TE KOWHAI EAST

STORMWATER MANAGEMENT PLAN

PROJECT INFORMATION

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1. STATEMENT OF QUALIFICATION & CODE OF CONDUCT

The qualifications and experience of the authors and reviewer of this report are summarised below. We record that we have read and agree to comply with the Environment Court's Code of Conduct for Expert Witnesses as specified in the Environment Court's Practice Note 2023. We confirm that this report is within our area of expertise, except where we state that we rely upon the evidence or reports of other expert witnesses lodged forming part of the project's application material. We have not omitted to consider any material facts known to us that might alter or detract from the opinions expressed.

RYAN WYLLIE

Ryan Wyllie is a Principal at Maven Associates Limited. He holds a Bachelor of Engineering with Honours from the University of Auckland and is a Chartered Professional Engineer practising in the field of civil engineering.

Ryan has over 14 years of professional experience working as a civil engineer and project manager in land development and infrastructure projects across New Zealand, Australia, the United Kingdom and Canada. His experience includes three waters infrastructure, stormwater management, roading and highways, bulk earthworks, urban infrastructure planning, development staging, and coordination of multidisciplinary land development projects.

In New Zealand, Ryan has led major land development projects including Richmond Residences in Mt Wellington, Kauri Green at Westgate, Lockerbie Estate in Morrinsville, East Coast Heights in Silverdale, and Rangitoopuni countryside living subdivision and retirement village in Riverhead. These projects have involved complex civil infrastructure planning, geotechnical constraints, stormwater and flooding constraints, roading design, wastewater and water supply servicing, utility coordination, and engagement with councils and infrastructure providers.

Internationally, Ryan served as Project Manager for Transport for London's Elephant and Castle Northern Roundabout redevelopment, where he managed the construction phase of a major intersection upgrade with significant public and stakeholder engagement responsibilities. More recently, with WSP in Canada, he managed major highway rehabilitation and safety upgrade projects on the Alaska Highway, and undertook preliminary design for a highway interchange and access road associated with the Garibaldi and Squamish mountain resort project.

Ryan's qualifications include a Bachelor of Engineering with Honours from the University of Auckland. He is also a Chartered Professional Engineer.

Signed:________________________________ Date: 28 August 2026

MITCHELL SMITH

Mitchell Smith is an Associate at Maven Associates Limited. He holds a Bachelor of Engineering with Honours from the University of Auckland and is a Chartered Professional Engineer practising in civil engineering.

With over 12 years' experience across New Zealand, the United Kingdom, and Canada, Mitchell brings a broad civil engineering background spanning design, project management, and construction monitoring across land development, airports, ports, coastal, and civil infrastructure projects.

Mitchell is the lead civil engineer for the Rotokauri Minor Arterial and Greenway Project in Hamilton, where he managed and undertook the detailed design of the full 4.7 km stormwater management corridor, including three artificial wetlands and three raingardens providing stormwater quality treatment and flood storage, and is currently delivering design support during construction of the project's first phase. He is also lead civil engineer for the Rotokauri Stage 1 Subdivision, managing the Resource Consent and Engineering Plan Approval design for the first stage of the development.

Signed:______________________________ Date: 28 August 2026

JAMES OAKLEY

James Oakley is a Principal three waters engineer at Te Miro Water with 15 years of experience in land development and three waters design and project implementation, specialising in stormwater management. He holds a Bachelor of Engineering (Hons) from The University of Waikato.

James' skills span stormwater master planning, integrated catchment management, engineering design, hydrologic and hydraulic modelling, project consenting, budgeting, construction supervision, technical review work and preparation of guidance documentation. James has proven experience in technically challenging projects from concept right through to construction and delivery in both New Zealand and International settings, for public and private sector clients and non-government organisations. James is known for his ability to relate to various stakeholders and collaborate with people across various disciplines.

Signed:______________________________ Date: 28 August 2026

KEVIN YIP

Kevin Yip is a Team Leader at Maven Associates Limited. Kevin has been employed with Maven for more than three years. He holds a Bachelor of Engineering with Honours from the University of Auckland.

Kevin has over 10 years of professional experience working in land development shared between 3 years working as a land development project manager and 7 years working as a civil engineer. As a project manager working for a private builder developer, Kevin has informed land acquisitions, managed development feasibilities/budgets, consenting delivery and construction contracts throughout various regenerated areas throughout Auckland. As civil engineer, Kevin has experience in stormwater design and management, three waters and roading infrastructure.

Kevin has led Maven's involvement in Te Kukūnga Waka (~4,000 medium-to-high density homes) in Auckland, delivering separable portions of the backbone infrastructure and open space projects led by the three Tāmaki Makaurau Rōpū of Marutūāhu, Ngāti Whātua and Waiohua-Tāmaki as well as their project partners.

Signed:______________________________ Date: 28 August 2026

2. EXECUTIVE SUMMARY

The purpose of this Stormwater Management Plan (SWMP) is to outline the proposed management of stormwater for the Te Kōwhai East (TKE) industrial development. The outcome of the SWMP ensures that the receiving environment is protected and that effects from the proposed land use change from rural pasture to industrial are appropriately mitigated. The overall goal of this SWMP is to mitigate effects of the development whilst trying to deliver positive effects on the receiving environment.

TKE is located within the Mangaheka, Te Rapa and Te Otamanui catchments. Integrated Catchment Management Plans (ICMP) have been prepared for those catchments, and have been reviewed, with their key outcomes adopted in developing this SWMP. This SWMP has also been developed to achieve the following objectives set by Te Ture Whaimana (The Vision and Strategy for the Waikato River). TKE provides a unique opportunity for improved stormwater outcomes and stream health within the site. This SWMP provides a framework that enables development that supports urban development but also ensures improved environmental outcomes.

The TKE SWMP achieves the following:

- ✓ Flood Mitigation – Provide safe containment and conveyance for the 2-,10- and 100-year flood to pre-development levels. The enhancement of the Mangaheka Stream and creation of roading corridors and conveyance channels creates a coordinated and centralised system that simplifies and improves the approach to asset management, maintenance and operation of stormwater.

- ✓ Flood Hazard Control – Flood waters within the proposed roading corridors and conveyance channels direct flooding away from the future industrial Lots to create opportunity for safe building platforms. Flood waters within the roading corridors will also comply with velocity and depth limits per RITs and enable safe access in all major storm events.

- ✓ Water Quality – The Mangaheka Stream has been identified with its ICMP as having poor overall water quality. Source and treatment train approaches for water quality ensure sustainable biodiversity.

- ✓ Stream Enhancement – Native revegetation and the creation of opportunities for stream habitats and generation of native flora and fauna biodiversity within the wetlands and Mangaheka Stream riparian margins. Management of smaller 2-Year ARI rainfall events to mitigate risks for stream erosion

- ✓ Stream Health and Erosion Control – ensure stream health is improved through the management of smaller (2-yr rainfall events), ensure discharges from outfalls and culverts are protected with erosion controls.

- ✓ Fish Passage Improvements – Ensures all culverts are provided with suitable fish passage and opportunity and enhancement of native black mudfish habitats.

- ✓ Incorporation of Cultural and Water Sensitive Design principles that align with mana whenua values.

Subject to future compliance with the framework set out in this SWMP, it is considered that adverse effects can be suitably mitigated and managed, and significant benefit to the site and surrounding environment will result post-development of TKE.

3. OVERVIEW

3.1 Project Introduction

This technical report assesses Stormwater Design and Management. The report has been prepared to support Te Kowhai East Limited Partnership's substantive application for approvals under the Fast-track Approvals Act 2024 (FTAA). The Project is a large-scale industrial development located on the north-western edge of Hamilton, adjacent to the established Te Rapa industrial area. The application provides for the creation of an integrated industrial precinct, including approximately 210 industrial lots, land for neighbourhood centre activities, reserves for recreation, stormwater management and ecological mitigation, and associated roading and infrastructure services. The application also seeks approval for the ultimate land use outcomes anticipated across the site, being predominantly industrial activities, along with a limited range of compatible non-industrial activities suited to an industrial environment. The development will form a logical extension of Hamilton's primary industrial node within the Upper North Island economic corridor and responds to projected growth and demand.

A comprehensive description of the Project is provided in the Substantive Application Report (SAR).

3.2 Site Description / Identification

The Project site comprises a large, contiguous landholding located on the north-western edge of Hamilton. It is generally bounded by Te Kowhai Road to the south, Koura Drive and State Highway 1C to the east, and Onion Road to the north. The site is made up of multiple land titles, legal descriptions, and associated physical addresses. For identification purposes, the site is commonly referred to by the primary addresses of 270 Te Kowhai Road and 28 Mathers Road. Full details of the landholdings are provided in the SAR. The site is identified in Figure 1 below.

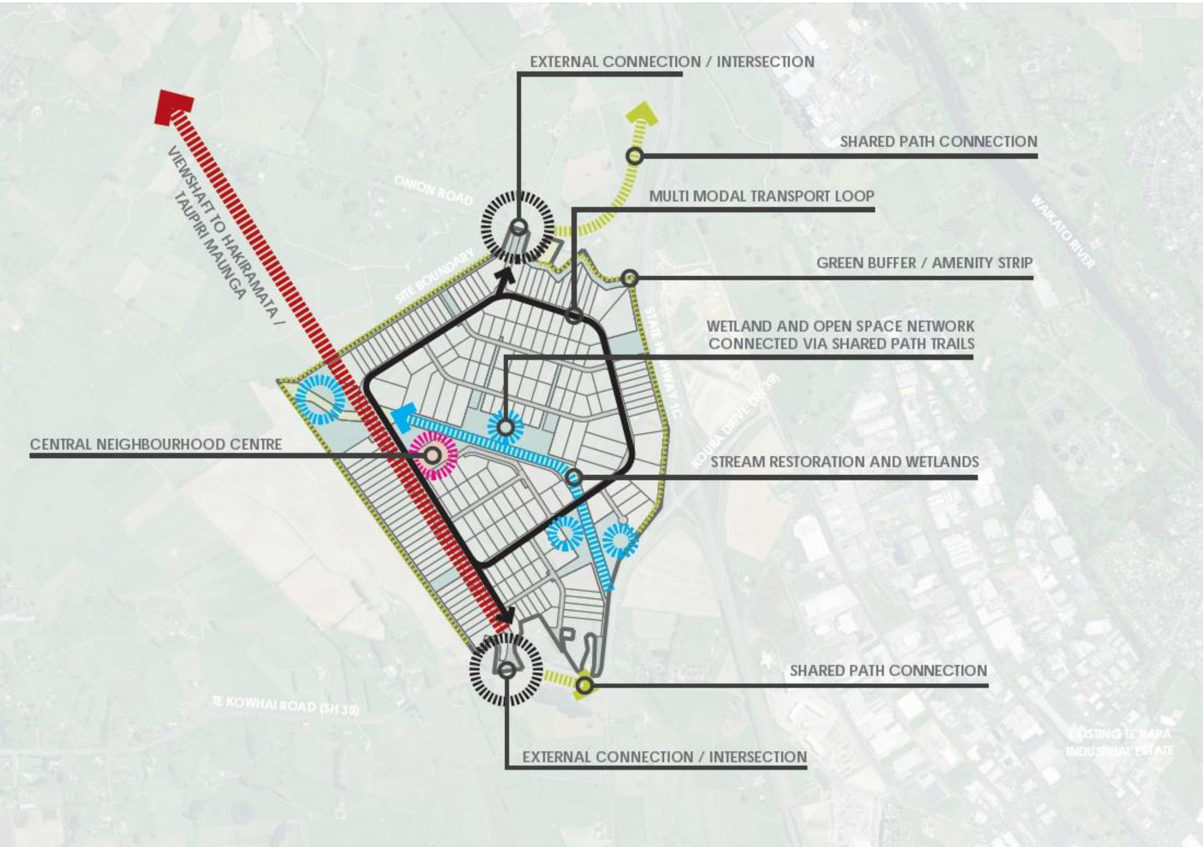


Figure 1: TKE Masterplan (Adapt Studio)

3.3 Consultation

Several workshops have been held with representatives from Waikato Regional Council (WRC), Waikato District Council (WDC) and Hamilton City Council (HCC) on the following dates:

- TKE Stormwater Workshop 15th February 2025
- TKE Multidisciplinary workshop 23rd April 2026
- TKE Stormwater concerns for wider catchment 1st May 2026
- Stormwater workshop 7th August 2026

High-level approaches to stormwater management were provided by Maven and progressively refined based on preceding feedback from those workshops. Specific details relative to the flood modelling and assumptions were also discussed and agreed. Some additional information pertaining to stream health and flood modelling assumptions was suggested, and these requests have been incorporated into the various Maven reporting which is supporting this application.

3.4 Basis of Design

The Basis of Design (BoD) sets out the framework for stormwater design for TKE which has been developed in consultation with Council stakeholders. The BOD consolidates the different variations of outcomes and standards between the reference documents listed below and the workshops with Council stakeholders per Section 3.3 above under a single framework.

- RITS V2
- TR20-06
- TR20-07
- Land Drainage Management Plan
- ICMP – Mangaheka
- ICMP – Te Rapa

The BOD is included as Appendix A. Where multiple criteria exist the most applicable scenario has been adopted in consultation with the different Council stakeholders. This document establishes the agreed technical basis for stormwater design and management for TKE. It defines the performance expectations and standards before hydrologic modelling and detailed design begin.

3.5 Departures

At time of writing, there are two known departures from the standards above.

1. <u>Flow Depth Exceeding Limits at Roading Sags</u>

   Several depths exceeding the 150mm limit (up to 400mm) at sags within the roading corridor have been identified in the hydraulic model. These sags provide a spillway for flood waters to exit the roading corridor and be conveyed away via secondary open channel networks. This departure is discussed in further detail separately in the Maven Civil Infrastructure Report.

2. <u>Increase in Post-Development Stormwater Volumes</u>

   While the proposed attenuation measures have managed to mitigate post-development peak flows (i.e. the rate at which stormwater leaves the site), they cannot reduce the volume, and the receiving watercourses carry elevated flows for a longer duration and longer drain down times after rainfall events. This additional duration has the potential to increase the risk of stream erosion over time. TKE have proposed an adaptive residual management approach to mitigate the effects of the increased volume in line with acceptable mechanisms outlined in RITs V2 and both the Mangaheka and Te Rapa ICMPs, and is discussed in detail via Section 9.4.3 of this SWMP.

4. CATCHMENT CONTEXT

4.1 Catchment Overview

The TKE development lies within three catchments and are listed below in order of decreasing hectarage within the boundaries of TKE: Mangaheka, Te Rapa and Te Otamanui. Figure 2 below shows the location of TKE relative to the different catchment boundaries.

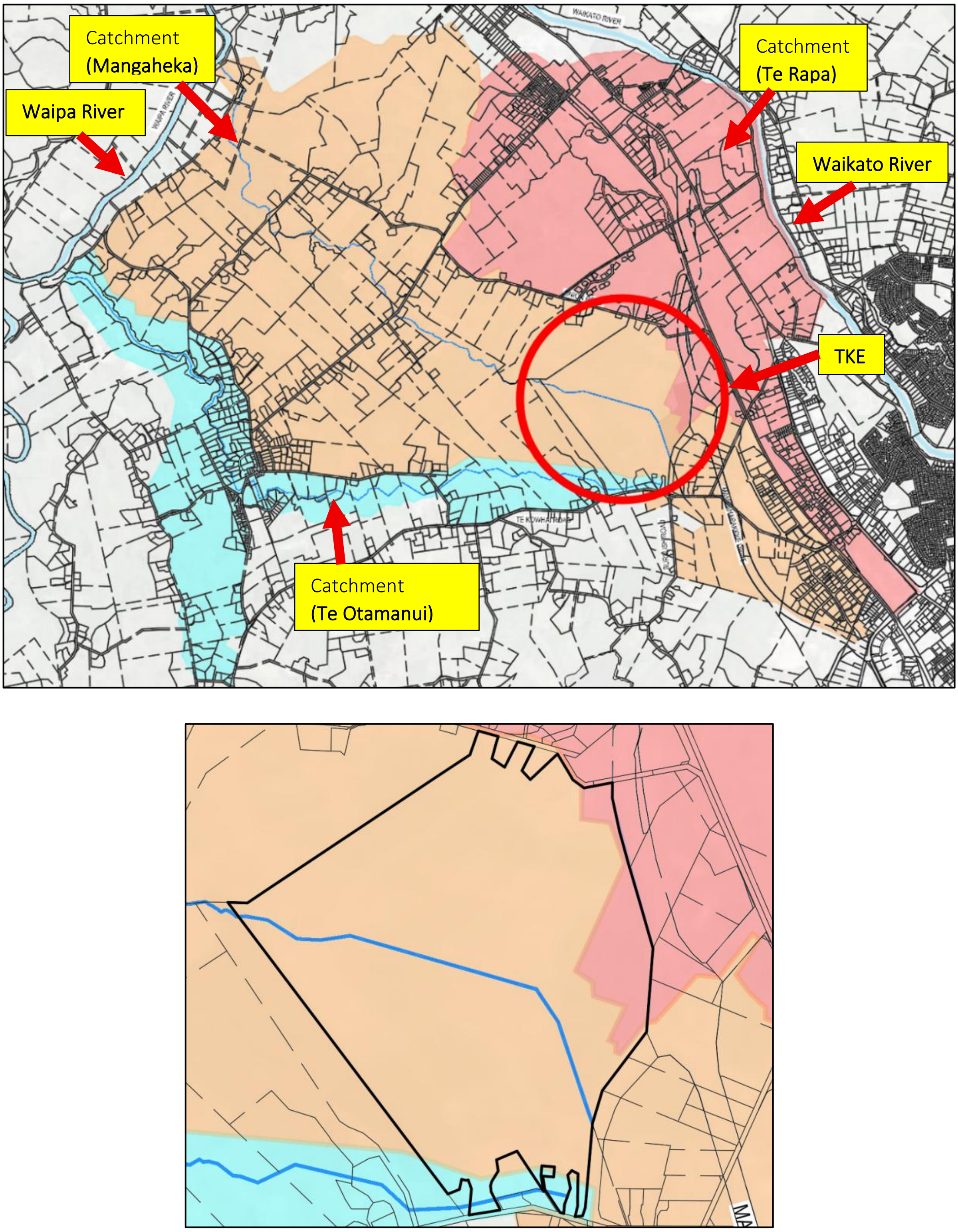


Figure 2: TKE & ICMP SW Catchments – Mangaheka (Orange), Te Rapa (Red), Te Otamanui (Blue)

4.1.1 Mangaheka Catchment

The boundaries of TKE lie primarily within the upper Mangaheka Stream catchment, a low-gradient system draining north-west toward the Waipā River. This catchment is governed by the Mangaheka ICMP (2019) and falls within WRC's jurisdictional area. The upper reaches of the Mangaheka stream that is located within the TKE development is also known as the Mcbeth Drain and forms part of a rural land-drainage network that is managed by WRCs Land Drainage Management Plan. The greater Mangaheka catchment covers an area of approximately 2,080ha with an approximate 86% of the catchment (the "lower catchment") under WRC management and the remaining 14% (the upper catchment) under HCC management. The TKE site is positioned near the top of the WRC managed "lower catchment". Existing land use within the lower catchment is predominantly rural in nature with commercial/light industrial development in the upper catchment. The Mangaheka ICMP provides a framework for stormwater management in support of the on-going urban development as rural land is gradually replaced with light industrial and commercial land uses, such as TKE.

4.1.2 Te Rapa Catchment

A smaller eastern portion of the development lies within the Te Rapa stream catchment, which drains north towards the Waikato River. This catchment is governed by the Te Rapa North ICMP (2025) and falls within HCC's jurisdictional area. The Te Rapa Catchment is located in the north of Hamilton, on the western side of the Waikato River. The headwaters and mid-catchment are located in the Hamilton City HCCs jurisdictional area with the lower portion of the catchment within the WDC area. The Te Rapa Stream flows in a generally northerly direction, with the Waikato River confluence located approximately 400m downstream of the Horotiu Bridge, within the Horotiu AFFCO New Zealand site.

4.1.3 Te Otamanui Stream Catchment

The Te Otamanui Stream catchment forms the southern adjoining catchment to the Mangaheka Stream catchment and starts near the Koura Drive roundabout with Te Kowhai Road. The Te Otamanui Stream catchment is approximately 9.5km long and 500 hectares in area, with an approximate grade of 1 in 550. The stream flows through farmland and a rural town (Te Kowhai) before discharging into the Waipa River.

