Stormwater Pricing Study

A report for the New Zealand Infrastructure Commission / Te Waihanga – Final Report

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Glossary

Abbreviation	Stands for
BMP	Best management practices
DIA	Department of Internal Affairs
ERU	Equivalent Residential Unit
GFA	Gross floor area
HUE	Household unit equivalent
ISA	Impervious surface area
MFE	Ministry for the Environment — Manatū Mō Te Taiao
NPS-FM	National Policy Statement for Freshwater Management 2020
NZTA	Waka Kotahi NZ Transport Agency
LDAC	The Legislation Design and Advisory Committee
LID	Low impact design – another term for WSD
LIUDD	Low Impact Urban Design and Development – another term for WSD
LGA	*Local Government Act 2002*
REF	Residential Equivalent Factor
RMA	Resource Management Act
SDF	Stormwater Development Fee
SUDS	Sustainable Urban Drainage Systems – another term for WSD
SUF	Stormwater user fee
WSD	Water sensitive design
WSE	Water service entity
WSUD	Water Sensitive Urban Design – another term for WSD

Executive summary

Best practice pricing of stormwater

Background

- Stormwater runoff is rainwater that flows over land (roads, roofs or other hard surfaces) into drains and along waterways, discharging to ground or eventually at the coast or into lakes.
- This runoff causes flooding damage to properties and damage to receiving waters. Urban development increases the impacts of stormwater on people, their properties and the receiving environment.
- Stormwater services refer to the provision and operation of infrastructure and other activities associated with the management and mitigation of stormwater runoff. These activities and the stormwater system are complex. They include:
    - different types of assets including blue, green and grey infrastructure
    - multiple parties involved in their planning, design, construction and operation
    - multiple structural and non-structural alternatives.
- Stormwater services have traditionally focussed on drainage to reduce flooding and erosion. More recently there has been an increased focus on waterway health.
- The beneficiaries of stormwater services are diverse. Improved stormwater management reduces flooding risk for properties. Stormwater services are primarily public goods; however, beneficiaries can be quite concentrated within particular areas.

Stormwater charges

- Charges for stormwater can be categorised as up-front charges associated with development (in New Zealand known as development contributions), ongoing charges (commonly referred to as stormwater fees), and miscellaneous fees for service.
- These charges fund stormwaters assets and services and can potentially be used to incentivise stormwater management.
- There are other mechanisms that play a similar role to the charges.
    - The complexity of the stormwater system also means there are other payments and service agreements between different parties (e.g. between councils and roading authorities, or stormwater operators and parks departments).
    - The regulatory framework is also an important consideration. Planning controls can be used to require building and maintenance of stormwater assets.

Issues and principles

Overview

- Pricing approaches are generally assessed according to efficiency and fairness. In the context of efficiency, it is also important that pricing ensures recovery of costs, and that administrative criteria are met (transparency, simplicity, and practicality).

Efficiency

- Development contributions and associated planning controls are an important opportunity to influence stormwater outcomes through better urban design. Mitigating stormwater impacts at the time of development is far more cost-effective than retrofitting stormwater interventions. Development contributions can be used to provide a price signal as to the cost impact of differing urban development (locations and design).
- In some jurisdictions stormwater fees are structured to align with the property's contribution to stormwater impacts. These include measures of property area, imperviousness (at neighbourhood or property level) and other hydrological factors.
- The available international evidence suggests that such stormwater fee pricing structures have had a limited impact on behaviour and stormwater outcomes. A key issue is property owner decisions that would affect runoff are infrequent and that the variation in stormwater fees is a small factor in comparison to the cost of new on-site stormwater infrastructure (e.g. permeable paving, rain gardens, rainwater tanks). Administration costs associated with measuring change is also an issue.
- To minimise administration costs, targeted programmes such as fee credits to target specific activities funded from fees appear to be preferable.

Fairness

- The perceived fairness of stormwater charges has been a critical consideration in the design of stormwater fee structures, particularly in the United States, where stormwater fees are subject to legal challenges. Such concerns have led to upfront development fees and ongoing stormwater management fees to be aligned to estimates of runoff, consistent with the polluter pays principle.

Cost recovery

- The collection of charges should ensure cost recovery. A well-established principle for upfront charges is that they pay for the cost of growth. This can encourage developers to seek efficiencies. Similarly, stormwater fees should be set for sustainable funding.
- As stormwater services are a public good it is not possible to recover their costs via an optional user fee. Rather compulsory levies on property owners for services to the community are appropriate.

Assessment of approaches in New Zealand

New Zealand context - overview

- Responsibility for stormwater systems is split across multiple parties. In addition to councils, these include council-controlled organisations (e.g. Auckland transport), regional councils, the Waka Kotahi New Zealand Transport Agency, developers, and property owners.
- Councils fund their stormwater services from developers through upfront development contributions and from rate payers through general rates, and/or targeted rates (i.e. rates specifically for stormwater).
- A significant amount of stormwater related expenditure is not funded by councils. Councils can organise for developers to directly invest in the stormwater system through development agreements (in lieu of developer contributions) and by imposing planning controls on

developers (by issuing development consents consistent with their planning policy). The stormwater related expenditure by developers and other non-council entities are self-funded by the responsibility entity.

Assessment of current stormwater charging practices

- The current funding approaches applied in New Zealand score well on administrative criteria. They are simple to follow, and practical to apply. While the use of general rates as a funding source diminishes transparency, councils' expected expenditure on stormwater is clearly documented in long term and annual plans.
- There have long been concerns over the sustainability of funding for stormwater services. A concern (not unique to stormwater) is that development contributions (which can be used to fund capital expenditure associated with growth) under recover, which puts additional pressure on recovering revenue from rate payers. The use of funding from general rates heightens the concerns over sustainability.
- The current funding approach provides little to no incentive for improved stormwater outcomes. While development contributions are often based on impervious surface area (ISA), the rate is generally fixed for residential developments and thus provides no incentive for reducing the ISA.
- The rating basis for stormwater fees is typically based on capital value or land-value, and consequently do not provide any incentive to change behaviour. However, experience suggests the incentive benefits of fees based on ISA/runoff would be very small and transitioning from the current structure would invariably result in some customers worse off and additional costs to council/utility in corresponding with customers.
- A potentially more attractive approach to incentivise private landowners to invest in source control and green infrastructure is to use targeted incentive programmes.

Transitioning to better practice

- There are multiple potential challenges with the transition to Water Service Entities (WSEs), in large part due to the complexity of existing arrangements. The extent of transition and transfer of assets may vary by council area.
- The quantum of stormwater charges varies substantially by council, which implies that uniform stormwater fees are not achievable without substantial cross-subsidies. Furthermore, different councils use a different rating basis for recovery.
- To effectively transition and to improve charging practices WSEs will need to:
    - review future funding requirements to ensure sufficiency of funding and to provide the basis for analysing pricing alternatives
    - analyse the potential stormwater benefits from stormwater management by property owners, by considering the potential to avoid costs to the system and the costs to the community and environment
    - gather the information (such as data on impervious area) needed to understand the impact of modifying charging practices
    - identify and evaluate the options for change. This would involve considering the pros and cons of the alternatives in terms of the efficiency benefits gained against the costs of transition.

Recommendations for future pricing

WSEs should have the flexibility to choose how they set stormwater fees and provide incentives (including discounts or direct payments) to landowners, or other entities responsible for stormwater assets.

- There appears to be no need to limit the structure that WSEs apply to development contributions or to ongoing levies.
- Based on existing evidence there is not a clearly preferred pricing structure.
- The available evidence suggests that stormwater fees have little influence on behaviour change. Nevertheless, WSEs need the flexibility to use financial incentives to trial innovative programmes.

WSEs pricing need not be co-developed with the pricing of water and wastewater services

- Stormwater services share some connection to the other water services: stormwater is a potential water source; there are common resources, and stormwater shares common environmental protection goals with wastewater.
- These connections need to be addressed but they are not sufficiently substantial as to necessitate co-development. It is not uncommon for stormwater services to be provided by separate utilities.
- Private laterals (stormwater connections to the sewer system) are a potentially important issue for the wastewater service that may be managed with financial incentives related to the wastewater services.

WSEs fees should not be harmonised within an entity. Rather they should consist of a local component (specific to the local council) and an entity-wide component (that reflects cross-entity costs)

- Stormwater charges vary substantially by council, implying that a uniform charge would necessitate some cross-subsidy between areas.
- Rather than improve affordability for small communities, fee harmonisation may do the reverse, as currently fees in smaller communities tend to be less than in larger councils.
- Local councils have significant influence over the costs that WSEs will incur for their council area. To ensure councils have incentive to balance these costs and benefits, WSEs should identify their costs specific to the council area and ensure that these are passed on to the local area (i.e. council / community/rate payer/ local property owner). WSEs would need to work with the local councils to manage these costs.
- WSEs fees should include an entity-wide component. These fees should be used to fund:
    - entity-wide programmes (including trials of incentive programmes) and other common costs (including stormwater/ catchment planning, research, education and administrative services)
    - services for supporting improvements to nationally significant or regionally significant waters affected by stormwater
    - support for local area services, which can be justified on the basis of:
        - hardship (e.g. for a small council area)

- ensuring areas meet national or regionally imposed service requirements or standards
- unexpected events.

WSEs fee structures need not be harmonised across the entity

- There is also no need to harmonise fees structures within a WSE region. WSE's should retain the flexibility to experiment with and use different fee structures in different regions.

WSE should have flexibility to charge local councils rather than rate payers directly

- Rather than charge property-owners directly, WSEs could charge local councils who then recover the costs from their ratepayers. This could involve a simple pass-through whereby councils collect fees on the WSE's behalf.
- Arguments for WSEs charging councils directly include that:
    - it would simplify the transition, by enabling the WSEs to leverage the councils' billing systems
    - councils need to charge ratepayers for any residual stormwater services they provide
    - stormwater services are predominantly a public good and more similar to other services (such as community infrastructure) provided by councils to ratepayers. It reduces the concerns that WSEs are seen as imposing a tax on ratepayers
    - councils will continue to have significant influence/control over the WSE costs.
- A concern with charging to councils is that it could undo the benefits of balance sheet separation with the WSEs. Nevertheless, there appears no reason to restrict the WSEs and councils adopting alternative arrangements if they are mutually beneficial.
- Regardless, we expect that the WSEs may wish to enter arrangements with local councils (as well as other parties) for the ongoing management of some stormwater assets and to incentivise councils to increase standards and implementation of stormwater management.

The Crown and other entities should pay their way

- Most Crown land – including land occupied by institutions such as schools, universities and hospitals – is currently exempt from rates that are used to fund stormwater services.
- In a 2019 inquiry, the Productivity Commission recommended that central government should pay rates on its properties and development contributions in line with local policies.
- Consistent with this recommendation we consider it appropriate that the Crown and other exempt entities should contribute to stormwater development contributions and fees.
- The WSEs should also have flexibility in its financial arrangements with these entities to incentivise improvements in stormwater management.

1. Introduction

The Government proposes to consolidate the delivery of Three Waters services (drinking water, wastewater, and stormwater) from the current 67 local Councils into four Water Services Entities (WSEs).

To influence / encourage the adoption of good pricing practices, the New Zealand Infrastructure Commission, Te Waihanga engaged us to undertake this Stormwater Pricing Study. The scope of the study includes:

- advice on best-practice pricing for stormwater services
- an assessment of how current approaches in New Zealand measure up against best practice, and
- recommendations on future pricing of stormwater services in New Zealand.

This report is structured in accordance with the above scope as follows:

- Section 2 provides a background on stormwater impacts and management
- Section 3 provides advice on best-practice pricing for stormwater services
- Section 4 reviews current pricing approaches
- Section 5 provides recommendations for future pricing of stormwater services in New Zealand.

More information is provided in the appendices.

2. Background

2.1 About stormwater

Stormwater runoff is rainwater that flows over land (roads, roofs or other hard surfaces) into drains and along waterways, discharging to ground or eventually at the coast or into lakes.

Effects from stormwater discharges on people, places and the environment are therefore directly linked to the increase in impervious surfaces. As land changes from bush or farmland to hard urban (impervious) surfaces, the amount of water running off the land increases and the amount of water soaking into the ground or evapotranspiring off plants decreases.

In urban areas, rain that falls onto roofs, roads and other hard surfaces (in addition to urban pervious areas) collects in stormwater catchpits and is carried through a system of pipes, often untreated, to our receiving waters. The network of stormwater pipes helps to protect public safety by directing runoff away from houses and businesses and to prevent flooding but does little for reducing the impacts of stormwater discharges on the receiving waters. The increase in impervious surfaces within urban areas leads to an increase in runoff discharges and volumes, in turn resulting in flooding and erosion, a reduction of levels of service within existing urban areas, a decrease in water quality and a destabilisation of freshwater aquatic habitats.

Worldwide, cities face a number of significant challenges related to the effects of stormwater discharges from historic development as well as continued growth and redevelopment of urban areas. New Zealand cities currently face issues such as:

- increased flooding which stresses existing property owners as well as existing infrastructure
- increased volume and flow of stormwater runoff which compromises existing levels of service as well as creating stressors on aquatic habitats through the process of accelerated stream channel erosion
- deterioration of the quality of receiving waters and sediments, and
- costs associated with long term maintenance of the stormwater network, including constructed stormwater treatment and attenuation assets built to mitigate the abovementioned effects.

2.2 Benefits of stormwater management

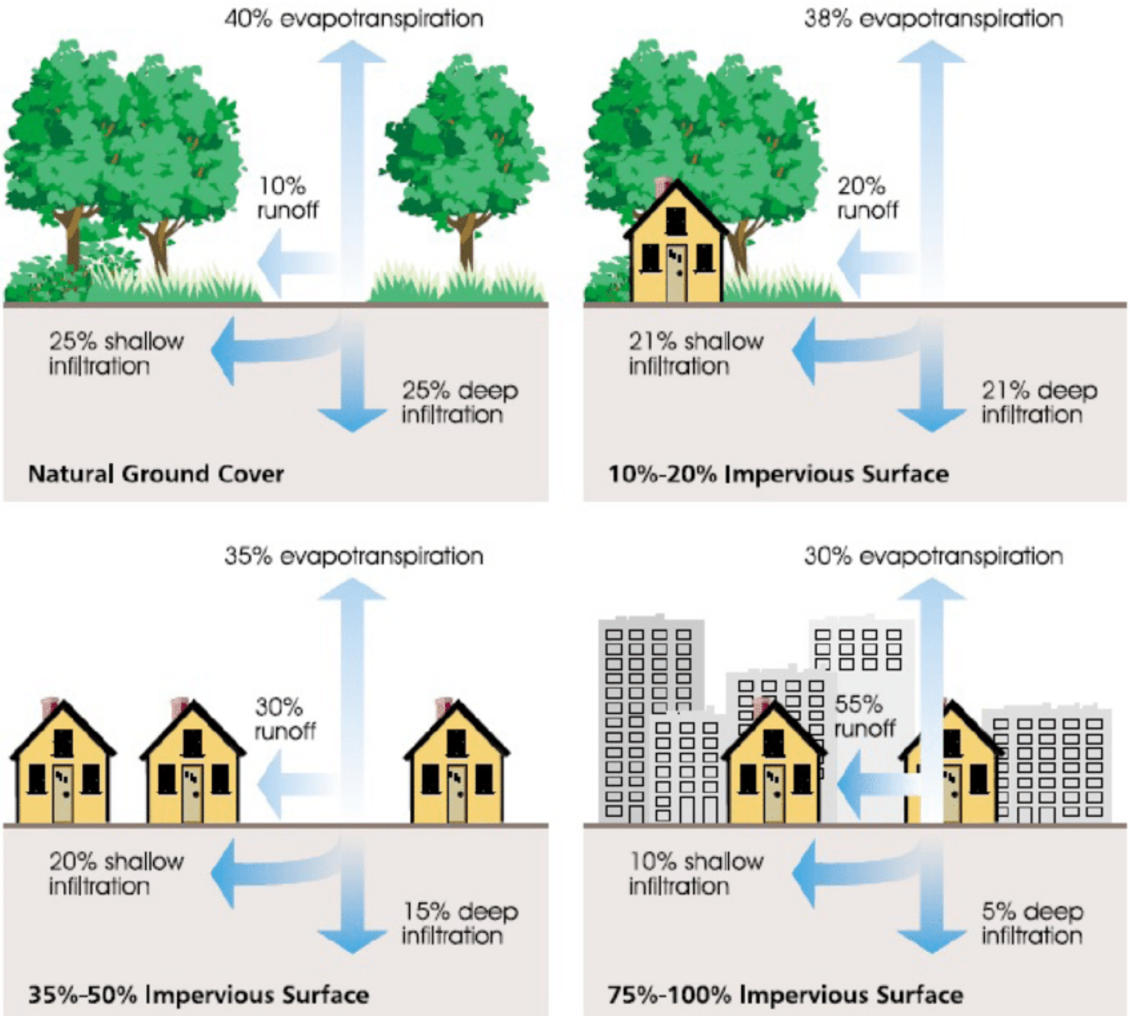
Stormwater services refer to the provision of infrastructure and activities associated with the collection, conveyance, attenuation, protection, treatment, and overall management and mitigation of stormwater runoff, including, activities needed for the ongoing operations and maintenance, capital improvements/ renewals and regulatory responsibilities for the system. Stormwater management involves a range of activities to manage the quantity and quality of stormwater and deliver a range of ancillary non-water benefits.

2.2.1 Water quantity management

The increase in impervious surfaces leads to increased peak flow and runoff volume, which has negative effects for communities and consequently increased costs of management to mitigate these effects.

