mm	10.38	14.96	85.04
PUKE_S_939	2D point source	storm	M21_PUKE_S_939	M21_PUKE_S_939	1.900	100yr_245mm	10.3	10.00	90.00
PUKE_S_94	2D point source	storm	M11_PUKE_S_94	M11_PUKE_S_94	16.201	100yr_233mm	10.09	10.01	89.99
PUKE_S_940	2D point source	storm	M21_PUKE_S_940	M21_PUKE_S_940	3.947	100yr_245mm	12.24	10.00	90.00

PUKE_S_941	2D point source	storm	M21_PUKE_S_941	M21_PUKE_S_941	3.824	100yr_245mm	10	10.00	90.00
PUKE_S_943	2D point source	storm	M21_PUKE_S_943	M21_PUKE_S_943	3.230	100yr_245mm	10	10.00	90.00
PUKE_S_944	2D point source	storm	M21_PUKE_S_944	M21_PUKE_S_944	1.388	100yr_233mm	10	10.90	89.11
PUKE_S_945	2D point source	storm	M21_PUKE_S_945	M21_PUKE_S_945	4.492	100yr_245mm	11.09	10.00	90.00
PUKE_S_946	2D point source	storm	M21_PUKE_S_946	M21_PUKE_S_946	3.205	100yr_245mm	22.31	10.00	90.00
PUKE_S_947	2D point source	storm	M21_PUKE_S_947	M21_PUKE_S_947	3.148	100yr_245mm	26.18	10.08	89.92
PUKE_S_948	2D point source	storm	M11_PUKE_S_948	M11_PUKE_S_948	40.040	100yr_245mm	56.56	10.00	90.00
PUKE_S_95	2D point source	storm	M21_PUKE_S_95	M21_PUKE_S_95	3.619	100yr_233mm	10	69.95	30.05
PUKE_S_950	2D point source	storm	M21_PUKE_S_950	M21_PUKE_S_950	2.496	100yr_245mm	10	10.00	90.00
PUKE_S_953	2D point source	storm	M21_PUKE_S_953	M21_PUKE_S_953	7.559	100yr_256mm	16.08	10.00	90.00
PUKE_S_954	2D point source	storm	M21_PUKE_S_954	M21_PUKE_S_954	2.515	100yr_245mm	12.73	10.00	90.00
PUKE_S_955	2D point source	storm	M21_PUKE_S_955	M21_PUKE_S_955	4.240	100yr_256mm	15	10.00	90.00
PUKE_S_956	2D point source	storm	M21_PUKE_S_956	M21_PUKE_S_956	3.186	100yr_256mm	14.77	10.00	90.00
PUKE_S_957	2D point source	storm	M21_PUKE_S_957	M21_PUKE_S_957	1.876	100yr_256mm	10	10.00	90.00
PUKE_S_958	2D point source	storm	M21_PUKE_S_958	M21_PUKE_S_958	4.018	100yr_256mm	10	10.00	90.00
PUKE_S_959	2D point source	storm	M21_PUKE_S_959	M21_PUKE_S_959	3.239	100yr_245mm	10	10.00	90.00
PUKE_S_96	2D point source	storm	M11_PUKE_S_96	M11_PUKE_S_96	3.217	100yr_233mm	28.52	15.81	84.19
PUKE_S_960	2D point source	storm	M21_PUKE_S_960	M21_PUKE_S_960	2.483	100yr_245mm	13.41	10.00	90.00
PUKE_S_961	2D point source	storm	M21_PUKE_S_961	M21_PUKE_S_961	5.583	100yr_245mm	12.58	10.00	90.00
PUKE_S_962	2D point source	storm	M21_PUKE_S_962	M21_PUKE_S_962	2.981	100yr_245mm	10	10.00	90.00
PUKE_S_963	2D point source	storm	M21_PUKE_S_963	M21_PUKE_S_963	2.248	100yr_245mm	15.54	10.00	90.00
PUKE_S_964	2D point source	storm	M21_PUKE_S_964	M21_PUKE_S_964	1.854	100yr_245mm	13.52	10.00	90.00
PUKE_S_965	2D point source	storm	M21_PUKE_S_965	M21_PUKE_S_965	4.169	100yr_256mm	10	10.00	90.00
PUKE_S_966	2D point source	storm	M21_PUKE_S_966	M21_PUKE_S_966	1.918	100yr_245mm	10	10.00	90.00
PUKE_S_967	2D point source	storm	M21_PUKE_S_967	M21_PUKE_S_967	2.301	100yr_245mm	21.89	10.00	90.00
PUKE_S_968	2D point source	storm	M21_PUKE_S_968	M21_PUKE_S_968	4.508	100yr_245mm	14.15	10.00	90.00
PUKE_S_969	2D point source	storm	M21_PUKE_S_969	M21_PUKE_S_969	2.584	100yr_245mm	10	10.00	90.00
PUKE_S_97	2D point source	storm	M21_PUKE_S_97	M21_PUKE_S_97	3.265	100yr_233mm	10.66	70.02	29.98
PUKE_S_970	2D point source	storm	M21_PUKE_S_970	M21_PUKE_S_970	3.310	100yr_245mm	10	10.00	90.00
PUKE_S_971	2D point source	storm	M21_PUKE_S_971	M21_PUKE_S_971	2.075	100yr_245mm	11.29	10.00	90.00
PUKE_S_972	2D point source	storm	M21_PUKE_S_972	M21_PUKE_S_972	5.598	100yr_245mm	10.18	10.00	90.09
PUKE_S_973	2D point source	storm	M21_PUKE_S_973	M21_PUKE_S_973	2.113	100yr_245mm	10	10.00	90.00
PUKE_S_975	2D point source	storm	M21_PUKE_S_975	M21_PUKE_S_975	5.354	100yr_245mm	10.46	10.00	90.00
PUKE_S_976	2D point source	storm	M21_PUKE_S_976	M21_PUKE_S_976	6.578	100yr_245mm	16.93	10.64	89.36
PUKE_S_977	2D point source	storm	M21_PUKE_S_977	M21_PUKE_S_977	5.093	100yr_245mm	10	10.00	90.00
PUKE_S_978	2D point source	storm	M21_PUKE_S_978	M21_PUKE_S_978	3.039	100yr_245mm	10	10.00	90.00
PUKE_S_979	2D point source	storm	M21_PUKE_S_979	M21_PUKE_S_979	1.033	100yr_245mm	10	12.64	87.36
PUKE_S_98	2D point source	storm	M11_PUKE_S_98	M11_PUKE_S_98	4.540	100yr_245mm	12.39	20.00	80.00
PUKE_S_981	2D point source	storm	M21_PUKE_S_981	M21_PUKE_S_981	6.617	100yr_245mm	10.91	10.00	90.00
PUKE_S_982	2D point source	storm	M11_PUKE_S_982	M11_PUKE_S_982	4.329	100yr_256mm	10	10.00	90.00
PUKE_S_984	2D point source	storm	M21_PUKE_S_984	M21_PUKE_S_984	8.956	100yr_256mm	12.15	10.00	90.00
PUKE_S_985	2D point source	storm	M21_PUKE_S_985	M21_PUKE_S_985	1.541	100yr_256mm	10	10.00	90.00
PUKE_S_986	2D point source	storm	M21_PUKE_S_986	M21_PUKE_S_986	6.038	100yr_256mm	10	10.00	90.00
PUKE_S_987	2D point source	storm	M21_PUKE_S_987	M21_PUKE_S_987	3.146	100yr_245mm	18.5	10.00	90.00
PUKE_S_988	2D point source	storm	M21_PUKE_S_988	M21_PUKE_S_988	2.264	100yr_256mm	14.82	13.77	86.23
PUKE_S_989	2D point source	storm	M21_PUKE_S_989	M21_PUKE_S_989	1.774	100yr_245mm	10	10.00	90.00
PUKE_S_99	2D point source	storm	M21_PUKE_S_99	M21_PUKE_S_99	10.549	100yr_245mm	30.48	16.38	83.62
PUKE_S_991	2D point source	storm	M21_PUKE_S_991	M21_PUKE_S_991	0.832	100yr_256mm	10	10.00	90.00

