PMP Information Series

Stormwater Regulations for Phosphorus Management

Bow River Phosphorus Management Plan

Stormwater Regulations in Alberta

What	Peak Flow Control	Sediment Control	Quantity Control
When Implemented	**1980's**	**2001**	**Now - Future**
Expressed As	**Release Rate (L/s/ha)**	**Removal Efficiency Target**	**Volume Targets**
Governance	Required by Province. Should match post-development flows to pre-development flows.	**Required by Province:** Remove 85% of total suspended sediment (TSS) >=75 µm (fine sand). **Required by City of Calgary:** Remove 85% of TSS >=50 µm (large silt).	No provincial requirement. Jurisdiction varies. Mandatory or voluntary. See map. May be expressed as an average annual runoff volume target (depth), a zero discharge, or a no net increase in volume from pre-development.
Techniques	Dry ponds, wet ponds, constructed wetlands.	Oil/grit separators, filters, wet ponds and constructed wetlands.	Green roofs, deeper topsoil, enhanced vegetation, rain gardens, permeable pavement, green conveyance, bioretention, rainwater harvesting and reuse.
Impact on Phosphorus	Sediment-bound P: Some settling in wet facilities, but may be re-mobilized under ice or in the presence of chloride. TSS removal efficiency target has little impact on P, since sediment-bound P is associated with finer soil particles (finer silt and clay). Dissolved P: Enhanced vegetation helps pull P into the nutrient cycle. Recent evidence shows ponds may turn sediment-bound P into more bioavailable forms.		Sediment-bound P: Captured on the landscape and filtered in the streetscape/ conveyance system. Dissolved P: Enhanced vegetation and soil help pull P into the nutrient cycle; harvesting and reuse re-direct runoff to irrigation (nutrient cycle), toilet flushing (wastewater treatment), or infiltration.

How can reducing stormwater volume impact phosphorus?

1. The tools used to reduce runoff are typically landscaping practices that return phosphorus to the plant/soil nutrient cycle.
2. Less runoff will not move as swiftly (less velocity), so it has less power to erode and entrain (lift) sediment that may contain phosphorus.
3. Treatment techniques (like bioretention) will work better and last longer when they don't have to process as much runoff.
4. Stable streams are in contact with their riparian areas (treatment zones) and are subject to less bank sloughing and erosion than streams without volume control. (Google 'Urban Stream Syndrome' for more on this topic.)

How are targets used?

A runoff volume target identifies the desired level of performance for proposed practices. Designers use a water-balance modelling approach to identify the pathways and amounts of all water coming into and going out of the area of interest over the long term. They then multiply the volume by the concentration to establish the loading. Examples of water balance tools are the Water Balance Spreadsheet for the City of Calgary and the various SWMM based rainfall-runoff simulation models. In order to improve the accuracy of loading calculations, significant research and monitoring are needed to better understand the performance of the various practices.

Treatment Train Approach to Stormwater

Main Zone of Volume Control

1 Better Planning, maintenance and landscape practices.
For example: conservation areas, parks planning, complete streets, reduced paving widths, tree canopy, grading practices, and street sweeping.

2 Prevent pollution.
For example: bylaws for washing cars, picking up after pets, only rain down the drain, restricting the use of fertilizers and pesticides, and product replacement.

3 Stop runoff on the lot.
For example: green roofs, rainwater harvesting, deeper topsoil, rain gardens, permeable pavement, deeper-rooted turfgrasses, grading hardscape flows into softscapes.

4 Treat runoff in the street.
Clean dirty street runoff by using ditches, swales, bioretention areas, soil cells, soil/grit separators, filters, and chambers/ reservoirs for irrigation.

5 Detain/retain what remains.
By the time runoff reaches our dry ponds, wet ponds, and constructed wetlands, the focus should be on controlling the rate of runoff, retention for irrigation, and final polishing.

Additional information
Bow River Phosphorus Management Plan
http://aep.alberta.ca/

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Status of Runoff Volume Targets in the PMP Study Area

Current
Where mandatory targets currently exist, they have been implemented to protect stream morphology and/or to reduce downstream flooding impacts. Some areas have an annual average runoff volume target. This is the most common way to express volume reduction in the study area. In the case of the Western Headworks Canal Direct Discharge Area in Calgary, volume reduction is expressed as a net zero increase requirement (over time, even if a site undergoes more development, no more runoff can be discharged). In the case of zero discharge because of lack of offsite servicing (the absence of drainage infrastructure to take runoff from the development to the receiving body) the requirement is to match predevelopment rate and volume.

Proposed/ Future
As of January 2017, the Co-operative Stormwater Management Initiative proposes a volume target of 40 mm. While the City of Calgary volume control targets are currently voluntary in the mainstem of the Bow and Elbow watersheds, as well as the Fish Creek watershed, they will become mandatory once the city-wide volume control targets are finalized.

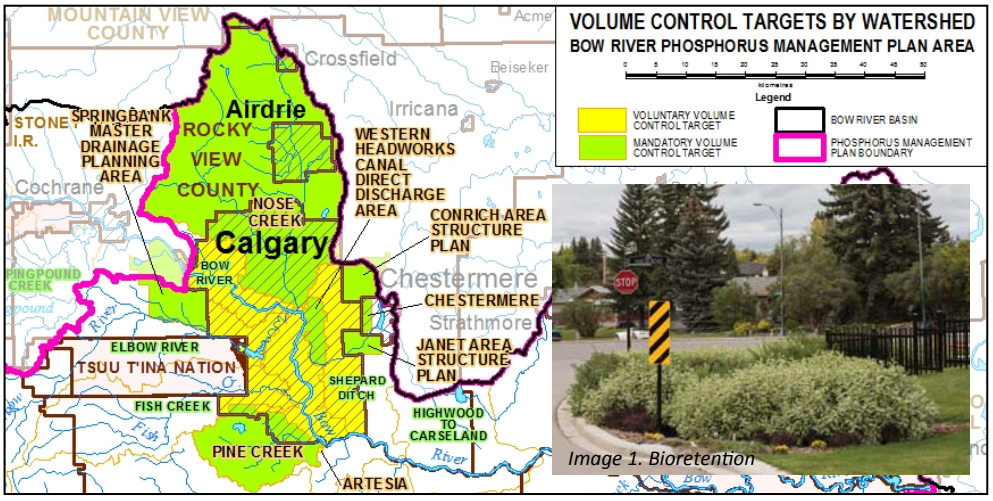

Figure 1. Mandatory and voluntary volume control targets adopted by municipalities within the Bow River PMP Study area.

Emerging Issues, Opportunities & Information Gaps

Information Gaps
- Ephemeral and intermittent streams are most prone to be impacted by lack of volume control. Scientific study is needed to determine the preferred hydrologic regime for these small features (the preferred regime is often equivalent to predevelopment hydrology). Monitoring is needed to validate analytical procedures.
- In order to improve the accuracy of loading calculations, significant research and monitoring are needed to better understand the performance of the various low-impact practices.

Emerging Issues
- Source water protection
- Resilience to climate change
- Some areas currently have zero discharge because of lack of offsite servicing (absence of drainage infrastructure to take runoff from the development to the receiving body). When drainage infrastructure is built, it is possible that current volume control restrictions may be lessened or eliminated.

Needed
- For healthy receiving bodies, matching the flow duration curve is necessary. Volume control is required to achieve this. Political will is necessary to move us forward in this direction.
- Policy to enable stormwater use and reuse to be used as a tool to achieve volume reduction.