The Te Otamanui Lagoon is located in the downstream part of the catchment, just upstream of the discharge point to the Waipa River. This lagoon has appeared to be drying out in recent times and supplementing flows is seen as something that may improve this situation. The current Te Otamanui Lagoon catchment starts near the Koura Drive roundabout with Te Kowhai Road.

The upper part of this catchment (upstream of Koura Drive) appears to have been disconnected at some stage in the past and now drains towards the Mangaheka Stream. The construction of Koura Drive as part of the Te Rapa Bypass project, has further reinforced the disconnection by not providing a flow path under Koura Drive into the Te Otamanui Stream. The history is unclear, but it is possible that the two catchments were previously one, and that there were two outlets to the catchment. Figure 3 below shows the current extent of the Te Otamanui Stream upper catchment adjacent to Koura Drive.

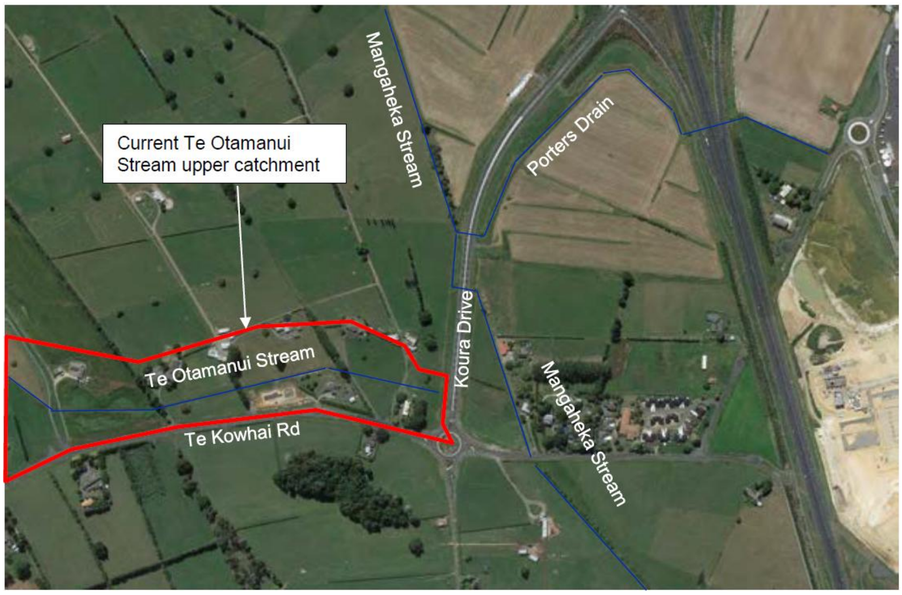


Figure 3: "Upper Te Otamanui catchment" – from CH2M Beca Te Otamanui Fatal Flaw Assessment"

HCC engaged CH2M Beca Ltd in May 2017 to undertake a fatal flaw assessment to confirm whether flows could be diverted from the Mangaheka Stream catchment into the Te Otamanui catchment. The Mangaheka ICMP indicates that HCC are preparing a scope of works to undertake further modelling and survey of the Te Otamanui sub-catchment and will discuss with WDC and other stakeholders. It is expected this will model a few development scenarios in order to reach a conclusion on whether re-connection is possible. This modelling has not been undertaken as part of the TKE development.

The proposed road from Te Kowhai Road into the site will require the upper end of the Otamanui Stream channel to be culverted. No discharge of stormwater from the site into this channel is proposed and the current catchment boundaries will be maintained. The TKE design does not alter the Mangaheka Stream inverts at the Koura Drive culverts and does not propose any change to the Te Otamanui Stream beyond the Te Kowhai Road culvert crossing (1,500 x 1,000 box culvert) and approximately 65 m of associated in-stream works, per Section 4.3 of the Stream Works Management Plan.

4.1.4 Waikato Regional Council Administered Drainage Areas

The Development site is located within the Waikato Central Drainage Scheme, Ngaruawahia District. WRC administers and maintains drainage networks across 92 designated drainage areas within the Waikato Region, primarily serving low-lying rural and agricultural land where natural drainage is limited. These drainage schemes have been established to improve land productivity, maintain accessibility, lower groundwater levels, and reduce flood risk by conveying excess surface water to suitable outfalls. While design standards vary between catchments to reflect local conditions, the general level of service is based on removing ponded surface water resulting from a 10% Annual Exceedance Probability (AEP) / 10-year ARI rainfall event within three days. This drainage performance standard is intended to minimise damage to pasture and support ongoing agricultural land use.

The site contains four managed drains; McBeth, McCosh, Gore and Alabama Light. Refer Figure 4 below for the location of the WRC managed drains within the site. The central McBeth drain (Mangaheka Stream) continues to Horotiu Road where it discharges under the road via twin 1200mm culverts. Downstream of Horotiu Road, the main Mangaheka channel flows in a westerly direction within an incised gully system discharging to the Waipa River approximately 4km downstream of Horotiu Road.

Figure 4: Existing Land Drainage Networks within TKE

4.1.5 Catchment Land Use

The site has been used predominantly for pastoral farming with flooding and irrigation supported by the existing WRC administered land drainage networks. This type of similar land use extends downstream all the way to the Waipa River. The catchment upstream of the site is predominantly composed of a mixture of industrial and future residential zones. Refer to Figure 5 below for mapping of the different catchment land uses assessed for the site.

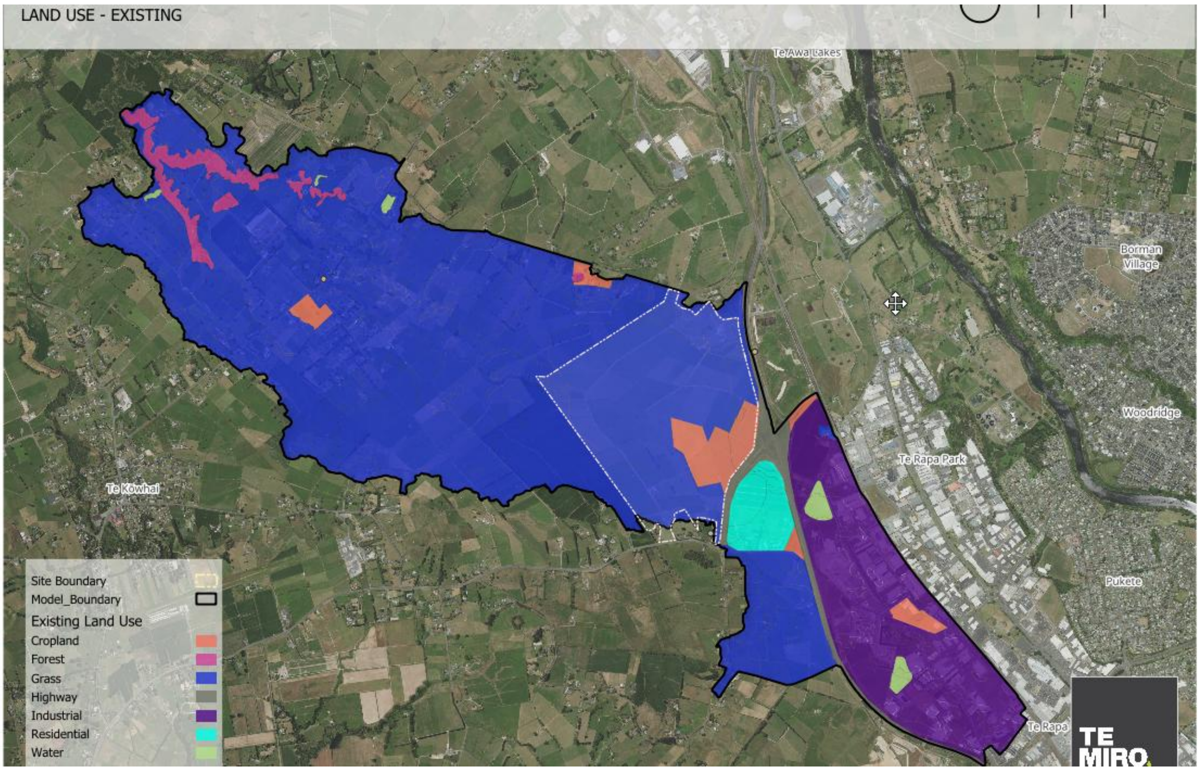


Figure 5: Existing Land Use (Source: TMW Model Build Report)

5. EXISTING SITE CHARACTERISTICS

5.1 Geotechnical Assessment

Geotechnical investigations by CMW Geosciences indicate that the site is underlain predominantly by interbedded sands and silts of the Hinuera Formation across the entire extent of the low-lying plains with the rolling hill topography underlain by a sequence of Walton Subgroup soils consisting of weathered volcaniclastic and alluvial deposits comprising clays, silts and sands.

The full Geotechnical Investigation Report by CMW can be found in the substantive application appendices.

5.2 Hydrogeology

Site investigations undertaken and groundwater monitoring undertaken by CMW and WGA confirm shallow groundwater conditions across the site, with water levels ranging from 0.5 m to 1.0 m below ground level (bgl) during winter and seasonally lowering to approximately 2.0 m bgl in the summer months. Each piezometer exhibits relatively similar responses and trends, which is assessed as indicative of a connected shallow groundwater system across the site.

Contouring of the late summer groundwater levels (phreatic surface) indicates shallow groundwater flow is toward the Mangaheka Stream and northwest. A similar groundwater flow direction towards the Mangaheka Stream is expected for winter conditions when groundwater levels are high. The Mangaheka Stream is expected to draw shallow groundwater toward it and therefore influence the groundwater flow pattern along with the general land gradient of the site towards the northwest.

The full Hydrogeological Assessment Report by WGA can be found in the substantive application appendices.

5.3 Natural Features

Figure 6 below, extracted from Mangaheka ICMP, indicates that the existing McBeth drain (Mangaheka Stream) bisecting the middle of the site is identified as a modified stream with intermittent drain flow. Upstream flows are controlled by multiple artificial ponds that collect the runoff from industrial zones.

A site-specific Ecological Impact Assessment (EcIA) and watercourse survey has been undertaken by ecoLogical Solutions Ltd (ESL). Watercourses within the Site include the Mangaheka Stream (1,900 m), 220 m of the Te Otamanui Stream, a highly modified unnamed watercourse (212 m), and an extensive network of artificial farm drains. The classification status of watercourses within the site provided by ELS is presented via Figure 7 below. These artificial land drains are described as providing poor quality habitat conditions due to straight channel alignments, lack of aquatic habitat diversity, lack of vegetated riparian margins, low channel gradient, poor channel shade and their ephemeral nature. Stagnant surface water was covered in green and brown algae and stained orangey brown from ferrous iron in some areas reflecting the low velocity environment of the drains, the absence of adequate shading and the high nutrient concentrations from the adjacent farming activities. Despite their degraded state and ephemeral nature, some drains have been observed to support black mudfish.

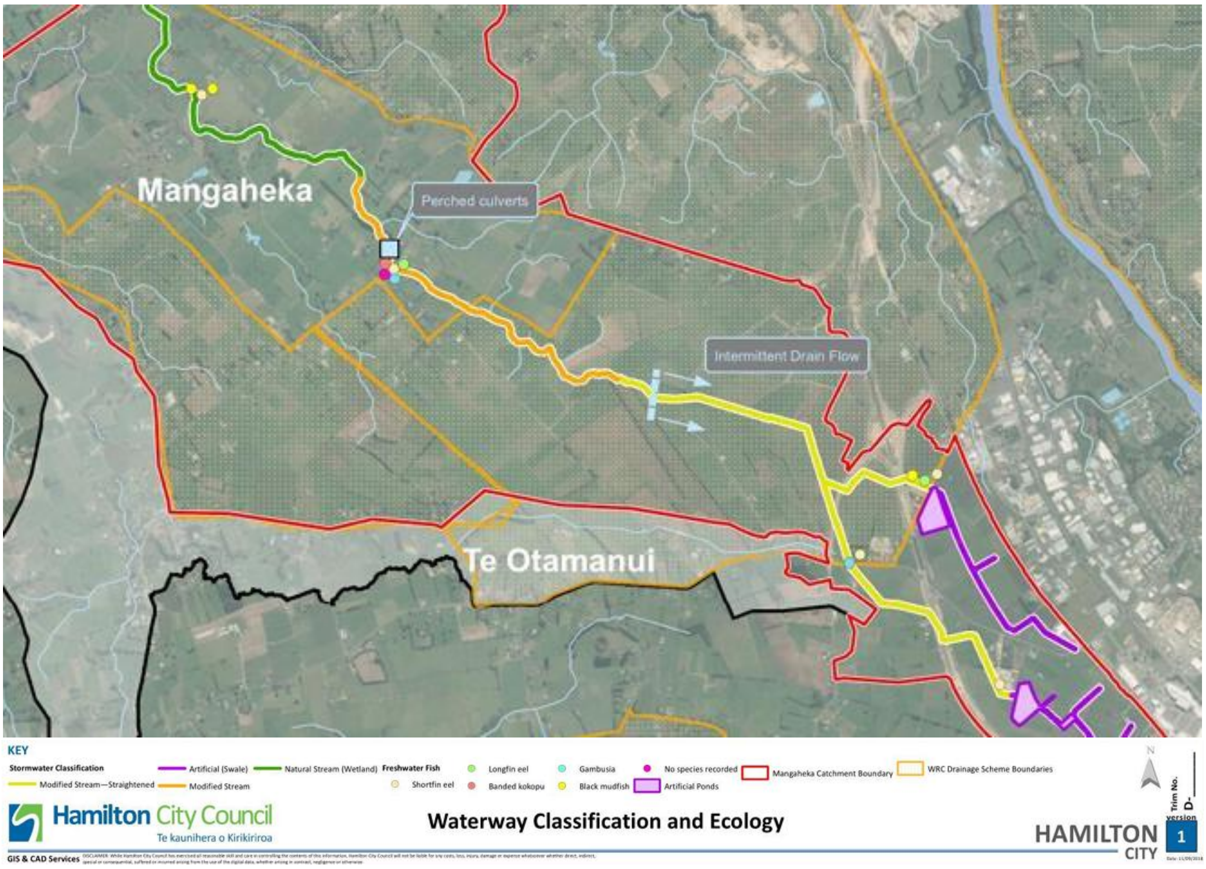


Figure 6: Waterway Classifications & Ecology (Source: Mangaheka ICMP)

Figure 7: Watercourse Classifications (Source: ecoLogical Solutions – TKE EcIA report)

5.3.1 Flooding & Overland Flow Paths

The site has a very shallow gradient that generally falls to the north-west. The only notable OLFPs are shown concentrated along the existing drains within the site. In larger storm events where the banks are overtopped, the majority of flows sheet across the site. Figures 8-10 below show the pre-development 2, 10- and 100-Year ARI flood maps that have been prepared by Te Miro Water and serve as the existing baseline for which the effects from the TKE development will be mitigated to.

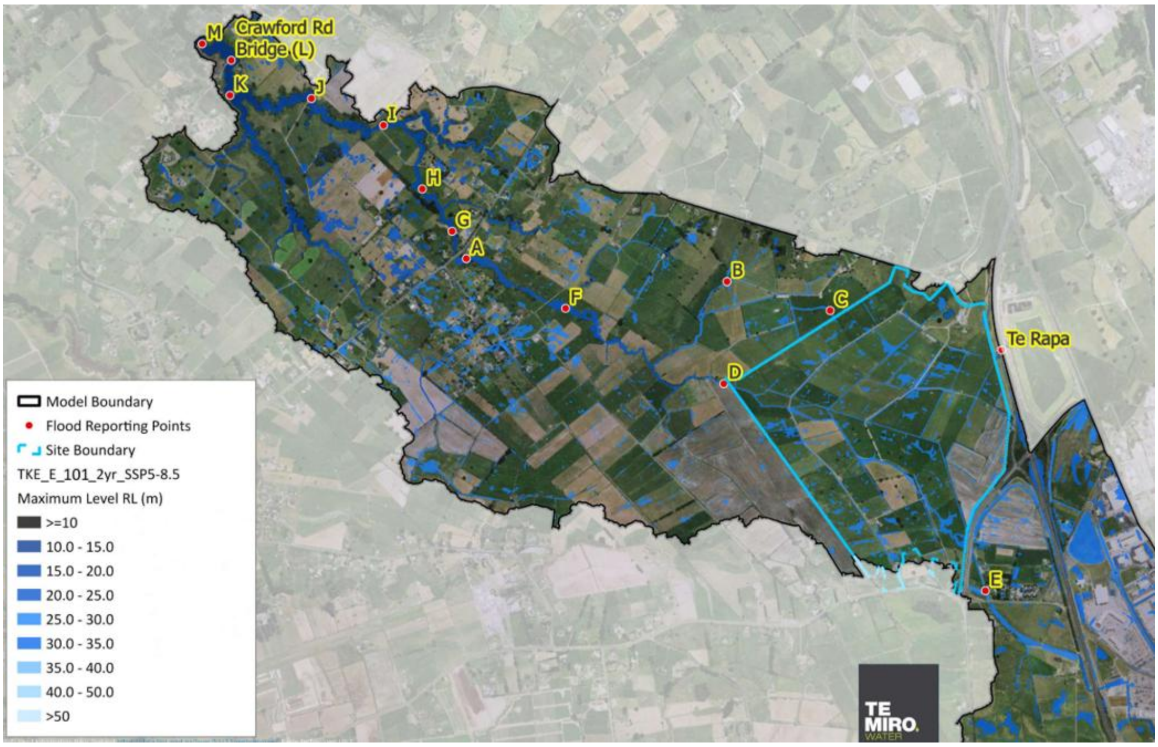


Figure 8: Pre-Development 2-Year ARI (CC) Flood Model (Source: TMW Flood Model Build Report)

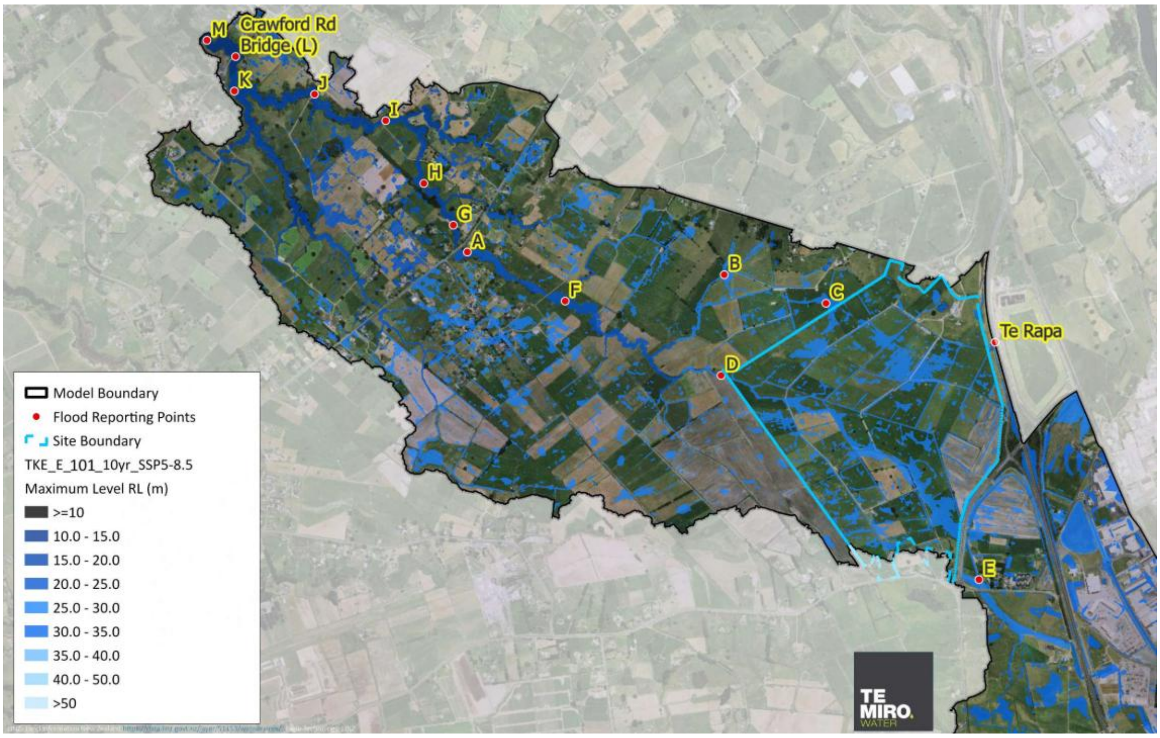


Figure 9: Pre-Development 10-Year ARI (CC) Flood Model (Source: TMW Flood Model Build Report)