APPENDIX C

Flood Model Result Maps



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				CHECKED	AD
				APPROVED	-

8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

WOODS Est.1970

P23-057 ATR Pukekohe
Maximum Flood Depth
Pre Development 2yr 2.1°C

STATUS	ISSUED FOR INFORMATION	REV
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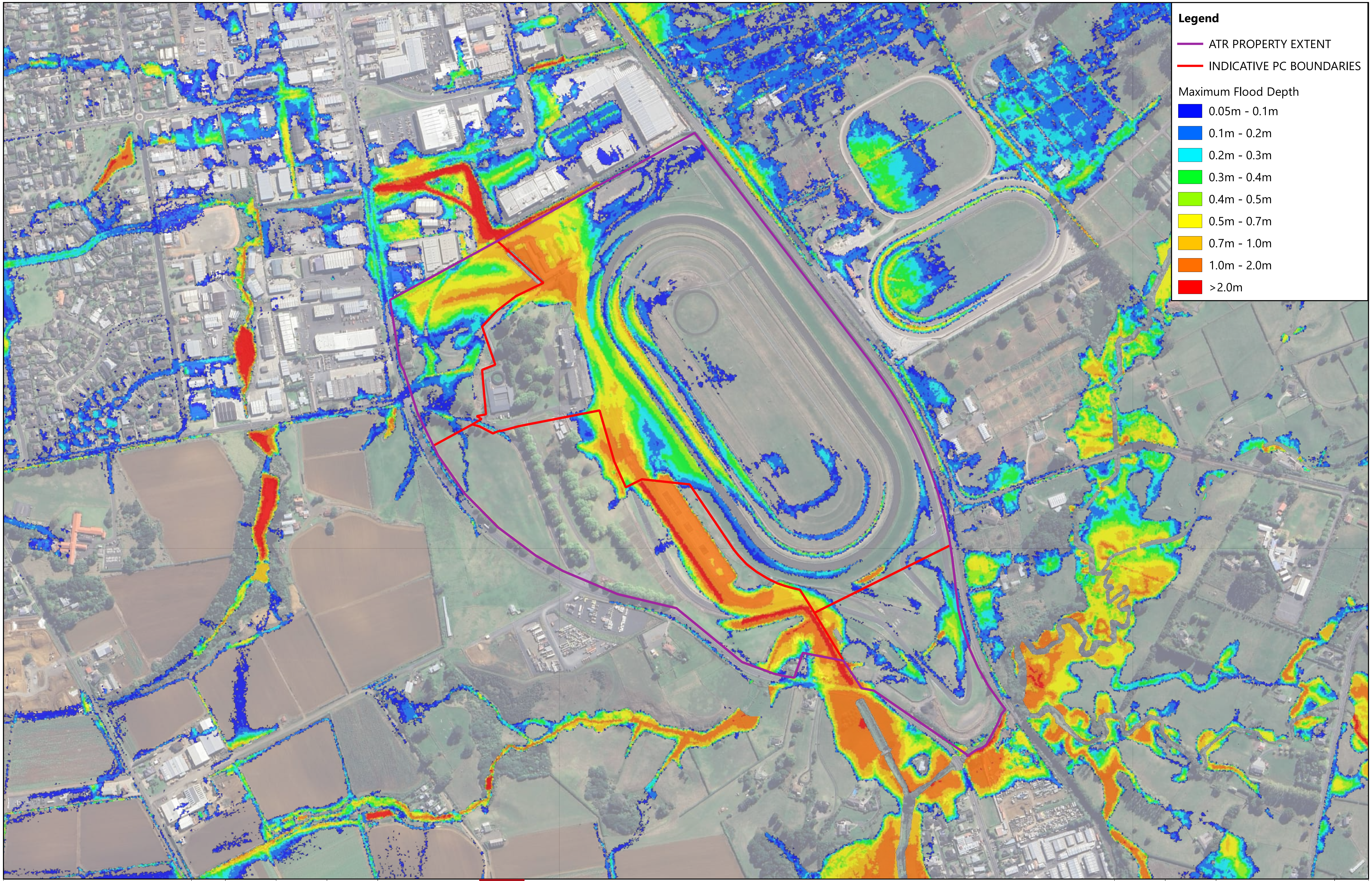

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				CHECKED	AD
				APPROVED	-

8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

P23-057 ATR Pukekohe
Maximum Flood Depth
Pre Development 10yr 2.1°C

STATUS	ISSUED FOR INFORMATION	REV
SCALE	NTS	1.0
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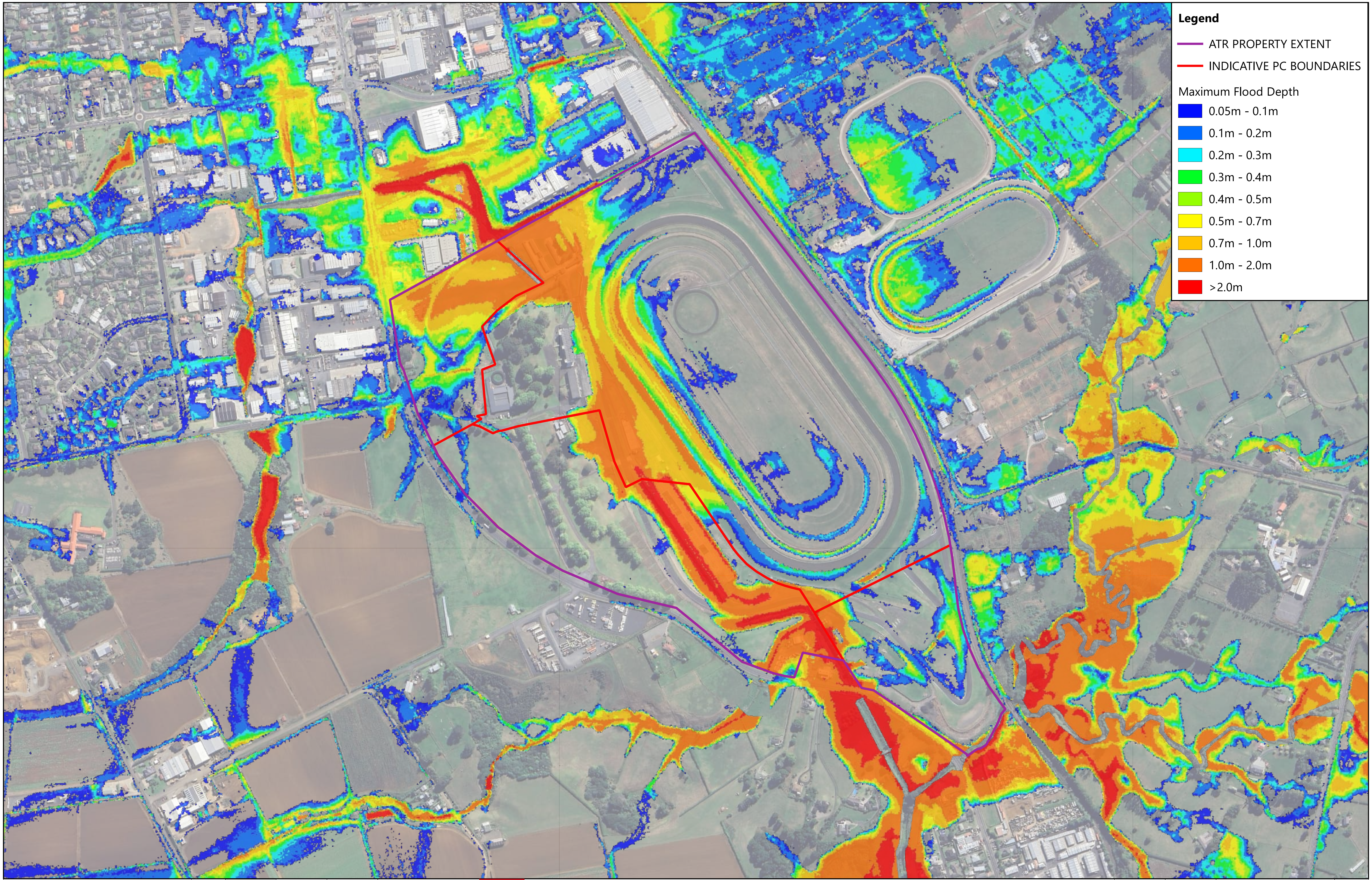