The two key effects from a water quantity perspective are increased flooding and the destabilisation of stream channels. The primary trigger for these effects is a change in land use from natural bush areas or rural farmed areas to urbanised areas which have higher levels of imperviousness (Figure 1).

Figure 1: Change in stormwater runoff with increasing impervious surfaces



Source: Federal Interagency Stream Restoration Working Group (1998).

Traditional stormwater management places a focus on conveyance (via kerb and channels, catchpits and pipes) and attenuation of stormwater flows, via assets such as wetlands, ponds or tanks to reduce flood risks, or by the construction of levees along stream corridors to restrict flood flows. Increases in impervious areas, lead to more stormwater needing to be conveyed and attenuated, resulting in larger and more expensive pipes and systems which need to be built. These traditional approaches focus on reducing peak stormwater flows and releasing them at pre-development levels to reduce flooding.

More recently the focus has shifted to a water sensitive design (WSD) approach, the naming convention of which varies by location. Historically, it has been referred to as Low Impact Design (LID) in the United States, Low Impact Urban Design and Development (LIUDD) in New Zealand, Sustainable Urban Drainage Systems (SUDS) in the United Kingdom and Europe, and Water Sensitive Urban Design (WSUD) in Australia and more recently in New Zealand.

The WSD approach seeks to protect the natural hydrological and environmental values of the land as much as possible, thereby mimicking the natural water cycle and reducing the additional volume of stormwater runoff generated via urban development. It promotes protecting, restoring, and (if possible) enhancing, the natural stream hydrology through the use of traditional assets in combination with green infrastructure assets (e.g. rain gardens, swales, tree pits, infiltration trenches and permeable paving) and land use controls (e.g. requiring reduced impervious areas or that native bush be retained where practicable) to reduce flooding and stream destabilisation impacts.

2.2.2 Water quality management

Impervious urban surfaces collect contaminants such as litter, dust, decomposing vegetation, sediment, heavy metals, hydrocarbons and other pollutants. Stormwater runoff then washes these contaminants into drains, streams, lakes and ultimately the sea, thereby leading to a deterioration in the water quality of the receiving environments.

Contaminants in stormwater can act in many different ways to cause adverse effects on aquatic biota (Table 1). Sediments reduce light transmission through the water, clog fish gills, affect filter feeding shellfish, smother organisms, change habitats and fill up estuaries. Elevated levels of metals in stormwater can collect in and are toxic to filter feeding shellfish. Metals also affect the food chain by reducing the number and diversity of marine animals in our estuaries and harbours.

Given that most of the stormwater networks constructed after 1950 are separated from the sewer system, the majority of stormwater runoff from existing urban areas (prior to the introduction of the *Resource Management Act 1991*) discharge to the receiving environment without treatment. The focus of water quality management strategies since the early 2000s has shifted to reducing the source of contaminants (e.g. using inert building materials), at-source treatment of contaminants, primarily via rain gardens, swales, permeable paving and filter systems, and catchment based treatment via ponds or wetlands. This approach is also consistent with a WSD approach to stormwater management.

Stormwater treatment systems encompassing organic material and plants are most effective for removing a range of contaminants.[1]

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[1] This is because 'live' treatment systems are more effective at removing a range of suspended and dissolved contaminants, in addition to dealing with other adverse effects such as "urban heat island effect" and temperature loading of freshwater and marine environments.

Table 1: Contaminants that can be found in urban stormwater

Contaminant	Description and Sources	Effect
Suspended sediments	Soil and organic particles entrained in stormwater flows often from earthworking activities, unstabilised areas and accelerated stream channel erosion.	Sediments reduce light transmission through water column, clog fish gills, affect filter feeding shellfish, smother benthic organisms, fill up estuaries and lakes.
Oxygen demanding substances	Soil organic matter and plant detritus which reduce the oxygen content of water when they are consumed by bacteria (chemical oxygen demand, total organic carbon and biological oxygen demand). Can be the result of combined sewer overflows or algae blooms.	Reduces the oxygen content available to aquatic fauna within the water column.
Pathogens	Pathogens are disease-causing bacteria and viruses, usually derived from sanitary sewers. Faecal coliform and enterococci are often used as indicators of the presence of pathogens	Pathogens are a public health issue as they can cause skin rashes, diarrhoea, vomiting, and other illnesses.
Metals	Metals can be in particulate or soluble form. Most commonly measured metals of concern are zinc, copper, and chromium. Sources of metals include building materials (e.g. roofs) and roads as a result of vehicle wear (tyres and brake-pad wear).	Metals are persistent and do not decompose, they accumulate in sediments, plants and filter feeding animals such as shell fish.
Hydrocarbons and oils	Generally associated with vehicle use	Effects of hydrocarbons and oils on aquatic fauna varies widely. They can cause die off of plants and aquatic invertebrates and kill fish. Oil spills in less flowing waters are less toxic to vegetation.
Toxic trace organics and organic pesticides	Compounds found in streams including polycyclic aromatic hydrocarbons (PAH's) and organo-chlorine pesticides (e.g. DDT). PAHs are formed during the incomplete burning of coal, oil and gas.	PAHs and organic pesticides are toxic to aquatic life.
Nutrients	Usually considered to include nitrogen and phosphorus.	Nutrients stimulate algal growth, and if climatic conditions are right, can lead to algal blooms. They can cause daily fluctuations in oxygen concentrations and also lead to anaerobic decomposition.
Microplastics	Small plastic particles <5mm in size which result from the breakdown of plastics and synthetic products.	Can cause death of aquatic and terrestrial animals. Microplastics have been found in

Contaminant	Description and Sources	Effect
		human blood in almost 80% of people tested.
Litter	Often referred to as gross pollutants.	It has a high visual and amenity impact.
Other contaminants	Temperature, pH	Can cause aquatic life to die if outside of base-line environmental ranges.

Source: Adapted from Auckland Regional Council (2003).

2.2.3 Non-water benefits of stormwater infrastructure

Many types of stormwater assets known as "green infrastructure" have environmental, economic, social and cultural benefits which extend well beyond the water benefits for which they would have originally been designed and constructed. Stormwater infrastructure, such as ponds and wetlands which incorporate walkways and cycleways, can provide significant amenity, transport connectivity and other benefits for local communities (see for example, Figure 2). In many instances, the amenity value of large-scale green infrastructure interventions, especially in ultra-urban areas, forms the basis for funding.

Figure 2: Smales Farm business park stormwater wetland

Source: Sue Ira.

Other non-water benefits of green stormwater infrastructure include:[2]

- carbon sequestration and mitigation (widespread vegetation, especially trees and wetland plants, act as carbon sinks and assist with climate adaptation)
- reduction of the urban heat island effect and microclimate management (e.g. from trees and living roofs)
- creation of green corridors and improvement to terrestrial ecosystem connectivity
- promotion of community health, wellbeing and safety (multifunctional urban green spaces and green corridors encourage active transport modes, shared accessways and other public spaces, create traffic calming opportunities and promote mental well-being)
- consideration of fundamental infrastructure resilience design features such as multifunctionality, redundancy, modularity, diversity and operational reliability.

2.3 Roles in stormwater

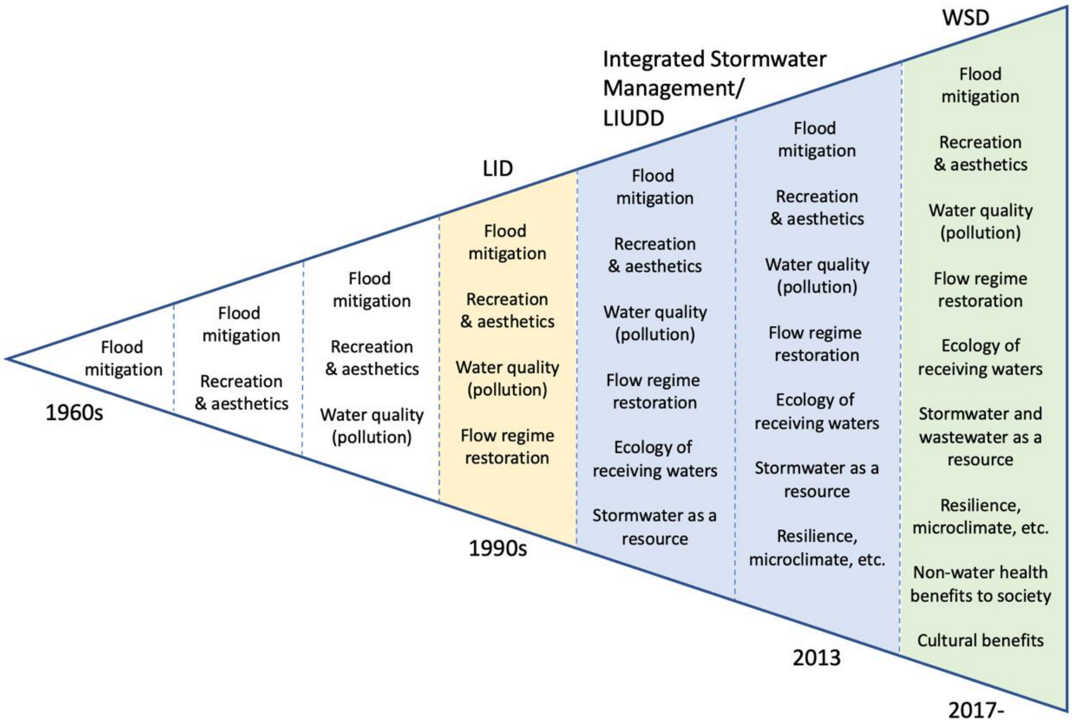
As our understanding of stormwater management has changed over time, so have our approaches to managing the effects of discharges evolved (Figure 3). Pre-1990s, the stormwater management focus in New Zealand primarily revolved around flood mitigation. With a change in legislation in 1991 (the first ratification of the *Resource Management Act 1991*), water quality treatment and ecological considerations (such as providing for fish passage) were incorporated into stormwater management approaches. Nowadays, climate change resilience, flow regime restoration and cultural and social benefits have all led to a variety of lot-scale and catchment interventions being applied in a treatment train approach.

This progression has meant that New Zealand cities incorporate a myriad of stormwater management interventions, which vary depending on the timing and level of growth in each locality. Stormwater from roads is generally managed via one or more of the following types of interventions: street sweeping, pipes, catchpits and manholes, gross pollutant traps, swales, rain gardens, wetlands, and ponds. Industries and commercial properties may incorporate filter systems, oil and water separators, detention tanks, rain gardens, along with pipes for stormwater conveyance and inert building materials for source control of zinc and copper. Residential properties may be required to provide for on-site mitigation via rain tanks, rain gardens, permeable paving, soakage or swales, along with the use of inert building materials.

The types, sizing and designs of these different stormwater interventions are generally determined at the land use planning stage, with requirements for mitigation set via local and regional plans. Council planners and engineers involved in land use planning, and processing of discharge and development consents can therefore significantly influence the design and composition of the stormwater network.

[2] Adapted from Moores and Batstone (2019).

Figure 3: Change in stormwater management over time



Notes: With the advent of LID in the 1990s and integrated stormwater management and WSD in the 2000s. A full WSD approach would additionally consider wider non-water benefits to society to improve urban liveability and cultural benefits. Source: Ira, 2022, adapted from Fletcher et al., 2015.

Resultantly, local councils and network operators generally maintain a wide variety of stormwater infrastructure. When the infrastructure is constructed on public land, such as in road reserves or parks, then these stormwater assets are generally owned and maintained by the councils and/ or network operators. Private businesses or individuals generally own and operate stormwater infrastructure on their own private lots, prior to their connection to the public stormwater network. Urban streams form a vital part of the stormwater network; however, much of the urban stream system can be held in private ownership. Given the heavy reliance of the urban stormwater system on private infrastructure, the long term environmental and social outcomes of the public stormwater system is heavily reliant on this private infrastructure being well maintained and resilient. Monitoring the state and function of the private network is therefore an important role which the council or network operator needs to assume.

Even within the public sector, the stormwater system can be owned by various parties. Stormwater assets within park or recreational areas are generally owned and maintained by parks departments, stormwater from roads by the roading authority, stormwater within non-recreational public land by the stormwater operator, stormwater flood protection services by the regional council. In some cases, service level agreements are drawn up to facilitate and streamline maintenance of stormwater assets; in other cases, each department has their own maintenance contractor with differing levels of understanding of stormwater infrastructure and methods of maintenance.

3. Advice on best-practice pricing for stormwater services

3.1 Relevant characteristics of stormwater and the New Zealand context

This subsection builds on Section 2 to discuss the characteristics that are particularly relevant for the purposes of pricing.

3.1.1 The economics of stormwater

3.1.1.1 Stormwater is not a private service

Private landowners receive some benefits from being connected to a stormwater drainage service. However, the primary beneficiaries of stormwater services are much broader. They include:

- properties downstream who benefit from a reduced risk of flooding
- other providers of stormwater services who benefit from reduced pressure on the stormwater services under their control
- the local community who benefits from improved waterway health and the ancillary benefits of stormwater assets
- the broader community (including future generations) who benefit from protection (and possible enhancement) of the environment.

Consequently, it is not practical – in contrast to water and wastewater services – to have landowners voluntarily opt-in to the service. Rather stormwater services can largely be characterised as a public good[3] that requires some public funding.

3.1.1.2 Land use choices have significant impacts

Property owners through their land use choices affect the impact of stormwater and the cost of stormwater services.

Urban development (when not adequately managed) exacerbates the problem caused by stormwater, increasing the need for stormwater services. For example, infill development and intensification can compromise levels of service of existing stormwater infrastructure and cause increased flooding, whilst

[3] In economics, a public good is a good that is:

- non-excludable – it is not practical to exclude parties from benefiting from the good. Once stormwater services are provided it is not practical to exclude downstream properties from benefiting from the reduced flooding risk and the general community from benefiting from the improved waterway health.
- non-rivalrous – the use of the good by one party does not prevent the use of the good by other parties. For stormwater services, the benefits derived from one property do not detract from the benefits derived from another property.

development in greenfield areas can cause a deterioration in receiving water quality, destabilisation of freshwater stream systems and flooding effects.

However, choices on how the land is developed and used can significantly reduce the impacts of the stormwater problem and cost of stormwater solutions. An implication is that developers and property owners can potentially be incentivised to reduce the stormwater impacts from private land.

As owners can change their land-use over time and some private stormwater solutions require maintenance, ongoing monitoring will be required.

3.1.1.3 Variety of issues and solutions

The sources and solutions to stormwater issues can vary greatly.

The nature and extent of the sources of problems are important considerations. Of note, the sources of stormwater issues:

- are not just about rateable land. Up to 35 per cent of impervious surfaces are located on non-rateable land (in particular, roads), and approximately 60 per cent of expenditure associated with pollution control is required because of pollution caused by motor vehicles (Ira, 2019)
- are not just about future greenfield developments. Intensification of urban areas and development within floodplains compromises overland flow paths, flood storage, and can exacerbate existing flooding issues and levels of service
- are not just about flows across land and into stormwater systems. Infiltration and inflow into the wastewater network from direct connection of private stormwater laterals to the wastewater network is also an issue
- relate to a large variety of pollutants and pollutant sources. Source control of pollutants can involve changes to a range of practices including changes in farming practices, building materials, vehicle use, waste management, littering etc.
- include the issues of continued degradation. Stormwater treatment only provides for a degree of mitigation of stormwater contaminants, and environmental degradation from poor water quality can still occur following treatment.

There are multiple ways in which stormwater issues may be addressed. For example, there are choices as to the extent to which:

- issues are mitigated through development design and/or post-development activities
- on-lot measures and/or catchment measures are used to control stormwater
- stormwater volume is managed through reduction in impervious surfaces or managed through use of retention/detention
- pollutants are eliminated/reduced at source, prevented from entering receiving waters, and/or subsequently removed from the environment.

A key implication is that a holistic consideration of options is required. Flexibility is necessary to select the most cost-effective solutions, in coordination with multiple parties. Pricing—the focus of this report—should be cognizant of these interconnections.

3.1.1.4 The need for investment in stormwater management is increasing

Internationally and nationally, there is an increasing interest in the environment and support for initiatives which lead to environmental benefits. For example, when Auckland Council undertook consultation on their proposed water quality targeted rate 60 per cent of respondents supported the targeted rate.[4] This increased interest in the quality of the environment, coupled with legislative requirements, will lead to a need for increased investment in stormwater management.

Changes in rainfall patterns and intensity, resulting from climate change, may drive a need to upgrade stormwater systems in some areas. There is a resultant trend by stormwater operators to upgrade and use green stormwater management technologies (where practical), which tend to be more resilient than traditional piped approaches and can sequester carbon.

Additionally, emerging contaminants[5] are generally not currently included in routine State of the Environment monitoring which is undertaken by councils. At present there is scant knowledge in New Zealand on ways of treating emerging contaminants and developing strategies for management. Future research, national direction and an understanding of costs of treatment and monitoring will be needed (Macdonald and Conwell, 2021).

3.1.1.5 Mitigating at the time of development is preferable

Mitigating stormwater impacts at the time of development is not only more cost-effective than retrofitting stormwater interventions, but it allows for management to be implemented at various scales. Whether a stormwater intervention is being built in a greenfield (un-developed) or brownfields (developed) catchment, or if it is a retrofit solution, can have a significant effect on the efficacy of the system and life cycle (construction, operation, maintenance and decommissioning) costs.

