REPORT

Tonkin+Taylor

Ōmokoroa Stage 3 - Stormwater catchment Management Plan

Prepared for
Western Bay of Plenty District Council

Prepared by
Tonkin & Taylor Ltd

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Appendix A Stage 3 Stormwater management concept

1 Introduction and background

Western Bay of Plenty District Council ("WBOPDC") have developed a Structure Plan for Ōmokoroa Stage 3 ("Stage 3"). The Structure Plan will be incorporated into the District Plan through a Plan change. As part of the development of the Structure Plan for Stage 3, various stormwater management related technical reports have been prepared. These technical reports have addressed matters such as stormwater quantity and quality requirements for developable areas, options for water sensitive design and natural wetland classification.

As part of the Plan Change process to incorporate the Stage 3 Structure Plan into the District Plan, WBOPDC have been working with the Bay of Plenty Regional Council ("BOPRC"). Feedback from the BOPRC to WBOPDC is that to finalise the Plan Change, BOPRC request WBOPDC to prepare a Catchment Management Plan ("CMP").

Taking onboard the BOPRC feedback, WBOPDC have opted to:

- Prepare a high-level summary of the various technical reports prepared for stormwater management within Stage 3 over the years.
- Prepare this CMP.

The objective of the high-level summary and CMP is to:

- Assist with Plan Change reporting requirements.
- Assist with the development of stormwater management related polices, rules and other methods for inclusion in the District Plan required to support the Structure Plan.
- Demonstrate that a sufficient level of detail is in place to inform the Structure Plan.
- Set out residual matters to be dealt with through future detailed design processes associated with development proposals in Stage 3, proposed Best Practice Guidelines and Small Site Earthwork Guidance and a future updated CMP.

WBOPDC requested Tonkin & Taylor Ltd (T+T) to prepare the high-level summary and the CMP. The high-level summary report was provided to WBOPDC in February 2022.

The content of this CMP follows the expected content supplied to WBOPDC by BOPRC. This report provides the CMP and has been prepared in accordance with the contract between T+T and WBOPDC dated 23 December 2021.

2 Philosophy of this CMP

This CMP has been prepared at a time when the catchment it addresses is still predominantly greenfield[1]. Consequently, this CMP is not based on a starting position of an existing urban catchment with degraded stormwater quality and flooding issues that need to be addressed in an integrated and progressive manner. Rather, this CMP is based on a philosophy of proactively managing stormwater quality and quantity throughout the development of urban areas within Stage 3.

Key objectives and policies contained in the National Policy Statement for Freshwater Management 2020 ("NPS-FM") have been used to guide the development of the content of this CMP. In particular, this CMP prioritises the health and wellbeing of water bodies and freshwater ecosystems over communities, social and economic wellbeing (Objective 2.1). This prioritisation recognises the fundamental importance of water and that protecting the health of freshwater, in turn protects the health and well-being of the wider environment. This CMP achieves Objective 2.1 of the NPS-FM by

[1] "Kaimai Views", "Te Awanui Waters" and "Harbour Ridge" developments are all well advanced.

engaging with Tangata Whenua, managing freshwater in an integrated manner, considering the receiving environment and the influence of climate change, and avoiding the loss of streams and wetlands.

3 Catchment objectives

The overarching objective of this CMP is to minimise the generation of stormwater and entrained contaminants within Stage 3 and, to the extent practicable, disconnect the source of the stormwater from the receiving environment. This will ensure the quality of urban sourced stormwater entering Te Awanui (Tauranga Harbour) is enhanced. Stormwater quantity will be reduced, and quality will be enhanced through the following:

- Extended detention of stormwater to reduce the potential for stream erosion and slope instability.
- Work with Tangata Whenua to ensure that Mātauranga Māori principles including Te Mana o te Wai are reflected in the work covered by this CMP.
- Applying a water sensitive urban design ("WSUD") based hierarchy of controls. Specifically:
  - Minimising generation of stormwater runoff and contaminants through source control.
  - Managing stormwater as close to the source as possible.
  - Treating and slowing stormwater as it moves through the catchment.
  - Using green infrastructure to achieve multiple objectives.
  - Protecting and enhancing the natural environment.

The primary measures for achieving the above are to reduce impermeable areas, reserve and enhance stream corridors, and develop treatment trains for individual land use related sub-catchments.

Generally speaking, "attenuation" is a common concept associated with flood management. Attenuation is the temporary storage of stormwater runoff from large, infrequent storm events (typically greater than 2 year Average Recurrence Interval (ARI) for the purposes of preventing downstream flooding. Within Area 3, a large portion of the land drains direct to the Harbour or into gullies which WBOPDC will own. Consequently, downstream flooding is not a concern for most of the catchments in Area 3 and thus attenuation is not a critical feature of this CMP.

The term "detention" (or "extended detention") is used throughout this CMP. Detention is the temporary storage of stormwater runoff from small, frequent storm events (typically less than 2 year ARI). These frequent storm events drive stream erosion. Avoidance of stream erosion within Area 3 is a key objective of this CMP.

The detailed design and engineering approval process undertaken at subdivision consent stage will need to demonstrate how detention of stormwater will be provided for.

4 Regulatory framework

4.1 Catchment Management Plans

A CMP was prepared in 2002[2] and updated in 2017[3] for Ōmokoroa and includes Stage 3. The 2002 CMP was developed to support the Comprehensive Discharge Permit ("CDP") for Ōmokoroa as

[2] *Omokoroa Peninsula Stormwater Management Plan* prepared for Western Bay of Plenty District Council. Beca Carter Hollings and Ferner Limited. July 2002.
[3] *Omokoroa Peninsula Stormwater Management Plan – Addendum* prepared for Western Bay of Plenty District Council. Beca Limited. November 2017.

Ōmokoroa is not encompassed within the "Central" CDP. The Ōmokoroa CDP expires in 2024. Consequently, the 2002 CMP remains relevant to Stage 3 but only until this CMP has been approved. Once this CMP has been approved, the 2002 CMP will become redundant

4.2 Supporting mechanisms

The following key statutory and non-statutory mechanisms relate to this CMP for the reasons stated:

- WBODPC District Plan: Sets out the requirement to manage stormwater in accordance with this CMP. The Stage 3 Stormwater Management Concept (Appendix A of this CMP) provides the intended general arrangement and purpose of engineered wetlands and treatment trains for different land use zones (the "overall scheme"). The detailed design and engineering approval process undertaken at subdivision and/or land use consent stage (hereafter referred to as the "approval process") will ensure Developers deliver a stormwater system in general accordance with the overall scheme and/or meet the objectives of this CMP. Proposed Best Practice Guidelines will assist Developers with designing stormwater devices (such as swales and engineered wetlands) which are not currently contained in the WBOPDC Development Code. The District Plan, the CMP and the approval process collectively ensure the CDP will be complied with.
- WBOPDC Annual and Long Term Plans: Allocation of funding to develop and implement additional stormwater quantity and quality related mitigation, which may or may not be required in the years to come following initial implementation of the measures required under the Structure Plan.
- New Zealand Building Act 2004: The companion Building Code, through Clause E1, states that "surface water" from a 2% Annual Exceedance Probability (AEP) rainfall event shall not enter buildings. This performance criterion will be applied to the design of stormwater quantity and quality related measures required to be implemented for Stage 3. Further, the Act contains specific limitations and restrictions on granting building consents for buildings on land subject to natural hazards. "Flooding", "overland flow", "ponding", "erosion" and "slippage" are all identified as natural hazards. Avoiding natural hazard effects on land is a key outcome sought through the design of the treatment trains contained in this CMP. This avoidance is principally achieved through reserving the existing gully systems from development.
- BOPRC Hydrological and Hydraulic Guidelines 2012: Provide design guidelines for stormwater management in so far as engineering calculations and assessments are required. The guidelines have been applied to the development of numeric modelling completed to date which has been considered in the development of the treatment trains contained in this CMP. The guidelines will be applied through the approval processes undertaken in relation to stormwater quantity and quality related measures required to be implemented for Stage 3.
- BOPRC Stormwater Management Guidelines for the Bay of Plenty Region 2012: Set guidelines for stormwater quality treatment and stormwater quantity control. The guidelines will be applied where stormwater quantity and quality related measures required to be implemented for Stage 3 are a stormwater "practice" [device].
- WBOPDC Development Code 2009: Sets the design standards for stormwater works undertaken by Developers and vested in WBOPDC, as well as works undertaken by WBOPDC. Where relevant, the Code will be applied to the design of stormwater quantity and quality related measures required to be implemented for Stage 3.
- WBOPDC Stormwater Bylaw 2020: Controls the discharge of contaminants into the WBOPDC stormwater network. Therefore, the Bylaw will assist with managing quality issues (should they arise) following implementation of the measures required under the Structure Plan. This bylaw is more likely to apply to the industrial land use zoning near State Highway 2. The treatment train contained in this CMP for Industrial Zones in Stage 3 takes an "Industrial and

Trade Activity" based approach to segregating high risk activities undertaken within buildings from external pavements.

- Conditions of the CDP: Set out design criteria for new and upgraded stormwater infrastructure. The design criteria listed under the condition will be applied to the design of stormwater quantity and quality related measures required to be implemented for Stage 3.
- WBODPC have an Incident Management and Reporting Procedure, maintenance contractor based Pre-heavy Rainfall Inspection Checklist and are developing a stormwater related Education and Awareness Programme.

In addition to the key documents described above, there are other planning documents and regulations prepared by Central Government and the BOPRC that lend support to and/or inform the development and implementation of this CMP. These documents include the NPS-FM, the National Policy Statement on Urban Development, the New Zealand Coastal Policy Statement, the National Environmental Standard for Freshwater ("NES-F"), the Bay of Plenty Regional Policy Statement, the Bay of Plenty Regional Coastal Environment Plan, and the Bay of Plenty Regional Natural Resources Plan.

The NPS-FM has specifically been commented on within Section 2 as the key objective and policies of this policy statement, as well as a Water Sensitive Urban Design (WSUD) approach, inform the philosophy and catchment objectives of this CMP. Further, WBOPDC's obligations (as a Territorial Authority and Local Authority) under NSP-FM are confined/limited when compared to BOPRC obligations. For example, it is the BOPRC's task to map and monitor wetlands, monitor river conditions (extent, values and deposited sediment), and identify barriers to fish passage and develop an action plan for restoration of fish passage where applicable. Once the Regional Natural Resources Plan has been amended to include objectives for Freshwater Management Units, there is a possibility this CMP will require updating.

5 WBOPDC Stormwater Strategy

WBOPDC have not prepared a Stormwater Strategy for the District. The WSUD controls developed for Stage 3 are consistent with the *Vision Statement* (Section 2.2) and *Overriding Objectives* (Section 2.3) contained in the BOPRC's 2005 Stormwater Strategy for the Region.

6 Catchment description

The 2002 CMP and T+T 2020 Conceptual Water Sensitive Design Plan[4] contain detailed descriptions of the catchment. In the interests of brevity, key excerpts are reproduced in the sections below.

6.1 Site extent and catchment setting

Stage 3 (or "the site") extends from State Highway 2 in the south to the East Coast Main Trunk railway ("the railway") in the north and is bound by the Waipapa River (otherwise referred to as "the Waipapa Estuary") to the west and Mangawhai Estuary to the east. The catchment area for Stage 3 is approximately 360 hectares with all flows draining into the Waipapa River and Mangawhai Estuary.

Figure 6.1 shows the location and extent of Stage 3, the receiving environment of Stage 3's stormwater catchment, and the Waipapa River and Mangawhai Estuary and catchment boundaries.