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8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

WOODS Est.1970

P23-057 ATR Pukekohe
Maximum Flood Depth
Pre Development 100yr 2.1°C

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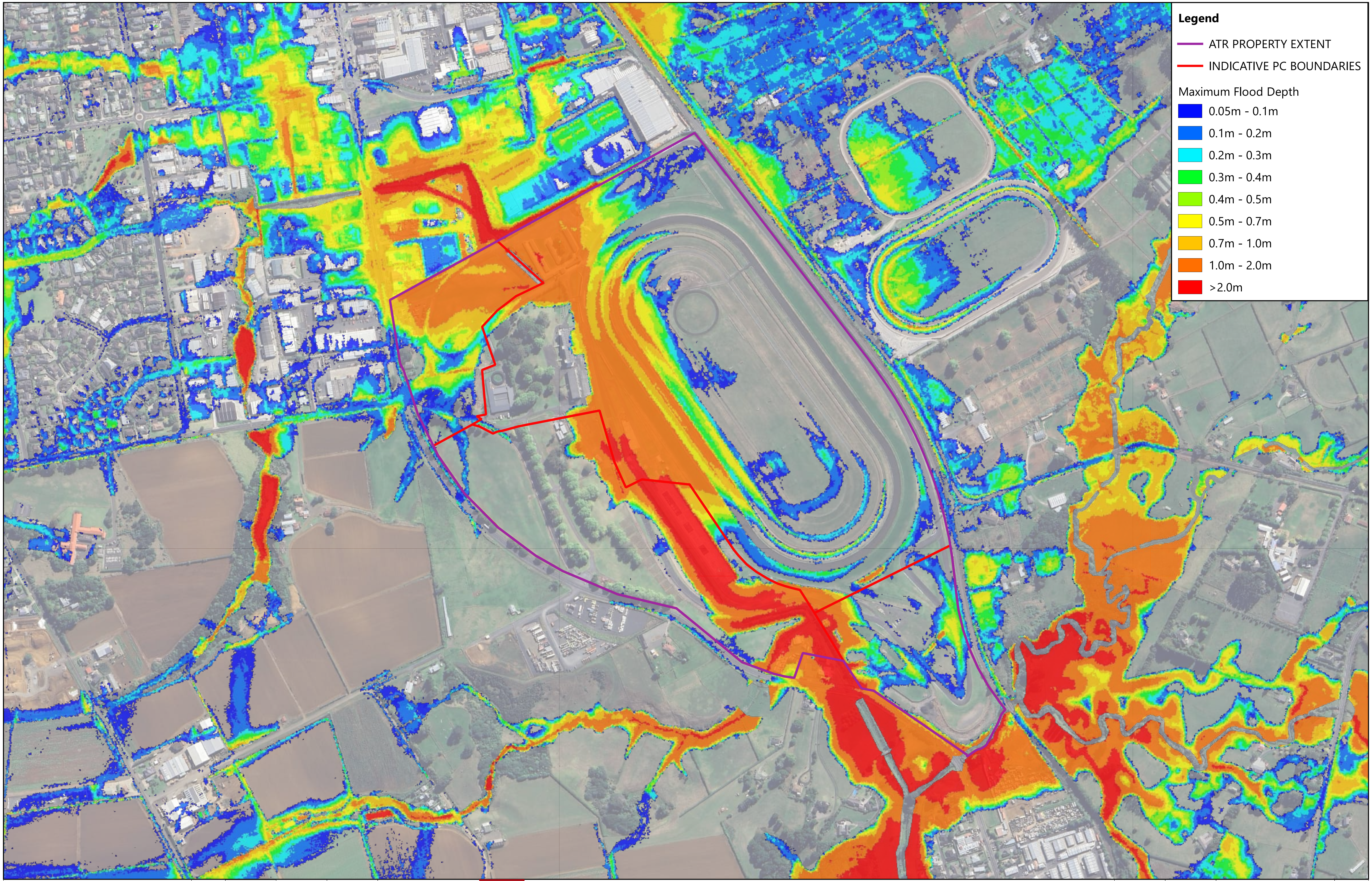

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8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

P23-057 ATR Pukekohe
Maximum Flood Depth
Pre Development 100yr 3.8°C

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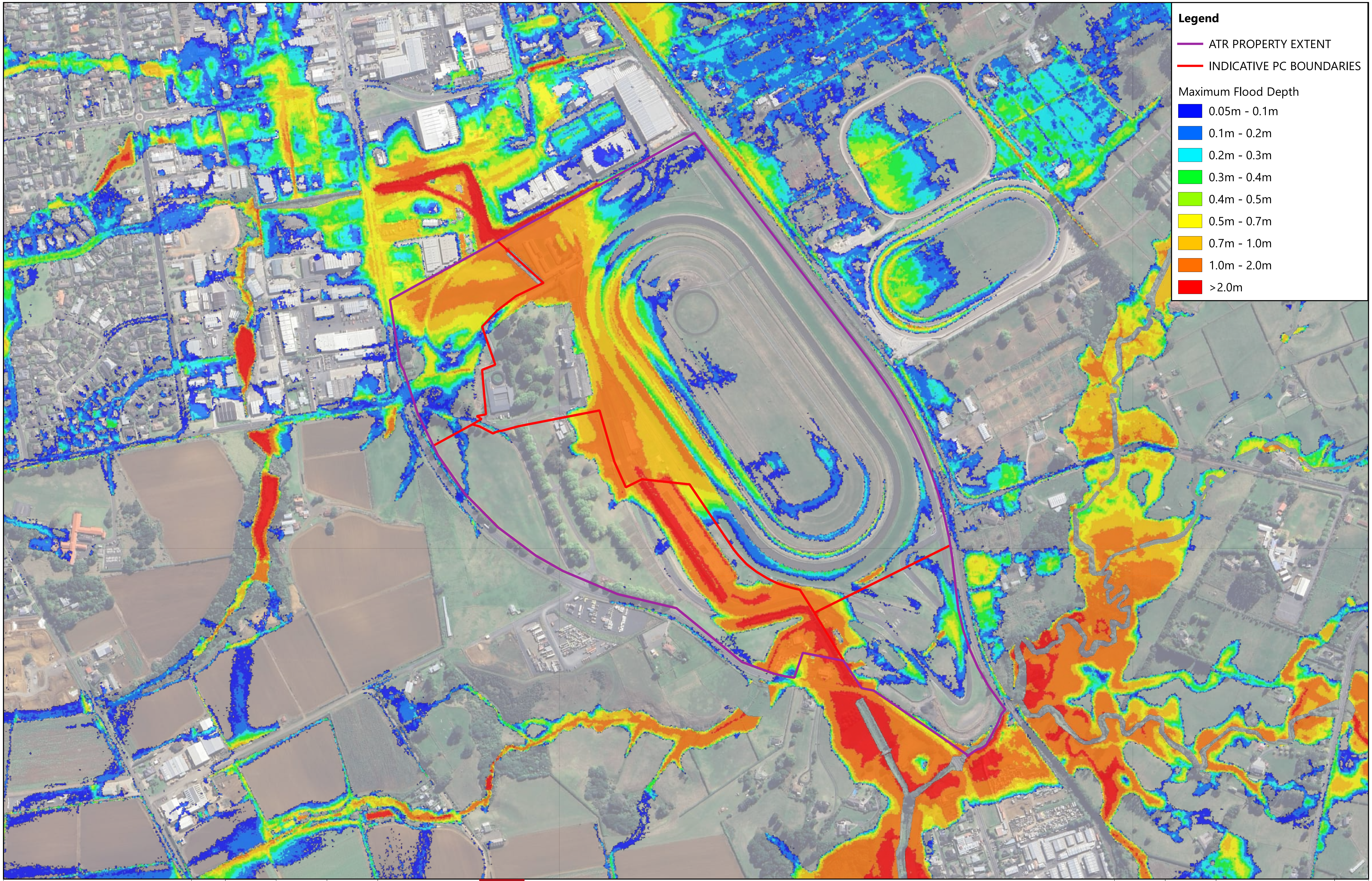

