Partnership for Water Sustainability in British Columbia

Beyond the Guidebook:

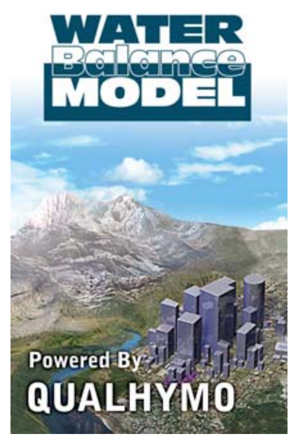
Water Balance Model powered by QUALHYMO

One of the tools developed under the umbrella of the Water Sustainability Action Plan is the **Water Balance Model for British Columbia**.

Developed by an Inter-Governmental Partnership (IGP) as an extension of **Stormwater Planning: A Guidebook for British Columbia**, the Water Balance Model enables users to visualize how to implement green infrastructure solutions that achieve rainwater runoff source control at the site scale.

The Guidebook's premise that **land development and watershed protection can be compatible** represented a radical shift in thinking in 2002. The Guidebook recognized that water volume is something over which local government has control through its infrastructure policies, practices and standards.

Beyond the Guidebook is an initiative that builds on this foundation by advancing a runoff-based approach and tool – the '**Water Balance Model powered by QUALHYMO**' – to help local governments achieve desired urban stream health and environmental protection outcomes at a watershed scale.



Hydrologic Impact Assessment

1. Use continuous simulation to assess the mass balance of rainfall, runoff, infiltration and evaporation.
2. Graphically represent the mass balance analysis.
3. Use the continuous simulation to estimate discharge exceedances. These would be the values of runoff plus groundwater return to the system.
4. Present results of flow exceedance analysis results in tabular or graphical format.
5. Use BMP's to achieve the desired objectives.

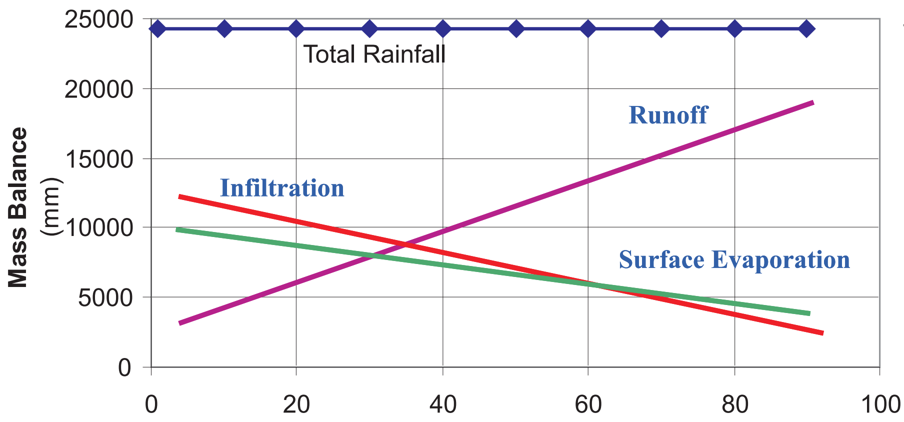
Establish Targets

Two methods can be used to establish targets used for design of LID facilities.

1. Use the volume of runoff from predevelopment or existing watershed conditions, or
2. Use the stream flow duration and exceedance analysis combined with the stream erosion potential to establish discharge rate and volume targets.

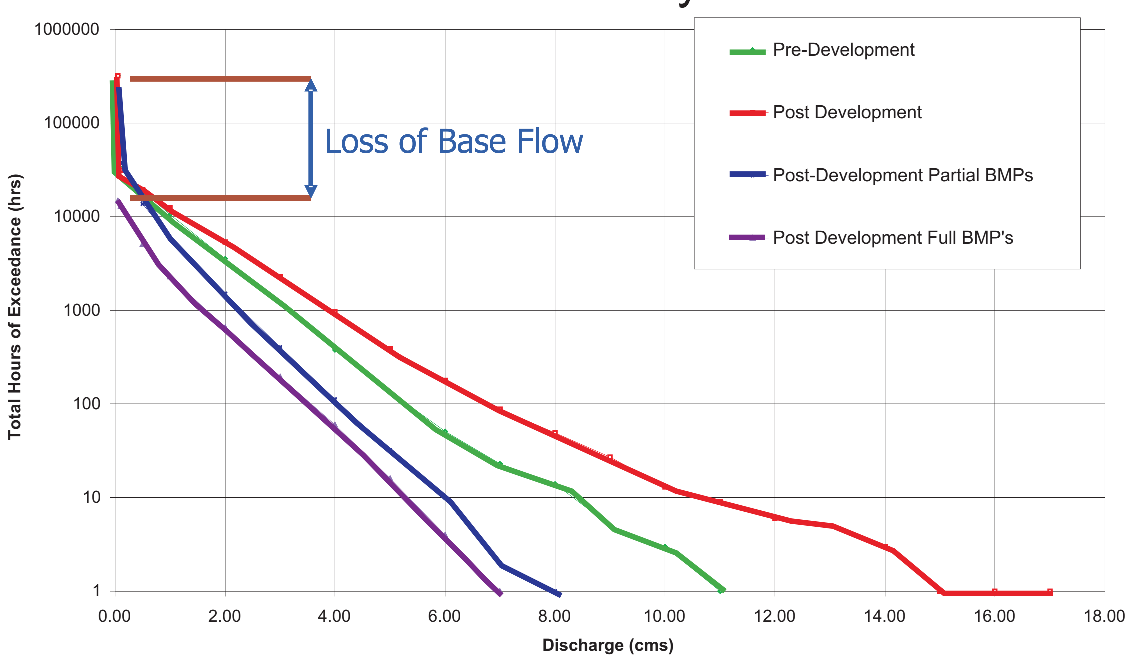
Test and optimize the size and the operation of the LID facilities in the watershed to achieve the desired targets.

