Appendix 1
Temuka Stormwater Management Plan

Temuka Stormwater Management Plan

Prepared for

Timaru District Council

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Quality Control Sheet

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Executive Summary

The area of the Temuka stormwater management area (SMA) is approximately 470 ha (Figure 1)and consists of a mixture of residential, reserve, industrial, and commercial land use with some lifestyle blocks and pasture to the north. Timaru District Council (TDC) has a series of resource consents from Environment Canterbury (ECan)that permits the discharge of stormwater to land and into the Temuka River and Taumatakahu Stream; this management plan outlines how TDC will manage the activities and TDC's stormwater network to minimise the effect the stormwater may have on the environment.

This stormwater management plan captures the long term vision for the management of stormwater within Temuka and outlines how the remedial and improvement programmes are identified and prioritised, and how they will realise the communities objectives and targets for the management of Temuka's stormwater.

The Vision for Te Umu Kaha/Temuka's Stormwater Management is:

Together we value, protect and restore the mauri/lifeforce of the waterways so that it enables Mahinga kai, ki uta ki tai (mountains to the sea).

TDC manages the urban stormwater, whilst ECan has a responsibility for the flood defences of the Temuka River and minimising the effects on the community of Temuka. TDC has developed a multi-valued approach to the management of the water bodies and groundwater within the stormwater management area. This approach follows the principles of Te Mana o Te Wai as set out in the National Policy Statement for Freshwater Management (2020).

TDC have adopted adaptive stormwater management principles to improve the management of stormwater in Temuka. Whilst this document outlines the principles and approach that TDC will apply, the mechanics of the approach are expressed in the "Temuka Stormwater Monitoring Plan", "Temuka Stormwater Implementation Plan" and associated guides; this management plan should be read in conjunction with these documents.

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1.0 Introduction

1.1 Purpose of this Document

The purpose of this SWMP is to:

- State the vision, goals, and objectives for stormwater management in Temuka (Figure 1);
- Outline the current stormwater management issues in Temuka;
- Provide an overview of the existing stormwater system and the receiving environment;
- Outline the stormwater management approach;
- Introduce the methodology and tools TDC applies to manage the stormwater in Temuka; and,
- Provide guidelines for monitoring the performance of the stormwater system and actions to be undertaken if the system is not meeting the performance standards.

This SWMP is not a design report, nor does it contain standard procedures for designing stormwater infrastructure. It is intended to provide a framework for implementing stormwater management practices to identify and then prioritise infrastructure or management process improvements.

Figure 1: Temuka Stormwater Management Plan Catchment and Waterways

2.0 Stormwater Management Vision and Strategy

The structure of this management plan applies the planning framework presented in Figure 2. Where the vision describes the future and hopes for the management of stormwater for the community Temuka and the environment, and each subsequent component in the hierarchy supports the vision.

Figure 2: Stormwater Strategic Hierarchy.

2.1 Vision

The vision statement for stormwater management in Te Umu Kaha/Temuka is:

Together we value, protect and restore the mauri/lifeforce of the waterways so that it enables Mahinga kai, ki uta ki tai (mountains to the sea).

2.2 Principles

Te Mana o te Wai is the fundamental concept of the National Policy Statement for Freshwater Management 2020 (NPSFM), and "…refers to the fundamental importance of water and recognises that protecting the health of freshwater protects the health and well-being of the wider environment."

TDC has decided that the principles that underpin the concept of Te Mana o te Wai will be used as the Principles of this management plan. Ie these key principles are:

- Mana whakahaere: the power, authority, and obligations of tangata whenua to make decisions that maintain, protect, and sustain the health and well-being of, and their relationship with, freshwater;
- Kaitiakitanga: the obligation of tangata whenua to preserve, restore, enhance, and sustainably use freshwater for the benefit of present and future generations;
- Manaakitanga: the process by which tangata whenua show respect, generosity, and care for freshwater and for others;
- Governance: the responsibility of those with authority for making decisions about freshwater to do so in a way that prioritises the health and well-being of freshwater now and into the future;
- Stewardship: the obligation of all New Zealanders to manage freshwater in a way that ensures it sustains present and future generations; and,
- Care and respect: the responsibility of all New Zealanders to care for freshwater in providing for the health of the nation.

2.3 Goals

TDC has identified four goals in their draft *Stormwater Management Plan and Resource Consent Application Vision and Strategy* document (dated 6 September 2021):

1. Planning and Regulation: Planning and regulatory framework supports and facilitates integrated stormwater management;
2. Asset Management: Stormwater assets are managed effectively and efficiently using the industry's best practicable options to meet the adopted level of service of the primary network able to accommodate a 1 in 5-year rain event for residential areas and a 1 in 10-year rain event for commercial/industrial areas without the inundation of habitable floor areas;
3. Receiving Environment: The impact of the stormwater systems results in the quality and flow regime of receiving environments being maintained; and,
4. Stakeholder Engagement and Education: Broader community and stakeholder participation and understanding are established, and strong coordination and capability.

These goals will be achieved through the objectives which have been developed to align with the NPSFM and are presented in the next section.

2.4 Objectives and Targets

The NPSFM has the following Objective which sets out the hierarchy of obligations for Te Mana of te Wai:

> *"to ensure that natural and physical resources are managed in a way that prioritises:*
>
> *a) First, the health and well-being of water bodies and freshwater ecosystems*
>
> *b) Second, the health needs of people (such as drinking water)*
>
> *c) Third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future."*

Temuka specific objectives and targets have been identified and are expressed in the context of these three priorities, as summarised in Table 1.

Table 1: Hierarchy of obligations, objectives, and targets for stormwater management in Temuka			
Te Mana o te Wai Hierarchy of Obligations	**Objectives**	**Targets**	
A. First, the health and well-being of water bodies and freshwater ecosystems.	1. Progressively reverse the diminished ecosystem health in the Taumatakahu Stream.	For Taumatakahu Stream and its tributary by 2040: ⁘ A trend of reducing fine sediment depth and cover; ⁘ Sediment quality ≤ ANZG DGV; ⁘ MCI scores improved from baseline (86 -91) to 100; ⁘ QMCI scores increased from baseline (4.29 – 4.85) to ≥ 5; and, ⁘ Improvements in riparian margins within the SMP Area where overland flow is an issue. Improve dry weather water quality and reduce the number of dry weather exceedances (if any) of ANZG receiving 90% species level of protection, for stormwater derived toxicants. Wet weather flows in Taumatakahu Stream are to meet any national acute toxicant guideline values for stormwater derived toxicants within 10 years of the guideline being published, or within 5 years if MCI and QMCI scores are not > 100 and 5 respectively. Improving trend in F IBI scores from baseline	For Taumatakahu Stream and its tributary near the expiry of the consent: ⁘ ≤ 30% of fine sediment; ⁘ Sediment quality ≤; ⁘ ANZG DGV; ⁘ MCI scores ≥ 120; ⁘ QMCI scores ≥ 6; ⁘ F-IBI scores ≥28; ⁘ Satisfaction in cultural; and, ⁘ Use indicators.

Table 1: Hierarchy of obligations, objectives, and targets for stormwater management in Temuka		
Te Mana o te Wai Hierarchy of Obligations	**Objectives**	**Targets**
	2. Protect and enhance the ecosystem health of the Te Uma Kaha / Temuka River.	For Te Uma Kaha River: ⁘ Improve the baseline scores for MCI (101 -103) and QMCI (5.13 -5.26); ⁘ Maintain and improve trends in stormwater derived toxicants sediment quality from baseline and no exceedance of ANZG Sediment Quality DGVs or any revisions or successors to this guideline; and, ⁘ Improvements in the riparian and in-stream habitat where the existing and future stormwater network is connected to the Te Uma Kaha.
	3. TDC advocate for ki uta ki tai (from the mountains to the sea) in Te Uma Kaha catchment during TDC's involvement as stakeholder and regulator in RMA and LGA processes.	None
	4. Where practicable prioritise addressing effects of stormwater quality and quantity at or close to their source rather than at the end of pipe into surface water or instream.	⁘ ##% of new development buildings or structures do not use materials that contribute to stormwater contamination; ⁘ ##% of new subdivision, use and development is to achieve stormwater neutrality on site or improvements towards stormwater neutrality; and, ⁘ Council roading and carpark upgrades and redevelopment projects incorporate as far as practicable treatment of stormwater.

Table 1: Hierarchy of obligations, objectives, and targets for stormwater management in Temuka		
Te Mana o te Wai Hierarchy of Obligations	**Objectives**	**Targets**
B. Second, the health needs of people (such as drinking water)	5. Stormwater discharges do not cause or exacerbate the risk to human health where groundwater is abstracted from bores for drinking water.	⁘ No recorded incidents of *E.coli* concentrations in abstracted water that is not treated confirmed as being related to stormwater discharges.
	6. Progressively reduce the acute and cumulative impacts of the stormwater network and stormwater discharges on waterbodies connected to and within the Opihi Mātaitai downstream of Temuka so the habitat is healthy and suitable for safe mahinga kai harvesting, and the mahinga kai species are safe to eat.	⁘ No human source incidents of *E.coli* concentrations entering waterways via the stormwater network (e.g., through cross connections or wastewater overflows).
C. Third, the ability of people and communities to provide for their social, economic, and	7. Recognise and respect mana motuhake – the whakapapa and the relationship Kati huirapa have with water ecosystems in their rohe and actively involve them in stormwater management.	Refer to the associated consent conditions ##, ##, and ## that are in relation to Kati huirapa contributions to the: ⁘ Development of the Implementation Plan to achieve the objectives and targets; and, ⁘ The periodic reviews of the Monitoring (Trigger Actions and Response) Plan and Stormwater Management Plan.

Table 1: Hierarchy of obligations, objectives, and targets for stormwater management in Temuka		
Te Mana o te Wai Hierarchy of Obligations	**Objectives**	**Targets**
cultural well-being, now and in the future	8. When investing in stormwater infrastructure environmental, social and cultural benefits are optimised.	⁘ Investment is shown to have prioritised options that achieve environmental, cultural and social benefits.
	9. Stormwater is managed so that run-off from urban areas, the primary stormwater network and overland flow paths, does not exacerbate the flooding, erosion or damage to property or infrastructure or cause risks to human safety.	⁘ Zero flooding for rain events up to a 1 in 5 year return for residential zones, and a 1 in 10 year return for commercial and industrial zones; ⁘ Stormwater does not exacerbate flood events that affect Te Hapa o Niu Tirena Marae and Arowhenua Native Reserve 881; and, ⁘ Zero deaths and notified injuries from stormwater runoff.
	10. Temuka township is more resilient to the effects of flooding and the associated the adverse impacts of climate change.	⁘ The above targets for Objective 9 will be achieved by considering and designing for predicted climate change increases in storm intensities and depths beyond 2031 for the duration of the consent; and, ⁘ Modelling for predicted climate change increases in storm intensities and depths beyond 2031 is undertaken by XXXX and periodically reviewed for the duration of the resource consent to ensure Objective 9 is at least meet.

2.5 Approach

The approach enables the rest of the hierarchy structure to be implemented via targeted monitoring of performance and planning of stormwater management upgrades. The approach is explained in Section 5.0.

3.0 Description of the Stormwater System and the Environment

3.1 Scope of the SWMP

The Temuka SWMP covers the activities and TDC's infrastructure within the Temuka SMA (Figure 2). TDC has obtained a series of Resource Consents from Environment Canterbury that permit TDC to manage and discharge stormwater to groundwater, the Taumatukahu Stream and the Temuka River.

- XXX List and summarise these resource consents here XXX; and,
- Second consent number – details XXXX.

As a result, TDC can permit properties within the SMA to discharge stormwater, subject to the specific conditions in the consents and that any stormwater discharges comply with TDC's Stormwater Bylaw. Specifically, TDC has consents that permit the following discharge or activities:

- XXX list the activities – reconfirm once the consent applied for/granted XXX;
- Discharges of stormwater generated from urban areas within the SMA Area that are from the TDC reticulated network;
- In addition, TDC can permit the discharge of non-connected residential, retail and commercial sites within the SMA that discharge onto or into land within their site or directly to surface water; and,
- The discharge of construction-phase stormwater from development construction areas.

However, several discharges are excluded from the consent, being:

- Land disturbance stormwater discharges into the reticulated stormwater network and onto or into land within the SMA or into surface water that exceeds 4 ha of a disturbance at any one time;
- Where an approved Erosion and Sediment Control Plan has not been implemented for land development construction areas;
- Discharge of stormwater onto or into land or to surface water from any development construction area or mitigation facility that HAIL activities have occurred; and,
- Sites that have received a written stormwater disconnection notice from TDC.

It is important to note that the SWMP and associated resource consents are limited to managing activities within the SMA.