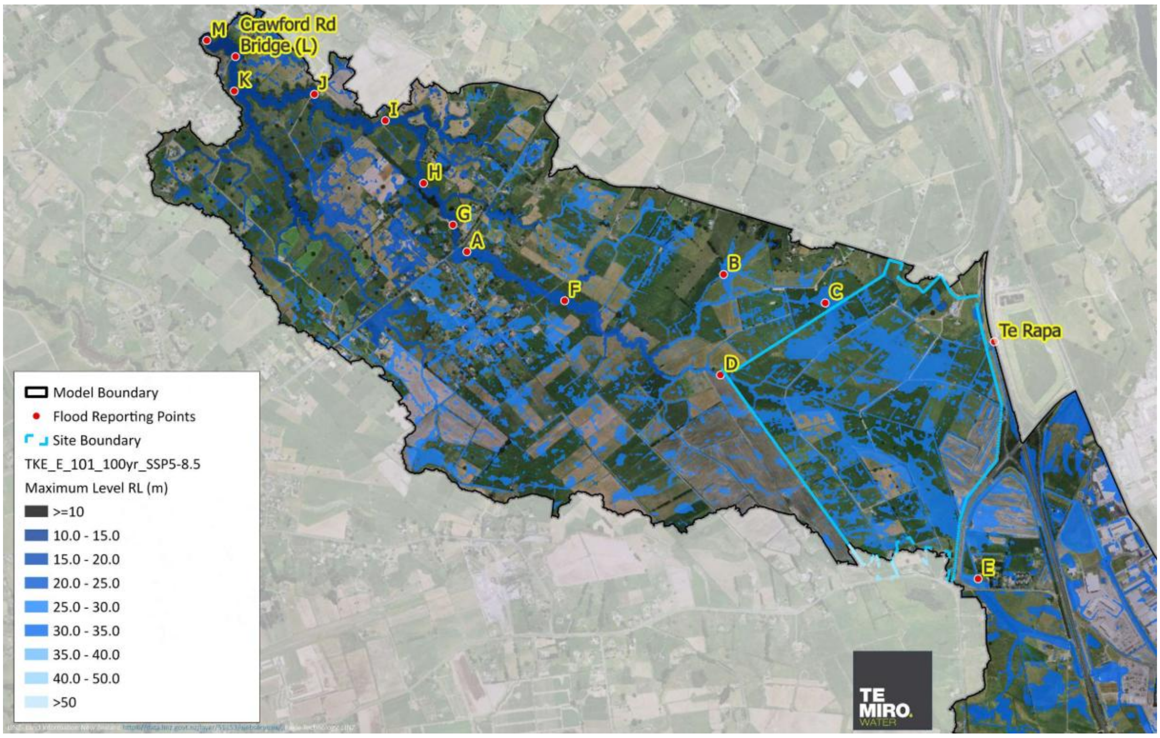


Figure 10: Pre-Development 100-Year ARI(CC) Flood Model (Source: TMW Flood Model Build Report)

6. STORMWATER MANAGEMENT OBJECTIVES

Based on the receiving environment, statutory requirements, stormwater guidelines and BOD document the following stormwater management is proposed within the development.

6.1 Stormwater Quality

- **Water Quality Volume**: Treat runoff from the 1/3rd of the 2-Year ARI (CC), 24-hour rainfall event

- **Water Quality Treatment:** per RITSV2 and the TKE Basis of Design

Item/Parameter	Requirements
Either 1: At point of discharge from centralised treatment device or; 2: At point of discharge from on-lot treatment device (where no centralised device is downstream).	
Suspended solids	75% removal on a long-term average basis (Waikato Stormwater Management Guideline definition) calculated at the discharge point
Hydrocarbons	No visible sheen. Installation of submerged outlets or shielded outlets required on devices (as required by ITS)
Temperature	<23°C at the point of discharge to a waterway and existing water temperature change of no more than 3°C. Achieved via wetland planting over >80% of the device area or vegetated swale as per the ITS.
Gross pollutants	No gross pollutants
Other Contaminants	Removal designed in accordance with the ITS Note: Lots with High-Risk activities require a Pollution Control Plan and on-lot source control and treatment.
Ammoniacal nitrogen	Less than 0.88gm/m^3
Micro-organisms	No exceedance of relevant guideline values (Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas. MfE, 2003)
In Receiving Watercourse (achieved after reasonable mixing)	
Turbidity	No greater than 25 NTU in the stormwater discharge in a water quality storm (1/3rd of the 2-Year ARI 24-hour storm).
Colour	No conspicuous changes in colour downstream of the discharge point (WRC Regional Plan)
Dissolved oxygen	Greater than 80% of saturation concentration. If the concentration of dissolved oxygen in the receiving environment is below 80 percent saturation concentration, any discharge into the water shall not lower it further. (WRC Regional Plan)

- **Industrial Areas:** Implement a two-stage treatment train, on-lot source controls and Pollution Control Plans specific to the proposed activity

6.2 Stormwater Quantity

- **Runoff Volume Control:** Post-development runoff volumes for the 2- and 10-Year ARI (CC) events to avoid exceeding the pre-development volumes or otherwise mitigated to maintain downstream level of service.

- **Runoff Retention:** Retain a minimum of 10 mm from impervious surfaces
- **Extended Detention Volume (EDV):** Provide 1.2 × Water Quality Volume (WQV) with release over approximately 24 hours to mitigate stream erosion.
- **Peak Flow Attenuation:** Limit post-development peak discharges to pre-development rates for the 2-year, 10-year and 100-year ARI events. Pre-development targets shall be designed with historical rainfall when assessing the site alone, with climate change only applied when considering flows from external catchments.
- Flood Management
  - **Flood Conveyance:** Safely convey the 100-year ARI event through the primary/secondary stormwater system and overland flow paths without adverse flooding impacts.
  - **Flood Neutrality:** Demonstrate no increase in flood risk, flood levels, or ponding duration upstream or downstream of the development.
  - **Freeboard:** Provide a minimum 300 mm freeboard to commercial and industrial building platforms.

6.3 WRC Administered Land Drainage

- Maintain capacity and performance of WRC-managed drains and avoid increasing downstream flood levels and drain downtimes, including;
  - Maintain discharge rate of **38 mm/day in WRC managed drain**
  - Drain-down time to top of bank level within **72 hours for the** 10-year ARI event.

6.4 Climate Change

- **SSP5-8.5:** Design primary and secondary stormwater infrastructure using NIWA HIRDS rainfall values for all events adjusted for climate change scenario SSP5-8.5, which predicts a warming of 4°C by the end of the 21st century. The increased values shall be in accordance with the specifications outlined in TR2025/26 and RITS V2.

7. TKE Stormwater Network Design

7.1 Stormwater Management Strategy

The creation of large-scale industrial lots within a rural setting and with discharge to sensitive downstream environments creates unique challenges for stormwater management. Assessment of the site has identified a number of constraints and challenges which have required careful consideration in developing an effective stormwater management strategy:

- Low gradient site topography with existing site drainage generally occurring via surface ponding/infiltration or low velocity surface runoff;
- Elevated/perched water tables restricting site soakage and drainage efficiencies;
- Existing internal farm drainage networks discharging to shallow drainage outlet points;
- The Mangaheka site discharge (northwest outlet) comprising a private rural drainage network with potential for adverse effects both on the downstream drains (from increased development runoff) and potential tailwater effects on the proposed development (downstream drainage impediment due to lack of maintenance);
- Conveyance of external upstream catchment flows affecting secondary overland flow management options.

The proposed stormwater management strategy has been developed to address and accommodate these constraints to ensure that an effective system can be developed and operated without resulting in adverse environmental effects both within and beyond the site.

The key features of the proposed stormwater management system include:

- Piped reticulation designed for the 10-Year ARI storm events supported alongside open channel conveyance channels;
- All flows from the developed site conveyed to one of eight centralised wetlands. These provide Water Quality Treatment, Extended Detention and attenuation of post-development peak flows (with climate change) to pre-development flow rates (no climate change) for the 2-,10- and 100-Year ARI events;
- Modification to the central Mangaheka Stream provides increased ecological function, amenity, an increase of hydraulic grades laterally across the development, increase of flood conveyance capacity from external flows and online mitigation to avoid adverse flooding effects. The reconstructed low flow channel will meander, with riffle, run and pool features detailed for approval at engineering plan approval, per the Infrastructure Report Section 4.2.
- Volume retention of the 10mm initial abstraction depth or equivalent via amalgamated raingarden, re-use tanks and nominal soakage where soil conditions allow;
- Treatment train and Pollution Control Plan requirements for future industrial Lot developments.

A full detailed description and functionality of the stormwater system, network and individual devices is provided in the Maven Infrastructure Report contained in the substantive application appendices.

7.2 Stormwater Network Hierarchy

Stormwater reticulation is proposed with a combination of piped drainage and open conveyance channels, with channels used where larger concentrated flows combine and a fully piped solution becomes impractical due to the flat nature of the site and limited fall towards the Mangaheka Stream. The conveyance channels are proposed to be vested as public stormwater reserve and will include maintenance access based on consultation to date with the relevant Councils.

The network will convey runoff to stormwater management devices at controlled discharge locations to the stream. Soakage layers have been proposed within the amalgamated raingardens and conveyance channels where practical. Lot connections will generally discharge to a piped network, which in turn outlets to the conveyance channels.

Stormwater infrastructure will be staged to align with the development programme. Each stage will be required to provide appropriate treatment, attenuation, flood management, and overland flow provisions prior to title issue or occupation, unless otherwise provided for through consent conditions or approved staging arrangements. The general flow of stormwater runoff from the site to its receiving environment is summarised via Figure 11 below.

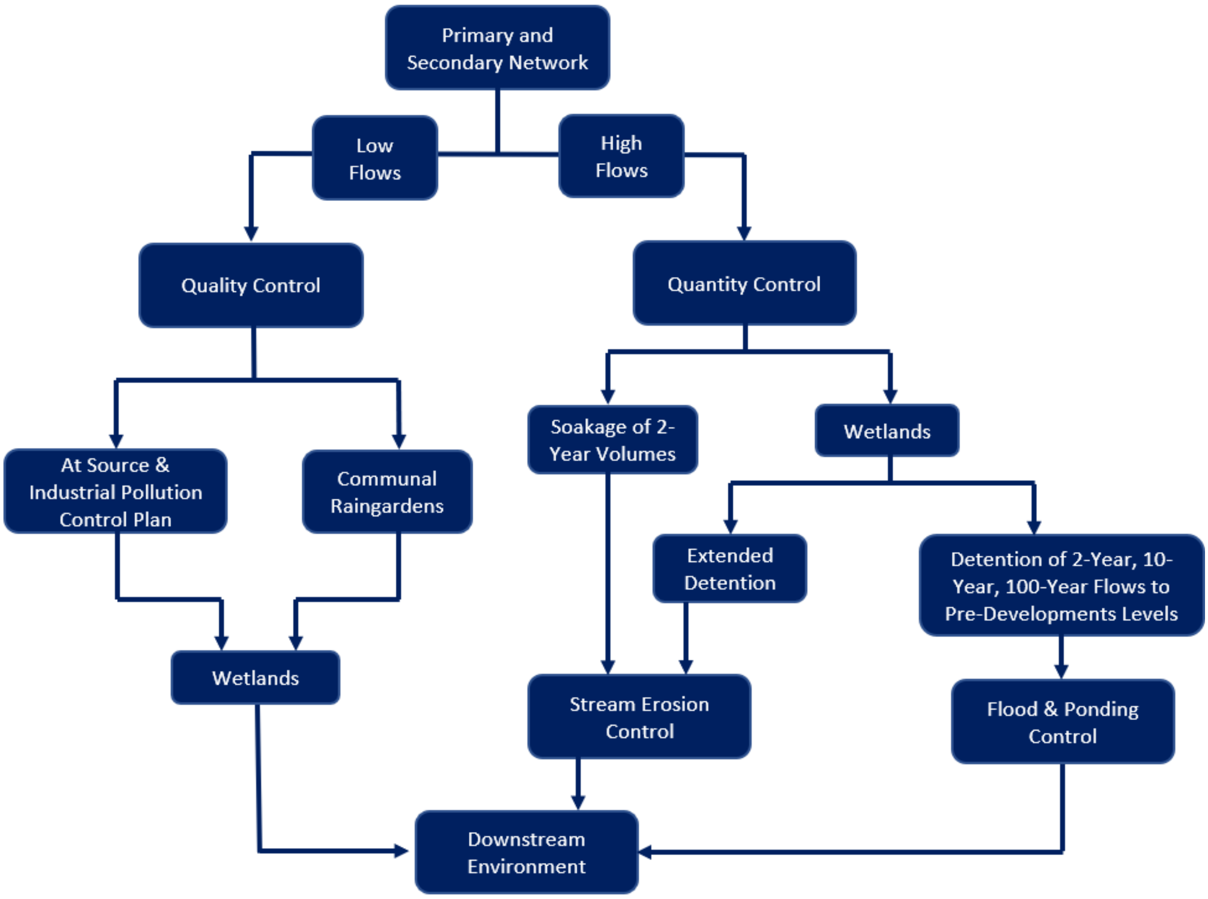


Figure 11: Stormwater Design Hierarchy

7.3 Design Rainfall

Historical rainfall data were extracted from HIRDS NIWA v4 at Latitude -37.735, Longitude 175.201. The historical depths have been used to assess the existing baseline levels of service for the receiving environments. Post-development effects and the design of the proposed stormwater infrastructure for the development adopts the climate change adjusted rainfall depths per the Tables below.

Table 1: Historical & CC Adjusted Rainfall Depths – 24Hr Storm

Storm Event	Historical Depth (mm)	% Increase per °C per RITS	Total % Increase per SSP5-8.5	CC Adjusted Rainfall Depth (mm)
2-Year ARI	63.2	7.2%	28.8%	81.4
5-Year ARI	81.9	7.8%	31.2%	107.5
10-Year ARI	96.0	8.1%	32.4%	127.1
100-Year ARI	148.0	8.6%	34.4%	198.9

Table 2: Historical & CC Adjusted Rainfall Intensities – 10min

Storm Event	Historical Intensity (mm/hr)	% Increase per °C per RITS	Total % Increase per SSP5-8.5	CC Adjusted Rainfall Intensity (mm/hr)
10-Year ARI	91.1	13.1%	52.4%	161.3

7.4 Impervious Coverages

The proposed impervious coverage limits sought for the industrial Lots are shown in Figure 12 below. In general, a 100% impervious coverage limit is proposed for the perimeter Lots where they abut a perimeter conveyance channel, and a 90% impervious coverage limit for internal Lots. Overall, the site will average a 90% Maximum Probable Development (MPD) coverage when combined with the public drainage reserve areas.

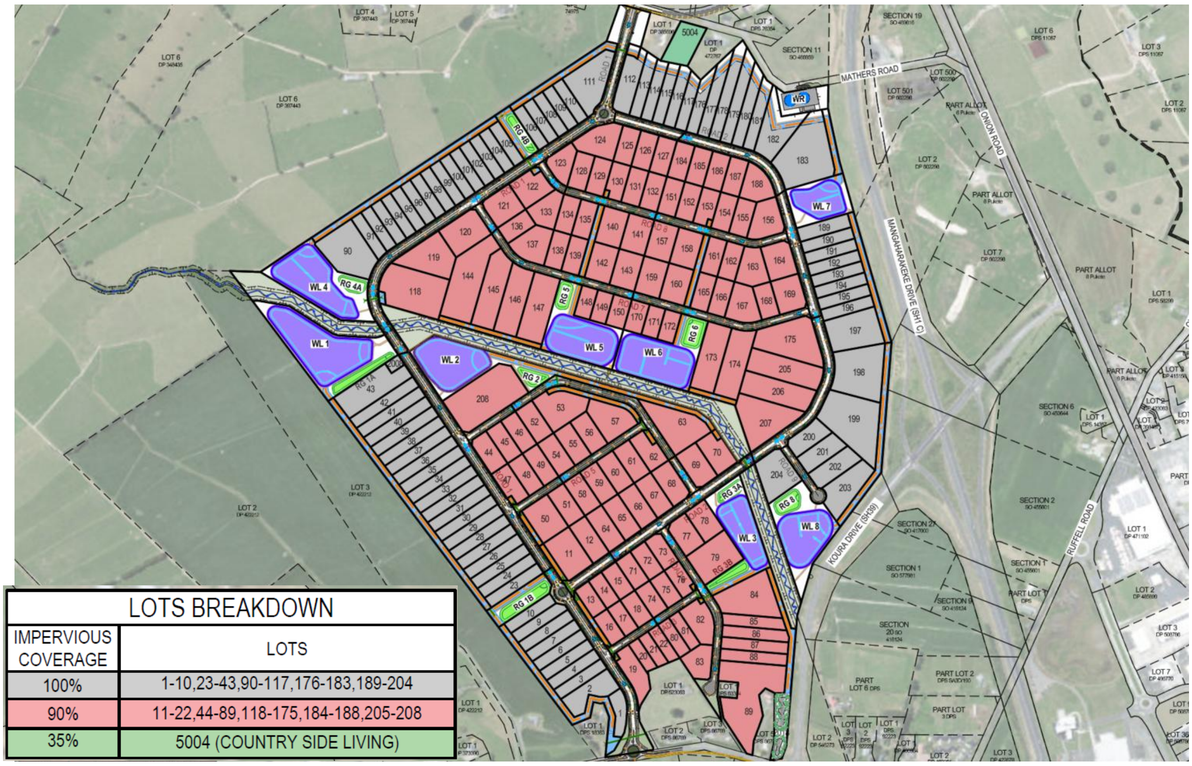


Figure 12: Proposed Impervious Lot Coverage

Note that the southern portion of Lot 89 is bisected by the Te Otamanui Stream and is therefore physically separated from both the Mangaheka and Te Rapa catchment. The TMW hydraulic model has still assumed a 90% impervious coverage over this Lot for general flooding and downstream effects as a conservative assessment. The existing ground levels within the southern portion of Lot 89 are not proposed to be changed and this area will retain its existing discharge to the Te Otamanui stream. This application does not seek to develop within the southern portion of the Lot. Further information of the specific discharge strategy for Lot 89 is discussed in Section 4.2.2 of the Infrastructure Report.

8. HYDRAULIC MODELLING

8.1 Overview

Te Miro Water (TMW) has undertaken hydraulic modelling via TUFLOW software to assess the proposed development flooding and mitigation of peak flows discharging from TKE. The required flood storage and associated downstream mitigation is provided through:

- Stream corridor storage within the Mangaheka system; and
- Wetland and basin attenuation areas.

The system is designed to attenuate peak flows and manage exceedance conditions safely. The proposal provides flood attenuation via controlled outlets in wetlands, conveyance channels, and Mangaheka Stream corridor works to manage peak flows, runoff volumes, flood duration and discharge velocities. The design will be assessed against the TKE BOD, including downstream level of service, land drainage requirements, flood duration, peak water levels and non-erosive discharge velocities.

The full Hydraulic Model Build Report by TMW can be found in the substantive application appendices.

8.2 Model Boundaries & Reporting Points

Modelling extents is shown in Figure 13 below, with the Mangaheka catchment extending just downstream of Crawford Road and the extent of the Te Rapa catchment limited to the SH1C culvert downstream. The reporting points within the TMW hydraulic model is also provided per Table 3 below.

