



WATER RESOURCES/WATER SERVICES **AMENDMENTS TO THE 2011 STORMWATER MANAGEMENT & DESIGN MANUAL**

Over the last number of years Water Resources/Water Services have increasingly had to deal with the presence of excessive amounts of gravel, sand and sediments in its storm sewer system and storm ponds. Based on the composition of the sewer and pond sediments, a significant source of these excessive deposits appear to originate from construction activities. The efficiency of forebays has been found to be smaller than anticipated due to the presence of stratification within the ponds and the fact that the particle size distribution of sediments tends to include more particles of a smaller size than originally estimated. These smaller particles tend to either wash through the forebays or be remobilized; larger particles on the other hand are found to deposit in the pipes upstream of ponds.

Costs of cleaning out a storm pond and disposing of sediments have run in the order of \$3M to \$5M, depending on the size of the facility. In addition to excessive amounts of sediments in our storm ponds, storm sewer system pipes have been found to be up to half full with sediments, specifically in pipes with standing water such as occur upstream of storm ponds. Besides the costs of clean-up, which ultimately must be passed on to the rate-payer, the presence of these sediments also jeopardizes the operation of the drainage system during storm events.

In order to address these concerns, the following amendments to the 2011 Stormwater Management & Design Manual (Manual) are effective immediately. They apply to any development for which there is not yet a Development Agreement in place:

1. The sediment accumulation in storm ponds contributed by the upstream developing catchment up to full stabilization (i.e., landscaping) of all tributary phases shall be less than 2 tonnes/ha/year as per the 2011 Erosion & Sediment Guidelines, adjusted by the contribution from winter sanding operations for those phases having already received FAC. The proponent shall enter into a Special Development Agreement (or equivalent) to ensure that the City of Calgary holds necessary security to clean out the storm pond if required in the opinion of the Director of Water Services.
2. An off-line oil/grit separator, or similar device(s) with equivalent functionality, shall be installed in lieu of a forebay and skimming weirs/skimming manholes, prior to any pipes with standing water. The off-line oil/grit separator, or similar device(s) with equivalent functionality, shall, on average for each year, remove 85% TSS for particles 150 microns or greater in case the storm pond equals a wet pond as per Section 6.3.2.8.2 of the 2011 Manual, or 85% TSS for particles 75 microns or greater in case the storm pond equals a constructed stormwater wetland as per Section 6.4.2.9.2 of the 2011 Manual.

3. The CCC / FAC of the storm pond as well as the Special Development Agreement, shall include any pipes with standing water.
4. Options to divide the storm pond into smaller cells that can be individually operated and dewatered shall be discussed with Water Resources during the preparation of the Staged Master Drainage Plan. Besides the operational advantages, smaller cells will reduce the potential of remobilization of deposited sediments by wind action compared to the larger facilities built in Calgary over the last few decades. Smaller cells will also provide better opportunity to minimize impacts on existing sensitive wetland areas within the content of a larger stormwater management system.
5. When deemed appropriate by Water Resources, a multi-dimensional numerical analysis of the storm pond to estimate the location and rate of sediment deposition and to optimize flow patterns shall be conducted as part of the Pond Report analysis.
6. Ponds shall not be over-excavated to provide additional sediment storage capacity during the construction phase of a development because of the tendency of these sediments to remobilize. Also, stormwater ponds shall not be used as ESC sedimentation ponds.
7. An as-built survey of the pond shall be conducted as part of the CCC submission, prior to any water being allowed to enter the pond. In addition, an ultrasonic sediment survey (or approved equivalent method) shall be conducted at the time of FAC of the storm pond and at the time of full stabilization (i.e., landscaping) of all phases tributary to the pond. Criteria pertaining to the surveys will be issued by Water Resources in the near future. In the meantime, contact Water Resources for more information on the grid to be used for these surveys.
8. The range in water levels to be covered by the monitoring equipment shall extend from the (Lower) Normal Water Level to the water level corresponding to the design flow rate for the emergency escape route, see also Section 6.1.3 of the 2011 Manual.
9. In case of natural wetlands receiving stormwater runoff, the rate, volume and quality of stormwater entering the natural wetland and the resulting change to the hydroperiod from predevelopment or existing development conditions shall be to the satisfaction of Calgary Parks. Treatment of runoff targeting the removal of fine sediments and nutrients may be required.

The Special Development Agreement (or equivalent) under Amendment #1 may be extended to cover the need for rehabilitative measures or additional compensation to the satisfaction of Calgary Parks in case of stormwater discharges into wetlands subject to compensation.

10. In case of bioretention areas, bioswales and permeable pavement structures, the sediment accumulation contributed by the upstream developing catchment up to full stabilization (i.e., landscaping) of all tributary phases shall be less than 2 tonnes/ha/year as per the 2011 Erosion & Sediment Guidelines, or the amount established in the Stormwater Management Report for those features in question, whichever is lower. If the sediment accumulation is more than these expectations resulting in sub-standard infiltration performance, sediment shall be removed and the infiltration capability restored at the expense of the developer at the time of full stabilization (i.e., completion of landscaping) of all tributary phases. Infiltration testing shall be used to confirm the performance of these LID features at the time of full stabilization of the catchment.

In addition to the above challenges, Water Resources/Services has also experienced problems with storm sewer system pipes subject to extreme velocities. In some cases, this has led to significant damage and complete failure of the pipe system. Water Resources will update the relevant sections in its Stormwater Management & Design Manual to provide more guidance on these design challenges. Until that time, pipe slopes resulting in design velocities greater than 4.5 m/s (i.e., a 50% increase of the upper limit identified in Section 3.3.2.3 (iii) of the 2011 Manual) shall be avoided. Drop manholes shall be provided in order to reduce the design velocities and minimize the chance of hydraulic jumps in the storm sewer system. The drop manholes shall be equipped with appropriate erosion protection such as steel plates at the opposite wall of the manhole and at the bottom of the manhole in the case of the drop exceeding 1 m and flow rates exceeding 0.5 m³/s. The height of each drop shall be limited to 2 m. Special attention shall be paid to appropriate aeration and venting of the storm sewer system.

Last, in response to concerns expressed that the installation of drainage infrastructure on private sites may not conform to the design, as of January 1, 2014, the installation of drainage infrastructure shall be inspected and approved by the design engineer, and as-built prepared. The as-built drawings and sign-off confirmation shall be included with the Operation & Maintenance Manual and sample maintenance log sheets that are already to be provided to the property owner as per Section 4.13 of the 2011 Manual. The property owner shall also enter into an initial 5-year maintenance program with a maintenance service provider.

Water Resources recognizes that there will be a transitional period and therefore will be flexible where possible in the implementation of the above amendments, and is open to constructive alternatives provided that the intent of the

above amendments is met to Water Resources' satisfaction. To this extent, Water Resources will organize a briefing session to illustrate the challenges experienced over the last decade and discuss potential remedies.

The above amendments are in effect as of January 1, 2014, and will be incorporated in the next update of the City of Calgary Stormwater Management & Design Manual. Water Resources will also review its ESC Guidelines to improve the guidance provided.

For questions related to the above, please either contact Maggie Zhang, Leader Development Approvals at (403) 268-2855 or at maggie.zhang@calgary.ca and/or Bert van Duin, Senior Development Engineer at (403) 268-6449 or at bert.vanduin@calgary.ca.