3.2 Description of the Environmental

3.2.1 Wider River Catchment

Temuka is situated on the southern part of the Canterbury Plain near the junction of the Temuka and Opihi Rivers. The surrounding country consists of a flat alluvial plain, except in the northwest, where rolling to hilly land rises gradually to the Four Peaks Range. The main highway between Christchurch and Timaru and the South Island Main Trunk railway passes through the town.

Temuka is part of the wider Ōpihi River catchment which has a size of approximately 245,000 ha including its tributaries Te Ana-a-Wai River, Ōpuha River and Te Umu Kaha (Temuka River) (Figure 1). The Temuka River catchment measures around 34 km^2 and includes residential, recreational and rural land use classes. The dominant land cover in the Temuka River catchment is high production exotic grassland, owing to widespread pastoral agricultural land use.

3.2.2 Catchment History

Today within this catchment area agriculture predominates the land use. Historically, wetlands and swampland were far more prevalent in the Ōpihi River catchment (Scarf, 1984) but have been significantly reduced through drainage and the ongoing pressure for such land to be made agriculturally productive. Figure 3 depicts the Temuka catchment area in its pre-European, largely natural state as digitised from the original 19th Century 'Black Maps', whilst

Figure 4 demonstrate the urbanisation of Temuka from 1937 to 2017.

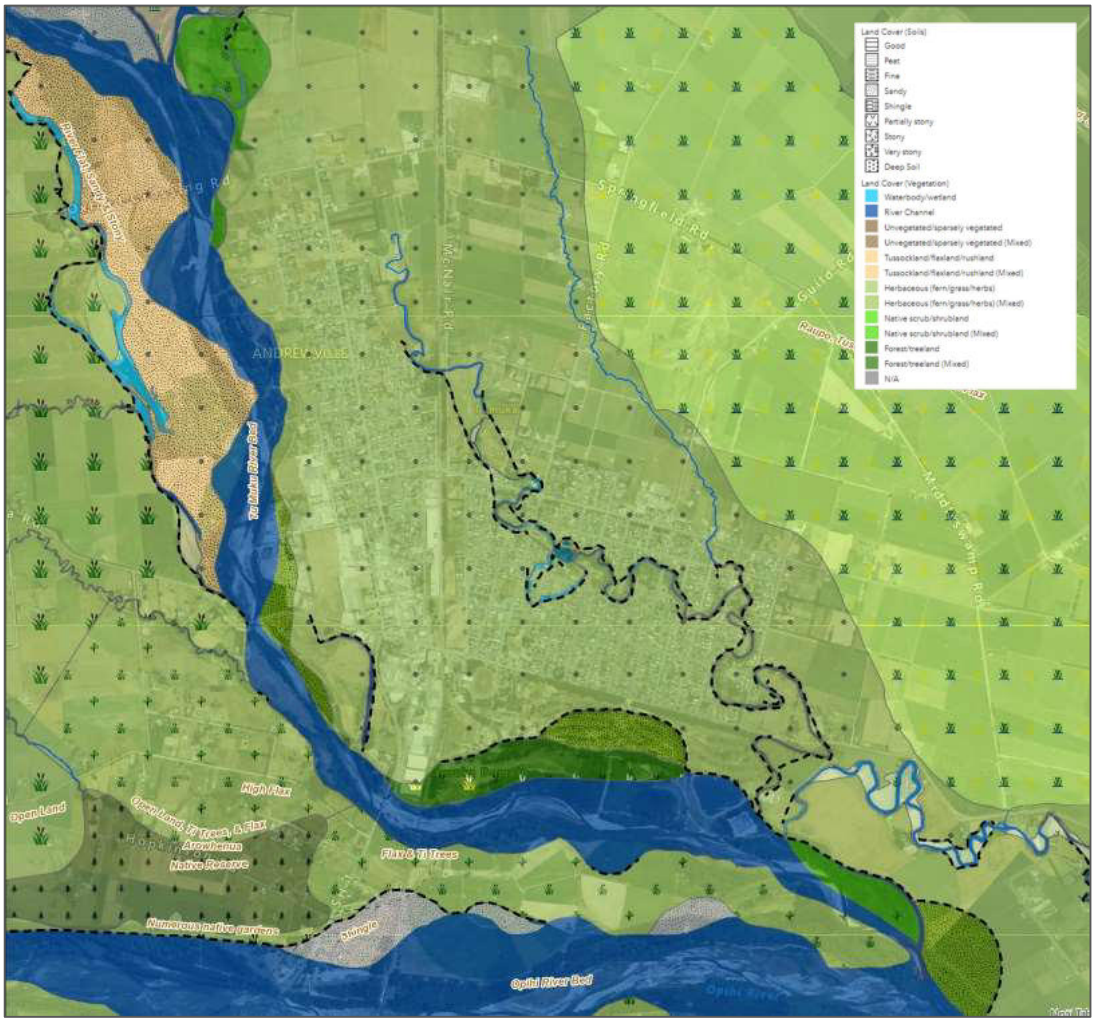

Figure 3: 19th Century Black Maps representing a pre-European, largely natural landscape (https://mapviewer.canterburymaps.govt.nz/)

Figure 4: Urban growth in east Temuka,1938(bottom) vs 2017(top)

3.2.3 Temuka River

The Temuka River catchment is located northeast of Timaru and encompasses an area of 34.1 km^2 including the town of Temuka. The catchment includes residential, recreational, and rural land use classes, with the dominant land cover being high production exotic grassland. The primary source of urban runoff within this catchment is the Temuka township.

The Temuka River borders the town of Temuka to the south and west and receives stormwater via direct discharge from outfalls as well as from its tributaries such as the Taumatakahu Stream. Before its confluence with the Opihi River downstream of Temuka township, the Temuka River is a sixth-order braided watercourse with an estimated mean annual flow rate of 6.28 m^3/s.

The Opihi riverbed (downstream of Temuka) is characterised as a Land of National Significance and a Site of Special Wildlife Significance by the Department of Conservation (DoC). Approximately 3 km downstream of the confluence with the Temuka River, the Opihi River forms the Opihi River Mouth Lagoon. This lagoon has been characterised as a highly significant and moderately threatened wetland, land of national significance (DoC), a site of special wildlife significance (DoC), and contains significant habitat for inanga spawning. The Opihi River catchment (particularly at the coast) is also of very high value to Arowhenua, being the locale of several historic settlements. As such, this area was gazetted a Mātaitai reserve in 2014.

3.2.3.1 Water and Sediment Quality

In general, water quality in the Temuka River was found to be good, with all metals, metalloids, and total petroleum hydrocarbons (TPH) being below the guideline values. Nutrient concentrations in water were found to be elevated, with little variation between sites. Total nitrogen and nitrate-nitrogen both exceeded the ANZG trigger values at all three sites, whilst dissolved reactive phosphorus exceeded the ANZG triggers at two sites and all three sites exceeded the Opihi Regional Plan water quality limits (Figure 5).

Fine sediment cover was within the trigger value limits at all three sites. One site (TE_S2) had elevated levels of lead in sediment in the dry weather monitoring; however, all other sites had concentrations of metals and metalloids in sediment that were below the guideline values. Polycyclic aromatic hydrocarbon (PAH), TPH and nutrient concentrations were also found to be low in sediment samples from all three sites.

The elevated lead concentration in sediment is indicative of the cumulative effects of stormwater discharging into the Temuka River. However, the consistently elevated nutrient concentrations are likely a result of activities occurring upstream of the SMA.

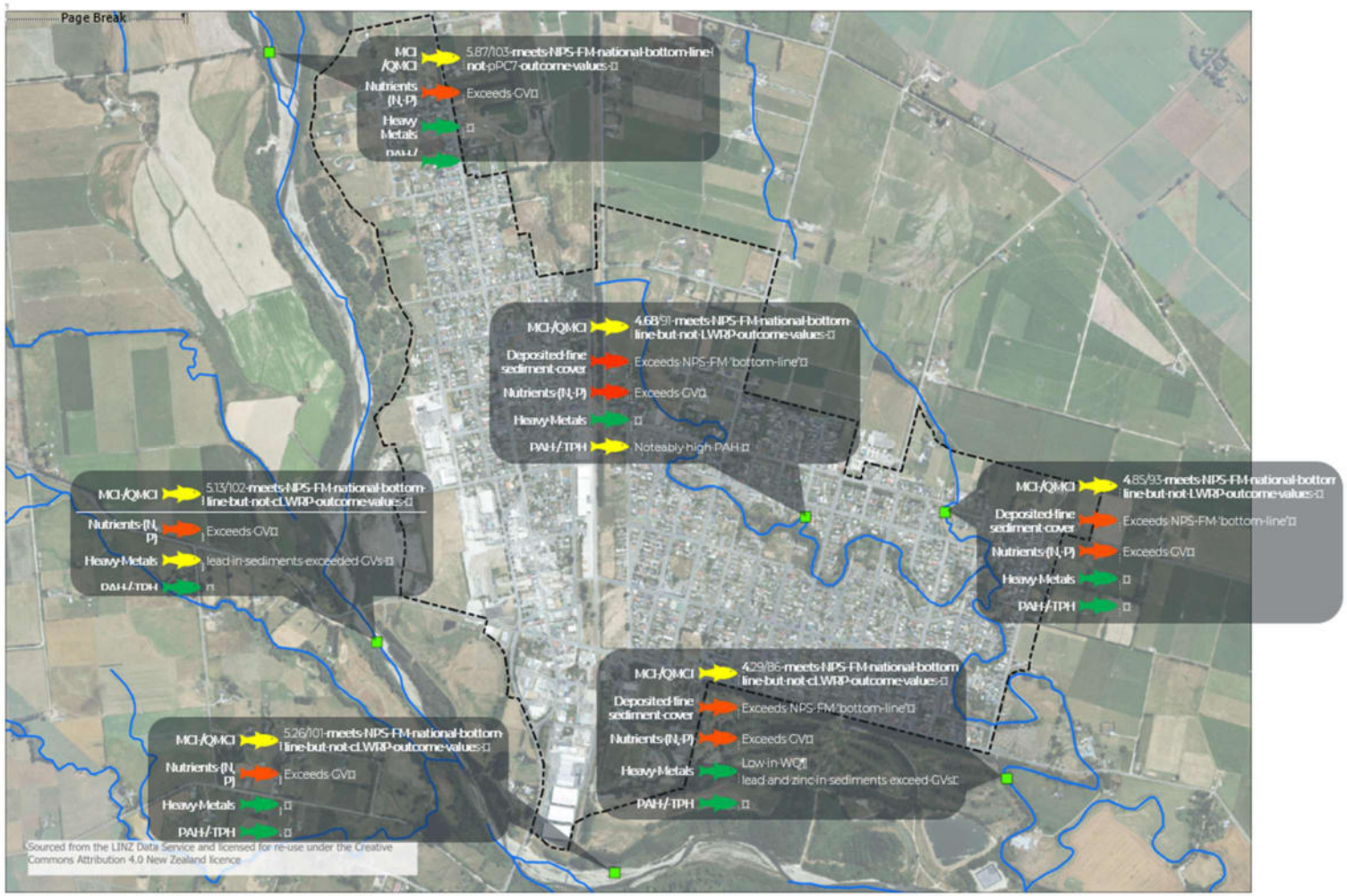

Figure 5: Summary of the Existing Aquatic Environmental Baseline Conditions

3.2.3.2 Aquatic Ecology and Ecological Value

The review of the NZFFD found a total of 12 freshwater fish and large macroinvertebrate species in the wider Temuka River catchment, 11 of which are native to New Zealand. This indicates that historically the catchment contained a diverse and high-value aquatic community.

The NIWA Fish Passage Assessment Tool did not find show any fish passage barriers within the main channel of the Temuka River.

The sampling sites in the Temuka River were 'hard-bottomed' (which is characteristic of braided rivers) and had very low fine sediment cover. A high abundance of organisms with low diversity was found during the ecological sampling, with a high proportion of sensitive organisms present.

The Temuka River sites had high MCI and QMCI scores, consistently indicating good ecological health, albeit with probable mild organic pollution. All sites met the NPSFM national bottom line; however, all sites were slightly below the LWRP proposed Plan Change 7 freshwater outcome value for QMCI of 6. This outcome target is set for 2030.

3.2.4 Taumatakahu Stream

Two spring-fed tributary streams pass through and confluence within the residential area on the eastern side of the Temuka township. The combined streams confluence with the Temuka River downstream of the Temuka wastewater treatment plant. The southern-most stream (Taumatakahu Stream) is a second-order stream with an estimated mean flow of 0.04 m3/s, while the northern waterway that confluences with the Taumatakahu Stream is a first-order stream with an estimated mean flow of 0.01 m3/s.

The Taumatakahu Stream has been undergoing ecological enhancement since 2006 through Environment Canterbury's Living Streams Programme. Rural reaches of the stream have also been planted where the stream has been fenced from livestock.