Breaking into existing services, connections to existing services traffic management and working within brownfield/ retrofit site constraints tend to lead to increased construction costs over greenfield subdivisions (Ira and Simcock, 2019). Current research[6] suggests that retrofitting stormwater treatment into existing road areas can effectively double the construction cost when compared to a greenfield situation.

Addressing stormwater at the time of development enables taking a WSD approach (see Box 1) to stormwater management for greater effectiveness and other benefits (Section 2.2). Stormwater management at the time of development also is likely to result in more permanent solutions. Stormwater assets constructed to mitigate effects of land use changes are permanent assets (as opposed to temporary sediment and erosion controls used to mitigate effects during the construction

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[4] Approximately 30 per cent opposed it. Auckland Council. Undated. AC WQ Targeted Rate: https://ourauckland.aucklandcouncil.govt.nz/media/19292/attachment-b-water-quality-targeted-rate.pdf . Accessed on 1 February 2019.

[5] "*….an emerging contaminant is a chemical or material characterized by a perceived, potential, or real threat to human health or the environment or by a lack of published health standards* ". https://portal.ct.gov/DEEP/Remediation--Site-Clean-Up/Contaminants-of-Emerging-Concern/Contaminants-of-Emerging-Concern

[6] Memo from Karen Mateleska, EPA Region-I to Opti-Tool TAC, 20 February 2016. Accessed March 2018. https://www.epa.gov/water-research/system-urban-stormwater-treatment-and-analysis-integration-sustain

phase) and, in many instances, the asset life span ranges from 50 to 100 years. The permanency of this infrastructure means that it is difficult and costly to upgrade and change over time.

Box 1: The beneifts of embedding WSD

The benefits of WSD are most strongly realised if relevant mitigation measures are applied at the time of development. In the New Zealand context, WSD is defined as "*an approach to freshwater management, it is applied to land use planning and development at complementary scales including region, catchment, development and site. Water sensitive design seeks to protect and enhance natural freshwater systems, sustainably manage water resources, and mimic natural processes to achieve enhanced outcomes for ecosystems and our communities*" (Lewis et al., 2015). WSD aims to:

- promote interdisciplinary planning and design
- protect and enhance the values and functions of natural ecosystems
- address stormwater effects as close to source as possible
- mimic natural systems and processes for stormwater management, often via the use of green infrastructure

A WSD approach to land development therefore uses a myriad of stormwater interventions, from minimising earthworks on a site, to enhancing stream values, to avoiding the generation of contaminants by using inert materials (source control), and finally to mitigating the effects of stormwater discharges through structural controls applied across the site. Additionally, a 'treatment train' approach (an approach to stormwater management which uses a series of source control, on-lot, local and catchment-based treatment solutions to avoid or mitigate stormwater effects) is integral to WSD to reduce effects from the quality and volume of water discharged to a receiving system. The requirements for stormwater management within a particular region, catchment or sub-catchment will determine the level and scale of stormwater mitigation required, which has flow-on effects for public and private capital and ongoing stormwater management costs.

3.1.1.6 The impact of stormwater and the costs of stormwater management can vary greatly by location

Whilst there are a high number of variables which impact the cost of stormwater management, these variables relate mainly to the jurisdiction in which the works are located. In this regard, typical cost influences include:[7]

- site conditions (including, slope/site topography, soils, underlying geology, groundwater levels, and the nature and sensitivity of the receiving environment to stormwater discharges).
- land use
- drainage area (specifically the level of imperviousness)
- material availability and transport
- project size (larger project areas can have lower costs per metre squared due to construction efficiencies/economies of scale), and

[7] Adapted from US Army Corps (2014).

- stormwater management requirements for treatment, attenuation and volume control.

Costs of stormwater management, especially capital costs, can also vary depending on the underlying land use (see Section 3.1.1.5). Given that investment in the renewal and upgrade of the stormwater system has tended to occur on a more reactive basis (DIA and Beca, 2021), addressing legacy issues of stormwater systems in existing urban areas which do not meet national standards or levels of service, is likely to be a key capital cost driver for the WSEs, with the result that the optimal service level may differ between brownfield and greenfield environments.

The stormwater management requirements for a particular locality will also vary greatly depending on the sensitivity of the receiving waters to stormwater impacts and existing flooding issues. For example, a project which discharges to a lacustrine environment would only require stormwater quality treatment. In contrast, a project that discharges at the headwaters of a small stream system with existing flooding downstream, would likely require water quality treatment, peak flow attenuation, extended detention, and volume control.

Together, the underlying land use, sensitivity of the receiving environment and geographical conditions can lead to a variation in costs and affect the types of stormwater solutions chosen.

3.1.2 The New Zealand context

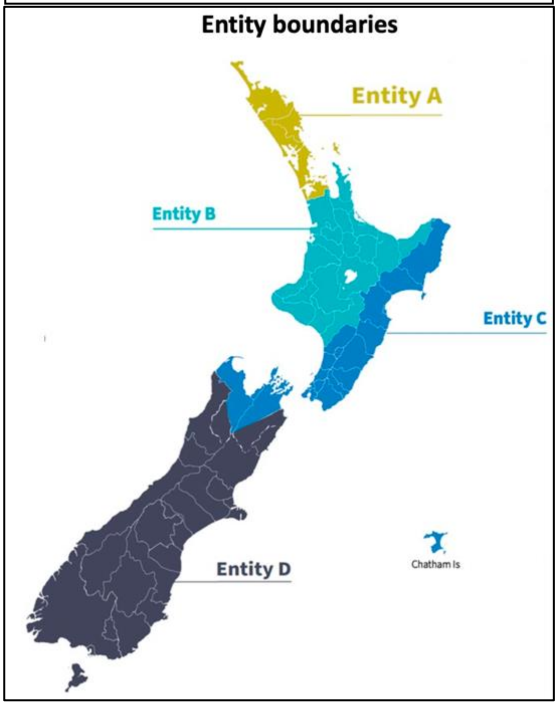
3.1.2.1 Three waters reform and transition

The New Zealand Government launched the Three Waters Reform Programme in July 2020. The aim of the programme is to improve the safety, quality, resilience, accessibility, and performance of three waters services, in ways that are efficient and affordable for New Zealanders.[8]

Four publicly owned water service entities (WSEs) are proposed (see Figure 4) which encompass significant geographical and receiving environment variability.

A stormwater technical working group was set up in 2021 to develop a framework to support the transfer of stormwater responsibilities from councils to the WSEs. The WSEs are in a transition phase, with working groups set up for each WSE to work out what assets would be transferred, how service level agreements and relationship agreements would work, and other administrative issues needed to ensure that the WSEs are 'up and running' on 1 July 2024.

Figure 4: Water Service Entities



[8] https://www.dia.govt.nz/diawebsite.nsf/Files/Three-waters-reform-programme-2022/$file/Three-waters-reform-case-for-change-and-summary-of-proposals-15-June-2022.pdf

The characteristics of the three waters reform will be important, and the stormwater working group identified a number of "key transfer issues" for further investigation and consideration (DIA and Beca 2021).

3.1.2.2 The biophysical environment

In considering pricing principles for New Zealand and lessons from other locations, it is important to consider these challenges in the context of the biophysical environment.

New Zealand's unique biophysical environment varies greatly, from short, steep muddy-bottom streams (e.g. in the Auckland region and surrounds), to complex braided stream systems (e.g. in Canterbury), to lacustrine environments (e.g. in the central North Island), multi-faceted groundwater systems (e.g. the Bay of Plenty region), large depositional estuaries and harbours (e.g. the Onepoto and Pauahatanui Inlets near Wellington), dynamic mountainous stream systems, some with debris mobilisation processes (Central Otago area), and irreplaceable constructive and destructive coastal environments.

These receiving environments are all impacted by stormwater discharges and land development in differing ways. The sensitivity of these environments to stormwater impacts in New Zealand is highlighted in Table 2. Relative to other nations of interest (for example the USA, UK or Australia), many of New Zealand's stream systems (especially in the North Island) are short, steep streams which are highly susceptible to impacts from the additional volume of stormwater discharged due to urban development.

Given the high level of diversity in the geography and receiving environments of New Zealand, costs of stormwater management will vary greatly across the WSE jurisdictional areas.

Table 2: Receiving environments and stormwater issues in New Zealand

Receiving system	Flooding issues	Stream erosion issues	Water quality
Streams	May be a priority depending on location within a catchment	High priority if the receiving stream is a natural, earth channel	High priority
Ground	Not an issue depending on overflow	Not an issue	High priority
Estuaries	Not an issue	Not an issue	High priority
Harbours	Not an issue	Not an issue	Moderate priority
Open coast	Not an issue	Not an issue	Low priority
Lakes	Not an issue	Not an issue	High priority

Source: (NZTA, 2010)

3.1.2.3 Stormwater systems

Urban development over time has also led to different stormwater management approaches being adopted in New Zealand when compared to the USA, UK or Europe, with major expansion in New Zealand cities often only occurring after the 1950s when separate stormwater and wastewater systems were constructed. In the USA and Europe, the huge cost of reducing overflows from combined stormwater and wastewater systems is a major driver for an incentive-based approach to use green infrastructure to separate stormwater flows away from the wastewater network, rather than enacting expensive large-scale sewer upgrades.

However, in New Zealand the majority of stormwater networks are separated from the wastewater networks and therefore the cost differential between a "business as usual" grey piped approach over a green infrastructure or WSD approach is greatly reduced (Ira *et al.*, 2015). As a result, the objectives for, and context of, stormwater management within a particular jurisdiction must first be determined and understood to accurately evaluate the effectiveness of incentive-based stormwater fees used overseas if applied in New Zealand.

3.1.2.4 Legislative and cultural framework

New Zealand's legislative framework has been undergoing significant, continuous change since the 2010s. This change has created uncertainty for councils and network operators, and new requirements for councils and developers alike to meet National Policy Statement for Freshwater Management 2020 (NPS-FM), climate change standards, and the potential unification of flood mitigation standards will all have noteworthy cost implications.

Figure 5 is a simplified illustration of New Zealand's environmental planning framework, highlighting that it is influenced by and needs to be consistent with national legislation, policy statements and environmental standards. Most notably is the updated NPS-FM which came into effect on 3 September 2020.[9] The NPS-FM "*aims to:*

- *stop degradation of our freshwaters;*
- *start making immediate improvements so water quality improves within five years;*
- *reverse past damage to bring our waterways and ecosystems to a healthy state within a generation.*"[10]

An implication of the NPS-FM is that a greater investment in stormwater quality management, and a change in the approach to how land is developed within New Zealand, will be needed.

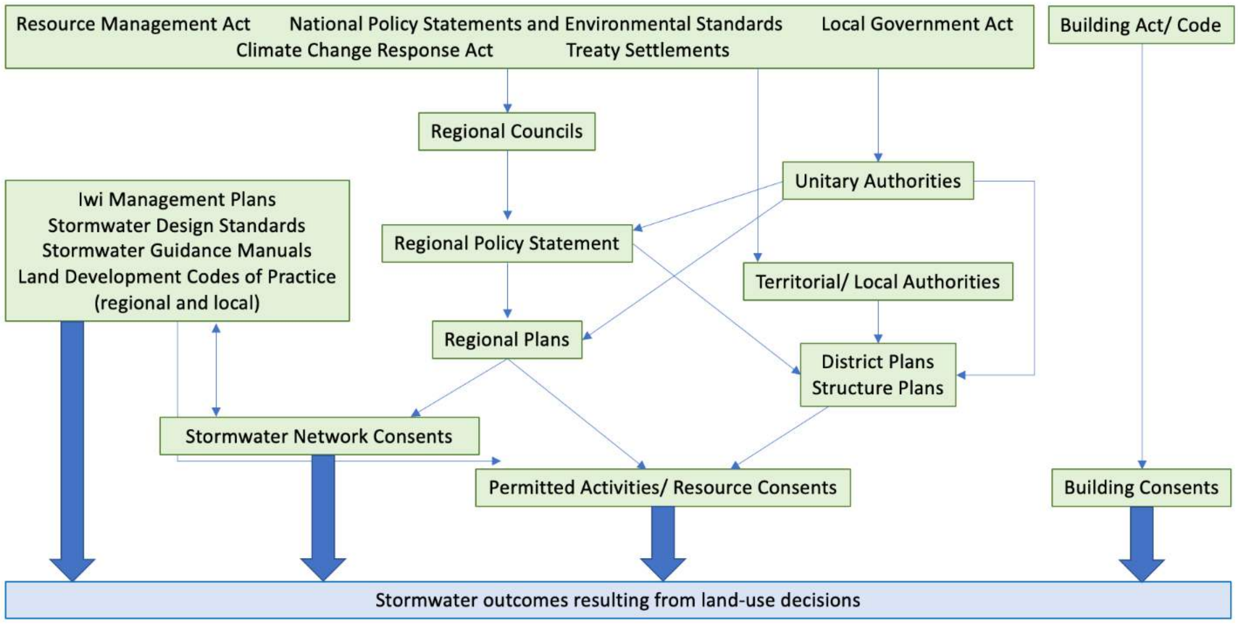
The Stormwater Technical Working Group (DIA, 2021) recognised that regulatory requirements that impact how stormwater is to be managed are numerous, and that the roles and responsibilities for

[9] https://environment.govt.nz/acts-and-regulations/national-policy-statements/national-policy-statement-freshwater-management/

[10] Ministry for the Environment. (2020). *Attributes and Values Factsheet*, p.1: https://environment.govt.nz/assets/Publications/Files/NPS-FM-overview-of-values-and-attributes-fact-sheet-final-october.pdf

stormwater management across local and regional council, as well as iwi co-governance partners, is complex.

Figure 5: Overview of New Zealand planning framework



Regulations can increase the costs of WSD. Anecdotal evidence[11] suggests that further factors influencing cost in New Zealand include: restrictive or out-of-date codes of practice that set requirements for road widths, building materials, the building code and Building Act; infrastructure layout; planning rules and a restrictive consenting process; poor design of green infrastructure leading to increased rehabilitation and maintenance costs; the type of land use; and perceived market demand for a particular house or building type.

Figure 5 additionally highlights that discharges from the public stormwater network require authorisation under the RMA (called network or comprehensive discharge consents). These network consents set the objectives for stormwater management and requirements for discharges within a particular network, catchment or geographical area. On-lot or at source stormwater management interventions (which are a key aspect of WSD), whilst generally excluded from a network consent, form an important part of the overall stormwater management approach for a catchment. However, the current planning framework generally limits the ability for councils to monitor performance of privately owned on-site devices to assess their impact on the consented public stormwater network. It is also difficult for councils to undertake compliance on poorly maintained private stormwater assets which are impacting on the public network. Additionally, in many regions around New Zealand, the urban stream network forms an integral part of the public stormwater network, yet these streams can be located on private land. Given that the existing legislative framework does not support the long-term, sustainable and reliable use of private infrastructure performing a public good function, ongoing operation, maintenance and monitoring of stormwater infrastructure will be a challenge for the WSEs.

[11] Reported via a National Science Funded study into "Activating WSD in New Zealand" (Moores et al., 2018).

The *Local Government Act 2002* (LGA) and the Local Government Act 1974 are also important components of the planning framework. Together they set out the scope of council responsibilities within the purpose of local government and strongly enables community-based decision making. Councils are required under the LGA to develop and consult on plans (including long-term plans and annual plans) that outline their proposed activities and expected costs. These plans are used to forecast the financial requirement of councils with regards to stormwater (and other services) and form the basis for setting charges to recover these costs. The LGA also sets out the requirements for development contributions and charges that councils use to fund their stormwater activities.

Depending on the transfer of assets and working agreements for each WSE under the Three Waters Reform, the ability for councils to address these factors and influence the holistic planning and implementation of stormwater management could be reduced. Conversely, since the aim of the Three Waters Reform is to increase regulation, accountability and resources for water services, the WSEs could also incentivise councils to increase standards and implementation of stormwater management.

The cultural perspective is an important influence on New Zealand's approaches for stormwater management. As reported by Afoa and Brockbank (2019), wai is an integral part of Māori wellbeing and identity and all water bodies have their own mauri which gives them distinct personality or mana. Stormwater discharges can degrade the mauri of water, and particular practices must be observed to maintain harmonic balance and prevent this degradation.

The concept of Te Mana o te Wai – the vital importance of water – has been embedded into the NPS-FM (2020) (MFE, 2020). Te Mana o te Wai sets a new standard for management of New Zealand's fresh waters, and it sets a hierarchy of obligations (MFE, 2020):

1. first prioritising the health and well-being of water;
2. second is the health needs of people (such as drinking water);
3. third is the ability of people and communities to provide for their social, economic and cultural well-being.

Six principles inform the implementation of Te Mana o te Wai, as shown in the text box below. These principles and the implementation of Te Mana o te Wai set a new national standard for stormwater management within New Zealand which will need to be met by the WSEs.

This cultural perspective and the principles of Te Mana o te Wai, align with good stormwater management practices. The primary effect of these is to place greater importance on waterway health, co-governance and social responsibility.

Box 2: The six principles of Te Mana o te Wai

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

Care and respect: the responsibility of all New Zealanders to care for freshwater in providing for the health of the nation

Source: (MFE, 2020)

3.2 Pricing objectives and issues

3.2.1 Pricing objectives and criteria

The core objectives of pricing are commonly categorised as relating to:

- efficiency – concerned with maximising the societal value (net of costs), and
- fairness (distributional outcomes) – concerned with the distribution of benefits and costs.

