Guidance for Development Activities in Redside Dace Protected Habitat

Ministry of Natural Resources and Forestry
Species at Risk Conservation Policy

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The Redside Dace (*Clinostomus elongatus*) is a small colourful cyprinid (minnow family) that lives in small streams in the southern Great Lakes basin, the upper Mississippi drainage and the upper Susquehanna River drainage. In Canada, the Redside Dace is found only in southern and central Ontario where it most frequently occurs in streams flowing into western Lake Ontario. Based on observed declines and threats to remaining populations the species has been listed as endangered under Ontario's *Endangered Species Act, 2007* (ESA).

Redside Dace populations in Ontario are subject to numerous threats, the most notable being the loss of suitable habitat, which has likely been the major factor contributing to declines. The species is now primarily restricted to the headwaters (i.e., the source and most upstream sections) of many streams where it was once widespread. A large proportion of Redside Dace populations in Ontario are found around the Greater Toronto Area – a region that has been experiencing rapid urban growth over the past 20 years. Urban development has the potential to impact Redside Dace habitat through: 1) increasing the percentage of impervious surfaces, which affects runoff patterns, increases erosion and alters hydrologic regimes and may increase water temperatures; 2) site grading and excavation which may lead to increased sedimentation and erosion of stream banks; and 3) loss of habitat, which may occur through loss of riparian vegetation, in-stream habitat features, wetlands and groundwater sources.

This document is intended to provide guidance to proponents interested in developing lands in and adjacent to protected habitats of Redside Dace. While each development situation is unique and will need to be assessed on a case by case basis, these guidelines are intended to assist by providing a description of Redside Dace habitat, and the protection provided to the species and its habitat under the ESA. Additionally they provide a description of what exemptions may apply to development activities or when a permit is required under the ESA and the project review and permitting process. It also provides guidance as to best management practices (BMPs) for development activities to avoid or mitigate impacts on Redside Dace and their habitat.

This document provides an overview of BMPs that have been based upon current requirements, guidelines and existing development practices in Ontario. These BMPs include the following:

1) **Comprehensive Planning for Subwatersheds**
   Planning at a subwatershed level allows for the evaluation and assessment of potential cumulative effects of urbanization on Redside Dace and its habitat. Incorporation of these subwatershed plans, prior to the Secondary Planning stage will inform the planning process and help ensure that consideration is given for Redside Dace upfront, when there is greater flexibility and more opportunities for avoiding or minimizing impacts.

2) **Stream Crossings**

Development activities should minimize the number of stream crossings and where required, minimize lengths/widths, target straight sections of the stream and areas that have been previously disturbed, minimize activity/footprint within regulated habitat, including spanning the meander belt, adherence to timing windows, incorporation of effective erosion and sediment control measures, and being designed in a manner that provides fish passage.

3) **Construction Activities**

Construction activities may result in the removal of vegetative cover and grading of adjacent lands, which, can lead to increased sediment delivery and erosion to the stream and its banks. Site preparation should be completed in a manner that prevents suspended sediment concentrations from exceeding 25 mg/L of background conditions in occupied reaches. In addition, site preparation and construction should follow an approved Erosion and Sediment Control Plan, including minimizing disturbed areas, stabilizing soils through erosion control blankets and revegetation efforts as soon as possible, and using multiple-barrier approach to sedimentation, effective sediment and erosion ponds and sediment traps, where applicable. In addition, regular on-site monitoring and site inspections are required to ensure mitigation strategies are working effectively and as intended.

4) **Stormwater Management**

Untreated runoff of urban landscapes may impact Redside Dace habitat by altering hydrologic regimes, increasing water temperatures, and conveyance of chemicals and pollutants to watercourses. Stormwater management ponds should target outflows consistent with Redside Dace habitat requirements, including water temperatures less than 24°C, dissolved oxygen levels above 7 mg/L and having total suspended sediment levels less than 25 mg/L above background conditions. Stormwater management should mimic pre-development hydrologic regimes by incorporating a ‘treatment-train’ approach and low-impact development designs.

5) **Installation of Infrastructure**

The placement of infrastructure such as gas pipelines, storm and sanitary sewers, and hydro conduits near streams has the potential to impact Redside Dace habitat. Utilities near streams should be located either over or under streams to avoid potential for impact and should be constructed in conjunction with new or replacement stream crossings. Trenchless techniques such as directional drilling and jack and boring are generally encouraged over open-cut approaches when soil conditions are appropriate.

