URBAN STORMWATER GUIDELINES AND BEST MANAGEMENT PRACTICES FOR PROTECTION OF FISH AND FISH HABITAT

DRAFT DISCUSSION DOCUMENT

Revision 4

Fisheries and Oceans Canada
Pêches et Océans Canada

Overview

This paper provides a description of the best management practices (BMP) that are proposed, as well as implementation criteria to describe the development situations they could potentially be applied to. The BMPs are general descriptions specific to the implementation plan. The last section provides information on the hydrological design criteria best suited for determining impacts of development and implementation of mitigation through application of BMPs and for watershed hydrological studies. The references attached provide many sources for additional detailed examples, design criteria, and construction details.

Rationale

Since 1993, Fisheries and Oceans Canada has been promoting the protection of fish and fish habitat through detention of stormwater flows from urban development areas. Broadly stated, these goals were to limit the 1-in-2 year post-development runoff to rates equal to the pre-development levels and to maintain, as closely as possible, the pre-development hydrology and water quality.

Application, monitoring and research of best management practices, stormwater modelling and planning processes in the past years have increased our fundamental knowledge about impacts to aquatic systems from stormwater and urban development. More focus has been placed on minimizing the effects of impervious area, management of more frequent runoff events and emphasizing on runoff reduction through infiltration. Systems that incorporate physical and biological systems, including soil-water contact, have been shown to have significant capacity to remove contaminants and pollutants from runoff.

In light of this information and other research, the requirements for what is best, practically, to protect fish and fish habitat must be updated. An initial priority will be placed on source control and runoff reduction. This is accomplished by reducing impervious areas and retention of runoff by infiltration or long-term storage. Second, greater volumes of total runoff must be afforded treatment to remove contaminants and pollutants that degrade water and habitat quality. Smaller, frequently occurring runoff events must be routed to areas where combined biological and physical processes work to improve runoff water quality. Third, rates of runoff from events less than 1-in-5 year return periods must be detained at greater levels to reduce hydraulic and hydrological impacts to stream

systems and habitats. Given the state of knowledge, these guidelines and BMPs represent what best protects fish and fish habitat from the impacts of stormwater runoff.

Description of Best Management Practices

Volume Reduction BMP (VR)

Purpose:

Reduce and mitigate the total runoff volume caused by increased urban development and subsequent increasing impervious areas, as well as to maximize the amount of runoff returned to shallow groundwater via recharge.

Guideline:

Volumes from the post-development 6 month/24 hour events from impervious areas are not discharged and are infiltrated to ground. If infiltration to ground has been determined by an engineer not to be possible, the rate-of-discharge from VR BMPs will **be equal to the calculated release rate of the infiltration system.

Suitable BMPs:

Ground infiltration systems, biofiltration swales or burrows, long-term storage in constructed wetlands or ponds or through EIA reduction.

Water Quality BMP (WQ)

Purpose:

Mitigate water quality impacts to fish habitat by collecting and treating “first flush” events of smaller storms and more frequent runoff events from impervious areas.

Guidelines:

Collect and treat the volume of the 24-hour precipitation event equalling 90% of the total rainfall from impervious areas with suitable BMPs. Rate-of-discharge will not be greater than required to provide suitable hydraulic retention time as to maximize the effectiveness of the specific BMP.

Suitable BMPs:

Biofiltration swales or burrows, constructed wetlands, exfiltrating dry detention pond systems.

Detention or Rate Control BMP (RC)

Purpose:

To restrict the post-development peak runoff flow rate to that of the pre-development peak runoff flow rate for selected design return periods.

Guidelines:

Design BMPs so the post-development flows match the volume, shape and peak instantaneous rates of pre-development flows for the 6 month/24 hour, 1-in-2 year/24 hour and 1-in-5 year/24 hour precipitation events.

Suitable BMPs:

Suitable BMPs include extended dry detention ponds, constructed wetlands or wet ponds, storage swales.

Implementation

These are general criteria for development and application of best management practices (BMP):

- BMPs should be based on site and watershed planning processes with appropriate application based on resource values, site suitability, basin size and type of development
- BMPs should be ecosystem-based utilizing both physical and biological processes providing both water quality and quantity benefits
- BMP design is based on existing predevelopment conditions, but should address cumulative development impacts or societal requirements for enhancement or restoration of aquatic conditions within a watershed
- BMPs should not be sited or designed with footprint impacts to existing fish habitat

Unless otherwise determined on a site-specific basis, BMPs should be designed and implemented in the following priority:

1. Volume Reduction (VR)
2. Water Quality (WQ)
3. Runoff Control (RC)

Below is a guide for selection and targeting of BMPs on a watershed or catchment level, acknowledging space and infrastructure limitations in redevelopment scenarios:

Redevelopment Scenario	*BMP Implementation*	*Potential Watershed Coding*
Rural Residential to Urban Residential (0 - 10 units/ha and IA* < 30%)	**VR, WQ, RC**	
Residential Densification to Multifamily (10 - 20 units/ha and IA* < 60%)	**VR, WQ**	
Multifamily to Urban (> 20 units/ha and IA* > 60%)	**VR** or **WQ**	

* - impervious area

Due to the wide range of site-specific conditions encountered prior to implementation of stormwater BMPs, it is important to determine the best BMP investment for the site characteristics, past and future development history. Note that the use of volume reduction or water quality BMPs can be functionally interchangeable, and may be dependent on factors such as location within the watershed, hydrogeology, topography and proximity to large areas of impervious area. Use of site specific or local BMPs may be part of a catchment or sub-watershed plan resulting in layering of BMP types. For example, VR could be implemented at the lot level (e.g., roof top infiltration via swales) requiring specific WQ controls at EIA sources (e.g., biofiltration, pocket wetlands at parking lots, road systems) and RC BMPs at sub-catchment scales (e.g., wet detention/wetlands at neighbourhood level).

Hydrological Design

- Pre-development rates of runoff from developed and undeveloped sites will be modelled using public-domain hydrological analysis programs with continuous simulation (e.g., HSPF or SWMM) or third-party programs based on these models. The model shall be calibrated in saturated and non-saturated conditions using 6 months continuous flow data.
- A minimum of 12 month period of site hydrological data will be required unless acceptable regional data is available (e.g., comparable AES data).
- Single event models are acceptable for preliminary sizing of BMPs, conveyance systems and post-development conditions if representative multiple event scenarios are modelled.

- Without hydrological data or a calibrated continuous simulation model, assumed peak pre-development runoff flows for the 6 month/24 hour precipitation event will be 4.0 l/s per hectare areas in the Lower Mainland.
- Volumes and rate-of-discharge for the BMP criteria must be detailed in both reports, and construction and as-built plans.

References

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