With respect to infrastructure, two common additional criteria include:

- revenue sufficiency – ensuring that revenue recovered through the prices set are sufficient to cover the costs, and
- administrative criteria – concerned with matters of simplicity, transparency, and practicality etc,

Of note, these objectives and additional criteria can be competing. In particular, greater efficiency often comes at a cost of greater administrative complexity. Price changes invariably create winners and losers and impact on perceptions of fairness. However, the objectives can also align. For example, cost-based (i.e. consumption-based) pricing for services such as water and electricity can be both efficient and perceived as fair.

These objectives and criteria provide a foundation for analysing pricing issues and developing pricing principles. In 2022, the Infrastructure Commission published six core principles for infrastructure funding and financing that are consistent with these core objectives and criteria. These principles and our assessment of how they map to the above objectives and criteria are shown in Table 3 below.

The Infrastructure Commission principles for infrastructure funding and financing are a useful starting point. However, for developing pricing principles for stormwater, it is also useful to closely examine the underlying objectives and issues with respect to stormwater.

Table 3: Infrastructure Commission's core principles for infrastructure funding and financing

Principle	Relevant objective, criteria
Principle 1: Those who benefit pay – Infrastructure services should be paid for by those benefiting from the services (the benefit principle) or creating a need for the service (the causer principle).	Efficiency, fairness
Principle 2: Intergenerational equity – Funding and financing arrangements should reflect the period over which infrastructure assets deliver services and be affordable for current and future generations.	Fairness
Principle 3: Transparency – There should be a clear link between the cost to provide infrastructure services and how services are funded. Wherever possible, prices should be service-based and cost-reflective.	Administrative criteria
Principle 4: Whole-of-life costing – Funding requirements should include the ongoing costs to maintain and operate an infrastructure asset and the cost to renew or dispose of it at the end of its life as well as the up-front cost to construct or purchase it.	Revenue sufficiency
Principle 5: Administratively simple and standardised – Administrative costs for both providers and users should be minimised unless there are clear benefits from more complex funding and financing arrangements.	Administrative criteria
Principle 6: Policies for majority of cases – Funding and financing policies should be written to work for the majority of cases. If needed, alternative or supplementary mechanisms should be added to provide flexibility and ensure fairness	Administrative criteria

Source: New Zealand Infrastructure Commission (2022, p. 123) and Sapere analysis

3.2.1.1 Efficiency

A common starting point to pricing is to consider the extent to which pricing encourages efficient outcomes. Infrastructure prices can contribute to efficiency by encouraging parties to make better decisions in the interest of society.

A golden rule for efficient pricing is that the price of activity is set to the marginal social cost. Marginal cost refers to the cost of an additional unit (of supply or activity). The qualifier 'social' is used because optimal pricing incorporates consideration of all societal impacts – not just those of the party providing the service. When a reward (e.g. discount) is provided for a desired activity, this golden rule may be phrased as the reward being set to the marginal social benefit of the activity.

The rationale for marginal cost pricing is clear. Pricing can provide a signal to both consumers and suppliers for efficient use of resources. When the price of an activity is set to marginal social cost, the paying party has incentive to undertake the activity only when their 'private' benefits exceed the societal cost; that is, when there is, in total, a net benefit to society.

However, pricing at marginal social cost can be difficult. Common problems include that:

- it can be challenging to identify and quantify the societal impacts
- there can be multiple cost drivers
- it can be difficult to measure activity
- there are incremental changes.

These problems are particularly significant for stormwater relative to other utilities. For example, for drinking water, there is a single primary cost driver (volume of use), activity can be easily measured (using water meters) and there are small societal impacts of use.

The setting of prices at the margin to reflect marginal social cost is a minimum but not sufficient condition to achieve efficient pricing. Setting all prices equal to marginal social cost can fail to be efficient because infra-marginal prices (all prices other than the price at the margin) may not convey the full economic cost of supply. The economic efficiency implications for inframarginal pricing may be particularly important where the activities being priced involve commitments over extended periods. It is the infra-marginal decisions that often determine which activities are engaged in and whether to engage in an activity; marginal decisions tend to allocate resources within a pre-determined set of activities.[12]

In many real-world settings, the distinction between infra-marginal and marginal decisions may depend on the timeframe for the analysis. Investment decisions often involve not only the decision to invest but also how the outlay would be recovered, with adjustments to those decisions subsequently as conditions and information change. Distinctions between marginal and infra-marginal pricing can also be important where an attribute of service is necessarily common to a large group. For service

[12] Cheng & Yang, (2004, p. 138).

attributes that are common, decisions that are efficient at the margin for the supplier may, in some circumstances, lead to choices that are welfare reducing.[13]

3.2.1.2 Fairness

Fairness (also referred to as equity) relates to the distribution of benefits and costs. Perceptions of fairness can vary – what is viewed as fair to some, may be viewed as unfair by others. Regardless it is generally agreed preferable that:

- parties in similar circumstance are treated equally (a concept known as 'horizontal' equity)[14]
- customers, particularly lower-income groups, should not be subject to large and unexpected price-shocks.

Fairness is a prominent consideration for the pricing of stormwater services, for a few reasons:

- changes in pricing policies increase the risk of pricing shocks to customers
- the public good nature of stormwater services means there is subjectivity as to how funds are recovered
- there is a lack of clarity of rights
- there is a general lack of awareness of the sources and impact of stormwater
- due to the long-lived nature of assets and impacts, there is a risk of intergenerational inequity, whereby liabilities are unfairly placed on future generations or conversely existing generations are forced to pay for investments whose benefits largely pass to future generations.

Furthermore, what may be perceived as fair, may not be efficient. For example, a popular principle regarding fairness is that the polluter pays. However, in some instances it may be more efficient to financially reward polluters to halt pollutions.

3.2.1.3 Administrative criteria

To be efficient and fair, pricing practices also need to meet a suite of administrative criteria. These typically include:

- **Simplicity.** Simple methods are preferred. More complex approaches may require greater information, may be more difficult to apply and can lead to greater uncertainty and greater debate.
- **Transparency.** Transparency in the setting of charges is important. A lack of transparency in application can discourage investment and can raise concerns of bias.
- **Practicality.** Ease of application can refer to the costs associated with applying the methodology and any additional process in reviewing costs.

[13] Judge Richard Posner provides an example on a shared blog with Nobel Laureate Gary Becker. In this example, Judge Posner shows that it may be profitable for an airline to lower quality (e.g., increase flight delays) to reduce costs to offer lower prices to attract a marginal customer while making infra-marginal customers worse-off, see http://www.beck-posner-blog.com/2007/08/air-transportation-delay--posner.html

[14] 'Vertical equity' refers to the concept that parties in different circumstance should be treated differently.

3.2.1.4 Revenue sufficiency

Revenue sufficiency requires that the prices are set to ensure that sufficient revenue is collected to meet funding requirements. Lack of revenue sufficiency is a common concern with infrastructure providers. Insufficient funding can lead to:

- stormwater objectives not being met due to lack of financing
- inefficient allocation of activities
- volatility in pricing
- inefficient use of other revenue sources (including government support).

3.2.2 Issues in pricing

The pricing objectives provide a foundation for common pricing principles and for analysing many common issues in pricing.

3.2.2.1 Beneficiary pays or polluter pays?

A common pricing approach for environmental goods (which can be considered for stormwater) involves invoking a 'polluter pays' principle, whereby the parties causing environmental damage (the polluters) pay for the costs of the managing the pollution. An alternative – competing principle – is that of 'beneficiary pays', whereby those who benefit from the environmental management pay the costs.

In effect, the choice of approach determines who has rights to use the environment. The polluter-pays principle assigns rights to the beneficiaries and thus requires the polluters to pay for the damage caused. The beneficiary-pays principle assigns rights to the polluters thereby requiring beneficiaries to pay for the cost of addressing the problem.

The two competing alternatives can be considered in terms of efficiency and fairness. In terms of efficiency, both approaches could (conceivably) lead to the same environmental outcome – under a beneficiary pays approach, the beneficiaries could pay to incentivise the polluters to reduce the pollution to the same level as if the polluters were paying. In practice, the costs of such a transaction can be prohibitive, and the environmental outcome depends on the approach taken. In this regard the polluter-pays approach can be more efficient when the polluters are able to respond to the incentives. From an efficiency perspective, an advantage of the beneficiary-pays approach is that the beneficiaries have the information on the value of pollution control.

The polluter-pays approach is commonly described as being fair. However, an argument for the beneficiary-pays approach is that the rich tend to value, and thus benefit more from, improved environmental outcomes.

From a stormwater perspective, the key value of the polluter-pays approach stems from its application in incentivising those contributing to run-off to address the problem.

3.2.2.2 The need for compulsory charges

A key implication of stormwater services being predominantly public goods is that it is not possible to charge an optional fee-for-service. Rather some form of compulsory charge is needed, for which legislative support is required. The Legislation Design and Advisory Committee (LDAC) provides guidance (LDAC 2021) on how charges should be categorised and applied. Based on their guidance stormwater charges should be considered levies and not taxes as they are earmarked for a purpose/ function.[15]

LDAC (2021, p. 90–91) provides additional guidance on how levies may be applied. Of note, they state that [emphasis added] a levy 'does not relate to a **specific** good or service' rather that it is 'to help fund a particular government **objective or function**.' and that 'The person paying might **never benefit personally** from the government service, but it is desirable that they contribute to the cost.' The LDAC emphasises the need for 'a proper relation between the levy amount charged and the particular objective or function concerned.' and that the 'amount of a levy imposed on a **particular group should be commensurate with the degree of connection** between the group and the objective or function concerned.'

These concepts are echoed in guidance provided by The Treasury and the Audit Office for setting fees and levies.[16]

3.2.2.3 Regulatory instruments

In setting prices, it is necessary to consider the role of other regulatory instruments as these can have a similar impact to prices and potentially crowd out the need for pricing. For example, planning regulations can require developers to implement and fund stormwater services, thereby reducing the dependency to use prices to fund services. Similarly, planning controls can be used to influence the development design, thereby reducing the benefit of price to encourage behaviour.

The choice between using regulation and pricing can be an important consideration.

3.2.2.4 Valuing stormwater impacts

In theory the most efficient price for stormwater abatement will reflect the marginal cost of additional stormwater run-off, which is the lower of the cost of:

- the impact of stormwater on properties and the environment (see Box 3 below), and
- the additional management activities to offset the additional stormwater (which has been referred to as the Damage Avoidance Cost).

[15] Legislation Design and Advisory Committee (2021, p. 90) notes that "[the key distinction between a levy and a general tax (such as income tax or GST) is that revenue gathered by a tax is not usually earmarked for any particular purpose. Rather, it is appropriated and spent by the Government according to the particular policy objectives or requirements of the day."

[16] See https://www.treasury.govt.nz/publications/guide/guidelines-setting-charges-public-sector-2017-html, and https://oag.parliament.nz/2021/fees-and-levies

Ideally these two cost-measures would be similar, because the net benefits of the investment in stormwater management will be greatest when the cost of the additional stormwater management equates to the additional benefit in reducing the impact of stormwater.

Nevertheless, it appears infrequent that either measure of cost is estimated and used to inform stormwater charging.[17] Rather when stormwater fees are based on a measure of imperviousness (or other runoff measure) the price is typically determined by simply dividing the forecast stormwater management costs by the aggregate measure to calculate an average cost measure.

Researchers have expressed the concern that stormwater fees calculated using this average cost approach are significantly lower than the true marginal cost.[18] This may be explained by:

- the marginal cost of stormwater management is increasing with development such that the marginal cost is greater than the average cost[19]
- there is an underinvestment in stormwater management – in part because the increased value the community is placing on environmental outcomes is yet to be fully reflected in stormwater management activities
- the investment in stormwater management in response to growth does not completely offset the costs of growth.

An implication is that prices set on an average cost of stormwater management approach may be too low to send an efficient price signal.

Box 3: Estimating the impacts of stormwater

Valuing the impact of stormwater on properties and the environment requires:

- estimating the impact of stormwater runoff on the community and environment, including in terms of the additional flooding, and impacts on the environment, and
- quantifying the cost of these impacts.

Quantifying the costs of the environmental impacts can be achieved through non-market valuation studies, which may include surveys to elicit what the community would be willing to pay for improved environmental outcomes (see, for example, Marsh et al. (2011) and Miller et al. (2015) who have used such approaches to value freshwater streams in New Zealand).

[17] We found some examples where the marginal cost of stormwater runoff has been estimated using the Damage Avoidance Cost method. Examples are Marsden Jacob Associates (2012) who considered the marginal cost of stormwater run-off in evaluating regulation pertaining to rainwater tanks; and Fisher-Jeffes and Armitage (2013) in an assessment of stormwater fee analysis for South Africa.

[18] Parkih et al. (2005, p. 137) argue that setting the stormwater user fee would need to be raised 'to reflect the marginal costs of reducing the desired level of runoff'.

[19] This is consistent with the analysis in section 5.3.1 that shows higher stormwater spend per household in council areas with more households.

3.3 Types of stormwater charges

3.3.1 Overview

Charges by stormwater utilities can be broadly categorised as:

- Upfront charges, which in New Zealand are referred to as development contributions
- Ongoing charges, commonly referred to as stormwater fees. In New Zealand these are commonly charged through general or targeted council rates
- Fees for special services, for example (connecting to a stormwater service).

Funding for stormwater may also be supplemented by other revenue sources such as grants.

The above list does not also cover the funding of stormwater services provided by other parties, most notably the providers of roads.

3.3.2 Upfront charges

It is common practice internationally that developers pay a charge to contribute to the cost of servicing the growth driven by their development. The description and nature of these charges varies by jurisdiction. In New Zealand they are known development contributions. In other jurisdictions they are known as developer charges, community infrastructure levies, impact fees, system development charges (or fees) and infrastructure contributions. Such charges may be applied to a range of infrastructure including other water utility infrastructure, roads, and community infrastructure etc.

A common principle for these charges is that they are set so that existing customers do not subsidise new development,[20] and, consequently, existing ongoing charges should not increase due to growth. However, this principle may be rarely met. Often developer charges are limited to contributing to capital expenditure.[21] The setting of developer charges can be challenging as it involves identifying the future infrastructure costs of servicing growth as well as the timing of development growth.

Developer charges can be structured to provide incentives for improved stormwater management practices. For example, the stormwater developer charges may be based on impervious area thereby encouraging a reduction in impervious surface.[22] Other approaches involve the use of fee credits to encourage development of stormwater improvements (see for example, Box 4 below). Despite there being many examples of stormwater development charges being based on the runoff attributable to the impervious area, we were unable to locate any literature that has assessed the impact of such charging on behaviour. Nevertheless, there appears to be recognition that (consistent with the

[20] This may be referred to as 'growth funding growth' or 'development paying its way'.
[21] New Zealand is such an example. An exception is in NSW, Australia, where the prescribed methodology for developer charges accounts for future operational costs and revenues.
[22] For example, the City of Springfield, Oregon, charges SDC for stormwater based on impervious area. https://www.springfield-or.gov/wp-content/uploads/2016/12/SDC_StormwaterMethodology.pdf

arguments provided in section 3.1.1.5) the greatest opportunity to have a large impact on stormwater reduction is to influence stormwater management at the time of the development.[23]

Box 4: Case study South East Metro Stormwater Authority (Colorado, USA)

The South East Metro Stormwater Authority (SEMSWA) provide stormwater management services for drainage and flood control facilities in the areas of Colorado, USA.

It charges stormwater developer fees (SDF, also referred to as drainage basin fee) that vary by basin area ranging from USD$816 to USD $12,000 per impervious acre.

The SEMSWA has an SDF Credit program of up to 100% of the drainage basin fee. The credit policy states that

> [The SDF Credit] is defined as a one-time reduction in the drainage basin fee resulting from the construction of stream improvements or construction of a regional detention or water quality pond that benefits SEMSWA's stormwater management program.
>
> SDF credits give developers an incentive to build regional facilities that might not otherwise be built, encouraging the over-design of facilities that could help prevent or lessen flooding and channel degradation in the long term. The SDF Credit increases the equity of the rate structure because it recognizes a property's reduced impact on the stormwater system. For example, a new development that completes stream stabilization ahead of development would be eligible for an SDF Credit. However, a new development in an area with adequate regional water quality treatment may not be eligible, since there would be no need for or opportunity to provide treatment for other properties.

Source: https://www.semswa.org/customer-service/types-of-fees/system-development-excess-capacity-fees/

3.3.3 Ongoing charges

3.3.3.1 Type of stormwater fees

There is a large variety of ongoing charges that are used by stormwater service providers internationally to fund stormwater management activities. The most common charging approaches can be summarised (in order of increasing sophistication) as being based on:

- a fixed (i.e. flat) fee that may vary by property-type
- rateable value, which is typically capital value or land value
- land area
- the land parcel's impervious area estimated:
    - as an average of like properties in the locality or zoning
    - for the individual property
- a measure of run-off.

[23] See, for example, Lavasidis (2016, p. 79).

In all cases, the broad approach to determining the quantum of the fee involves:

- estimating the revenue required to finance stormwater management activities
- estimating the number of units across which the revenue is to be allocated (e.g. number of properties, land area, etc)
- calculating a unit rate, equal to the revenue required divided by the number of units
- calculating the charge for an individual parcel as equal to units for the property multiplied by the unit rate.

A description of the different approaches considered is discussed in Appendix A (and a summary of the more popular types is provided in Table 4). A large literature has developed on these charges, particularly on the range of charges (known as stormwater user fees, SUF) used in North America, which is regarded as 'the most evolved country in stormwater funding mechanisms'[24] and where it is estimated there are over 2500 stormwater utilities.[25]

The fee types vary in sophistication from the most basic approach of charging a flat fee (which generally varies by property type) to charge a fee based on the estimated run-off from a parcel of land.