[4] *Omokoroa Stage 3 Structure Plan – Conceptual Water Sensitive Design Plan* prepared for Western Bay of Plenty District Council. Tonkin & Taylor Limited. February 2020

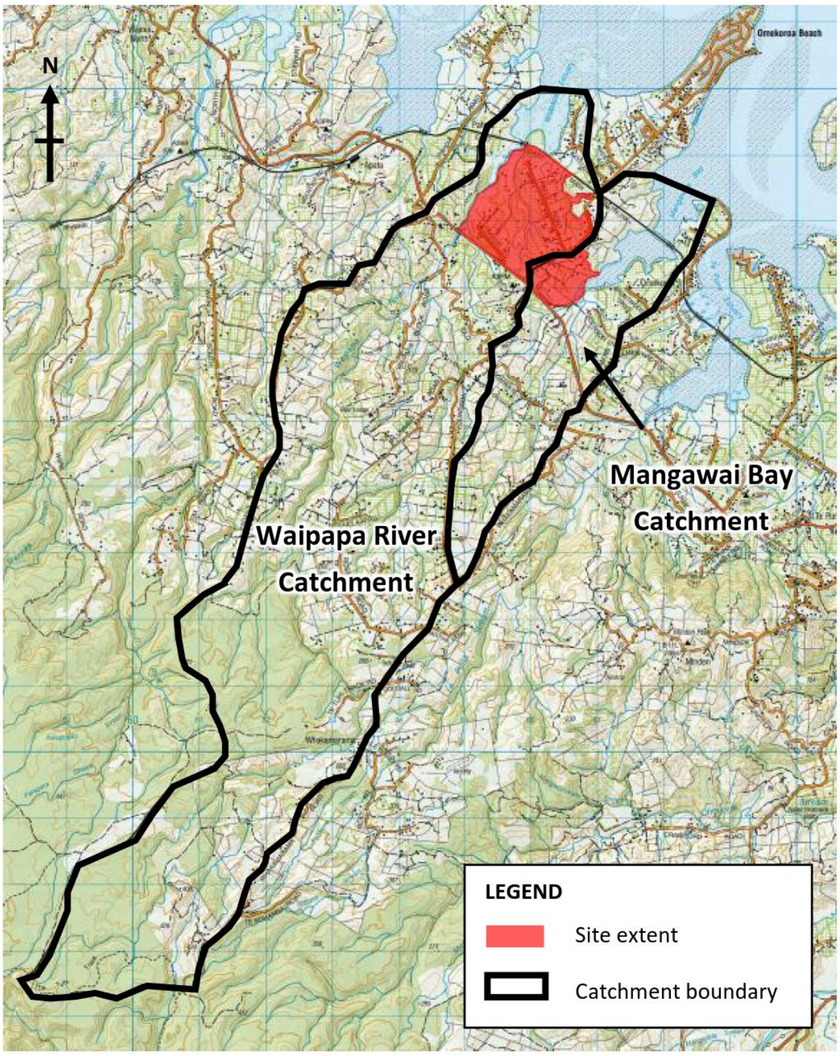

Figure 6.1: Stage 3 CMP catchment setting *Source of background topographical map LINZ 2022*

Within Stage 3 there are six main sub-catchments. Two drain to the Waipapa River to the west, two drain under the railway to the north and then to the Waipapa River, and two drain to Mangawhai Estuary to the east.

6.2 Topography

The site topography is characterised by gently undulating terraces interrupted by incised stream gullies and several knolls that form the top of the sub-catchments. Elevations range from RL[5] 0 m adjacent to Tauranga Harbour, to RL 75 m in the middle of the site. The sides of the stream gullies are steep in places, but the slope angles decrease within the gully floors. Away from the stream gullies and harbour margins, the slopes within the site are generally less than 10 degrees.

Ground elevations and slope angles for the site (taken from WBOPDC's 2015 LiDAR survey) are shown in Figure 6.2 and Figure 6.3 respectively.

[5] Relative to Moturiki Vertical Datum (MVD1953)

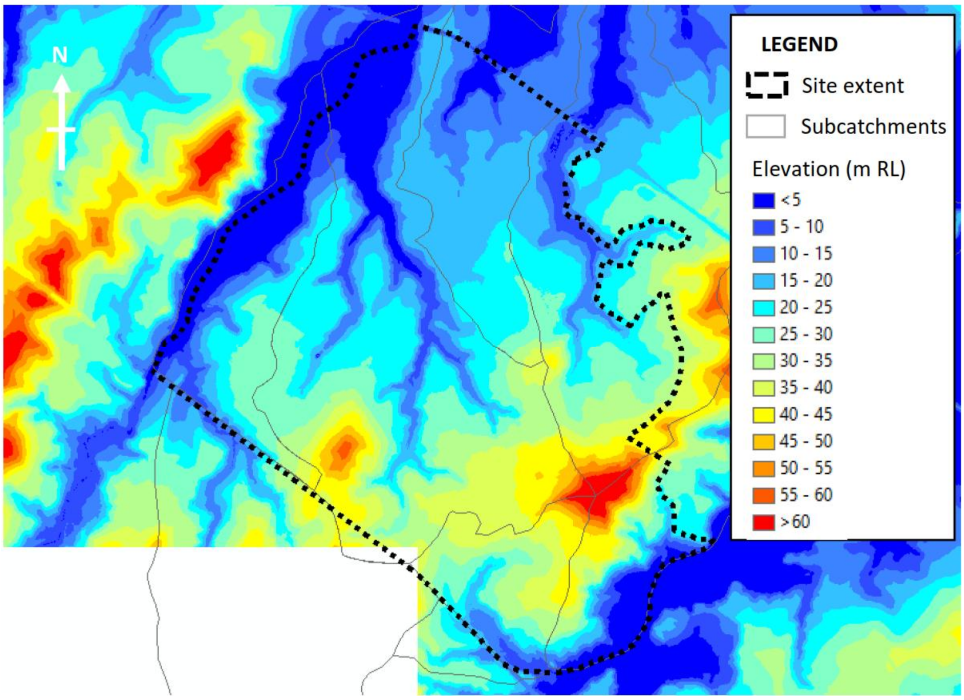

Figure 6.2: Existing site topography – elevation

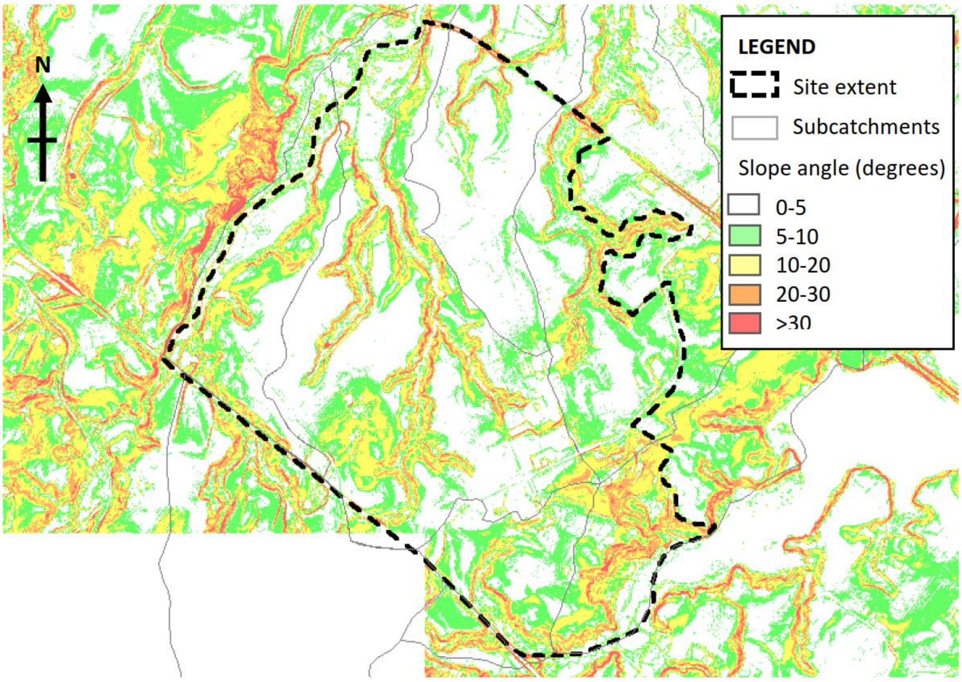

Figure 6.3: Existing site topography – slope angle

6.3 Geology

Published geology (Briggs et al., 1996) indicates that the site is underlain by three different geological units (refer Figure 6.4).

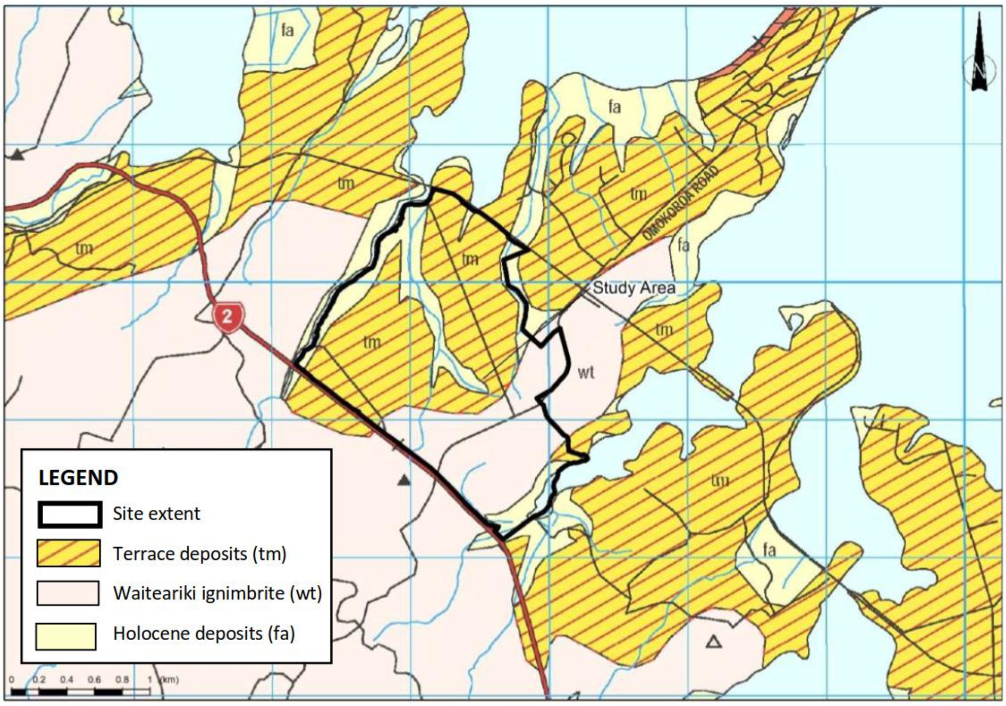

Figure 6.4: Geological map *Source: Briggs et al. 1996*

Figure 6.4 shows that terrace deposits (tm) of the Matua Subgroup dominate the study area. The Matua Subgroup comprises sands, gravels and lignites. Borehole data collected from near the railway shows that the local geology is variable, both laterally and vertically, and mostly underlain by clayey and sandy sediments. This geology is typical of the Tauranga area.

6.4 Landuse

The site generally comprises rural land used for agriculture, horticulture and lifestyle properties. In the last few years some residential development has begun to occur in the northeast of the site with the "Kaimai Views", "Te Awanui Waters" and "Harbour Ridge" developments being advanced.

Based on Landcare Research's Land Cover Database version 4 (LCDB4) dated 2012 (i.e., prior to any residential development occurring), orchards comprise almost 50% of the site while pasture comprises approximately 45% of the site.

6.5 Infrastructure

State Highway 2 forms the upstream boundary of the site and the railway forms the downstream boundary.

There is little existing stormwater infrastructure located within the site. The predominant conveyance mechanism for stormwater runoff is overland flow into the stream gullies. The major roads within the site (Ōmokoroa Road, Prole Road and Francis Road) do not have kerb, channel, or catchpits and are drained with grassed roadside swales. Culverts are located where private driveways cross the swales.

6.6 Natural hazards

In 2020, T+T undertook a natural hazards risk assessment[6] for the site using Appendix L of the Bay of Plenty Regional Policy Statement. The natural hazards assessed were rainfall-induced flooding, tsunami, coastal inundation, coastal erosion, active fault hazards and liquefaction.

Rainfall-induced flooding is the only natural hazard relevant to this CMP. This is because all other natural hazards are confined to the "constrained land" shown on the Structure Plan (the stream corridors).

A combined 1D/2D model was built by Beca in 2020 to predict the 1% AEP enveloped[7] flood extent for the site. The Beca flood model results are reproduced in Figure 6.5.

