Appendix 1
Pleasant Point Stormwater Management Plan

DRAFT - Pleasant Point Stormwater Management Plan

Prepared for

Timaru District Council

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Executive Summary

The area of the Pleasant Point stormwater management area (SMA) is approximately 170 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 Pleasant Point Stream and German Creek; this management plan outlines how TDC will manage the activities that operate within the SMA and discharge into TDC's stormwater network, specifically 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 Pleasant Point 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 Pleasant Point's stormwater.

The Vision for Pleasant Point's Stormwater Management is:

Working together to value, protect and restore the mauri/lifeforce of the waterways for the benefit of all.

TDC manages the urban stormwater, whilst Environment Canterbury has a responsibility for the flood defences of the Te Ana-a-Wai (Tengawai River) and Ōpihi to minimise the potential flood effects on the community of Pleasant Point. 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 Pleasant Point. Whilst this document outlines the principles and approach that TDC will apply, the mechanics of the approach are expressed in the "Pleasant Point Stormwater Monitoring Plan", "Pleasant Point 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 Pleasant Point (Figure 1);
- Outline the current stormwater management issues in Pleasant Point;
- 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 Pleasant Point; 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.

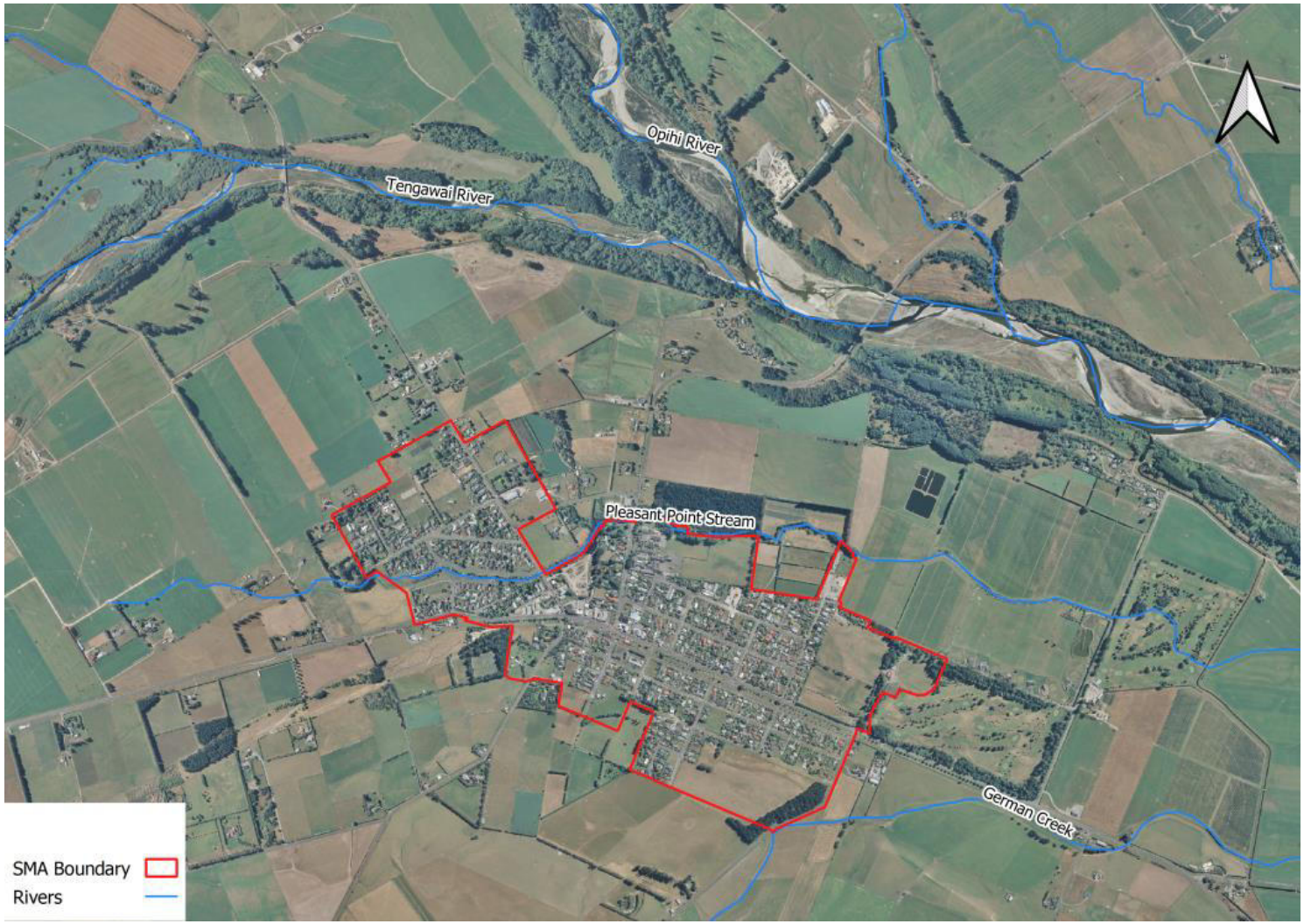

Figure 1: Pleasant Point Stormwater Management Area and Waterways

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 of Pleasant Point 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 Pleasant Point is:

Working together to value, protect and restore the mauri/lifeforce of the waterways for the benefit of all.

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; i.e. 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."*

Pleasant Point 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 Pleasant Point		
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 reduce the mass of stormwater related contaminated sediment within Pleasant Point Stream flowing to the Ōpihi River.	All vegetated stormwater channels and/or swales are maintained so that grass is in a healthy and uniform state with the exception of seasonal browning off, to minimise the contaminant build up in topsoils being mobilised; and revegetated where erosion or die-off has resulted in bare or patchy soil cover. Pleasant Point Stream sediment quality ≤ ANZG GV High within the SMA or adjacent Council land; unless an investigation determines the effects on Ōpihi River are negligible. Improvements in stabilisation of Pleasant Point Streams bed and banks within Council Land. Improvements in riparian margin planting of Pleasant Point Stream within the SMP Area where overland stormwater flow may be an issue.
	2. 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
	3. 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 Pleasant Point		
Te Mana o te Wai Hierarchy of Obligations	**Objectives**	**Targets**
B. Second, the health needs of people (such as drinking water)	4. Stormwater impacted sediment in Pleasant Point Stream that is accessible in public areas does not pose a risk to human health	⁘ Pleasant Point Stream stormwater impacted sediment quality within areas accessed by the public, within the SMA, or adjacent Council land, is less than or equal to the nationally recognised parks/recreational soil contaminant standards (SCS)
	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 within the SMA
	6. Progressively reduce the acute and cumulative impacts of the stormwater network and stormwater discharges on waterbodies connected to and within the Ōpihi Mātaitai downstream of Pleasant Point 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 Pleasant Point		
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; ⁘ Zero deaths and notified injuries from stormwater runoff.
	10. Pleasant Point 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.

Acronyms:

ANZG: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines, **GV**: Guideline Value

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 6.0.

3.0 Description of the Stormwater System and the Environment

3.1 Scope of the SWMP

The Pleasant Point SWMP covers the activities and TDC's infrastructure within the Pleasant Point SMA (Figure 1). The SMA extent is primarily based on the operative district plans zoned residential and commercial areas with some open space zoning of the Pleasant Point Domain. TDC has obtained a series of Resource Consents from Environment Canterbury that permit TDC to manage and discharge stormwater from existing urban areas and future urban growth to groundwater, the Pleasant Point Stream and German Creek.

- 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 Environment

3.2.1 Wider River Catchment

Pleasant Point is part of the wider Ōpihi River catchment which has a size of approximately 246,000 ha including its tributaries Te Ana-a-Wai River (Figure 1), Ōpuha River and Te Umu Kaha (Temuka River).

Pleasant Point is located on the southern portion of the Canterbury Plains near the junction of the Te Ana-a-Wai (the Tengawai River) and Ōpihi Rivers. The Pleasant Point catchment, therefore, comprises the contributing catchment areas of the Te Ana-A-Wai and Ōpihi Rivers upstream of this junction.

Te Ana-a-Wai flows from Mt Nessing eastward for approximately 35 kilometres before joining the Ōpihi River 20 kilometres north of Timaru, near Pleasant Point. The Te Ana-a-Wai sub-catchment is approximately 48,811 ha equating to 26% of the larger Ōpihi catchment.

The following description of Te Ana-a-Wai is taken from Aoraki Environmental Consultancy Limited's (AEC) Mana Whenua Impact Assessment for the Pleasant Point SWMP.

Te Ana-a-Wai contains occasional pools which are over two metres deep and the river's substrate consists of bedrock, boulders, and cobbles. The gorge substrate consists mostly of bedrock but there are some areas of mud and silt. Macro-invertebrates, observed in upland areas, indicate that these habitats are in good condition.

Te Ana-a-Wai catchment includes the Little Opawa which generally flows east from a ridge 20 kilometres southwest of Fairlie, joining with its southern neighbour, the Opawa River very close to their joint outflow into Te Ana a Wai, close to the settlement of Albury.

Other tributaries, including Tramway Stream, flow through grassland, shrubland, scrub, forest and at higher altitudes, tussock land. Forest occurs in four main areas: a large area adjacent to the Te Ana-a-Wai River gorge, Cherry Tree Stream, in the valley immediately east of Cherry Tree Stream and in Tramway Stream. Stock and wild animals have access to streams, although access is restricted in the steeper gorges. The streams vary in width. Most of the permanent streams are approximately 300 mm deep, although pools of over one and a half metres

deep are present in Tramway Stream. The substrates of all permanent streams are mainly boulders and cobbles, with areas of bedrock and silt. Macro-invertebrates observed in this area indicate that these habitats are in good condition.

The Ōpihi River flows from the foothills of the Southern Alps at elevations of up to 2,200 m, through the Timaru downlands and over the Canterbury Plains (i.e. including the Levels Plains area) to the coast. The Ōpihi River has three tributaries Te Ana-a-Wai (Tengawai River), Ōpuaha (Ōpuha River) and Te Umu Kaha (Temuka River) (AEC, 2020).

3.2.2 Catchment History

Today, agriculture is the predominant land use within this catchment. Historically, wetlands and swampland were far more prevalent in the Ōpihi River catchment (AEC, 2020) but have been significantly reduced through drainage and the ongoing pressure for such land to be made agriculturally productive (or altered for other reasons). Section 3.3 provides further context as to the immense significance the wider catchment has to Te Rūnanga o Arowhenua.

The digitised 19th Century 'Black Maps' provide an indication of the pre-European state of the land in and around Pleasant Point. As illustrated in Figure 3, prior to European settlement Pleasant Point comprised of broken terraced ground, vegetated with a combination of grasses, herbs and flaxes. It is likely that flaxes would have dominated in the ephemeral watercourses.

As demonstrated in Figure 4, Pleasant Point has grown significantly with urbanisation of pastural land.

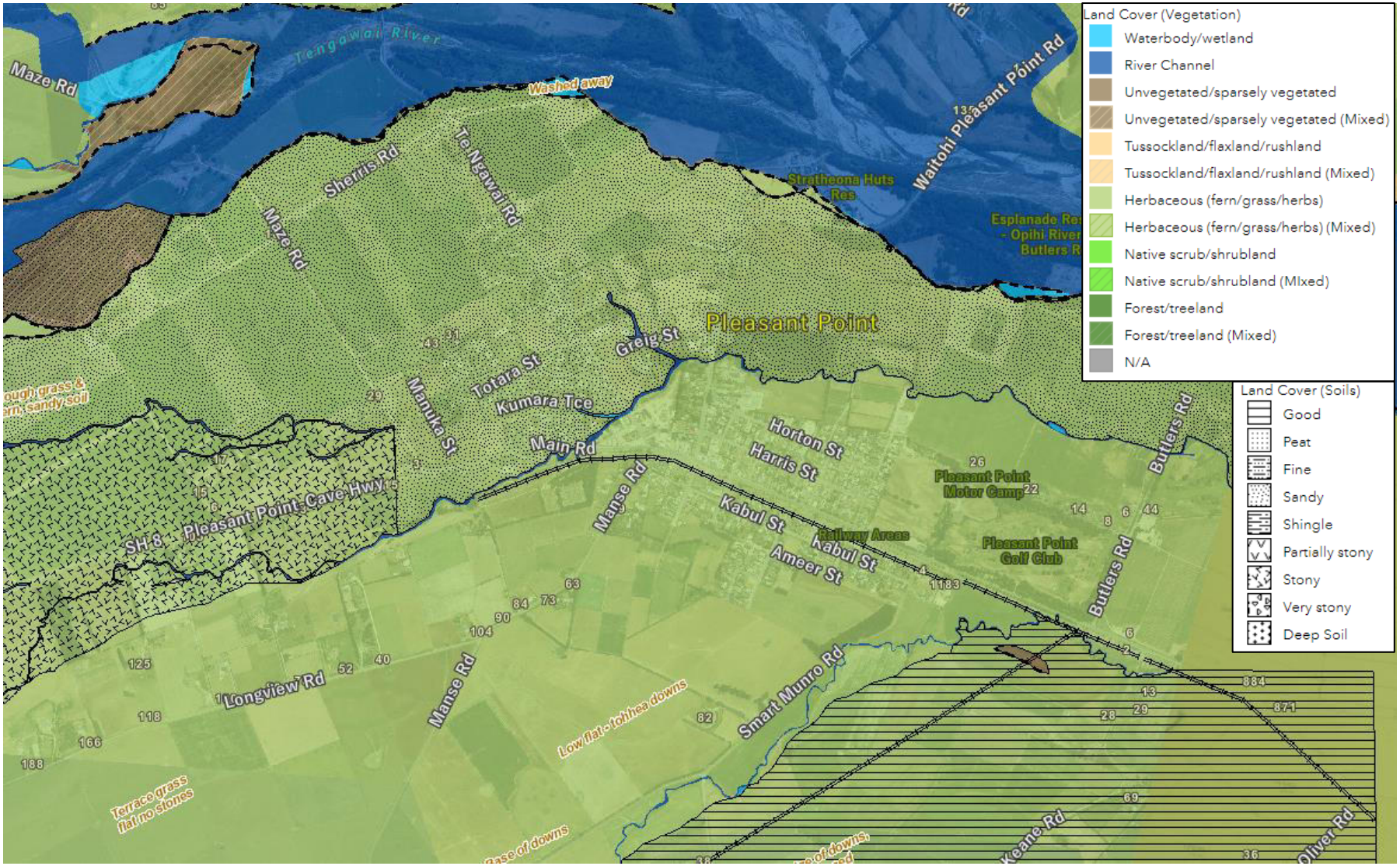

Figure 3: 19th Century Black Maps representing a pre-European, largely natural landscape (https://mapviewer.canterburymaps.govt.nz/)

