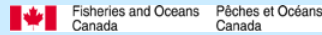


Development of an Improved Design Criteria for Construction Storm Water Management Control Ponds

Edward Graham, M.A.Sc.Eng., P.Eng.

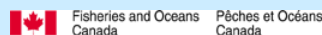
Pradeep Behera, Ph.D. Eng.

Clarifica Inc.



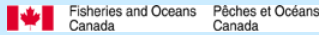
Acknowledgement

- Toronto and Region Conservation Authority
- Department of Fisheries and Oceans
- Ministry of Environment
- Environment Canada
- Great Lakes Sustainability Fund
- Town of Richmond Hill
- Natural Science and Engineering Research Council
- Clarifica Inc.
- Ryerson University



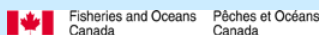
Presentation Outline

- Context
- Current initiatives – Development of an improved design criteria for sediment control ponds
- Approach
- Current Status
- Road Ahead



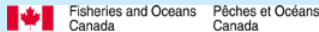
Context

- **Recommendations from Previous Studies** –
 - *“Investigation to Develop an Improved Sizing Approach for Construction Sediment Control Facilities”* and *“Urban Construction Sediment Control Study”*
 - Need to improve the effectiveness of ESC practices to better protect receiving waters has been established.
 - The objective of a new design criteria is to achieve specific receiving water protection targets.
 - Applicable for large construction sites (e.g., ≥ 5 ha).



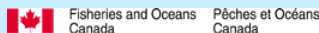
Current Initiative

Monitor and analyze performance of SWM facilities designed for ultimate “stable” conditions and determine modifications necessary to achieve receiving water protection targets.



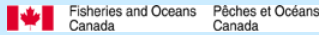
Objectives

- Use the monitoring results to characterize the flow and sediment from a typical urban construction sites over two years and the removal effectiveness within typical SWM facilities (e.g., load/concentration, particle size distribution).
- Develop a detailed, calibrated model to evaluate the SWM facility performance designed for ultimate development conditions.
- Assess potential and optimal design improvements to meet receiving water targets.
- Complete the investigation by March 2005.



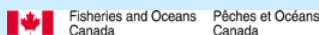
Objectives

- To verify the adequacy of existing MOE Level 1 SWMP sizing criteria for use under construction environment.
- To evaluate temporary storage optimization for the removal of construction sediments.
- To establish a relationship between treatment levels and receiving water protection using mixing-receiving water targets.
- To provide recommendations for construction sediment inspection and removal maintenance intervals.



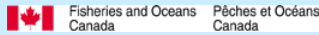
Modelling Approach

- Work closely with field monitoring team to ensure data will be suitable for model development, calibration, verification.
- Develop a continuous simulation model for the Ballymore construction site and sediment control pond using U.S. EPA SWMM model.
- Calibration and verification of the simulation model with monitored data.



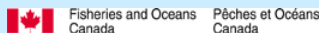
Modelling Approach

- Simulation of runoff and sediment load generation for various construction phases.
- Performance analysis of a sediment control pond during each phase.
- Identification of significant design parameters and ranges (e.g., permanent pool volume, outflow rate).

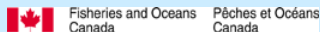
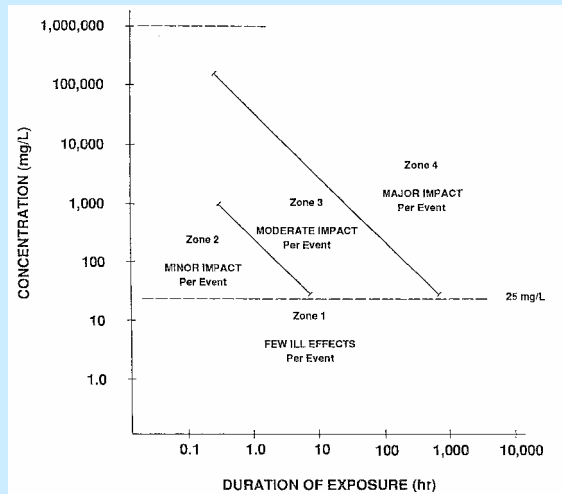