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				APPROVED	-

8 NUGENT STREET
GRAFTON 1023
AUCKLAND

WOODS.CO.NZ

WOODS Est.1970

P23-057 ATR Pukekohe
Maximum Flood Depth
Pre Development (ED within site) 100yr 2.1°C

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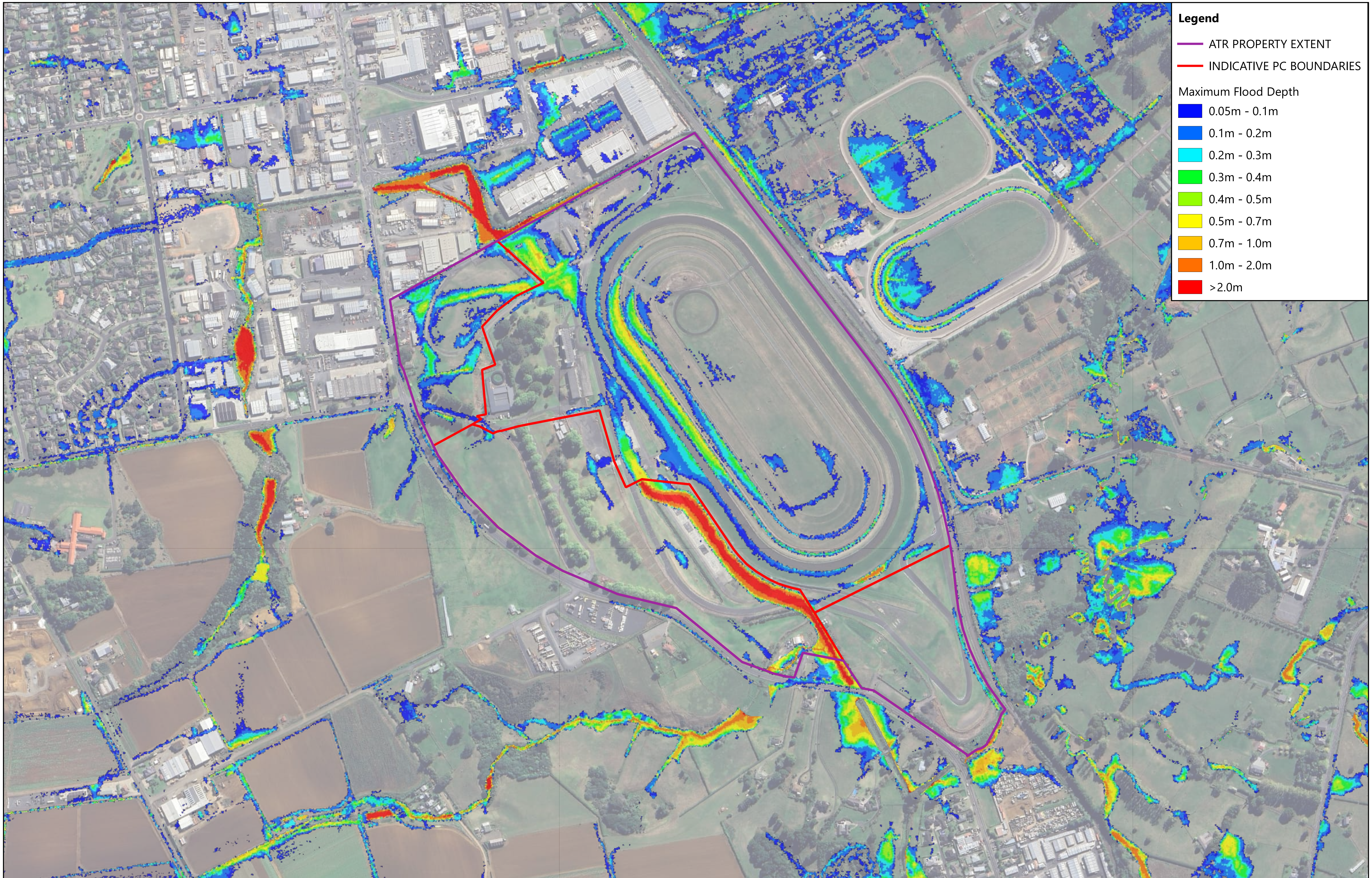

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				APPROVED	-

8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

WOODS Est.1970

P23-057 ATR Pukekohe
Maximum Flood Depth
Post Development 2yr 2.1°C

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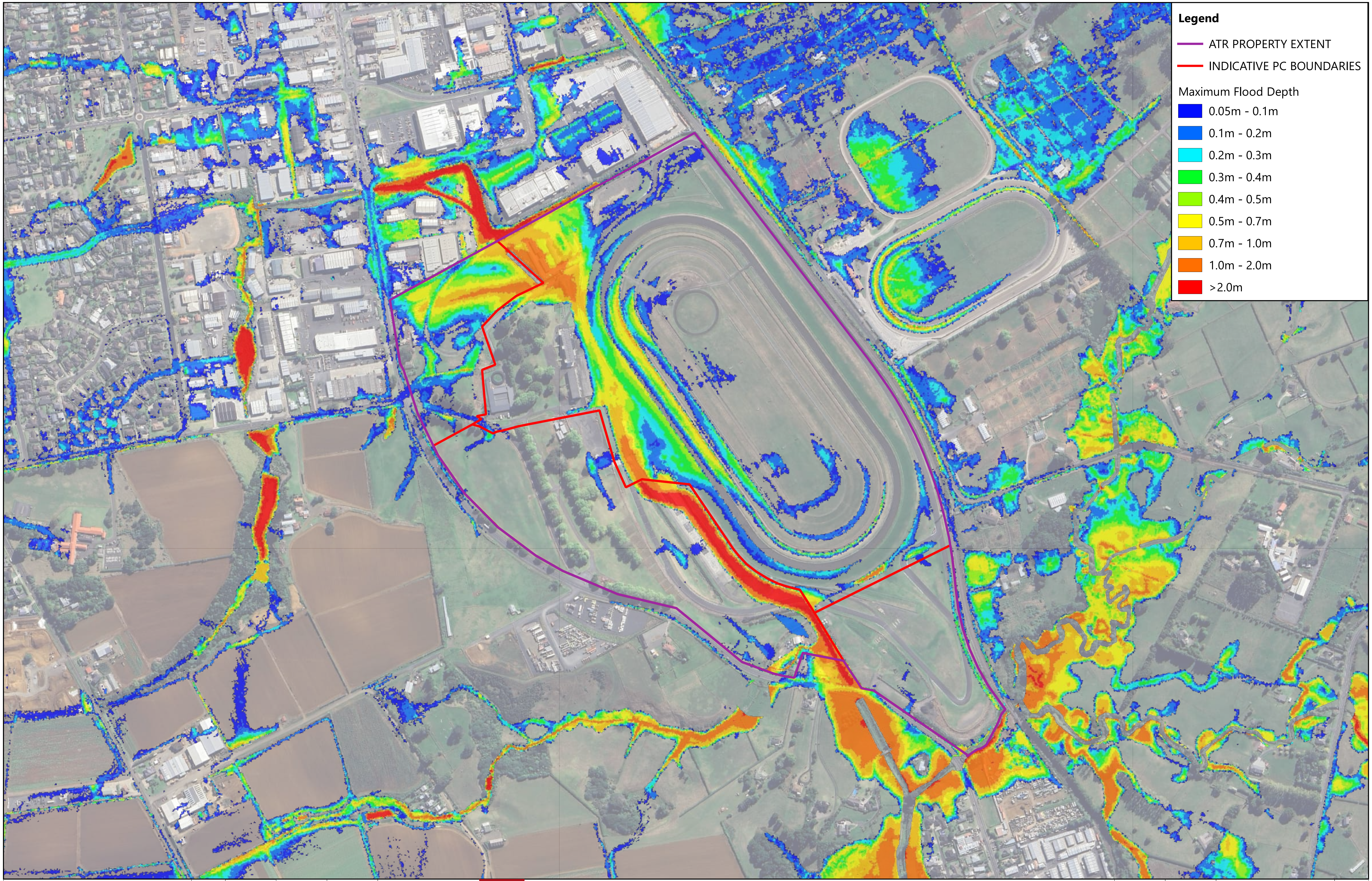