6) **Stream realignment and relocation**

While stream realignments or relocations are discouraged, in some situations they may be unavoidable. In these situations stream realignments and relocations should be based on an approved subwatershed plan and connect to existing Redside Dace streams. They should also incorporate natural channel design concepts and habitat features consistent with Redside Dace habitat requirements (e.g., overhanging terrestrial vegetation, pool-riffle habitat, water temperatures, and dissolved oxygen), and vegetated corridors consistent with the Redside Dace habitat regulation (i.e., meander belt and 30 m riparian corridor).

1.0 Purpose

The purpose of this document is to provide guidance to persons interested in developing areas in southern Ontario that have Redside Dace (Clinostomus elongatus) habitat. Redside Dace, which is an endangered species, and its habitat are protected under the Endangered Species Act, 2007 (ESA). While each development situation, as described below, will need to be assessed by the proponent using the best available information. In some cases this could include consultation with the local Ministry of Natural Resources and Forestry (MNRF) district office or others with expertise relating to the species or its habitat. The results of the assessment will help to determine if the proposal qualifies for an exemption requiring registration or if a permit is required. These guidelines are intended to assist by providing the following information:

- A description of Redside Dace, where they are located, and the habitat they require.
- An explanation of the protection provided to Redside Dace and their habitat under the ESA.
- Reference to where to access information related to exemptions that may apply to development activities affecting Redside Dace or their habitat and the conditions that must be met to benefit from the exemption.
- A description of when a permit is required under the ESA, and the activity review and permitting process under the ESA.
- Best management practices for development activities to avoid or mitigate impacts on Redside Dace and their habitat.

It should be noted that, given site-specific complexities with any given activity, this document is not intended to be prescriptive as to which activities may qualify for an exemption requiring registration or require a permit. Proponents are encouraged to seek the best available information in making theses assessments and may contact their local MNRF district office to determine if an activity will require review under the ESA.

2.0 Context

2.1 Introduction to the Species and its Habitat

2.1.1 Species Characteristics

The Redside Dace is a small colourful minnow (i.e., a cyprinid), with an average length of 7 cm, reaching a maximum of 12 cm. They are silvery in colour, with red sides and a purple sheen (see photograph on Cover Page). Typically Redside Dace have a life expectancy of 3 to 5 years (MNR 2010a).

Redside Dace have an unusually large mouth for a minnow. They are specialized feeders, their primary food consisting of terrestrial (land-based) insects, especially adult flies, which they capture by leaping out of the water to obtain such prey. On occasion, they may also feed on aquatic insects. Redside Dace spend most of their time in mixed-species schools in pools, at or near a mid-depth position in the water column.

Typically, the Redside Dace is sexually mature at two years, but spawning may not occur until its third year. Spawning occurs in late May/ early June when water temperature reaches 16 to 18°C. This limited temperature range results in a short spawning period, and while females can produce from 400 to over 1500 eggs, survival to the adult stage is limited (MNR 2010a). These factors and other specialized spawning habits as described below, may limit the ability of Redside Dace to rebound from low population levels (MNR 2010a).

2.1.2 Habitat Preferences

In Ontario, Redside Dace generally inhabit slow moving sections of permanent and intermittent streams that are usually less than 10 m in width (i.e., 2nd - 4th order size streams). Redside Dace are most commonly found in stream sections flowing through open meadows with scattered trees and shrubs. These streams are typically partially covered by overhanging vegetation and undercut banks, having submerged branches and logs. The overhanging vegetation is an important component of the species habitat as it provides a source of cover to protect Redside Dace from aerial and terrestrial predators. It also provides habitat for its prey items (i.e., terrestrial insects) and it shades the stream, acting to maintain cool water temperatures, Redside Dace typically occur in streams having gravel and/or sand or other coarse sediment substrates which provide suitable spawning habitat.

Redside Dace require clear water in order to see their prey and are highly sensitive to turbidity (i.e., the cloudiness of the water from suspended particles). Redside Dace are a cool water species, preferring temperatures less than 24°C and dissolved oxygen concentrations of at least 7 mg/L (MNR 2010a). Although Redside Dace can leap up to 30 cm out of the water to catch flying insects, they are not known to jump over small dams or other barriers in streams. Collectively these conditions limit the widespread dispersal of the species.