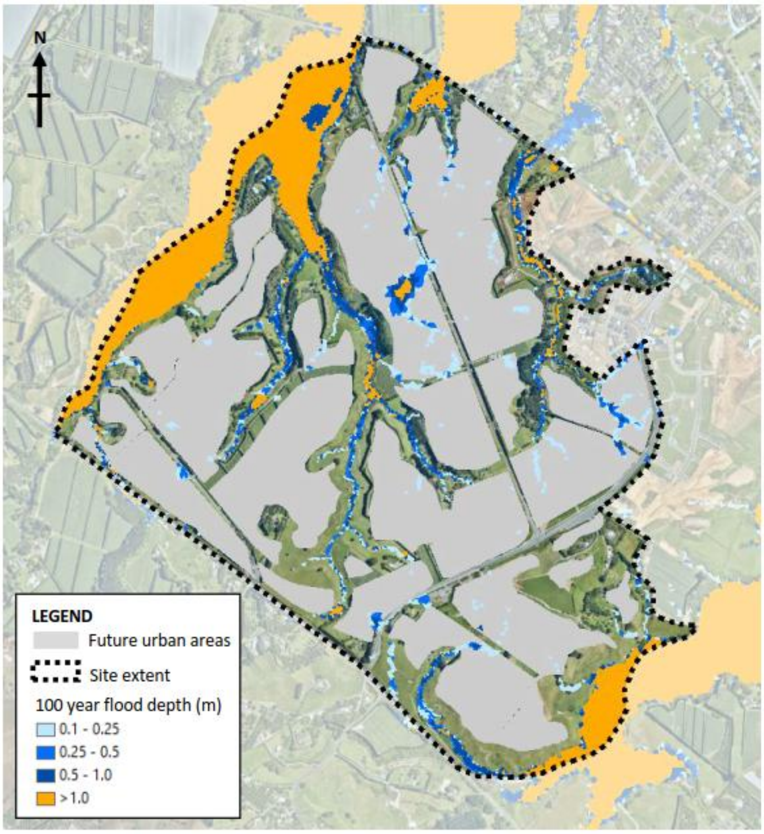

Figure 6.5: Beca flood model results (1% AEP)

From reviewing Figure 6.5 it is evident that rainfall-induced flooding is largely confined to the constrained land shown on the Structure Plan. Where flooding is predicted to affect the "developable land", then predicted flooding is between 100 mm and 500 mm deep. The exception is the depression near 85 Prole Road, where the predicted flood depth exceeds 1 m. Flood depths between 100 mm and 500 mm deep are likely to be able to be managed through earthworks required to prepare the land for development, and/or compliance with the freeboard requirements set out in the New Zealand Building Code and WBOPDC Development Code. Further, the modelling shows that all major overland flow paths for rainfall events up to, and including the 1% AEP event, are contained within the stream corridors. Clearly, this is an advantageous starting position for development of a Structure Plan and CMP.

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[6] *Omokoroa Stage 3 –Natural Hazards Risk Assessment* prepared for Western Bay of Plenty District Council. Tonkin & Taylor Limited. June 2020.

[7] The maximum flood extent resulting from rainfall and storm tide combinations with a joint probability of 1% AEP.

Consequently, this CMP's approach to water quantity management predominantly focuses on avoidance and mitigation of stream erosion, not avoidance or mitigation of flood hazard effects on infrastructure and buildings. The exception is where there is private property or infrastructure downstream that would be adversely affected by an increase in flood levels due to increased stormwater attributable to development within Stage 3.

7 Receiving environment

7.1 Streams

7.1.1 Stream classification and erosion susceptibility

In general, streams within the site will play an important role in conveyance of stormwater runoff as well as providing ecological, cultural and amenity value. Further, if not appropriately managed, stormwater runoff from impervious surfaces can adversely affect stream health through increased contaminant and sediment loads, which can negatively impact on instream biota and water quality. Impervious surfaces also result in changes in hydrology, particularly increased flow velocity, peak flows and duration of stream bank-full flows, all of which can lead to stream erosion. Erosion contributes to sedimentation within streams and the downstream marine environment. Sedimentation negatively impacts instream and intertidal habitat.

To ensure the streams' function and their effect on the receiving environment was appropriately understood and factored into the T+T 2020 Conceptual Water Sensitive Design Plan, T+T characterised the streams within the site and their erosion susceptibly. All streams were visually assessed for character and erosion susceptibility during a two-day site visit in November 2019. The existing wetlands at the site are "online" within the streams and so for this CMP, are treated as streams.

All streams on site were assessed as soft bedded and first order. Most of the streams throughout the site have been characterised as "valley fill" stream types. Valley fills generally have discontinuous channels (i.e., no defined channel) and are rare and sensitive stream types linked to erodible soils. Valley fill stream systems play an important role in regulating flood flows and facilitating surface water and groundwater interactions. An increase in flow volumes or velocities may promote incision, channelisation and the subsequent loss of the "valley fill" morphology.

In some of the reaches, willow cover is providing a degree of protection from incision. If the willows are to be removed in the future, then this should be undertaken giving careful consideration to the stability and integrity of the valley fill systems, including staged removal of willow and underplanting of indigenous vegetation.

All streams within the site are spring fed, with either perennial or ephemeral springs located at the head of these systems.

Erosion susceptibility has been scored for each reach based on several factors. These factors included channel slope, bank slope, observed erosion, channel modification and riparian vegetation. Weightings were applied to each factor depending on its importance in determining erosion potential. Based on this assessment method and as shown in Figure 7.1 below:

- 35% of the reaches on site have high erosion susceptibility of both their bed and banks.
- 50% of the reaches on site have moderate erosion susceptibility of their banks only.
- 60% of the reaches on site have moderate erosion susceptibility of their bed only.
- 10% of the reaches (two reaches) have low bank erosion susceptibility.

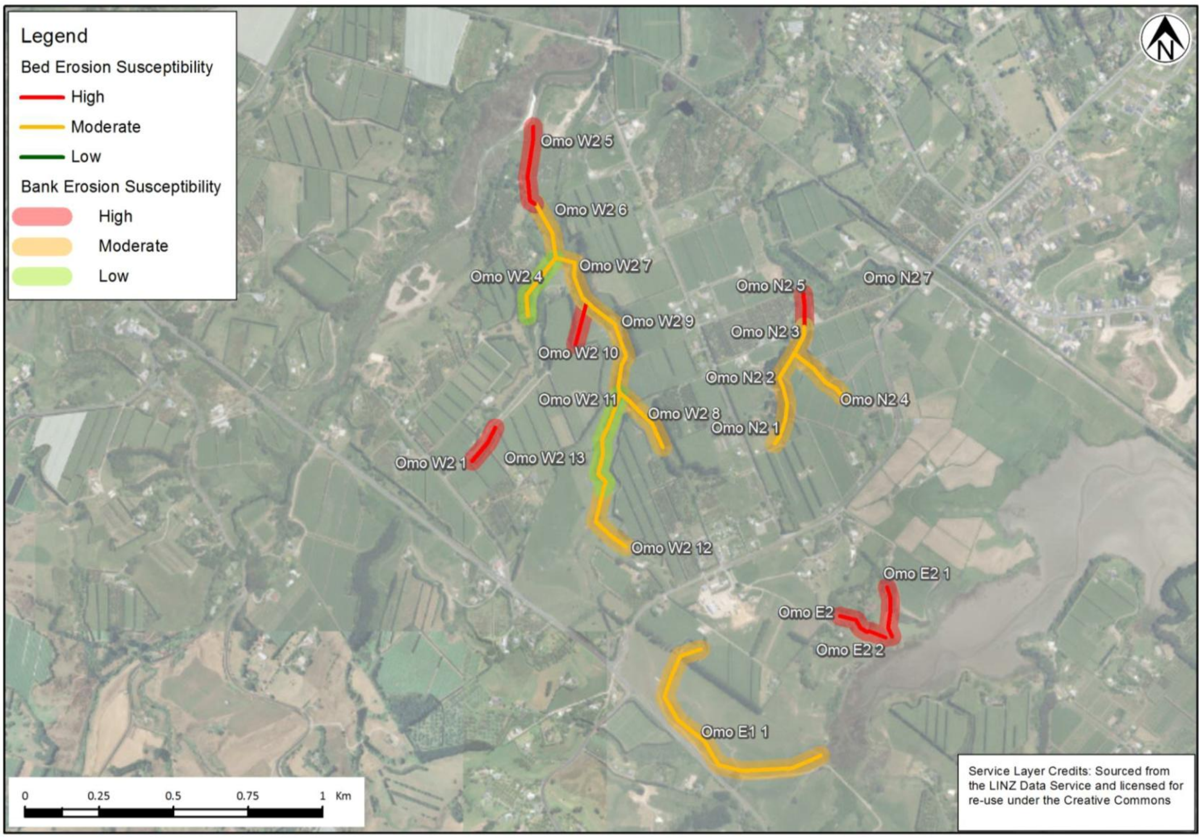

Figure 7.1: Erosion susceptibility scores for steam banks (thick lines) and steam beds (thin lines) on site

The erosion susceptibility of streams on site is elevated due to the unconsolidated and fine-grained nature of sediments in the bed and banks, steep sloped banks, bank shape and evidence of erosion already occurring.

Based on the above, stormwater management for the site should:

- Avoid degradation of valley fill morphology through vegetation and stormwater volume and velocity management.
- Maintain the existing surface water and groundwater interactions to ensure adequate flows are maintained in the streams.

These objectives have informed the development of the T+T 2020 Conceptual Water Sensitive Design Plan, the Stage 3 Stormwater Management Concept annexed as Appendix A and Sections 12 – 15 of this CMP.

7.1.2 Instream ecology

T+T assessed instream habitat and ecological value of the streams within the site using the Rapid Habitat Assessment ("RHA") methodology in 2020 as part of the development of the Conceptual Water Sensitive Design Plan. Stream reaches traversing a wetland were classified and assessed as "streams" and the RHA applied.

The RHA scores habitat based on several parameters, with the total score providing a condition ranking for habitat. The potential for other ecological functions outside of general habitat (such as spawning and detritus sorting) and water quality parameters (which may impact on habitat value or ecological function) were also considered. Figure 7.2 shows the assessed habitat classification for each stream reach within the site.