3.2.4.1 Water and Sediment Quality

Total nitrogen and nitrate-nitrogen exceeded the ANZG trigger values at all three sites. Dissolved reactive phosphorus also exceeded the ANZG and Opihi Regional Plan trigger values, with the TE_S6 site also exceeding the NPSFM national bottom line. Total phosphorus exceeded the ANZG trigger values in two of the three sites. Metals, metalloids, and hydrocarbons were all below the trigger values and were mostly below laboratory detection limits.

Fine sediment cover was high at all three sites and exceeded the ECan Plan Change 7 and NPSFM national bottom line at TE_S5 and TE_S6. Lead and zinc in sediment exceeded the ANZG trigger values at TE_S6. Elevated concentrations of some PAH compounds were found at TE_S4, with lower levels of several PAH compounds found in TE_S6. TPH concentrations were consistently low across the three sites.

As with the Temuka River, the elevated nutrient concentrations in water are likely a result of activities occurring outside of the SMA. However, the sediment samples indicate an accumulation of lead, zinc, and hydrocarbons resulting from stormwater discharges to the Taumatakahu Stream and its tributary. This result is not surprising, given that a significant portion of the stream's catchment is urban.

3.2.4.2 Aquatic Ecology and Ecological Value

The NIWA Fish Passage Assessment Tool shows seven 'Very High Risk' instream structures in the Taumatakahu Stream. Four of these barriers are located a short distance upstream of the stream's confluence with the Temuka River.

The Taumatakahu Stream had 'soft-bottomed' features with a high cover of fine sediment. The high sediment cover is likely due to several human-influenced sources including bank instability due to riparian clearing, channelisation of the stream, and sediment-laden stormwater discharges. Sedimentation was highest (100%) at the TE_S6 site, whilst the other two sites were more characteristically 'hard-bottomed' streams; however, both had been impacted by high sediment inputs. These softer bottomed sites had fewer sensitive species and a higher diversity of organisms.

The MCI and QMCI scores for Taumatakahu were lower than for the Temuka River, indicating fair ecological health and probable moderate organic pollution, although all sites met the NPSFM national bottom line. Site TE_S6 does not meet the cLWRP proposed Plan Change 7 freshwater outcome values for QMCI of 5 (set for 2030).

3.2.4.3 Climate

In general, Temuka has a dry moderate climate. As it lies approximately 8 km inland from the coast and is on average 20 m above sea level.

As presented in Table 2, the average monthly temperature varies from 5.2^{o}C in winter to 15.9^{o}C in summer. The monthly rainfall is relatively constant in the order of 30 to 50 mm/month.

Table 2: Historic Climate (2000 – 2021)													
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Temperature (°C)	15.9	15.6	14.1	11.1	8.3	5.8	5.2	6.6	8.8	10.4	12.4	14.7	10.7
Rainfall (mm)	52	47	36	53	44	31	35	51	31	46	50	51	548
Wet Days (no.)	7.6	5.9	5.9	6.2	5.5	5.0	4.5	5.9	5.5	7.4	7.1	7.7	75.1

Notes:

1. *Source: Timaru Airport automatic weather station (NIWA Network# H414325)*

3.3 Manu Whenua Context

3.3.1 Cultural Setting

Ngāi Tahu whānui are the iwi (Māori tribe) who hold mana whenua over a large proportion of Te Waipounamu – the South Island. Today, Ngāi Tahu are organised around eighteen marae-based communities (Papatipu Marae), each recognised under the Te Rūnanga o Ngai Tahu Act 1996 and is represented by a Papatipu Rūnanga (assembly, Council); of which Te Rūnanga o Arowhenua is the local Papatipu Marae, and asserts ancestral rights and responsibilities of local Arowhenua families and individuals to mahinga kai as guaranteed under the Treaty of Waitangi/Te Tiriti o Waitangi (1840) and reserved under Sales and Purchase Agreement for Canterbury (Kemp's Deed, 1848).

Temuka is believed to have come into existence because of its proximity to convenient fords on the Temuka and Opihi Rivers, crossing places on the main north-south route in early times. The site of the township is identical to the original Maori settlement called Arowhenua. Other villages, now deserted by Arowhenua, were located between this place and the mouth of the Opihi River. At Orakipaoa (4 km south-east) evidence of former occupation is still to be seen in the vestiges of an old Maori fortification.

Government established the town east of the present railway line and took the name of the pa, Arowhenua. The local Iwi removed to the present-day site of Arowhenua Pa, about 1.6 km south of the town. The name Temuka, transferred to the town from the nearby river, is stated to be properly Te Umu Kaha, meaning "the strong oven," and in all likelihood is associated with the many Maori ovens found in this locality.

Arowhenua has been the main centre of Māori life in South Canterbury since the mid-19th century when the Māori people of the area moved from nearby Te Waiateruati. While Arowhenua marae was not the first pā for Arowhenua Māori, it has been the main settlement area for the iwi since the mid-1800s.

The Ōpihi and Temuka Rivers as well as the township of Temuka lie within the takiwā of Te Rūnanga o Arowhenua, which "centres on Arowhenua and extends from the Rakaia River in the north to the Waitaki River in the south and inland to the Main Divide."

Ōpihi River

The Ōpihi River is of immense significance to Arowhenua. The renowned Arowhenua forest and cultivations stood at the junction of the Ōpihi River and Te Umu Kaha (Temuka River). Several kāika (settlements) were located near the lower reaches of the Ōpihi, sustained by the river's rich food supply. Foods gathered from the river included tuna (eel), inaka (whitebait), kōkopu (native trout), upokororo (grayling), kanakana (lampreys), pātiki (flounder), aua (yellow-eyed mullet), paraki (endemic smelt), panako (fish sp.) and pipiki (fish sp.).

The Ōpihi was the principal travel route from the Arowhenua region to Te Manahuna (the Mackenzie Basin), and this is reflected in the high density of rock art sites in the Ōpihi catchment. Together with the nearby catchments of Ōpuaha (Ōpuha River) and Te-Ana-a-Wai (Tengawai River), more than 250 rock art sites are located in the limestone outcrops.

Ōpihi Freshwater Mātaitai

A freshwater mātaitai reserve was established on the Ōpihi River in 2016 to enhance and maintain the patiki fishery, ensure access for customary and recreational fishers who have less fishing capacity, and ensure the long-term future of the fishery is protected. Opihi Mātaitai includes the Opihi Lagoon, lowland Opihi River, Orakipaoa Creek, and Temuka River. Notably, Taumatakahu Stream is not included in the Opihi Mātaitai.

Te Umu Kaha (Temuka River) and Tributaries

The Temuka River drains the eastern foothills of the Opihi River catchment and has four significant tributaries, the Kakahu, Hae Hae Te Moana, Taumatakahu and Waihi rivers that originate in the Four Peaks Range. In summer, lowland spring-fed tributaries provide significant contributions to surface flows in the Waihi-Temuka River. Notable among these tributaries are Raukapuka Creek, Dobies Creek and Taumatakahu Stream.

The Taumatakahu Stream is a highly valued spring-fed tributary of the Temuka and Lower Opihi Rivers, contributing to reliable flows within the main river system. The Taumatakahu River is known to contain historic gathering sites along the riverbanks as the waterway was a reliable source of drinking water in the lower Temuka (and lower Opihi) area for travelling rūnanga. Restoration has commenced in the area but is yet to be completed.

3.3.2 Arowhenua Concerns and Expectations

The concerns to whanau for Temuka were identified by cultural experts during site visits in September 2020 as the following:

- Lack of biodiversity, riparian habitat, and cultural materials;
- Poor instream habitat;
- Loss of the extent and condition of wetlands and springs;
- Sedimentation impacting on the ability to use the waterways;
- The contamination and poor condition of mahinga kai in the area and how that impacts the ability to use that waterway;
- The odour from the water within the waterways;
- Absence of any interpretation or recognition of the cultural significance of the sites;
- Impacts of water extraction and modification of waterways on mahinga kai;
- The lack of water in some sites;
- Parts of the network that is grazed and potential pooling contaminants; and,
- Lack of flood protection for Te Hapa o Niu Tireni marae and Arowhenua Native Reserve 881. The stopbanks cause floodwaters to flow towards the marae and reserve.

In addition, Arowhenua seek that the following matters are addressed in stormwater management for Temuka. Kitson Consulting (2022) summarises the needs of the waterways connected to TDC stormwater networks from the iwi management plan as the following:

- The responsibility of the Crown and other agents with authority delegated by the Crown is to actively protect Treaty rights, including mahinga kai and other taonga;
- The need for environmental management to consider the rights and needs of future generations;
- Arowhenua whānau must be involved in matters that impact their values and interests;
- Provision for cultural and spiritual values, customs, and traditions;
- Protection and enhancement of waterways, including stopping discharges of contaminants, diffuse and point-source;
- All mahinga kai taken from waterways to be fit for human consumption; and,

- Exercise of traditional rights and customary uses is enabled, and opportunities increased, including protection and restoration of:
  - Sufficient water quality and quantity;
  - Natural habitat (instream and riparian);
  - Wetlands;
  - Fish passage;
  - Mahinga kai and taonga species; and,
  - Traditional cultural materials (e.g., Flax and other native plant species).

Additionally, the following expectations from the cultural impact assessments directly relate to the SWMP (Kitson Consulting, 2022):

- Meaningful participation in decision making;
- TDC takes a ki uta ki tai approach to Stormwater Management and planning;
- Stormwater Management and planning include continuous environmental improvement;
- Avoidance of impacts on Mātaitai and waterbodies feeding into them;
- Avoidance of degradation of water quality and loss of taonga species;
- Opportunities to improve mahinga kai values (including water quality, water quantity and habitat) over time; and,
- Mahinga kai outcomes are monitored and include cultural monitoring/Kaupapa Māori methods and mātauranga Māori.

3.3.3 Issues

The issues of concern to whanau for Temuka were identified by cultural experts during site visits in September 2020 and have been incorporated into issues summary (Section 4.0) but focused on the possible sources of contamination and poor condition of mahinga kai in the area and possible impacts on the recreational use of the Temuka waterways.

A summary of the assessment of the Temuka SMA in terms of the thresholds set by Arowhenua for cultural use is presented in Table 3. The waterways in Temuka are not meeting the thresholds for cultural use in their current condition.

Table 3: Temuka assessment of thresholds for cultural use (Kitson Consulting, 2022)	
Threshold	**Condition**
Mahinga kai resources being present	Poor
Mahinga kai species in sufficient numbers and in good condition	Poor
The ecosystem supports mahinga kai species and resources	Poor
Human health safety for gathering and consuming kai	Poor
Access to mahinga kai is available	N/A
Nitrate and ammonia toxicity in NPSFM National Objective 'A' band	Fail
E.coli concentration exceeds NPSFM National Objective 'A" Band	Fail

3.4 Timaru District Council Stormwater Network and Infrastructure

3.4.1 Existing Stormwater Infrastructure

Stormwater within the Temuka SMA relies heavily on the kerb and channel flow to convey stormwater to some 15.67 km of pipe network, which discharges to the ground via soakpits, stormwater basins or to one of the surface waterbodies within the SMA (Figure 6). Moderate to well-drained soils and flat topography are the key drivers for this network layout, as these conditions are well-suited for discharges to ground and overland flow. There is limited information on the physical condition of the pipe network; however, the network is believed to be aged.

