City-UDI Task Group on Criteria for Stormwater Management

Evaluation of Alternative Proposals to the Standard Minimum 5-acre (2.0 Hectare) Lake Design

Presented below are submission requirements for alternate stormwater management proposals based on the five criteria that had been developed through the review process undertaken with the joint City-UDI Task Group. The detail included for each criteria will be utilized to assess in a principled manner whether the alternative submission meets the intent of the broader criteria.

1.0 Meets the City's design requirements for design storms, hydraulics, inflow and outflow capacities, runoff coefficients and consistent with regional land drainage plan.

1.1 General

- The storm water management concept being proposed shall be consistent with the City's regional land drainage plan.

- Storm water management facilities servicing more than one privately held lot may be located on public lands, or on private lands provided appropriate caveats identifying and controlling operation and maintenance are filed against private property titles.

1.2 Design Requirements

The City will consider alternative land drainage facilities based on the following general design requirements and standards. Existing requirements identified in Tables 1 and 2 shall be considered baseline requirements for assistance in developing and evaluating alternative proposals. Any deviations from these design requirements must be identified by the developer in their submission of alternative stormwater management proposals.

Table 1
Recommended Design Requirements for Land Drainage Conveyance Systems

Enclosed Conduit or Piped Systems	Hydraulic capacity equal to or greater than a City of Winnipeg 5 year design storm (See Table A-2 Drainage Safety Guidelines for additional info).
Open Channel Systems	Local Ditches/Channels - 25 year design storm contained within channel. Regional Waterways - 100 year design storm contained within channel or floodway.
Hydraulic Calculations	Use Manning's Formula.
Hydraulic Grade Line (Enclosed Conduits)	Remains below any openings to ground level and includes appropriate allowances for minor hydraulic losses.
Inflow and Outflow	Arrange for disposal of all storm water in, from and through the development, which may be cut off from its natural drainage course.
Flow Restriction	Provide flow restriction to control maximum discharge rates to any sewer or body of water as required by the City drainage plans.
Peak Runoff Rate Calculations	May use Rational Method for Area < 100 Ha Use Hydrograph Method (e.g. SWMM) ≥ 100 Ha

Table 2
Recommended Design Requirements for Land Drainage Retention/Detention Facilities

Flood Level or High Water Level (HWL)	100 year design storm. Check Spring Condition for Tc > 6 hours.
Maximum Design Water Level Rise 25 year	1.2 m Residential. 1.8 m Industrial or Open Space (only if no backwater effect on adjacent storm water facilities).
Freeboard Elevation (from 100 year)	0.6 m.
Drawdown Time	120 hours for 100 year design storm. 48 hours for 5 year design storm.
Minimum Depth	2.5 m.
Side Slopes - (Current SRB Standard)	Varies above freeboard. On Public Lands - 7H:1V (or flatter) from freeboard to 3.0 m (hor.) from NWL. On Private Lands - 5H:1V (or flatter) from freeboard to 3.0 m (hor.) from NWL. 4H:1V from 3.0 m (hor.) from NWL to bottom.
Minimum Width	6 m or greater width at 2.5 m depth. May be reduced at bridge or crossing structures.
Inlets and Outlets	Wherever possible inlets and outlets shall be located a minimum of 0.6 m below NWL.
Minimum Outlet Structure Opening	0.45 m. Install anti-clogging protection such as trash racks or other approved devices to ensure functioning of principle outlet or spillway.
Revetment	Public Shoreline: [50 mm crushed rock on line 3.5m above and 2.0m below NWL. Private Shoreline: 50mm crushed rock or owner's responsibility
Ownership Boundary	Adjacent private landowner owns 2.5 m (hor.) into water.
Minimum Lot Depth Adjacent to Retention System	54.5 m.
Building Setback Limits measured from rear lot line	Min. of 28.4 m to any principle building. Min. of 22.9 m to any detached accessory building. Min. of 15.3 m to any temporary structures.
Public Access	0.4 Ha of land for every 1.6 Ha of impoundment area or 25 % of land reserved for public access.
Maintenance Ramp	3.0 m wide precast concrete pads 5.0 m above and 8.0 m below NWL; turfstone units above ramp
Hydraulic Calculations or Computational Methods	A detailed hydrograph method such as the EPA-SWMM must be used for final design of pipe networks, open channels, and storage facilities that incorporate regional retention/detention facilities.