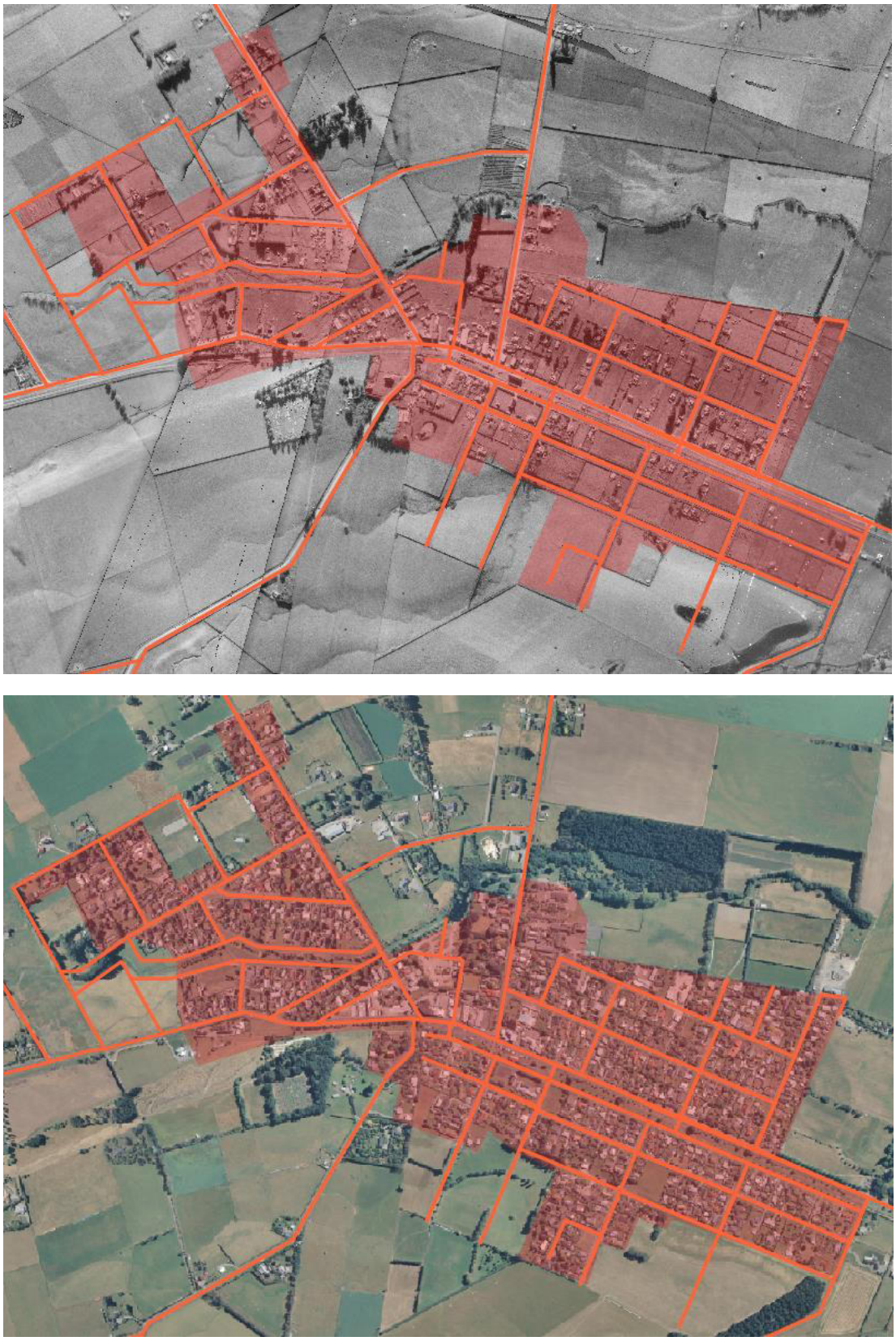

Figure 4 Historic imagery of Pleasant Point, 1937 (top) with the modern urban extent and road network overlaid, 2017 (bottom) (Sourced from https://retrolens.nz and licensed by LINZ CC-BY 3.0)

3.2.3 Pleasant Point Stream

The Pleasant Point Stream catchment covers approximately 15.9 km^2 and includes rural, residential, recreational, and commercial land use classes. The majority of the catchment is exotic grassland for agricultural use. Pleasant Point Stream is an ephemeral second-order watercourse as it passes through the Pleasant Point township. It has an approximate mean flow of 0.04 m^3/s, and generally only flows for a short periods of time following heavy rainfall.

The Ōpihi riverbed (downstream of Pleasant Point) is characterised as a Land of National Significance and a Site of Special Wildlife Significance by the Department of Conservation (DoC). The Ōpihi 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.

The ephemeral nature of Pleasant Point Stream means that its ecological value is expected to be low. However, as the stream feds into the Ōpihi River, it may be a potential source of contaminants for this River. Monitoring locations have been selected downstream of each of the two main discharges from the Pleasant Point stormwater network. The streambed near the upstream monitoring site consists of exotic grass, whilst the downstream monitoring site has a bed of bare soil and cobbles/boulders.

3.2.3.1 Water and Sediment Quality

Two sampling sites were selected with the ephemeral watercourse, the upstream site (PP_S1) was situated at portion of the stream that had an exotic grass bed while the downstream site (PP_S2) had a bed of bare soil and cobbles/boulders. During the 2020 ecological sampling programme (PDP, 2021d), in both the winter and summer sampling rounds there was insufficient flow within the channel to obtain water quality samples, hence sample results are only available for sediment quality.

Total arsenic concentrations measured from the upstream site (PP_S1) exceeded the ANZG (2018) default guideline value (DGV) during both monitoring rounds. For the downstream site (PP_S2), total arsenic exceeded the ANZG (2018) DGV during the winter monitoring only, with a concentration that was nearly three times lower during the summer monitoring. Total lead and zinc concentrations were consistently above ANZG (2018) DGVs at both sites.

Polycyclic aromatic hydrocarbon (PAH) concentrations were typically higher during the first monitoring round at both monitoring sites; which are naturally occurring in coal, crude oil and motor-vehicle fuels, and can be produced when organics (wood and rubbish) are burnt. The highest PAH concentrations were measured from downstream site.

Total petroleum hydrocarbon (TPH) concentrations were typically higher during the winter monitoring round at the upstream site and higher during the summer

monitoring round at the downstream site. Concentrations were similar between sites during the winter monitoring round, while the concentration measured from the downstream site during the summer monitoring round was nearly twice that measured at the upstream site. Overall, the TPH values were consistently high (920-1,620 mg/kg) and above the ANZG (2018) DGV.

TP concentrations were comparable across both sites and sampling rounds. TN concentrations showed higher variation, with consistently higher concentrations recorded from the upstream site. Concentrations measured during the summer monitoring round were similar between sites, but the TN concentration measured from the upstream site during the winter monitoring was nearly double the concentration at the downstream site.

3.2.3.2 Aquatic Ecology and Fish Passage

Due to the ephemeral nature of the watercourse the aquatic ecology was unable to be assessed. The National Institute for Water and Atmospheric Research (NIWA) Fish Passage Assessment Tool provides a database of known potential barriers to fish passage in New Zealand. This tool has been used to determine potential barriers to fish passage within the waterways in the Pleasant Point SMA.

There are several unassessed structures within Pleasant Point Creek in the SMA, including culverts under Halstead Road and Tengawai Road, with four unknown structures upstream of these. However, as the creek is ephemeral the effect of these structures on migratory fish species is likely to be minimal

3.2.4 German Creek

The German Creek catchment is located immediately to the south of the Pleasant Point Stream catchment and includes a minor part of the Pleasant Point township. The catchment covers an area of approximately 18.5 km^2, including rural, residential, and recreational land use classes. As with Pleasant Point Stream catchment, the German Creek catchment is dominated by high production exotic grassland; however, the majority of stormwater is generated from residential land within the township. German Creek forms part of the wider Ōpihi River catchment.

German Creek is a third-order watercourse that passes through rural land on the southern border of the Pleasant Point township. This watercourse generates a mean annual flow of 0.11 m^3/s[1] and is understood to be ephemeral with low ecological value.

3.2.4.1 Water and Sediment Quality

Two monitoring sites were selected on German Creek, both of which were located below stormwater discharges. The tyre tracks and low exotic grass

[1] https://data.mfe.govt.nz/search/?q=flow

present at the upstream site (PP_S3) indicate that this site is likely grazed (although stock were not present at the time of sampling) and used as a farm track.

Metal and metalloid concentrations in surface sediment samples were typically low and below guideline limits. However, a notably higher arsenic concentration was measured from the downstream site (PP_S4) during the winter monitoring round that exceeded the ANZG (2018) DGV. Consistently elevated concentrations of lead were measured from the upstream site (PP_S3). At the downstream site concentrations of arsenic, chromium, and copper were notable higher in winter than summer, indicating that this site may exhibit seasonality in heavy metals concentrations.

The concentration of PAH compounds in soil were almost all below laboratory detection limits at both sites.

TPH concentrations were higher during the second monitoring round at both sites, and concentrations were consistently higher at the downstream site than at the upstream site. The TPH concentration measured from the downstream site during the summer monitoring round was more than twice the concentration measured from the upstream site and exceeded the ANZG (2018) DGV.

TP concentrations were similar at the upstream site between monitoring rounds. The TP concentration measured at the downstream site during the second monitoring round was approximately twice that measured during the first round. TN concentrations measured from the upstream site were comparable across monitoring rounds; however, TN concentrations measured from downstream site were almost five-times higher during the second monitoring round. The high variance in TN measured from the downstream site between monitoring rounds is in part a result of a nearly two-hundred-fold increase in nitrate-nitrogen concentrations.

3.2.4.1 Aquatic Ecology and Fish Passage

Again, due to the ephemeral nature of the watercourse the aquatic ecology was unable to be assessed. The structures downstream within German Creek downstream of Pleasant Point have mostly been assessed and have a risk rating of “very low”. The remaining structures that are upstream of Pleasant Point township are mostly unassessed and the type of structure is unknown. As with Pleasant Point Creek, the presence of these structures is unlikely to have a significant effect on migratory species as the creek is ephemeral.

3.2.5 Ecological Summary

The environmental baseline is summarised in Figure 5. The aquatic environment issues are summarised as:

- Pleasant Point Stream and German Creek are both ephemeral waterbodies and are expected to have limited aquatic ecological value.

However, contaminants entering these waterbodies have the potential to impact the Ōpihi River downstream.

- Metals in sediment that were elevated above guideline values were found in samples from three of the four monitoring sites, two of which are consistent with metals often found in stormwater.
- Hydrocarbons in sediments were also found to exceed the guideline values at three of the four sites.
- The elevated heavy metals and hydrocarbons in sediments are indicative of contaminants in stormwater accumulating in the bed of the Pleasant Point Stream.
- Improvements to the stormwater network, particularly in the Pleasant Point Stream catchment, would improve the quality of stormwater entering the stream and subsequently lower the potential ecological impacts in the Ōpihi River downstream.