Redside Dace inhabit different sections of the stream throughout different seasons and periods of their life, including:

- In spring, adults move upstream from overwintering areas to find suitable spawning habitat, which consists of faster flowing "riffles" or gravel bars (deposits of gravel in the stream).
- Non-breeding habitat is most often in the form of pools in headwater streams.
- In late summer, young Redside Dace move upstream from the areas where they hatch residing in shallow pools.
- Redside Dace often rely on groundwater-fed pools for refuge habitat during warm summer months.
- Redside Dace have been observed moving downstream from the habitat they occupy during the summer to overwinter.

Redside Dace commonly use nests of Creek Chub and/or Common Shiner for spawning and synchronize their spawning with that of these two species. The Creek Chub or Common Shiner likely guard the Redside Dace eggs from predation, and keep the nest free of silt (MNR 2010a).

Existing knowledge of Redside Dace habitat is primarily based on studies conducted during the spring, summer and fall, with little work being conducted in the winter.

Headwaters of streams (i.e., source and most upstream sections of a watercourse) are a key source of the habitat described above that Redside Dace require. It has been estimated that 90 percent of the flow of a river originates from the watershed's headwaters. Flows from headwaters, which includes groundwater discharge areas and wetlands, also supply important habitat features to Redside Dace including cool water, food, and coarse sediment for spawning habitat.

2.1.3 Range

In Canada, Redside Dace are only found in southern Ontario and the Two Tree River on St. Joseph Island (see Figure 1). Most populations in southern Ontario occur in tributaries in the Greater Toronto Area (GTA) (i.e., the City of Toronto, and the Regions of the municipalities of Durham, Halton, Peel and York) and the City of Hamilton, flowing into western Lake Ontario from Spencer Creek in the west, to Pringle Creek in the east. Populations are also known to occur in the following areas outside of the GTA:

- The Saugeen River system (Grey and Bruce Counties);
- Gully Creek and an unnamed creek south of Gully Creek (near Bayfield in Huron County);
- Irvine Creek in the Grand River watershed (near Fergus in Wellington County); and
- Humber River system (extends in to Simcoe County).

Ontario currently has fewer than five percent of the global range of Redside Dace. Ontario populations have experienced a continuing decline over the last 50 years. Historically, Redside Dace was found in 24 watersheds in Ontario. In 1987, the species was considered provincially vulnerable and nationally to be of "special concern". In 2000, the species was designated as "threatened" in the province of Ontario based on it being present in approximately 20 locations. In 2009, the species was provincially designated as "endangered" based on its remaining presence in 16 watersheds.

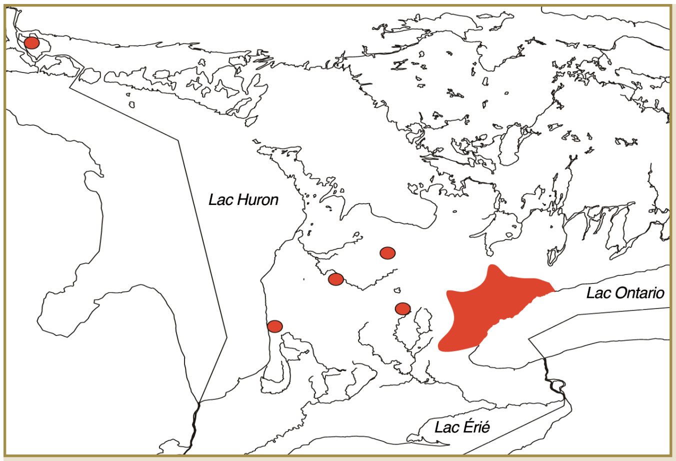


Figure 1. Distribution of Redside Dace (*Clinostomus elongatus*) in Ontario, 2001 (MNR 2010a).