Mass Balance Analysis

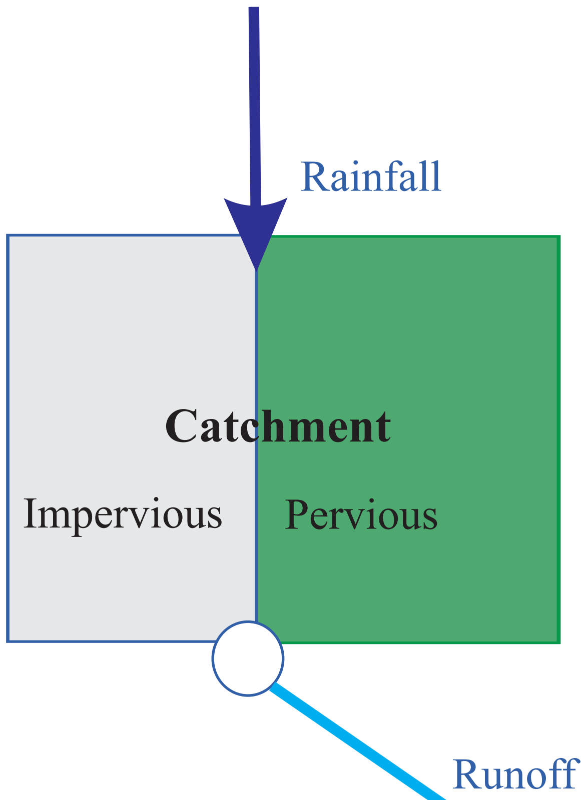


Period of rainfall record
1982 through 1999

Flow Exceedance Analysis



Hydrologic Change Assessment



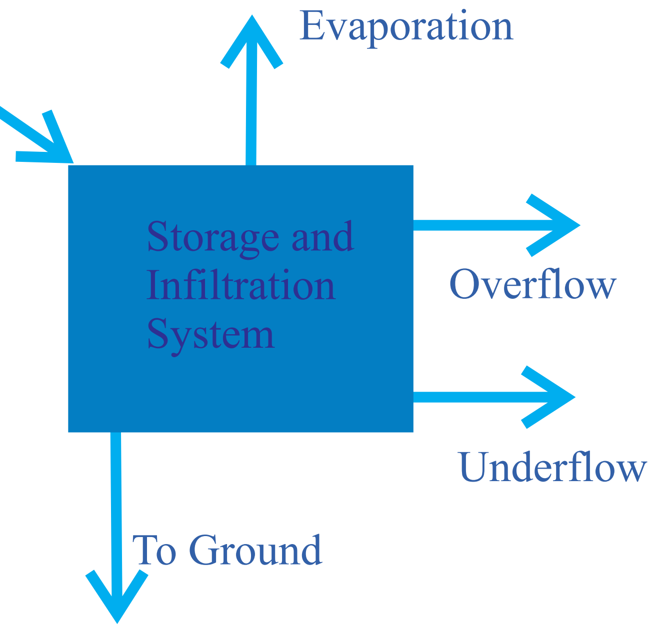
Watershed Discharge

Changing the watershed surface characteristics, or catchment parameters, can provide an assessment of changes in hydrologic function of watersheds resulting from development.

Several volume reduction methods or LID facilities can also be assessed using altered catchment parameters. Low impact development facilities falling into this category consist of augmented or enhanced surface conditions that include:

- increased top soil depth
- soil porosity or moisture holding capacity
- surface infiltration rates
- vegetation and ground cover
- imperviousness
- surface roughness

Similarly, alterations of the surface conditions such as increased imperviousness can also be analyzed.