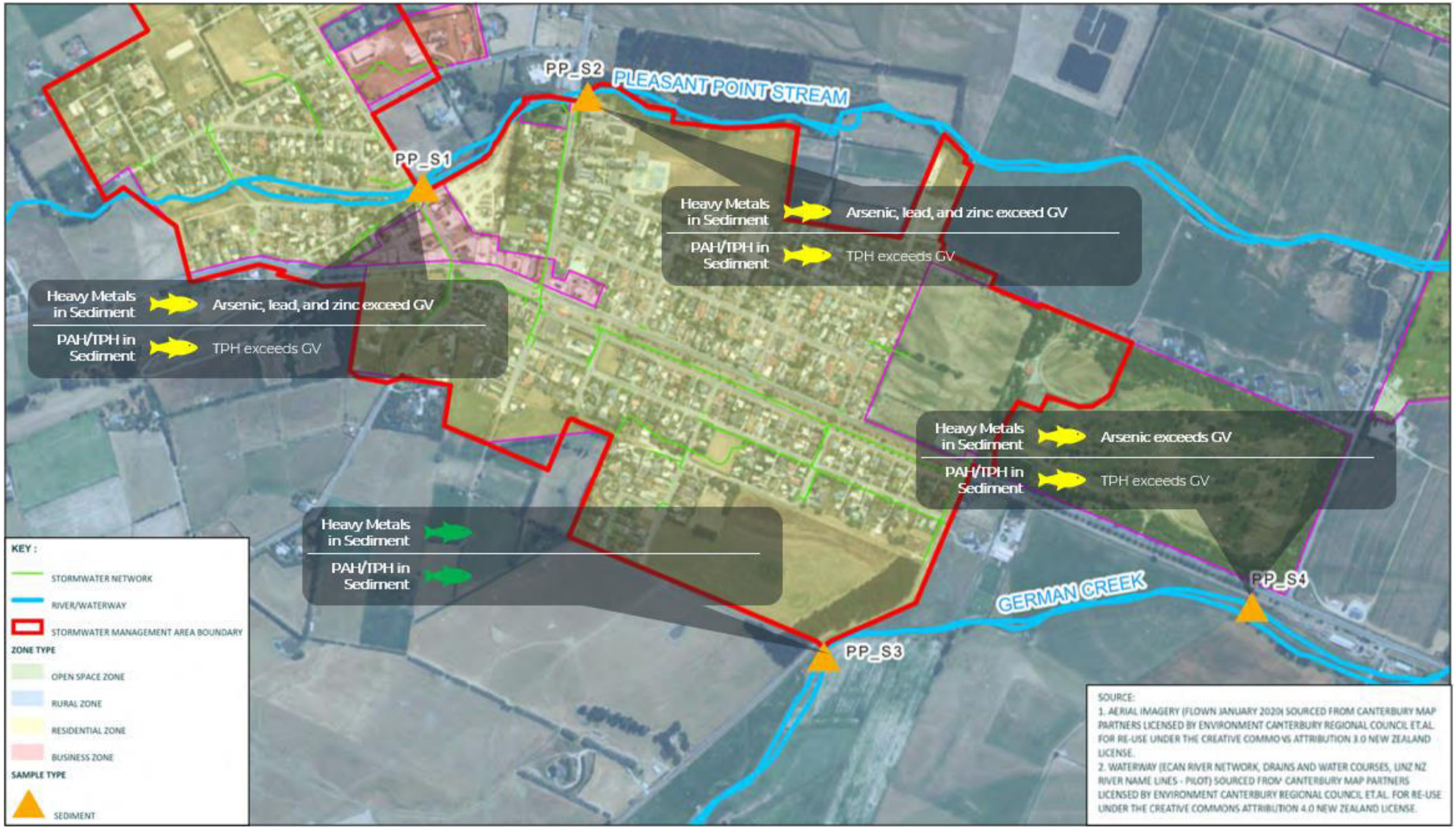

Figure 5: Summary of the Existing Aquatic Environmental Baseline Conditions

3.2.6 Climate

In general, Pleasant Point has a dry moderate climate. As it lies approximately 15 km inland from the coast and is on average 65 m above sea level.

As presented in Table 2, based on the nearest weather Station at Timaru Airport the average monthly temperature varies from 5.2°C in winter to 15.9°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# H41325)*

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).

As part of the baseline studies undertaken to inform the Pleasant Point SWMP, AEC have been engaged by TDC to prepare a Mana Whenua Impact Assessment on behalf of Te Rūnanga o Arowhenua.

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 Te Ana-a-Wai (Tengawai) Rivers as well as the township of Pleasant Point 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." Pleasant Point is located at the junction of the Te Ana-A-Wai and Ōpihi.

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 and extended in 2022 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. Part of the Ōpihi mātaitai extends from the Ōpihi Lagoon past the confluence of the Te Ana-a-Wai and Ōpihi. The Ōpihi mātaitai extends up Te Ana-a-Wai to the west of the Tengawai Road Bridge. Whilst Pleasant Point Stream or German Stream are not encompassed by the Ōpihi mātaitai, the Ōpihi Mātaitai Reserve is considered relevant to this SWMP.

Te Ana-a-Wai

Te Ana-a-Wai flows east for 35 kilometres before joining the Ōpihi River 20 kilometres north of Timaru. The Te Ana-a-Wai has occasional pools over two metres deep. Its substrates are bedrock, boulders, and cobbles, with mainly bedrock in the gorge. But there are some areas of mud and silt. Macro-invertebrates observed in upland areas indicate that these habitats are in good condition.

3.3.2 Arowhenua Concerns and Expectations

The concerns to whānau for Pleasant Point 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 health risk from contaminated sediment in waterways, in particular where Pleasant Point Stream flows path a school and park area;
- Absence of any interpretation or recognition of the cultural significance of the sites;
- Impacts of water extraction and modification of waterways on mahinga kai, and;
- The lack of water in some sites.

In addition, Arowhenua seek that the following matters are addressed in stormwater management for Pleasant Point. 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 whānau for Pleasant Point were identified by cultural experts during a site visit in September 2020 and have been incorporated into issues summary (Section 4.0); the site visit 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 waterways in the vicinity of Pleasant Point.

A summary of the assessment of the Pleasant SMA in terms of the thresholds set by Arowhenua for cultural use is presented in Table 3. The waterways downstream of Pleasant Point are not meeting all thresholds for cultural use other than nitrate and ammonia toxicity in their current condition, whilst the sediment monitoring in Pleasant Point Stream is above relevant guideline values.

Table 3: Pleasant Point 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	N/A
Access to mahinga kai is available	N/A
Nitrate and ammonia toxicity in NPSFM National Objective 'A' band	Pass
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

The Pleasant Point SMA has limited piped stormwater infrastructure with much of the catchment relying heavily on disposal to soakpits. Runoff from the catchment west of Kyber Street and Halstead Road is conveyed by the reticulated network to Pleasant Point Stream. Whilst runoff in the catchment south of SH8 is mainly conveyed via open channels with culverts, and discharges into German Creek (Figure 6). The remaining catchment north of SH8 relies almost entirely on soakage to ground

The ownership and subsequent responsibility for the operation and maintenance of stormwater assets is split between has TDC's Land Transport Unit, which manages the street infrastructure (i.e. sumps in the roads), the Drainage and Water team are generally responsible for all other stormwater infrastructure, while the Parks and Reserves team tend to maintain the planted areas (e.g. raingardens, stormwater basins, swales). Additionally, significant portions of the swale/open drain network are located within private property and hence difficult to maintain.

Table 4: Stormwater Infrastructure Summary

Stormwater Infrastructure	Quantity
Stormwater pipe size	2,500 m total
<300 mm diameter	950 m
300 – 500 mm diameter	1,450 m
500 – 1,000 mm diameter	100 m
>1,000 mm diameter	0 m
Swales	2,700 m
Stormwater outfalls	7
Soak Pits	73

Figure 6: Pleasant Point Stormwater Infrastructure

TDC maintains and operates some 2,700 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 73 TDC-owned soak pits within the Pleasant Point 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 7 stormwater outfalls within the SMA, including 6 outfalls into the Pleasant Point Stream and 1 outfall into German Creek 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

As part of TDC's preparation of the Stormwater Management Plans, WSP have been commissioned to complete an assessment of the stormwater reticulation network capacity and flood hazard (WSP, 2021).

A summary of the assessment results presented in Figure 7. 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. The study was limited to GIS mapped public TDC stormwater pipes only and excluded sump leads and pipes 300 mm in diameter or smaller. Approximately 40% of Pleasant Point's piped public stormwater network is smaller than 300 mm.

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

Length of pipe not able to meet 2-Year ARI	Length of Pipe (m) Meeting the Capacity Performance			
	2-Year ARI	5-Year ARI	10-Year ARI	Total Length Assessed
189 (32%)	404 (68%)	389 (66%)	320 (54%)	**593**

The capacity assessment found that 32% of the assessed pipe network is unable to convey 2-year ARI peak flows. Whilst 66% of the assessed network is able to convey up to 5-year ARI peak flows and 54% can convey up to the 10-year ARI peak flows. It should be noted that, where pipe capacity is exceeded, this is does not immediately result in habitable floors being inundated rather some ponding of stormwater may occur and/or secondary stormwater flow paths may transport the stormwater. This assessment highlights the need for increased capacity in some of the Pleasant Point stormwater network, specifically to reduce the frequency of predominantly nuisance flooding in parks, roads, and private properties.

3.4.1 Flood Mapping Assessment

Pleasant Point is situated in remnant flood channels from the Te Ana-a-Wai River, which now form significant overland flow paths through Pleasant Point. Two of these channels are known as German Creek and Pleasant Point Stream.

WSP (2021) flood mapping assessment found that the generally significant flooding is restricted to these remnant flood channels and flooding outside of these channels is limited, typically to shallow depths (<100 mm). The town is largely served by swales with very few stormwater pipes; whilst nuisance flooding is predicted no significant capacity issues have been modelled or observed.

Figure 7 shows the level of service provided by the stormwater network in Pleasant Point, together with the predicted 10-year ARI flood depth, network level of service and modelled/observed 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 Pleasant Point.

The flood mapping represents a coarse approach to understanding the potential flood risks for the area and does not constitute an in detailed flood risk analysis. The assessment considers runoff from localised catchments only and includes the Mase Road Dam. It does not assess the risk of overtopping or failure of upstream flood protection infrastructure, such as the stopbanks on the Te Ana-a-Wai (the Tengawai River.

TDC have engaged WSP to undertake further detailed modelling of the main urban centres within the district. The additional modelling will allow a more thorough analysis of the performance of the existing stormwater network as well as establishing a better understanding of how climate change may impact the network. The detailed model build for Pleasant Point is anticipated to commence in 2024.

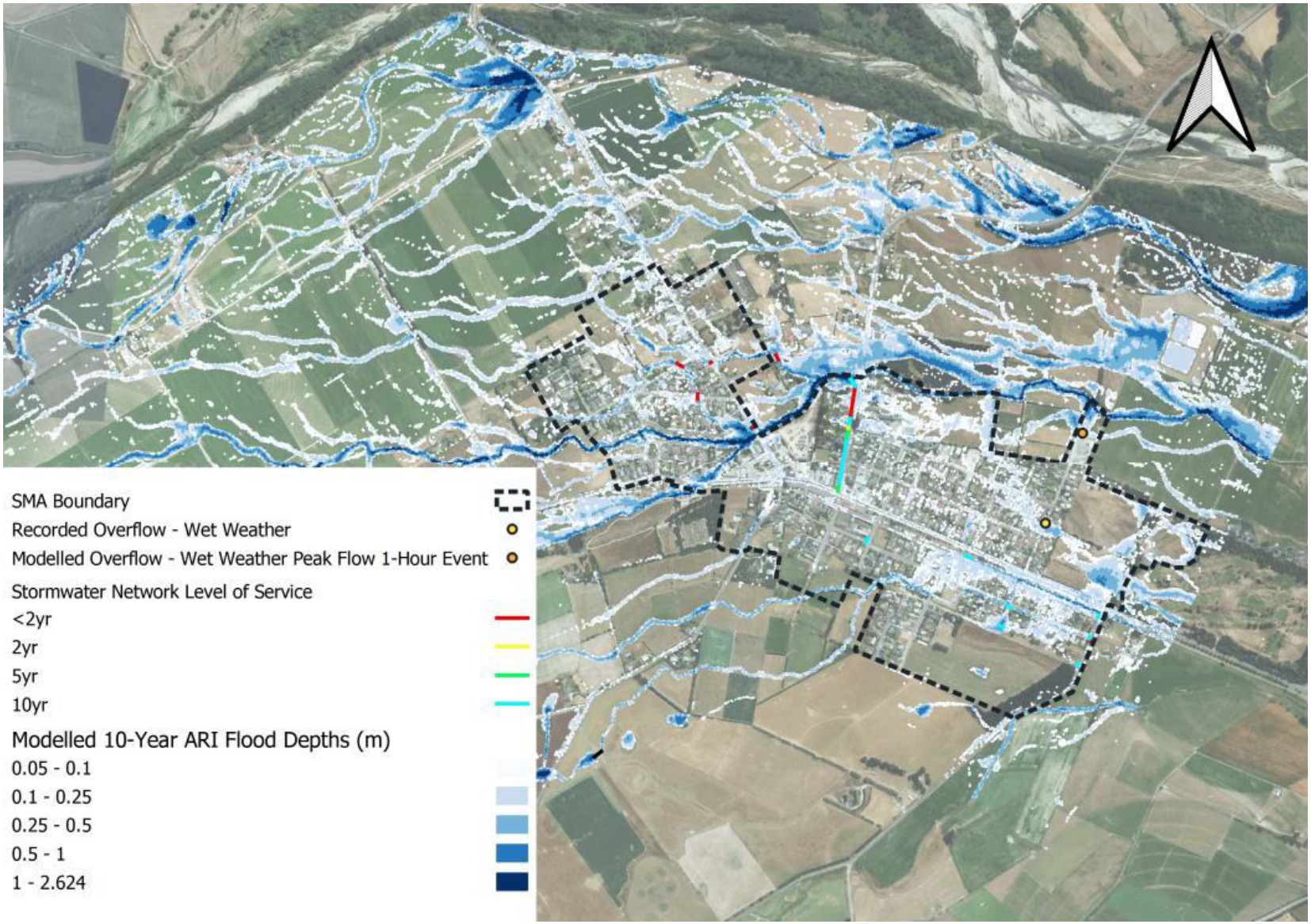

Figure 7: 10-year rain on grid flood depth, customer complaints and network capacity