The most common fee structure used in North America is known as the equivalent residential unit (ERU) which is based on the impervious area of standard residential parcel.[26] The approach often involves charging residential parcels one ERU (in effect, a fixed fee) and charging non-residential parcels a multiple of ERUs based on the ratio of the parcel's impervious area to that of the standard ERU. A more refined approach involves assigning the number of ERUs for residential properties based on the property area,[27] and some utilities determine the ERUs for residential properties based on estimates of impervious area.

More sophisticated measures have also been applied. These include accounting for:

- the intensity of development (i.e. the impervious area relative to land area)
- soil-types in combination with land-use to estimate runoff volumes (the residential equivalent factor).

The large variety of approaches reflects that there is a trade-off between simplicity and accuracy in allocating based on the stormwater impact.

3.3.3.2 Stormwater credit programs

In North America, it is common for stormwater utilities to provide stormwater programs to incentivise property owners to undertake on-lot activities that reduce their stormwater impact. Generally, these incentives are in the form of a fee reduction (see example in Box 5 below).

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[24] Tasca et al. (2018).
[25] Campbell (2022, p. iv).
[26] An area of land with defined boundaries.
[27] For example, a large residential property might be assigned 1.5 ERUs.

In a 2020 survey[28] of North American stormwater utilities, 55 per cent of respondents offered a stormwater credit program. The credit programs were primarily targeted at non-residential customers – 56 per cent of respondents who offered programs only offered them to non-residential customers. The majority (81%) of the programs involved a maximum fee reduction, which in two-thirds of cases ranged between 25 and 75 per cent.

The survey also found that the take-up is generally small, with the majority (76%) of respondents reporting that less than 5 per cent of 'parcels' receive credits. Only around 9 per cent of respondents reported a take-up of 15 per cent or more. As discussed below, this low take-up rate may reflect that the costs of on-lot activities tend to be large relative to the stormwater fees.

Box 5: Case study: Township of O'Hara Fee Reduction Program

The township of O'Hara in Pennsylvania, United States recently introduce a Fee reduction program for residential and non-residential customers.[29]

- Fee reductions are offered for a range of stormwater management facilities including Bio-Swale (up to 20% reduction per swale); Cistern (20% per Cistern); Dry Well/Stone Pit (up to 30%); Grass Swale (10%); Green roof (30%); Rain barrels (5% per barrel); Rain Garden (30%); Riparian Buffer (20%); stormwater pond (50% multiplied by the area served by the pond as a fraction of total site area)
- All stormwater management facilities require the execution of a maintenance agreement
- The Township will undertake inspections (biannually for single family residences)

3.3.3.3 The pros and cons of different charging approaches

The core variation between the different stormwater fee types is the extent to which they are based on the stormwater runoff and thus impact associated with property. The core benefits of aligning stormwater fees with runoff are:

- to improve the perceived fairness of the policy
- to incentivise property owners to reduce their impact.

The perceived fairness of the policy appears to be an important consideration, particularly in North America where stormwater fees structures can be open to legal challenge. We discovered several examples where rate structure reviews were undertaken, but the focus of the review was framed in ensuring that pricing was perceived as equitable and likely to withstand legal challenge (see notes in Box 6).

[28] Black and Veatch (2021).
[29] Source: https://www.ohara.pa.us/building-officialcode-enforcement/files/stormwater-fee-reduction-guide-and-application

Box 6: Driver for reviews of stormwater pricing

The Village of Libertyville, Illinois commissioned a stormwater useability and rate study to finance the implementation of a significant stormwater management plan.[30] Notably, the stated purpose was to 'recommend an equitable and defensible funding mechanism' and the evaluation of pricing structure options did not consider the role of pricing in driving behavioural change.

In a recent survey[31] of North American stormwater utilities, 21 per cent of respondents stated that their fees had faced a legal challenge, and that the "Rate methodology/equity and fairness" was a basis of the challenge in 39 per cent of cases.

As earlier noted, economic efficiency is encouraged by setting price equal to marginal cost. In the case of stormwater, this would imply that property owners pay a fee equal to the expected impact caused by stormwater runoff from their property.

However, there are challenges in applying this rule for stormwater. Most significant, is that it is difficult to measure and quantify the impact of an individual property on the stormwater system and environment. This is because of difficulties in, and consequently the cost of:

- the expected run-off (quantity and quality) caused by a property
- quantifying the impact of that run-off due to the cumulative nature of stormwater effects

Each of these challenges can be mitigated with additional resources invested in measuring and analysis; however, doing so adds costs and consequently, the optimal charging structure depends on whether benefits of a more sophisticated charging mechanism outweigh the costs. This trade-off has been considered by parties (water utilities and regulators) in New Zealand and around the world. To reduce the measurement cost, it is common to use proxy measures for the stormwater run-off.

Aligning fees with expected impact has potential to incentivise property owners to make more efficient decisions in reducing the stormwater impact of their properties. That is, for example, a fee based on impervious area could incentivise property owners to reduce the impervious area and consequently stormwater runoff.

There has been a small amount of research on the incentive benefits of stormwater fees. This research has tended to conclude that financial incentives have limited benefit in encouraging participation in improvements in stormwater management practices. A common concern is that potential incentive from a reduction in stormwater user fees is too low.[32] This has been demonstrated by considering the economic costs and benefits from the perspective of the property owner as illustrated in Box 7 below. Most notable is that the key decisions affecting the volume of stormwater run-off (e.g. the extent of concreted area) tend to be significant decisions that are made at the time of development.

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[30] https://www.libertyville.com/DocumentCenter/View/21167/Stormwater-Study-Phase-I-Report
[31] Black and Veatch (2021).
[32] See Parkih et al. (2005, p. 137), Fortin et al (2018, p. 17), Gmoser-Daskalakis et al (2019, p. 8), Valderrama et al (2013, p. 13). Larson et al (2014).

Box 7: An illustration of the economic incentives provided by stormwater user fees

An approach to investigating the incentive benefits of stormwater user fees is to estimate the potential economic benefits to property owners of investing in on-lot stormwater management initiatives. An illustrative example is Fortin et al. (2018), who compared the cost to property owners in Ontario, Canada of installing LID technologies against the economic benefits associated with a reduction in stormwater fees. Key results of the analysis are presented in the figure below.

As illustrated, the annualised costs are substantially higher than the annual benefits achieved through a fee reduction. Similar analysis conducted by Valderrama et al (2013) for Philadelphia, US provides similar findings. These results help to explain the low take-up rate of on-lot measure in response to fee reduction incentives.

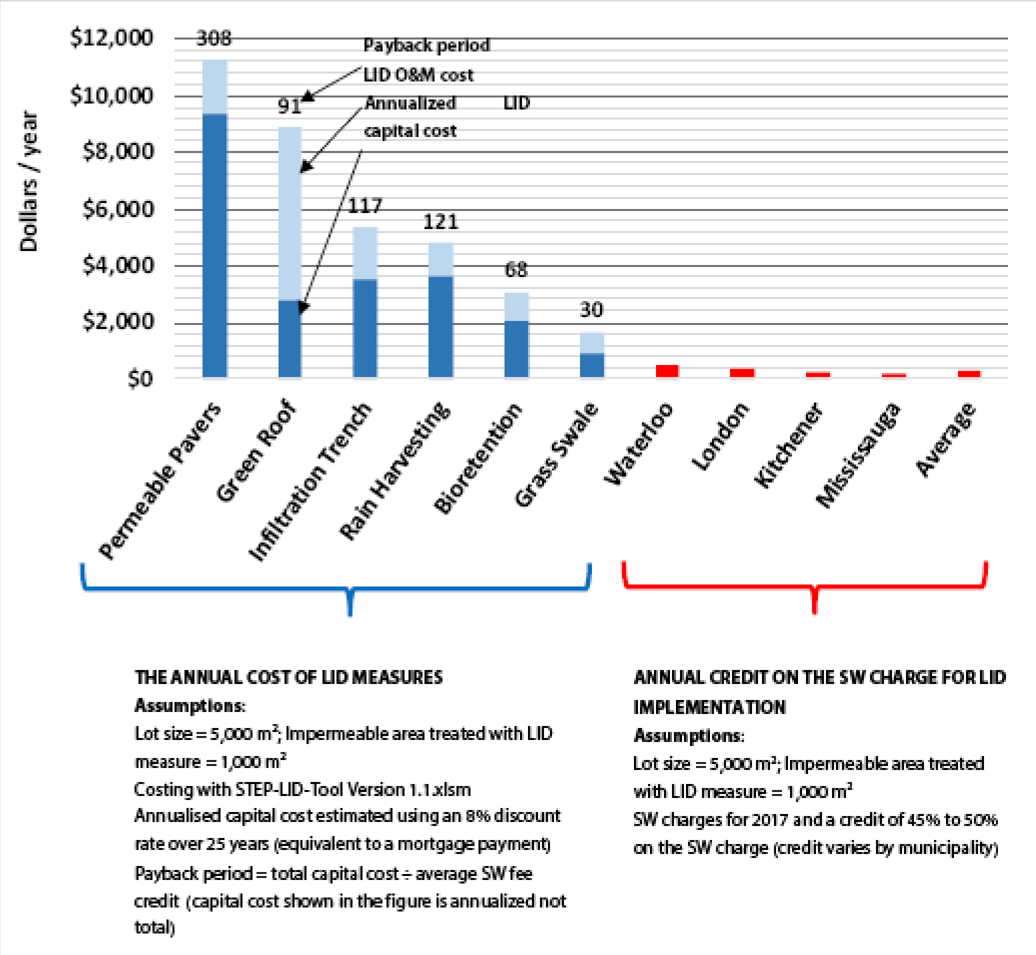

Figure 3: Comparing Annual LID Costs to SW Fee Credits

The potential benefits of basing stormwater charges on a measure of run-off may also be diluted where the design of the property has already been influenced by development contributions that are based on impervious area. A further issue is that without continual monitoring benefits may reduce over time.[33] Similarly a potential barrier to those considering installing green infrastructure to mitigate impervious areas is the perceived ongoing maintenance cost.

There is some evidence that financial incentives were not a driving factor for many participants and that other factors such as care for the environment are influential in the decision by property owners to install green infrastructure.[34] This finding lends weight to a more targeted incentive program (such as fee credits) to encourage installation of green infrastructure.

A common conclusion is that the greatest potential benefits are likely to come from non-residential programmes.[35] This is consistent with the finding that stormwater fee credit programmes are often just targeted at non-residential customers. The key argument for including residential customers in such programmes appear to be associated with perception of fairness[36] and from incentives made at the development level.

3.3.4 Other charging matters

In some locations, it is common for stormwater drains to connect into the sewer system. This is typically an expensive means of addressing stormwater as it can overload the sewer system and downstream wastewater treatment plants.

Some utilities modified the fees they charge for drainage to reflect these additional costs. This is perceived as fairer and can provide incentives for efficient disconnection. A prominent example is in England where it is common for surface water to be connected to the sewer and for water utilities to provide customers a rebate where they can demonstrate that no surface water from their property enters a public sewer.[37]

3.4 Recommended best practice pricing principles for stormwater

In light of the above considerations and international experience, we recommend the following set of best practice pricing principles for stormwater management.

The principles build on and are consistent with the New Zealand Infrastructure Commission's core principles for infrastructure funding and financing discussed in section 3.2.1.

[33] Larson et al (2014).

[34] For example, Lavasidis (2016, p. 53) reported the perception that 'most of the program participants were either environmentalists, or those who had problems with flooding on their own properties'. Larson et al (2014) observed that the incentive structure appeared to not have much influence on participation levels in programs.

[35] See Lavasidis (2016, 78-79).

[36] See Lavasidis (2016, 78-79).

[37] An example is, Thames Water https://www.thameswater.co.uk/help/account-and-billing/understand-your-bill/reduce-your-wastewater-bill. See also discussion at https://www.ofwat.gov.uk/households/your-water-bill/surfacewaterdrainage/

Revenue sufficiency

1. Funding should be sufficient to recover the whole-of-life costs to meet agreed stormwater objectives.

   That is, the meeting of stormwater objectives should not be compromised due to a lack of funding. Funding needs and projected revenue should be periodically reviewed and pricing and/or objectives should be re-evaluated should any shortfall be identified.

2. The costs of stormwater services (including the cost of funding programs and targeted credits) should be primarily met through targeted (i.e. reserved for stormwater) upfront and ongoing charges.

   To ensure revenue sufficiency, the cost of stormwater services should not be funded out of general tax revenue (with rare exceptions).

3. Upfront charges should be set with the aim of ensuring existing development does not subsidise new development.

   This is in the interests of fairness and efficiency. Upfront charges are a useful means of providing a price-signal to encourage new development to mitigate the costs of the development. Furthermore, a lack of recovery from upfront charges places additional pressure on ongoing charges and the potential for revenue shortfalls.

4. Ongoing charges should not vary substantially over time

   Ongoing charges should not fluctuate and/or increase significantly over time. Pricing volatility is costly to customers. Significant pricing increases may not be perceived as fair (due to intergenerational inequity) and may be met with resistance that leads to funding constraints. A possible exception to this principle is where prices rise in the future to reflect a higher level of service.

Transparent, simple, and practical

5. The basis for charges should be transparent, simple, and practical to implement.

   Transparency and simplicity can improve perceptions of fairness. A transparent process to setting price can ensure useful feedback is incorporated before prices are set.

Efficiency and fairness

6. The funding and pricing should be consistent (and preferably developed in concert) with the planning and regulatory framework.

   Planning and regulatory requirements can play a similar role to pricing in influencing decisions around design and development. Consequently, it is important that the regulatory framework and pricing structure do not conflict and rather are developed concurrently for maximum efficiency and effect.

7. The upfront charges and regulatory framework should facilitate and incentivise cost-effective stormwater solutions (e.g. centralised vs development vs on-lot) and effective management.

8. Charges should be reflective of local costs and community needs.

   The costs and benefits of stormwater management naturally vary by location. Given the large potential variation in costs it is in the interests of both fairness and efficiency that costs and incentives reflect local cost variations. This is also consistent with the LDAC guidelines that there 'must be a proper relation between the levy amount charged and the particular objective or function concerned'.[38]

9. Stormwater service providers should consider (and the have flexibility to use), a range of financial incentives to incentivise stormwater management.

   Given the variety of sources of impact and potential solutions, it is important that stormwater service providers have the flexibility to implement different pricing and incentive programmes.

[38] This issue is discussed further in section 5.3.

4. Assessment of current practices

4.1 Current practices

Stormwater services in New Zealand are developed and maintained by a range of parties. Most salient, and of relevance to this report, are local councils (including district and city councils)[39] who have responsibility for ongoing maintenance of the public stormwater system and also act as the local roading authority. Other stormwater system assets are provided and developed by:

- developers
- private landowners
- regional councils, who provide flood management assets, some of which may be better characterised as stormwater assets
- Waka Kotahi New Zealand Transport Agency – who has responsibility for the road network not provided by the local roading authority.

The funding of assets managed by local councils that will be transferred to the WSEs largely come from upfront development contributions, and ongoing charges, recovered through general or targeted rates.[40]

4.1.1 Development contributions and funding of capital works

In New Zealand, upfront capital costs can be funded through development contributions. These are a funding tool set out in the LGA that enable territorial authorities (i.e. city or district councils) to recover from developers a contribution to the total cost of capital expenditure on stormwater and other community facilities[41] necessary to service growth over the long term.

The LGA specifies limits on the use of development contributions. In particular:

- they may not be used to fund maintenance (LGA s204)
- the territorial authority must provide a refund if it does not provide the reserve or infrastructure that was the reason for the contribution (LGA s209)
- developers have the right to seek reconsideration of requirement for development contribution (LGA s199A).

There is some variation in how development contributions are implemented and applied. Each council determines and publishes its Development Contributions Policy, which includes details of how stormwater development contributions are determined. Of note, the DIA (2021) published a guide and template for developing such policies. Most development contribution policies we reviewed based the

[39] Of note, Wellington Water a council-owned and funded entity manages stormwater assets on behalf of Wellington City Council, Porirua City Council, Hutt City Council and Upper Hutt City Council. and Kāpiti Coast District Council. https://www.wellingtonwater.co.nz/about-us/our-asset-management-approach/
[40] In addition, there are small service-specific fees.
[41] Community facilities network infrastructure, reserves and community infrastructure (e.g. sports complexes, community centres).

stormwater developer charge on the impervious surface area (ISA) of the land being developed.[42] We observed others that based the stormwater charge on the number of lots,[43] allotment size[44] and gross floor area.[45]

An example of a policy using ISA is provided in Box 8 below. Of note, the typical approach involves calculating charges as a multiple of the household equivalent unit (HUE) and assigning a residential dwelling a charge of one HUE (regardless of its true ISA) and calculating the charge for non-residential development as a multiple number of HUEs proportional to the ISA of the development to the typical residential dwelling. Thus, under this approach there is, in effect, a flat charge for residential dwellings, and a charge proportional to the ISA for non-residential dwellings.