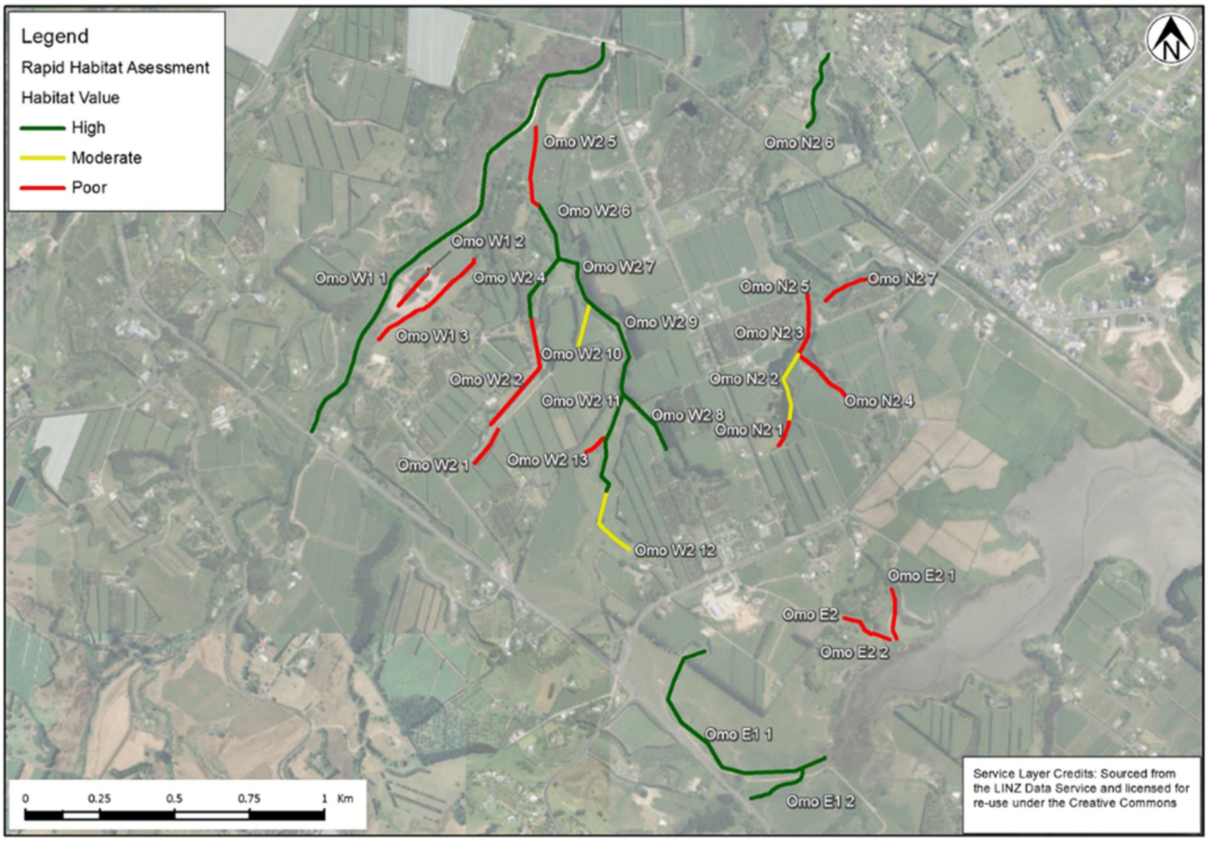

Figure 7.2: Habitat Value classification for stream reaches throughout the site

In summary, Figure 7.2 and site observations demonstrate that:

- The stream that flows into the Mangawhai Estuary head and the Waipapa River itself have high ecological values at the interface with estuaries. This high value is attributed to the presence of native fish spawning habitat, comparatively less human development/intervention, and a higher proportion of indigenous plant species.
- The mid reaches of the main tributary flowing to the Waipapa River and the stream that flows into the Mangawhai Estuary head have high ecological values due to comparatively more varied instream habitat, vegetation canopy coverage, intact riparian margins, and fewer fish passage restrictions.
- All other reaches have moderate to poor habitat and ecological values due to a range of factors including a lack of hydraulic diversity, lack of shade and in-stream organic matter (due to lack of riparian vegetation) and no provision for fish passage.

Overall, the in-stream habitat and ecological value of all reaches throughout the site was assessed as being "moderate". Modifications of the headwater areas of all reaches have altered ecological character, through damming, bank modification, vegetation clearance, and livestock damage. However, some headwater reaches have been fenced and planted with indigenous riparian vegetation and overtime could improve in value.

No fish were observed during the 2020 T+T site assessment. Records from the New Zealand Freshwater Fish Database (NZFFDB, 2019) suggest some indigenous species may be present within the site (such as Longfin eel, Shortfin eel, Torrent fish, Banded Kōkopu, Īnanga, Common Bully, Giant Bully and Redfin Bully). T+T identified several partial fish barriers during the 2020 site assessment.

These barriers are in the mid-reaches of the streams in the centre of the site and may be limiting the number, distribution and diversity of indigenous fish throughout the site, especially in the upstream or headwater reaches, where suitable fish habitat exists.

In 2021, T+T undertook a classification and delineation[8] of potential "natural wetlands" within areas which would be affected by the construction and use of potential engineered stormwater treatment wetlands contained in the Conceptual Water Sensitive Design Plan. The 2021 T+T Wetland Report provides extensive detail relating to wetland vegetation, wetland soils and wetland hydrology in key areas of the site.

Based on the above, stormwater management for the site should aim to avoid or mitigate sedimentation and increased flow velocity related effects on the spawning habitat within the mid reaches of the main tributary flowing to the Waipapa River, the stream that flows into the Mangawhai Estuary head and the Waipapa River.

The BOPRC have confirmed that they have not undertaken any reporting on the instream habitat and ecological value of the Waipapa River or its tributaries located within the site.

7.2 Marine

Most of the streams on site discharge to the Waipapa Estuary. Two small streams discharge to the Mangawhai Estuary. Both estuaries are the ultimate receiving environment for stormwater from the site.

The most relevant report to this CMP prepared by the BOPRC, in terms of the existing state of the Estuaries, is the 2020 Estuary Monitoring Report[9]. This report provides:

- An assessment of the level of contaminants contained in sediment against national environmental guidelines.
- Spatial data to assess sediment contamination trends over time.
- Data to help with interpretation of benthic ecology (macrofauna) health.

The BORPC collected annual sediment samples from sites within both estuaries[10] between 2015 and 2020 and had the samples analysed in a laboratory for particle size distribution, total nitrogen, total phosphorus, metals and total organic carbon. Mean concentrations of the analytes over the 5 year period were then compared to the ANZG 2018 ISQG - low guideline values ("the guideline values"). Shellfish sampling, water sampling and analysis of samples for PAH, pesticides and emerging organic contaminants was undertaken in other estuaries of Tauranga Harbour, but not the two subject Estuaries.

The results of the BOPRC sampling and analysis undertaken to date show that:

- The measured levels of metals in the sediment samples were below the guideline values.
- Whilst below the guideline values, cadmium levels in the Mangawhai Estuary samples were comparatively high.
- Trend analysis show Arsenic, Cadmium and Zinc levels to be increasing at site Tau 39 (Tauranga Harbour seaward of the Waipapa Estuary).

[8] *Omokoroa Structure Plan – Wetland Delineation and Options Report* prepared for Western Bay of Plenty District Council. Tonkin & Taylor Limited. October 2021.

[9] *Bay of Plenty Comprehensive Contaminant Report 2020* – Bay of Plenty Regional Council Environmental Publication 2021/07. Bay of Plenty Regional Council. July 2021.

[10] Site Tau P37 is located in the Mangawhai Estuary near the railway approximately opposite Anglers Way. Site Tau P40 is located in Tauranga Harbour at the outlet of the Waipapa Estuary approximately opposite the end of Kaylene Place.

The BOPRC outline in their report that the increase in metals at the Waipapa Estuary site could be attributed to seagrass affecting hydrodynamics, and causing finer sediments (which metals adsorb more readily to) to deposit in the sampling site, rather than the finer sediments being flushed into subtidal areas where they are transported away from the site. Further, the BOPRC outline that cadmium is generally associated with phosphate fertiliser use. It is considered the uptake of urban development within the site will reduce cadmium discharges to the Mangawhai Estuary.

The BORPC conclude that spatial trends identified in their report show that generally sheltered urbanised estuarine areas are “hotspots” for metals to deposit in estuarine water. Copper, zinc and lead have been measured at levels exceeding ANZG 2018 Default Guideline Values (DGV) in estuarine water in more intensely developed parts of Tauranga Harbour, such as Welcome Bay.

Based on the above, stormwater management for the site should aim to avoid or mitigate the potential for metals and hydrocarbons to become entrained in stormwater and sediment and discharge to the Estuaries.

8 Catchment constraints and opportunities

Based on the catchment and receiving environment descriptions provided above, there are some constraints and opportunities relevant to stormwater management under this CMP. These constraints and opportunities are summarised below:

Table 8.1: Summary of constraints and opportunities

	Constraint	Opportunity
Water quantity	· The stream corridors play an important role in stormwater conveyance, flood storage, amenity and ecological habitat and should be preserved and enhanced to the extent practicable. · Slope instability risk may preclude the use of infiltration and unlined bioretention devices in some areas. · There are existing flooding issues in the golf course downstream of the site.	· Stage 3 comprises predominantly a greenfield area which provides an opportunity to incorporate WSUD to maintain pre-development hydrology and consider alternative approaches. · The site is relatively flat outside of the stream gully corridors. This topography is conducive to the use of devices such as swales. · WSUD provides some opportunity for on-site infiltration to improve aquifer recharge and stream baseflow. Within Stage 3 the influence of infiltration on recharge is not substantial, due to the site’s position in the catchment (i.e., the groundwater table intersects with the estuaries which form the catchment boundaries) · There are currently several existing ponds/storage areas that can be utilised for stormwater management. · Other than the flooding issues within the golf course, there are no other known downstream flood risks. · Flooding has been demonstrated by modelling to be confined to the stream gullies i.e., the developable land is not floodable.

	Constraint	Opportunity
		· There are several sub-catchments within the site that discharge directly to the Tauranga Harbour. This reduces the need to manage stormwater quantity in these areas, provided stream erosion is not a concern.
Water quality	· Urban development of the site could increase sediment loads during construction phases and increased metal and hydrocarbon concentrations in stormwater discharge could result from land use change which negatively impact instream biota and water quality.	· The change in landuse from rural to urban is an opportunity to reduce sediment and nutrient loads in freshwater systems and in the marine environment if sediment loads during earthworks are carefully managed.
Erosion	· Soil characteristics, slope angles and groundwater conditions on site can result in heightened erosion susceptibility. This susceptibility can be further aggravated by point source discharges from stormwater outfalls. · Valley fill streams are susceptible to erosion. New impervious surfaces can result in changes in hydrology, particularly increased flow velocity, peak flows and duration of stream bank-full flows, all of which can lead to stream erosion. Erosion contributes to sedimentation within streams and the downstream marine environment. Sedimentation negatively impacts instream and intertidal habitat. Erosion of valley fills drives morphological change and alters their function in terms of ground and surface water interactions.	· In some of the reaches, willow cover is providing a degree of protection from incision. Staged removal of the willows and underplanting of indigenous vegetation could enhance ecological values. · The stream corridors are generally accessible for planting of riparian vegetation to introduce shade and organic matter to streams. · A WSUD approach can reduce the volume of stormwater generated and provide disconnection between the source and the receiving environment. These outcomes will reduce erosion and consequential sedimentation potential.
Ecology	· As above, erosion, sedimentation and contaminants entrained in stormwater associated with increased stormwater flows and change in land use can adversely impact instream and marine biota.	· In some of the stream reaches removal/modification of artificial fish passage barriers will improve the ability of migrant fish species to access upstream habitat. · The site contains several streams and wetlands with high ecological values. These could be enhanced to regulate stream flows and enhance ecological functions.

9 Water quality

Contaminant sources for the site include those typically associated with urban land use. These sources are roads, carparks and building materials. These sources produce the following contaminants which become entrained in stormwater runoff:

- Primary contaminants: Metals, hydrocarbons and suspended solids, with suspended sediment from construction being the greatest concern.
- Secondary contaminants: Nutrients, gross pollutants and possibly emerging organic contaminants ("EOC") such as microplastics.

Table 1.2 of the BOPRC Stormwater Strategy[11] sets out typical suspended solid concentration ranges for the Tauranga Area within stormwater generated for residential, commercial and industrial land use activities (all proposed within Stage 3) under "high" and "low" flow conditions. The BOPRC Strategy states that NIWA have independently studied typical suspended solid concentrations in the Rotorua Area, and that the results are similar to the BOPRC results for the Tauranga Area.

Table 1.3 of the BORPC Strategy also sets out typical nutrient, metal, faecal coliform and chemical oxygen demand concentration ranges for a range of land use scenarios. Table 1.3 is based on "TP 10"[12] and states that studies conducted in the Bay of Plenty suggest the contaminant concentrations provided in Table 1.3 for Auckland are conservative if being applied in the Bay of Plenty. The BOPRC Strategy concludes that appropriately designed structural or engineered treatment measures based on best practice will effectively reduce contaminant loadings.

Auckland Regional Council (the forerunner to Auckland Council) developed a Contaminant Load Model[13] ("CLM") with associated Load Reduction Factors ("LRF"). The CLM provides typical contaminant loads for Total Suspended Solids (TSS), some metals and hydrocarbons for a range of land use activities (as termed by the authors) such as roofs, roads and construction sites. The CLM then assigns LRF to these land use activities based on different treatment devices. In summary, the LRF for the treatment devices nominated within the treatment trains in this CMP vary.