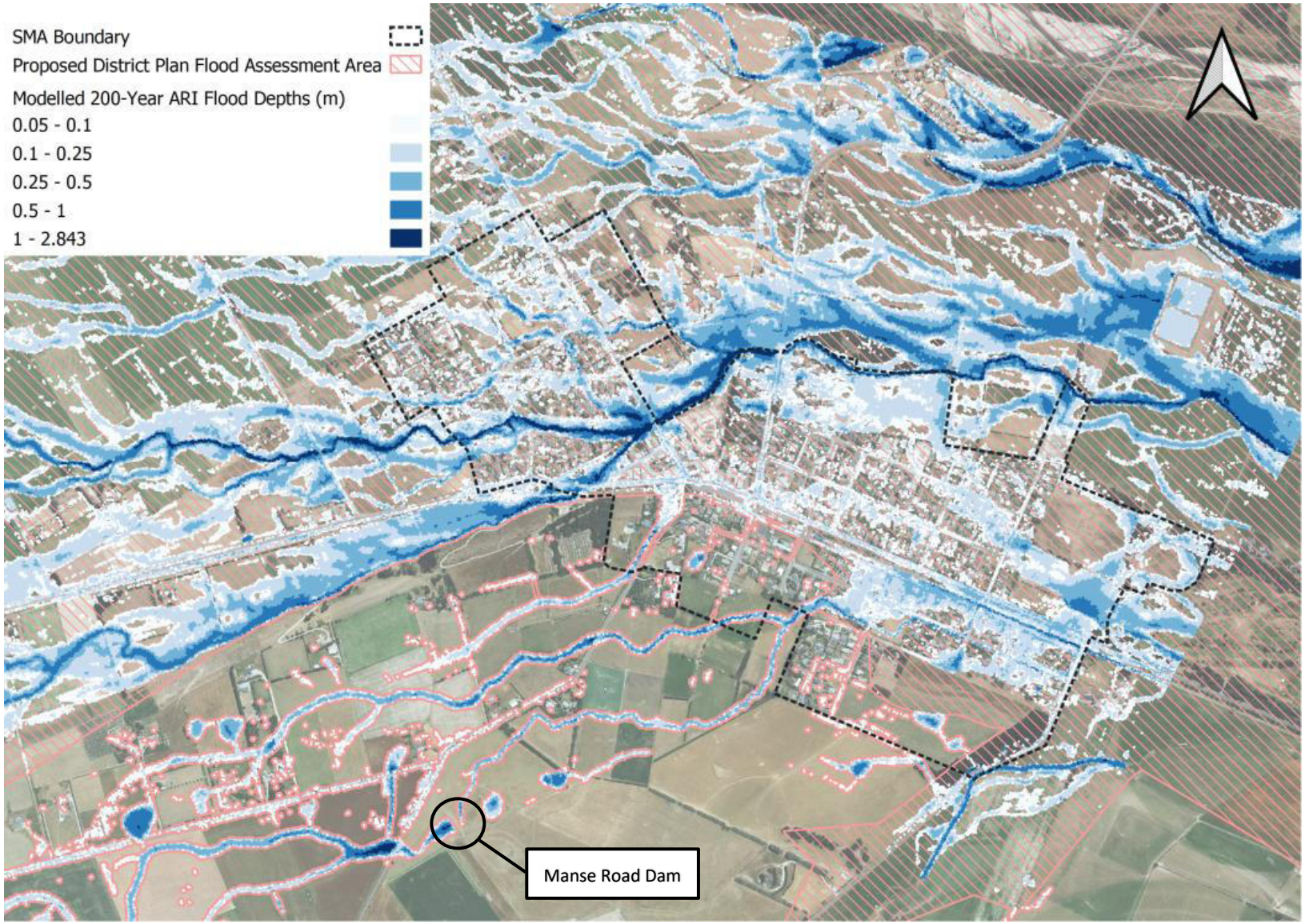

Figure 8: 200-year flood depth

3.4.2 Impacts from Wastewater

Pleasant Point has a reticulated wastewater network that services all the existing urban area. The Pleasant Point Wastewater Treatment Plant and associated ponds is located off Butlers Rd immediately north of the SMA. Shallow groundwater combined with surface ponding results in inflow and infiltration (I&I) into the wastewater system.

Historically, high volumes of I&I had increased the flow of wastewater to the Pleasant Point Wastewater System. Works to resolve / reduce sewer overflows in Pleasant Point, commenced in 2016, TDC undertook an extensive sewer manhole rehabilitation programme to reduce groundwater infiltration in Pleasant Point. This was followed in 2017 by comprehensive house-to-house sewer inspections and smoke testing, and an ongoing CCTV inspection programme to determine infiltration sources to the network for remediation works.

The emergency overflow (orange dot in Figure 7) at the George pump station on the northern side of the township was predicted (in a model) to overflow to Pleasant Point Stream during a peak wet weather flow event (1 hour duration, 5-year ARI). However, this is a direct discharge, not via the stormwater network, and has not been recorded as occurring in the last 7 years since record keeping has improved. If flows were higher, overflows are also predicted to occur at manhole GEOR-MH07004 (yellow dot in figure 7); The I&I reduction works are likely to have reduced the risks of overflows.

3.5 Geology and Soils

The 1:250,000 scale geological map of the Pleasant Point area (Cox and Barrel, 2007) indicates that the surficial geology comprises mostly of Late Pleistocene Holocene river deposits of the Springston/Nine Mile Formation. These river deposits are generally unweathered (Figure 9).

A small area in the south of the SMA comprises Early to Mid-Pleistocene river deposits from the Woodland and Hororata Formation. These river deposits include slightly to moderately weathered mixtures of gravel, sand, and clay

Manaaki Whenua (Landcare Research) digital soil map for New Zealand summarises the majority of Pleasant Point soils as moderately deep to shallow and imperfectly drained (Figure 10).

Soils that are moderately deep and poorly drained, along with moderately deep to shallow and well-drained occupy small areas within the south and the south-west regions of the SMA, respectively. The soil profile typically has silty textures to around 0.5 m, after which a gravelly layer extends to 1 m bgl. Clay content of these soils typically ranges from 18 to 35%. Overall soil permeability appears to be low.

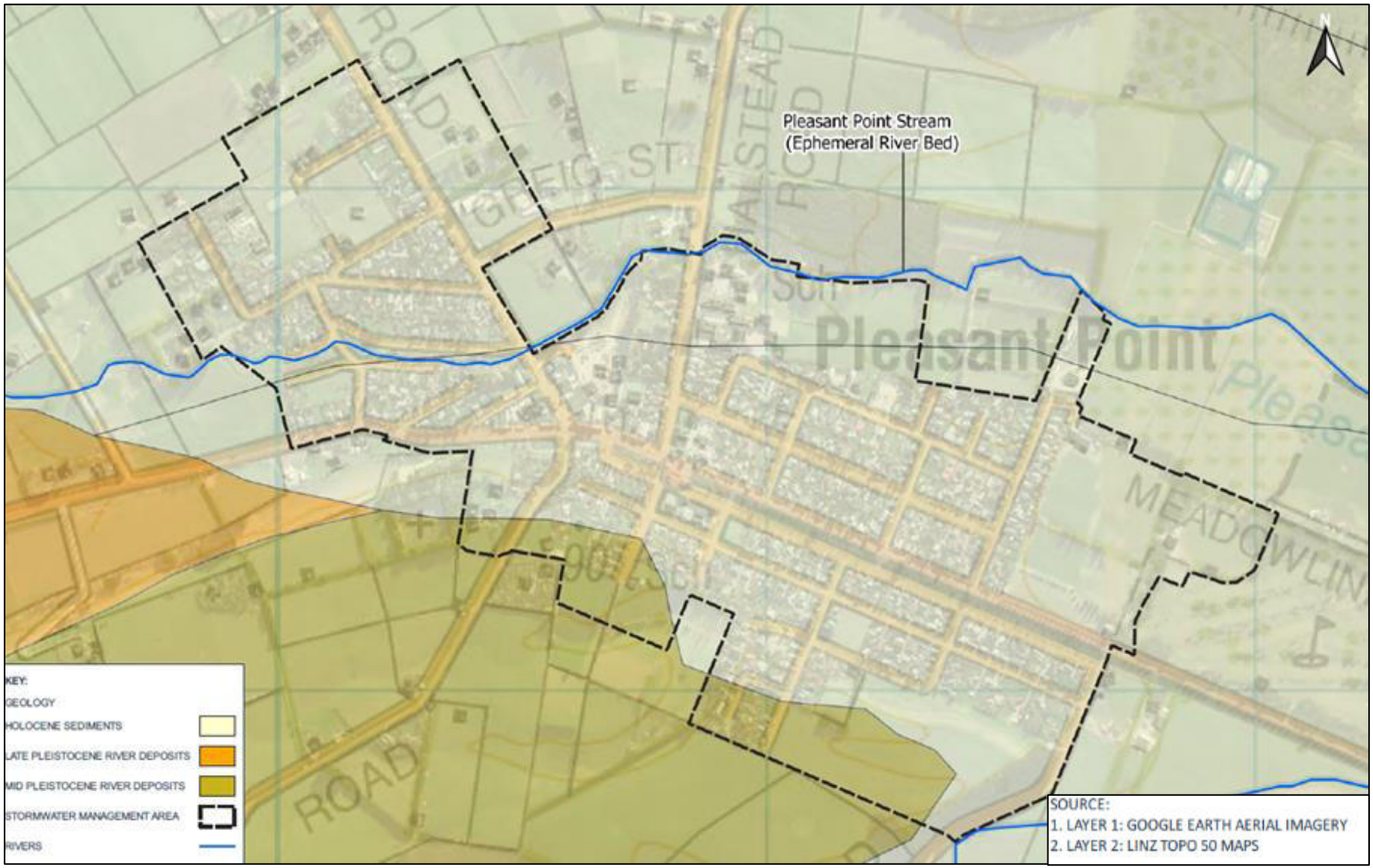

Figure 9: Pleasant Point geology

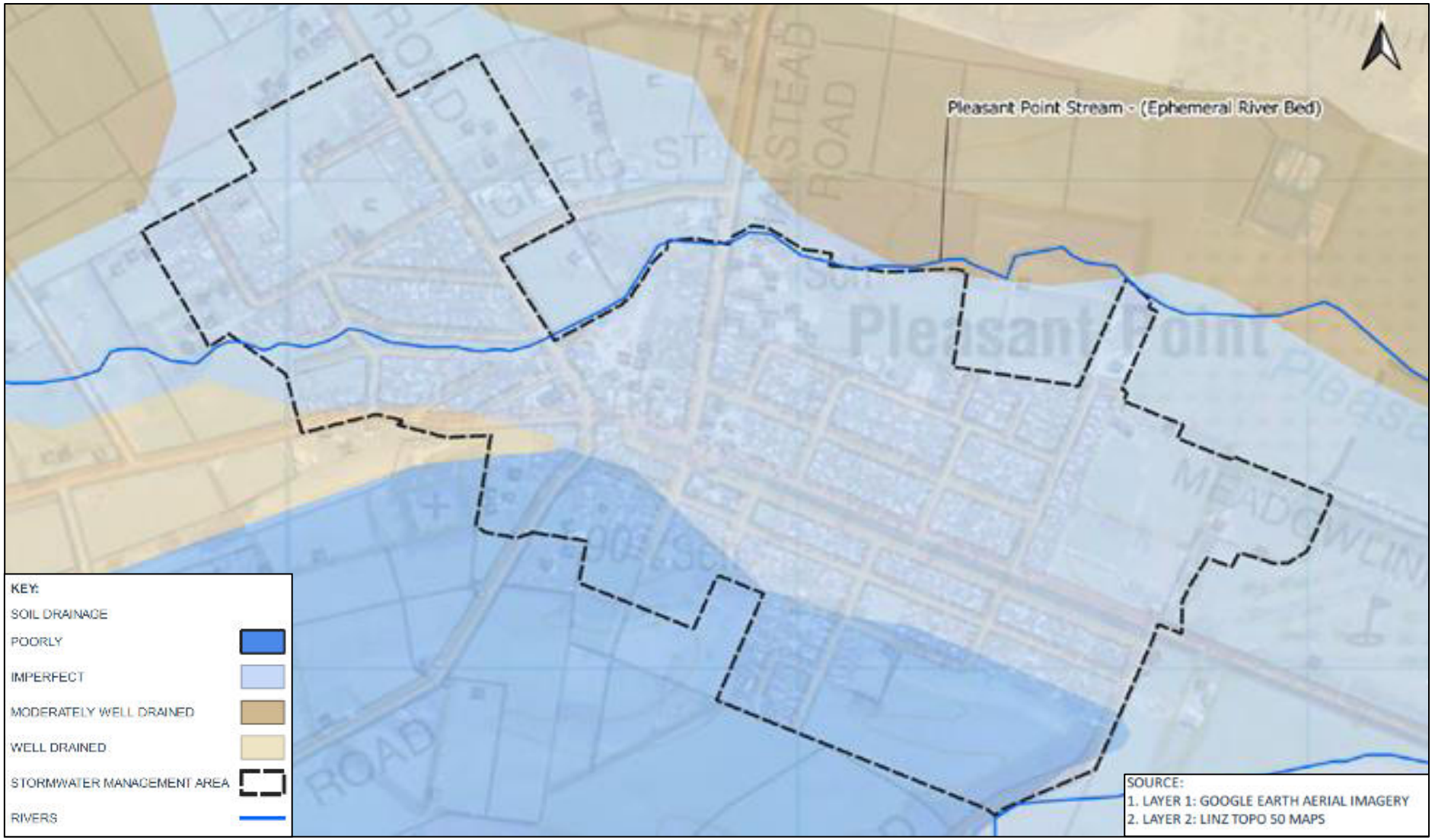

Figure 10: Pleasant Point Soil Drainage Characteristics

3.6 Groundwater

3.6.1 Hydrogeological Setting

As shown in Figure 11, groundwater is expected to flow generally from to east towards the coast and sub parallel to rivers in the area as per the piezometric contours (relative to mean sea level) for shallow wells (<30 m deep) measured between Rangitata and Pareora in 1975 (sourced from Canterbury Maps).