The development contribution charges are typically calculated by locality (e.g. a stormwater catchment area) within a council area by dividing the projected capital costs by the projected number of dwellings. This process can lead to substantially large variance of developer charges within a council area reflecting the variation in local costs. For example, the stormwater component of development contributions in:

- Tauranga in 2022/23 varies from $39k to $284k per hectare.[46]
- Auckland for 2022 varies from $0 to $24,084 per HUE.[47]

Box 8: Case Study – Gisborne District Council

The stormwater Development Contributions policy for Gisborne District Council is typical of a number of councils. The policy states:

> A stormwater development contribution for the [Gisborne Urban Area] catchment is based on the value of future growth components, and any works already completed since June 2012, to be located within the entire catchment in order to meet the defined level of service under the fully developed catchment scenario. Anticipated future components are identified in Council's current LTP which identifies proposed capital development budgets.
>
> The allotment area of development and hence information related to site coverage and impermeable surface area (ISA) has been used to calculate a unit of demand. All residential and nodal development is assumed to create one HUE. All non-residential development is assessed on the amount of ISA (site coverage) compared with residential development, with a minimum of one HUE. … With driveways and paths the

[42] Examples include the current development contributions policies of Auckland, Christchurch, Gisborne, and Rotorua Lakes.
[43] For example, for some sections of Tauranga City Council.
[44] For example, in Palmerston North City Council.
[45] For example, Kapiti Coast Council, Wellington City Council, and some sections of Tauranga City Council.
[46] Tauranga City Council 2022/23 Development Contributions Policy, p. 14. Available at https://www.tauranga.govt.nz/Portals/0/data/council/development_contributions/2022-23/files/development-contributions-policy-2022-23.pdf
[47] Auckland Council Development Contributions Policy 2022. Available at https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-policies/development-contributions-policy/Pages/development-contributions-policy.aspx

ISA of an average residential lot is now assessed at 340 m2. This is the ISA used to determine the number of HUE's for each non-residential development.

The policy (p. 52) determines the contribution per HUE to be $1,616 (excluding GST) calculated as ~$2.5 million of stormwater capital expenditure to be funded by development contributions over 2021 – 2031, divided by 1,544 which is the number of additional HUEs expected in this period.

The stormwater contribution is set at:

- 1 HUE per lot for residential developments
- 0.29 HUEs per 100m2 of ISA for non-residential developments (calculated as 100m2 / 340m2)

For example, a non-residential development on a vacant lot that creates an additional ISA of 2,000m^2 including carparks would incur a stormwater development contribution of 0.29 x 20 x $1,616 = $9,370

Councils may also reduce the development contribution to recognise that some developments control the additional stormwater they produce and consequently, have a reduced impact on the council's network (see example contained in Box 9 below).

Box 9: Case Study – Nelson City Council's policy for low-impact developments

Nelson City Council's Development Contributions Policy 2021 includes a potential reduction on the development contribution for low-impact developments. The policy states:

7.6 Low impact developments

Council recognises that some developments control the additional stormwater they produce and consequently, have a reduced impact on Council's network. Where this impact is permanent and won't become redundant as a result of Council works in the future, Council may reduce the [development contribution] for stormwater. In exercising this discretion, Council will be guided by:

(i) Where, following an event equal to or greater than a one in 15 year storm event, stormwater will not discharge into a Council managed system, stormwater DCs may be reduced by up to 50%;

(ii) Where, following events equal to or greater than a one in 15 years storm event, the stormwater will discharge into a Council managed system, the stormwater DC may be reduced by up to:

1. 25% - where primary stormwater flows are managed to predevelopment levels;

2. 50% - where both primary and secondary stormwater flows are managed to pre-development levels

The maximum 50% discount reflects the fact that all developed properties receive benefit from associated stormwater mitigation capital expenditure work by Council in the catchment area. For example, the catchment will either be directly protected or the ability to move around the area unencumbered during storm events will be improved.

Councils may also use other approaches to incentivise improved stormwater management practices. The LGA (s207) allows territorial authorities to enter in voluntary development agreements with developers, through which developers provide infrastructure in lieu of a development contribution. These agreements can be used to provide additional incentives for stormwater management.

In some instances, local councils may refuse to accept ownership of stormwater management infrastructure constructed as part of development projects. This tends to occur when the asset management arms of councils do not want to take on the cost burden of maintaining stormwater treatment devices (such as swales and rain gardens) within a development, despite the requirement for such infrastructure through their district plans or via regional council stormwater discharge consents. In this case, the developer will form a body corporate (or similar) to own, operate and maintain the stormwater infrastructure in the long-term.

The Kapiti Coast District Council includes in its 2021 District Plan development incentives to improve stormwater quality. Councils may also provide other incentives. Kapiti Coast District Council provides incentives for landowners to 'carry out substantial enhancement activities to restore and enhance their local environment or who carry out sustainable development activities.' From a water quality perspective, the council provides incentives for planting on riparian margins, retirement of erosion-prone land, and removal of contaminants. The incentives include, for example, 'the ability to create additional dwelling on site' and relaxation of car park space requirements. [48]

4.1.2 Ongoing stormwater charges

Currently, local authorities recover the costs of stormwater services predominantly from ratepayers through general rate revenue and/or targeted rate (i.e. rates or charges specific to stormwater services). As illustrated in Figure 6 below, within each WSE region, a significant proportion of councils continue to use general rates to fund stormwater charges.

The rating basis varies by council. Rates are commonly based on the property's capital value (and less frequently land value).[49] Target rates for stormwater may also be based on a fixed charge for residential properties and in some cases a combination is used (e.g. a fixed charge plus a rate per capital value).

There are multiple other variations and special circumstances. For example:

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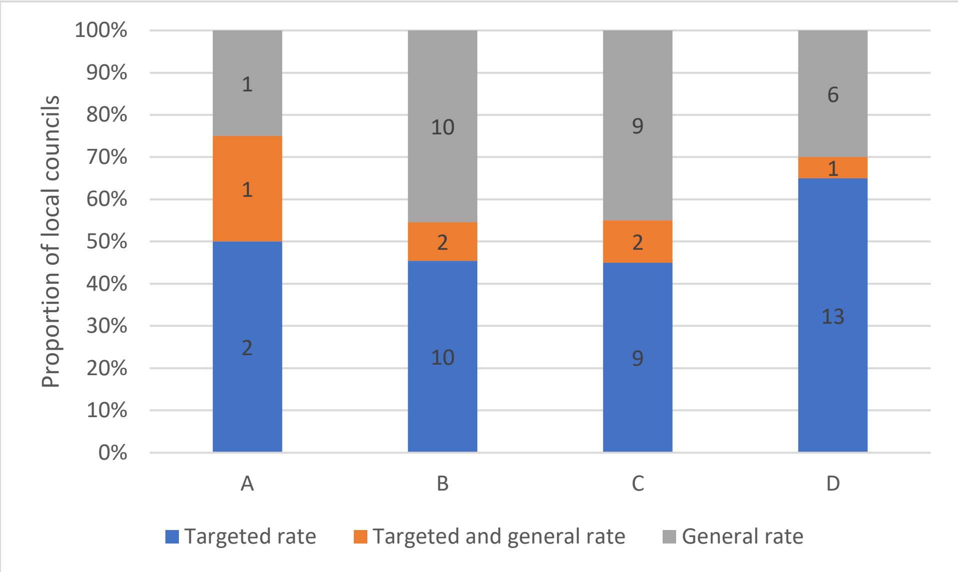
[48] Operative Kāpiti Coast District Plan 2021. APP1 – Development Incentive Guidelines https://eplan.kapiticoast.govt.nz/eplan/rules/0/276/0/12995/0/186

[49] The capital value reflects the most likely selling price of the property. The land value is the probable price of the bare land (i.e. excluding buildings or other improvements to the property). The rating basis (i.e. capital or land value) is used to determine a property's share of the required revenue.

- the target rate for stormwater services may be bundled in with other services. For example, Dunedin City Council charge a targeted rate which covers drainage services that includes sewage disposal and stormwater
- target rates may be set for a specific purpose and not cover the full scope of stormwater services. For example, Auckland Council have a targeted rate to fund water quality programmes but fund normal drainage maintenance out of general rates[50]
- rates (targeted or general) commonly vary by property type. (e.g. Dunedin provides discounts for "commercial, residential institutions and schools")[51]
- targeted rates may vary by location, reflecting contribution to specific schemes (e.g. Dunedin p. 5).

Figure 6: Frequency of stormwater charging basis by WSE



Source: WaterNZ supplemented with information from websites.
Notes: Numbers show the count of councils in each category. Dunedin's targeted rate is a bundled targeted rate that includes wastewater and drainage services. The policy of one local council in entity D could not be identified.

We are unaware of any cases in New Zealand where stormwater charging is aligned to the volume of run-off. We are aware that staff at one council had previously (~5 years ago) investigated, but ultimately chose not to pursue, basing stormwater rates on impervious area. The key reason cited for not proceeding further was that efficiency benefits were likely to be very small and that the change would have a substantial impact on some customers and ultimately council in managing correspondence with affected customers.

50 https://www.aucklandcouncil.govt.nz/environment/looking-after-aucklands-water/water-quality-targeted-rate/Pages/default.aspx
51 https://www.dunedin.govt.nz/__data/assets/pdf_file/0007/725434/201920-Rates-Resolution.pdf

4.1.3 Other fees and income

Many councils also charge fees for specific stormwater activities such as stormwater connections, disconnections, and consents.[52] These appear to be cost-based.

Councils also charge a range of fees for stormwater management on industrial and construction sites. These include fees for specific services (e.g. site inspections) and licencing fees.[53] Of note the annual licence fees may be risk based.[54]

4.2 Assessment of current practice

4.2.1 Administrative criteria

The current funding approaches applied in New Zealand tend to score well on administrative criteria.

In terms of transparency:

- Councils' expected expenditure (i.e. revenue to be raised) is documented in long-term and annual plans and where revenue is collected through general rates, councils tend to highlight what portion of a ratepayer's bill is spent on stormwater
- The pricing approaches and method (of both development contributions and targeted rates) of determining prices are generally clearly documented.

The current pricing approaches are generally simple to understand and practical to administer:

- For ongoing charges, they typically align with the approach used for general rates.
- For development contributions, it is common that the basis of charging for stormwater differs to other infrastructure (with impervious area being used for stormwater and gross floor area); however, the approach used is still a simple structure.

4.2.2 Sufficiency

4.2.2.1 Underfunding /spending

A commonly raised concern is that stormwater services are underfunded. An indicator of potential underfunding is that the ratio of the capital expenditure on renewals matches the annual depreciation charge.[55] Based on data collected by DIA, we found that in 2020/21, that capital expenditure on

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[52] See for example: https://hamilton.govt.nz/your-council/fees-and-charges/wastewater-stormwater-and-water/

[53] Dewatering authorisations – the removal of surface water from for example a construction site. (e.g. Tauranga Stormwater fees https://www.tauranga.govt.nz/council/forms-fees-and-payments/fees-and-charges/stormwater-fees)

[54] For example, Christchurch introduced an annual licence fee for industrial stormwater based on the assessed premise risk. The fee varies from zero for a low-risk site to $4,080 for a high-risk site. See Stormwater and Land Drainage Bylaw 2022.

[55] The Controller and Auditor General (2020, part 2) use this measure to assess the adequacy of reinvestment by councils. They found that in 2019/20 (across all infrastructure) Councils' renewal capital expenditure was 74% of depreciation.

stormwater renewals was around 68 per cent of the depreciation charge, suggesting an issue of underinvestment (43 per cent for councils excluding Christchurch, for which there is significant reinvestment).

The Stormwater technical working group (DIA and Beca 2021, p. 7) raised the concern that "The costs of funding the current stormwater services are likely to be significantly understated. Investment in the renewal and upgrade of the stormwater system has tended to occur on a more reactive basis."

The stormwater funding gap in New Zealand has long since been acknowledged and historically there have been significant challenges in securing funds for stormwater operators to address the cost of maintaining desired levels of service, as well as for planning for future growth (Ira, 2019).[56]

4.2.2.2 Sufficiency of development contributions

Stakeholders we spoke to raised concerns that development contributions were not sufficiently funding growth. An issue raised was the difficulty in recovering funds from developers. A key concern affecting recovery was the difficulty in meeting the LGA requirements of demonstrating a causal link between the development contributions and the future long-term expenditure program, which can be significantly uncertain. However, a 2021 High Court judgement (see Box 10 below) provides support for councils not needing to be precise in specifying how the expenditure to be recovered relates to development contributions.

A related issue is the difficulty in accurately forecasting future capital expenditure requirements.[57] Development contributions may also lead to an underfunding because they can only be used for capital expenditure.

If development contributions are insufficient to fund growth, then the additional costs of growth will need to be recovered from the ongoing stormwater fees. In effect, any underfunding from development contributions means that existing property owners would need to subsidise new development.

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[56] In 2004, PriceWaterhouseCoopers (PwC) identified that to merely maintain the status quo of stormwater infrastructure in the Auckland region (i.e. focus management efforts primarily on flood mitigation) the cost to Council would be in the order of $1.9 billion over a 20 year planning horizon. In 2015 the National Infrastructure Unit estimated that the cost of renewing the three waters network (wastewater, potable water and stormwater assets) was in the order of $30 billion to $50 billion over the next 15 years. PwC (2004) determined that if water quality outcomes were identified to be important (as they have now through the NPS-FM), then expenditure could rise to as high as $11.2 billion over a 20 year planning horizon in Auckland. In the early 2010s, the Auckland Plan has identified a funding shortfall of between $10 - $15 billion to meet infrastructure costs. The Otago District Council envisaged that meeting standards set through the NPS-FM would incur additional costs of around $10 million over 7 years, whilst Tasman District Council expected to spend an additional $2 million over the next 10 years (National Council of Local Government NZ, 2015a).

[57] The timing of development contributions can be a challenge because a) for financing projects, funds may arrive after the project is developed b) a lack of certainty over the project may contribute to developers challenging the contribution amount. Councils face the issue of non-payment of development contributions.

Box 10: High Court judgement on development contributions

In late 2021, the High Court released a judgement regarding a contested Hamilton City Council (HCC) development contributions policy.

The following are extracts from a summary by Murphy (2021):

> An application for judicial review was brought against HCC by a group of developers who were essentially claiming that HCC's DC policy was not compliant in a number of respects with the provisions of the LGA, which was resulting in significant overcharging of development contributions.
>
> - The Court held that as long as a causative link can be established between the development and infrastructure demand, development contributions are still attracted, and it is not appropriate to isolate individual components of infrastructure for which a development generates direct demand and only charge development contributions in respect of those individual components.
> - The Court also found that where a development contributions policy identifies catchments for various development contribution fees, it is not essential for projects that are funded by that specific fee to be located within the catchment, as long as there is a causal link i.e. that developments within that catchment create demand for a particular project.
> - A claim was also brought against a part of the policy which calculated stormwater infrastructure development contributions for residential developments based on the number of bedrooms in a dwelling. Given that stormwater infrastructure generally relates to the size of an impervious surface, this method of calculation did not make sense for multi storey developments. The Court declined to find this method of calculation 'unreasonable' but did provide some informal direction to HCC to reconsider this in light of the increasing prevalence of multi-storey, high density developments.
>
> … The overarching theme of the judgment is that councils cannot be reasonably expected to calculate personalised development contribution figures for each development taking into account its precise features.

Of note the HCC appears to have accepted the Court's informal direction regarding the stormwater development contribution for multi-storey dwellings. They have included in their draft development contributions policy for 2022/23 a modification to reflect that 'multi-storey dwellings with four or more bedrooms will not necessarily give rise to increased impervious surfaces beyond those expected from a standard residential dwelling.'[58]

[58] https://haveyoursay.hamilton.govt.nz/city-planning/payingforgrowth/user_uploads/d-4098374--proposed-development-contributions-policy-2022-23--tracked-.pdf (clause 10.36)

4.2.2.3 Sufficiency of ongoing charges

There are also concerns with the sufficiency of ongoing charges. An issue with general rates to fund stormwater services is that they may not be a sufficient and secure funding source. A common concern is that general rate revenue is vulnerable to political process and that funds required for stormwater management will be redirected towards other projects. A related concern is that limits on general rate revenue growth will limit the growth in funding for stormwater. In contrast, stormwater providers may find it easier to obtain support for additional revenue for stormwater management improvements.

There are also broader concerns of funding pressures for local governments. Many local authority areas have very low rating bases, and some face either no growth or projected retrenchment (National Council of Local Government NZ, 2015a), leading to a reduction in rates revenue and an increased funding shortfall. In a review of local government funding and financing the NZ Productivity Commission (2019, p. 6, chapter 7) identified that while the property rates-based system was appropriate, in some situations – relating to climate change, unfunded central government mandates, high growth areas, and tourism growth – the current funding system is either inadequate or unlikely to be sufficient in the future.[59]

4.2.3 Efficiency and fairness

4.2.3.1 Incentive provided by development contributions

As has been described above, many councils have set development contribution policies for stormwater that are based on impervious surface area (ISA). Some councils also provide additional incentives for stormwater management. Such practices would appear to provide some incentive to reduce the ISA and/or to focus development in areas with lower cost, which in turn should reduce the stormwater impact.

However, the incentive provided may be less than optimal, because the contribution per unit of ISA is less than the marginal social cost associated with ISA.. For residential development, development contributions are generally set per lot and thus do not vary according to the impervious area on the residential developments.

Non-residential developments are generally based on the actual size of the impervious area, but the incentive may still be small. In the Gisborne District Council example provided in Box 8, the stormwater development contribution equates to $475 per 100m2 of impervious surface. This amount seems unlikely to make a material difference to development designs. The values can be significantly greater in other locations. For example, in Manurewa Papakura ward of Auckland, the stormwater development contribution equates to $8248 per 100m2 of ISA. However, such large values appear rare.

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[59] The National Council of Local Government NZ (2015b) raised similar concerns and argued for complementing rates with funding tools to address the emerging challenges.