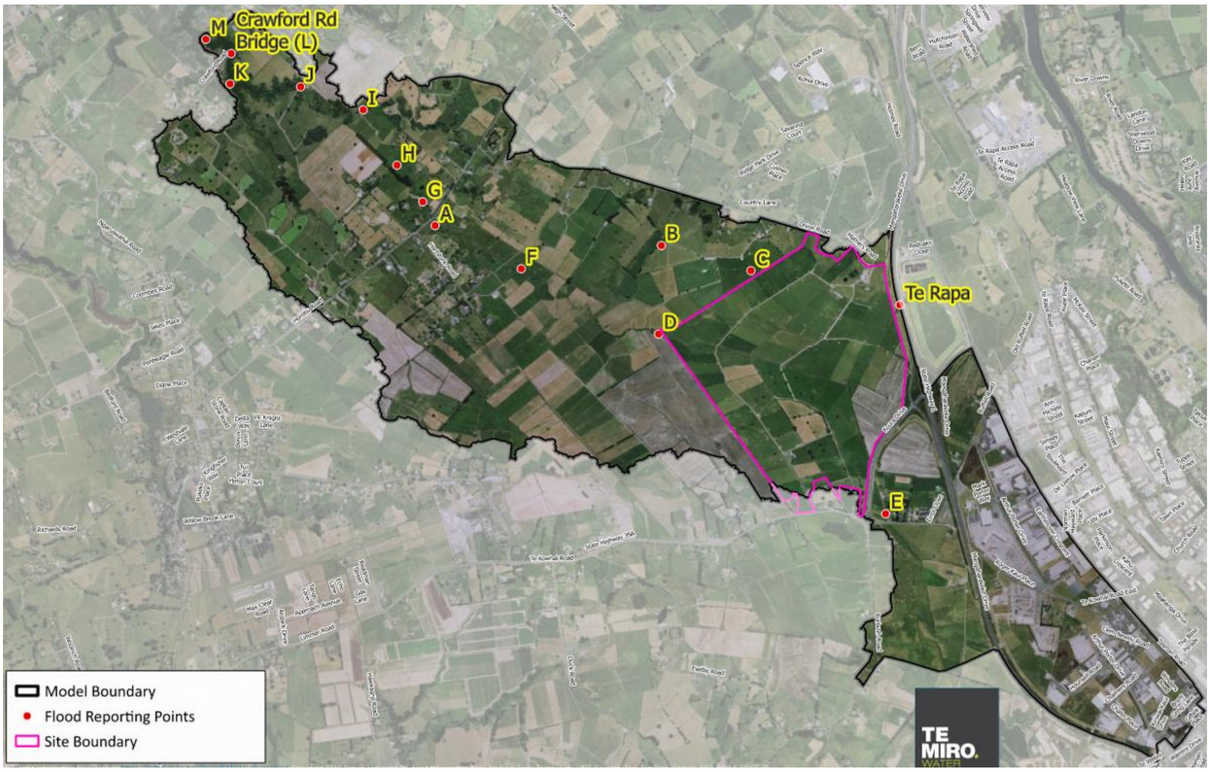


Figure 13: Flood Model Boundary & Reporting Locations: (Source: TMW Flood Model Build Report)

Table 3: TMW Hydraulic Model Reporting Locations

Point ID	Location
A	Main Mangaheka Channel Immediately upstream of Horotiu Road
B	Side branch of WRC managed drainage scheme
C	Side branch of WRC managed drainage scheme
D	On main Mangaheka Stream immediately downstream of site.
E	Upstream of Koura Drive
F	Between Point D and A on main channel

Point ID	Location
G	Immediately downstream of Horotiu Road
H	Main Mangaheka Channel downstream of Horotiu Road
I	Main Mangaheka Channel downstream of Horotiu Road
J	Main Mangaheka Channel downstream of Horotiu Road
L	Crawford Road Bridge
M	Main Mangaheka Channel Downstream model boundary

8.3 Scenarios Assessed

8.3.1 WRC Administered Land Drainage & Flood Conveyance

The Mangaheka Stream bisecting the site also receives flows beyond the boundaries of the site from external HCC catchments upstream of TKE. The TMW hydraulic model assesses the effects on downstream impacts to WRC administered land drainage networks and flooding at a catchment-wide level. In consultation with the Regional and District Councils, climate change has therefore been applied across the wider catchment for both the pre- and post-development assessment. This approach recognises that TKE should not be required to mitigate climate change effects generated outside the site. The separate assessment of runoff generated from the TKE site compares post-development flows, including climate change, against the existing historical baseline without climate change per Section 8.3.2 below.

8.3.2 Internal TKE Wetlands & Stormwater Infrastructure Design

Post-Development effects as a result of developing TKE and climate change increase will be mitigated back to existing pre-development levels without climate change. All proposed stormwater infrastructure within TKE will be designed to service the effects from climate change.

8.4 Flood Model Validation

89 Degrees have been engaged to undertake a peer review of the hydraulic model built by TMW. The review focuses on model schematisation, setup, robustness, its fitness for purpose, input data, sensitivity and uncertainty. The findings of that review, including any recommendations and subsequent changes or sensitivity assessments undertaken by TMW, are summarised in the TMW Hydraulic Model Report and peer review documentation.

9. HYDRAULIC RESULTS & ASSESSMENT

9.1 Objectives

In general, the objective of the flood management is to meet requirements outlined in the ICMPS, RITs and TR20-07, ensuring that the development does not increase flood risks to neighbouring properties and incorporates the appropriate flood mitigation measures. With regard to the flood management for the site, the objectives are summarised below;

- Mitigation of adverse flooding effects on downstream properties during 2-Year, 10-Year and 100-Year ARI storm events.
- Ensure post-development peak flow rates exiting the boundaries of the site do not exceed pre-development levels. If total mitigation to pre-development levels cannot be feasibly met, then demonstrate that there are no adverse flooding effects.
- Ensure no increase in flood levels or flood plain encroachment due to development activities.
- Provide private and public vehicle access improvements as to ensure flood depths and velocity risks are suitably improved and/or managed.
- Ensure WRC-managed drains are generally intended to drain down within a period of around 3 days

The above objectives are detailed further below as relevant to the different aspects of the overall development.

9.2 Peak Flows – TKE Site Boundary

Eight new artificial wetlands, one for each TKE sub-catchment, have been proposed to attenuate their respective post-development runoffs. These wetlands have been designed to mitigate peak flows from the 2-Year, 10-Year and 100-Year ARI storm events back to or below their existing pre-development flow rates. Notably, the level of attenuation has also considered the effects from climate change within TKE and mitigates for this future increase in rainfall as well.

TKE discharges most of its runoff into the Mangaheka catchment with a smaller portion along the north-eastern portion of the site discharging to the Te Rapa catchment. Tables 4 and 5 below summarises the reduction in post-development peak flows achieved with the proposed wetlands and demonstrate that peak flow effects from the TKE development will be appropriately mitigated.

Table 4: Peak Flow Mitigation Results – TKE Site Only Discharge to Mangaheka

TKE Site Only – Discharge to Mangaheka (Catchments 1 – 6 & 8) – Measured at Point D				
ARI Event	Pre-Development (No CC) (m^3/s)	Post-Development (With CC) (m^3/s)	Peak Flow Reduction (m^3/s)	Post % of Pre
2-Year	2.30	1.51	- 0.79	66%
10-Year	4.93	3.39	- 1.54	69%
100-Year	9.93	9.34	- 0.59	94%

Table 5: Peak Flow Mitigation Results – TKE Site Only Discharge to Te Rapa

TKE Site Only – Discharge to Te Rapa (Catchment 7) – Measured at Point 'Te Rapa'				
ARI Event	Pre-Development (No CC) (m^3/s)	Post-Development (With CC) (m^3/s)	Peak Flow Reduction (m^3/s)	Post % of Pre
2-Year	0.35	0.25	- 0.10	71%
10-Year	0.79	0.55	- 0.24	70%
100-Year	1.37	1.10	- 0.27	80%

9.3 Peak Flows – TKE Site & Upstream Catchments

The Mangaheka Stream bisecting the site also receives flows from external HCC catchments upstream of TKE. The existing stream corridor which currently provides the primary flood conveyance corridor, does not adequately contain pre-development peak flows within its bank and flooding spills across the site. Reconstruction of the Mangaheka stream improves the capacity for flood conveyance within its new corridor and in doing so effectively improves tailwater conditions downstream of the Koura Drive culverts.

The attenuation culverts within the two road crossings over the stream manage this tailwater improvement by temporarily storing and releasing flood waters gradually. This ensures downstream peak flow rates are maintained while making use of the additional storage created by the reconstructed channel. The attenuation culverts have been designed so that the combined flows from TKE internally and upstream HCC catchment flows are mitigated to pre-development levels.

TMW flood model assesses this effect at a catchment-wide level. In consultation with Regional and District Councils, the relevant pre-development baseline, when combined with external upstream catchments, shall include climate change. This approach recognised that TKE should not be required to mitigate climate-change effects generated outside of the site. If those upstream catchments are developed in future, they are expected to mitigate their own climate-change effects, further reducing downstream flood risk downstream of TKE. Table 6 below summarises that the reduction in post-development peak flows achieved with the combined TKE wetlands and attenuation culverts within the Mangaheka Stream will be appropriately mitigated to the agreed baseline.

Table 6: Peak Flow Mitigation Results – TKE & External Catchments

TKE & External Upstream Catchments – 2 Year ARI				
Reporting ID	Pre-Development (With CC) (m^3/s)	Post-Development (With CC) (m^3/s)	Peak Flow Reduction (m^3/s)	Post % of Pre
D	3.65	2.89	-0.76	79%
A	5.08	3.68	-1.4	72%
I	5.66	4.08	-1.58	72%
L	6.81	5.16	-1.65	76%
M	6.83	5.17	-1.66	76%
Te Rapa	0.36	0.36	0	100%

TKE & External Upstream Catchments – 10 Year ARI				
Reporting ID	Pre-Development (With CC) (m^3/s)	Post-Development (With CC) (m^3/s)	Peak Flow Reduction (m^3/s)	Post % of Pre
D	7.24	6.95	-0.29	96%
A	9.22	8.45	-0.77	92%
I	10.64	9.66	-0.98	91%
L	14.11	12.90	-1.21	91%
M	14.16	12.95	-1.21	91%
Te Rapa	0.88	0.75	-0.13	85%

TKE & External Upstream Catchments – 100 Year ARI				
Reporting ID	Pre-Development (With CC) (m^3/s)	Post-Development (With CC) (m^3/s)	Peak Flow Reduction (m^3/s)	Post % of Pre
D	15.86	13.90	-1.96	88%
A	16.21	13.80	-2.41	85%
I	18.42	15.88	-2.54	86%
L	26.07	25.13	-0.94	96%
M	26.20	25.26	-0.94	96%
Te Rapa	1.41	1.39	-0.02	99%

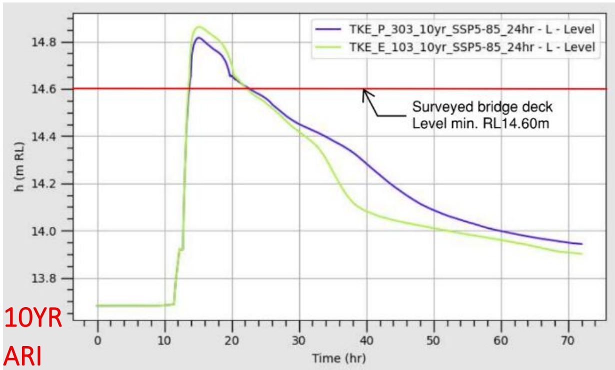
At all reporting points on the Mangaheka Stream and the outlet to Te Rapa, the post-development peak flows are below existing peak flow conditions for the 2, 10 and 100-Year ARI storm events and meet the mitigation targets in the BoD. Collectively, the design and associated modelling confirm that there is no increase of offsite peak flow effects caused by the development.

9.4 Receiving Environments

9.4.1 Crawford Road Bridge

Flooding over Crawford Bridge is an existing situation and is known by WDC. The boundary of the TMW hydraulic model has been extended to include the bridge to assess pre- and post- development effects for this reason. The hydraulic model results show Crawford Road bridge acts as a hydraulic restriction on the Mangaheka channel, with the model confirming the water levels exceed the bridge deck level in the existing and post-developed 10 and 100-year ARI events. During the 2-Year ARI event, the model shows the flood waters overtop at a lower point in the road, adjacent and before the bridge deck.

Figure 14 below has been extracted from the TMW report and shows the hydrographs of the 10- and 100-Year ARI water levels (pre- and post-development) at the bridge. The hydrographs demonstrate the reduction in peak water levels compared to the pre-development case.



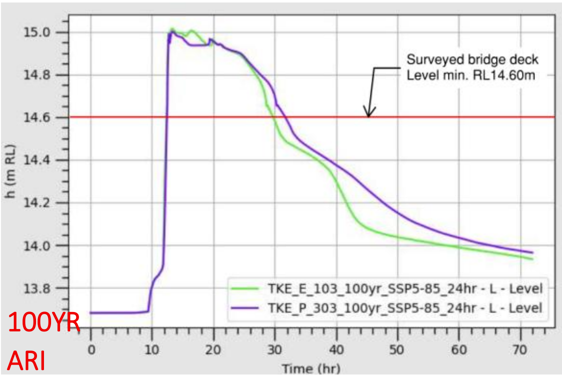


Figure 14: TMW Hydraulic Model 10- & 100-Year ARI Water Elevations at Crawford Road Bridge

The duration of flooding above the bridge deck is comparable during the 10-year ARI event. In the 100-year ARI event, the increased runoff volume results in water levels remaining above the bridge deck for approximately 20 hours post-development, compared with approximately 18 hours pre-development.

Notwithstanding this increase in duration, peak water levels at Crawford Road Bridge are lower post-development and peak velocities are not increased relative to the pre-development condition. The

TMW assessment therefore concludes that the development does not result in adverse afflux or a material worsening of the existing hydraulic restriction at Crawford Road Bridge.

Figure 15: Crawford Bridge Photo

9.4.2 WRC McBeth Land Drain - Drain Down Durations

The TMW hydraulic modelling confirms that excess runoff volume occurs under post-development conditions. This excess volume is most evident along the central channel and at hydraulic restrictions, such as culverts and bridges. While the model confirms that there is no increase in peak flows and peak water levels, the increased run-off volume post-development results in prolonged elevated water levels compared with pre-development conditions.

The Mangaheka channel (McBeth drain) between Koura Drive and Horotiu Road is a WRC managed drain and accordingly has a level of service to drain the runoff volume from a 10-year ARI 24-hour event within 72-hours. Table 7 below confirms the 10-year ARI drain down times within the McBeth drain at Points A and F, downstream of the site.

Table 7: 10-year ARI Drain Down Times

Reporting Point	Top of Bank (mRL)	Pre-Dev CC drain down time (hrs)	Post Dev CC drain down time (hrs)	Difference (hrs)
A	19.5	21.63	31.15	+9.52
F	21.5	14.63	17.30	+2.67

The drain down time measures the time taken for flows to recede back "within bank". Point F is expected to experience an increased duration of 3-hours and Point A is expected to experience a longer ponded duration of approximately 10-hours. While the post-development results show that the drainage channel will still comply with the maximum drain down time of under 72-hours, an assessment on the effects to the level of service is provided below.

The TMW reporting states that the reference point at 'A' for the drain down time comparison is the top of the bank of the low-flow channel. Note that this low-flow channel sits within an incised gully area. The report identifies that whilst there is evidence the low-lying gully floor is occasionally used for grazing, the main farming activities within the WRC managed drain occur on the elevated ground (approximately RL 25m) well above the maximum 10-year ARI flood level. Accordingly, the increased drain down time is not expected to adversely affect the majority of farming activities within the drain catchment. Figure 16 below is extracted from the TMW report and illustrates the incised nature of the McBeth drain and assessment point (RL19.5m) at Point A.

Accordingly, while the development results in an increase in drain-down duration within the McBeth Drain, the required WRC drainage level of service continues to be achieved. The additional duration occurs principally within the incised low-flow channel and does not result in an increase in peak flood level or materially affect the elevated land on which the principal farming activities occur. The change in drain-down duration is therefore not expected to result in a material adverse effect on the performance or function of the WRC-managed drainage system.

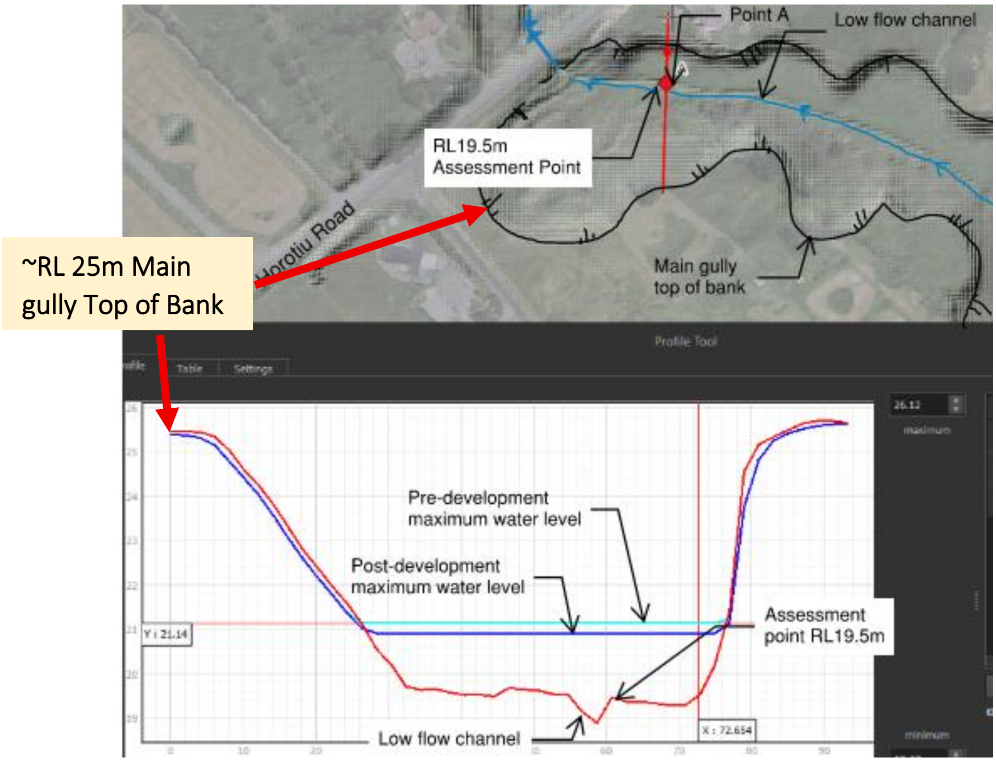


Figure 16: Section at Point A (low-flow channel within incised gully) Source: TMW Model Build Report

9.4.3 Residual Effects – Increase of Post-Development Volumes

The hydraulic modelling demonstrates that the proposed stormwater management system appropriately manages peak-flow and flood-level effects associated with the development and maintains the required level of service within the WRC-managed drainage network. However, the proposed attenuation measures do not achieve full runoff-volume neutrality.

Downstream of Horotiu Road (Point I), the effects of the excess post-development runoff volume in the 10- and 100-year ARI events become less noticeable, with peak water levels lower than the pre-development scenario, however water levels will remain elevated for extended periods.

While the proposed attenuation measures have managed to mitigate post-development peak flows (i.e. the rate at which stormwater leaves the site), they cannot reduce the volume, and the receiving watercourses carry elevated flows for a longer duration and longer drain down times after rainfall events. This additional duration has the potential to increase the risk of stream erosion over time.

A Multi-Criteria Analysis (MCA) has been prepared to document the possible solutions that have been proposed by TKE for both Regional and District Council consideration. These solutions are considered to be in line with acceptable mechanisms outlined in RITs V2 and both the Mangaheka and Te Rapa ICMPs. A summary of the MCA options is provided in Table 8 below. Option P_304 scored the highest within the MCA and is also the preferred solution proposed by TKE in this application. This framework ties the extent of mitigation to actual measured effects, with on-going monitoring and a bonding mechanism ensuring the works have secured funding and financial contribution delivered in proportion to what eventuates once the industrial Lots and their proposed activity is known.

Table 8: MCA Summary - Residual Volume Mitigation

	Description	Comments
P_303	• 10mm retention only	• Does not provide any management for the increase in 2-Year post-development runoff volume • Does not provide any mechanism for financial contributions to District/Regional Councils for downstream erosion prevention works • Residual effects from volume increase remain unmitigated with no financial contribution to remedy/reinforce downstream watercourses
P_304	• 10mm retention; **AND** <u>Adaptive residual management:</u> • Volume of soakage*1/re-use to be progressively tracked until the completion of the final stage of TKE and approved Building Consented soakage*1 /re-use provisions for the industrial Lots are known; • Prior to certification under section 224(c) of each subdivision stage, provide the Building Consented soakage/re-use volumes within the industrial Lots; **AND** • Provide a geomorphological assessment on the remaining residual effects to stream erosion based on latest soakage/re-use volumes; **AND** • Monitoring of downstream watercourses in accordance with the consent conditions; **AND** • Financial contribution pro-rated based on latest soakage volumes/reuse and the certification of effects by a geomorphological assessment	• Match pre-development runoff volumes as much as feasibly possible via future industrial Building Consents and future vested stormwater device EPAs through reduced runoff practices & sub catchment management including soakage and reuse • Given that the industrial activities are not yet known, an adaptive approach is proposed to be adopted. As individual Lots are sold off and their Building Consents approved, the volume of soakage and reuse for each development is progressively tracked. • If full volume neutrality has not been achieved at the completion of the final stage of TKE, then mitigation within the receiving environment will be provided via a financial contribution to Council for downstream erosion prevention works. • Assessment from a suitably qualified geomorphologist to be provided at the completion of each subdivision stage • Financial contribution to be bonded to secure funding for stream erosion prevention works and to be pro-rated based on what final soakage/re-use volumes achieved.