Table 4: Stormwater Infrastructure Summary	
Stormwater Infrastructure	**Quantity**
Stormwater pipe size	15,676 m total
<300 mm diameter	5,425 m
300 – 500 mm diameter	9,052 m
500 – 1,000 mm diameter	1,101 m
>1,000 mm diameter	98 m
Swales	2,560 m
Stormwater outfalls	32 (including private)
Stormwater Basins	2

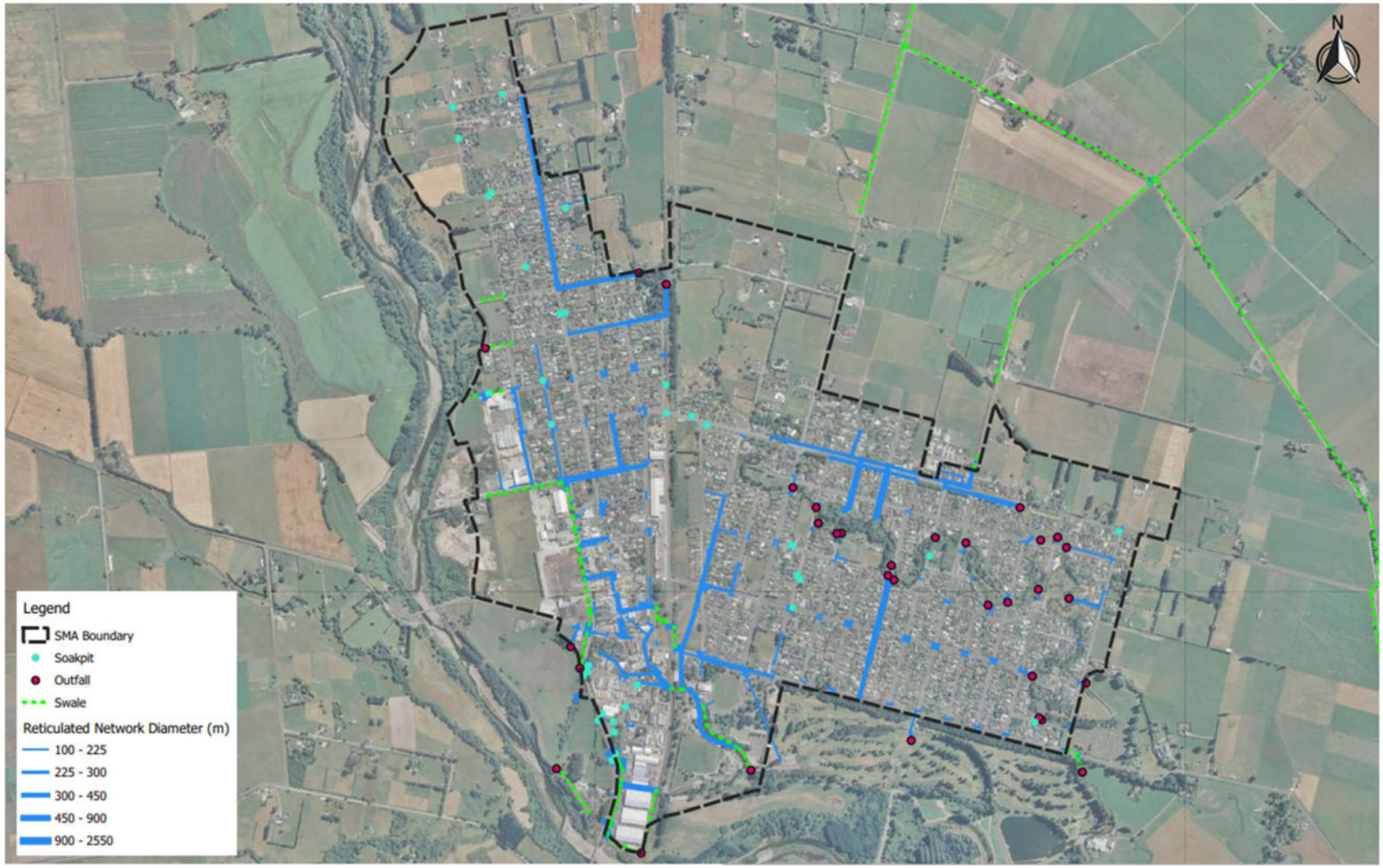

Figure 6: Temuka Stormwater Infrastructure

TDC maintains and operates two stormwater basins on Domain Avenue and Fraser Street. The Domain Avenue stormwater basin has been designed as an attenuation basin but will provide some settlement of particulate solids in the stormwater. Whilst the Fraser Street basin, has recently been redesigned (2019-20); underdrains and engineered media placed in the basin will attenuate and absorb some stormwater contaminants. In addition, TDC has some 2,560 m of swales, whilst these are designed to convey stormwater the nature of a swale will provide some treatment and provides an opportunity for stormwater to infiltrate into the shallow groundwater.

There are 37 TDC-owned soak pits within the Temuka SMA, as well as numerous private soak pits for discharging roof runoff to the ground. In addition to the soak pits, there are a total of 32 (including private) stormwater outfalls within the SMA, including 7 outfalls into the Temuka River and 25 outfalls into the Taumatakahu Stream and its northern tributary.

The level of service currently adopted by TDC is that water will not inundate habitable floor spaces in the:

- 5-year ARI for urban residential areas; and,
- 10-year ARI for industrial and commercial areas.

This means that ponding can be expected to occur in parks, roads, and private properties during the above rainfall events.

3.4.2 Stormwater Network Capacity Assessment

An assessment of the capacity of the stormwater network has been completed, as presented in **Error! Reference source not found.**.

An assessment of the capacity of the piped stormwater network has been completed by WSP (2021). The assessment results are summarised in **Error! Reference source not found.**. The assessment did not report the associated land use for the pipes so a direct comparison of land use and level of service is not able to be undertaken.

Table 5: Temuka stormwater pipe network capacity performance (WSP, 2021)

Length of Pipe (m) Meeting the Capacity Performance				
<2-Year ARI	**2-Year ARI**	**5-Year ARI**	**10-Year ARI**	**Total Length**
3,230 (35%)	6,081 (65%)	4,927 (53%)	4,620 (50%)	**9,319**

The capacity assessment found that 35% of the pipe network is unable to convey 2-year ARI peak flows. 53% of the network is able to convey up to 5-year ARI peak flows and 50% can convey 10-year ARI peak flows. However, where pipe capacity is exceeded, this is does not immediately result in habitable floors being inundated. This assessment highlights the need for increased capacity in the Temuka stormwater network to reduce the frequency of predominantly nuisance flooding in parks, roads, and private properties.

3.4.1 Flood Hazard Assessment

WSP (2021) flood mapping assessment found that the generally flat topography combined with the undersized pipe network results in extensive nuisance flooding across the SMA in the level of service rainfall events. However, even in extreme rainfall events such as the 200-year ARI, the modelled flooding is generally shallow other than within or adjacent to stream channels or in historic overland flow paths and depressions in the topography. The modelling indicates that extensive shallow sheet flooding can be expected in the rural land north of Richard Pearse Drive.

Figure 7 shows the level of service provided by the stormwater network in Te Umu Kaha / Temuka together with the predicted 10-year ARI flood depth, and customer complaint records of blocks or overflows from the wastewater system; whilst Figure 8 shows the predicted 200-year ARI flood depth. This information forms the basis for the below stormwater and flood risk issues summary for Te Umu Kaha / Temuka.

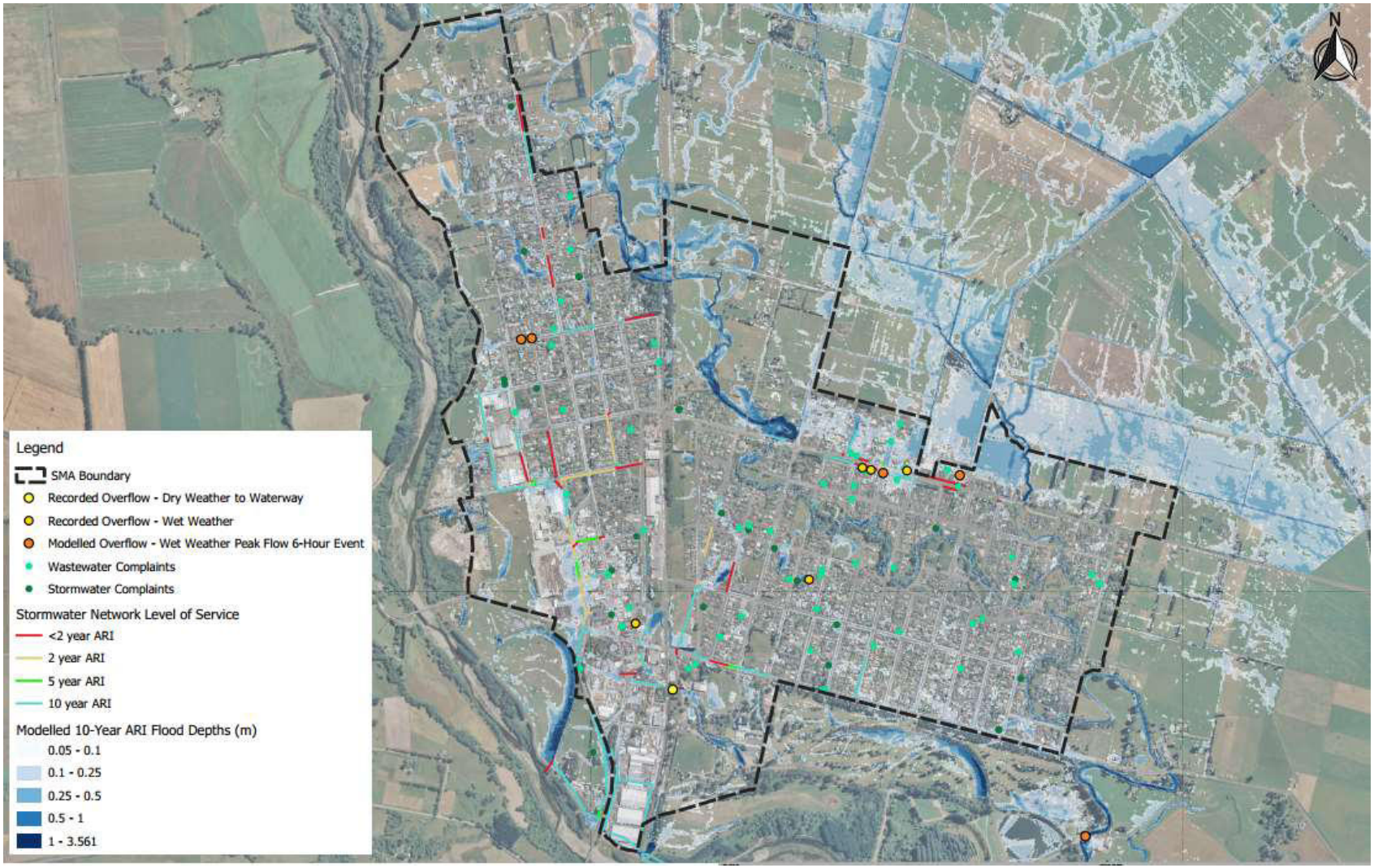

Figure 7: 10-year rain on grid flood depth, customer complaints and network capacity

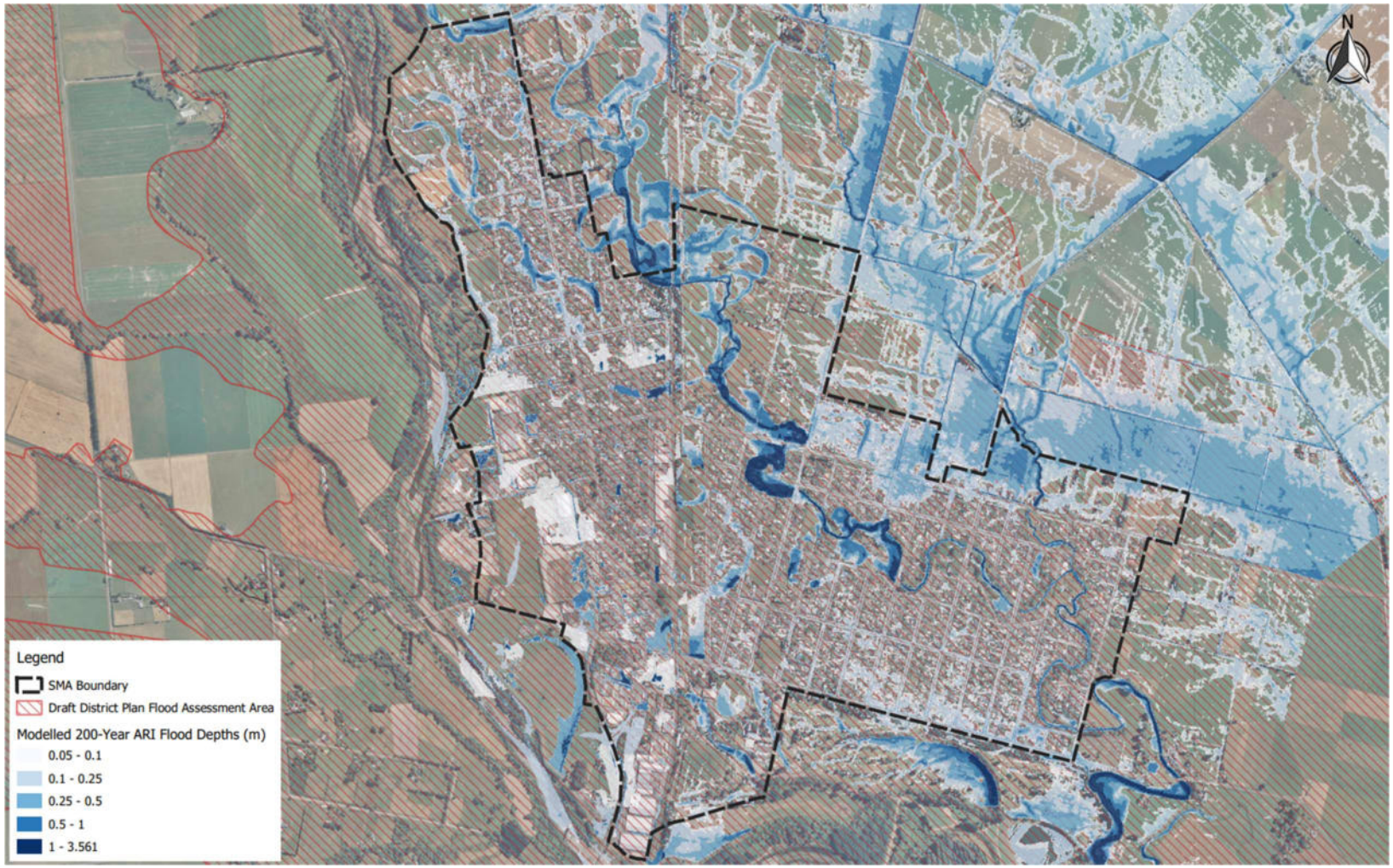

Figure 8: 200-year flood depth and flood assessment area

TDC (2018) identifies that "In the specific case of Temuka stormwater, the characteristically flat terrain of the town coupled with typically high groundwater table is an issue in the efficient and sustainable drainage of stormwater" and that there are "Inadequate formally identified and designated secondary flow paths".