A potential issue is that the stormwater development contributions do not fully incorporate the costs of additional growth. This may be because:

- the long-term plans only include the costs associated with managing additional stormwater drainage by council and not the additional costs to manage the impact on waterway health
- the costs may not include the impact on other aspects of the stormwater system (e.g. on roads)
- of the difficulty in forecasting capital expenditure
- additional operational expenditure is not included.

4.2.3.2 Incentive provided by stormwater fees

The current approach in New Zealand of funding stormwater management based on property rates does not provide any encouragement for property owners to reduce their stormwater impact. Furthermore, relative to a charge based on impervious area or other measure of runoff, the current approach does not signal to property owners that stormwater runoff is a problem.

There also seems to be limited used of fee credit programmes to further incentivise better stormwater management practices.

4.3 How the WSEs can transition to best-practice approaches for pricing stormwater services

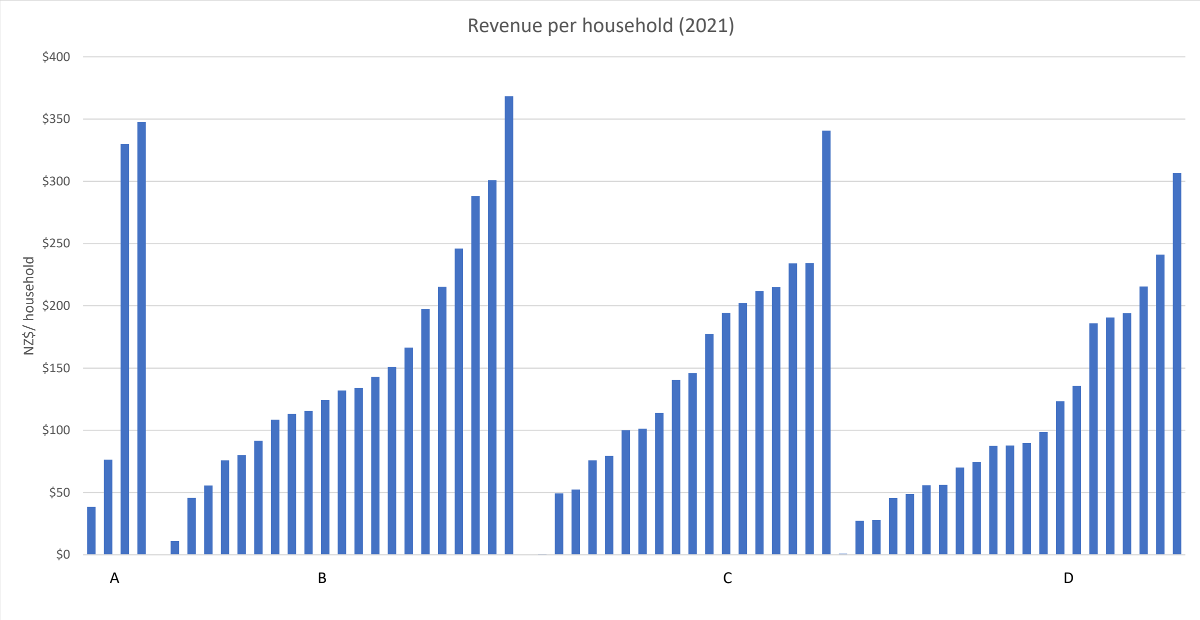
4.3.1 Challenges with transition

The Stormwater Technical Working Group (DIA and Beca 2021) identified many challenges associated with the transition of services to the WSE. Of relevance to pricing these include:

- risks regarding funding, including:
    - significant information gaps, which creates difficulty in construction of forward estimates of funding needs
    - concerns of underfunding of assets
    - the transition coincides with a significant shift in focus on stormwater management
- ongoing complexity of arrangements with a need for bespoke arrangements and ongoing collaboration
- lack of sophistication and understanding of value.

An additional consideration is the variation in current funding across councils within WSE areas. As shown in Figure 7 below, this variation is large and would provide a potential issue to pricing reforms that attempted to harmonise charging across the entity. This issue is considered in the following section.

Figure 7: Stormwater fee revenue per household by local council organised by WSE



Source: Sapere analysis of data supplied by DIA.

4.3.2 Transitioning to best practices

As discussed in the assessment of current practice (section 4.2), the key concerns with the current approach relate to:

- lack of sufficiency of funding
- lack of incentive provided by charges for stormwater management by landowners.

4.3.2.1 Sufficiency of funding

The sufficiency of funding is potentially a more significant issue for the WSEs than councils, as they have no potential to draw upon general rate revenue to supplement any shortfalls. Furthermore, given their singular focus, they may face greater scrutiny over the performance in delivering stormwater outcomes and thus less able to defer expenditure.

To ensure sufficiency of funding, WSEs can use a mix of development contributions and ongoing stormwater fees. Ultimately any shortfall in development contributions will need to be met through an increase in ongoing fees.

4.3.2.2 Improving incentives for stormwater management

The greatest potential for impacting stormwater outcomes through pricing appears to be at the time of development. This could involve more refined pricing to align development contributions to projected runoff and/or additional financial incentives to encourage WSD.

As has been discussed in section 3.3.3 the available evidence suggests that financial incentives provided by stormwater fees are unlikely to materially change behaviour of landowners to reduce stormwater runoff. However, transitional issues asides, there are also no significant downsides to adopting pricing structures that are more aligned with the cost of stormwater services. For example, it should be reasonably simple to base the stormwater fees pricing structure on the same charging structure used for development contributions (which is often based on ISA). Arguments for such a transition include that:

- the three waters reform provides a unique opportunity to reform stormwater pricing
- raises awareness of the stormwater management challenges and solutions
- more closely aligning charges to runoff may be perceived as fairer over the longer term
- with improvements in technology, the cost of monitoring ISA (or more refined measures of runoff) will fall.

Nevertheless, the transitional issues are likely to be significant. Any reforms would inevitably lead to some ratepayers paying substantially more and lead to complaints being made. It also may be viewed poorly from a fairness perspective, as a shift from pricing based on capital (or land) value would lead to those owning lower value properties potentially paying more in stormwater charges.

A less challenging (and potentially more effective) approach, to provide incentives for landowners to install or maintain green infrastructure is through using credits and other targeted programmes (funded through stormwater management fees). This approach has several advantages.

- it would not involve substantial increases to any ratepayers
- it is relatively easy to administer as it involves an opt-in
- it could be reasonably effective as it would effectively target those landowners willing to adopt green infrastructure.

4.3.2.3 Steps to transition

Considering the above, we recommend the following steps by WSEs to manage the transition with respect to pricing.

First, WSEs should comprehensively review future funding requirements, which would involve:

- evaluating the current state of stormwater system and waterways
- selecting options, via catchment management planning, to address the issues. This may involve consideration of non-conventional programmes
- forecasting future funding needs
- engaging with stakeholders (councils, developers, and communities).

As discussed in Section 3.1.1.4, this requires research into better understanding of costs of treatment and monitoring.

Second, WSEs should analyse the potential stormwater benefits from changes in land-use. This would involve analysing the potential impact in terms of runoff from changes in land-use and valuing that impact. As discussed in Section 3.2.2.4, this value will be a function of the cost-reductions achieved from changes in land-use and the value to the community and environment from changes in flooding and pollution. This may involve leveraging existing research and/or commissioning new research on the community’s willingness to pay for improvements to waterways and other aspects of the environment impacted by stormwater.

WSEs should use such analysis to assess the optimal incentive to provide developers and landowners to reduce runoff and to assess the potential benefits from pricing reforms. Such analysis should also be an input into the evaluation of the WSE's investments in other programmes and assets to improve outcomes.

Third, WSEs should gather the information to understand the impact of changing charging practices. This would include gathering data on the extent of impervious area[60] and other potential factors that affect runoff.

Fourth, using the information gathered to evaluate options for change, WSEs would need to:

- identify potential reform options to development contributions and the structures for ongoing stormwater levies. This should include considering a range of alternatives including targeted programmes
- model the potential distributional impacts (i.e. to landowners) of transitioning to the new pricing arrangements
- engage with stakeholders (councils, developers, communities etc) on the reform options
- evaluating the pros and cons of the alternatives in terms of the efficiency benefits gained against the costs of transition.

[60] This may involve conducting aerial surveys (to determine the extent of impervious area through cities within each WSE area) and integrating GIS and property data to allow for impervious area mapping, monitoring and charging.

5. Recommendations for stormwater pricing

5.1 On the structure of WSE stormwater levies

Recommendation 1

> ***WSEs should have the flexibility to choose how they set stormwater fees and provide incentives (including discounts or direct payments) to landowners, or other entities responsible for stormwater assets.***

As discussed in prior sections, there are a range of pricing structures that have been applied to ongoing stormwater charges and development contributions.

Based on existing evidence there is not a clearly preferred pricing structure and there appears no need to limit the pricing structures that WSEs apply. Rather it appears preferable that WSEs have the flexibility to experiment with the fee structures overtime.

While there are potentially efficiency benefits of basing levies on a measure of run-off (e.g. based on impervious area) there are higher administrative costs of doing so and distributional impacts associated with change. Nevertheless, the attractiveness of such fee structures may increase over time as technology improvements reduce the administrative costs and thus it is important that WSEs have the flexibility to introduce such charging in the future.

WSEs also need the flexibility to use financial incentives to trial innovative programmes. As has been discussed, there may be benefits to providing incentives that go beyond a simple fee reduction.

Considering the above, we recommend that WSEs have the flexibility to:

- choose how they set stormwater fees
- provide incentives (including discounts or direct payments) to landowners, or other entities responsible for stormwater assets.

Consistent, with our recommendations in the previous sub-section, we recommend that WSEs place a high priority in investing in understanding the value of potential benefits of WSD and post-development solutions (e.g. green infrastructure). This will benefit their assessment of pricing structures as well the evaluation of their own investments.

5.2 On the relationship of pricing to other water services

Recommendation 2

> ***WSEs pricing need not be co-developed with the pricing of water and wastewater services***

As is commonly recognised and has been discussed in this report, stormwater services differ from water and wastewater services in they are primarily public good services. Nevertheless, a common consideration is the extent to which the pricing of stormwater services should be considered in concert with the pricing of the other two water services. In this regard, the Stormwater Technical Working Group (DIA and Beca 2021, p. 23) argued that "Stormwater should not be considered in isolation [to other water services]" and that the "potential funding and charging regimes should recognise the connection through te hurihanga wai (the water cycle) and the potential for stormwater to be a resource for non-potable (and potentially potable) water supply."

Stormwater services share some connection to the other services in that:

- stormwater is potentially a source of water
- some resources may be shared across the three water services
- wastewater and stormwater services share a common objective in protecting the environment. In particular:
    - Healthy receiving waters require both effective wastewater and stormwater systems.
    - Private laterals that connect stormwater to the sewer system are both a cost to the sewer system and a threat to the environmental goals of the wastewater system.

In our opinion, these connections are not sufficiently substantial as to necessitate stormwater funding and pricing to be co-developed with the funding of water and wastewater services. In this regard, we note that it is not uncommon internationally for stormwater services to be provided by institutions that are separate to water and wastewater services.[61]

The connections between stormwater and the other services do need to be addressed. In this regard:

- The potential for stormwater as a water supply should be identified in the planning of water and stormwater services. The use of stormwater as a water supply of resource is a benefit that reduces (i.e. helps to offset) the cost of stormwater services. However, it does not affect the pricing structure and should not materially affect the pricing of stormwater services.
- The use of common resources is a matter of cost allocation, which should not have a material impact on pricing.

The issue of private laterals is a potentially important consideration. These can impose a substantial cost on the wastewater system, and through overflows, on the environment. To address the issue, WSEs may wish to provide incentives to encourage customers to identify and address these connections. Our expectation is that such incentives will be best addressed through the pricing of the wastewater service as the impact of these manifests itself through the wastewater services. For example, WSEs may impose additional charges (penalties) where private laterals are detected, but also offer subsidies and/or support to those customers who identify and agree to remove a lateral.

[61] For example, in North America it is common to have dedicated stormwater utilities. In Australia, it is common for stormwater services to be provided by councils while water and wastewater services are provided by a separate organisation. Furthermore, the beneficiary of the services can differ. Some ratepayers may not be connected to water and wastewater services but benefit from the public good aspects of the stormwater service.

5.3 Revenue recovery across the WSE's geographic area

5.3.1 Should prices be harmonised across an entity?

Recommendation 3

WSEs fees should not be harmonised within an entity. Rather they should consist of a local component (specific to the local council) and entity-wide component (that reflects cross-entity costs)

An important issue is how WSEs should recover revenue from the different council areas across the entity and whether pricing should be harmonised (i.e. geographically averaged) over the entity. Of note the Stormwater Technical Working Group (DIA 2021, p. 23) argued that "Stormwater networks most closely meet the definition of 'public good' investments, and as a general approach they should be funded through a universal or harmonised charge from the proposed water service entity."

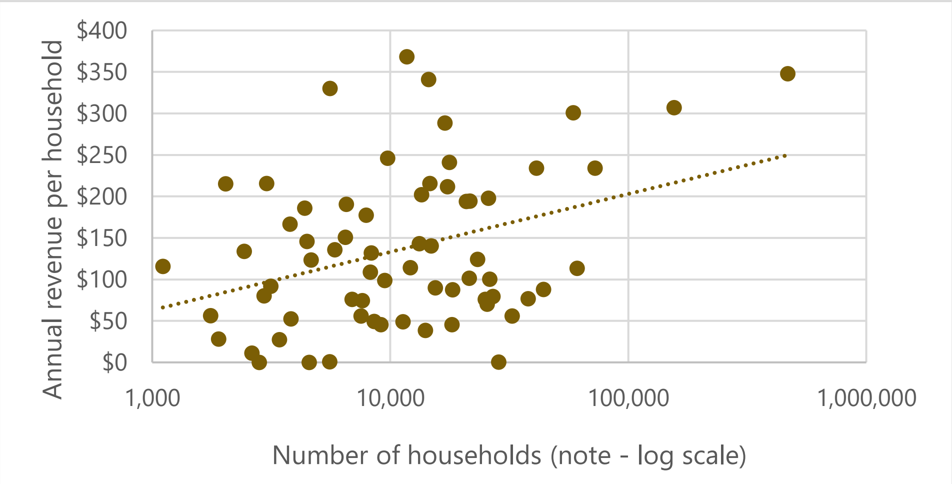
The need for localised fees

One possibility is that the WSE apply a uniform charge (or rate) for all rate payers within the entity. A single uniform charge, (regardless of rating basis) could be simple to understand and (once transition is complete) simple to administer.

However, the quantum of current stormwater charges varies substantially by local council area within each entity (see section 4.3), implying that a uniform charge would necessitate some cross-subsidy between areas, which may be further accentuated once future liabilities are considered.

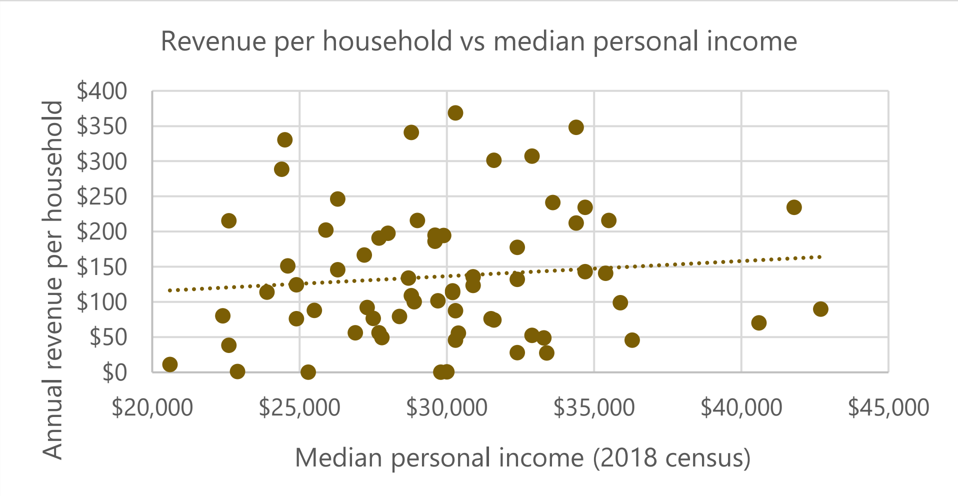
However, harmonisation may increase perceived inequities. The figures below show how, by council, the annual fees (estimated as annual revenue per household) vary with the number of households in the council (Figure 8) and with median incomes in the council area (Figure 9). This data suggests that harmonisation of prices would generally result in cross-subsidies to councils with greater population and higher incomes. This data is consistent with the costs of stormwater management being generally greater in more heavily populated areas, which in turn tend to be richer; however, underinvestment in smaller council areas may also be a contributing factor.

Figure 8: Stormwater revenue per household vs households by council (2021)



Source: Data collected by DIA.

Figure 9: Stormwater revenue per household vs median personal income



Source: Data collected by DIA combined with median total personal income taken as reported in 2018 census

Another – potentially more significant – issue is that a uniform charging approach may distort incentives and consequently lead to unnecessary frictions between councils and the WSEs. There are two related issues. First, relates to the transfer of stormwater responsibilities. As has been noted, the transfer of stormwater responsibilities will be complex and may vary considerably. Under a uniform charging approach, councils have increased incentive to transfer responsibilities to the WSE so that the costs of that responsibility are socialised across the entire entity. This may lead to suboptimal outcomes and tensions between WSEs and councils.