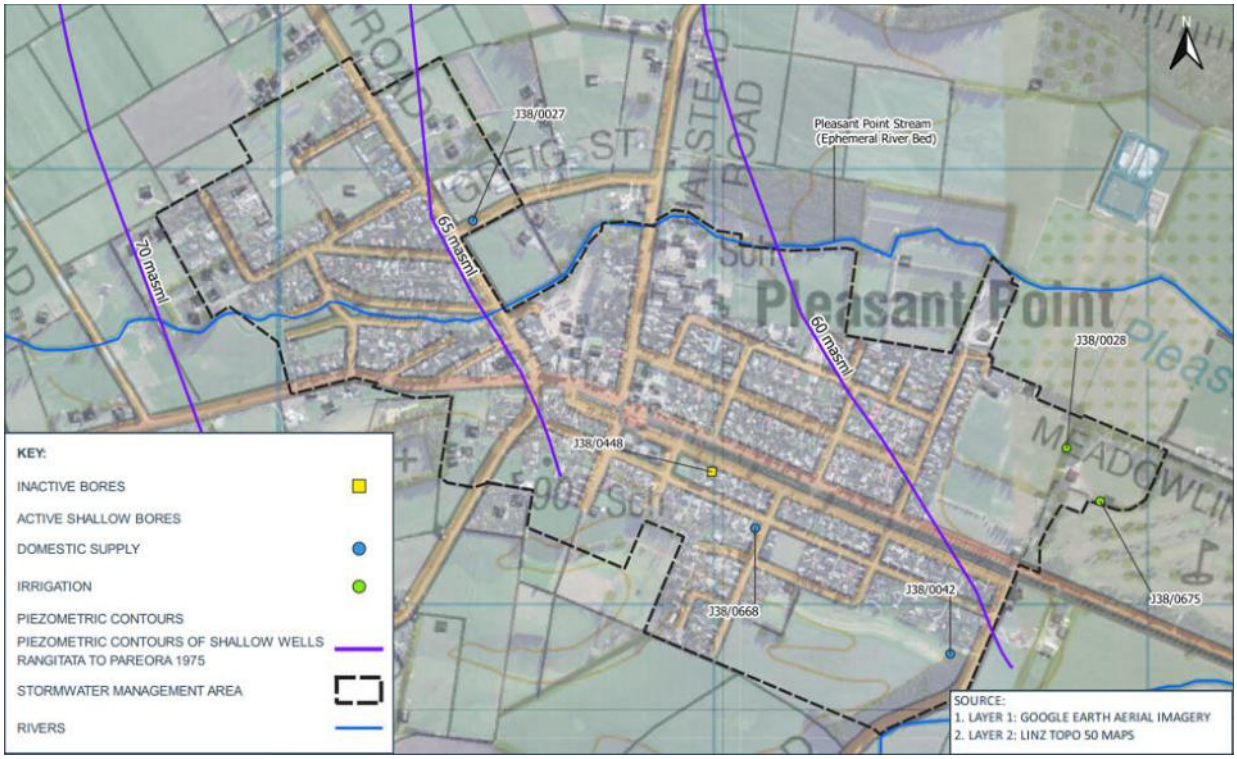

Figure 11: Piezometric Contours of the groundwater beneath Pleasant Point

As part of the baseline SWMP assessments, PDP undertook a desktop groundwater assessment (PDP, 2021a) and a stormwater contaminant transport assessment for Temuka and Pleasant Point (PDP, 2022). Whilst groundwater level data is limited within the SMA, an analysis of shallow bores indicates that groundwater is expected to range from 1.9 to 5.2 m bgl within the SMA. Groundwater levels are anticipated to be well connected hydraulically to the adjacent surface water bodies. Ground and adjacent surface water in the area is expected to be well connected hydraulically.

There is insufficient data to conclusively characterise the permeability of the shallow strata within the SMA, but as outlined earlier soil characterisation would suggest the soils may have low to moderate permeability. Similarly, there is insufficient data to conclusively characterise the quality of shallow groundwater within the SMA.

It is recommended that additional groundwater monitoring is undertaken as to establish a better understanding of groundwater levels within the SMA.

3.6.2 Public Drinking Water Supply Sources

The vast majority of the Pleasant Point SMA is within a Community Drinking Water Protection Zones (CDWPZ) associated with a bore on Meadowlinks Lane (J38/0730, 7.5m deep) as shown in Figure 12. This bore is a small community/rural supply called Meadowlinks for the Meadows Lane private subdivision of 12 lots and is classified as serving 25 to 100 people.

In addition, there is three CDWPZ's that intersect the northern portion of the SMA, associated with TDC's bores J38/0261 (7.4 m deep), J38/0251 (9 m deep) and J38/0917 (8.5 m deep) located within 50 m of each other at Stratheona Road. Due to the proximity of the three supply bores to each other the protection zones overlap significantly. The three bores provide the water supply to Pleasant Point Township (classified as serving 501 to 5,000 people). Treatment of the supply is UV disinfection and chlorination. The Pleasant Point community supply bores in the area appear to be over 500 m cross-gradient from the SMA and are not considered to be at risk of contamination from stormwater discharges within the SMA (PDP, 2022).

3.6.3 Contaminant Transportation Modelling

Contaminant transport modelling (PDP, 2021c) was undertaken to determine the risk that microbial pathogens entrained in stormwater runoff may pose to non-public drinking water supply sourced groundwater sourced drinking water supplies.

Modelling results indicate that the 500 m buffer is likely conservative and the risk of elevated *E. coli* concentrations occurring in groundwater decreases with distance from the stormwater discharge locations.

The bores identified from ECan's online GIS database within a 500 m buffer are shown in Figure 12. It is important to note that these bores identified in the vicinity of the SMAs, particularly shallow bores, will be vulnerable to microbial pathogens from several other sources, such as wastewater discharges, agricultural land use and river water recharge and should be receiving appropriate treatment if they are in use, regardless of the discharge of stormwater to ground.

Subsequent discussion with the bore owners, identified five bores provide drinking-water. All five bore owners filter the groundwater prior to use, and four have a further treatment element, specifically UV disinfection, to further manage the risk of pathogens in the groundwater.

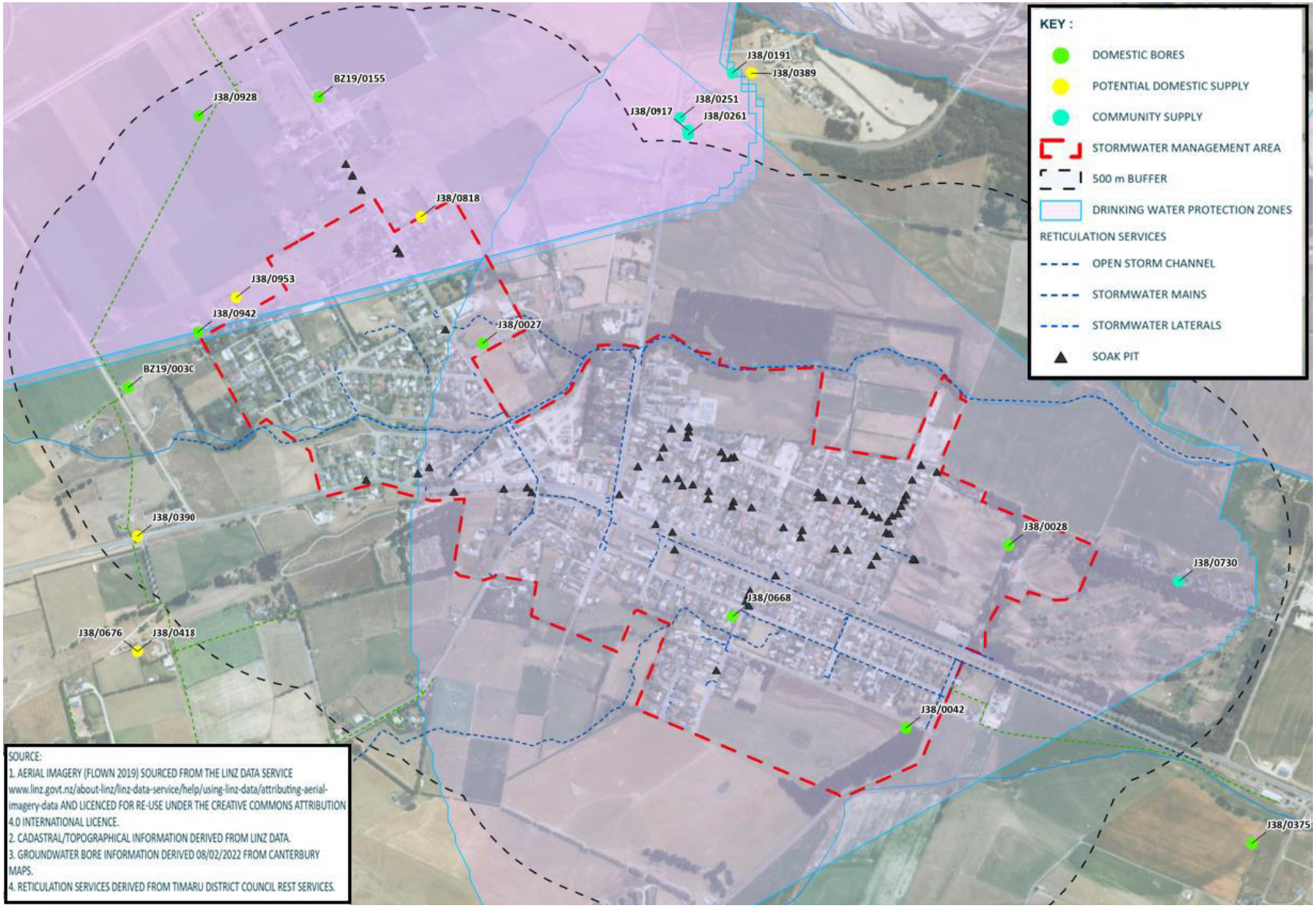

Figure 12 Domestic or potentially domestic and community supply bores within 500 m of Pleasant Point SMA

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 Pleasant Point, 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.

3.8 Non-Residential Assessments

The non-residential assessments conducted by PDP (PDP, 2021b) identified four commercial or industrial properties that present a potential risk to the quality of stormwater within Pleasant Point. 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 Pleasant Point, all four sites were initially deemed to be low-risk due to the current activities occurring at the sites. However, a further consideration of the Contractor's Yard located at 17 Te Ngawai Road, which was historically a timber treatment site and currently stores treated timber elevates the risk that contaminants may be present in the site's stormwater runoff.

Due to the risk of historical and current leaching of timber preservation chemicals such Copper, Chromium and Arsenic (CCA) entering the stormwater system / being entrained in stormwater which infiltrates to ground, this site has been upgraded to high risk and will undergo auditing of the stormwater management practices. It is noted that the site is adjacent to Pleasant Point Stream.

Assessments of similar sites in the district 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

As outlined in Section 3.4.1, the majority of stormwater from the Pleasant Point SMA discharges to ground via a series of swales or soakpits. Whilst some primary discharge of stormwater may occur into the Pleasant Point Stream or German Creek, generally only secondary runoff flow paths will discharge into these two ephemeral waterways. Therefore, the vast majority of runoff from any activities or land uses and infrastructure within the SMA has the potential to discharge contaminants to ground in the first instance and then into the waterways.

To establish a better understanding of the likely contaminant loads with the SMA a contaminant load modelling (CLM) assessment tool was developed for Pleasant Point (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 CLM splits runoff from the SMA into three distinct catchment areas as follows; German Creek Catchment, to the southeast of Pleasant Point, encompasses 46.4 ha or 30 % of the SMA. Whilst the Pleasant Point Stream Catchment covers the land to the northwest, some 64.8 ha (or 42% of the SMA). The Catchment Land-East Pleasant Point encompasses 42.3 ha or 28 % of the Pleasant Point SMA and encompasses an area which predominantly discharges to ground. An evaluation of the likely annual mass of principal stormwater contaminants from each catchment is present in Table 7 and Figure 13.

Table 6: Contaminant Load Model Predictions (PDP, 2021c)				
	Total Suspended Solids (t/year)	**Total Zinc (kg/year)**	**Total Copper (kg/year)**	**Total Petroleum Hydrocarbons (kg/year)**
German Creek Catchment (30% of SMA)				
CLM Predictions	15.6	10.9	1.3	11
% of SMA load	35%	22%	29%	46%
Pleasant Point Stream Catchment (42% of SMA)				
CLM Predictions	18.3	34.2	2.5	11
% of SMA load	41%	68%	56%	46%
Land-East Pleasant Point (28% of SMA)				
CLM Predictions	11	5.4	0.7	2
% of SMA load	24%	11%	16%	8%

Contaminant loads for certain pollutants are expected to decrease over time as new materials and regulations limit previous high contaminant yield materials/practices. For example, it is expected that new builds and replacement roofs within the SMA will utilise materials which have a reduced risk of leaching zinc into the stormwater runoff. Education campaigns, such as the effects of copper disk brakes on environment, at a local and national level have the potential to significantly speed up this process.