Te Umu Kaha / Temuka is serviced by a limited stormwater pipe network, much of it undersized, instead of relying heavily on the kerb and channel flow to convey stormwater. Due to the generally flat topography and lack of capacity in the piped network, there is extensive nuisance flooding across the catchment in the level of service events.

3.4.2 Impacts on Wastewater

In addition to the direct impacts of flooding such as ponding and sheet flow, the existing stormwater system also has an impact on the wastewater system in Temuka. Shallow groundwater combined with surface ponding results in inflow and infiltration (I&I) into the wastewater system.

There has been widespread reports of wastewater blockages or overflows in the urban catchment; 1,187 occurrences have been observed by the TDC's contractor since 2013 and 69 customer complaints recorded since 2017. However there has only been six instances of wet-weather-associated overflows from the wastewater network and only one instance where the wastewater overflow entered a waterway (Taumatakahu Stream), which occurred during dry weather (period 2013 to 2021).

Historically, high volumes of I&I has increased the flow of wastewater to the Temuka Wastewater Treatment Pond and contributed to the ponds spilling excess wastewater to the Temuka River; however, recent wastewater pipeline and pump station upgrades have addressed this issue.

3.5 Geology and Soils

The 1:250,000 scale geological map of the area (Cox and Barrel, 2007) indicates that the surficial geology consists mostly of Late Pleistocene river deposits, including mixtures of gravel, sand, silt and clay (Figure 9) Holocene river deposits (unweathered loose gravel, sand and silt) also occur towards the boundaries of the western and southern catchment and are primarily associated with the recently active Temuka River flood plain.

Holocene deposits are also associated with Taumatakahu Stream in the southeast of the study area.

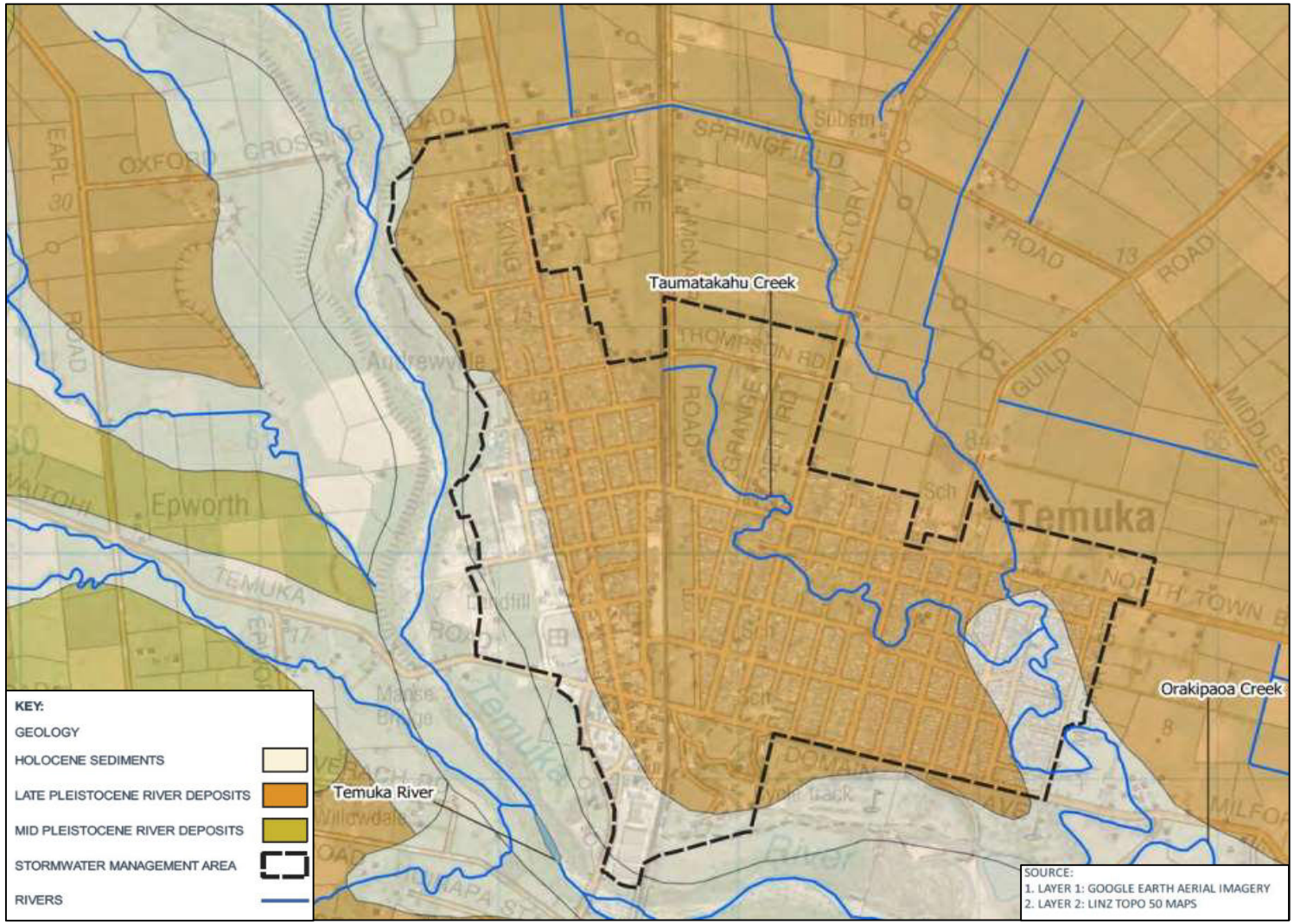

Figure 9: Geology of Temuka

Based on S-Map Online, the permeability of the soils in the Temuka SMA is variable (Figure 10). Most of the soils in the west and south-west are well-draining with moderate permeability, typically with a clay content ranging from 8-18%.

In the east, the soils are moderately well-drained, whereas small areas in the north-east are quite variable ranging from well-drained to poorly drained.

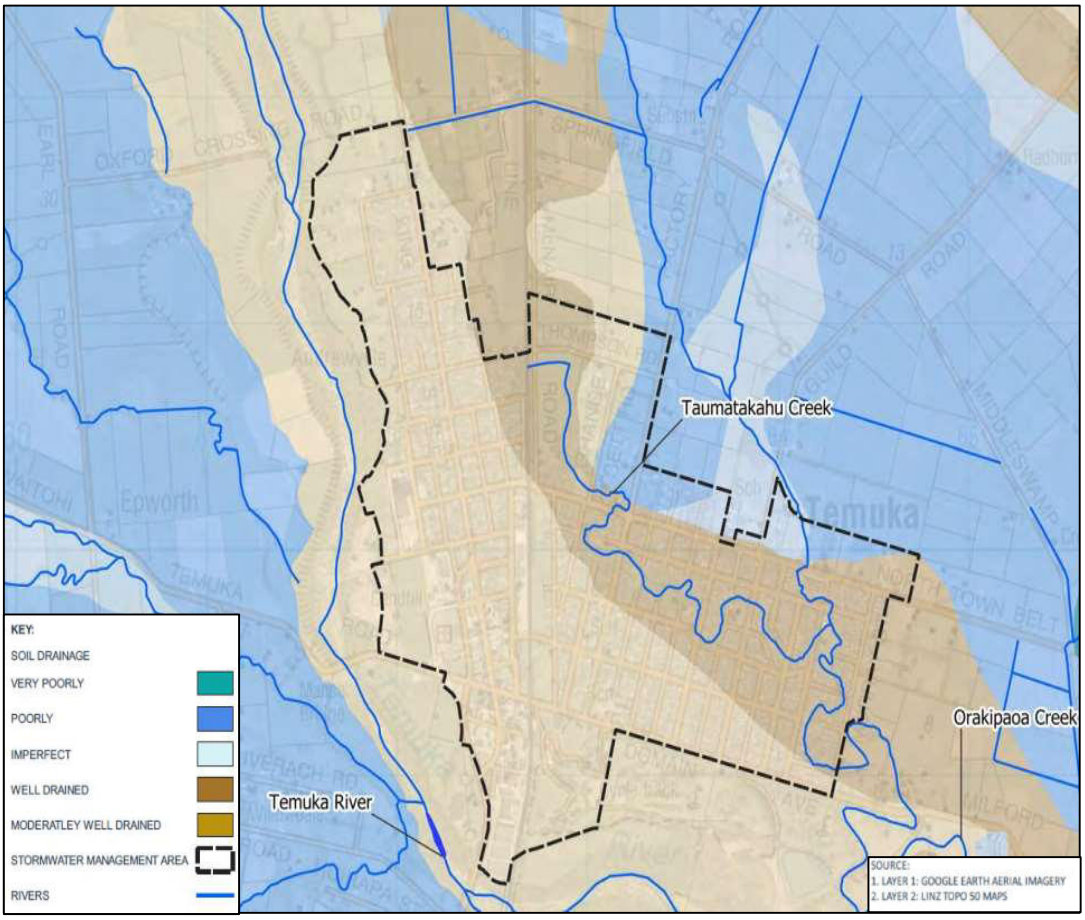

Figure 10: Temuka Soil Drainage Characteristics

3.6 Groundwater

Figure 11 shows piezometric contours (relative to mean sea level) for shallow bores (<30 m deep) of the Rangitata-Opihi Plain from August 2012 (sourced from Canterbury Maps).

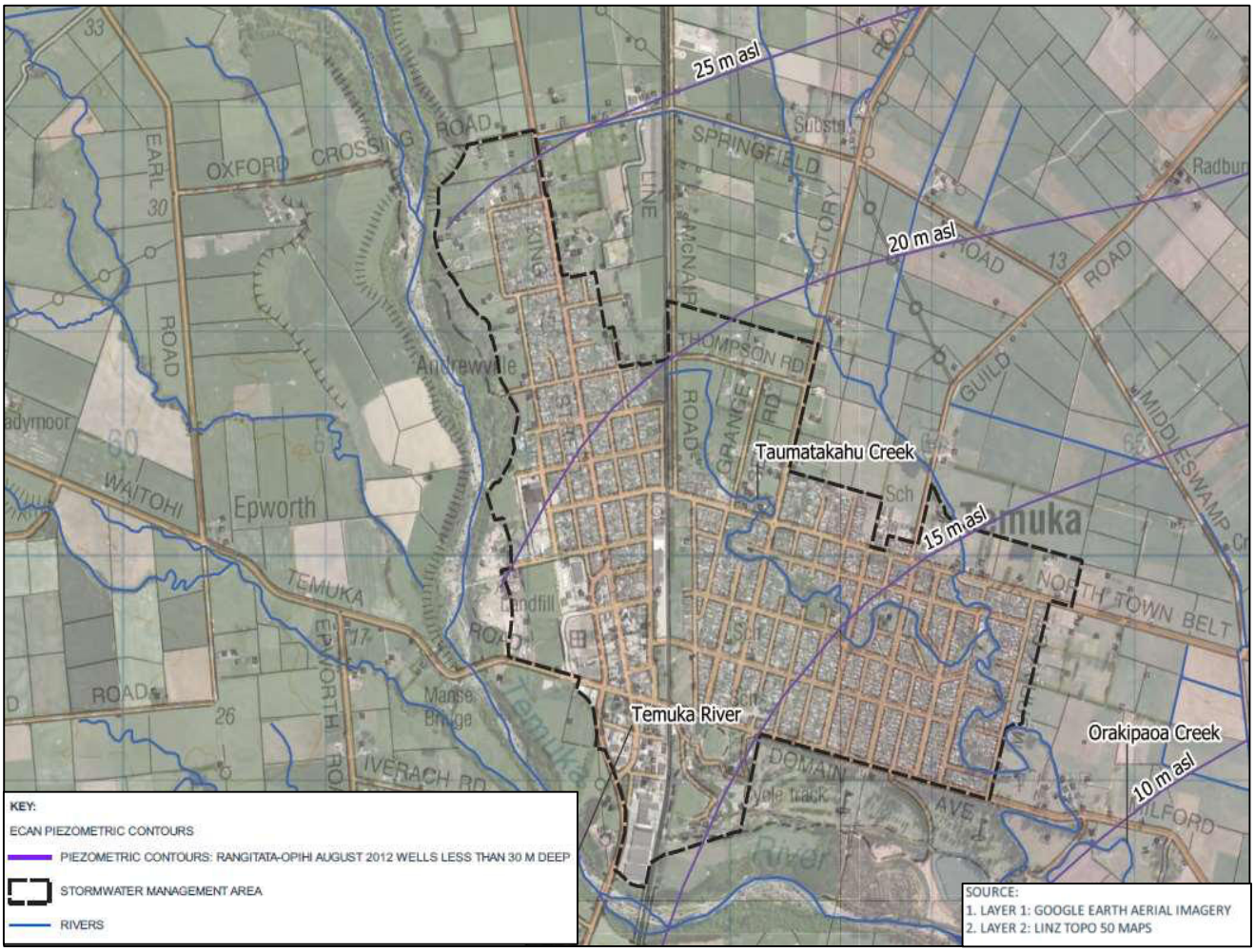

Figure 11: Piezometric Contours of the Groundwater below Temuka

PDP conducted a desktop groundwater assessment for TDC as part of the wider SWMP assessments (PDP, 2021a). The analysis of shallow bores indicates that groundwater flows to the southeast in the north of the Temuka SMA area with a progressively more easterly flow direction to the south of the study area. Groundwater is expected to be shallow (1 to 4 m bgl) within the SMA; however, this is based on a limited number of groundwater level readings. Groundwater levels are anticipated to be well connected hydraulically to the adjacent surface water bodies.