P_305	• 10mm retention; **and** • Partial soakage*1 (25,000m^3) of the post-dev increase from the 2-Year ARI storm	• Similar to P_304, but instead of adaptive approach it provides a clear numerical target for the consent. • Not recommended as exact numerical target cannot be guaranteed. Adaptive approach with a fallback to financial contributions provides a clear consenting path.
P_306	• 10mm retention; **and** • Full soakage*1 (48,000m^3) of the post-dev increase from the 2-Year ARI storm event	

*1 – Soakage shall be sought via On-Lot soakage or reuse, and/or beneath vested raingardens and conveyance channels where soil conditions allow and subject to detailed hydrogeological monitoring and future EPA approvals

WGA has reviewed the post-development groundwater model and has provided a preliminary assessment of potential locations for soakage within TKE. Their assessment currently indicates that most of the proposed conveyance channels and raingardens are on the order of 0.5 to 1.0 m below the interpreted summer groundwater level. This would mean that soils at the base of these devices and strata below (including any introduced soakage materials/layers) would be expected to be saturated with no accommodation space for inground storage/flood attenuation.

However, the proposed deepened Mangaheka Stream is expected to have a long-term drawdown effect in the order of 1.0 m in the vicinity of surrounding proposed conveyance channels. Based on WGA's current groundwater interpretation, they consider the most promising areas for additional soakage storage to be along the shallower channels that are in close proximity and running parallel to the deepened Mangaheka Stream. The deepened stream is expected to provide some localised long-term groundwater drawdown, and in this case, an expected further 1.5m clearance between subsurface stormwater attenuation devices/layers beneath these shallower conveyance channels from the seasonal high groundwater level. WGA have provided indicative locations where soakage may be achievable within the conveyance channels and Lots per Figures 17 and 18 below.

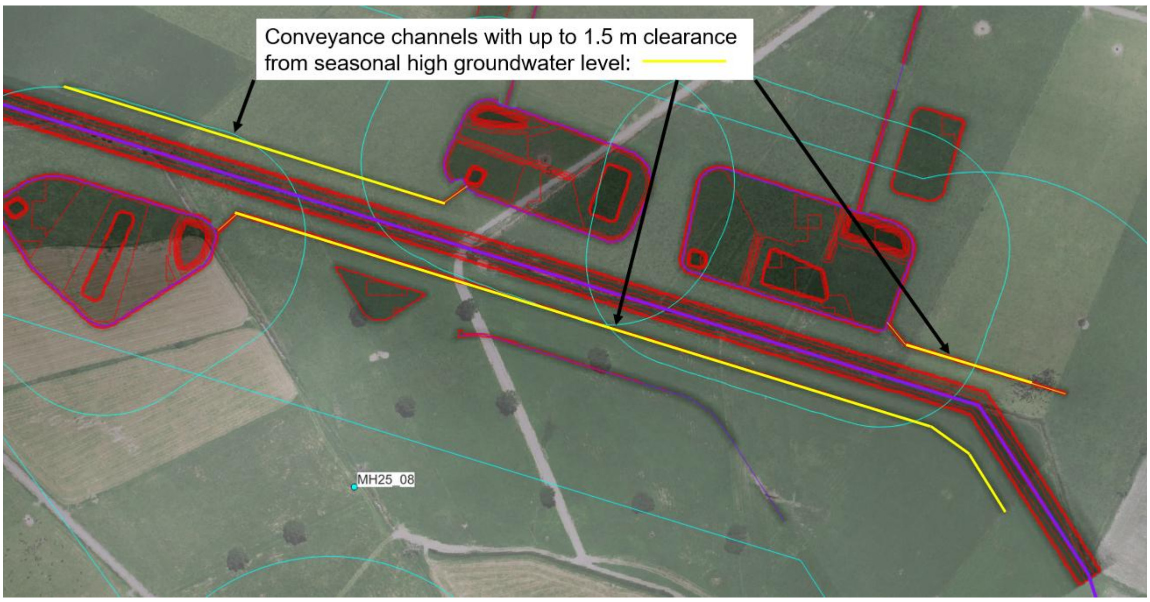


Figure 17: Potential conveyance channels (in yellow) that have a 1.5m clearance to the reduced winter groundwater level adjacent the Mangaheka Stream (Source: WGA Correspondence)

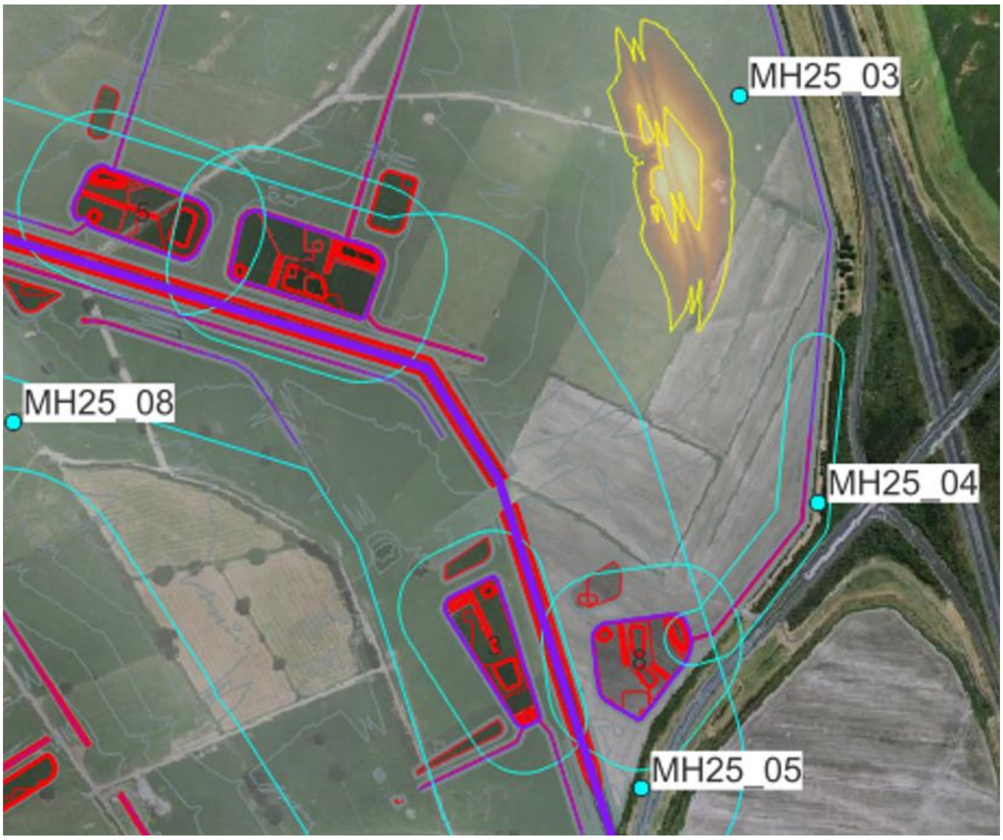


Figure 18: Lot areas (in yellow) with potential for 2.5m clearance from the seasonal high groundwater level (Source: WGA Correspondence)

The assessment provided by WGA is only indicative at this stage and is subject to further groundwater monitoring for detailed design. Figure 17 demonstrates potential locations where a 0.5m soakage device may be installed within public conveyance channels. Figure 18 demonstrates potential locations where a 1.0m deep soakage device (+0.5m cover) may be installed within private Lots.

This SWMP notes that a 1.0m clearance is typically required from the invert of any soakage devices to the seasonal high-groundwater table per TR20/07. This SWMP anticipates that greater opportunities for soakage can be found spatially within the site at detailed design, subject to the following:

- Additional groundwater monitoring; and
- Reduced depths of soakage devices; and
- Reduced clearances between the invert of soakage devices to the groundwater table (subject to approval with Council).

In addition, once the industrial activities are known, any increase in non-potable reuse on their respective Lots over and above the minimum 10mm retention requirement will also help contribute to reducing effects from the increase of post-development runoff volumes.

9.4.4 Stream Erosion Control

The overarching design of the stormwater system mitigates post-development effects to reflect the existing pre-development scenario and benchmarked against the maximum permissible velocities from Table 7-1 in TR2020/07. CMW have confirmed that the low-lying plains are generally overlain by a silt loam (typically 0.5m – 1.0m thick), underlain by sand / silty sand with interbedded silt layers (noncolloidal) is reflective of a Silt Loam (non-colloidal) material. This material present in the low-lying plains and drains within the site has a corresponding maximum permissible 2-Year ARI velocity of 0.61m/s

Material	Velocity (m/s)
Fine sand (colloidal)	0.46
Sandy loam (noncolloidal)	0.53
Silt loam (noncolloidal)	0.61
Alluvial silt (noncolloidal)	0.61
Ordinary firm loam	0.76
Volcanic ash	0.76
Fine gravel	0.76
Stiff clay	1.14
Graded loam to cobbles (noncolloidal)	1.14
Alluvial silt (colloidal)	1.14
Graded silt to cobbles (colloidal)	1.22
Coarse gravel (noncolloidal)	1.22
Cobbles and shingles	1.52
Shales and hard pans	1.83

Figure 19: Table 7-1: Maximum permissible velocities (Source TR20/07)

Table 9 below is extracted from the TMW hydraulic model and shows that the velocities downstream of the site in the post-development scenario are all below the existing velocities in the 2-Year ARI storm event and are mostly below the erosive 0.61m/s velocity limit.

The exceptions are the Te Rapa discharge into the SH1C culvert and at the Crawford Road Bridge, both of which are existing conditions. Review of the model outputs shows that this reported value at the bridge is an aggregated velocity of flows over and under the bridge associated with the 2D structure modelled in TUFLOW. Analysis of results immediately upstream and downstream of the Crawford Road bridge show the velocities are low, typical of elsewhere along the stream channel, hence the elevated velocities are an isolated occurrence at the bridge.

Table 9: Pre- v Post-Development 2-Year ARI Velocities

Reporting Point	2-Year ARI Velocity Pre-Development (m/s)	2-Year ARI Velocity Post-Development (m/s)
D	0.57	0.54
A	0.23	0.22
I	0.28	0.27
L (Crawford Road Bridge)	1.47	1.47
M	0.46	0.40
Te Rapa	1.28	1.28

While the effects of peak velocities have been demonstrated to be mitigated, TKE acknowledges that the increased duration of the elevated water levels caused by increased volumes of stormwater will have an impact on the risk of stream erosion.

TR20/07 recommends that the difference between the pre- and post-development total volume for rainfall events up to the 2-Year ARI event is retained to address stream erosion. The Mangaheka and Te Rapa ICMPs have both identified downstream erosion. This SWMP therefore recognises the importance of increased post-development volumes being retained on site. As such, the proposed 'adaptive residual management' strategy to capture the increase in post-development 2-Year ARI volumes outlined in Section 9.4.3 is proposed as a condition of consent.

9.5 Flooding – TKE Internal

Commercial and industrial building platforms will be required to provide appropriate freeboard above the 100-Year ARI design flood level per the TMW flood model. A consent notice over the proposed Lots will be applied to ensure that this requirement is followed through in TKE's final built form. Final building floor levels will be confirmed at Building Consent once lot-specific building footprints, finished yard levels, internal drainage and overland flow arrangements are known.

The design of the proposed roading corridors aims to safely convey overland flow towards designated low points adjacent to a public conveyance channel. The design also aims to ensure flood hazards within the proposed roading corridors are within acceptable limits per RITs V2 which limits flood waters:

- A maximum velocity limit – Less than or equal to 1m/s
- A maximum depth limit – 150mm depth, 1.5m from kerb

Supplementary to the criteria above, an assessment against Guideline 7-3 from the Australian Institute for Disaster Resilience has also been undertaken. The TMW flood model results show that the safest H1 Hazard Vulnerability classification, which is considered generally safe for vehicles, people and buildings, is achieved throughout the proposed Lots and roading corridors.

Flood model mapping results provided in Figures 20-22 show that:

- There is no flooding within the proposed Lots
- Velocity within the roading corridors comply with the maximum velocity limit
- Depths within the roading corridors are broadly complying with the maximum depth limit, except at the roading low points (where flood waters are intended to spill into a public conveyance channel or wetland).
- H1 Hazard Vulnerability (the lowest hazard) is achieved throughout TKE except at two locations that align with the increased depth at the roading low points.

The flooding depth at the roading sags are a departure from RITSV2 roading standards and is discussed in detail separately in the Maven Infrastructure Report.

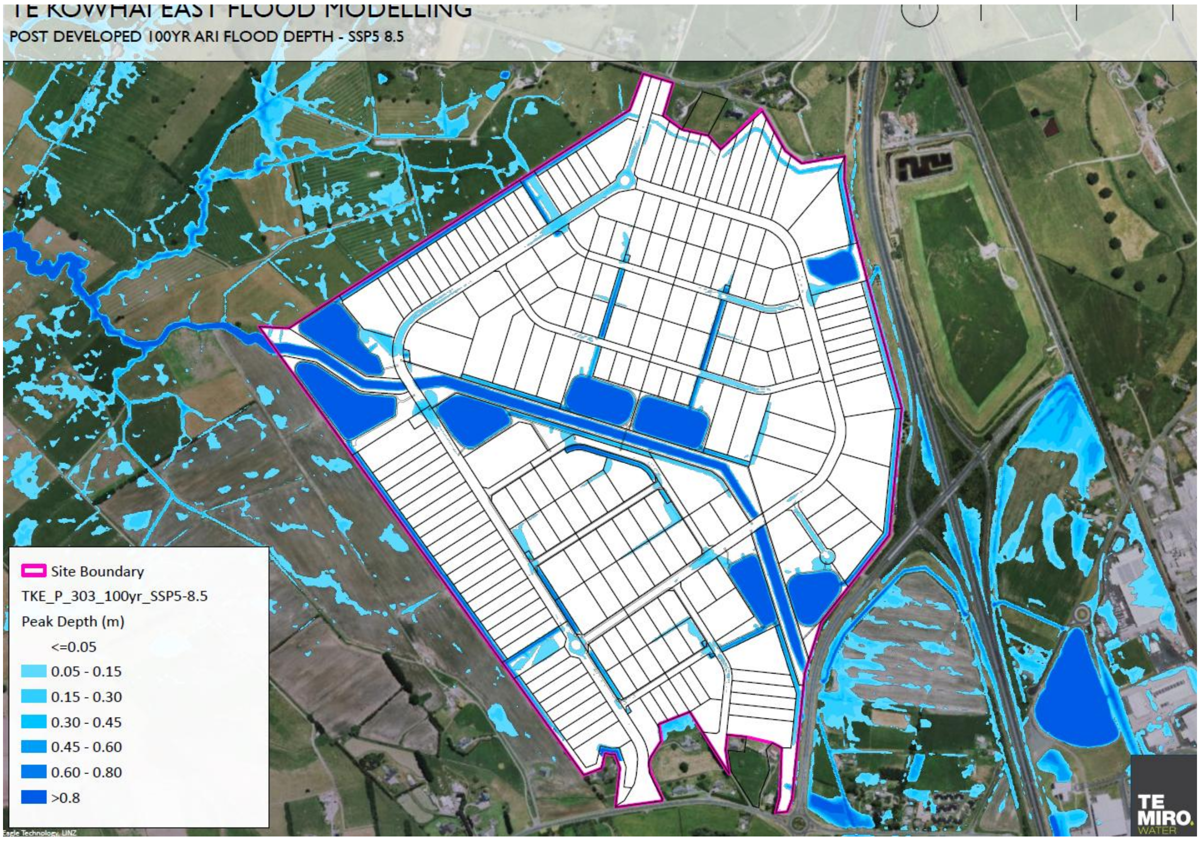


Figure 20: TKE Flood Depth Map (Source: TMW Model Build Report)

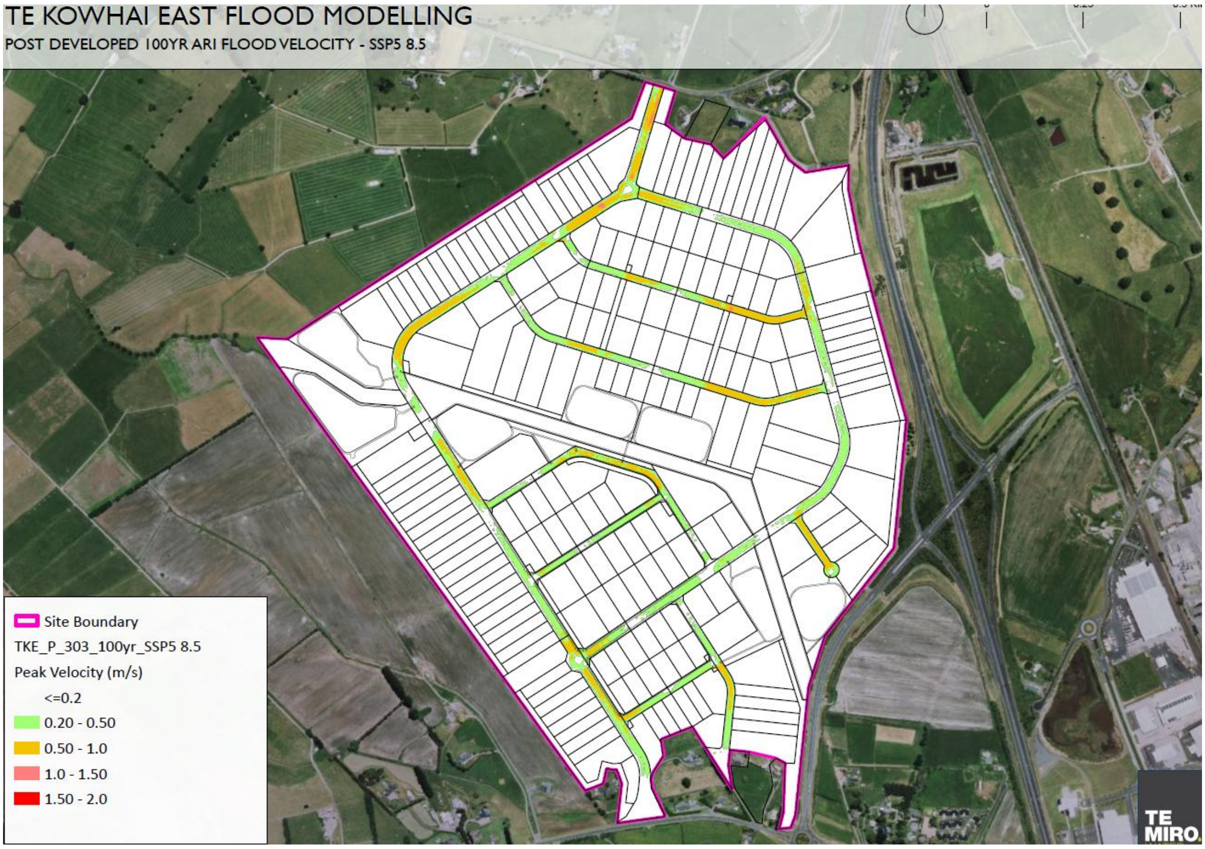


Figure 21: TKE Flood Velocity Map (Source: TMW Model Build Report)

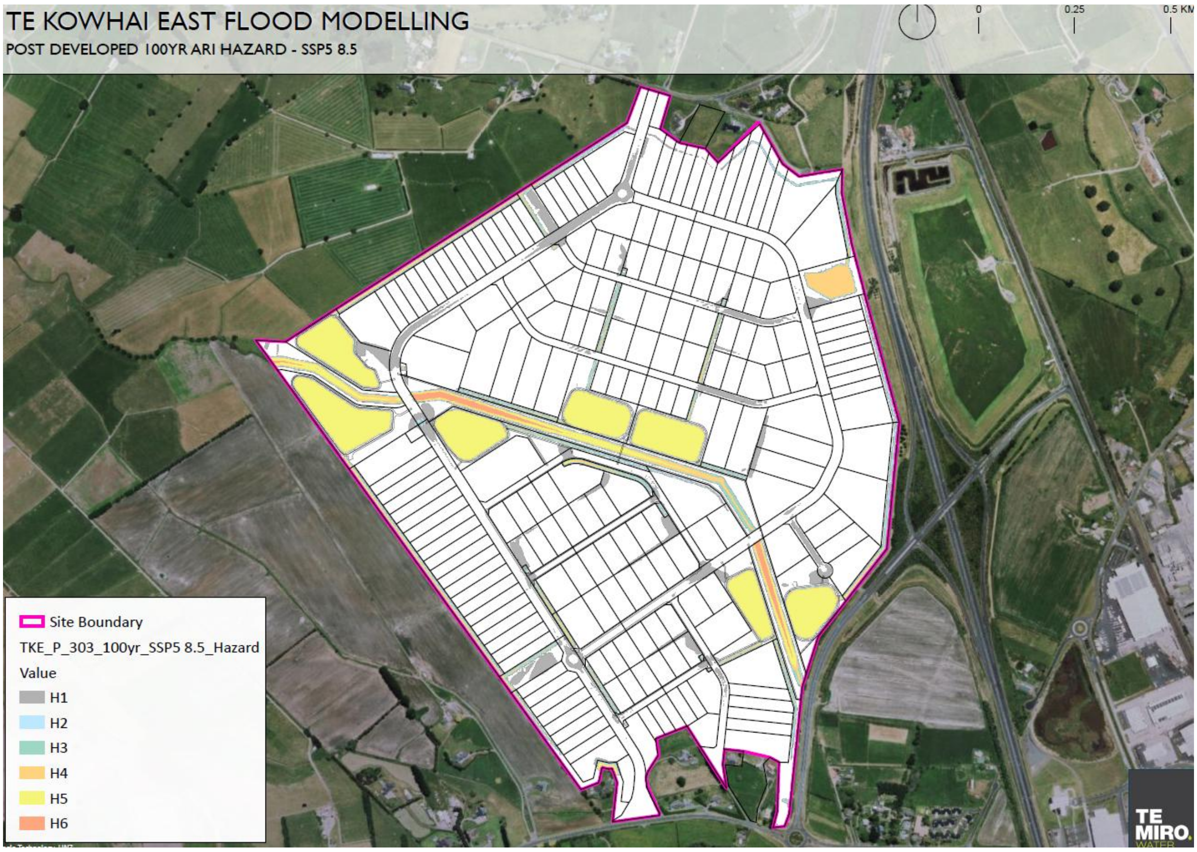


Figure 22: TKE Flood Hazard Vulnerability Map (Source: TMW Model Build Report)

9.6 TMW Model Sensitivity Checks

The TMW hydraulic Model has undertaken several sensitivity checks following initial review and feedback from Council. These are summarised below but are discussed in detail in the TMW model build report.