Second, following transition, councils will maintain significant influence over costs that are incurred by the WSE through their planning and consenting activities and through their management of other related assets. Furthermore, councils may have a strong interest in the design of stormwater assets developed by the WSE due to the multi-purpose potential of some assets. Under a uniform charging structure, councils will not bear the full costs of additional investments and activities spent in their area and consequently will be incentivised to seek a higher level of investment than is optimal, which again may lead to suboptimal outcomes and additional tensions.[62]

If, in contrast, the stormwater fees reflected different costs by council area, councils would have an incentive (in the interest of its rate payers) to seek efficient outcomes that balanced the costs and benefits. [63]

For these reasons, we recommend that WSE's fees reflect local costs.

The need for an entity-wide fee

[62] The issue regarding cost-variation is mitigated somewhat by development contributions, which can be set to reflect local cost variations. However, as noted earlier there are limits to the use of development contributions.

[63] In the United States, where stormwater services are provided by separate stormwater utilities, the services and thus fees are based on much smaller geographic areas (around 17 times smaller) than the average area covered by the WSEs.

There are also reasons why at least some portion of the fees may not reflect local costs.

First, WSEs will have some entity-wide common costs. These may include:

- overhead costs (e.g. associated with management, planning, and administration), and
- costs associated with entity-wide programmes; for example, campaigns, or innovative trials (which may begin in a particular location but later extended to the entity)

A second rationale is that some stormwater services may be focussed on improvements to nationally or regionally significant waters affected by stormwater and thus have an entity-wide benefit.

Finally, WSEs may be justified in directing support to a particular location. This may be because of:

- hardship concerns, whereby higher income council areas support lower income areas
- ensuring local areas meet national or regionally imposed requirements or standards
- unexpected local cost impacts.

In light of the above considerations, we recommend that the fees charged by WSEs vary by local council, reflecting the variation in costs by each council, but also incorporate entity-wide costs.

5.3.2 Should the fee structure be harmonised across an entity?

Recommendation 4

WSEs fee structures need not be harmonised within an entity.

A related question is whether the fee structure needs to be harmonised across a region. While a harmonised fee structure is administratively simple, there may be benefits to different fee structures in different areas of an entity. For example, the optimal fee structure may differ between urbanised and non-urbanised areas due to differences in stormwater costs and administrative costs. Furthermore, WSEs may wish to trial a different fee structure in on area before rolling it out more broadly.

In light of the above, we recommend that WSEs have flexibility to set different fee structures by area within the WSE.

5.4 Should WSEs have flexibility to charge local councils?

Recommendation 5

WSE should have flexibility to charge local councils rather than rate payers directly

Rather than charge property-owners directly, WSEs could charge local councils who then recover the costs from their ratepayers.[64] Two alternatives are:

1. a simple pass-through, whereby WSEs set a fee that councils collect on their behalf
2. the WSEs charge the council who determines how they collect monies from ratepayers.

[64] Historically, local councils have charged ratepayers on behalf of regional councils. For example, the former Auckland Regional Council recovered fees from the local councils in the Auckland area.

There are several arguments for WSEs charging councils directly:

- it would simplify the transition, by enabling the WSEs to leverage the councils' billing systems
- the councils will need to charge ratepayers for any residual stormwater services they provide
- stormwater services are predominantly a public good and more similar to other services (such as community infrastructure) provided by councils to ratepayers. It reduces the concerns that WSEs are seen as imposing a tax on ratepayers
- Councils will continue to have significant influence/control over the WSE costs.

Matters to be considered in such approaches are:

- who bears the collection risk
- under option 2, the extent WSEs would have influence over the price structure
- the implications for the council's credit rating (depending on how the above matters are resolved).

In a Regulatory Impact Statement on WSE Implementation Arrangements (2022, pp. 24–27) considered and rejected option 2,[65] on the basis that

> [it] is likely to undo the balance sheet separation between territorial authorities and water services entities. This would affect the ability of territorial authorities to borrow money and negate one of the large benefits of the reforms.

Nevertheless, there appears no reason to restrict the WSEs and councils adopting alternative arrangements if they are mutually beneficial. Rather it seems preferable to enable WSEs the flexibility to have local council charge ratepayers on their behalf rather than charge ratepayers directly.

Regardless, we expect that the WSEs may wish to enter arrangements with local councils (as well as other parties) for the ongoing management of some stormwater assets.[66] As noted in section 3.1.2.4, WSEs could also incentivise councils to increase standards and implementation of stormwater management.

5.5 Charging other entities

Recommendation 6

The Crown and other entities should pay their way

Most Crown land is currently exempt from rates, aside from a limited set of targeted rates. Crown land includes land occupied by institutions such as schools, universities and hospitals, with large areas of impervious surface, as well as the conservation estate. Exemptions from rates also include land used for airports, railways and ports, some of which may be owned by the Crown and some by other entities such as regional councils, as well as land used for other (primarily non-profit) activities listed in Part 1 of Schedule 1 of the Local Government (Rating) Act 2002.

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[65] Described as: 'Water services entities bill territorial authorities for stormwater services, with territorial authorities then recovering those charges through rates'.
[66] Councils will retain responsibility for stormwater assets associated with local roads (DIA 2022, p. 4).

Targeted rates may be applied to land exempt from rates if the rate is set solely for water supply, sewage disposal, or refuse collection. We understand that this provision does not permit Councils to recover the costs of storm water services from Crown land and land used for the other activities listed in Part 1 of Schedule 1 of the Local Government (Rating) Act 2002.[67]

In previous inquiries, the Productivity Commission recommended that central government should pay rates on its properties. As an alternative, the Commission in its 2019 report *Local Government Funding and Financing* (page 10) recommended that the Crown should at least pay its way in the following circumstances:

- If the Crown, as owner of property within a district, benefits directly from council services, or imposes costs on councils, then it should cover the cost of those services.
- The Government should pay development contributions on all developments it undertakes in line with the development-contributions policies of the local authorities in which the developments are located.

We consider that these same charging principles should apply to Crown land (and other entities currently exempt from rates) benefiting from, or imposing costs on, the provision of regional storm water services provided by a WSE. That is, we consider it appropriate that the Crown and other exempt entities should contribute to stormwater development contributions and fees. The WSEs should also have flexibility in its financial arrangements with these entities to incentivise improvements in stormwater management.

[67] Productivity Commission (2019, p. 199).

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Appendix A International practices

This section provides an overview of different types of stormwater charges used in other jurisdictions. It begins with a review of the charging mechanisms used in North America (United States and Canada), where a broad range of charging mechanisms are used.

North America

As summarised by Tasca et al (2018) the United States is 'the most evolved country in stormwater funding mechanisms.' Campbell (2022) estimates there are over 2500 stormwater utilities in the United States.

A summary of different types of charging approaches used in North America is provided in Table 4 below. The table is broadly organised in terms of increasing levels of sophistication. A more detailed description of the more complex and common methods follows the table.

Campbell (2022) notes 82 Canadian stormwater utilities that use a range of fees structures. Most common appear to be the Tier System, and ERU.

Table 4: Overview of common charging approaches used in North America

Fee type	Description	Frequency of use
Flat fee	A flat fee to users of a stormwater conveyance system is charged. [68]	Medium (~10-15% cases)
Tier system	Single fee where consumers are categorised based on a select variable and charged accordingly.	Medium (~10-15% cases)
Total property area	Based on the total area of the property.	Rare
Equivalent residential unit (ERU)	Based on average impervious area on all single-family residential parcels within the territory of a given city. Residential parcels are typically charged a single ERU and non-residential properties are charged in proportion to the ratio of the parcel impervious area to the ERU. However more sophisticated methods may be used.	High (50%+ of cases)

[68] For example: Residential: $11.69 per residential unit per month; Non-residential: $148.51 per meter monthly. Aurora Town Council, Ontario, 2022 Water Billing Information. https://www.aurora.ca/en/town-services/resources/Water-and-Sewer/2022_WaterBilling_Insert_Apr26.pdf Accessed 24 Nov 2022

Residential equivalent factor	Based on a measure of runoff generated by different lands use and occupation. One unit represents the runoff amount of a single-family property for a specific storm event.	Low medium (~5-10% of cases)
Dual	Two Level System (Residential/Commercial)	Low (~5-8% of cases)
Intensity Development Factor (IDF)	IDF is an extension of the ERU, which adds a land use component to the stormwater fee calculation based on intensity of development	Rare
Equivalent hydraulic area	Lots are charged according to the combined impact of permeable and impermeable areas on the generated runoff.	Rare
Hydrological alternative	Based on the property characteristics: soil type, topography, impermeable area, canopy trees and land use.	Rare

Source: Adapted from Tasca et al (2018) and Campbell (2022)

Equivalent residential unit (ERU)

The Equivalent residential unit (ERU) approach is by far the most common approach adopted in North America. Under the approach all parcels are charged according to a number of ERUs that reflects the impervious surface area (ISA). However, there are multiple variations in how the number of ERUs are determined.

A common simple approach involves charging each residential dwelling a single ERU and charging non-residential and multi-unit parcels a multiple of ERUs based on the ratio of the parcel's ISA to the ISA of the typical residential unit.[69] Greater refinement is achieved by organising residential properties into tiers based on type or area.[70] Increasingly residential parcels are charged based on their individual ISA.[71] Typically non-residential parcels are charged a number of ERUs equal to the ratio of the parcel's impervious area to the ERU. Campbell (2022) notes that a few utilities use ERU systems with a cap.

Residential Equivalent Factor (REF)

The Residential Equivalent Factor (REF) method involves calculating fees based on the amount of runoff, which is determined by the ratio of runoff volume generated by one acre of land to runoff volume generated by one acre of low-density residential land. The charge is calculated as a function of the REF, the base rate, and the net area of the parcel. That is:

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[69] See for example City of Chicopee, Massachusetts https://www.pvpc.org/sites/default/files/files/PVPC-Stormwater%20Utilities.pdf

[70] See for example City of Belle Meade, Tennessee https://citybellemeade.org/faq/stormwater-user-fee-calculation/

[71] An example is in Washington DC Square where impervious area is measured 'using the geographical information system data from DC GIS and Office of the Surveyor'. See https://www.dcwater.com/impervious-area-charge

Stormwater fee = Parcel area x REF x Rate

Different methods are used to calculate the REF. A simple method (known as the Rational Method) involves basing the charges on an impervious factor by property type. For example, a residential unit may have a factor of 0.35 and industrial space a factor of 0.85.[72] An alternative method involves using a computation method developed by the National Resources Conservation Service that accounts for a variety of factors including land cover and hydrologic soil group.

Equivalent Hydraulic Area (EHA)

Parcels are billed on the basis of the stormwater runoff generated by their impervious and pervious areas, charging impervious area a much higher rate than the pervious area. For example

Stormwater Fee = $19.533 per impervious 1000 sq. ft. + $0.00456 per pervious 1000 sq. ft[73]

Intensity of Development Factor (ID)

The intensity of development factor (IDF) method is an extension of the ERU approach, by including an IDF factor that is based on the percentage of each parcel's impervious area relative to its size. That is:

Stormwater Fee = (ERU x ERU rate) + (IDF x IDF rate)

The IDF method recognises that impervious area with less surrounding pervious area into which rainwater can percolate, generates more significant stormwater runoff.

Other

EPCOR a multi-utility service company provides stormwater services in several North American cities. In Edmonton it calculates stormwater charges according to the following formula[74]

Stormwater utility charge = A x **I** x **R** x **Rate**

Where

A: The area of the property in square metres (m^2), and the proportion of the building lot area attributable to each unit for multiple units sharing a single building of property.

I: The measure of the portion of lot being used for its intended development. The development intensity factor of 1.0, except for properties where owners demonstrate that they contribute significantly less stormwater runoff per property area to the City's land drainage system during rainfalls than other similarly-zoned properties.

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[72] See Dritschel (2016, pp. 13–14).

[73] City of Monona, Wisconsin Equivalent Hydraulic Area (EHA) Rate Structure Example https://www.nj.gov/dep/dwq/pdf/eha-monona-wi.pdf Accessed 24 Nov 2022.

[74] Source: https://www.epcor.com/products-services/drainage/rates-terms-and-conditions/Pages/rates.aspx#:~:text=Rate%3A%20The%20monthly%20charge%20of,square%20metres%20(m2).

R: Runoff coefficient—the permeability of the lot's surface (i.e. grass versus concrete), based on land zoning.

Other jurisdictions

Australia

In Australia stormwater charging practices vary by location. In most locations local councils are responsible for drainage services and funding comes from general rates. Notable exceptions are:

- In some areas of Sydney, property owners pay a stormwater drainage services fee to Sydney Water (currently ~NZD$100 per annum).[75] Sydney Water residential customers can apply to be a low-impact property.[76]
- Councils in NSW may charge a fixed 'Stormwater Management Charge' (up to $25 per annum) to fund building, upgrading and maintaining the stormwater system. Local councils may also charge an additional 'environmental' levy that may be used to fund local environmental projects.
- Residents of Greater Melbourne pay a common waterways and drainage annual charge to Melbourne Water (currently AUD $109.68)
- In Perth, Western Australia, Water Corporation charges for drainage based on each property's gross rental value.[77]

England and Wales

In England and Wales, it is common for surface water from properties to drain into the public sewer system. Historically, charges were based on rateable value of the premises and included as part of the waste water service charge.

In 2003, Ofwat (the economic regulator of water utilities in England and Wales) recommended that, for non-household customers, utilities move from charging based on the rateable value of the premises to a charge in relation to site area.[78] However, not all companies have shifted to this approach. In 2015 Ofwat consulted on "How best can site area-based surface water drainage charges be adopted? And what lessons can be learned from how companies have moved to this basis so far?"[79] Ofwat's final report noted that:

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[75] For example, Central Coast Council "Businesses and Non-Residential Properties which have taken steps to reduce the impact of their stormwater drainage discharge can apply to Council for consideration of a discounted Low Impact stormwater drainage charge." https://www.centralcoast.nsw.gov.au/residents/property/pay-rates-and-water-bills/pay-water-bill/water-sewerage-and-stormwater-drainage

[76] https://www.sydneywater.com.au/content/dam/sydneywater/documents/residential-low-impact-stormwater-assessment.pdf

[77] https://www.watercorporation.com.au/Our-water/Wastewater/Sewerage-and-drainage-services

[78] https://www.ofwat.gov.uk/nonhouseholds/surface-water-drainage/site-area-based-charging/

[79] Ofwat (2015) *Final charges scheme rules and summary of responses to our draft charges scheme rules*. November 2015 https://www.ofwat.gov.uk/wp-content/uploads/2015/09/res_stk20151117chargingrulessummary.pdf

> While some respondents agreed with the principle of site area-based charging for surface water drainage, all recognised that there would be implementation challenges. …
>
> Some of the water and sewerage companies that had not adopted site area-based charging for surface water drainage had concerns related to:
>
> - premature implementation of a mandatory scheme, not least due to insufficient evidence that demonstrated the effectiveness of the proposal;
> - potentially significant implementation costs (for questionable benefits); and
> - the scope for targeted assistance to be more effective at mitigating surface water drainage.

Customers (household and non-household) may be able to apply for a 'surface water drainage rebate'. As explained by Ofwat:[80]

> Companies do not know the surface water drainage arrangements of all the individual properties in its area. This means that you usually need to make an application for a rebate.
>
> You should apply to your company providing evidence that none of your surface water enters the public sewer. Your company should explain the kind of evidence that it would need to see. They will check whether you qualify and if you do:
>
> - you will not be charged for surface water drainage on future bills
> - some of the amount you paid previously may be refunded
>
> Sometimes your company does know, or might reasonably be expected to have known, that your property was not connected to its sewerage system for surface water drainage. In this case we would expect it to apply the rebate (and refund any money overpaid) from the date at which it knew (or might reasonably be expected to have known) the property was not connected.

Box 11: An example of stormwater charging in England – Wessex Water

Wessex Water is a private water utility serving around 1.3 million customers across the south west of England, including most of Dorset, Somerset and Wiltshire.

The stormwater services are incorporated into wastewater services.

It charges a flat annual 'Surface water and highway drainage only charge' (£49). It also charges wastewater fees based on rateable value of the property. Of note, a lower 'abated' rate is charged (£1.5142 vs £1.6515) for properties where no part of the property is connected for surface water drainage.

For new connections, the sewerage infrastructure charges depend on how stormwater is treated. The per-dwelling infrastructure charge for development is:

- £251 with no surface water abatement

[80] https://www.ofwat.gov.uk/nonhouseholds/surface-water-drainage/reducing-your-surface-water/

- £126 with the inclusion of an agreed [sustainable drainage scheme] scheme that attenuates the flow of surface water into [their] existing or proposed network
- £25 for schemes that commit to zero surface water discharge into [their] existing or proposed network.

Source: https://www.wessexwater.co.uk/your-account/your-bill/our-charges , https://www.wessexwater.co.uk/services/building-and-developing/charges-and-performance

Germany

Germany is reported to have been successful in using stormwater fees and incentives to drive change.[81] As reported by Trincheria and Yemaneh (2016)

> Germany was one of the first countries to include rainwater and stormwater management measures (especially addressing decentralized solutions) into policies… Their application is incentivized through tax reductions, e.g. rain taxes are collected for the amount of impervious surface cover on a property that generates runoff directed to the local storm sewer. As a result, more rainwater is caught and conserved, less is the runoff added to the storm drains which allows construction of smaller storm sewers at the site and property owners can apply for rain tax reductions by converting their resistant pavement/roof into a porous one.

[81] See also Maunsell (2005).

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