There is limited information available for the aquifer properties beneath the Temuka SMA; however, the available data and historic performance of existing soak pits demonstrates that the strata is suitably permeable for discharging stormwater to ground. However, high groundwater coupled with mounding may prohibit or restrict the feasibility of discharging stormwater to ground, particularly for larger disposal systems.

As outlined in Section 3.2, there are currently 37 TDC-owned soak pits for stormwater management within the Temuka SMA. There are 21 potential domestic water supply wells within 1,000 m radius of the soakpit discharges, some of which may be used for drinking water (Figure 12). Cumulative impacts of stormwater contaminants on groundwater and surface water (in the case of the spring-fed Taumatakahu Stream) may occur unless stormwater is treated before discharging to ground.

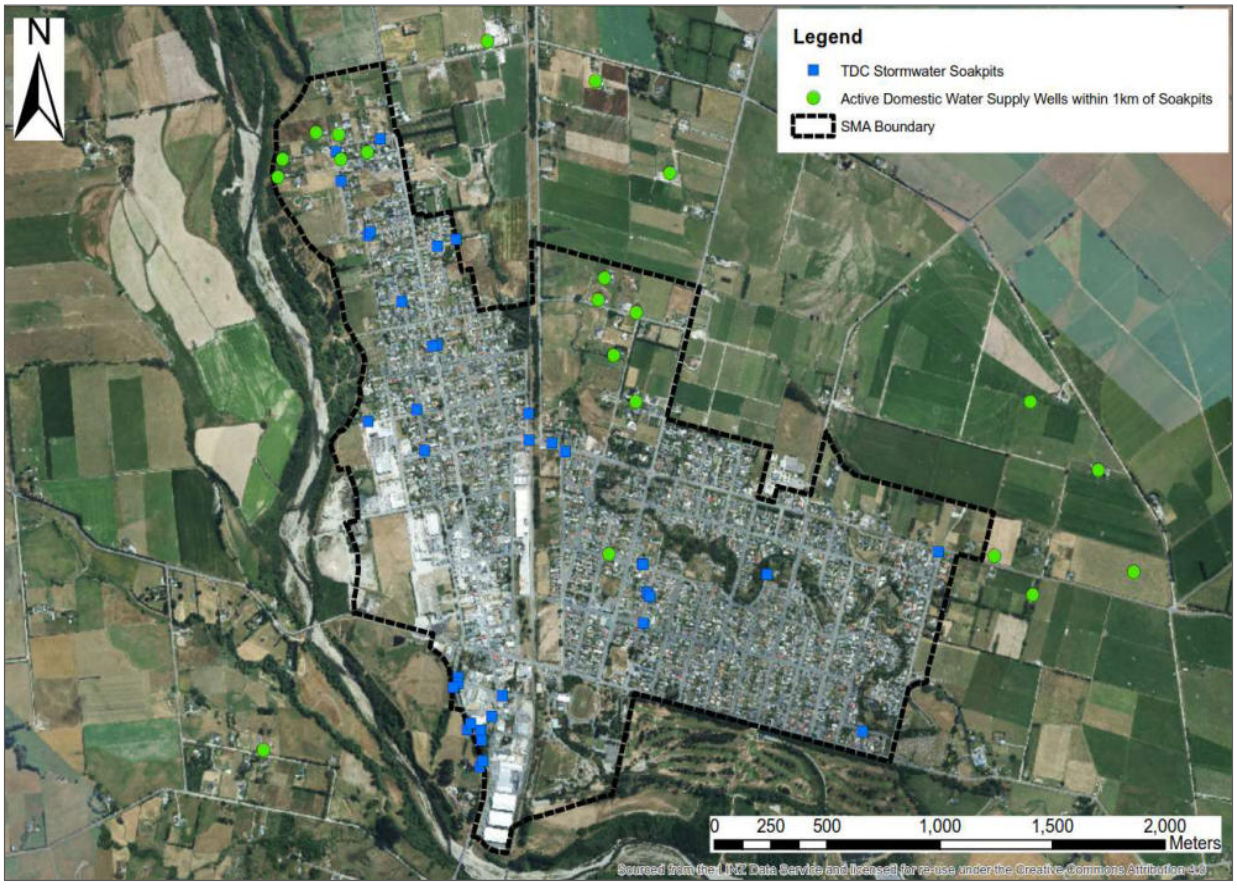

Figure 12: Soakpits and Drinking Supply Wells in Vicinity of the Stormwater Management Area

3.7 Climate Change Implications

MfE (2018) climate change projections for Canterbury forecast an increase in temperature, an increase in the number of hot days, a decrease in the number of frost days and snow days and an increase in annual rainfall. Specifically, MfE (2018) predicted temperatures will likely be 0.7°C to 1.0°C warmer by 2040 and 0.7°C to 3.0°C warmer by 2090.

A recent update of climate change predictions by NIWA (2020) is forecasting rainfall to change by between +/-5 percent for most of the Canterbury region by 2040 and 2090. Whilst by 2090 winter rainfall in eastern parts of South Canterbury near Timaru is projected to increase by 20 to 25 percent.

The NIWA (2020) predictions have formed the basis of PDP (2021e) assessment that a future increase in groundwater levels underlying all four townships (Timaru, Washdyke, Temuka and Pleasant Point) is anticipated, although this could also lead to an increase in groundwater losses to streams which may provide a buffering effect. Unfortunately, current depth to groundwater data is sparse in Temuka, although in general groundwater levels are already shallow in many locations. It is not possible to easily quantify the potential increase in groundwater levels given the uncertainty regarding the climate predictions and the current limited knowledge of the groundwater system within the study area. However, the predicted increases in groundwater levels would likely have impacts on the ability of the existing and future stormwater discharges to continue to discharge to ground in some areas.

Climate change predictions will increase the incidence and intensity of extreme and very extreme rainfall events, particularly for shorter duration events with associated larger floods. This will result in an increase in the duration of stormwater infiltration to ground, and associated groundwater level impacts, and is an important consideration for sizing future stormwater infrastructure and basins.

3.8 Non-Residential Assessments

The non-residential assessments conducted by PDP (PDP, 2021b) identified 28 commercial or industrial properties that present a potential risk to the quality of stormwater within Temuka. A desktop assessment was carried out to determine the risk level of commercial and industrial sites in the Timaru District by the activities occurring at the sites. In Temuka, five sites were deemed to be high-risk due to the type of activity occurring at the site.

Following the desktop assessment, high-risk sites were identified for detailed site assessments which involved a site walkover using a GIS-based survey to record areas of interest and notes from the site. The purpose of these assessments was to ensure compliance with TDC's stormwater bylaw and to identify opportunities for progressive improvement in water quality from potential high-risk sites.

Two sites in Temuka were audited in person by PDP during the assessments, and recommendations have been made for improving stormwater management and reducing potential environmental impacts at both sites.

In general, the site assessments found a lack of understanding of stormwater contaminants and their effects on the aquatic environment. Education for business owners on good stormwater management practices, combined with more frequent auditing and enforcement, were determined to be key actions that would aid in improving stormwater management, and subsequently stormwater quality, at private sites.

3.9 Contaminant Sources

A contaminant load modelling (CLM) assessment tool was developed for Temuka (PDP, 2021c). The CLM allows TDC to identify areas that contribute the highest contaminant loads and would therefore likely benefit the most from stormwater treatment. The results (Figure 13) of this assessment identified five catchments within the Temuka SMA that contribute the highest contaminant loads, being:

- South-east Temuka, that discharges to land;
- Central Temuka including the Domain catchment, that discharges to land;
- The upper reach of the Taumatakahu Stream, which indirectly discharges into the Taumatakahu Stream;
- North Temuka catchment has discharges into the North Branch of the Taumatakahu Stream; and,
- Northwest Temaka discharges from an outfall into the upper reach of the Taumatakahu Stream.

These catchments account for more than 50% of the total load of total suspended solids, zinc, copper, and TPH. The industrial area in the southwestern part of the SMA showed the highest loads of zinc, copper, and TPH, whilst the more rural catchments had the highest total suspended solids loads.

The CLM can be used to assess the effectiveness of different stormwater treatment options as part of the implementation of stormwater management plans in the future.

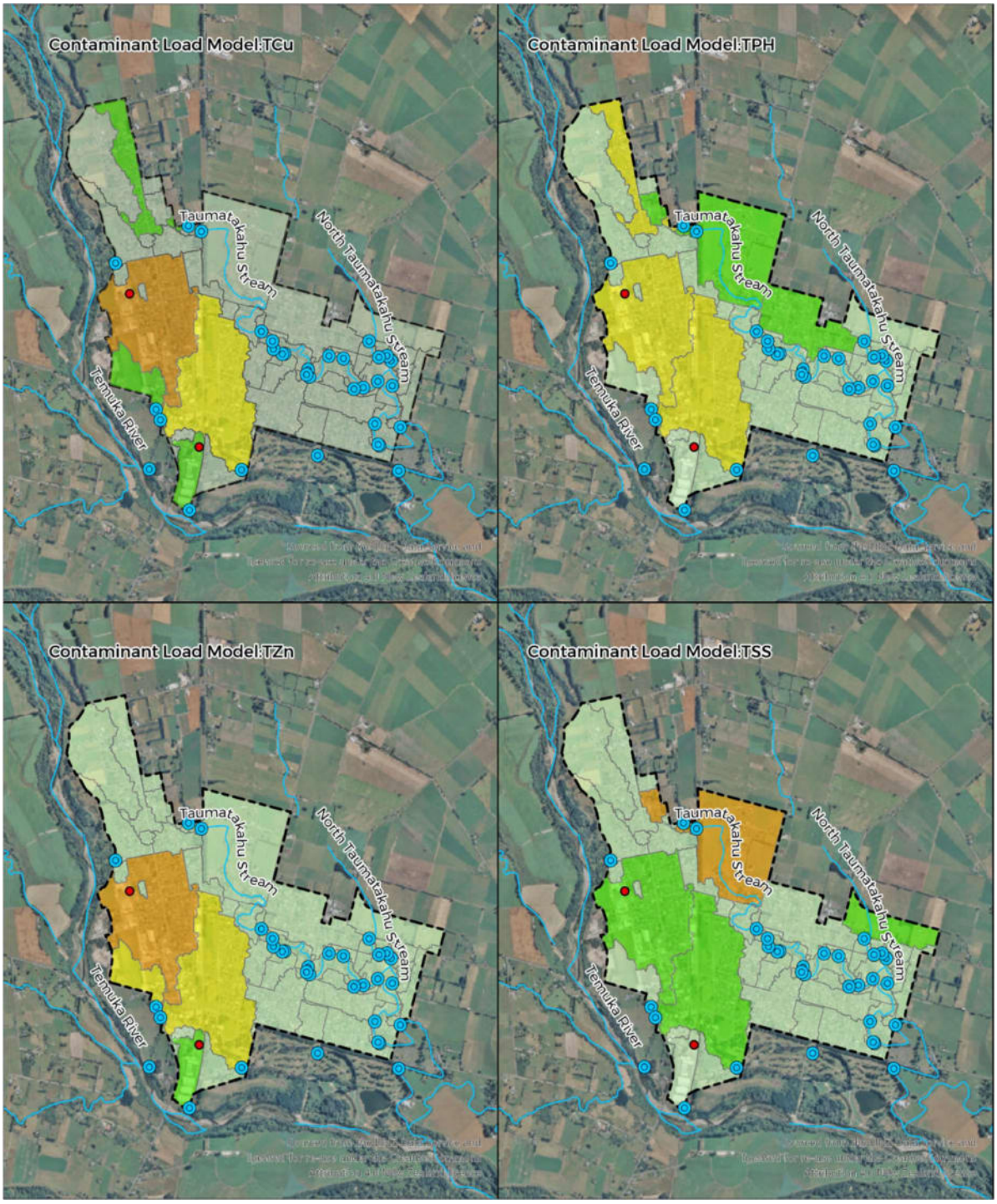

Figure 13: Temuka Contaminant Load Model Assessment

4.0 Key Issues with Stormwater Management

Community feedback in conjunction with the Technical Reports that supported the development of this management plan has identified a series of known issues associated with the management of stormwater in Temuka (below). These have fed into the identification of the goals and objectives of this SWMP, which should be progressively addressed as TDC implements improvements to the stormwater infrastructure and/or management practices.