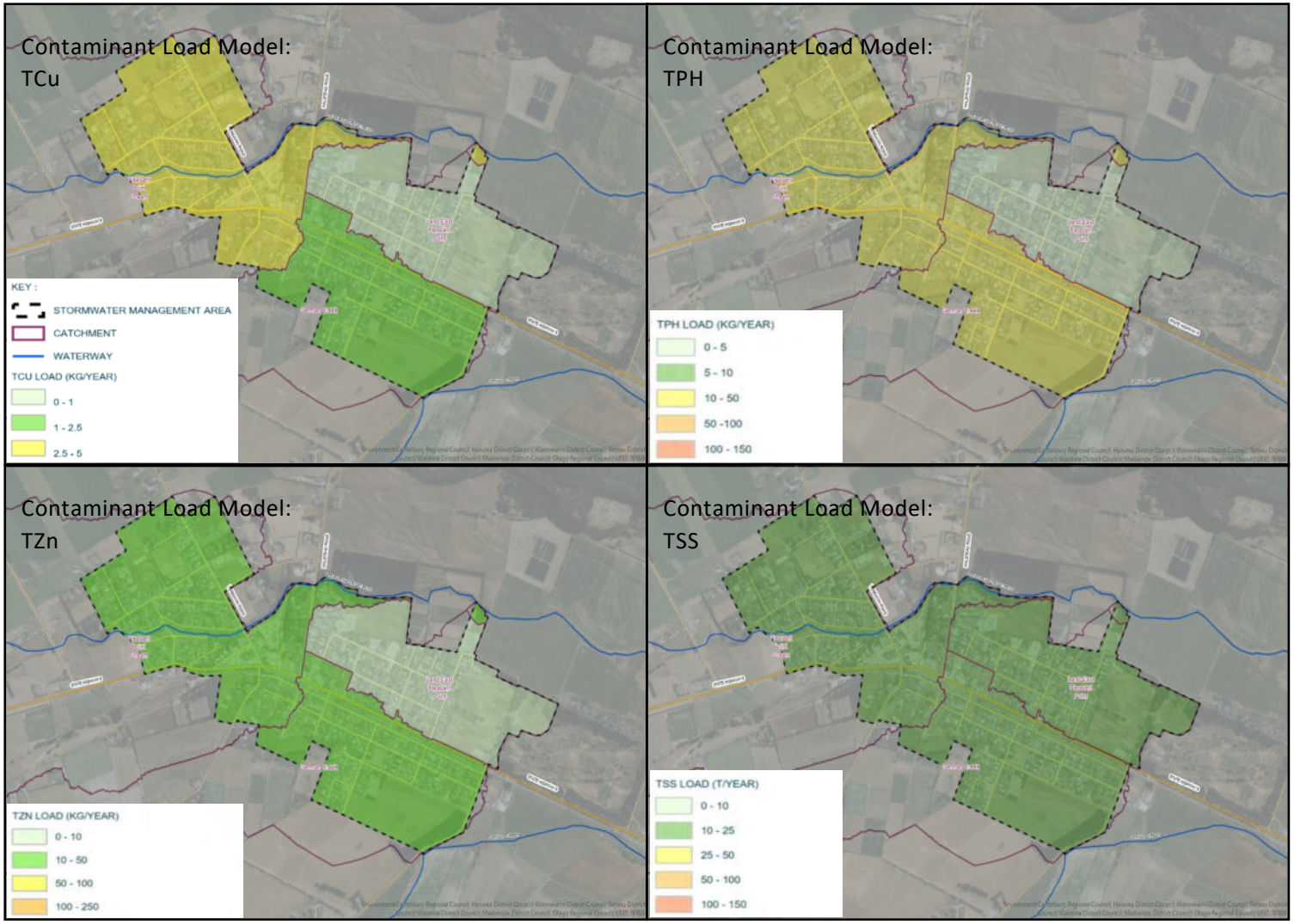

Figure 13: Pleasant Point Contaminant Load Model Assessment

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 Pleasant Point (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:

4.1 Flooding

Parts of the urban areas of Pleasant Point suffer from nuisance flooding and ponding, particularly when it rains for an extended amount of time. This is attributed to runoff from the rural areas, limited drainage and blockage of natural flow paths.

Flooding is a natural phenomenon and typically occurs around waterway corridors, overland flow paths and in low lying areas. The stormwater network is designed to a specific capacity or level of service, during rainfall event which exceed the level of service, stormwater runoff will either pond or flow via secondary overland flow paths. This has the potential to cause adverse effects to the community. The stormwater ponding related issues we have identified in Pleasant Point include:

- The topography of Pleasant Point being flat terrain with some low lying areas combined with seasonal high groundwater presents an issue for draining stormwater from some areas of the Township.
- High groundwater levels and localised mounding effects from stormwater discharges in some parts of Pleasant Point causes stormwater to pond until the groundwater level drops.
- There is limited pipe reticulation within Pleasant Point and in some areas where pipes are undersized or non-existent stormwater flows over land when the pipes are full or not available.
- The Township is located in remnant flood channels from the Te Ana-a-Wai and Ōpihi Rivers, which now form significant overland flow paths through Pleasant Point. Overtime, development within Pleasant Point has partially blocked these historic natural channels and lesser overland flow paths resulting in flood water having a potentially greater impact on the wider built environment.

4.2 Pollution

Polluted stormwater is contributing to reduced water quality and diminished ecosystems in the local ephemeral streams and downstream waterways, this impacts the community, and in particular Te Rūnanga o Arowhenua, ability to interact with these ecosystems

Stormwater runoff picks up pollutants from hard surfaces such as roads, carparks, industrial yards and certain building materials. Polluted stormwater is discharged to the environment, contributing to contaminants in the sediments of the ephemeral waterways. This can affect the aquatic ecosystem and how the community views and interacts with the waterways. The following stormwater pollution related issues have been identified in Pleasant Point:

- Contaminants entrained in the stormwater are directly discharged into Pleasant Point Stream and a lesser extent German Creek. Low flows and infiltration to ground within these channels result in the deposition of contaminated sediment.
- Pollutants accumulated in the sediment are a potential source of contaminants for the Ōpihi River when mobilised during significant flood events. This impacts the relationship of Te Rūnanga o Arowhenua with the river and the Ōpihi Mātaitai Reserve, which are protected mahinga kai/food gathering areas.
- High nutrients concentrations (Nitrogen and Phosphorus) have been found in the streams downstream of the Pleasant Point SMA. This is consistent with nutrients from upstream agricultural runoff and surrounding urban activities in the areas.
- High heavy metals concentrations (Arsenic, Zinc and Lead) have been found accumulating in the sediment, particularly high Arsenic concentration in Pleasant Point Stream. These can be attributed to the historic and potentially present industrial activities in the area, vehicle movements and roofs/building materials.
- High petroleum hydrocarbon and heavy metal concentrations have been found accumulating in the sediments in the waterway, which indicates pollution from stormwater is accumulating within the beds of waterways.
- High use roads (e.g. State Highway 8) and carparks without treatment of the stormwater runoff contributes to the pollution in the stormwater system and the waterways.
- Industrial and commercial activities present risks to the quality of stormwater and waterways. There are a few commercial and

industrial properties identified in the SMA. However, the risk posed by these properties was assessed as being low.

- Stormwater discharges to ground (via soak pits) may result in pollutants (e.g., bacteria from dog/bird waste) traveling through the soil into groundwater bores and wells.

There are five bores that provide drinking-water within 500 m of soak pits in the plan area that could be potentially impacted; all have some filtration and four have additional UV disinfection. The majority of the Pleasant Point SMA falls within existing Community Drinking Water Protection Zones.

4.3 Impacts on Aquatic Life

19th century "Black Maps", as depicted in Figure 3, indicate that what is now referred to Pleasant Point Stream used to flow between the banks of the Point Ana-a-Wai and the Ōpihi. The stream is now ephemeral and only flows to the Ōpihi during significant rainfall events.

The downstream waterways are important habitats for several native species, mahinga kai, cultural use and the transmission of matauranga Māori.

Localised ephemeral streams are important features in the urban landscape and contribute to the general wellbeing of the community. The key stormwater issues related to aquatic life identified in Pleasant Point include:

- Pleasant Point Stream and German Creek are now dry for much of the year, when previously they were reported to flow year-round. This means connectivity to the Ōpihi River is affected and fish, eels and other aquatic life are not able to establish.
- Pleasant Point Stream and German Creek may be a source of pollution (through pollutants accumulating in sediment) into the Ōpihi River.

As highlighted in the Manu Whenua Impact Assessment, while Pleasant Point is not within the Ōpihi Mātaitai the actions with the SMA have an impact on the relationship of Te Rūnanga o Arowhenua with the river and the Ōpihi Mātaitai Reserve.

4.4 Operation and Maintenance

The limited maintenance of the stormwater system and waterways has an impact on the system's ability to function and the community's enjoyment of the waterways.

Proactive management of the existing and future stormwater infrastructure within Pleasant Point will improve the stormwater quality outcomes within the

SMA. The key stormwater issues related to maintenance identified in Pleasant Point include:

- Operations and maintenance responsibilities of the stormwater system and waterways are spread amongst multiple teams within TDC. This impacts the consistency and level of service provided.
- There are a significant number of soakpits within the SMA which require ongoing maintenance, community consultation has identified that soak pits may not be maintained as frequently as required.
- Parts of the streams are on private property which affects the maintenance and use of the waterways.
- Some maintenance of waterways that occurs generally falls under Environment Canterbury's drainage bylaw, which focuses on maintaining conveyance/flood capacity. There is currently no mechanism to consider maintenance of waterways from a water quality or aquatic health perspective.
- The stormwater network in Pleasant Point is ageing and there is limited information on the condition of some of the stormwater infrastructure. Hence some parts of the network may be at the end of their service life and could be damaged or blocked.

4.5 Development

The community within the Pleasant Point SMA will continue to grow and as development intensifies, stormwater runoff will increases placing greater pressure on the existing stormwater system and the environment.

Previously as development occurred, stormwater system were designed to collect and transport runoff as quickly as possible to waterways, largely untreated. This approach has resulted in damage to the natural environment and limitations for the system to cope with increased development and the need to provide treatment before discharge into waterways.

Growth and development in the town requires careful stormwater planning and management to ensure adequate level of service is provided. The key stormwater issues related to development identified in Pleasant Point include:

- Legacy issues due to the previous approach to development, where existing stormwater networks are no longer meeting the capacity and treatment level of service.
- Future development will increase stormwater runoff and put greater pressure on the existing capacity of stormwater networks, making flooding and water quality issues worse if stormwater is not managed appropriately going forward.

4.6 Climate Change

The existing climate is changing, and more extreme weather events are expected to heighten existing stormwater issues within the SMA. Whilst the magnitudes of the effects are uncertain due to the long-term nature of climate change, it is commonly accepted that there will be an 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. The key stormwater issues related to climate change identified in Pleasant Point include:

- It is likely that more intense rain events will occur more frequently, which will further increase flooding and damage to the natural environment.
- The stormwater management system will need to be resilient and adaptable to cope with the impacts of climate change.

4.7 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 Pleasant Point Stormwater Management system, including a possible realignment of the SWMP goals and objectives to address the issue shall be undertaken every periodically as outlined in Section 9.0.

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

5.0 Management Approach

In the case of the Pleasant Point 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 Pleasant Point Stormwater Consents. Therefore, 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 Pleasant Point. 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 Pleasant Point'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.

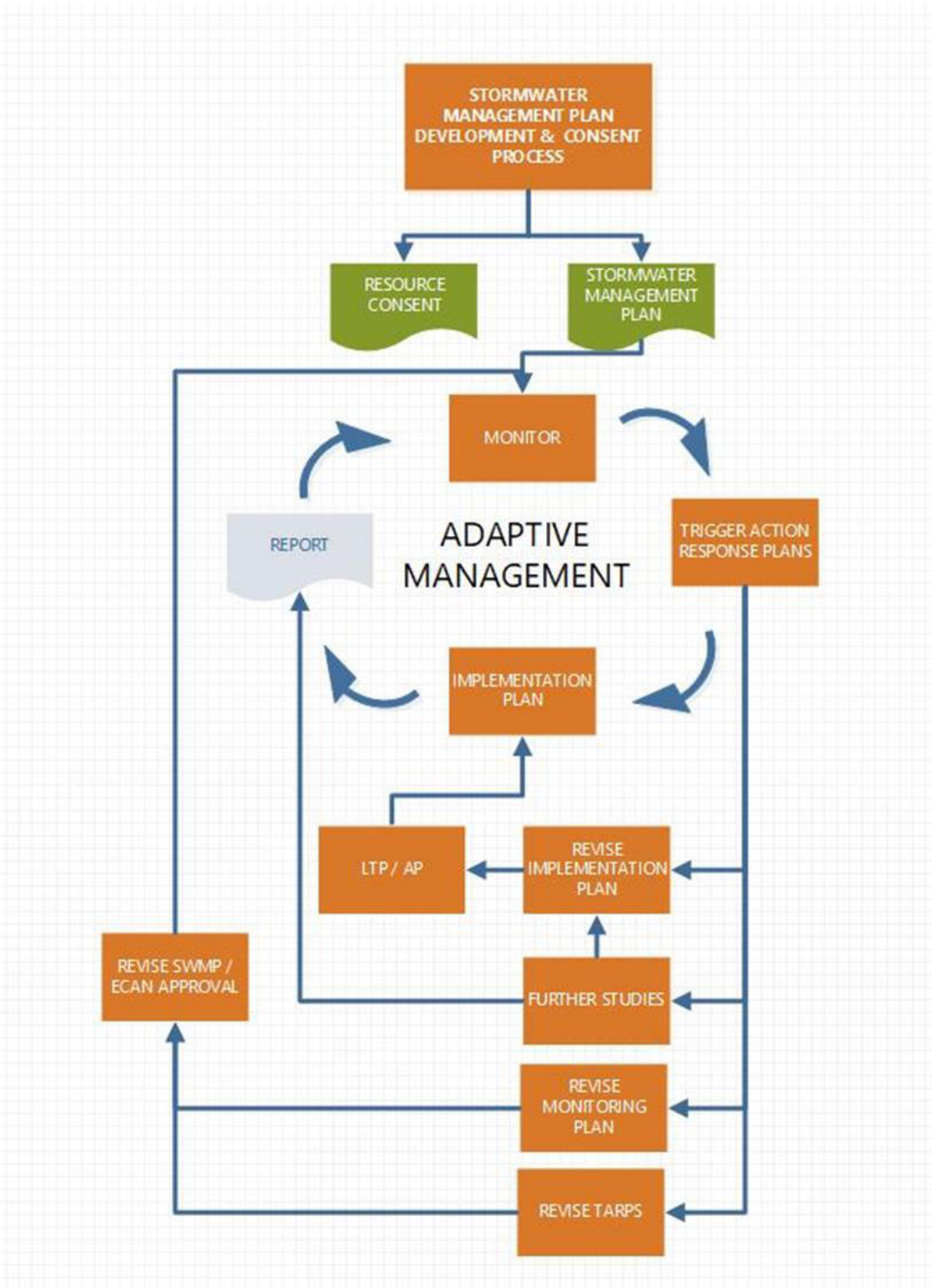

Figure 14: Pleasant Point Stormwater Management Plan Adaptive Management Approach

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 Pleasant Point. 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 7 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 7):
  - 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 potential projects or management actions will be identified, either as the recommendation as to the result of the Monitoring Plan (Section 7.0) 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 funding budgets the new and existing projects will be rescheduled and projects and actions with the greatest benefit prioritised.