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				APPROVED	-

8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

P23-057 ATR Pukekohe
Maximum Flood Depth
Post Development 10yr 2.1°C

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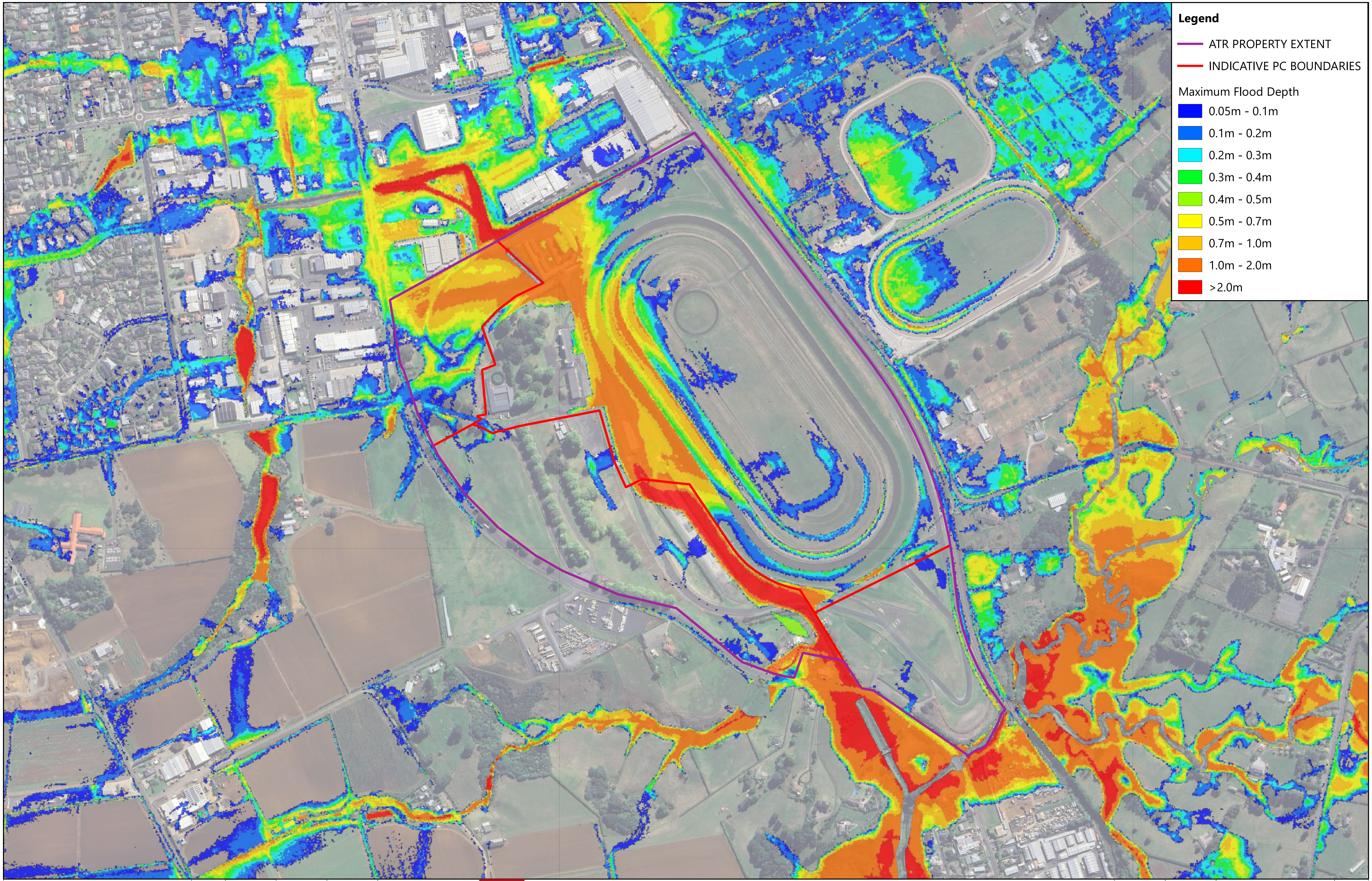

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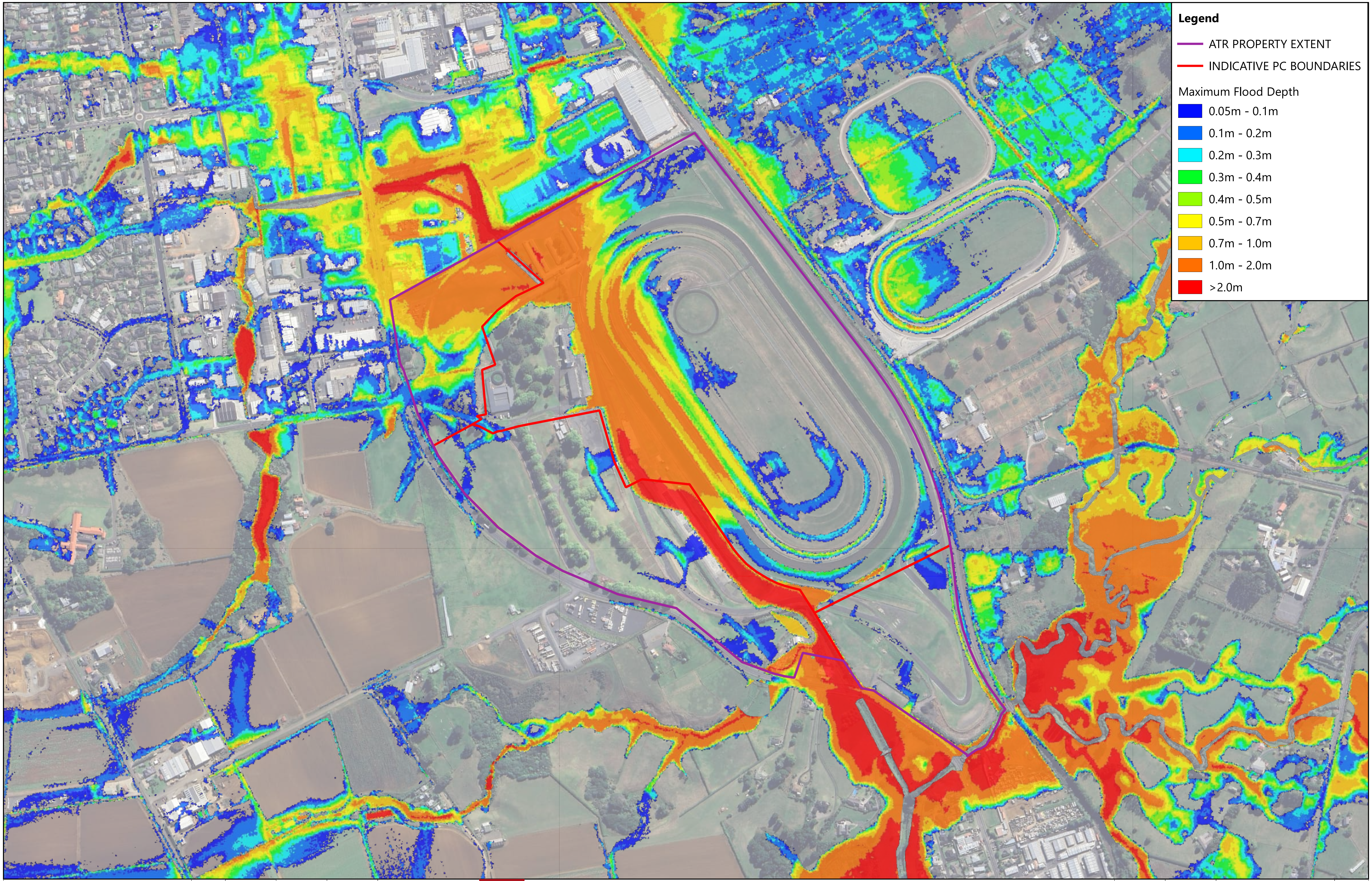