Key known issues within the stormwater management area, include:

- A portion of the Temuka Township stormwater is untreated and discharges to the spring-fed Taumatakahu Stream (and its northern tributary);
- Metals and metalloids commonly found in stormwater have been observed to accumulate in sediments in the lower Taumatakahu Stream and mid-reach of the Te Umu Kaha / Temuka River. These metals and metalloids lead to the poor condition of mahinga kai in these waterways;
- In the upper stretch of the Taumatakahu Stream hydrocarbons have been observed in the stream sediments;
- Use of some existing soak pits and possible future discharge to land in the vicinity of the Taumatakahu Stream could lead to some indirect discharges of dissolved stormwater contaminants into the stream;
- Lack of biodiversity, riparian habitat, and cultural materials;
- Taumatakahu Stream is impacted by sedimentation. Attributed to a combination of bank instability, sediment in stormwater and/or agricultural runoff. This can impact the condition of mahinga kai and the appearance of the waterway;
- There are currently 37 soak pits for stormwater management that service the SMA, and may affect existing active drinking supply wells within the SMA and a conservative 500 m buffer downgradient of the SMA;
- Stormwater inflows (in addition to groundwater infiltration) into the Temuka wastewater system have contributed to increased wastewater flows and have led to wastewater overflows. Recent wastewater pipelines and pump station upgrades should have addressed this issue;
- Loss of the extent and condition of wetlands and springs;
- The ability to provide an efficient and sustainable stormwater drainage system is challenging due to the characteristically flat terrain of the town together with a typically high groundwater table;

- Limited and undersized pipe networks and road drains (or swales) result in high-frequency nuisance flooding across the urban catchment as well as some areas subject to high hazard flooding that may be a risk to public safety;
- Absence of any interpretation or recognition of cultural significant sites; and,
- Agricultural and grazing practise in the upper catchments present a risk to the water quality in the Taumatakahu Stream.

4.1 Review of Issues

The current set of key issues has been identified based on the community feedback and the reports that supported the development of this management plan. It is anticipated that new issues may be identified during the Monitoring Plan and included in the routine review of the SMWP. However, a detailed review of the issues with the Temuka Stormwater Management system, including a possible realignment of the SWMP goals and objectives to address the issue shall be undertaken every XXX six years XXX.

The review shall seek advice from the community, Arowhenua, and key stakeholders as well as an assessment of the performance of the Temuka stormwater infrastructure and management systems.

5.0 Management Approach

In the case of the Temuka SWMP the baseline environmental and cultural impact assessments have identified the known issues and community concerns with the current management of stormwater. Furthermore, these studies have informed the objective and targets of this management plan.

TDC has adopted an adaptive management approach to monitor the performance of the stormwater system to comply with these targets as well as guide the identification of projects or management actions. It is anticipated that the objectives and targets may evolve during the life of Temuka Stormwater Consents. As a consequence, the programme of projects or actions will need to be adapted to ensure the order of projects or actions continues to best address the objectives of the Stormwater Management Plan.

5.1 Adaptive Management

TDC applies an adaptive management approach to the management of the stormwater in Temuka. Adaptive management is an investigational approach to management, often defined as 'structured learning by doing. It has three elements, (1) monitoring, (2) adapting and (3) learning, as presented in Figure 14.

The monitoring plan will assess the performance of the management of Temuka's stormwater management systems relative to the specified Objectives and Goals, as well as identify projects or management actions that would progressively improve the management of stormwater or address a specific issue(s). As the Objectives and Goals may evolve in response to community concerns or changes in the environmental regulatory environment, TDC's Long Term Plan will need to adapt.

As outlined in Section 6.0 (Implementation Plan) the Implementation Plan will be reviewed annually, which in turn will feed into TDC's Annual Plan and Long-term Planning processes. A continual review of the latest techniques and consideration of the performance of the implemented projects or management actions will ensure that TDC expenditure will be directed to projects and actions that will progressively address the Goals and Objectives of the Stormwater Management Plan.

As outlined in Section 7.0 the Monitoring Plan will allow TDC to evaluate the performance and progress of the stormwater management infrastructure to achieve these objectives and targets, and more importantly, trigger the identification of additional projects that would improve the outcomes of the stormwater system.

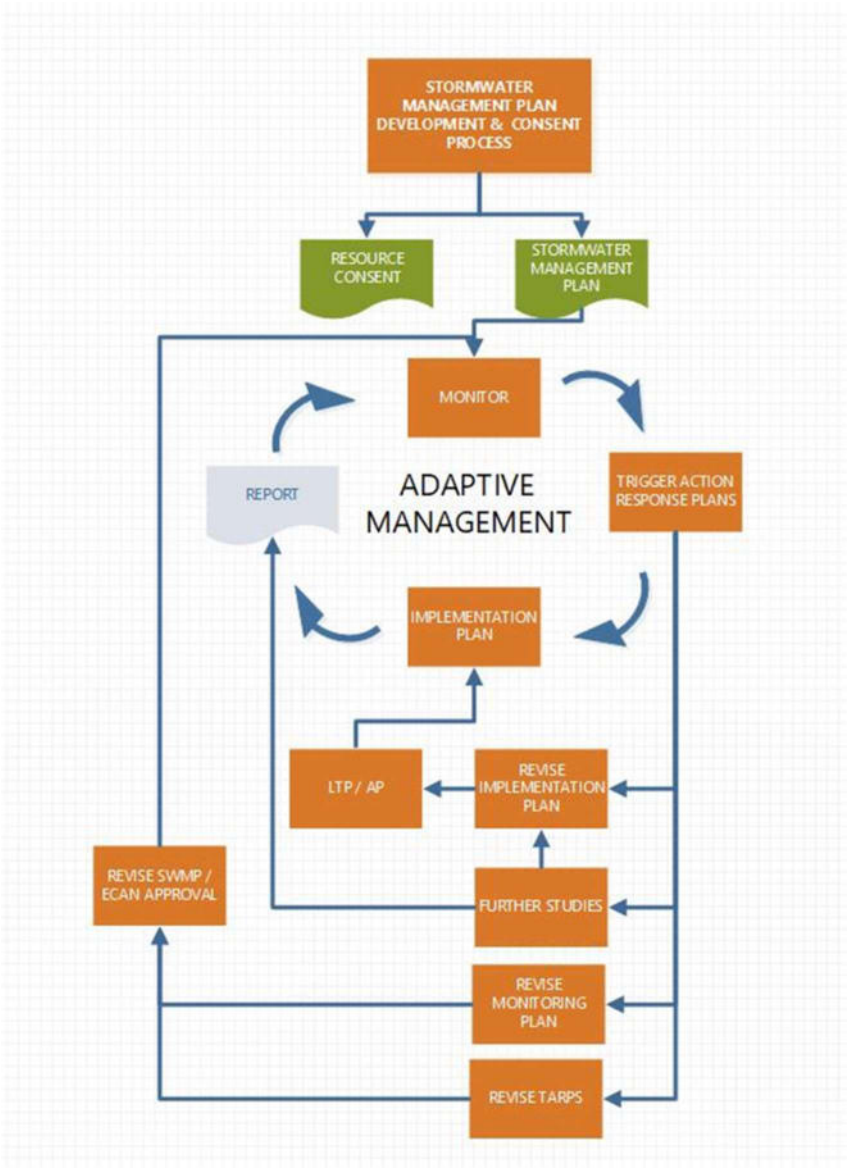

Figure 14: Temuka Stormwater Management Plan Adaptive Management Approach

5.2 Management Tools

TDC operates a suite of tools, management systems, policies and procedures to support the management of stormwater infrastructure and activities that occur within the SMA. These include:

- The Info-IPS Asset Management System. The asset management information system includes details of:
  - Public flooding complaints;
  - Manhole and culvert inspections;
  - Asset Invert surveys;
  - CCTV condition inspections and assessments;
  - Construction and maintenance records; and,
  - Consent condition compliance records.
- Asset condition assessments include:
  - Pipe CCTV inspections;
  - Downstream channel inspections; and,
  - Outfall inspections.
- Infor-IPS is integrated with TDC's Authority's Customer Relations Management (CRM) function which includes details of the public inundation complaints;
- Hydraulic Capacity Assessments;
- Stormwater Bylaw;
- District Plan;
- Stormwater Infrastructure Standards, include Timaru district high intensity rain depths;
- Soakaway Drainage Capacity Assessments;
- Commercial / Industrial Site Audits;
- Building Consent Approvals - new development controls (floor level, approval of new connections, network capacity assessments);
- Water Quality Monitoring; and,
- Education programmes (both internal and external).

Monitoring of environmental parameters and the associated Trigger and Response Plans (TARPs) (Section 7.0) enables a quantitative assessment of stormwater management. This monitoring provides key feedback into the management plan that identifies areas that should be targeted for improved stormwater management as well as monitoring the performance of management practices that have already been implemented.

A stormwater bylaw under the Local Government Act 2002 is operative, this can require existing sites connected to the stormwater network to undertake improvements to stormwater management on site and monitoring of discharge quality.

The draft Timaru District Plan review enables stormwater management standards in terms of Quantity and Quality to be enforced through activity rules and land-use zones.

Stormwater management can be implemented through the management of applications to the building consenting and stormwater approvals teams. TDC has minimum infrastructure standards that align with the stormwater management objectives and the District Plan Review is seeking that new developments and discharges will implement appropriate standards for improving stormwater management.

Audits of commercial and industrial sites that are operating under TDC's stormwater consents enable TDC to identify sites that are not performing by the consents and may be affecting TDC's compliance with their consents. Improved stormwater management will be recommended for non-complying sites. The consequence of not carrying out the required improvements will be the site losing its ability to discharge under TDC's stormwater consent, therefore requiring a separate consent from ECan with likely the same required improvements.

Education is a key component of improving stormwater management. The wider public may be unaware of the consequences of activities such as washing their vehicles or waste bins into the stormwater network or may not understand the steps they can take to improve the quality of stormwater in their neighbourhood.

6.0 Preparation of Implementation Plan

The Implementation Plan provides a summary of the schedule of projects or management actions that TDC will implement to progressively improve the management of stormwater in Temuka. The plan includes indicative costing for each action or program (if the actions can be grouped into programs) as this is useful for planning and setting budgets in TDC Annual Plans and Long-term Plans; similarly, any funding limitations will be reflected in the scheduling of projects or actions.

The Implementation Plan defines who is responsible for implementing the actions and includes an implementation timeline from planning, design and implementation. Table 6 provides an example of the structure of an Implementation Plan in a tabular format. Note, that the actual Implementation Plan would contain more specific information. If a project or action has actions for other agencies/groups, there will be a formalised agreement or partnership

arrangement with the other agencies/groups regarding the implementation of the recommendations.

Implementation Plan Checklist:

- Introduction;
- Review date;
- List or map of proposed Project(s) or Management Actions; and,
- Implement Plan Table (similar to the example presented in Table 6):
  - The issue to be addressed and the corresponding Objective;
  - Description of the Project or Management Action;
  - Estimated cost;
  - Agencies or departments that will be responsible for the implementation of the project or action;
  - Timeline, including planning, concept, design and delivery dates; and,
  - Key performance indicator(s).

As illustrated in Figure 15, the Implementation Plan is revised annually. During the year new potential projects or management actions will be identified, either as the recommendation as to the result of the Monitoring Plan (Section 7) or other sources (e.g., council officers, working party recommendations, etc). Annually these potential projects or actions are evaluated, along with the existing projects or actions in the Implementation Plan. The evaluation considers how well the projects or actions will progressively improve the management of stormwater, specifically to achieve the Objectives and Targets of the SWMP. Working within existing funding budgets the new and existing projects will be rescheduled, where projects and actions with the greatest benefit being prioritise.

The annual review process will allow the schedule of projects and action to adapt to changes in the environment or social issues, and regulatory changes during the life of the consent.