Required Submittals	- Stage-discharge rating curves for each outlet and/or spillway and for combined outlet and spillway discharges. Include backwater effects.
	- Elevation-Area/Volume curves for each storage facility including notation of the storage volumes allocated for permanent residual water storage and to runoff at the 5-year, 25-year and 100-year re-occurrence intervals.
	- Routing curves for the 5-year, 25-year and 100-year design storms with time plotted as the abscissa and the following plotted as ordinates:
	  - Inflow hydrographs
	  - Outflow or discharge hydrographs
	  - Stage elevation

	- Cumulative inflow volume, discharge and storage
Drawing Submissions	The 100-year flood plain and 100-year flow line or floodway shall be indicated on the engineering plans in addition to the information normally required to build and check the design of the storm water management system.

2.0 Meets Safety Requirements

2.1 General

All retention/detention facilities must meet the City of Winnipeg's Drainage Safety Guidelines. Significant attention will be paid to multi-use or joint-use facilities that have the potential of increasing the general public's exposure to drainage hazards. The retention/detention site may present a hazard depending on site features such as playgrounds, athletic fields, etc.

Note that some of the requirements below have been listed in the previous section under "Design Requirements."

2.2 Side Slopes

Side slopes for retention/detention facilities shall respect safety, stability, ease of maintenance and aesthetics.

2.3 Inlets and Outlets

Inlet and outlet structures that incorporate and/or require safety grates in the design must be checked to ensure that dangerous pinning forces are not developed at any time during the functioning of the facility under the design event(s). This may in some instances preclude the use of the same structure as both an inlet and an outlet.

Whenever and wherever possible, inlet and outlet conduits shall be located a minimum of 0.6 metres below normal water level. Non-submerged outfalls and outfall structures shall be fenced to prevent accidental access to the receiving water course.

2.4 Access

Provisions shall be made within the retention/detention facility to permit access to and use of auxiliary equipment to facilitate emptying, cleaning, maintenance, or for emergency purposes.

2.5 Required Submittals

Submissions shall include supporting calculations and details for any drainage safety control devices included in and/or required for the development.

3.0 Compatibility with adjacent and nearby land uses.

3.1 General

Each site and proposal needs to be reviewed on an individual basis. The context of the proposal(s) is critical. The site, neighborhood and community relationships must be identified and established, and community specific solutions implemented. The solutions should encompass the needs of the entire subdivision and surrounding area not just the local area surrounding the impoundment.

Concepts should be reviewed with the Planning, Property and Development Department before embarking on detailed hydraulic computations required as part of items 1.0 and 2.0

Acceptance and evaluation will need to be on a site by site basis, depending on the context, existing open space, recreation or community potential, drainage times, soil analysis, proposed planting plans, maintenance schedules, etc.

3.2 Landscaping Plan

A landscaping plan will be required for all storm water management retention/detention facilities and ancillary park open space with sufficient information to also enable assessment of impact on hydraulics, capacity, maintenance and safety as provided in Items 1 and 2 above.

The alternative proposal shall include a landscape implementation plan and schedule, and cost sharing proposal.

3.3 Land Credit

Credit toward land dedication will be dependent upon the capability of the site to meet recreational and open space needs in the community and will be negotiated between the City and the proponent on a case-by-case basis.

4.0 Multi-use public amenity where appropriate preferred over single use facility

4.1 General

The City will consider multi-use retention/detention facilities compared to the current single-use facility standard. Following are some possible alternative concepts.

4.2 Multi-Use or Joint-Use Retention/Detention Facilities

Multi-use or joint-use detention/retention facilities that incorporate active and/or passive recreational elements may be considered if inundation is restricted to less frequent events. The following joint-use tiers or elevations versus frequency of inundation may be utilized as a starting point in evaluating various multi-use opportunities:

Table 3
Appropriate Uses for Various Frequencies of Inundation

Maximum Frequency Of Inundation	Tier	Uses
2 year	Lowest Lying areas	Semi-natural riparian (vegetated) areas
5 year	Lower elevated tiers	Picnic areas, passive turf, naturalized zone, ball fields, soccer fields
25 year	Upper elevated tiers	Court games
100 year	Above flood level	Restrooms, parking lots, slab-on-grade structures

The proposed joint-use facility will require input from various departments in the City of Winnipeg who will ultimately be responsible for operating and maintaining these types of facilities.