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				APPROVED	-

8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

WOODS Est.1970

P23-057 ATR Pukekohe
Maximum Flood Depth
Post Development 100yr 3.8°C

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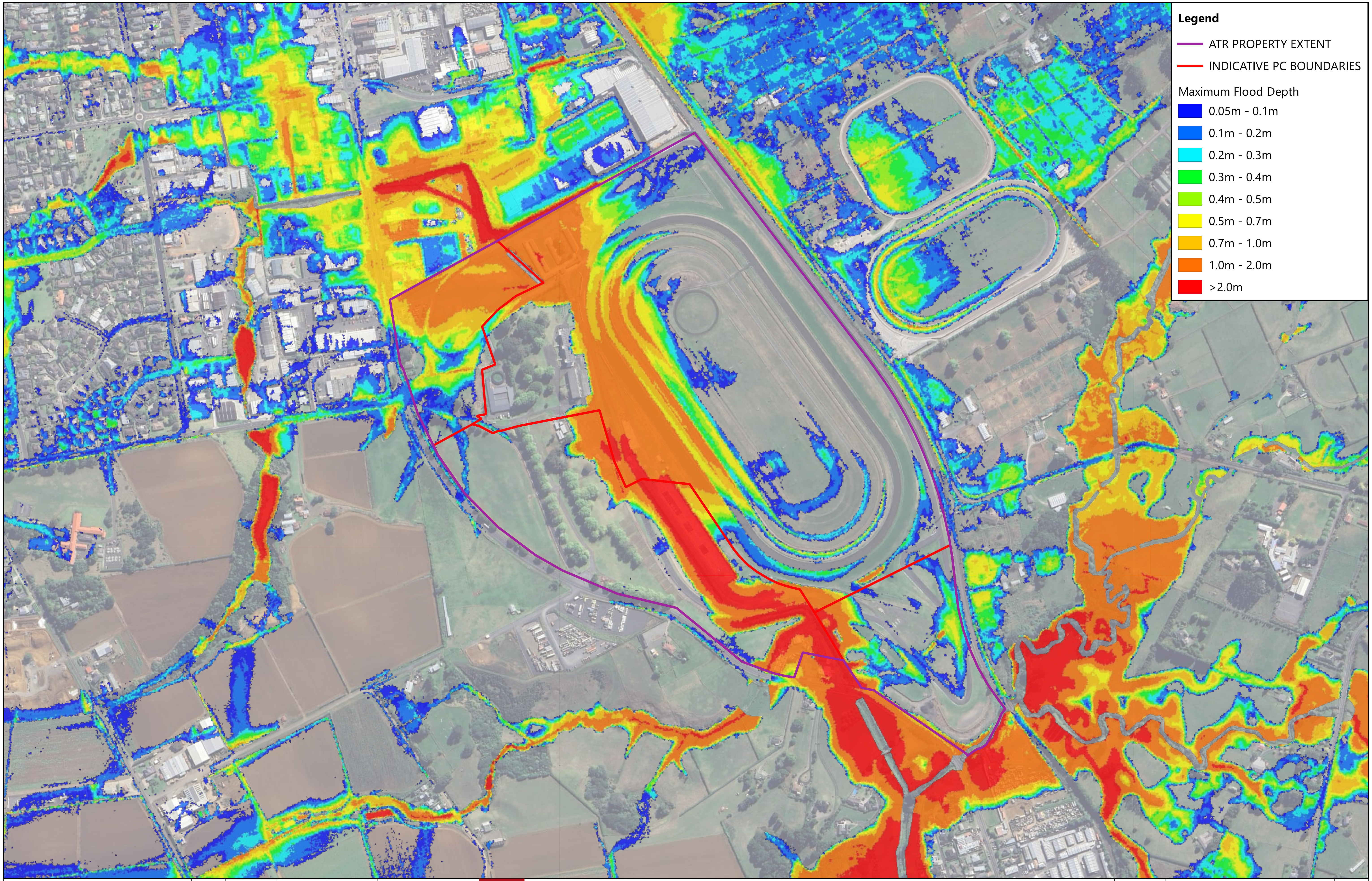

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				APPROVED	-

8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

WOODS Est.1970

P23-057 ATR Pukekohe
Maximum Flood Depth
Post Development (ED within site) 100yr 3.8°C