9.6.1 Effects of Residual Upstream Ponding

The TMW hydraulic model does not include the stormwater reticulation network which results in excess ponding or storage within upstream catchments such as the Te Rapa industrial area. The sensitivity check confirmed that additional runoff volume generated within the Te Rapa area results in slight increases in flows including through the Koura Drive culverts and this effect is more noticeable for the larger storm events. This is estimated to add an approximate $0.5m^3/s$ of additional peak flows during the 100-Year ARI event.

The stormwater design proposes two culverts within the reconstructed Mangaheka Stream channel. An embankment is proposed to contain the culvert with the top level corresponding with the 100-Year ARI water level. A bridge will be constructed with additional freeboard above the embankment to cater for increased flow over the emergency spillway which will activate if a blockage scenario were to occur or if peak flows are anticipated to increase slightly from the sensitivity results above. This spillway ensures that the maximum water level within the stream will not flow back within the site in an emergency scenario providing overall resilience to the design solution. The typical attenuation culvert arrangement proposed in the stream is shown in Figure 23 below.

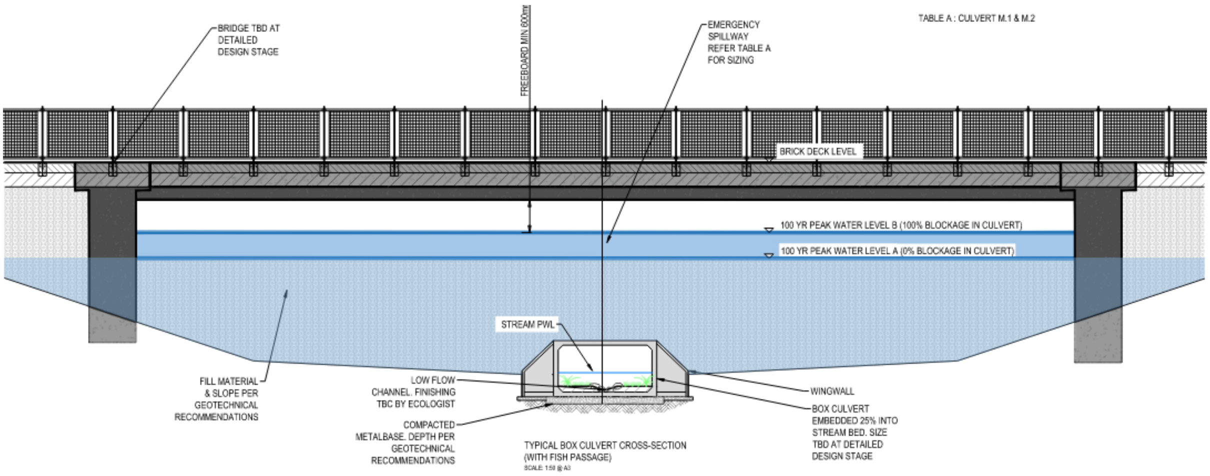


Figure 23: Mangaheka Attenuating Bridge-Culvert Typical Configuration

9.6.2 Rotokauri Emergency Spillway Overflows

The Rotokauri Greenway is located south of TKE and is designed with an emergency spillway that activates in the 100-Year ARI RCP8.5 climate change event. Flood waters from the activated spillway ultimately join into TKE via the Te Kowhai Road culverts.

The TMW hydraulic model found that due to the timing and magnitude of flows from the emergency spillway, there were no peak flow or peak water level effects downstream. However, it does result in approximately 48,000m^3 of additional volume to pass through the Central Mangaheka stream within TKE and the receiving downstream channels. This results in water levels remaining elevated within the channel for an additional duration of approximately 3 hours.

The TMW build report states that the significance of this additional volume on development channel design will be negligible, however, to ensure any potential effects are captured in design, the post-development effects has retained the flows from the spillway and has been used as the design base case.

9.6.3 WRC Administered Land Drain (38mm/day)

Table 15-1 in TR2020/07 requires an additional 38mm of runoff to be cleared within 24hours for WRC administered land drains. TMW has provided an assessment in the model build report of the post-development runoff within the Mangaheka catchment at modelling point A (main Mangaheka Channel immediately upstream of Horotiu Road) and confirms this drainage standard has been achieved in the post-development scenario.

9.7 Summary of Effects

The table below summarises the effects of the proposed mitigations and whether any residual effects are outstanding.

Table 10 Summary of Effects

Assessment	Results	Residual Effects
Peak Flows		
TKE Site Only	For both Mangaheka & Te Rapa catchments, wetland attenuation provides: • 80% of pre-development (without climate change) of the 2- & 10-Year ARI peak flows • 100% of pre-development (without climate change) of the 100-Year ARI peak flows • 24-hour release of the EDV	None
TKE + External Upstream Catchments	For both Mangaheka & Te Rapa catchments, wetland and online attenuation provides: • 100% of pre-development (with climate change) of the 2-,10- & 100-Year ARI peak flows • 24-hour release of the EDV	None
Receiving Environment		
Downstream flood levels (10 and 100-year ARI)	Post developed water levels are all lower than pre-development levels including at all hydraulic restrictions i.e. Horotiu Road and Crawford Road bridge.	None
WRC managed drains - Level of Service (10-year drawdown)	Drawdown increases of 9.5 hours (Point A, immediately upstream of Horotiu Road) and 2.7 hours (Point F, between TKE boundary and Point A).	Increase in drawdown times, however overall LoS of WRC managed drain is achieved and no material adverse effect on surrounding land drainage is identified. Compliant with BOD as no increase in overbank flooding beyond 24hours.

Volume neutrality	Neutrality for the post-development increase in 2-Year ARI volume not achieved. Circa 44,000m^3 and 4,000m^3 additional volume discharged to Mangaheka & Te Rapa catchments respectively.	Receiving watercourses carry elevated flows for a longer duration and longer drain down times after rainfall events, posing a risk of stream erosion over time. Proposed to be mitigated via adaptive residual management and bonded financial contribution.
TKE Site		
Flooding – TKE Internal	• There is no flooding within the proposed Lots • Velocity within the roading corridors comply with the maximum velocity limit per RITs • Depths within the roading corridors are broadly complying with the maximum depth limit, except at the roading low points • H1 Hazard Vulnerability (the lowest hazard) is achieved throughout TKE except at two locations that align with the increased depth at the roading low points.	None

10. STORMWATER TREATMENT

10.1 Treatment Train

TKE is a proposed industrial development and as such is classified to have a 'high contaminant load profile' under RITSV2. The stormwater management strategy will implement a treatment train approach based on the 'public roading' and 'on-Lot' catchments per Figure 24 below.

In summary, the proposal shall provide:

- At source control measures for industrial Lots, to be constructed at a later stage when Lots are developed by future purchasers;
- Primary treatment via planted conveyance channels;
- Integration of bioretention of the initial abstraction via raingardens where appropriate; and
- End-of-line treatment via constructed wetlands.

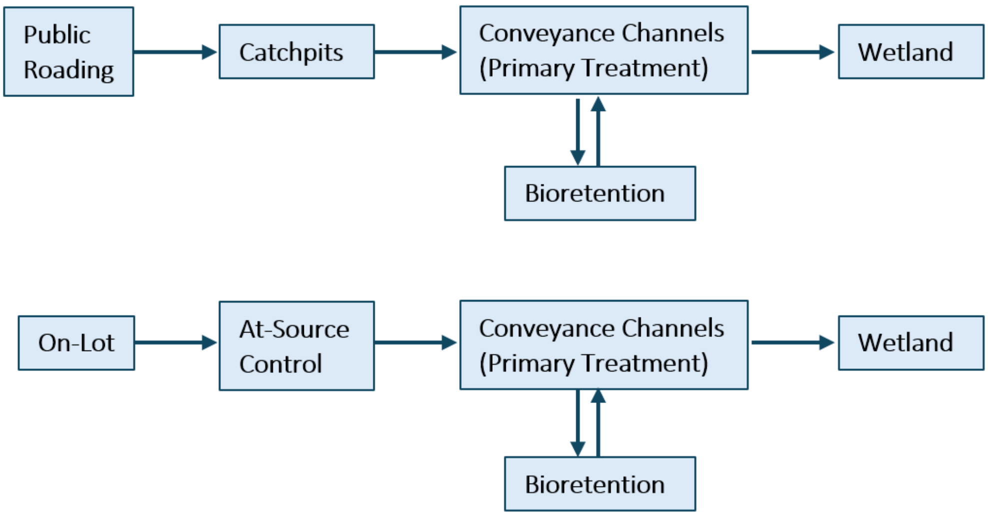


Figure 24: Treatment Train for Public Roading and Lots

10.2 At-Source – Private on Lot

Stormwater discharges from industrial sites must be managed in accordance with the design criteria in TR20-07 and must be supported by Pollution Control Plans. TR20-07 Table 13-1 sets out various industrial activities, their contaminants of concern and acceptable on-lot treatment processes. The private treatment device must be fit for purpose based on the proposed industrial activity.

A template for a Pollution Control Plan is attached to Appendix B of this SWMP. Consent notices shall be applied for on all Lots to detail specific stormwater treatment provisions in accordance with the requirements of this SWMP and shall be submitted for approval with their respective Building Consents.

10.3 Primary Treatment – Conveyance Channels

The proposed open conveyance channels provide conveyance of the primary and secondary flow paths but also provide a primary treatment function before discharging into their respective wetlands for final treatment.

Where used as the only mechanism for treatment, these channels shall be sloped and planted to slow passing stormwater long enough to achieve an average 9 minute or longer Hydraulic Retention time in accordance with RITSv2 and TR20/07. These open channels shall be vested and protected as a public drainage reserve.

Where soakage is proposed in future under these channels to provide volume retention, detailed design shall ensure that the water has been treated before it is discharged to ground.

10.4 Bioretention

Bioretention of the 10mm initial abstraction volume from public roading catchments shall be provided via raingardens. RITSV2 and TR20/07 requires all stormwater runoff within industrial zones to be dual treated. As such, runoff captured by these raingardens shall not be discharged into the ground directly. The base of raingardens shall be impermeably lined and bioretention achieved through evapotranspiration per TR20/07 guidelines.

10.5 Final Treatment – Wetlands

End-of-line of the treatment train is proposed via one of the eight new centralised wetland devices. These provide the greatest potential for treatment of the anticipated contaminants. The shallow and deep marshes in the main body of the wetland, together with their deeper pools will provide treatment of the WQV and also extended detention.

Design and planting within the wetland shall be in accordance with RITSv2 and TR20/07. Integration to create amenity is recommended where practical and shall be low maintenance to Council's satisfaction.

11. STORMWATER MANAGEMENT FRAMEWORK

Item	Design Criteria	
24Hr Rainfall Depths (CC Adjusted)	**Catchment Wide**	**On-Lot**
50% AEP (2Yr ARI)	81.4mm	
10% AEP (10Yr ARI)	127.1mm	
1% AEP (100Yr ARI)	198.9mm	
Treatment	**Catchment Wide**	**On-Lot**
Water Quality	• Treat 1/3rd of the 50% AEP 24-hour rainfall depth via treatment train approach • Public Roads via Catchpits → Conveyance Channels → Wetland • Industrial Lots via On Lot Source Control → Conveyance Channels → Wetland	• AT MINIMUM: Provide pretreatment in accordance with RITS and specific Pollution Control Plan based on type of industrial activity • AT MINIMUM: Use of inert construction materials • RECOMMENDED: Provide 2-Year ARI soakage and/or decrease the amount of impervious areas
Volume & Stream Protection	**Catchment Wide**	**On-Lot**
Initial Abstraction/Soakage	• Retention of min. 10mm via bioretention within raingardens	• AT MINIMUM: Retention via On-Lot tanks for non-potable reuse prorated based on 100m3 per 1ha of Lot area (based on 10mm initial abstraction) • RECOMMENDED: Provide 2-Year ARI soakage and/or decrease the amount of impervious areas
Extended Detention Volume	• Attenuation and 24-hr slow release of the volume via wetlands.	• Provide On-Lot detention if coverage exceeds TKE consented limits
Land Drainage Management	• Controlled discharge of the 10-year ARI volume via the wetlands and upstream stormwater devices • Ponded waters from the 10-year ARI volume to be cleared within a maximum of 72-hours.	• Not applicable
Conveyance	**Catchment Wide**	**On-Lot**
Primary Network	• Capture and convey the 10% AEP rainfall event via open channel swales and/or piped network	• Future extensions from the public network shall be sized for the 10-Year ARI event
Secondary Network	• Directed away from building platforms • Contained within the Central Stream, public road reserves and public stormwater conveyance channels	• Retain overland egress and entry for future development • Do not obstruct overland flows or provide Lot specific engineering design
Flood Management	**Catchment Wide**	**On-Lot**
Freeboard for habitable floor levels	• Not applicable	• Minimum 300mm freeboard above the 1% AEP Flood Level
Downstream & Upstream Environment	• Ensure redevelopment does not cause or increase inundation of buildings of other properties for rainfall events up to the 1% AEP	• Ensure future site layout design maintains internally generated overland flow to their designated outlets • Do not obstruct overland flows or provide Lot specific engineering design
Peak Flow	• Mitigate post-development peaks to pre-development levels for the 2-, 10- & 100-Year ARI storm events storm event via centralized stormwater devices and online mitigation • TKE catchment designed to a 90% MPD impervious catchment wide coverage.	• Provide On-Lot detention if coverage exceeds TKE consented limits
Volumes	• Retention of min. 10mm via bioretention within raingardens • Soakage layers within public stormwater devices where feasible • Controlled release of unretainable volume to an acceptable Level of Service.	• AT MINIMUM: Retention via On-Lot tanks for non-potable reuse prorated based on 100m3 per 1ha of Lot area (based on 10mm initial abstraction) • RECOMMENDED: Provide 2-Year ARI soakage and/or decrease the amount of impervious areas

12. ON-LOT INDUSTRIAL STORMWATER COMPLIANCE TOOLBOX

This toolbox provides a guideline to basic means of compliance for future owners/developers of the proposed industrial Lots created within TKE. If the development is unable to fully comply with any aspects of the toolbox, then specific engineering design in accordance with the requirements of this SWMP shall be provided by a suitably qualified engineer. The proposed stormwater solution to each Lot or amalgamation of Lots in reference to this SWMP and toolbox shall be provided for approval with their respective Building Consent applications.

#	Requirement / Measure	Mechanism
A. Retention / Volume		
1	Rainwater re-use tanks on all lots (~100 m^3/ha), plumbed to non-potable internal use (toilet/laundry; garden option)	Consent notice (s221) on each title Lot-level design at Building Consent
2	Hardstand/overflow areas to soakage where ground conditions allow, with pre-treatment before soakage	Consent notice (s221) on each title Lot-level design at Building Consent
3	Reduced impervious cover; maintain natural drainage paths where practicable	Design guidance only, to be "considered" but is not mandated
B. Quality / At-Source		
4	Inert construction materials, no exposed zinc or copper building products.	Consent notice (s221) on each title
5	Gross pollutant traps within on lot drainage	Consent notice (s221) on each title Lot-level design at Building Consent
6	Carpark/trafficked areas drain to on-lot pre-treatment device (swale/raingarden) before leaving lot	Consent notice (s221) on each title Lot-level design at Building Consent
7	Activity-specific Pollution Control Plan	Consent notice (s221) on each title Lot-level design at Building Consent
C. Flood / Conveyance (Lot Level)		
8	Minimum floor levels: 300mm freeboard above 100-yr flood level (commercial/industrial platforms)	Consent notice (s221) on each title Lot-level design at Building Consent
9	Lot secondary flows to conveyance channels; OLFPs clear of buildings and protected across titles Future development shall not impede upstream neighbouring OLFPs or affect downstream Lots.	Consent notice (s221) on each title Maintain 'principal' and 'secondary' OLFP configuration per Maven Engineering Drawings and Report, subject to flexible Lot boundary strategy. Specific Lot-grading design pending future purchaser requirements to be provided and protected via easements prior to s224
10	Connections to municipal stormwater system per RITS	Catchment-level design at Engineering Plan Approval

13. CONCLUSION

The report outlines the stormwater management framework that will enable TKE to be developed. The overall goal of this SWMP is to mitigate effects of the development whilst trying to deliver positive effects on the receiving environment.

The proposed stormwater design includes stream reconstruction, centralised wetlands, public conveyance channels, raingardens and future provisions for at source Lot controls. All future devices are subject to detailed design and require EPA/BC approval. Extensions for the stormwater network, both public and private, will be subject to specific design when building footprints and their intended use is known. These networks will be subject to comply with the requirements outlined in this SWMP, RITs and the New Zealand Building Code.

Flood modelling and catchment wide attenuation solutions via centralised wetlands have been developed to ensure pre-development flows and velocities are maintained and reduced for the 2, 10 and 100-yr rainfall events. As a result, pre-development peak water elevations have also been maintained downstream of the site in all rainfall events.

While the proposed attenuation measures have managed to mitigate post-development peak flows, they cannot reduce the volume, and the receiving watercourses carry elevated flows for a longer duration and longer drain down times after rainfall events. Full volume neutrality during the 2-Year ARI storm event is not achieved. The Mangaheka and Te Rapa ICMPs have both identified downstream erosion. This SWMP therefore recognises the importance for the increase in post-development volumes in the 2-Year ARI storm to be retained on site.

As such, the proposed 'adaptive residual management' strategy to capture the increase in post-development 2-Year ARI volumes outlined in Section 9.4.3 is proposed as a condition of consent. This 'adaptive' strategy recognizes that the future activities for the industrial Lots are not yet known and provides a consenting pathway to enable detailed design of the private Lots and future public stormwater devices to contribute to matching pre-development runoff volumes through reduced runoff practices such as soakage and non-potable reuse where practical. Where full volume neutrality has not been achieved at the completion of the final stage of TKE, then mitigation within the receiving environment will be provided via a financial contribution to Council for downstream erosion prevention works.