4.3 Linear Impoundment with Naturalized Fringe Area

Linear style lakes or impoundments may be considered for increased recreational possibilities such as canoeing, snowshoeing or alternative modes of transportation such as cycling and hiking paths. They can also be incorporated into other community amenities such regional greenbelts or parkway systems.

The developer will be required to provide appropriate signage at points around the facility and inform the general public and future homebuyers in the neighborhood that the proposed facility is a naturalized storm water management facility.

Provisions shall be made within the linear impoundment facility for access and use of auxiliary equipment for maintenance and emergency purposes through the provision of access ramps, easements, public rights-of-way, etc.

The design should also incorporate at least a biannual turnover rate in a year with average precipitation.

4.4 Wetlands

Following are guidelines to be considered when proposing the use of wetlands as a retention/detention facility in the City of Winnipeg. Wetland treatment will be subject to review by the City Naturalist and/or City Forester.

- Generally, a constructed wetland is to be about 5% of the total watershed area or drainage area, depending on the volume and quality of runoff. It is recommended that, as a minimum, constructed wetlands should be considered for storm water management only if the drainage area is greater than 20 hectares. Using the 5% rule above, this translates to a minimum constructed wetland size of 1.0 hectares (2.5 acres).

- It is recommended that a 1:1 ratio of shallow water vegetation to deep open water be considered to provide maximum habitat for waterfowl in constructed or natural wetlands intended for storm water management.

- Screening from adjacent land uses may consist of a vegetated (naturalized) buffer. For information, the City of Edmonton uses a minimum width of 8 metres from normal water level. A portion of the buffer perimeter may be reforested or allowed to be reforested by volunteer species.

- Mosquitoes inhabit most wetlands. The highest populations tend to occur in stagnant, organically rich waters. Therefore, wetlands should be designed to preclude stagnant waters wherever possible. Shading the water surface will also help minimize the mosquito problem.

- In general, the extended detention storage depth should be limited to 1.0 metres above the normal water level versus the normal water rise of 1.2 metres to 1.8 metres used in more conventional retention/detention facilities. Plant species normally found in wetland settings cannot withstand frequent water level fluctuations in excess of 1 metre.

- The developer will be required to provide appropriate signage at points around the facility and inform the general public and future homebuyers in the neighbourhood that the proposed facility is a constructed wetland operated for storm water management. It is intended to be a low maintenance, natural facility.

4.5 Offline Dry Basins

Offline or overflow type dry basins that are inundated on a relatively infrequent basis may be acceptable in large areas such as residential areas, railway yards, airports and industrial or commercial sites. These dry basins should be reviewed in a similar context to the joint-use or multi-use facilities recommended for use in recreational areas.

4.6 Ditch Storage

Generally it is not recommended that ditch storage be used for storm water management on public lands due to the inherent difficulty of designing a system that must convey and detain water at the same time. Appropriate consideration to the Drainage Safety Guidelines must be undertaken.

5.0 Lifecycle cost analysis of capital and maintenance costs to be available.

5.1 General

A proponent requesting consideration for an alternative storm water management proposal shall compare the capital cost and the ongoing operation and maintenance cost to the standard City 5-acre lake size and configuration. This cost analysis shall include the following and be submitted for the City's review.

- A life cycle cost (net present value) analysis (e.g. over 20 and 50 years) shall be provided to compare the capital cost and operating and maintenance cost of the proposed land drainage facility to the standard minimum 5-acre system.

- The Capital cost and the cost of operation and maintenance of the facility must be addressed in the proposal and any proposed conditions that would ultimately be included in the development agreement.

5.2 Capital Cost

- The Capital cost of the facility shall be identified separately from the Operation and Maintenance Costs.

- Developer Payback of the Capital cost of the facility will be based on its engineering function as a stormwater retention/detention facility and will be compared to the standard City 5-acre lake design. This clause does not limit or prevent the developer from seeking additional paybacks or credit for other uses of the land beyond a stormwater retention facility.

- Developer Payback shall be in accordance with Clause 7 of the Development Agreement Parameters (July, 1989).

5.2.1 Capital Cost Criteria

The City will review the Capital cost of alternative land drainage facilities compared to the standard 5-acre lake design based on the following items: Note the items listed may not be all-inclusive and the developer is expected to provide additional information as necessary to accurately portray the capital cost of the proposed facility.