Within these 16 remaining watersheds, Redside Dace populations have been lost from several tributaries flowing into western Lake Ontario, and the length of stream occupied by several populations has been reduced. For example, in the Spencer Creek watershed Redside Dace were found in several locations in a stream stretch of approximately 18 km in the early 1970s. Intensive sampling from 1997 to 2001 at historical sites produced only a single specimen. Reductions in range and abundance have also occurred in other watersheds including the Lynde Creek, Don River, Duffins Creek, Kettleby Creek, Fourteen Mile Creek and Bronte Creek watersheds. Redside Dace currently occupy less than four percent of the total stream length in the GTA.

Given that close to 80 percent of the Redside Dace populations that occur in Ontario are found in the GTA, an area that is subjected to development pressures, this document largely targets urban development activities, although many of the same activities occur in rural areas (e.g., stream crossings, infrastructure, etc.).

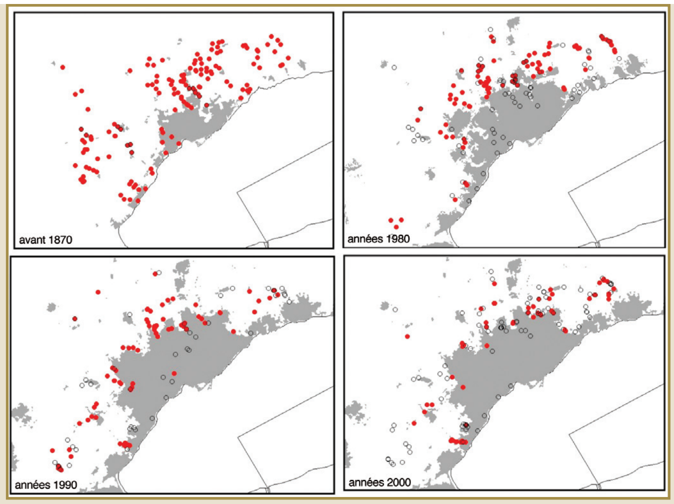


Figure 2. Distribution of Redside Dace in the GTA over time. Degree of urban area at the respective time period (lower left corner of each frame) shown as grey shading. Red circles represent sites where Redside Dace were captured; open circles represent sites of former Redside Dace occurrences, but no Redside Dace were captured in later sampling events. Taken from COSEWIC (2007).

2.1.4 Urban Development – Threats and Opportunities

Threats to Redside Dace

Redside Dace populations in Ontario are subject to numerous threats that vary across its range. While additional research may be beneficial to fully understand the specific causes and effects for Redside Dace, the loss of suitable habitat is likely the major factor contributing to Redside Dace declines in Ontario (MNR 2010a). The species is now primarily restricted to the headwaters of many streams where it was once widespread. Figure 2 depicts the occurrence of Redside Dace over time in the GTA and the level of urbanization from 1970 to 1999.

Development can impact Redside Dace habitat through:

1. Increasing the percentage of imperviousness (i.e., impenetrable) surface of the subwatershed which:
   - Reduces the ability of the ground to absorb rainwater resulting in reduced groundwater discharge to streams, which in turn results in reduced stream baseflows and increased water temperature;
   - Increases the amount of surface runoff during rain storms (i.e., stormwater) causing streams to become wider and more unstable as erosion of the banks occurs and increased sediment enters the streams as result of the erosion of the banks;
   - Increases stream water temperature through the addition of warmed rain water from heated surfaces; and
   - Alters natural flow regimes by changing the frequency of high flow events.

2. Site grading and excavation activities which can result in soil erosion which deposits silt (fine sediment) into streams:
   - Silt enters streams and reduces water clarity thereby affecting the ability of Redside Dace to see their prey; and
   - Excessive silt may result in the loss of habitat by covering up coarse substrate (e.g., gravel) areas required for spawning and filling in pool habitat areas; excessive silt can also suffocate Redside Dace eggs and affects respiration of all life stages.

3. Loss of Habitat:
   - Removal of riparian vegetation impacts the production of terrestrial insects. Riparian vegetation is also an important source of cover in the small streams inhabited by Redside Dace;
   - Straightening or enclosure (i.e., piping) of streams eliminates habitat including pools and riffles;
   - In-stream barriers and weirs affect Redside Dace access to nursery and spawning areas located further upstream; and
   - Loss of natural heritage features like wetlands and groundwater discharge areas affects the flow of water and food to downstream reaches of streams, and increases water temperatures at the site and in downstream reaches.