A representative scenario to Stage 3 would be the LRF provided for stormwater sourced from roads being treated within a constructed wetland. The LRF are TSS (0.80), Zn (0.6), Cu (0.7) and TPH (0.6). If a swale was to be used up-catchment of the constructed wetland, then the LRF for roads would be TSS (0.75), Zn (0.40), Cu (0.5) and TPH (0.4). Consequently, when used in series, such as the case in the treatment trains in this CMP, the treatment devices can aggregately achieve higher LRF than those stated above for single devices, which means contaminant concentrations will be negligible in the receiving environment.

No contaminant modelling has been undertaken to develop this CMP. This is because:

- The BOPRC Strategy states that best practice will effectively reduce contaminant loadings.
- The treatment trains represent best practice. This is evidenced by their disconnection and pre-treatment focus, as well as their unique targeted approach taken to Industrially Zoned sites and Arterial Roads. This targeted approach to contaminant potential is consistent with the Auckland Council's "high contaminant generating activities approach".
- The CLM and associated LRF demonstrate contaminants will be effectively assimilated by the treatment devices within them, which act in series to ensure contaminant concentrations are negligible within the receiving environment.
- The results of the BOPRC monitoring of sediment in the Waipapa and Mangawhai Estuaries demonstrate that metal related sediment guideline values for the protection of the environment are being met at present. There is no reason to consider that the current

[11] *Stormwater Strategy for the Bay of Plenty Region -Environmental Publication 2005/20.* Bay of Plenty Regional Council. October 2005.
[12] *Stormwater management devices: Design Guidelines Manual - ARC TP10, Second Edition*, Auckland Regional Council. May 2003
[13] *Development of the Contaminant Load Model*. Auckland Regional Council Technical Report 2010/004 Auckland Regional Council 2010.

predominantly greenfield catchment of Stage 3 would be resulting in PAH and EOC contaminants entering Te Awanui.

Overall, the treatment trains, supplemented by the Structure Plan rules, the proposed Best Practice Guidelines and the proposed Small Site Earthwork Guidance will collectively provide a high degree of confidence that potential adverse effects of urban stormwater sourced from Stage 3, on water and sediment quality in Te Awanui, will be appropriately avoided or mitigated and that ANZG 2018 guidelines will continue to be met. Further, all structural controls contained in the treatment trains and non-structural controls to be included in the Structure Plan rules are recognised within industry as being effective in stormwater contaminant removal and none are new or experimental in nature.

10 Engagement and consultation

WBOPDC recognises its obligations to engage with its Tangata Whenua partners in the development and implementation of this CMP.

WBOPDC convened a hui with Tangata Whenua of the Ōmokoroa area on 10 June 2022 to discuss stormwater management for the Ōmokoroa urban area. At the hui, WBOPDC provided an overview of the 2002 CMP and this CMP and the process they are about to commence to renew the Ōmokoroa CDP, which is due to expire in May 2023. WBOPDC then explained that they would like to engage to finalise the development and implementation of this CMP and the future CMP for the balance of Ōmokoroa, as well as the core stormwater management approaches in Ōmokoroa. One desired outcome of the engagement will be that key Mātauranga Māori principles are imbedded into the CMP and/or their associated Monitoring Plans, which reflect Te Mana o Te Wai. WBOPDC and Tangata Whenua have agreed to wānanga where they will work collaboratively on these issues, with the first of these occurring in July 2022.

WBOPDC have been consulting with the Community on Stage 3 since 2017 with the most recent open day held on 26 May 2022. A draft version of this CMP was available for public review at the most recent open day. In addition, through WBOPDC's "have your say" email address the public are able to make a booking to discuss Stage 3, including the draft CMP and wider stormwater management issues for the Ōmokoroa urban area.

Further, WBOPDC has dedicated webpages for Stage 3 including:

https://www.westernbay.govt.nz/council/news-and-updates/news?item=id:2iebr8l2c17q9s626alz

https://haveyoursay.westernbay.govt.nz/Ōmokoroa-lets-talk-housing

WBOPDC have been consulting on Stage 3 with Developers regarding Stage 3 and the stormwater management requirements set out in this CMP.

11 2002 CMP and existing CDP requirements

The 2002 CMP and Ōmokoroa CDP contain key considerations and requirements for stormwater management in Stage 3. These are reproduced in abbreviated form as:

- Stormwater discharging to Tauranga Harbour should be of a high quality.
- Slope instability issues are not exacerbated by stormwater disposal.
- Impervious areas can adversely affect instream biota and water quality.
- Stream corridors could be reserved from development and enhanced.

There is significant commonality between the 2002 CMP and CDP, in so far as limiting impervious areas, using swales and other WSUD measures to reduce rates, volumes and contaminant loads in stormwater, and avoiding significant adverse effects on instream biota.

12 This CMP's requirements

12.1 Overall management framework

The stormwater objectives and the basis for developing the stormwater management framework for Stage 3 are presented below. The stormwater management framework is aligned with the WSUD philosophy and is consistent with Objective 2.1 of the NPS-FM, and is as follows:

1. Source control: minimise the generation of runoff and contaminants through:
   - Clustering development
   - Minimising soil compaction through earthworks
   - Using inert building materials
   - Reducing impervious areas
2. At source management: manage stormwater as close to the generation source as possible through:
   - Capturing and reusing stormwater
   - Permeable paving and living roofs where appropriate
   - Revegetation
   - Infiltration of stormwater where appropriate
3. Filtering and conveyance: treat and slow runoff as it moves through catchment though:
   - Use of swales where appropriate
   - Use of pre-treatment where appropriate
4. Downstream treatment devices: green infrastructure incorporating bioretention and detention to achieve multiple objectives by:
   - Mimicking natural physical, biological and physical treatment processes
   - Utilising infiltration to maintain stream base flows and assist with aquifer recharge in headwater areas of the streams located in Stage 3
5. Enhancement of receiving environment: protect and enhance natural systems by:
   - Reserving stream corridors from development
   - Undertaking riparian planting
   - Protecting streams from erosion through items 1-3 above
   - Removing existing barriers to fish passage
   - Ensuring water quality and ecological values in the streams and Tauranga Harbour are not affected by sediment and other contaminant loads in stormwater

The stormwater management framework is intended to be hierarchical in nature with the top of catchment-based interventions, source control and at source management, given primacy due to them being the most influential in managing stormwater quality and quantity.

12.2 Water quality

The WSUD based stormwater management framework above provides an opportunity for contaminant concentrations to be reduced at source and managed throughout a series of interventions in a treatment train[14]. The following principles inform the treatment trains set out in the following sections:

- Water quality treatment will be applied to all impervious surfaces (except for those in rural-residential zones) with a focus on providing a higher level of treatment for the land uses which have the greatest potential to contribute contaminants to stormwater (e.g., Industrial Zones and arterial roads). This focused approach to contaminant potential is consistent with the Auckland Council's[15] "high contaminant generating activities" approach.
- Within Industrial Zones a cascading approach will be taken to stormwater management. This will involve:
  - Private stormwater component: High Risk Activities[16] being required to internalise their activities and potential discharges to buildings, all activities providing pre-treatment through measures such as proprietary devices for yard sourced stormwater, and yards are constructed to have positive fall to the public road.
  - Public stormwater component: Swales slowing and treating stormwater as it is conveyed to engineered wetlands for water quality treatment and extended detention, where necessary for mitigation of stream erosion (see below).
- In Medium Density Residential and Commercial Zones, a decentralised approach comprising raingardens, swales and similar is generally preferred to engineered wetlands for water quality treatment, except where existing informal stormwater ponding areas and artificial ponds could be retrofitted into treatment wetlands. In these circumstances, it is proposed that these natural storage areas are converted to engineered wetlands to be utilised instead of decentralised devices. The number of new centralised storage devices is proposed to be minimised as far as practicable, because wetlands treat at the bottom of a catchment and this approach is inconsistent with the hierarchal approach described earlier.
- Wetlands are to be "offline" to avoid contaminant sinks being established within the streams and minimise any need to undertake earthworks or drain water within a natural wetland as defined and regulated under the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 when constructing the wetlands.

12.3 Stream erosion

The following principles inform the treatment trains set out in the following sections:

- For sub-catchments W2a and W2b that do not discharge directly to Tauranga Harbour, extended detention will be provided for the 90th percentile rainfall event to mitigate stream erosion. This is because stream channel formation is predominantly driven by flowrates below bankfull flow, which typically occurs during a 2 year ARI or smaller event[17].
- Extended detention of the 90th percentile rainfall event will not be provided for sub-catchments W1, E2 and N1. This is because these reaches are near Tauranga Harbour, have

[14] A treatment train is the combination of sequential stormwater management responses that collectively deliver stormwater quality and quantity objectives for a site.
[15] *Auckland Unitary Plan stormwater management provisions: Technical basis of contaminant and volume management requirements – Technical Report 2013/03.* Auckland Council. August 2013.
[16] As defined in Section 4 of the Regional Natural Resources Plan.
[17] *A Rehabilitation Manual for Australian Streams: Volume 2*. Land and Water Resources Research and Development Corporation and Cooperative Research Centre for Catchment Hydrology (Monash University). March 2000

short flow paths, a lack of grade and high tailwater levels, which collectively reduce stream erosion potential.

12.4 Water quantity

The following principles inform the treatment trains set out in the following sections:

- Currently, the only sub-catchment requiring attenuation is N2 and this is provided by the existing pond. This is because land downslope in the vicinity of Kaylene Place and the Golf Club is susceptible to flooding and development of the said sub-catchment is likely to exacerbate this susceptibility. It is possible that sub-catchment N1 could require attenuation to be provided in Wetland N1 if the future hydraulic assessment referred to in Section 14.1 determines this to be necessary.

12.5 Slope stability

Given the history of landslides in Ōmokoroa (particularly at the distal end of the peninsula), the approval process will need to consider the effect stormwater disposal will have on slope stability. The detailed design process should address the appropriateness (or otherwise) of soak holes (including those for roof downpipes), unlined bioretention devices, and demonstrate that overland flow paths in "developable areas"[18] are appropriate/managed to ensure slope instability issues do not arise. Site specific soakage and geotechnical investigations should be undertaken by Developers to inform the approval process.

12.6 General requirements

General structural and non-structural controls also apply within Stage 3. These general requirements will be met through either the Structure Plan rules or the approval process through the application of the Best Practice Guidelines prepared by WBOPDC. Table 12.1 sets out the requirements.

Table 12.1: General structural and non-structural controls

Requirement	Structure Plan Rule or Best Practice Guideline
Maximum impervious surface limits apply to the Medium Density Residential and Rural Residential Zones to reduce the generation of stormwater. These limits could encourage the adoption of alternative development forms, such as multi-storey dwellings or mitigation measures such as pervious pavement/living roofs. Imperviousness limits may be able to be exceeded on a case-by-case basis if onsite mitigation is provided, such as detention/retention using a raintank with non-potable reuse.	Structure Plan Rule
Impermeable areas associated with roads should be minimised. This could be achieved by reducing road widths, having footpaths on one side of the road, having a joint footpath cycleway and or using pervious pavement or "gobi" blocks or similar for on street parking.	Best Practice Guideline
Utilising inert exterior building materials to minimise the generation of contaminants (i.e., no unpainted zinc or copper products that would result in soluble metals become entrained in stormwater unless additional treatment provided).	Structure Plan Rules

[18] Numerical modelling shows that all major overland flow paths for rainfall events up to and including the 1% AEP are contained within the stream corridors.