Table 4
Capital Cost Items

Capital Cost Item	Unit	Quantity	Price	Amount
Excavation	M^3			
Grading	M^2			
Compaction	M^2			
Revetment	M^2			
Sodding	M^2			
Seeding	M^2			
Inlet Control Structures	Lump sum			
Outlet Control Structures	Lump sum			
Manhole bases	Each			
Manhole risers	Vert. M			
Manhole frames and covers	Each			
Inter-connecting piping	Lin. M.			
Outfall and piping	Lump sum			
Rip Rap	M^3			
Television Inspection	Lin. M.			
Concrete Approach	M^2			
Barrier Curb	Lin. M.			
Turf stone	M^2			
Maintenance Ramp concrete pads	M^2			
Make-up well	Lump sum			
Sod Maintenance - Warranty	M^2			

5.3 Operation and Maintenance

5.3.1 Operation and Maintenance Cost Criteria

The City will review the operation and maintenance costs of alternative land drainage facilities compared to the standard 5-acre lake design based on the following items: Note the items listed may not be all-inclusive and the developer is expected to provide additional information as necessary to accurately portray operation and maintenance costs of the proposed facility. The City can assist in the cost derivation based on budget funds currently allocated for certain activities. Examples of typical 2000 costs for certain items are shown below.

Table 5
Operation and Maintenance Cost Items

Type of Maintenance	Interval	Unit	Quantity	Price	Amount
Lake and Waterway Areas					
Herbicide / Weed Control	Every year	Ha			
Vegetation Maintenance (aquatic/shoreline fringe)	Every 5 years	Ha			
Vegetation Maintenance (upland/flood fringe)	Every 5 years	Ha			
Sediment Removal (front end loader	As required	M^3			
Sediment Removal (vacuum truck)	As required	M^3			
Remove Shoreline Debris	As required	Each			
Remove Floating Debris	As required	Each			
Aquatic Weed Harvesting	As required	Ha		* $1516	
Inlet/Outlet Pipe Maintenance	As required	Each			
Revetment Replacement	As required	M^2			
Open Areas					
Grass Cutting	3 x per year	Ha		* $1100	
Litter Removal	2 x per year	Ha		* $400	
Weed Control	Every year	Ha			
Limestone Paths	As required	M^2			
Recreational Areas					
Sports Field Preparation	Every year	Each		* $1215	
Play Equipment Maintenance	As required	Each		* $900	
Rink Installation & Maintenance	Every year	Each		* $2000	
Wetlands					
Tree plantations	Every year	Ha		* $350	
Shrub plantations	Every year	Ha		* $350	
Woodland and forest areas Occasional trimming / thinning	As required	Ha		* $350	
Edging around naturalized areas	As required	Linear M.			
Boardwalks	As required	Each			
Interpretive Signs	As required	Each			
Benches	As required	Each			

- Estimated 2000 rates

5.3.2 Operation and Maintenance Costs Estimates

If the maintenance costs are forecast to be higher, the following items may be considered in order to mitigate the cost to the City:

- A capital contribution from the developer equivalent to the additional maintenance costs.
- More private ownership and responsibility of shoreline to reduce City maintenance costs.

6.0 Joint UDI-City Advisory Committee

It is proposed that an Advisory Committee comprised of City staff and UDI representatives and/or their consultants be established to review alternative stormwater management proposals that are submitted for consideration. It is envisioned that the Advisory Committee would consist of 6 members, 3 each from the City and UDI. City representatives would be one each from the Water and Waste Department, the Planning, Property and Development Department, and the Public Works Department. Operating protocol for the Advisory Committee would be as follows:

- Participation in the Advisory Committee would be voluntary.
- UDI to submit list of volunteers to participate in the Advisory Committee.
- Alternative proposals would be reviewed by Advisory Committee members that are not proponents in the development under consideration.
- The developer and their consultant would be invited to meet with the Advisory Committee to explain and provide any additional clarification on their alternative proposal.
- Decisions of the Advisory Committee will be reached by consensus. Dissenting comments will be recorded and all advice will be reported back to the City and the proponent.
- Advice provided by the Advisory Committee shall not be binding on the City.
- Feedback of the Advisory Committee will be provided back to the proponent within one month of receipt of the alternative proposal.
- The City will work with proponents to identify additional information required when submissions are considered incomplete.
- The criteria for evaluation of alternatives, membership in the Advisory Committee, and the function and effectiveness of the review process shall be reviewed with the Joint City-UDI Task Group on Criteria for Stormwater Management in about one year but no later than March 1, 2002, or within a mutually agreed upon timeframe.