The above information has largely been summarized from the Recovery Strategy for Redside Dace (*Clinostomus elongatus*) in Ontario (MNR 2010a). For further details and references, please refer to the strategy which can be found on the MNRF's Species at Risk Webpage for Redside Dace.

Opportunities for Economic Benefits from Protection and Recovery Activities

Redside Dace require the same environmental conditions that can support high local property values: clean water from clear and cool streams. This presents an opportunity for developers and consumers to consider the economic returns that may be realized from Redside Dace protection and recovery.

Economic studies from across North America found that people are willing to pay more to live near clear and clean watercourses. A survey of more than 3000 residents within the Grand River watershed in the mid-1990s confirmed that residents are willing to pay an average of 19 percent more on their water bill in order to attain improved water quality (Brox et al. 1996). Similar results have been found within other watersheds, including in the St. Mary's watershed in Baltimore, Maryland where the effects of urban development have been widely studied over time (Poor et al. 2007). In this watershed, water quality is only affected by runoff from developed and paved areas, which have increased since a boom in development in the 1990s. During that time, economic analysis has revealed that even small changes in the environmental health of nearby streams can explain significant differences in property values (Poor et al. 2007). Even if streams are not located within or next to a subdivision, their economic benefits to property values can be measured within the local area.

Economists have also discovered that developers often have misconceptions regarding consumers' preferences for green spaces. Studies have shown that consumers are willing to pay a premium for areas of high environmental health (Bowman and Thompson 2009). A key finding from research on this issue is that local market research should be used rather than discussions with realtors and experiences from model-house showings, since this information usually reveals consumer preferences for the structural characteristics of the house and not the natural environment (Bowman and Thompson 2009).

Actions to support the recovery of Redside Dace have the added benefit of making streams clearer and cooler. Upstream riverbank restoration could reduce the amount of sediment washing into streams, and thereby prevent the sediment from impacting Redside Dace's ability to find food and/or cover spawning habitat. Recovery of Redside Dace could return economic benefits to local property owners in addition to providing them with improved environmental health.

Actions to protect Redside Dace and other species at risk, all contribute to the protection of biodiversity (i.e., the variety of living organisms that occur in an area). Maintaining natural biodiversity, and the interaction among species, is critical in maintaining natural ecosystem functions, many of which provide substantial benefits to society, including:

- Improved air quality;
- Stabilization of climate (e.g., removing carbon from the atmosphere);
- Water purification;
- Pollination; and
- Erosion control.

Ontario's economy benefits from these functions through:

- Reduced costs of water treatment;
- Natural areas help to protect property from erosion and to store carbon to slow the rate of climate change;
- Natural areas also provide places for recreation. Ecological research has revealed that biologically diverse ecosystems typically provide a greater flow of ecosystem services than non-diverse systems (Hooper et al. 2005, Flombaum and Sala 2008); and
- Biodiversity acts as insurance against some of the impacts of climatic change, since biologically diverse ecosystems are more resilient to change.

These benefits are defined as nature's "ecosystem services." Ecosystem services are nature's benefits to humans that are not traded in the marketplace, so they do not have a market price. These benefits have an economic value which can be revealed by various statistical and survey techniques known as ecosystem valuation. Recent research has revealed tens of billions of dollars in value from these ecosystem services across the Southern Ontario landscape (Troy and Bagstad 2009).

The need to retain biodiversity is now recognized as an international priority. The impact of human activity globally, through increased industrialization and urbanization, is causing diversity to be lost at an accelerated rate. The United Nations General Assembly named 2010 as the International Year of Biodiversity to increase awareness of the importance of biodiversity and increase actions aimed at reducing the loss of biodiversity. Ontario has undertaken several actions, including passing the ESA, to protect its biodiversity.

2.2 Redside Dace and the *Endangered Species Act*

In Ontario, species that may be at risk are reviewed by a team of experts known as the Committee on the Status of Species at Risk in Ontario (COSSARO). COSSARO is made up of people with expertise in certain scientific disciplines or Aboriginal Traditional Knowledge and are appointed by the Lieutenant Governor in Council. Once classified by COSSARO as "at risk", a species is added to the Species at Risk in Ontario (SARO) List.