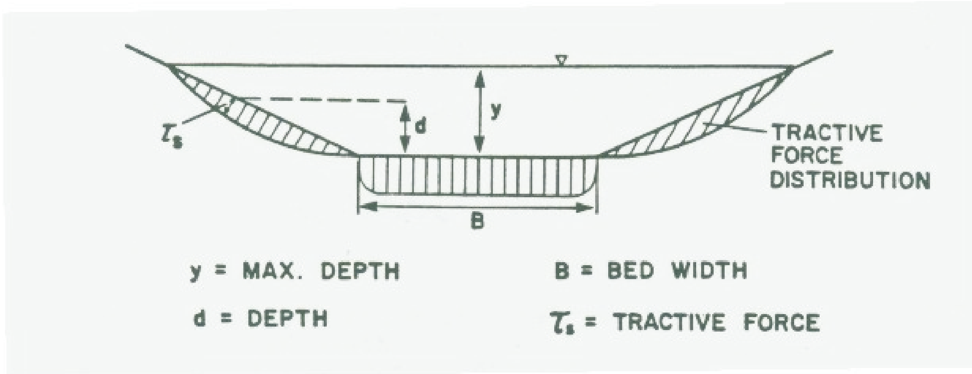


Runoff Management Facilities

Any runoff control or Low Impact Development (LID) facility that provides discharge control or reduces surface runoff volumes must be analyzed following the calculations of catchment hydrology. These systems typically include a storage volume and can include infiltration to ground. The infiltration will be in addition to the surface infiltration calculated for the catchment. LID’s falling into this include:

- infiltration galleries
- rain gardens
- retention ponds
- some forms of green roof
- most bio-filtration swales

The key to this LID analysis includes a reduction of surface runoff after it occurs and some volume of stored water.



Steps in the stream assessment

1. Estimate the Tractive Force applied to the stream bed and banks for a range of discharge values.

2. Estimate the critical tractive force below which erosion will not occur. Use only the tractive forces in excess of the critical in the next steps.

3. Use the continuous simulation to estimate the duration of discharge for a range of occurring stream flows.

4. Estimate the Impulse by applying the discharge and estimating the tractive force applied at the section over the duration of the simulation. The impulse is the sum of the tractive force over time

5. Present results for different watershed conditions or LID alternatives in tabular or graphical format.

Tractive Force

= Rs, where

= unit weight of water

R = hydraulic radius of flow, and

s = slope of channel

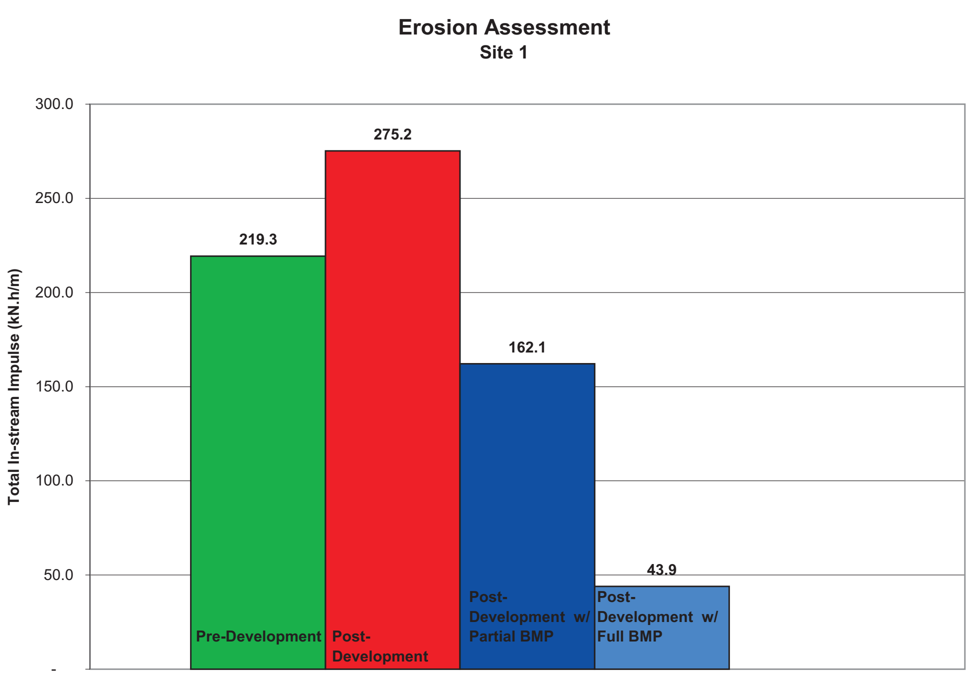
Impulse

I =∑(PT) , where

= Tractive Force

P = wetted perimeter

T = time



Stream Impact Assessment