STATUS	ISSUED FOR INFORMATION	REV
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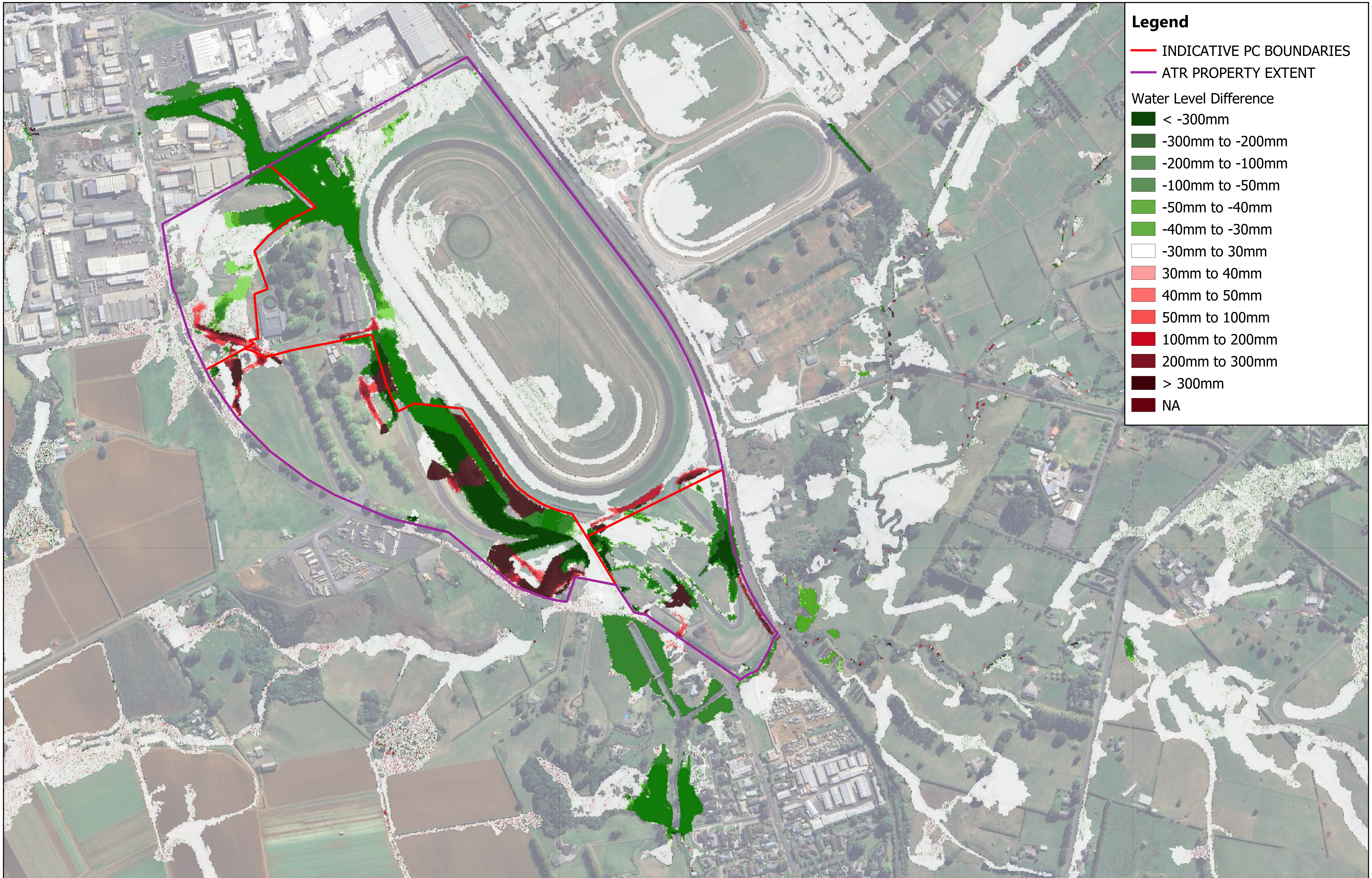

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				CHECKED	AD
				APPROVED	-

8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

WOODS Est.1970

P23-057 ATR Pukekohe
Water Level Difference
Post Development vs Pre Development 2yr 2.1°C

STATUS	ISSUED FOR INFORMATION	REV
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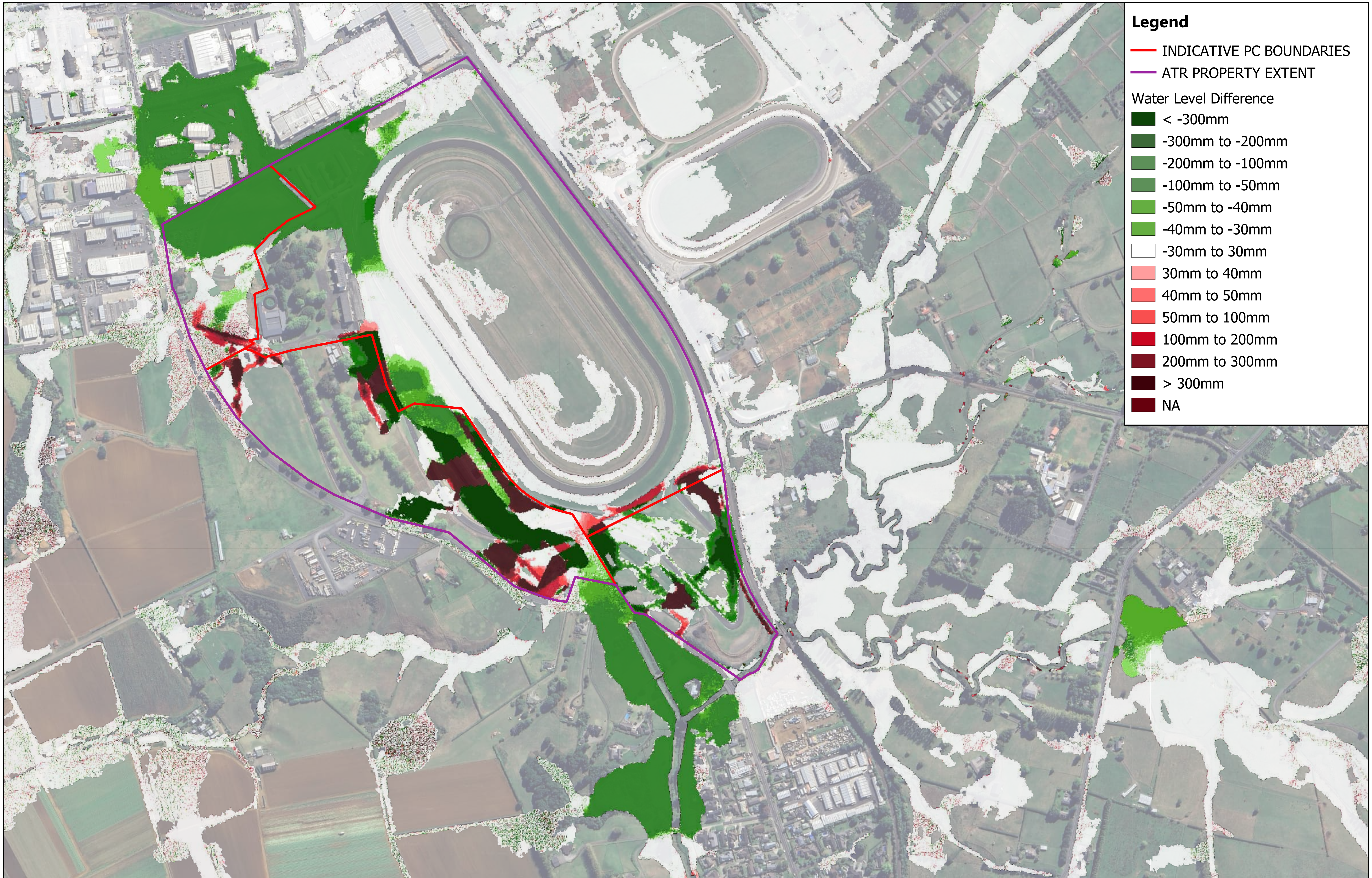

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				APPROVED	-

SURVEYED -

8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

WOODS Est.1970

P23-057 ATR Pukekohe
Water Level Difference
Post Development vs Pre Development 10yr 2.1°C

STATUS	ISSUED FOR INFORMATION	REV
SCALE	NTS	1.0
COUNCIL	AUCKLAND COUNCIL	
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				CHECKED	AD
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8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

WOODS Est.1970

P23-057 ATR Pukekohe
Water Level Difference
Post Development vs Pre Development 100yr 2.1°C