The Redside Dace was originally listed by COSSARO as a threatened species in 2000. Following re-assessment by COSSARO, the status of Redside Dace was changed from threatened to endangered on February 18, 2009 under the ESA. A species is classified as "endangered" if it lives in the wild in Ontario but is facing imminent extinction or extirpation. The Redside Dace was classified as endangered based on significant declines in most of the 24 Ontario watersheds where it was historically known to occur along with the ongoing threats to the species.

2.2.1 Species Protection – Section 9 of the ESA

Endangered, threatened and extirpated species on the SARO List are automatically afforded protection under the ESA. Section 9 of the ESA prohibits harmful actions such as killing, harming, harassment, possession, buying, and selling of any of these species. As an endangered species, Section 9 of the ESA applies to Redside Dace.

2.2.2 Habitat Protection – Section 10 of the ESA

Section 10 of the ESA prohibits the damage or destruction of the habitat of all endangered and threatened species including Redside Dace. Under the ESA, "habitat" is defined as either:

- General Habitat (based on the general definition in clause 2(1)(b) of the Act) – "an area on which a species depends directly or indirectly to carry on its life processes including life processes such as reproduction, rearing, hibernation, migration or feeding" or

- Regulated Habitat (as defined in clause 2(1)(a) of the ESA) – the area prescribed for a specific species in a habitat regulation.

Only one definition will apply to a species at any given time. Therefore the habitat that is protected for any given species will either be the habitat based on the general definition in the ESA or the habitat specifically prescribed for that species in a regulation.

General Habitat

General habitat protection provides immediate habitat protection to a species added to the SARO List as threatened or endangered. This can help allow for the continued persistence of the species until a more precise evaluation of the habitat needs of the species is completed and identified in a species-specific habitat regulation. Once a habitat regulation is in place, the habitat for that species is as described in that regulation.

Habitat protection based on the general definition described above applies to species listed as threatened or endangered and added to the SARO List after June 30, 2008, and to the species that were protected under the previous legislation (which are identified in Schedule 1 of the ESA). From the time it was added to the SARO List as endangered in 2009, Redside Dace has received general habitat protection. The general definition of habitat applied until the Redside Dace habitat regulation came into force.

Regulated Habitat

A habitat regulation prescribes an area as the habitat of the species. This can be done in several ways: by describing boundaries, features of an area, or describing the area in any other manner [S.55 (3)(a)]. The regulated area may be smaller or larger than the area described as general habitat [S.55(3)(c)]. The goal of species-specific habitat regulations is to protect habitat and help ensure the survival and recovery of endangered and threatened species.

The ESA requires that proposals for species-specific habitat regulations for newly listed species be published within two years of listing on the SARO List for endangered species, and within three years of listing for threatened species. In keeping with these legislative requirements, MNRF developed a Habitat Regulation for Redside Dace, which was finalized in July 2011. The Redside Dace Habitat Regulation can be found in Appendix B.

2.2.3 Recovery Strategy and Government Response Statement for Redside Dace

In February 2010, the recovery strategy for Redside Dace was finalized. Under the ESA, a recovery strategy provides advice to government on what is required to achieve recovery of a species. The recovery strategy outlines the habitat needs and the threats to the survival and recovery of the species. It provides recommendations on the objectives for protection and recovery, the approaches to achieve those objectives, and the area that should be considered in the development of a habitat regulation.

Within nine months of approving a recovery strategy, the Act requires the Minister to publish a statement summarizing the government's actions and priorities in response to the recovery strategy. The Redside Dace Ontario government response statement was published in November 2010.

The recovery strategy and the government response statement are available on the MNRF's Species at Risk Webpage for Redside Dace.

The recovery strategy, government response statement and species and habitat protection are all part of the government's approach to providing for protection and recovery of Redside Dace.

2.3 Other Approvals Required for Development Activities in Redside Dace Habitat

While these guidelines are specific to the requirements under the ESA, there are other approvals related to development work conducted in Redside Dace habitat that may be required. In Ontario, federal, provincial, and municipal permits and approvals may be required for activities in and around water. These include, but are not limited to the following:

Federal:

- *Fisheries Act* (e.g., prohibits serious harm to fish)
- *Navigation Protection Act*
- *Species at Risk Act (SARA)* (e.g., fish and migratory birds listed under this Act throughout Canada, and other species at risk listed under this Act on federal lands) Note: Redside Dace is currently listed as Special Concern on Schedule 3 of SARA. As a species of Special Concern it is not afforded legal protection under SARA. In April 2007, COSEWIC assessed Redside Dace as Endangered, and it is currently being considered for listing under SARA.
- *Canadian Environmental Assessment Act* (e.g., federal Environmental Assessment process applies whenever a federal authority has decision making authority on an activity)
- *National Energy Board Act*

Provincial:

- *Lakes and Rivers Improvement Act* (e.g., dams)
- *Public Lands Act*
- *Crown Forest Sustainability Act*
- *Conservation Authorities Act* (e.g., flood and erosion control, water course alteration)
- *Fish and Wildlife Conservation Act* (e.g., research permits)
- *Ontario Water Resources Act* (e.g., stormwater management)
- *Ontario Environmental Assessment Act* (e.g., process required for infrastructure activities by the public sector and certain regulated private sector organizations)
- *Pesticides Act*
- *Aggregate Resources Act*
- *Environmental Protection Act*
- *Drainage Act*
- *Safe Drinking Water Act*
- *Nutrient Management Act*
- *Planning Act* (e.g., provincial policy restrictions on development in significant habitat of endangered and threatened species and fish habitat)
- Planning legislation/regulations specific to certain geographic areas (e.g., *Oak Ridges Moraine Act, Greenbelt Act, the Niagara Escarpment Planning and Development Act*)

- *Green Energy Act*
- *Provincial Parks and Conservation Reserves Act*

Municipal:
- Bylaws related to development (e.g., topsoil preservation bylaws)

A committee comprised of Fisheries and Oceans Canada (DFO) and MNRF staff has been created to develop a protocol to provide guidance on a coordinated approach to the review and approval, under the *Fisheries Act*, SARA and the provincial ESA, for projects that are located in or near water.

The objectives of the protocol are to:
- Ensure that SARA and the ESA are implemented in a coordinated and efficient manner in Ontario with respect to aquatic species;
- Ensure that processes are in place to minimize duplication and address any inconsistencies between the two Acts with respect to aquatic species, within the limits of legislation, to the extent possible; and
- Clarify the roles and responsibilities of DFO and MNRF staff for the review of project proposals related to aquatic SAR.

It is the responsibility of the proponent planning any activities in Redside Dace habitat to obtain all necessary approvals and permissions (both under the ESA and/or any other applicable legislation) prior to the undertaking. Section 3.0 below provides a description of the activity review and permitting process under the ESA.

For more information on Ontario's provincial legislation, please see the E-laws website. For more information on Canada's federal legislation, please see the Department of Justice Canada's website.

Further information on the permitting and approval under the Fisheries Act and Species at Risk can be found on the Fisheries and Oceans Canada website on the Fisheries Protection Program webpage and the Species at Risk Act Permits webpage.

3.0 Understanding The Activity Review, Registration, and Permitting Process

Proponents are encouraged to consider Redside Dace early when planning and designing their activity so that species and habitat protection measures can be planned at the outset and to avoid unanticipated delays. Redside Dace within Ontario are predominantly found in the GTA within MNRF's Aurora district. For MNRF district contact information please see the References Section.

Broad scale Redside Dace location information is available through the Natural Heritage Information Centre (NHIC) and within recent Fisheries Management Plans. Additional information about how to access natural heritage data can be found on our website. More detailed information regarding the species' range throughout a watershed is available through local district offices. In an effort to assist proponents with identifying where Redside Dace occur on the landscape, MNRF has mapped Redside Dace occupied and recovery reaches which is available to partner agencies and municipalities.

If an assessment of the activity has identified adverse impacts to the species or its habitat the proposal should be modified in a way to avoid the impacts. If the activity cannot be modified in a manner to fully avoid impacts two options may exist. The first would be to determine if the activity may be eligible for registration with MNRF, and that the proponent can meet all associated regulatory requirements. Additional information related to eligibility requirements for exemptions requiring registration with MNRF may be found on the government of Ontario website.

The second option would be to seek a permit under the ESA. Generally, each proposal will be assessed by MNRF on a case-by-case basis with consideration for the broader subwatershed context as described in Section 4.0 Best Management Practices. Where a proposed activity will result in a contravention of subsection 9(1) or 10(1) of the ESA, the proponent of the activity will require an authorization prior to proceeding with the activity to avoid the commission of an offence under the Act. Information on how to register an activity, get a permit or other authorization to conduct an activity that could impact an endangered or threatened plant or animal or its habitat can be found on the government of Ontario website.