Improved Design Considerations

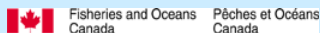
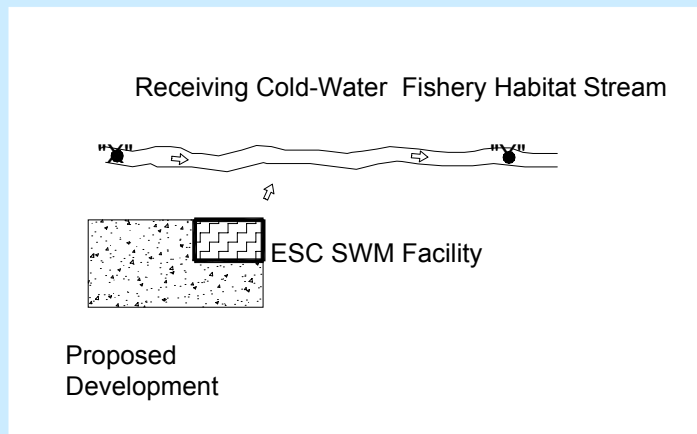
- How can design be improved ?
- Adjust current design criteria for improving construction sediment removal efficiency (e.g., detention time, permanent pool volume, etc.)



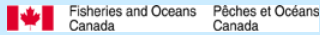
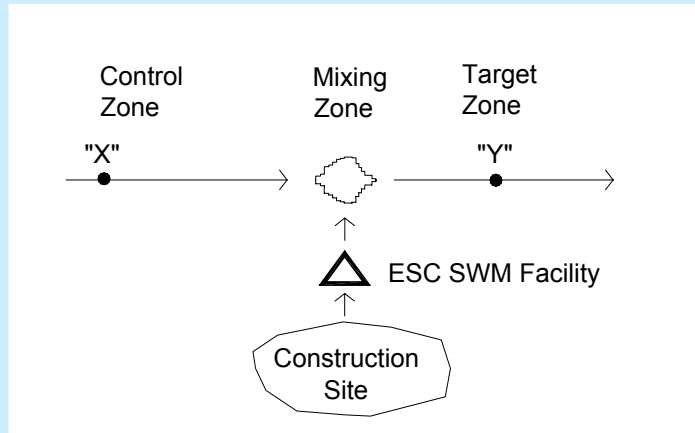
Receiving Water Targets



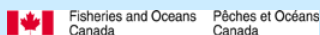
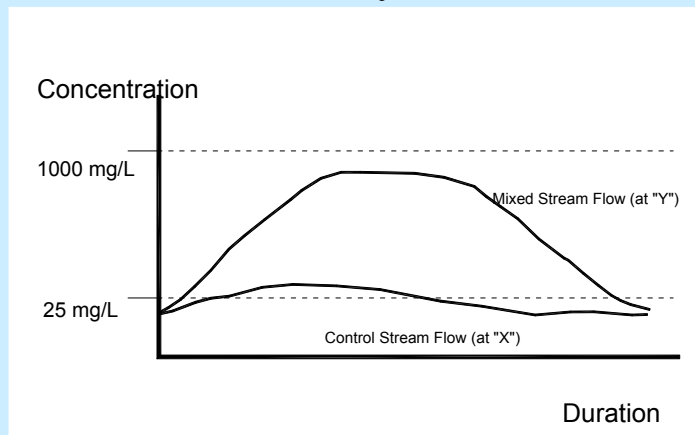
Receiving Water Target Analysis



Receiving Water Target Analysis

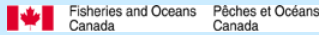


Receiving Water Target Analysis



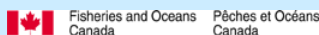
Project Progress

- March 2003
 - Prepared a report on “Preliminary Assessment for Improved Design Criteria for Construction Sediment Control Ponds”.
 - Objectives:
 - Literature review.
 - Particle size distribution of storm water runoff.
 - Development of preliminary analysis methodology.



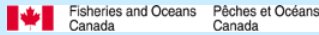
Key Findings

- Evaluation of TSS Particle Size Distribution
 - Most of the particles in storm water runoff from stable sites are fine (less than 100 μm).
- Ballymore Construction Site (few events)
 - 98% of particles are smaller than 42.2 μm
 - TSS concentration range entering to pond from construction site (500-15000 mg/L)
 - TSS concentration range leaving the pond (80-500 mg/L).



Investigations in U.S.

- **Construction Sediment Investigation Study in Maryland, U.S.**
 - Median TSS of 680 mg/L (range 24-58,000 mg/L)
 - 90% particles are finer (< 15 µm)
 - Overall sediment removal performance is around 65%
 - The removal efficiency is low for larger events.
- **Based on the Investigation the Recommendations include:**
 - Storage capacity should be increased from 125 m³/ha to 250 m³/ha
 - Half of the storage should be as permanent pool.



Road Ahead

- Model Development and Calibration.
- Performance analysis of sediment control pond.
- Recommendations for improved design criteria to meet receiving water protection.
- Completion of the investigation by March 2005

