



CATARAQUI REGION
CONSERVATION AUTHORITY

CRCA Guidelines for Hydraulic Design

This document is intended to summarize recommendations of the Cataraqui Region Conservation Authority (CRCA) for the preparation of hydraulic reports prepared by Professional Engineers or Geomorphologists. It should be read in conjunction with Section 5.3 of the Internal Procedures Manual for Regulation 148/06, Development, Interference with Wetlands and Alterations to Shorelines and Watercourses – Cataraqui region. It reflects the current knowledge of the CRCA and will be updated from time to time. These guidelines may or may not satisfy the specific requirements of other agencies.

Hydraulic design is required for watercourse crossings and channel alterations. CRCA staff shall provide data and design criteria parameters wherever possible to the party or organization responsible for the design. CRCA staff members encourage pre-consultation early in the design process in order to minimize redesign efforts.

This guideline outlines:

- The considerations, criteria and data requirements for the preliminary design phase;
- The required output for detailed hydraulic design; and
- The criteria for special design additions for those projects requiring hydraulic design.

1.0 PRELIMINARY DESIGN

The preliminary design must address the following issues:

- Hydrologic or hydraulic impacts
- Scour;
- Fisheries impacts;
- Ice/debris flow impacts;
- Erosion;
- Stream stability concerns;
- Floodplain impacts; and

- Riparian rights concerns.

It is the intent of CRCA regulations and guidelines that projects that may impact stream hydraulics are designed and conducted in such a way as to ensure the following:

- Scour and erosion are not increased;
- Fish passage through the altered area is maintained or improved;
- Fish habitat quality is not degraded;
- Any floodplain alteration is mitigated;
- Flooding is not exacerbated up or downstream of the alteration;
- Filling and alteration are minimized; and
- All riparian rights are considered and addressed.

1.1 Preliminary Design Criteria

Water crossings and channel alterations are the two main project types that require preliminary hydraulic design. If a preliminary design report is submitted, it should include consideration of all the applicable topics noted below.

Possible preliminary design considerations specific to water crossings and channel alterations:

- Scope and nature of works
- Location and alignment;
- Existing and proposed channel characteristics;
- Crossing type selected;
- Layout of abutment relative to stream cross section;
- Overall opening dimensions;
- Number of spans or cells.
- Diversion layout;
- Remedial erosion protection measures; and
- Layout of fish habitat structures.

The following criteria must be either met or identified:

- Fish passage:
 - Migration period;
 - Allowable delay in migrations (i.e. 3 day in 10 year return period event flow);
 - Maximum fish swimming performance for weakest fish species present; and
 - Special provisions for reforestation and substrate material.
- Fish habitat structures
 - Special hydrologic/hydraulic provisions (e.g. the effect of an artificial riffle on flows)
- Design flow frequencies (there may be more than one required);

- Maximum allowable back water elevation;
- Whether pressurized flow through a crossing is allowed; and
- Whether relief flows at or near a crossing are allowed.
 - If relief flow is allowed the following shall be provided:
 - Maximum allowable backwater elevation
 - Design flow frequency
 - Location of relief flow path
- Special provisions associated with stream diversion, if applicable; and
- Special provisions, if any, for bank protection.

1.2 Preliminary Design Data

1.2.1 General data requirements:

- Site plan, profiles and cross sections of project; and
- Surveys of the site, including stream profiles, invert profile, selected stream cross sections for a sufficient distance upstream and downstream of the site.

1.2.2 Specific design data for the reach of stream containing the project:

- Topographic maps and mosaics;
- Interpretation of stream geomorphology, land surfaces and texture;
- Flood plain mapping;
- Stream flow records and flow frequency analysis results or watershed maps,
- Precipitation records and hydrologic modeling results; and
- Fish data related to hydrologic/ hydraulic design.

1.2.3 Specific design data for the water crossing:

- Upstream and down stream crossings;
- Crossing types and arrangement of abutments and piers;
- Location of crossings relative to stream cross sections;

- Dimensions of openings of crossings;
- Control elevations of the crossing (e.g. crown of culvert, soffit of flow chord of bridge);
- Allowable and historical maximum backwater elevations; and
- Any past major past problems with crossings.

2.0 REQUIRED HYDRAULIC DESIGN OUTPUT

All submissions must be stamped by a Professional Engineer or Geomorphologist.

2.1 General Requirements

- Information from the preliminary design report;
- Analysis/design method used;
- Major data and assumptions;
- Flow frequencies and discharges;
- Analysis results; and
- Design notes and agreements reached between various designers of the project.

2.1.1 Specific Output for Water Crossings

- Estimated water surface elevation corresponding to various flow frequencies;
- Scaled plan, profiles and typical cross sections of crossings, abutment and piers;
- Special provisions required for scour protection, if applicable;
- Hydraulic detail of flow transitions, if required;
- Special provisions for river ice and debris flow, if required; and
- Special provisions for shore protection of a lake crossing, if required.

2.1.2 Specific Output for Energy Dissipaters

- Dimensioned plan, profiles and typical cross sections of energy dissipater;
- Elevations of channel invert, floor of stilling basin, and water surface profiles at and after the hydraulic jump for various design flows; and
- Provisions required for scour protection.

2.1.3 Specific Output for Channel Stabilization

- Dimensioned plan, profiles and typical cross section of the work area; and
- Key details of the stabilization work (e.g. type of cover/lining materials).

2.1.4 Specific Output for Fish Habitat Structures

- Hydraulic design details and special provisions required to assure hydraulic feasibility and sustainability of habitat.