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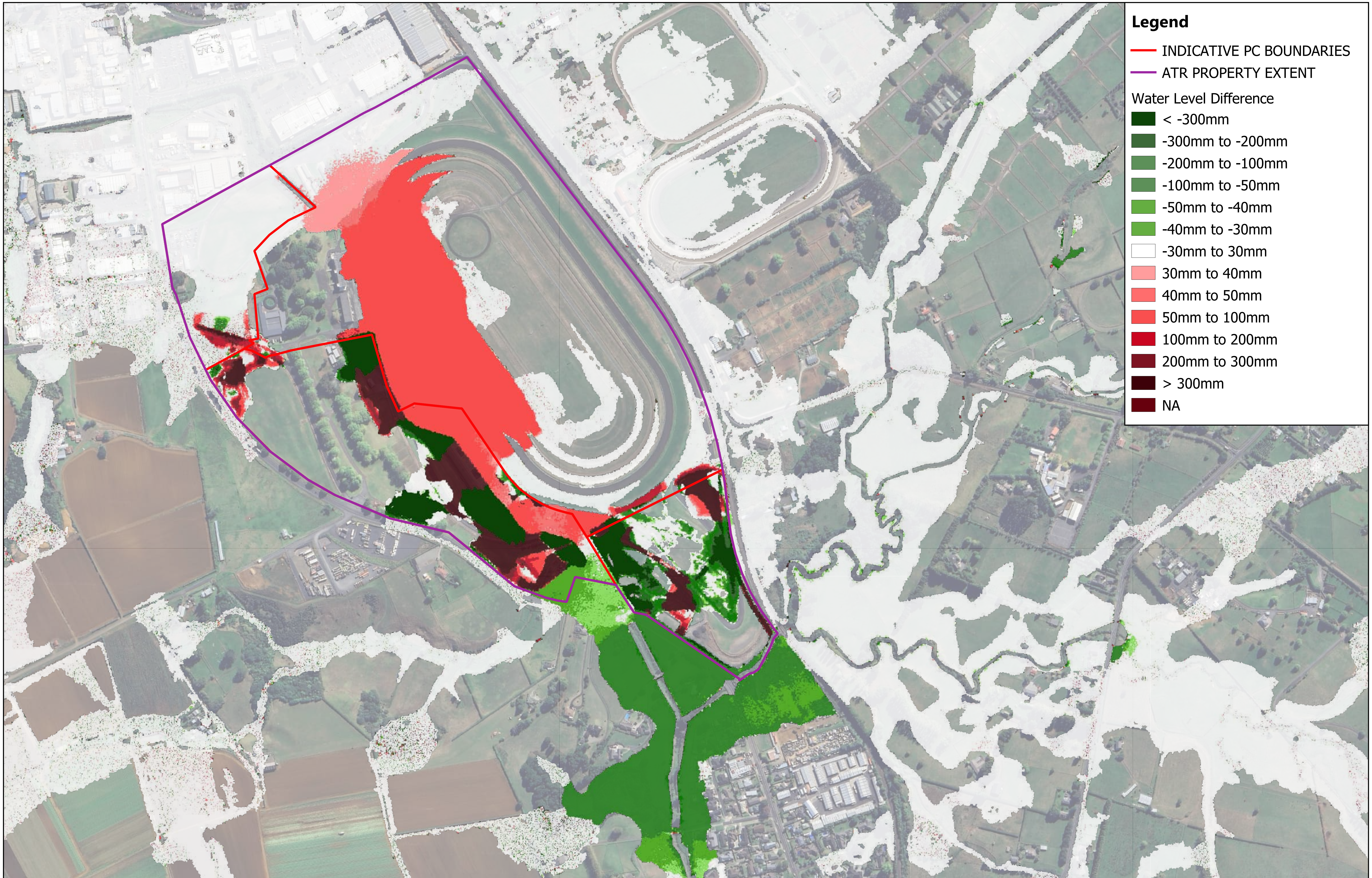

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8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

WOODS Est.1970

P23-057 ATR Pukekohe
Water Level Difference
Post Development vs Pre Development 100yr 3.8°C

STATUS	ISSUED FOR INFORMATION	REV
SCALE	NTS	1.0
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-	-	-	-	CHECKED	AD
				APPROVED	-

8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

WOODS Est.1970

P23-057 ATR Pukekohe
Water Level Difference
Post Development vs Pre Development (ED witihin site) 100yr 2.1°C

STATUS	ISSUED FOR INFORMATION	REV
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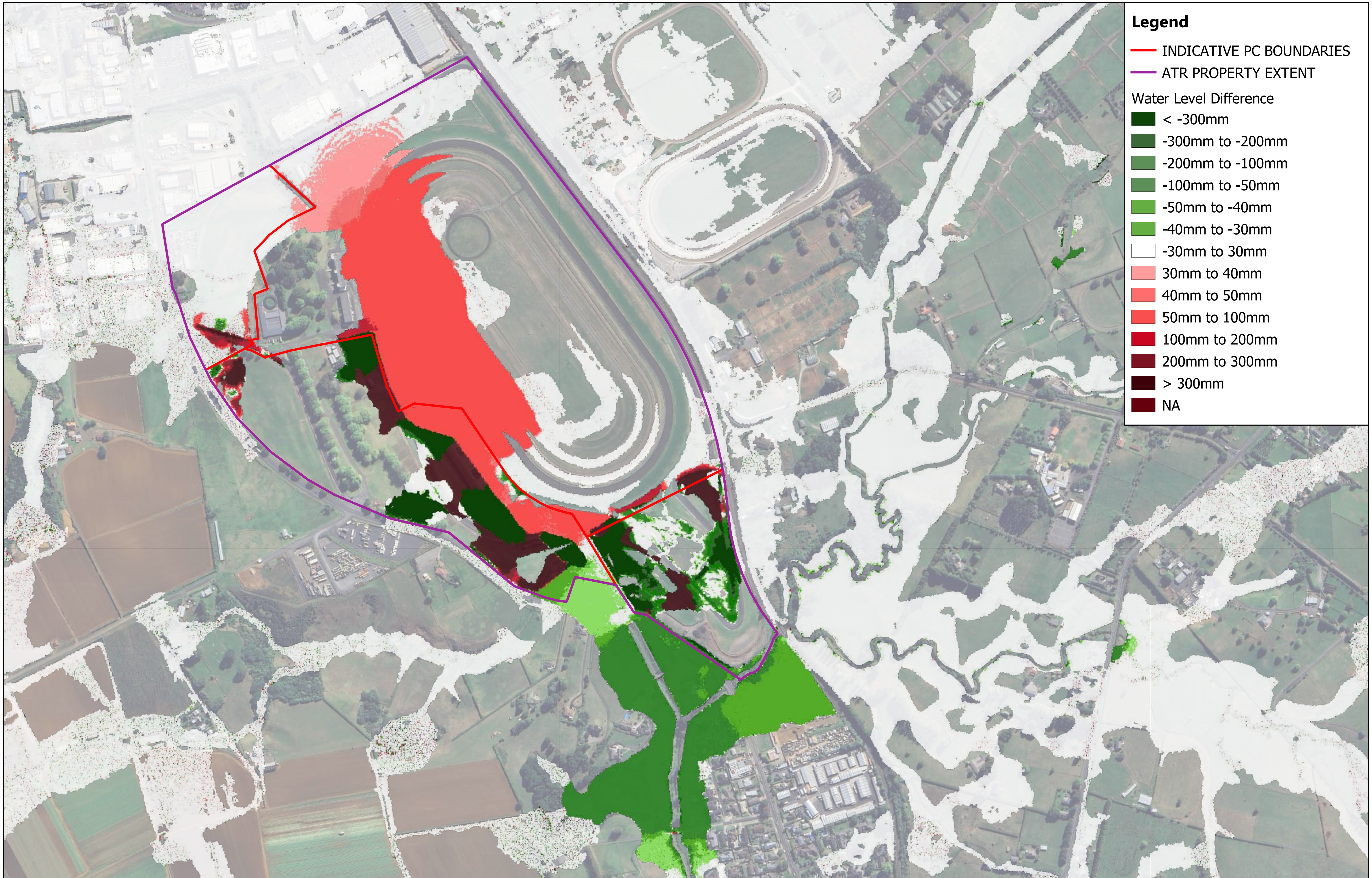

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SURVEYED: -

8 NUGENT STREET
GRAFTON 1023
AUCKAND

WOODS.CO.NZ

WOODS Est.1970

P23-057 ATR Pukekohe
Water Level Difference
Post Development vs Pre Development (ED witihin site) 100yr 3.8°C

STATUS	ISSUED FOR INFORMATION	REV
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