Requirement	Structure Plan Rule or Best Practice Guideline
Generally, swales should be preferred over raingardens, as swales also provide a conveyance function, thereby reducing the need for piping, and are less costly to construct and maintain.	Best Practice Guideline
"Green" outfalls should be considered for pipe outlets. A green outfall involves a length of naturalised open channel incorporating vegetation and roughness elements to reduce flow velocities and associated energy before stormwater reaches the receiving environment. Where pipe outlets are located on steep topography then appropriate energy dissipation will need to be incorporated into the outlet itself to mitigate the potential for local scouring effects to result.	Best Practice Guideline
Overland flow paths for large rainfall events (i.e., up to and an including a 1% AEP event) need to be identified and protected at a subdivision Scheme Plan scale as part of the approval process.	Structure Plan Rules
Pedestrian and transportation links which traverse stream gullies should not impede flood flows or create barriers to fish passage. The number of stream crossings should be minimised and, where they are required, should be in the form of bridges or fords (for pedestrian and cycleway crossings). Culverts should be avoided.	Best Practice Guideline
Maximise the use of vegetation throughout the development. Trees should be used where possible in road corridors, stream corridors and other public reserve areas to reduce the temperature of stormwater runoff entering the receiving environment and provide shading of stream corridors to improve ecological habitat value. All engineered treatment wetlands should have appropriate planting to reduce temperature effects to the extent practicable.	Best Practice Guideline
Existing sub-catchments boundaries within the site should remain largely unchanged to ensure that the volume of stormwater assessed as being appropriate for extended detention to mitigate against the potential for stream erosion remains applicable.	Best Practice Guideline

12.7 Construction erosion and sediment control

Sediment presents one of the greatest contaminant-based risks to the streams, as well as the Mangawhai and Waipapa Estuaries. Consequently, it will be crucial to ensure robust Erosion and Sediment Control Plans ("ESCP") accompany subdivision, land use consent and earthwork consent applications for development of the site. The ESCP will need to be prepared in accordance with the BOPRC's Guidelines[19] and approved by the BOPRC. To address sediment related risk associated with earthworks undertaken at a scale which do not require resource consent (i.e., for individual building platforms) WBOPDC intend to develop guidance like that Tauranga City Council (TCC) have[20].

Engineered wetland N1 is adjacent to a natural wetland. The BOPRC have identified that there is potential for suspended sediments to deposit in and damage the natural wetland as a consequence of physical works to retrofit the existing constructed pond into an engineered wetland (see Section 14.2). The detailed design of engineered wetland N1 will ensure that there is a buffer maintained between the natural wetland and the engineered wetland. Further, the detailed design

[19] *Erosion and Sediment Control Guidelines for Land Disturbing Activities – Guideline 2010/01*. Bay of Plenty Regional Council. June 2010.
[20] https://www.tauranga.govt.nz/Portals/0/data/council/water_services/water_advisory/files/managing_sediment_pollution.pdf

will be accompanied by a robust ESCP. Between these two measures, the natural wetland adjacent to N1 will not be affected by suspended sediment deposition.

12.8 Revegetation concept

Revegetation on site will assist with achieving multiple objectives, such as retaining valley fill morphology, improving ecological habitat through provision of shade and organic matter to streams, and reducing temperature in stormwater runoff. It is anticipated that revegetation will be undertaken across the site in a staged manner with focus given to the stream corridors, public roads, walkways/cycleways and public reserves. WBOPDC will prioritise riparian planting within the stream reaches that have been identified by T+T as having “high erosion susceptibility” of both their bed and banks (see Section 7.1.1). Revegetation within “developable land” will be a requirement of Developers through the approval process, whereas revegetation of the stream corridors will be undertaken by WBOPDC through Annual Plan related capital works programmes. WBOPDC will engage a suitably qualified and experienced person to develop and oversee the implementation of riparian planting programmes for the stream corridors.

13 Stormwater Management Concept

13.1 Treatment train principles

A conceptual treatment train has been developed for each of the land use zones within Stage 3. The conceptual treatment trains are set out on Figure 13.1 and shown on a larger figure annexed at Appendix A.

In developing the treatment trains WBOPDC’s objective was two pronged:

- To meet the catchment objectives set out in Section 3.
- To facilitate an increase in the uptake of WSUD solutions by Developers.

To ensure the second bullet retained its relevance throughout the life of the CMP, the treatment trains have been based on an outcomes-focused toolbox that gives Developers and WBOPDC flexibility to choose solutions that are fit for purpose as development in Stage 3 takes shape and evolves over years to come. It is envisaged that detailed design of stormwater systems and the approval process will ensure specific stormwater design solutions respond to the objectives of this CMP. Such an approach will provide certainty that the catchment objectives set out in Section 3 are met on an ongoing basis and account for cumulative effects of stormwater discharges from the catchment.

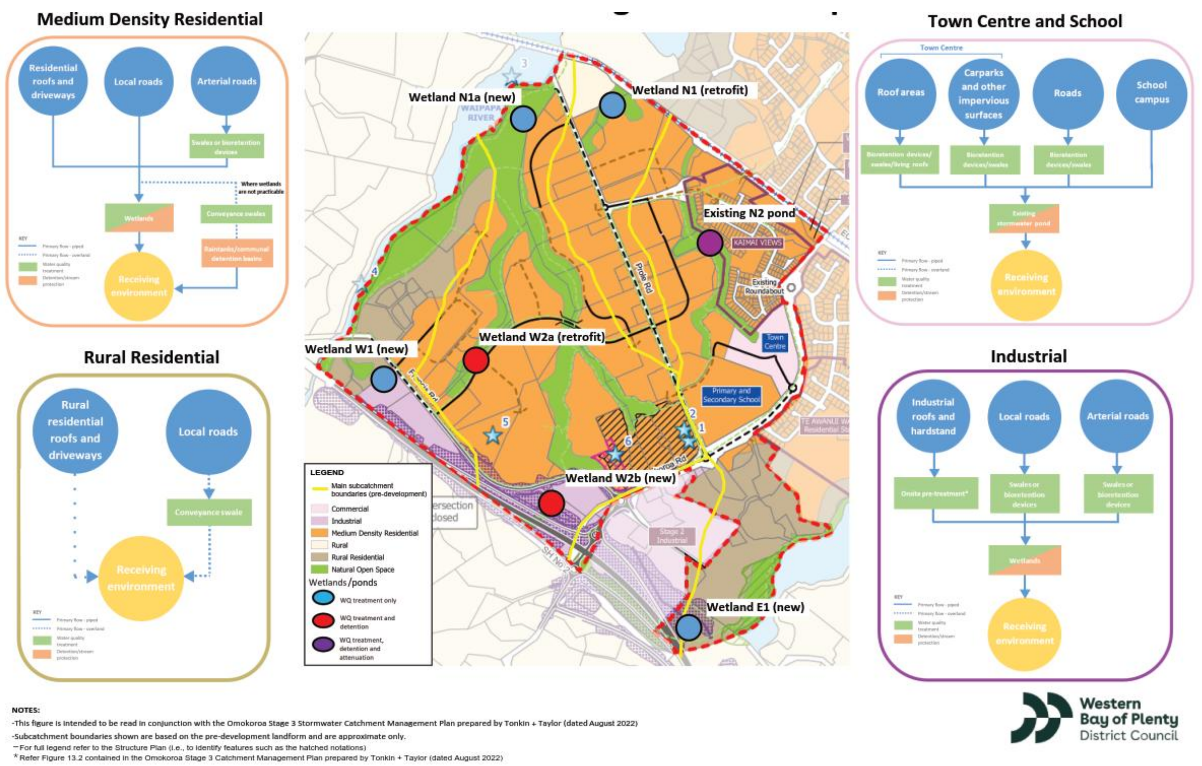

Figure 13.1: Stage 3 Stormwater Management Concept

13.2 Zone specific treatment train detail

Where specific requirements or explanation of the treatment trains is required then this is detailed below.

To maximise the potential to disconnect impervious areas from the receiving environment and avoid or mitigate adverse effects on the receiving environment, two additional structural controls could be incorporated into the treatment train; these are:

- Downpipes from residential roofs could be discharged above ground to grassed “yards” within individual residential allotments or communal areas serving several allotments. This approach would result in some of the stormwater infiltrating into the soils with contaminants being assimilated, and the balance of the stormwater being pre-treated through filtering prior to it arriving in a pipe network and being conveyed to the engineered wetland.
- Permeable paving with underlying storage and drainage to a pipe network could be used in driveways. This approach would provide similar benefits to those described for downpipes above.

13.2.1 Industrial zone

To maximise the potential to disconnect impervious areas from the receiving environment and avoid or mitigate adverse effects on the receiving environment a cascading approach will be taken to stormwater management. This will involve:

- Private stormwater component: High Risk Activities being required to internalise their activities and potential discharges to buildings, all activities providing pre-treatment through measures such as proprietary devices for yard sourced stormwater, and yards being constructed to have positive fall to the public road.

- Public stormwater component: Swales slowing and providing a degree of treatment to stormwater as it is conveyed to engineered wetlands for water quality treatment and extended detention, where necessary for mitigation of stream erosion.

The cascading approach is shown as "on site pre-treatment" on the Industrial Zone treatment train.

Figure 13.2 shows the general concept of the cascading approach to stormwater management for individual sites in Industrial Zones. It is anticipated that the approval process will ensure the concept, or similar concept which achieves the same outcome, is provided on each industrial site. The concept assumes that industrial site yards are graded such that positive fall is provided to roads and that the stormwater from yards arrives in the swales as a sheet flow. Bioretention devices, such as raingardens, will not be practicable due to the number of these devices required for such large impermeable areas.

The basic premise of the cascading approach is that contaminants from industrial processes are contained in a closed system within a building, that the "private" stormwater is pre-treated on the industrial site prior to arriving in the "public" system at the site/road interface, and that the swales convey the stormwater to the downstream engineered wetland.

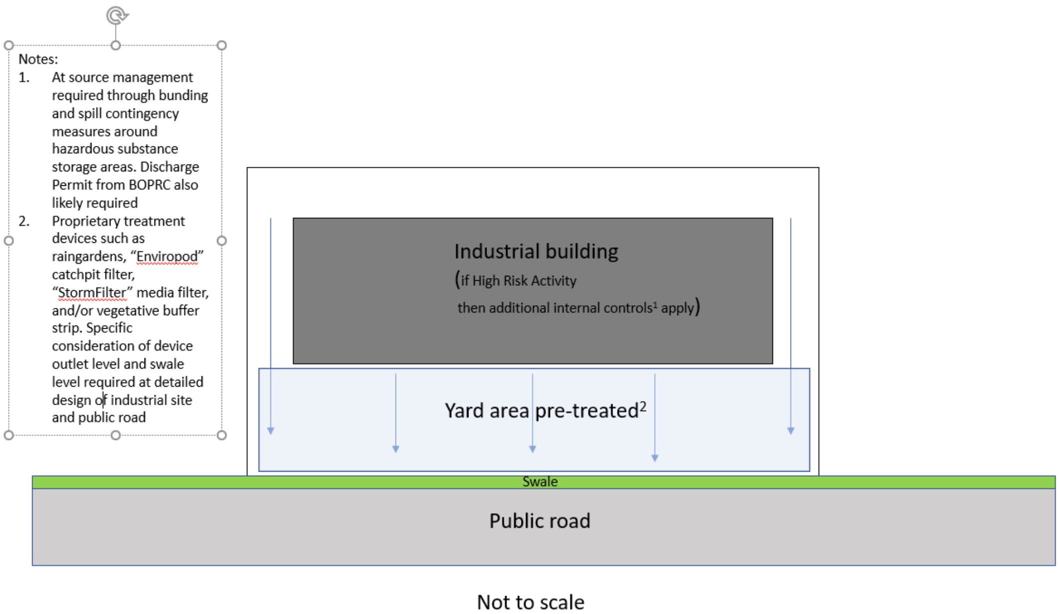

Figure 13.2: Stormwater management concept for individual industrial sites.

13.3 Rural residential

It is assumed that within this zone land use change is likely to be minor and that impermeable areas will be insignificant. On this basis, it is proposed that no formal water quality treatment of dwelling roofs or driveways is provided. This is because these impervious surfaces are generally disconnected (i.e., runoff must travel over pervious surfaces to the receiving environment) so informal treatment of stormwater will be achieved.

The comment provided relating to downpipes within the Medium Density Residential Zone equally applies to this zone. Permeable paving is considered unlikely practicable due to the likely length of driveways.

13.4 Best Practice Guidelines

The WBOPDC Development Code does not currently contain standard drawings for the structural controls shown in the treatment trains above. Consequently, to assist Developers and their Consultants with and inform the design of stormwater systems for the approval process, Best Practice Guidelines will be prepared by WBOPDC as a separate workstream. There are numerous existing guidance documents prepared by Auckland Council, Wellington Water, New Zealand Transport Agency, TCC and the BOPRC that will be drawn on to produce the new WBOPDC guidelines.

