MORPHUM environmental

Memorandum

Date:	18/10/2023
To:	Karen Inglis
From:	Stu Farrant (Morphum)
CC:	Michael Greer
Project Number:	P04004

Subject: Minimum Stormwater Contaminant Treatment Requirement for New Urban Development and Redevelopment – PC1 NRP

Morphum Environmental have been engaged by Greater Wellington Regional Council (GWRC) to support with the drafting of provisions to Plan Change 1 (PC1) of the Natural Resources Plan (NRP). This includes technical works to support the appointed planner (Karen Inglis) and Freshwater scientist (Michael Greer) who have also been engaged to prepare content and supporting technical reports.

The proposed PC1 will require urban development that involves development or redevelopment of impervious surface areas between 1000 m^2 and 3000 m^2 to implement contaminant treatment to mitigate the potential water quality impacts on freshwater receiving environments. Larger (i.e greater than 3000m^2) greenfield/brownfield/roading development redevelopment will also be driven to this treatment requirement through policy direction. We understand that the intent is to require a treatment device(s) that achieve an agreed performance outcome of what is agreed to be a 'minimum treatment device'. This will enable applicants flexibility with what their site specific solution may be but will ensure that an appropriate level of water quality treatment is provided to support long term aspirations for te mana o Te Wai and requirements of the National Policy Statement-Freshwater Management (NPS-FM).

The selection of treatment devices to mitigate urban stormwater need to consider the following;

1. Ability to treat contaminants in both particulate and soluble form.
2. Ability to reliably capture and treat a sufficient volume during rainfall to respond to the highly variable quality of stormwater and the need to treat runoff across a range of small and moderate rainfall events.
3. Ability to reliably capture contaminants and prevent the incidence of remobilisation during large events.
4. Ability to be easily maintained over a realistic lifespan by contractors without specialist equipment.

We understand that the focus of the GWRC PC1 is the treatment of Zinc and Copper to align with the requirements of the NPS-FM but it is important to note that other urban contaminants such as sediments, hydrocarbons, nutrients, microplastics, other metals and other emerging contaminants need to be mitigated to protect freshwater ecosystems. Additionally, biophysical metrics such as temperature, dissolved oxygen, pH and modified hydrology need to be considered where discharge connects to existing or piped waterways.

Typically, it is agreed that to provide robust mitigation, stormwater devices need to capture and treat at least 85% of the mean annual runoff volume. This is achieved through capturing all rainfall events up to the 3 month average return interval (ARI) which is approximated for design purposes as 1/3 of the 2 year ARI event rainfall runoff. This reflects the highly variable nature of urban stormwater and the need to preferentially treat the entire volume of the frequent rainfall events which are known to mobilise accumulated contaminants on urban surfaces. This is the basis of design guidance across New Zealand including the Wellington Water, *Water Sensitive Design for Stormwater: Technical Device Design Guideline (2019)*. The Wellington guidelines were developed based on continuous simulation modelling with 10 years of 5 minute timestep rainfall data for three representative rainfall gauges across the Wellington metropolitan area (did not include gauges from Kapiti or Wairarapa).

This technical approach determines that online devices such as swales and open water ponds do not provide reliable long-term performance and many proprietary devices that capture only coarse sediments or separate floatable oils are not capable of providing the level of protection required for freshwater ecosystems. It is noted that the use of other strategies which capture and divert rainfall to either reuse or evapotranspiration such as Green Roofs and Rainwater Reuse Tanks (where plumbed into constant internal demands) are very effective at managing roof areas and support other important outcomes such as hydrologic controls to mimic more natural catchment hydrology. The use of either of these methods to manage roof areas can therefore readily reduce the 'effective imperviousness' and therefore significantly reduce the requirements for other stormwater treatment devices. Therefore, in the instance that a development includes rainwater collection and internal non potable reuse (i.e. for toilet flushing and cold water laundry) the stormwater device would only need to be sized for non roof impervious areas.

Selection of treatment strategies for developments needs to consider the scale of development and the overall urban design integration. For large scale greenfield developments this will typically result in more complex strategies which may contain multiple devices in series (treatment train) and a mix of large scale consolidated devices (such as constructed wetlands) and small lot scale measures (such as rainwater reuse). For more intensive infill and brownfield development the solutions are often more simplistic with stormwater managed through a smaller number of consolidated devices which are integrated with landscaping.

It is considered that the optimal stormwater treatment device for the smaller scale urban development (and to provide a benchmark for a minimum contaminant treatment performance across other larger scale developments/redevelopment) captured by PC1 which could be easily used as a measure of compliance with the requirements of PC1 is a **bioretention device** (often referred to as a raingarden) which can receive flows from impervious surfaces up to around 2 ha. Bioretention is easily integrated into most sites and is spatially efficient with the ability to be elevated above surrounding surfaces and integrated with other hard landscape elements such as retaining structures and paths. Further bioretention is well suited to be integrated with the upgrade of existing roads given the limited footprint and the ability to be designed around other underground services. The following provides a summary of key metrics;

- Sized with a filter media area of 2% of the contributing impervious catchment.
- Designed with specific filter media layers and event detention (ponding) on surface in accordance with guidelines.
- Can capture and treat in excess of 85% of mean annual stormwater volume for all climate zones across Wellington region.
- Suited to variable micro-climates through selection of locally appropriate plant species.
- Easily designed and constructed to bypass flows in excess of 3 moth ARI events to protect from resuspension of captured contaminants.
- Able to be maintained, remediated and managed over long term.

Based on the design and construction of a bioretention in accordance with local design guidelines it is estimated that removal performance of the following can be achieved (as per WWL Technical design Guidelines);

- Total Zinc 90%
- Total Copper 90%
- Total Suspended Solids 90%
- Total Nitrogen 40%
- Total Phosphorous 60%

Based on the practicalities of constructing functional bioretention device it is suggested that a minimum contributing catchment area of 50 m^2 is required to sustain a minimum 1 m^2 bioretention.

The removal of contaminants (particularly nutrients) is limited by the inability to remove 100 % of contaminants (due to residual background concentrations) as well as the small amount of contaminants in infrequent bypass events. It is considered that any desire to increase contaminant removal through increasing the treatment footprint is not efficient or practical.

With regards to the current proposed wording for PC1 the following wording is recommended for Policy P1.

> Policy P1: Minimise new and reduce existing adverse effects of stormwater discharges from new urban subdivision, development or redevelopment through contaminant treatment devices or systems.
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> The adverse effects of the discharge of **stormwater** from new urban subdivision, development or **redevelopment** ~~where the discharge will enter water~~ shall be minimised by implementing:
>
> (a) On-site or communal stormwater treatment systems or devices that are designed to:
>
> (i) Receive at least 85% of the mean annual stormwater generated from all effective impervious surfaces of the site (approximated as treating up to the 1/3 50% AEP rainfall event); and
>
> (ii) Achieve load reduction factors for copper and zinc equal to or greater than those defined for Bioretention/Raingardens
>
> or
>
> ~~(b) Source control techniques that result in copper and zinc load reductions equal to or greater than what would be achieved through on-site or communal stormwater treatment systems or devices designed in accordance with (a):~~
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> *Note: Stormwater treatment systems and devices and source control techniques can be used in combination to achieve the copper and zinc load reductions required by (a). Copper and Zinc are used as proxies for suite of urban contaminants with stormwater treatment required for all impervious surfaces. Effective impervious refers to surfaces which do not have any other form of stormwater management such as rainwater collection and reuse of green roofs.*

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