Stormwater quality will be managed via a treatment approach via the planted conveyance channels, bioretention raingardens and centralised wetlands. Pollution control plans based on specific industrial activities will need to be provided for via at-source treatment.

The table below summarises the effects of the proposed mitigations.

Assessment	Results
TKE Site Only Post Development Peak Flows	Post development peak flows are mitigated back to 80% of pre-development (no CC) of the 2- & 10-Year ARI events and 100% of pre-development (no CC) of the 100-Year ARI peak flows. Wetlands also provide 24-hour release of the EDV.
TKE + External Upstream Catchments Post Development Peak Flows	Post development peak flows are mitigated back to 100% of pre-development (CC) of the 2-,10- & 100-Year ARI peak flows

Downstream flood levels (10 and 100-year ARI)	Post developed water levels are all lower than pre-development levels including at all hydraulic restrictions i.e. Horotiu Road and Crawford Road bridge.
WRC managed drains - Level of Service (10-year drawdown)	Drawdown increases of 9.5 hours (Horotiu Road) and 2.7 hours (between TKE and Horotiu Road).
Volume neutrality	Neutrality for the post-development increase in 2-Year ARI volume not achieved. Circa 44,000m^3 and 4,000m^3 additional volume discharged to Mangaheka & Te Rapa catchments respectively. Residual volume-related effects are proposed to be managed through the adaptive management framework
Flooding – TKE Internal	There is no flooding within the proposed Lots. Velocity within the roading corridors comply with the maximum velocity limit per RITs. Depths within the roading corridors are broadly complying with the maximum depth limit, except at the roading low points. H1 Hazard Vulnerability (the lowest hazard) is achieved throughout TKE except at two locations that align with the increased depth at the roading low points.

Future development of the Lots shall maintain the design intent of internally generated flow paths to their designated outlets; or otherwise provide a Lot-specific engineering design. The future industrial development will also require at-source water quality treatment and a specific pollution control plan tailored to the Lot's industrial activity.

Subject to future compliance with the framework set out in Sections 11 and 12 of this SWMP, it is considered that adverse effects can be suitably mitigated and managed.

14. APPENDICES

14.i Appendix A – TKE Basis of Design

Te Kōwhai East (TKE) Stormwater Basis of Design

Document Information

Project: Te Kōwhai East (TKE) Development

Prepared by: Te Kōwhai East – Client Technical Team

Purpose: Define the Basis of Design for Stormwater Design

For: Waikato District Council (WDC), Hamilton City Council (HCC), Waikato Regional Council (WRC)

Status: [Rev 2] Draft for Council Review / Agreement

Date: 11 August 2026

Agreement on Basis of Design

Party	Name / Position	Signature	Date
Te Kōwhai East (Applicant)			
Te Kōwhai East Consultant Team			
Hamilton City Council (HCC)			
Waikato Regional Council (WRC)			
Waikato District Council (WDC)			

1. Executive Summary

The Te Kōwhai East (TKE) development lies within the upper Mangaheka Stream catchment, a low-gradient system draining north-west toward the Waipā River. The Mangaheka Stream, also known as the McBeth Drain, forms part of a rural land-drainage network managed under Waikato Regional Council's Land Drainage Management Plan. A smaller eastern portion of TKE lies within the Te Rapa catchment which eventually drains downstream to the Waikato River.

This document establishes the agreed technical basis for stormwater management within the TKE Development. It defines the performance expectations and standards before hydrologic modelling and detailed design begin. This document is currently in draft to establish a starting baseline that is acceptable for all affected stakeholders. It is subject to further design, modelling, and site constraints while further and more detailed investigations are being carried out.

The application is to be lodged under the Fast-Track Approvals Act (FTAA). Accordingly, the actual and potential effects of the proposal will be assessed and managed in the context of the outcomes and benefits sought under the FTAA, rather than against traditional RMA effects-based tests. The assessment will therefore focus on how the project delivers the required economic, social, environmental and infrastructure benefits, and how any associated effects are avoided, remedied or mitigated in a manner consistent with the purpose and intent of the Fast-Track process.

Key outcomes include:

- **Volume retention**: Post-development runoff volume shall be managed to avoid exceeding the pre-development 10-year ARI runoff volumes, or otherwise mitigated to maintain downstream level of service. This is typically achieved through detention and controlled release of the post-development 10-year ARI volume over a maximum 72-hour drain-down period, consistent with LDMP performance criteria.
- **Volume retention**: Minimum 10mm retention of impervious area
- **Peak flows**: Attenuation of the 2-year, 10-year & 100-year ARI peak flows to pre-development levels
- **Stream erosion**: Attenuation and slow release of the 2-year ARI peak flows and Extended Detention Volume (EDV)
- **LMDP Level of Service**: Hydraulic performance of Waikato managed drains is maintained, with no reduction in capacity or increase in flood duration.
- **Flood conveyance**: 100-year ARI flows are conveyed via road reserves and overland flowpaths, with no adverse flooding effects
- Where complete conformance is unfeasible, assessments will be provided to confirm suitability of the ultimate design solution as the best practical option (BPO), Alternative mitigation options must be provided and adequately assessed.
- **Water-quality treatment**: Achieve minimum 75 % TSS removal on a long-term average basis and treat hydrocarbons, nutrients, and heavy metals through an approved treatment train in accordance with the Mangaheka ICMP.
- **Climate resilience**: Design rainfall depths & intensities based on SSP5-8.5

Design will conform to RITS V2, TR 20-06 / 07, the Mangaheka ICMP (2019), Te Rapa ICMP (Draft 2025) and the Land Drainage Management Plan (2019), using climate-adjusted rainfall from NIWA 2024 HIRDS.

The goal is a resilient, maintainable stormwater network that protects downstream communities and farmland, improves water quality, and complements the cultural and ecological values of the Mangaheka corridor.

A summary of adopted criterion is included within **Appendix A**. Where multiple criteria exist the most applicable to the site-specific scenario has been adopted.

2. Purpose and Scope

This Basis of Design (BoD) sets out the framework for stormwater design at TKE. It ensures compliance with WDC and WRC requirements, including the Mangaheka and Te Rapa North ICMPs, and aligns with the Waikato Regional Land Drainage Management Plan.

2.1. Catchment Context

- The site mainly drains to the Mangaheka Stream catchment governed by the Mangaheka ICMP (2019).
- A smaller eastern portion drains to the Te Rapa Stream catchment, governed by the Te Rapa North ICMP (2025).
- Downstream land-drainage systems are managed under the Waikato Regional Land Drainage Management Plan (PS2019/14).

2.2. Reference Documents

Stormwater design shall comply with:

- RITS V2 – WDC design standards
- TR20/06 – Waikato Stormwater Runoff Modelling Guideline (Hydrology)
- TR20/07 – Waikato Stormwater Management Guideline (Quantity & Quality)
- Mangaheka ICMP (2019) and Te Rapa ICMP (2025)
- WRC Land Drainage Management Plan (2019/14)
- NPS-FM (2020) and NES-F (2020) – National freshwater objectives

3. Design Framework

3.1. Climate Change

- Infrastructure design – SSP5-8.5
- Flood hazard assessments – SSP5-8.5

3.2. Hydrology and Catchment Modelling

- Design rainfall from NIWA HIRDS (2024) with climate uplift (RITS V2).
- Rational method for catchments less than 4 ha when appropriate.
- Full hydrologic routing applies to all contributing areas ≥ 4 ha using NRCS (SCS) method when appropriate.

3.3. Hydraulic Modelling

- Hydraulic analysis will use industry-accepted software, including but not limited to HEC-HMS, HEC-RAS and TUFLOW.
- Post-development analysis to include climate-change, infiltration, blockage, and downstream tailwater sensitivity. Pre-development analysis shall not include effects of climate-change within TKE.
- Downstream boundaries must align with WRC Land Drainage Management Plan control levels and the Mangaheka and Te Rapa ICMP network models
- The actual and potential effects of the proposal will be assessed and managed in the context of the outcomes and benefits sought under the FTAA, rather than against traditional RMA effects-based tests.

4. Stormwater Quantity and Erosion Control

4.1. Volume Control and Retention

- Runoff Volume Control: 10-year ARI runoff volume shall not exceed pre-development volume, or volume exceedance must be mitigated to maintain downstream LOS in accordance with LDMP performance criteria (10-year ARI volume release over a maximum 72hr drain-down).
- Runoff Volume Control: 2-year ARI runoff volume shall not exceed pre-development volume, or volume exceedance must be mitigated to maintain downstream LOS in accordance with TR20-07 performance criteria.
- Where non-compliance for the discharge of stormwater may be met, as assessment of effects would be required to determine the potential effects of the activity and any proposed mitigation

measures. If the assessment demonstrated that there was a predicted effect on the drainage system, and there were no alternative discharge points available or options to mitigate the effects, the system could be upgraded to accommodate the increase in flows and to ensure the drainage standard could be maintained per the requirements set out in Section 15.5.5 of TR20-07.

- The actual and potential effects of the proposal will be assessed and managed in the context of the outcomes and benefits sought under the FTAA, rather than against traditional RMA effects-based tests.
- Extended Detention: 1.2x Water Quality Volume (released over 24-hours)
- Initial Abstraction: Minimum 10mm retention of impervious area
- Retention Mechanisms: Retention may include reuse, soakage, or infiltration depending on site feasibility.

4.2. Peak Flow Attenuation

- Peak Flow Control: Post-development peak discharge shall be equal to or less than pre-development flows for the 2-Year, 10-Year & 100-Year ARI events

4.3. Stormwater Systems

- Primary network designed to SSP5-8.5
- Secondary network designed to SSP5-8.5
- Systems to incorporate either open channels or piped networks, or combination of both where best practical (per RITs V2 & TR20-07)
- Where non-compliance with this BoD and relevant infrastructure codes may arise, and where alternative options have been demonstrated to be ineffective, an assessment for the performance of the system against first principles shall be provided

4.4. Flooding & Freeboard

- Design secondary stormwater system to convey 100-Year ARI runoff from upstream catchment and within the site extents.
- Minimum 300 mm freeboard for commercial and industrial building platforms.
- Conduct a 100-Year ARI pre- and post-development assessment to confirm no flood risk within site or ponding duration for upstream and downstream channels/properties. Assessment to demonstrate no increase in adverse effects on downstream channel and downstream properties
- The actual and potential effects of the proposal will be assessed and managed in the context of the outcomes and benefits sought under the FTAA, rather than against traditional RMA effects-based tests.

5. Stormwater Quality Management

5.1. Objectives

Meet or exceed the best practicable outcomes in TR20/07 and both ICMPs:

- Treat the 1/3rd of 2 year-ARI, 24-hour storm event rainfall depth.
- Remove total suspended solids (TSS), hydrocarbons, nutrients, and heavy metals in accordance with Table 6-1 of Mangaheka ICMP & TR20-07 for industrial activities.

- Separate clean roof water from yard runoff in industrial areas.

5.2. Treatment Train

- Source controls: Building material selection, spill containment, and isolation of high-risk areas, pollution control plan.
- Pretreatment: Swales, raingardens or filter strips
- Primary treatment: Wetlands with a drain-down ≈ 24–72 hrs
- Industrial Lots: Required to provide an additional stage of treatment at source and a Pollution Control Plan that mitigates contaminants generated from the industrial activity
- Stormwater quality management devices to be designed in accordance with RITs V2 & TR20-07.

The water quality targets as per The Mangaheka ICMP table 6.2 are to be adopted for the site. These values are consistent with TR20/07 and RITS. For clarity, general treatment targets for water quality are tabularised below. For land use with high risk activities, these Lots will require a Pollution Control Plan and site-specific on-lot source control and treatment design.

Item/ Parameter	**Requirements**
Either 1: At point of discharge from centralised treatment device or; 2: At point of discharge from on-lot treatment device (where no centralised device is downstream).	
Suspended solids	75% removal on a long-term average basis (Waikato Stormwater Management Guideline definition) calculated at the discharge point
Hydrocarbons	No visible sheen. Installation of submerged outlets or shielded outlets required on devices (as required by ITS)
Temperature	$<$23°C at the point of discharge to a waterway and existing water temperature change of no more than 3°C. Achieved via wetland planting over $>$80% of the device area or vegetated swale as per the ITS.
Gross pollutants	No gross pollutants
Other Contaminant	Removal designed in accordance with the ITS Note: Lots with High-Risk activities require a Pollution Control Plan and on-lot source control and treatment.
Ammoniacal nitrogen	Less than 0.88gm/m^3
Micro-organisms	No exceedance of relevant guideline values (Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas. MfE, 2003)
In Receiving Watercourse (achieved after reasonable mixing)	
Turbidity	No greater than 25 NTU in the stormwater discharge in a water quality storm (1/3rd of a 2-Year ARI 24-hour storm).
Colour	No conspicuous changes in colour downstream of the discharge point (WRC Regional Plan)

Dissolved oxygen	Greater than 80% of saturation concentration. If the concentration of dissolved oxygen in the receiving environment is below 80 percent saturation concentration, any discharge into the water shall not lower it further. (WRC Regional Plan)

6. Land Drainage Integration

- Maintain level of service: Coordinate with WRC to ensure no adverse reduction in primary rural drain capacity, no increase in downstream flood levels or ponding duration, and compliance with LDMP drainage performance criteria (e.g. 72-hour maximum drain-down)
- Where non-compliance for the discharge of stormwater may be met, as assessment of effects would be required to determine the potential effects of the activity and any proposed mitigation measures. If the assessment demonstrated that there was a predicted effect on the drainage system, and there were no alternative discharge points available or options to mitigate the effects, the system could be upgraded to accommodate the increase in flows and to ensure the drainage standard could be maintained per the requirements set out in TR20-07.
- Assessment of effects will focus on how the project delivers the required economic, social, environmental and infrastructure benefits, and how any associated effects are avoided, remedied or mitigated in a manner consistent with intent of the FTAA.
- Outlet design: Size and detail outlets to achieve non-erosive discharge, incorporate energy dissipation, and provide for fish passage and ecological connectivity where required.
- Hydraulic neutrality: Ensure post-development hydrographs are managed to match or mitigate pre-development flow rates and volumes at the point of discharge.
- Access and maintenance: Maintain access corridors and setback clearances for drain inspection, maintenance, and future capacity upgrades in coordination with WRC.
- Sediment and water quality protection: Provide pretreatment or flow moderation to prevent sediment loading or degradation of rural drain water quality.

Appendix A – Te Kōwhai East: Criteria Cross-Reference Table

Design Element	TR20/06	TR20/07	Mangaheka ICMP	Te Rapa ICMP	Land Drainage Plan	RITS v2	Adopted Criterion
Climate Scenario	RCP 6.0 & 8.5 sensitivity	Used for detention design	2.08 degrees	RITs Standard	N/A	SSP5-8.5	SSP5-8.5 for Primary & Secondary system
Catchment Hydrological Routing/Method	>8 ha detailed	Consistent with TR20/06	N/A	≥4 ha confirmed	N/A	Less than 4ha → Rational More than 4 ha → Full routing	Less than 4ha → Rational More than 4 ha → Full routing (if practical)
Initial Abstraction / Retention	From CN /Soil type	From CN /Soil type	Follows TR20/06	Minimum of 10 mm of impervious area where infiltration or reuse is feasible.	N/A	From CN /Soil type	Minimum 10mm over all impervious areas on public roads and Lots; • Public roads shall provide mitigation of the initial abstraction volume via retention within public raingarden devices • Lots shall provide mitigation of the initial abstraction volume via non-potable reuse Additionally, within Lots Over and above the minimum 10mm retention, where deemed feasible (with confirmation from on-going groundwater monitoring at the completion of earthworks), provide: • On-Lot soakage; and/or • Provide and demonstrate for additional volumes for non-potable reuse
Volume Control	N/A	Match pre-development 10-year ARI runoff volume unless adverse effects are mitigated. LOS maintained.	Match pre-development 10-year ARI runoff volume unless adverse effects are mitigated.	Match or mitigate 10-year volume. Maintain or improve downstream LOS.	Match pre-development 10-year ARI runoff volume unless adverse effects are mitigated. LOS Maintained.	Match pre-development runoff volume through reduced runoff practices and sub-catchment management.	Where adverse flooding and draw-down effects are shown, provide: • Mitigation of the Post-Dev volume increase in the 10-Year ARI volume Where adverse stream erosion is shown, provide: • Mitigation of the Post-Dev volume increase in the 2-Year ARI volume
Peak Flow	N/A	≤ Pre-dev 10-year	≤ 70% pre-dev 100 year.	≤ Pre-dev 10yr ≤ Pre-dev 100yr	Maintain LOS. Clear ponded water from the 10-Yr ARI event within 72 hours	≤ 80% pre-dev 100 year where identified downstream flooding (or risk of) exists	**2-Year & 10-Year ARI Peak Flows** • ≤ 80% Pre-Dev **100-Year ARI Peak Flows** • ≤ 100% Pre-Dev; or • ≤ 80% Pre-Dev 100 year, where identified downstream flooding (or risk of) exists
Water Quality Volume (WQV)	N/A	1/3rd 2 Year-ARI (24 hr)	24mm (24hrs)	Per RITs	N/A	1/3rd 2 Year-ARI (24 hr)	1/3rd 2 Year-ARI (24 hr)
Extended Detention Volume (EDV)	N/A	1.2 x WQV	1.2 x WQV	1.2 x WQV	N/A	1.2 x WQV	1.2 x WQV (released slowly over approximately 24-hours)
Stormwater Water Quality Treatment	N/A	As per ICMP as applicable	ICMP Table 6-2	ICMP Table 2	N/A	As per ICMP as applicable	Two stage treatment for runoff generated by Industrial Land Use Level of treatment parameters per Mangaheka ICMP Table 6-2 Land Use with industrial activities require a Pollution Control Plan and site-specific on-lot source control and treatment design

14.ii APPENDIX B – POLLUTION CONTROL PLAN TEMPLATE

POLLUTION CONTROL PLAN

Hamilton City Council
Te kaunihera o Kirikiriroa

Introduction

This document provides practical advice and guidance to help you prevent pollution.

There are frequent pollution incidents from work sites/ factories/ building sites/mechanical workshops/ restaurants/ etc. every year that damage the environment, yet most can easily be prevented.

Managing your activities properly on site will protect people's health and the natural environment.

What is a Pollution Control Plan?
A Plan is a written record detailing how you will manage the pollution risks from your site. It is designed to ensure your site is set up correctly and that you and your employees know how to minimise the potential for pollution to occur.

Your Plan will contain important information about your site such as stormwater drainage, chemical storage areas, loading areas, processing areas, etc. It will also contain information about activities that are undertaken by you and the risks of pollution from these.

Your Plan will contain written procedures in the event of spills or other emergencies. It will also contain details of staff training that you undertake to ensure preparedness for pollution incidents.

Why does my site need a Pollution Control Plan?
A pollution control plan is required under Hamilton City Council's Stormwater Bylaw and is designed to protect you, your company and the environment from pollution.

What is my role in protecting the environment?
Everyone has a responsibility to protect our environment – especially people and companies engaged in high-risk activities.

What is Hamilton City Council's role in protecting the environment?
Hamilton City Council is responsible for managing the city's stormwater network, ensuring the community's safety and protecting our environment.

The Council has a pivotal role in actively promoting and protecting the environment through a range of planning tools and legislative requirements. The Hamilton Stormwater Bylaw helps protect the natural environment by setting out everyone's responsibilities in regards to stormwater.

What is stormwater?
Stormwater is rain which has run off sealed/paved surfaces such as roads, carparks, roofs into stormwater drains. From there it drains into local waterways, lakes, streams and the Waikato River.
Stormwater is drained from Hamilton's urban catchment area of approximately 9000 ha that services approximately 140,000 people including domestic, industrial and commercial properties.

Who else is involved in protecting the environment?
The discharge of stormwater into waterways is regulated by Waikato Regional Council. Hamilton City Council has a 'citywide' Stormwater Discharge Consent from Waikato Regional Council to divert and

discharge stormwater from across Hamilton city to waterways and the river from the stormwater network.

Hamilton City Council works closely with Waikato Regional Council and Tainui to protect the greater Waikato water catchment.

Basic principles – things you should know

<table>
<tr>
<td>What is pollution?</td>
<td>Pollution is the release of any substance that can harm people or animals, plants, soil or water; for example, an oil spill, or sediment getting into a river.

Common pollutants from sites include: silt, oil (including fuel), cement, concrete, grout, chemicals, sewage, and waste materials.