14 Engineered wetlands

14.1 Concept

Overall, three new wetlands are proposed for managing stormwater sourced from the Industrial Zones. For the Medium Density Residential Zones, it is proposed that the two existing informal stormwater ponding areas and artificial ponds are retrofitted into treatment wetlands and a new treatment wetland is constructed at the northern end of Prole Road to service this zoning. Figure 13.1 shows the indicative locations of the six new wetlands and the existing wetland located within the northeast quadrant of the site.

All six new wetlands will provide water quality treatment. The three wetlands that do not discharge directly to the Mangawhai and Waipapa Estuaries will also provide extended detention. The differing functions of the wetlands are shown on Figure 13.1 by way of colour coding.

As part of detailed design (including Wetland N1) for the area of the site contributing to Subcatchment N1 a hydraulic assessment should be undertaken. This assessment should consider the following matters relating to the existing 900 mm culvert under the railway:

- The culvert's capacity to pass increased peak flows of stormwater resulting from landuse changes within the site and whether any upgrade of the culvert is required.
- The following "related" effects relating to any potential upgrade of the culvert:
  - Increased water levels behind the railway embankment affecting the engineering performance of the embankment.
  - Increased water levels behind the railway embankment as a flood effect on KiwiRail owned land/assets.
  - Increased flows into the downstream land.

Notwithstanding that a future detailed design and hydraulic assessment needs to be undertaken, it is considered there are several potential scenarios and related pathways for providing Wetland N1 (or an alternative) in a manner which takes account of the culvert related issues. These scenarios and pathways include:

- The culvert can pass the increased peak flows with no related effects. In this scenario the concept for Wetland N1 provided within this CMP could proceed to detailed design without any further consideration given to the culvert.
- The culvert cannot pass the increased peak flows without related effects, but the effects are negligible in magnitude and/or consequence. In this scenario, the detailed design for Wetland N1 would not need to provide attenuation (if agreed with potentially affected parties) and no culvert upgrade is required.
- The culvert cannot pass the increased peak flows without related effects, and due to the magnitude and/or consequence of these effects an upgrade of the culvert is required. In this

scenario, the detailed design for Wetland N1 would not need to provide attenuation if the effects can be mitigated solely with an upgrade to the culvert.

- The culvert cannot pass the increased peak flows without related effects, and due to the magnitude and/or consequence of these effects the detailed design for Wetland N1 would need to provide attenuation. In this scenario, the concept for Wetland N1 provided within this CMP would need to be amended so that additional storage is provided. Creating more storage could necessitate undertaking earthworks in a natural wetland. We understand that the BOPRC consider that the NPS-FM provides a pathway for WBOPDC to undertake such earthworks.
- The culvert cannot pass the increased peak flows without related effects, and due to the magnitude and/or consequence of these effects the detailed design for the subdivision would need to provide attenuation devices within the developable land. In this scenario, the attenuation devices within developable land would be required because creating the additional storage by undertaking earthworks in a natural wetland is not viable from a regulatory perspective.

It is noted that the various means of addressing the effects outlined above are not mutually exclusive and may be employed in combination with one another.

During future subdivision consent design for Stage 3 it may become evident that, due to proposed modified topography, it is not practicable to drain stormwater to a downstream treatment wetland. In this scenario, decentralised controls can be adopted. It is envisaged that these decentralised controls would comprise treatment swales in the road for water quality treatment and onsite rain tanks or communal detention basins for areas where extended detention is required. An example of where this "alternative" might be implemented is the ridgeline midway between the eastern boundary of Subcatchment W2 and Prole Road. The Medium Density Residential Zone treatment train accounts for this alternative.

14.2 Engineered wetland details

In 2021, T+T undertook a classification and delineation[21] of potential "natural wetlands" within areas which would be affected by the construction and use of potential engineered stormwater treatment wetlands contained in the Conceptual Water Sensitive Design Plan. The 2021 T+T wetland report provided the following:

- Classification and delineation of potential wetlands within the engineered wetlands footprints as per the NPS-FM.
- High level regulatory implication advice for engineered wetland development considering the NPS-FM and the NES-F.
- Development of alternative options for stormwater management within Stage 3, based on regulatory constraints identified.

The results of the classification and delineation work was that, except for N1a[22], all indicative locations for the engineered wetlands encroached on natural wetlands. Further high-level assessment was then undertaken to present options for how the existing concept for providing centralised stormwater management could be modified for each indicative engineered wetland site to incorporate this new natural wetland spatial related constraint.

[21] *Omokoroa Structure Plan – Wetland Delineation and Options Report* prepared for Western Bay of Plenty District Council. Tonkin & Taylor Limited. October 2021.

[22] The BOPRC confirmed to WBOPDC this site would not be located within a natural wetland.

The options presented to avoid natural wetland disturbance and reduce associated resource consent risk were:

- Wetland N1:
  - Retrofit the existing constructed pond as a stormwater treatment pond; or
  - Excavate the ridgeline to the south-west and retrofit the constructed pond as an engineered wetland.
- Wetland W1:
  - Reposition the proposed engineered wetland location further downstream within the Rural Residential Zone (offline of stream); or
  - Move the proposed engineered wetland location to the high ground within the Rural Residential Zone.
- Wetland W2a:
  - Retrofit the existing constructed pond to the south-west as a stormwater treatment pond or constructed wetland. There may be some part of the sub catchment that cannot drain to this location which may require additional stormwater management devices.
- Wetland W2b:
  - Reposition the proposed engineered wetland location downstream of the proposed road embankment. However, it is unknown at this stage whether this site also would be classified as a natural wetland.
- Overall, all existing conceptual engineered wetlands for Stage 3, except for W2b, could likely be modified so that they are not constructed in locations considered to be natural wetlands. For W2b, it seems possible to consider that specific engineered wetlands as “specified infrastructure” in which case Resource Consent is likely required as a discretionary activity under Regulation 45 of the NES-F.
- It is anticipated that through the approval processes the location and geometry of all engineered wetlands will be confirmed. On that basis, it is expected that Figure 13.1 sufficiently addresses the location of potential engineered wetlands for the purposes of this CMP, and that the 2021 T+T wetland report can assist with the future approval process. Further, it is noted that the future work required to be undertaken by the BOPRC under the NPS-FM to map and monitor wetlands within Stage 3 will also assist with the approval process.
- To ensure the approval process appropriately takes account of this CMP’s indicative wetland concept, Table 14.1 provides the approximate requisite wetland footprint areas. The footprint areas presented are based on the surface area required for water quality treatment, plus an allowance for extended detention volume (EDV) storage (where relevant) and an allowance for freeboard.

Table 14.1: Summary of required treatment footprints/volumes

Wetland ID	Catchment area (ha)	Management functions	Required wetland surface area for water quality (m^2)	Extended detention volume, EDV (m^3)	Total wetland footprint (m^2) – allowing for EDV and freeboard	Total volume required for a stormwater pond (m^3)
N1	44.2	Water quality treatment only (see attenuation discussion in Section 14.1)	8,800	N/A	10,000	9,000
N1a	8.96	Water quality treatment only	4,500	N/A	5,800	4,700
W1	9.6	Water quality treatment only	1,900	N/A	2,400	2,000
W2a	29.3	Water quality treatment and extended detention	6,300	7,100	9,000	10,000
W2b	8.1	Water quality treatment and extended detention	1,600	2,400	3,200	3,400

The T+T 2020 Conceptual Water Sensitive Design Plan for Stage 3 recommends engineered wetlands in preference to stormwater ponds, due to the treatment efficacy provided by engineered wetlands. However, stormwater ponds are also an acceptable treatment device for treating urban stormwater runoff prior to discharge. Recalling that retaining some flexibility in the stormwater management framework for Stage 3 is a key requirement, Table 14.1 also presents the required volume if a stormwater treatment pond was used instead of an engineered wetland. Stormwater ponds are sized on a volume basis, not surface area basis as per the BOPRC Stormwater Management Guidelines. When attenuation of large storm events (e.g., greater than the 2 year average ARI) is not needed, the required pond volume is either:

- 100% of the water quality volume (where extended detention is not provided); or
- 50% of the water quality volume plus 120% of the extended detention volume (where extended detention is provided).

15 Maintenance

It is anticipated that subdivision consents for Stage 3 will require the submission of as built data and Operation and Maintenance Manuals to be prepared to the satisfaction of the WBOPDC for all stormwater structural controls as part of s 223/224 RMA process. The inspection and maintenance frequencies and requirements will be documented for each structural control as an “asset”, where it is a public one, and regular asset management will be undertaken by WBOPDC’s maintenance contractor. If some structural controls are required to be retained as private assets, then an appropriate legal mechanism will be established through the s 223/224 RMA process to ensure a private entity undertakes the same maintenance functions described above.

16 Monitoring

As discussed, the BOPRC undertake sediment sampling and analysis in the Mangawhai and Waipapa Estuaries, with the most recent reporting on results presented in the 2020 Estuary Monitoring

Report. The BOPRC do not undertake water sampling in the Waipapa River or streams feeding into the Mangawhai Estuary.

Based on the above, a comprehensive Monitoring Programme will be developed for the site and submitted for the approval of the BOPRC. The programme will include:

- Locations, frequencies and methods for water quality, sediment quality, macroinvertebrate and marine benthic organism sampling and analysis in the receiving environment.
- Annual sample result reporting requirements including but not limited to assessment against ANZG 2018 guideline values and trend analysis.

The Monitoring Programme should target the primary and secondary contaminants identified in Section 9, as well as microbial contaminants.

The Monitoring Programme will be implemented as soon as practicably possible. This will ensure there is an opportunity to characterise the state of the existing receiving environment prior to significant land use change occurring within the site.

The Monitoring Programme should be used to assist with the review and potential adjustment of the treatment trains and wider catchment management objectives as development within Stage 3 is sequentially advanced.

The Monitoring Programme can and should take account of any work undertaken by the BOPRC to update ecological knowledge of the site as required under the NPS-FM. This knowledge would be derived from mapping and monitoring wetlands, monitoring river conditions (extent, values and deposited sediment), and identifying barriers to fish passage and developing an action plan for restoration of fish passage where applicable.

17 Implementation of this CMP

WBOPDC will implement this CMP generally as follows:

1. Undertake further engagement with Tangata Whenua.
2. Obtain approval of the CMP from the BOPRC.
3. Prepare and lodge a renewal to the CDP.
4. Notify the Structure Plan and related rules for Stage 3. The rules will require non-structural controls through policies, rules and other methods. The treatment trains and WSUD wetlands Concept will be appended to the Structure Plan.
5. Develop and initiate the Monitoring Programme.
6. Develop a set of Best Practice Guidelines to supply Developers and their Consultants with and inform the design of stormwater systems for the approval process.
7. Receive, review, and approve detailed designs for subdivision and/or land use.
8. Construction of engineered wetlands through the use of Financial Contributions contained in the Structure Plan rules.
9. Development and implementation of restoration plan for stream gullies, including riparian planting of erosion hot spots and removal of fish passage barriers.
10. Review monitoring programme results and continually review performance of treatment trains to see what, if any, adjustments need to be made as Stage 3 is sequentially developed.