A suite of possible projects or management actions has been prepared and summarised in Appendix A. Whilst not an extensive list, this provides guidance on the possible solutions that TDC can apply in the Implementation Plan to address currently known issues and objectives for the Pleasant Point SMA. 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. 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.

It is noted that the success of the Implementation Plan requires collaboration with AECL/Te Rūnanga o Arowhenua and it is recommended consultation on this matter in undertaken on at least an annual basis.

Table 7. Example of Implementation Plan Table:

Issue	Objective	Project / Management Option	Estimated Cost	Agency/Dept	Timeline	KPIs	
			Capital	Ongoing			
Inadequate maintenance of stormwater devices	Decrease contaminated sediment in Pleasant Point Stream	Develop and use an electronic infrastructure management program		$ xxx	TDC – Infrastructure Group	2023	The infrastructure management programme and SWMP annual reporting
Localised inundation Russel St	Flooding Level of Service	Construct swale to convey flow	$ xxx	$ xxx	TDC – Parks TDC - Drainage & Water	2024 – Plan 2026 - Implementation	Flood frequency
Etc.							

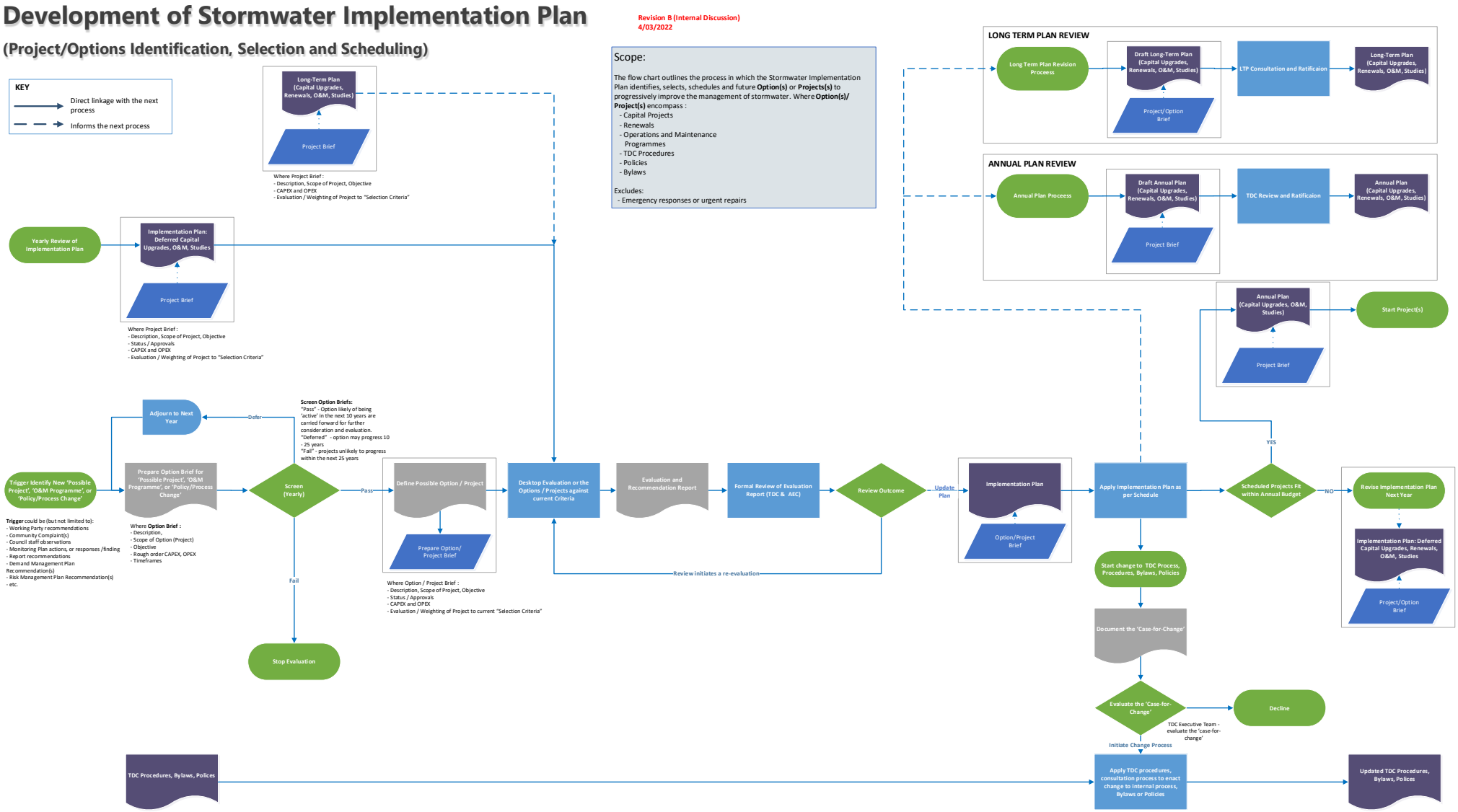

Figure 15: Stormwater Implementation Plan Development Flowchart

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 Pleasant Point; 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.

The TARP is presented in **Error! Reference source not found.**

7.2 Monitoring

Monitoring of water quality, aquatic ecology, stream sediment quality, groundwater and cultural is outlined in detail in the Pleasant Point 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 Pleasant Point. Current adaptive management actions are detailed within the TARP 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.

7.3 Maintenance Register

As part of the ongoing management of stormwater infrastructure within the Pleasant Point SMA, a maintenance register is to be established which outlines the location, known issues and maintenance requirements of TDC stormwater infrastructure within the SMA. A work in progress template is included in Appendix B.

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 Pleasant Point. 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 (Operation & Maintenance and Capital works programme);
  - Animal Control Section (Education programmes and monitoring);
  - Planning Section (new development requirements);
  - Pleasant Point 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 Ōpihi Pareora (OTOP) Water Zone Committee; and,
- Te Rūnanga o Arowhenua (Upcoming projects and general activities of interest, management plan milestones and achievements).
- Downstream water users within the affected Community Drinking Water Protection Zones.

9.0 Reviews

The Pleasant Point 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 Results for the Pleasant Point 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.

PDP. (2022). *Stormwater Contaminant Transport Assessment for Temuka and Pleasant Point.* Christchurch: Pattle Delamore 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

Appendix A: Suite of Possible Stormwater Management Solutions

Issues		Targets	Options				
			Capital Projects	Planning & Engineering	Operations	Maintenance	Public Involvement
Issue 1 - Flooding	1.1 Due to shallow groundwater under some parts of Pleasant Point, infiltration stormwater via infiltration and soakage-based stormwater treatment systems may be difficult. Site-specific investigations would be required when assessing options for any new stormwater disposal infrastructure. 1.2 Discharging stormwater to ground via soak pits in areas of high groundwater can mound the groundwater level even further and cause stormwater to pond on the surface until the groundwater level drops. 1.3 Limited and small pipe networks in some areas cause stormwater to flow overground when the pipe system is full or not available. 1.4 Blocked Overland Flow Paths - We have built in or obstructed places where stormwater would naturally flow and so it means we are more affected by flooding. 1.5 Flooding in the urban area can also be caused by overland flow from the wider rural catchment that follows historic river flood channels.	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 Zero deaths and notified injuries from stormwater runoff	Pipe upgrades and extensions to the reticulated stormwater network - as identified from a stormwater model/master plan Formalised attenuation storage with or without soakage - could be public and/or private (e.g. rain tanks). Modify/formalise/create overland flow paths - this may include regrading/reforming roads, upsizing culverts, modifying fences... Cut-off drain to intercept rural catchment runoff. Consider whether any improvements could be funded by new development	Comprehensive 1D-2D hydraulic model build System performance and development of a master plan to achieve LoS requirements Review of existing soak pits, are they still effective	Flood event monitoring (e.g. capturing flood photos and data) Rain gauge data collection and analysis Recording of customer complaints - review process and look for improvements in the way data is recorded to better support analysis of flood events. Liaison with LTU around aligning stormwater with roading projects, including reduction in imperviousness of the road corridor TDC advocate as a stakeholder in the flood protection of Pleasant Point township by ECan via stopbanks.	Street sweeping Sump clean-out Maintain rain gauges Soakpit testing and rehabilitation programme Maintain flood carrying capacity of waterways	Public awareness on safety around flooding and stormwater assets (e.g. streams, catchpits, manholes). Education on homeowner obligations and expectations around soak pits, rain tanks and impervious site coverage Public assist in capture of flood event photos and data - need system to enable this.
Issue 2 - Pollution	2.1 Contaminants entrained in the stormwater are directly discharged into Pleasant Point Stream and a lesser extent German Creek. Low flows and infiltration to ground within these channels result in the deposition of contaminated sediment.	Pleasant Point Stream sediment quality within areas accessed by the public, within the SMA, or adjacent Council land, ≤ nationally recognised parks/recreational soil contaminant standards (SCS) Pleasant Point Stream sediment quality ≤ ANZG GV High within the SMA or adjacent Council land, unless an investigation determines the effects on Opihi River are negligible. Improvements in stabilisation of Pleasant Point Streams bed and banks within Council Land. Improvements in riparian margin planting of Pleasant Point Stream within the SMP Area where overland stormwater flow is an issue.	Stormwater treatment - at source, bottom of pipe, somewhere in between... Proprietary treatment (typically on existing pipes/outfalls), incorporating as part of road or footpath re-design (e.g. raingardens, swales), vegetated filter strip/riparian buffer, dedicated land purchase and incorporation of wetland, basin, etc.	Feasibility assessment to review all outfalls and identify those that could practicably be upgraded to incorporate stormwater treatment prior to discharge. Use CLM to prioritise which of the feasible outfalls for treatment could have the biggest reduction in contaminant load		Provision for adequate maintenance of new stormwater treatment facilities in council maintenance programmes/budgets	Public consultation around level of investment in stormwater treatment will influence available budgets
	2.2 Pollutants accumulated in the sediment are a potential source of contaminants for the Ōpihi River when mobilised during significant flood events. This impacts the relationship of Te Rūnanga o Arowhenua with the river and the Ōpihi Mātaitai Reserve, which are protected mahinga kai/food gathering areas.	TDC advocate for ki uta ki tai (from the mountains to the sea) in Te Uma Kaha catchment during their involvement stakeholder and regulator in RMA and LG processes 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. A trend of improving -Mahinga kai scores at the downstream Pleasant Point Stream monitoring site.	Preference for at source treatment through a green infrastructure approach		On-going relationship and engagement with Rūnanga.		Public education in the form of signage to highlight the cultural significance of the wider area.
	2.3 Potential drinking water impacts as stormwater discharges to ground (i.e. via soak pits) may result in contaminants (e.g bacteria from dog/bird poo) migrating through the soil and groundwater and into drinking water supply wells. There are currently potentially seven existing active drinking supply wells within 1,000 m radius of soak pits in the stormwater management area.	No recorded incidents of *E.coli* concentrations in abstracted water that is not treated confirmed as being related to stormwater discharges	Soak pit upgrade programme to progressively rehabilitate and upgrade soak pits to include pre-treatment.	Use of well capture zones for new stormwater discharges to land and monitoring of groundwater impacts of these new systems Screening exercise to assess and prioritise suitable locations for soak pits to be upgrade with treatment	Assess whether any bore heads are located in areas subject to flooding		Consultation with potentially affected bore owners
	2.4 High use roads (e.g. State Highway 8) and carparks without treatment of the stormwater runoff contribute to the pollution in the stormwater system and the waterways. A large component of this is tyre pollution caused by braking and low speed turning.	Council roading and carpark upgrades and redevelopment projects incorporate as far as practicable treatment of stormwater.	Stormwater treatment on site or communal device downstream of sites designed for predicted contaminant loads.	Feasibility assessment to high use roads and carparks to identify those that could practicably be upgraded to incorporate stormwater treatment prior to discharge.			