Similarly, whilst the schedule of projects or actions will be matched to budgetary restraints, the Implementation Plan can demonstrate and support the business case for possible increases in Annual Plan and Long-term Plan funding.

Table 6. Example of Implementation Plan Table:							
Issue	**Objective**	**Project / Management Option**	**Estimated Cost** **Capital**	**Agency/Dept** **Ongoing**	**Timeline**	**KPIs**	
Inadequate maintenance of stormwater devices	Ecology of Taumatakahu River	Develop and use an electronic infrastructure management program		$ xxx	TDC – Infrastructure Group	2023	The infrastructure management programme and SWMP annual reporting
Localised inundation Bridge St	Flooding Level of Service	Infiltration Basin Centennial Park	$ xxx	$ xxx	TDC – Parks TDC - Drainage & Water	2024 – Plan 2026 - Implementation	Flood frequency
Etc.							

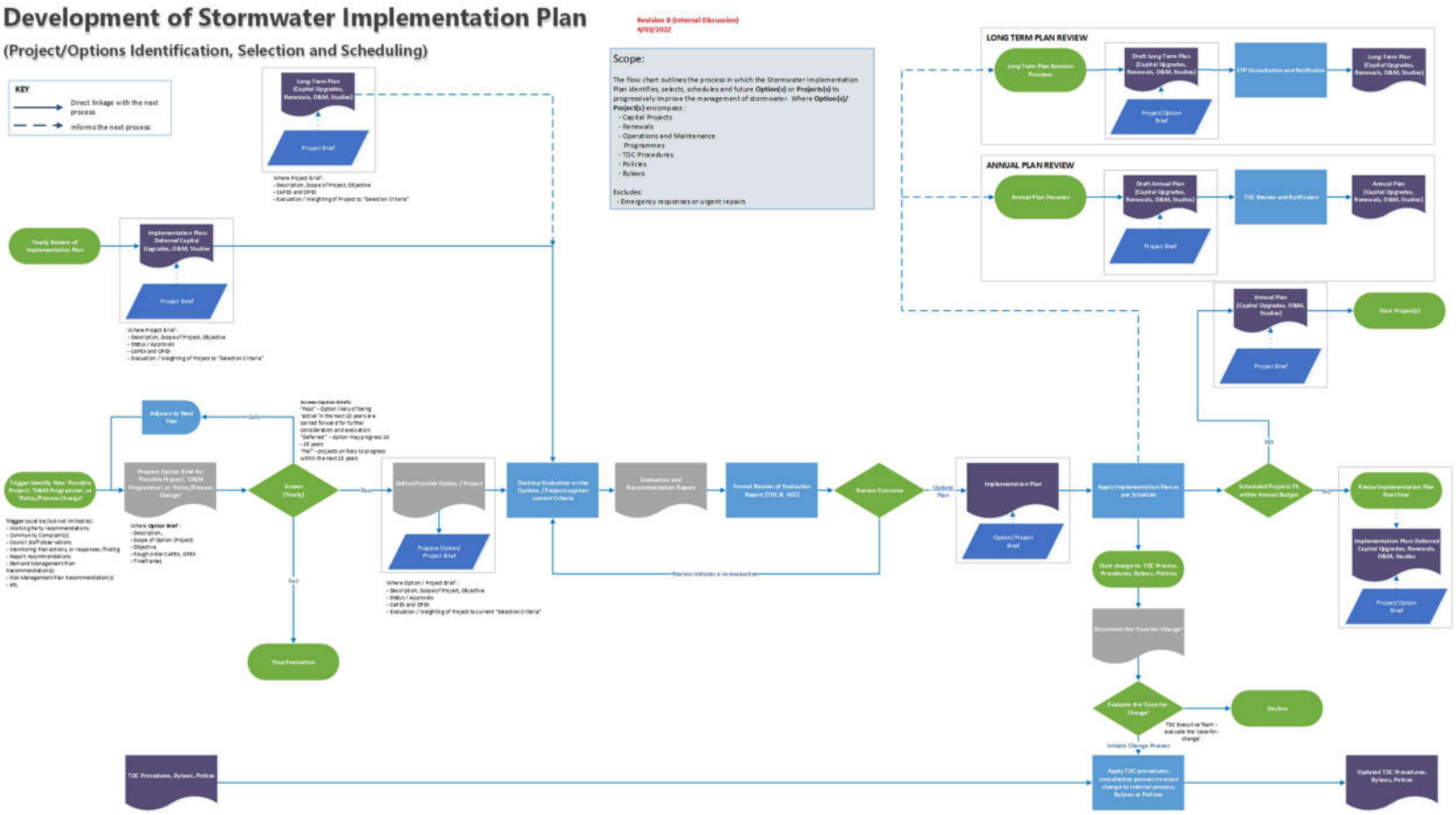

Figure 15: Stormwater Implementation Plan Development Flowchart

7.0 Monitoring and Trigger Action Response Plan

The Monitoring Plan has two roles (1) compliance monitoring to satisfy specific consent compliance conditions, and (2) performance monitoring of the stormwater management system, identifying possible issues and informing future projects or management actions.

Integral with the monitoring programme is the development of the Trigger Action Response Plan (TARP), which provides feedback on the performance of the Stormwater Management system and where/when additional projects or management actions are required; being the 'learning' element of the Adaptive Management Approach.

7.1 Trigger Action Response Plan

A key element of this management plan, and the success of the 'adaptive management approach is the use of a Trigger Action Response Plan (TARP). A TARP is a process that has been employed to feed information into the stormwater management or identify future projects that will improve the management of the stormwater in Temuka; hence allowing TDC to evolve or adapt the management of stormwater. Where these future projects are identified as the result of actions that are triggered in response to the results from the monitoring plan.

The TARP consists of using the Monitoring Plan with a set of documented and known environmental (and cultural) indicators that are checked continually in the SMA. The level of risk to the environment (or cultural indicator) is pre-identified, and when a trigger is reached that a responsible person(s) is required to react according, to the plan.

In general, each monitoring parameter (or groups of parameters) have pre-defined actions which fall into three categories (or levels) as summarised below:

- Trigger Level 3 (Green): Parameters are within the nominal trigger values and are indicative of good quality/performance;
- Trigger Level 2 (Orange): Parameters are showing signs of a reduction in the performance of the stormwater management practices. Actions are likely to be required soon, some further monitoring is likely; and,
- Trigger Level 1 (Red): Parameters are indicating the poor performance of the stormwater management practices that are likely to be having a noticeable effect on the receiving environment. More urgent stormwater management improvements and investigations of possible solutions are required.

7.2 Monitoring

Monitoring of water quality, aquatic ecology, stream sediment quality, groundwater and cultural is outlined in detail in the Temuka Stormwater Monitoring Plan. The plan outlines the proposed frequency of monitoring, parameters to monitor, and monitoring locations for:

- Surface water quality and quantity;
- Sediment quality;
- Ecology;
- Groundwater quality;
- Flooding complaints;
- Commercial and industrial site audits;
- Stormwater network outfall inspections; and,
- Cultural monitoring.

The monitoring programme has been designed to monitor the performance and ecological impact of the stormwater discharges on the environment and guide both reactive and proactive management and any additional maintenance of the stormwater infrastructure in Temuka. Current adaptive management actions are detailed within the TARP (trigger, action, and response plan) and included in the Monitoring Plan.

This includes the monitoring requirements that are recommended to be included in the resource consent as well as additional monitoring provided to assist TDC management of the network and understanding of the base environmental characteristics better.

The Monitoring Plan shall be reviewed annually. The annual review shall identify the monitoring parameters that should be added, dropped or frequency changed.

7.2.1 Database

In addition to any specific resource consent monitoring requirements, TDC will maintain an Environmental Compliance Database. This database will be used to record all aspects relating to compliance of the SMWP to resource consent requirements in addition to additional elements identified in this SWMP.

The Database/Register will be managed and maintained by the Drainage and Water Manager to ensure all SWMP compliance matters are addressed on time and per the monitoring requirements.

8.0 Communication and Reporting

Effective and regular communication of the performance of the Temuka stormwater network is important to deliver the successful implementation of the Temuka SWMP.

8.1 Internal Stakeholders

Internal communication refers to communication will TDC personnel (including maintenance and operations contractors) who are associated with providing and maintaining the stormwater infrastructure for Temuka. Key internal communication mechanisms will include:

- Customer Services receiving and responding to any stormwater 'complaints' or 'problems', per TDC's service complaints management procedure;
- Annual Reporting:
  - Asset data collection activities completed;
  - Asset data collection activities programmed;
  - Project status and milestones;
  - Operations and maintenance activities;
  - Implementation Plan revisions and programme progress;
  - Monitoring results;
  - Planned monitoring activities;
  - Additional investigations required;
  - Education activities completed; and,
  - Education activities proposed.
- Internal reporting & liaison, including but not limited to:
  - Waste Minimisation (Education programmes and monitoring);
  - Roading Section (O & M and Capital works programme);
  - Animal Control Section (Education programmes and monitoring);
  - Planning Section (new development requirements);
  - Temuka Community Board - (Upcoming projects and general activities, management plan milestones and achievements);
  - Infrastructure Community – (upcoming projects); and,
  - Environmental Services Committee – new development requirements and planned servicing upgrades.

8.2 External Stakeholders

External stakeholders and details required may include but are not limited to:

- Environment Canterbury (Pollution Control, waterway maintenance issues, environmental monitoring, compliance requirements);
- Orari Temuka Opihi Pareora (OTOP) Water Zone Committee; and,
- Te Rūnanga o Arowhenua (Upcoming projects and general activities of interest, management plan milestones and achievements).

9.0 Reviews

The Temuka Stormwater Management Plan should be reviewed initially every two years, with a detailed review of the issues, goals and objectives being undertaken every six years. The TDC Drainage & Water Manager (or delegate) shall undertake the review of the plan, policies and procedures associated with the implementation of the plan. The review of the management plan should be undertaken in consultation with Te Runanga of Arowhenua and Environment Canterbury.

Any changes to the plan shall be approved by the TDC Group Manager – Infrastructure.

The next routine review is due to be completed by XXXX insert date XXX, whilst a detailed review, incorporating a review of the key issues, goals and objectives shall be completed by XXX insert date XXX.

10.0 References

Kitson Consulting. (2022). *Assessment of effects on Te Rūnanga o Arowhenua values and interests by TDC Stormwater Management.* Kitson Consulting Ltd.

PDP. (2021a). *Desktop Groundwater Assessment to Support Stormwater Management Plans for Timaru, Washdyke, Pleasant Point and Temuka.* Christchurch: Pattle Delamore Partners Ltd.

PDP. (2021b). *Non-Residential Site Assessments for the Timaru, Washdyke, Pleasant Point and Temuka Stormwater Management Areas.* Christchurch: Pattle Delamore Partners Ltd.

PDP. (2021c). *Contaminant Load Model of the Timaru, Washdyke and Temuka Stormwater Management Areas.* Christchurch: Pattle Delamore Partners Ltd.

PDP. (2021d). *Baseline Receiving Environment Assessment of the Timaru, Washdyke, Temuka and Pleasant Point Stormwater Management Plans.* Christchurch: Pattle Delamore Partners Ltd.

PDP. (2021e). *Groundwater Assessment to Support Stormwater Management Plans for Timaru, Washdyke, Pleasant Point and Temuak - Effects from Climate Change.* Christchurch: Pattle Delmore Partners Ltd.

WSP. (2021). *Timaru District Interim Pipe Capacity and Urban Flood Hazard Mapping.* Christchurch: WSP.

WSP/PDP. (2021). *Temuka Issues and Objectives .* Christchurch: WSP.

List of Abbreviations/Terms and Definitions

Abbreviation/Term	Definition
AEP	Annual Exceedance Probability
ARI	Average Recurrence Interval
ANZG	Australia and New Zealand Guidelines for Fresh and Marine Water Quality (2018)
bgl	Below ground level
DGV	Default Guideline Value
F-IBI	Fish Index of Biological Integrity
LiDAR	Light Detection and Ranging
LTP	TDC Long Term Plan
LWRP	Land and Water Regional Plan
m^3/s	Cubic meters per second
MCI	Macroinvertebrate Community Index
NES-F	National Environmental Standards for Freshwater
NPSFM	National Policy Statement for Freshwater Management 2020
NZBC	New Zealand Building Code
NZFFD	New Zealand Freshwater Fish Database
PAH	Polycyclic Aromatic Hydrocarbons
PDP	Pattle Delamore Partners Ltd
QMCI	Quantitative Macroinvertebrate Community Index
RMA	Resource Management Act 1991
SMA	Stormwater Management Area
Target	Concentration or physical parameter (e.g., flow rate or % coverage) that is desired in order for the objectives of the SWMP to be met
Trigger Value	Concentration or physical parameter (e.g., flow rate or % coverage) from national or regional guidelines that must be met to minimise effects on the receiving environment
TDC	Timaru District Council
TPH	Total Petroleum Hydrocarbons