Common causes of pollution are: illegal discharges, pollutants carried by stormwater run-off, poor site maintenance or supervision, accidental spillage and vandalism.

</td>
</tr>
<tr>
<td>What’s at risk from pollution?</td>
<td>The Waikato River and Local Tributaries are at extreme risk from pollution.

• Pollution can kill fish and other aquatic life.
• Pollution affects other users of the Waikato River such as recreational users.
• Pollution can affect drinking water abstractions downstream
• Pollution can affect the ground water table.

It is an offence to pollute our environment.

Your site doesn’t need to be next to a stream or river to cause a problem; any pollutants getting into stormwater drains can end up in the river even if it’s miles away from site. The stormwater network in Hamilton doesn’t have any filters or treatment devices in it, so anything that enters into a catch pit will end up in local streams, lakes and the Waikato River.</td>
</tr>
</table>

What are the consequences if you cause pollution?	If your site activities cause pollution you may face a significant fine and court costs. Under the Hamilton City Council Stormwater Bylaw you may be liable for penalties not exceeding $20,000. Under the RMA, polluters can face fines of up to $600,000 and even imprisonment. You may also have to pay clean up and restoration costs. 
What are Pollution Control Plans?	 Pollution Control Plans contain important information about your site such as stormwater drainage, chemical storage areas, loading areas, processing areas, etc. It will need to contain information about activities that are undertaken by you and how you intend to reduce and manage pollution risks. A Plan may be required under Hamilton City Council's Stormwater Bylaw, depending on the type of activity you are carrying out. It will generally be required for facilities that undertake high risk activities and sites that have ongoing stormwater pollution issues.

Contents

1. Company overview

1.1 Company description and site location

Insert a brief description of your company and details of the location= including:

- **Company operations**, what does your company do or produce?
- **Staff numbers** (include detail of contractors used in the company's operations).
- **Company structure** i.e. key responsibilities and reporting lines where relevant.
- **Site address and legal description** (for all areas your company utilises for operations).

1.2 Scope of this Pollution Control Plan

Insert the scope of your PCP to clarify what it covers. You should include:

- **Legal requirements** outline the status of your site with regard to requirements set out in the Regional and District Plan as well as any resource consents you hold for the activity carried out onsite.
- **Multiple activities on site?** Does your PCP cover your whole site or do you have separate PCPs for different activities carried out in separate areas?
- **Multiple sites?** If you have more than one site, does the PCP cover all of them? Or do you have separate PCPs specific to each site?
- **Onsite and off-site activities,** if your company carries out some activities on your own site but also works for example on customers sites installing products you may want to separate these activities into separate PCPs as the off-site activities are likely to have quite different environmental risks and mitigation procedures.

1.3 Site activities, facilities and stores

Insert an outline of your site's activities, facilities and stores.
Include detail on the following:

- What you do / make / process/ handle on the site.
- The raw materials stored on site, where on-site the storage areas are
- Waste products, the volume of these wastes, where they are stored on-site and how they are disposed of
- Other supporting activities like vehicle and equipment maintenance and washing, loading and unloading

1.4 Site Plan

Insert a summary of your site layout and drainage. The site plan should include:

- Layout of buildings and all outdoor activity areas
- Vehicle traffic areas and loading/unloading areas
- Vehicle/equipment washing areas
- Storage areas, particularly of hazardous substances or materials
- Stormwater flow paths and ponding areas
- Stormwater drains, manholes, catchpits and soakholes with direction of flow.
- Sewer and tradewaste drains, manholes and cesspits with direction of flow.

This information will help you to identify risk areas on your site and how contaminants can enter receiving environments. It will also become an important part of your spill response plan. To create, plan or confirm the accuracy of an existing plan you may need to involve a specialist to investigate your drainage systems (using CCTV or dye testing).

1.5 Consents and permits

Insert an outline of any consents and permits that your site has or requires to undertake its onsite activities. Complete Table 1 (overleaf) if it helps you to summarise this information.

Table 1.1: Summary of authorisations, consents and permits

Some examples have been inserted for your information; these should be replaced with details that relate to your company's situation.

Type and number	Agency	Status	Summary of key conditions and monitoring required
Tradewaste discharge permit – No. XYZ	Hamilton City Council	Granted (expires 2012)	Relates to discharge from factory and wastewater treatment bund – Discharge Xm3/s (continual monitoring) pH maximum 8 (daily monitoring, mid-flow)

2. Pollution risks and controls

2.1 Pollution risks

Insert a summary of your sites pollution risks. Also insert details of these pollution risks into Table 2.1 overleaf. This table was developed to help you identify your pollution risks and find solutions to minimise and mitigate these risks.

2.2 Pollution controls

2.2.1 Structural and procedural controls – existing:

Insert a summary of your site's pollution controls that have already been implemented. Also insert details of these pollution controls into Table 2.1. You could categorise them into a section each for structural and procedural controls which have been defined below.

Structural controls are physical structures that are designed to control the movement of materials/contaminants (including contaminated stormwater) around your site. Examples could include things like bunds, cut-off valves and physical covers.

Procedural controls are written or informal descriptions of how and where you carry out key activities on your site. They include written standard operating procedures (SOPs) for routine activities as well as for spills e.g. SOP's for spill response.
.

2.3 Spill Response Plan

A spill response plan' is a key pollution control document that formalises the procedures during a spill.

A good spill response plan should include:

- training for staff
- appropriate equipment
- location of equipment
- step by step instructions for spill response
- notification protocols (internal management & external parties)
- Clean up and dispose of the contaminated materials
- restocking the spill kit
- investigation into the cause of event
- review spill procedures post event

Table 2.1: Structural and procedural controls

This table relates to the pollution risks and pollution controls sections (2.1 and 2.2) above. You may use this table or create a similar one of your own.

Area of site: Chemical storage area in Warehouse B **Activity/facility/store:** Activity – Chemical delivery

Risk identification and contaminants of concern		**Existing pollution controls**		**Improved or new pollution controls required**		
Risk	**Contaminant(s)**	**Structural**	**Procedural**	**Structural**	**Procedural**	**Timeframe**
Spills during unloading of chemicals	• hydrocarbons • dissolved metals • chemicals	• bunding of chemical delivery area • sealed surface.	Procedure • deliveries only within bunded area • contractors use safe practices (pallets wrapping, trolley jacks) Inspection • regular checks of seal and bund integrity etc. Training • staff/contractors trained in procedures and Inspections.	• n/a – no further structural controls required	• procedure / Spill response required for staff and contractors to follow in the event of a spill or leak.	• four week review of spill response procedures and produce document
Traces of contaminants tracked from bunded chemical delivery area to yard	As above	• yard area sealed	Inspection: • yard area regularly swept and residues collected for disposal. • integrity of concrete checked 6 monthly.	• stormwater treatment – oil interceptor and sand/peat filter for trace hydrocarbons and metals in yard stormwater	Procedures required for operation and maintenance of stormwater treatment devices	• 12 weeks to install appropriate interceptor system

3. Pollution programmes and systems

3.1 Inspection and maintenance programme

To make sure your Pollution Control Plan is effective in preventing pollution, you need to make sure the structural controls are in good working order and that the procedural controls are being followed. The way to do this is to develop an inspection and maintenance programme.

Insert a summary of your Inspection and maintenance programme.

Completed inspections checklists and maintenance logs with create a paper trail to demonstrate that your inspection and maintenance programme is being followed and will be looked on favourably in the event of an unforeseen spill or non-compliance issue.

3.2 Management and monitoring programme for stormwater treatment devices

Stormwater treatment devices often require more comprehensive checks and more intensive maintenance – they have therefore been given this separate section to outline their specific management and monitoring.

Insert a summary of your pollution control and monitoring programme for any treatment devices you have on site and attach a copy of the programme including any supporting forms as an attachment.

3.3 Record keeping

Insert a summary of the records you will keep in order to ensure (and demonstrate) your PCP works effectively.

This is part of your insurance in case of a spill, accident or non-compliance event. You should include completed forms, checklists and maintenance logs, identified problems and corrective actions taken, monitoring data and results from stormwater treatment devices, incident forms and results of assessments and compliance visits.

3.4 Roles and responsibilities

All staff and contractors have a responsibility in ensuring your Pollution Control Plan is followed and that it is effective in preventing pollution and compliance costs to the company. In order for staff and contractors to understand what is required, you will need to record this in your PCP.

3.5 Pollution Control Plan review

You will need to review and update your Pollution Control Plan regularly to make sure it reflects the changing shape of your business and current best practice techniques

4. Attachment 1- Stormwater Incident Report Sheet – Example form

Stormwater Incident Report Sheet

Use this form to record details of any spill events

Details	
Date/time of incident	
Location of discharge:	
Material/s discharged:	
Approx. volume discharged:	
Cause of discharge:	
Did any material escape offsite? If yes, where to?	

Action Taken	
Who detected the spill and what did they do?	
Who else on the staff was notified and what did they do?	
Were any external agencies notified?	

Health & Safety	
Were there any injuries?	
Any damage to plant or property?	

Costs Report	
Estimate costs of staff down	

time for clean-up and other response	
External clean-up costs	
Disposal costs	

Prevention	
Discuss any changes needed to prevent similar accidents in the future:	
Spill procedures:	
Equipment:	
Staff training:	
Drains or structures:	
Housekeeping practices:	
Standard operating procedures:	

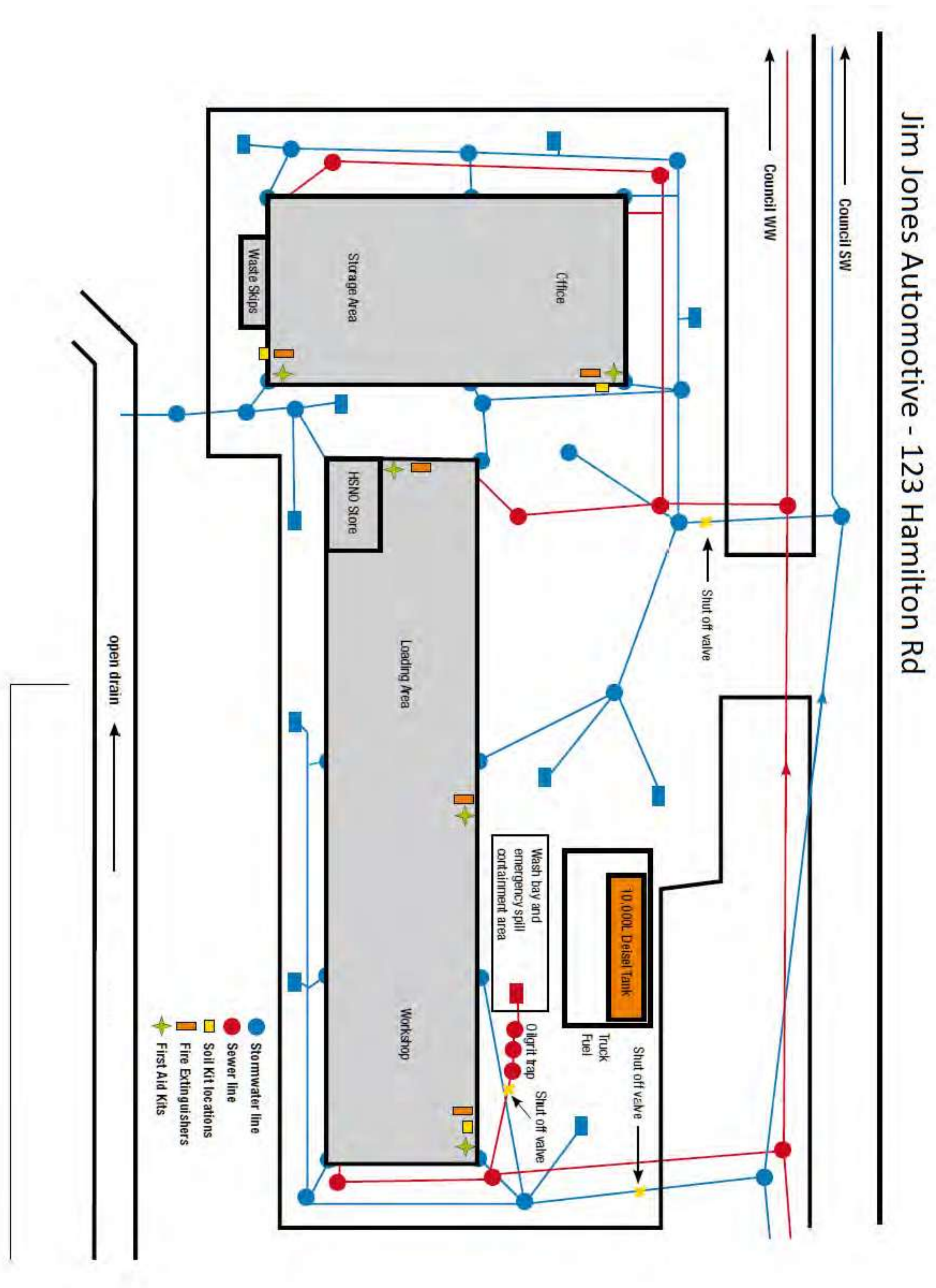
Other Recommendations

Photos

Report completed by

Report reviewed by

5. Attachment 2 – Site Drainage Example



Appendix I

Pollution Control Plan Checklist and Guidance Document

Hamilton City Council Pollution Plan Guide and Checklist - Industrial Zone Developments

Instructions

This guide/checklist should be filled out for all developments within the Industrial Zone as part of a Building Consent or Stormwater Connection (to the HCC network) Approval request .
Sections A to E need to be filled out by all developers.
Section E to J should be filled in if section E indicates you need to prepare a Pollution Plan

Regulatory Framework

HCC Partially Operative District Plan	
HCC Stormwater Bylaw 2015	HCC's Stormwater Bylaw 2015 requires that a person must take all practicable steps to store, handle, transport, and use materials in a way that prevents prohibited materials entering the stormwater system.
WRC Discharge Consents	HJV, Porters
HCC Comprehensive Stormwater Discharge Consent	

Definitions

Prohibited materials means anything	a) pose a danger to life b) pose a danger to public health c) cause flooding or any floor or sub-floor, or public roadway d) cause damage to property e) cause a negative effect on the efficient operation of the stormwater system f) cause damage to any part of the stormwater system g) cause erosion or subsidence of land h) cause long or short term effects on the environment i) cause adverse loss of riparian vegetation j) cause wastewater overflow to land or water k) and means anything that causes a breach of of any stormwater discharge consent condition binding Council.
Pollution Control Plan	Means a plan that includes appropriate policies, procedures and review timetable that is held onsite that guides appropriate management of any material either held on site or intended or likely to be onsite that may cause entry of prohibited materials into the stormwater system or any other breach of this bylaw.

A **Site Details**

1	Site Owner:	
2	Site Address:	
3	Site Legal Description	
4	Grid Reference location and manhole reference location of connection to HCC stormwater network:	
5	Downstream Treatment /Attenuation Facility	eg Porters Pond/HJV Pond

B **What size is your development?**

6	Total Area of lot (m^2)		
7	Proposed area of hardstand used by vehicles (m^2)		
8	Proposed area of hardstand used for product storage /other usages (m^2)		Product storage areas should be separate from other areas. Applicant to specify what "other" is .
9	Total Roof area (m^2)		
10	Total Landscaping area (m^2)		
11	Total area discharging to Tradewaste (m^2)		
12	Total Impervious Area (m^2)		

C **Traffic Movements**

13	How many traffic movements (on average) do you expect through your site per week?	
14	Cars	
15	Trucks	
16	Other (Please state type)	

D **Site/ Stormwater System Plans**

17	Please provide a detailed site plan including:	Lot boundaries Building locations Landscaping areas Parking areas Locations of likely vehicle movements Discharge point off site Stormwater catchments (based on proposed topography), conveyance paths from source, to treatment (if any) and to discharge point. Any proposed stormwater treatment system locations Locations where operations may result in contaminants entering the stormwater system Locations of any bunding to prevent contaminants entering stormwater
18	Please provide a more detailed plan of any proposed stormwater treatment systems ie Design Plans	

E **Do I need to prepare a Pollution Plan**

				Reference:
19	Proposed Business/Industry to be developed:			
20	Is your proposed business/industry on the WRC High Risk Facilities Register		If you answered Yes, please prepare a pollution plan according to the below guidance.	
21	Is your proposed business/industry on the list in Table 11.1 of the WRC SW Mgmt Guideline?		If you answered Yes, please prepare a pollution plan according to the below guidance.	Reference once published????
22	Is your proposed business/industry high/medium or low risk according to Table 11.1?	Low	No Pollution Plan required	
23		Medium	No Pollution Plan required	
24		High	If you answered Yes, please prepare a pollution plan according to the below guidance.	

E **Chemical Storage**

25	Do your site use/store/distribute chemicals		Yes - Please refer to HSNO regulations				
26	Are any of these chemicals regulated under the HSNO Act?		If yes, please provide details of controls required under the HSNO and any approvals required for these chemicals.				
27	Please list the chemicals your site ill use/store or distribute:						
	Chemical Name	**Storage Location**	**Reference to Site Plan and Pollution Plan**	**Sub catchment area**	**Storage Area**	**Volume Stored**	**Bunded Volume**
eg	Petrol	Outside not under cover	Fully bunded storage area draining to oil separator in NW corner of site. Discussed in Pollution Plan section x.x (State:)				
i							
ii							
iii							
iv							
v							
vi							

F

	Risk Assessment and Management		
	Refer section 11.3 of the WRC SW Mgmt Guideline or the High Risk Facilities Register		HSNO - storage and appropriate usage
28	For each contaminant listed, please answer :	Is the contaminant used/stored in a fully covered location?	
29		What source control measures have been implemented to prevent this contaminant entering the SW system? Eg bunding, sweeping	
30		If bunding is used, how is the stormwater within this managed and where is it discharged to?	
31		Are any Tradewaste discharges proposed for contaminated stormwater?	
32		Alternatively, what downstream on-lot treatment are you providing prior to discharge?	

33	Please provide details of how and where deliveries are made to site including:	What frequency, volume and type of deliveries are expected	
		Is it possible that contaminants could contaminate stormwater as a result of deliveries? Eg will some products be delivered in loose form and could be blown or dropped around the site?	

G

	Proposed Treatment System			**Reference:**
	Downstream SW Treatment Systems have been provided to treat the following standard contaminants			
	TSS		Link to HCC consent conditions	
	Hydrocarbons		Link to HCC consent conditions	MfE petroleum guidelines require 15 mg/L - refueling areas only
	Nutrients		Link to HCC consent conditions	
	Zinc		Link to HCC consent conditions	
	Copper		Link to HCC consent conditions	
34	What other contaminants do you expect your Industry/operation to produce?			
35	Is it likely that this contaminant could be entrained in stormwater?			
36	What on-lot treatment systems are provided to remove contaminants that become entrained?			
37	What types/rates of removal of contaminants are you expecting this treatment system to remove			
38	What guideline has been used to design this system?			TP10, WRC Draft SW Mgmt Guideline

H

	Operation, Inspections and Maintenance			**Reference:**
39	Please provide details of your proposed inspections including frequency, things to be inspected, and how you plan on ensuring that any maintenance identified as being required by the inspections, is carried out.			Section of WRC's SW Mgmt Guideline. Suggest there should be a check-list specific to the device being used - could use them from TP10 or something similar
40	Please provide details of any routine maintenance that will be carried out as well as frequency of this occuring.			TP10 section on Operation and Maintenance

I

Staff Education and training

41 Please provide details of any current or proposed education/training programmes for staff in charge of managing discharges from the site?

42 Please provide details of when training will occur, and the frequency of retraining ?

43 Please keep a record of training for submission to HCC upon request

J

Spill Response Plan

44 Do any regulations require you prepare a Spill Response Plan? If yes, please provide a copy of this plan?

L

Plan Review

45 How often do you plan on reviewing this plan to ensure it is up to date, including responsibilities for carrying

Key References and Links

	Website Link
WRD Draft SW Management Guideline	

District Plan	
WRC High Risk Facilities Register	See: https://www.waikatoregion.govt.nz/council/policy-and-plans/rules-and-regulation/regional-plan/waikato-regional-plan/3-water-module/35-discharges/3512-high-risk-facilities/
HCC Stormwater Bylaw 2015	See: http://www.hamilton.govt.nz/our-council/policies-bylaws-legislation/bylaws/Documents/Hamilton%20Stormwater%20Bylaw%202015%20-%20Final%20-%20D-1598128.pdf
HSNO Regulations	