18 Applicability

This report has been prepared for the exclusive use of our client Western Bay of Plenty District Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will use this report as part of the Structure Planning process for Stage 3 and that BOPRC will use the report in relation to undertaking its regulatory function associated with the CDP.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

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Authorised for Tonkin & Taylor Ltd by:

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Peter Cochrane
Project Director

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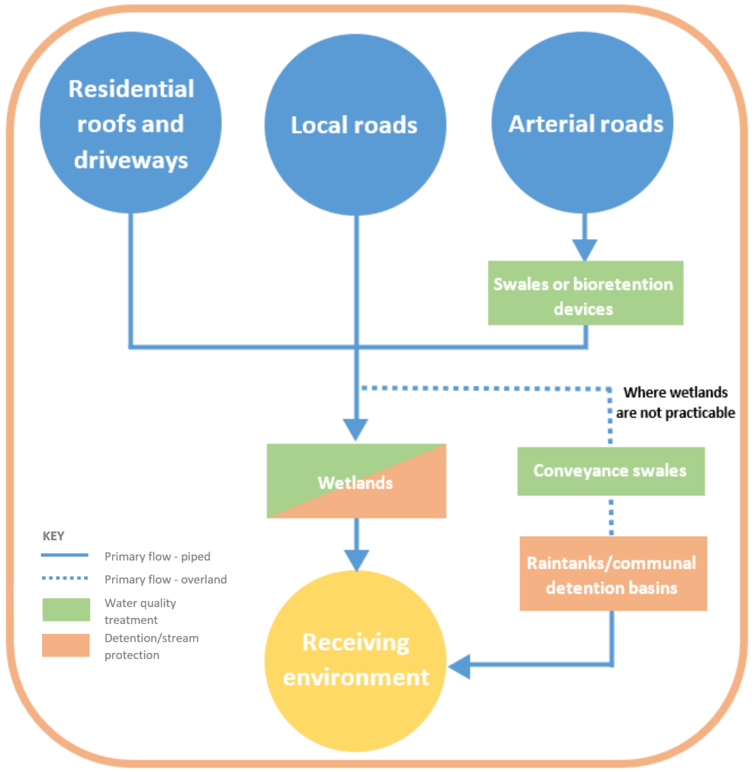
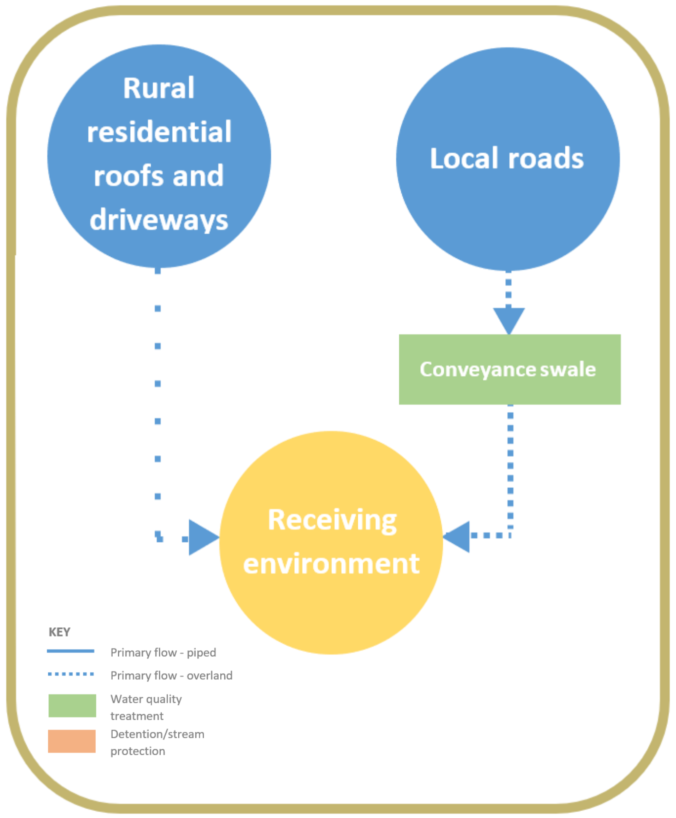
Appendix A Stage 3 Stormwater management concept

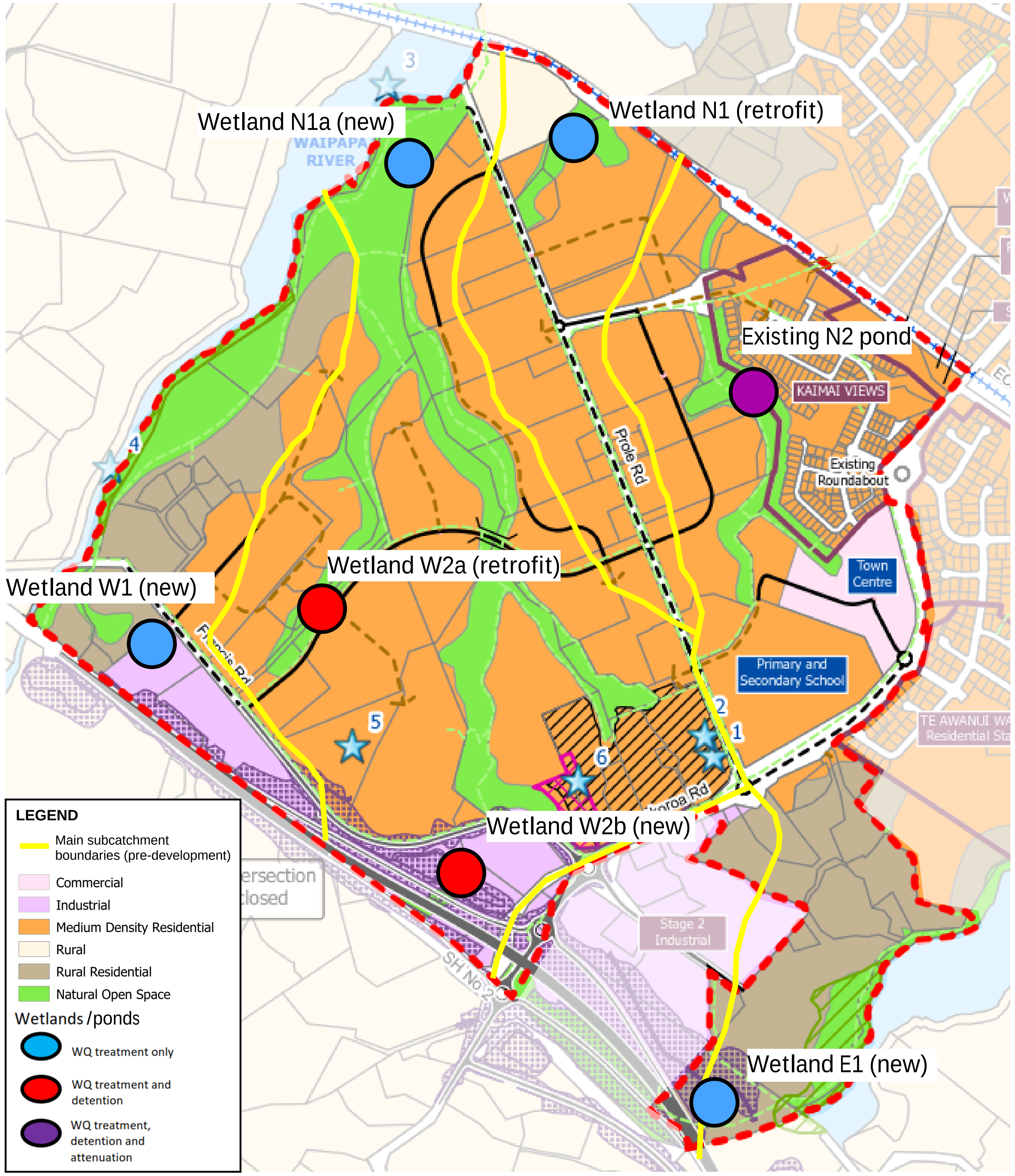
Ōmokoroa Stage 3
Stormwater Management Concept

Medium Density Residential

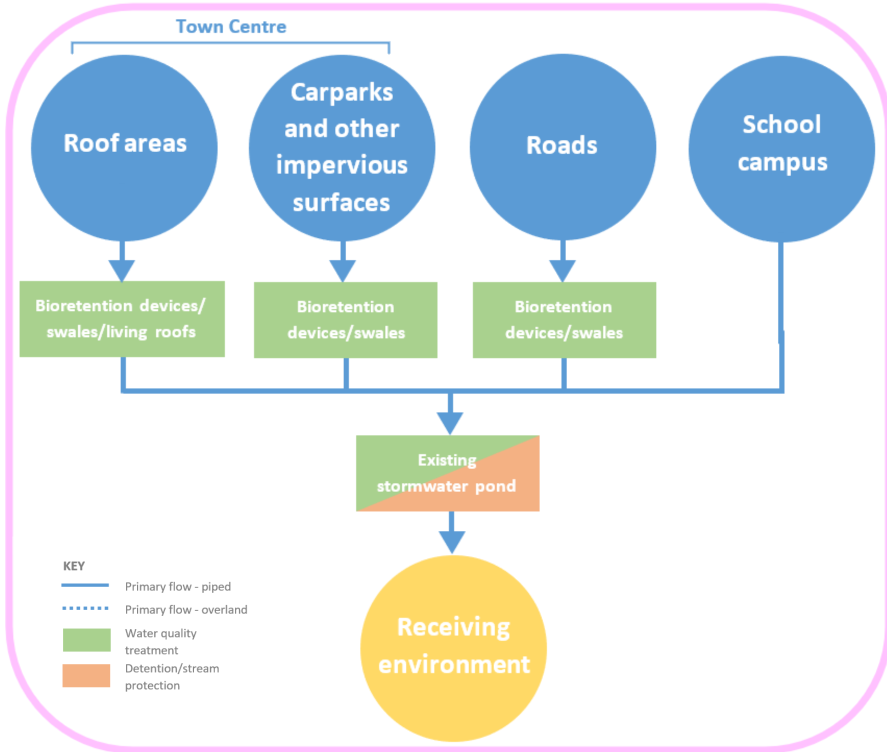


Rural Residential

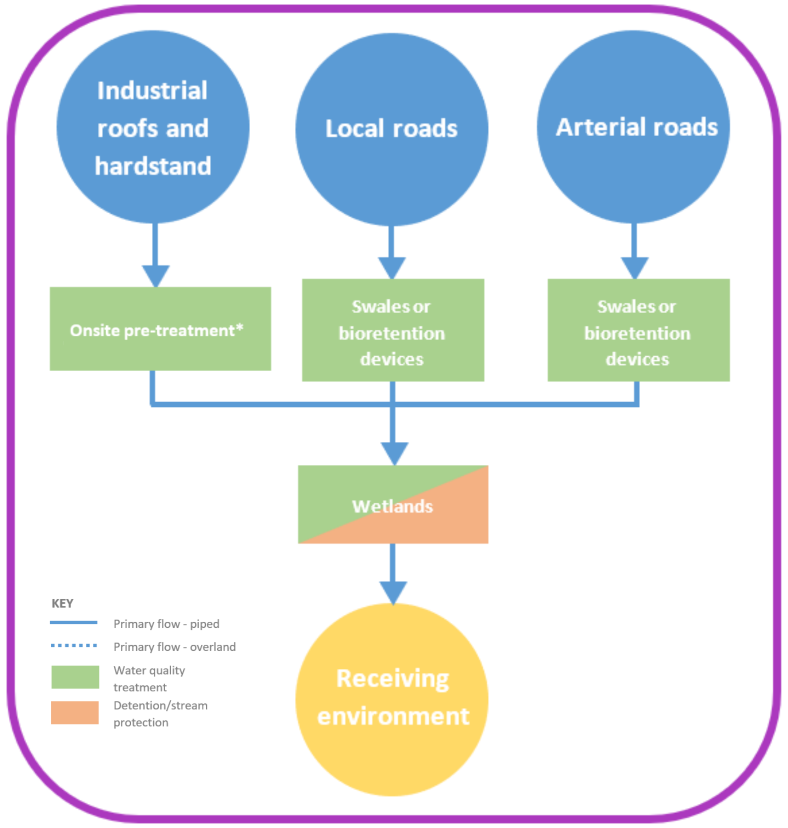




Town Centre and School



Industrial



NOTES:
-This figure is intended to be read in conjunction with the Omokoroa Stage 3 Stormwater Catchment Management Plan prepared by Tonkin + Taylor (dated August 2022)
-Subcatchment boundaries shown are based on the pre-development landform and are approximate only.
- For full legend refer to the Structure Plan (i.e., to identify features such as the hatched notations)
* Refer Figure 13.2 contained in the Omokoroa Stage 3 Catchment Management Plan prepared by Tonkin + Taylor (dated August 2022)

Western Bay of Plenty District Council

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