Issues		Targets	Options				
			Capital Projects	Planning & Engineering	Operations	Maintenance	Public Involvement
	2.5 Industrial and commercial zones - four commercial or industrial properties were identified as potential sources of elevated stormwater contaminants; however, the risk posed by these properties was assessed as being low.	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.		Industrial site assessment auditing programme including a requirement for improvements such as site management practices and on-site stormwater treatment. Where there are large roof areas this could include downpipe treatment units	Industrial site to be audited on an ongoing basis as part of the compliance phase of the SWMP.		
	2.6 Use of existing soak pits may, over time, release dissolved pollutants into the Taumatakahu Stream.		Soak pit upgrade programme to progressively rehabilitate and upgrade soak pits to include pre-treatment.	Screening exercise to assess and prioritise suitable locations for soak pits to be upgrade with treatment			
	2.7 Sewage/wastewater can overflow into the stormwater system and the waterways in Pleasant Point. This can happen during very heavy rainfall, particularly in low lying areas, when stormwater flooding enters the sewer system, causing it to overflow into the stormwater system and the waterways. This can also happen when the sewer system is blocked causing overflows.	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. No human source incidents of E.coli concentrations entering waterways via the stormwater network (e.g. through cross connections or wastewater overflows)	Further wastewater improvement projects to reduce overflows e.g. Increase capacity, raise gully traps (identified using wastewater model) Stormwater improvements to reduce ponding where this may enter the wastewater system e.g. new stormwater connection or land reshaping	Investigate stormwater ponding on private property and whether this regularly ponds high enough to enter gully traps or instances of downpipes connected to wastewater system.	Recording of customer complaints - review process and look for improvements in the way data is recorded to better support analysis of overflow instances.		Public education to ensure instances of stormwater ponding entering gully traps is reported to council. And no downpipes are connected to the wastewater system.
Issue 3 - Reduced Aquatic Life	3.1 Pleasant Point Stream and German Creek are now dry for much of the year, when they were previously in flow year round. This means connectivity to the Ōpihi River is affected and fish, eels and other aquatic life are not able to establish.	Improvements in stabilisation of Pleasant Point Streams bed and banks within Council Land. Improvements in riparian margin planting of Pleasant Point Stream within the SMP Area where overland stormwater flow is an issue.	Improvement in physical habitat (including riparian habitat and connected water bodies	High level assessment - undertake mapping of water races and irrigation takes within the wider waterway catchments of German Creek and Pleasant Point Stream. Detailed investigation - Quantify the impact of abstraction and water use on groundwater level and waterway baseflows. Note, a detailed assessment would likely be more appropriate as a regional project that could be part funded by some combination of ECan, Zone Committee, Arowhenua, TDC and other stakeholders.			
	3.2 Pleasant Point Stream and German Creek may be a source of pollution (through pollutants accumulating in sediment) into the Ōpihi River. As highlighted in the Manu Whenua Impact Assessment, while Pleasant Point is not within the Ōpihi Mātaitai the actions with the SMA have an impact on the relationship of Te Rūnanga o Arowhenua with the river and	Pleasant Point Stream sediment quality ≤ ANZG GV High within the SMA or adjacent Council land, unless an investigation determines the effects on Opihi River are negligible.	Removal/dredging of sediment	Utilise monitoring and implementation plan to progressively improve stormwater outcomes in the SMA			
Issue 4 - Operational and Maintenance	4.1 Operations and maintenance responsibilities of the stormwater system and waterways are spread amongst multiple organisations. This impacts the consistency and level of service provided.	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.					Public consultation around level of investment in stormwater treatment will influence available budgets
	4.2 Parts of the streams are on private property which affects the maintenance and use of the waterways.						
	4.3 Some maintenance of waterways that occurs generally falls under Environment Canterbury's drainage bylaw, which focuses on maintaining conveyance/flood capacity. There is currently no mechanism to consider maintenance of waterways from a water quality or aquatic health perspective.						
	4.4 The stormwater network in Pleasant Point is ageing and there is limited information on the condition of some of the stormwater infrastructure. This means that some parts of the network may be at the end of their service life and could be damaged or blocked.			Asset criticality mapping. CCTV and pipe condition assessment following a risk-based approach to identify asset renewal or rehabilitation.		Risk-based programme of cleaning stormwater assets	

Issues		Targets	Options				
			Capital Projects	Planning & Engineering	Operations	Maintenance	Public Involvement
Issue 5 - Development	5.1 Legacy issues due to the previous approach to development, where existing stormwater networks are no longer meeting the capacity and treatment level of service	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 Zero deaths and notified injuries from stormwater runoff	Pipe upgrades and extensions to the reticulated stormwater network - as identified from stormwater model/master plan Formalised attenuation storage with or without soakage - could be public and/or private (e.g. rain tanks). Modify/formalise/create overland flow paths - this may include regrading/reforming roads, upsizing culverts, modifying fences... Cut-off drain to intercept rural catchment runoff. Consider whether any improvements could be funded by new development	Comprehensive 1D-2D hydraulic model build System performance and development of a master plan to achieve LoS requirements Review of existing soak pits, are they still effective	Flood event monitoring (e.g. capturing flood photos and data) Rain gauge data collection and analysis Recording of customer complaints - review process and look for improvements in the way data is recorded to better support analysis of flood events. Liaison with LTU around aligning stormwater with roading projects, including reduction in imperviousness of the road corridor TDC advocate as a stakeholder in the flood protection of Pleasant Point township by ECan via stopbanks.	Street sweeping Sump clean-out Maintain rain gauges Soakpit testing and rehabilitation programme Maintain flood carrying capacity of waterways	Public awareness on safety around flooding and stormwater assets (e.g. streams, catchpits, manholes). Education on homeowner obligations and expectations around soak pits, rain tanks and impervious site coverage Public assist in capture of flood event photos and data - need system to enable this.
	5.2 Development will increase stormwater runoff and put greater pressure on the existing capacity of stormwater networks, making flooding and water quality issues worse if we don't change the way we develop.	##% 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 Council roading and carpark upgrades and redevelopment projects incorporate as far as practicable treatment of stormwater.	Council design and construct key infrastructure (e.g. Attenuation and treatment) and recover through developer contributions Council fund 'extra-over' to extend stormwater design for new development to also offset some existing issues.	Development of engineering design and construction standards Guidance notes for developers Council involvement and input to guide development designs towards achieving water quantity and quality objectives through early involvement in individual development applications or through structure planning Checking development design proposals using the stormwater model Write guidance document for operation and maintenance of private stormwater infrastructure	Draft District Plan has policy and rules relating to achieving hydraulic neutrality, restricting the use of particular building materials and limits on site imperviousness Subdivision and building consents issued compared to those requiring land use consent due to non-compliance with draft District Plan Rules SW-R1 to R3 Engineering design and construction standards Stormwater connection approvals will record compliance and improvements Environmental design evaluation undertaken and recorded. Compliance monitoring	Provision of adequate maintenance of new stormwater facilities in council maintenance programmes/budgets e.g. Nominal additional funds included in annual budgets new infrastructure Guidance for landowners regarding operation and maintenance of private infrastructure i.e. soak pits, rain tanks etc	Education around the benefit and use of rainwater tanks for stormwater attenuation as well as other 'green infrastructure'
Issue 6 - Climate Change	6.1 It is likely that more intense rain events will occur more frequently, which will further increase flooding, pollution and damage to the natural environment. 6.2 The stormwater management system will need to be resilient and adaptable to cope with the impacts of climate change.	The above Stormwater level of service targets 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. Modelling for predicted climate change increases in storm intensities and depths beyond 2031 is undertaken by 2027 and periodically reviewed for the duration of the resource consent to ensure Objective 9 is at least meet.	Any Capital projects implemented are designed to include a suitable climate change allowance Timing of future capital projects to align with/pre-empt realisation of climate change impacts Designs built with redundancy and/or the ability to expand in future e.g. build a smaller basin now but ensure sufficient land available to increase size in future Adjustable control structures	Hydraulic modelling to include climate change scenarios along with assessment of current issues (based on historic rainfall) to help differentiated prioritise resolution of current issues as well as future adaptation measures	Rules/standards/guidelines around new development needing to allow for climate change in their designs [check source in place / required e.g. Draft District Plan policy/rules]		

Appendix B: Trigger Action Response Plan

Table C1 - Trigger Action Response Plan

	Trigger level 1	Action	Trigger level 2	Action	Trigger level 3	Action
Surface water quality - wet event sampling	To be confirmed. Baseline sampling to be collected for 3 years to determine numberical triggers.	• Highlight the exceedance and advise the TDC Drainage and Water Manager and "ECan Regional Leader – Monitoring and Compliance". • Evaluate the extent of the elevated contamination, and possible sources, and/or temporal nature of the contamination. • If the extent is significant and/or sudden consider further studies to identify the source, and possible remedial actions. • Report findings to the TDC Drainage and Water Manager • Consider bringing forward possible capital expenditure in the TDC annual plans or long term plans • Continue monitoring programme as per normal	To be confirmed. Baseline sampling to be collected for 3 years to determine numberical triggers.	• Highlight the exceedance and advise the TDC Drainage and Water Manager • Evaluate the extent of the elevated contamination, and possible sources, and/or temporal nature of the contamination - If the extent is significant and/or sudden then consider further studies to identify the source, and possible remedial actions - Report findings to the TDC Drainage and Water Manager • Continue monitoring programme as per normal • Consider bringing forward possible capital expenditure in the TDC annual plans or long term plans	To be confirmed. Baseline sampling to be collected for 3 years to determine numberical triggers.	Continue monitoring programme as per normal.
Sediment quality	• TPH > 550 mg/kg dry wt • Cu > 270 mg/kg dry wt • Pb > 220 mg/kg dry wt • Zn > 410 mg/kg dry wt • PAH > 50 mg/kg dry wt	As above	• 280 < TPH ≤ 550 mg/kg dry wt • 65 < Cu ≤ 270 mg/kg dry wt • 50 < Pb ≤ 220 mg/kg dry wt • 200 < Zn ≤ 410 mg/kg dry wt • 10 < PAH ≤ 50 mg/kg dry wt	As above	• TPH ≤ 280 mg/kg dry wt • Cu ≤ 65 mg/kg dry wt • Pb ≤ 50 mg/kg dry wt • Zn ≤ 200 mg/kg dry wt • PAH ≤ 10 mg/kg dry wt @ 1% OC	Continue monitoring programme as per normal.
Groundwater quality	G001 - G003: • E. coli > 50 CFU/100 ml • Zn > 1.5 g/m^3 • Cu > 2.0 g/m^3 • Pb > 0.05 g/m_3 • Benzo(α)pyrene > 0.0007 g/m3	• Highlight the exceedance and advise the TDC Drainage and Water Manager and "ECan Regional Leader – Monitoring and Compliance". • Advise health authorities if a risk to domestic drinking water supplies. • Continue monitoring programme	G001 - G003: • E.coli > 1 and ≤ 50 CFU/100 ml • Zn >0.003 and ≤ 1.5 g/m3 • Cu > 0.001 and ≤ 2.0 g/m3 • Pb > 0.01 and ≤ 0.05 g/m3 • Benzo(α)pyrene > 0.00035 and ≤ 0.0007 g/m3	• Highlight the exceedance and advise the TDC Drainage and Water Manager • Repeat the groundwater sample for sites that exceed target, consider advising ECan and/or health authorities if a risk to domestic drinking water supplies • Consider bringing forward possible capital expenditure in the TDC annual plans or long term plans • Continue monitoring programme as per normal	G001 - G003: • E. coli < 1 CFU • Total Coliform < 1 CFU • Zn < 0.0015 g/m^3 • Cu < 0.001 g/m^3 • Pb < 0.01 g/m^3 • Benzo(α)pyrene < 0.00035 g/m^3	Continue monitoring programme as per normal.
Flood complaints	• Flooding Complaints ≥ 10 per year • Flooding of residential property floor(s)	• Highlight the exceedance and advise the TDC Drainage and Water Manager • Undertake additional hydraulic capacity assessments of stormwater infrastructure • Consider bringing forward possible capital expenditure in the TDC annual plans or long term plans • Continue monitoring programme as per normal	• 5 ≤ Flooding Complaints < 10 per year	• Highlight the exceedance and report to TDC Drainage and Water Manager • Inspect the condition of the stormwater infrastructure and undertake and remedial maintenance immediately • Consider increasing the frequency of the maintenance programme • Identify the capacity of the network and classify the cause of the inundation as maintenance, capacity limitation or extreme event	Flooding Complaints < 5 per year	Continue monitoring programme as per normal.
Visual inspections (Property Audits and Property Inspections)	• Observed oil or grease, floatables, scum or suspended solids • Conspicuous change in colour or clarity • Objectionable odour • Adverse effects on aquatic Life • Evidence of physical effects of discharge and / or compliance with connection requirements (< 80% Properties Compliant)	• Highlight the exceedance and advise the TDC Drainage and Water Manager and "ECan Regional Leader – Monitoring and Compliance" • Evaluate the extent of the elevated contamination, and possible sources, and/or temporal nature of the contamination • If the extent is significant and/or sudden consider further studies to identify the source, and possible remedial actions • Report findings to the TDC Drainage and Water Manager • Consider bringing forward possible capital expenditure in the TDC annual plans or long term plans • Continue monitoring programme as per normal	• No evidence of physical effects of discharge • 80% ≤ Properties compliant with connection requirements < 100%	• Advise property owner(s) and ECan Pollution Control • Follow up inspection of property within three months to confirm compliance	• No observed oil or grease, floatables, scum or suspended solids • No conspicuous change in colour or clarity • No objectionable odour • No adverse effects on aquatic Life • No evidence of physical effects of discharge and / or compliance with connection requirements (100% of properties)	Continue monitoring programme as per normal.

Appendix C: Stormwater Infrastructure Maintenance Plan

Example Pleasant Point Stormwater Infrastructure Maintenance Plan					
Asset	**Description**	**Date Installed**	**Last Inspected**	**Known Issues**	**Maintenance Requirements**
HALS-SO17053	Halstead Road Outfall into Pleasant Point Stream	August 2002	Xx/xx/2022	Sediment accumulated at outlet	Every three months, maintenance team to remove deposited sediment and dispose of appropriately.
GEOR-SP17227	Soakpit in berm outside 39 George Street	March 1995	Xx/xx/xxxx	Nearby sump receives a significant volume of deciduous leaves, suspect soakpit may be blocked	Inspect sump and soakpit annually.
KUMR-SI17080	DN600 culvert beneath Te Ngawai Road, screened inlet located at intersection with Kumara Terrace	August 2002	Xx/xx/xxxx	None	Inlet screen to be inspected biannually and prior to large rainfall events.
Etc.					