It is important to note that a permit or registration may be required for an activity occurring outside of Redside Dace habitat where the activity will adversely affect Redside Dace or its protected habitat (e.g. construction, repair or redirection of storm water drains outside of Redside Dace habitat resulting in stormwater effluent flowing into protected habitat). The Minister may issue a permit, provided that the appropriate legislated requirements are met (Note: those for an overall benefit permit are outlined in detail in section 3.1 below). There are four different types of permits that can be sought under Section 17 of the ESA.

The permit type varies depending on the purpose of the activity:

ESA Permit Type	Title	Description
Clause 17(2)(a)	Human Health or Safety Permit	For activities necessary for the protection of human health or safety (e.g., repairing a failing pedestrian bridge that is at risk of collapsing, therefore posing a risk to human health and safety)
Clause 17(2)(b)	Protection or Recovery Permit	For activities where the main purpose is to help protect or recover the species (e.g., undertaking a stream restoration and enhancement activity designed to improve overall riparian and aquatic habitat conditions within a portion of an occupied reach)
Clause 17(2)(c)	**Overall Benefit Permit**	**For activities where the main purpose is not protection or recovery of the species. The Minister must be of the opinion that through conditions outlined in the permit, an overall benefit for the species will be achieved within a reasonable time (e.g., road widening activities that have the potential to adversely effect Redside Dace habitat)**
Clause 17(2)(d)	Significant Social or Economic Benefit to Ontario Permit	For activities where the main purpose is not protection or recovery of the species, but significant social or economic benefit to Ontario will be provided (i.e., for limited circumstances and requires Cabinet approval)

Proponents are responsible for obtaining the appropriate permits or ensuring that they can meet the regulated requirements of exemptions prior to beginning a proposed activity.

The following section focuses on the activity[1] review and permitting process for overall benefit permits because these are typically the most appropriate ESA authorizations for development activities. The activity review and permitting process is described in detail in Endangered Species Act Submission Standards for Activity Review and 17(2)(c) Overall Benefit Permits, and summarized in Figure 3. Examples of development activities that may require an overall benefit permit under the clause 17(2)(c) of the ESA for Redside Dace include (but are not limited to):

1. In the context of this document, activity is defined broadly to include all components associated with all stages of the activity including, but not limited to, site access and investigation, site preparation and construction, operation and maintenance, closure, decommissioning and completion, and rehabilitation and restoration stages.

- Site preparation (e.g., removing vegetation and/or topsoil, grading land, constructing and/or maintaining utilities, roads and septic systems);
- Stormwater management;
- Removing or altering groundwater;
- Activities relating to the construction and maintenance of water crossings (bridges, culverts), stream diversions and ponds;
- Relocation of streams; and
- Road widening.

Please refer to Appendix C for examples of Case Studies that demonstrate how an activity can be modified to avoid adverse impacts to Redside Dace.

3.1 The Activity Review and Permitting Process

The activity review and permitting approval process involves six phases (Figure 3).

Legal Requirements for an Overall Benefit Permit

An overall benefit permit may be issued where the following legal requirements are satisfied:

17(2)(c) the Minister is of the opinion that the main purpose of the activity authorized by the permit is not to assist in the protection or recovery of the species specified in the permit, but,

a. the Minister is of the opinion that an overall benefit to the species will be achieved within a reasonable time through requirements imposed by conditions of the permit,

b. the Minister is of the opinion that reasonable alternatives have been considered, including alternatives that would not adversely affect the species, and the best alternative has been adopted, and

c. the Minister is of the opinion that reasonable steps to minimize adverse effects on individual members of the species are required by conditions of the permit.

In addition, before an overall benefit permit may be issued, subsection 17(3) of the ESA requires the Minister to consider any government response statement that has been published under subsection 11(8) of the Act with respect to Redside Dace.

Actions deemed to provide an overall benefit to Redside Dace will typically be tangible (e.g., an appropriate length of the inhabited stream channel restored), outcome-oriented (i.e., focused on achieving a specific, predetermined goal), and linked to protection and recovery of the species (including addressing key threats).

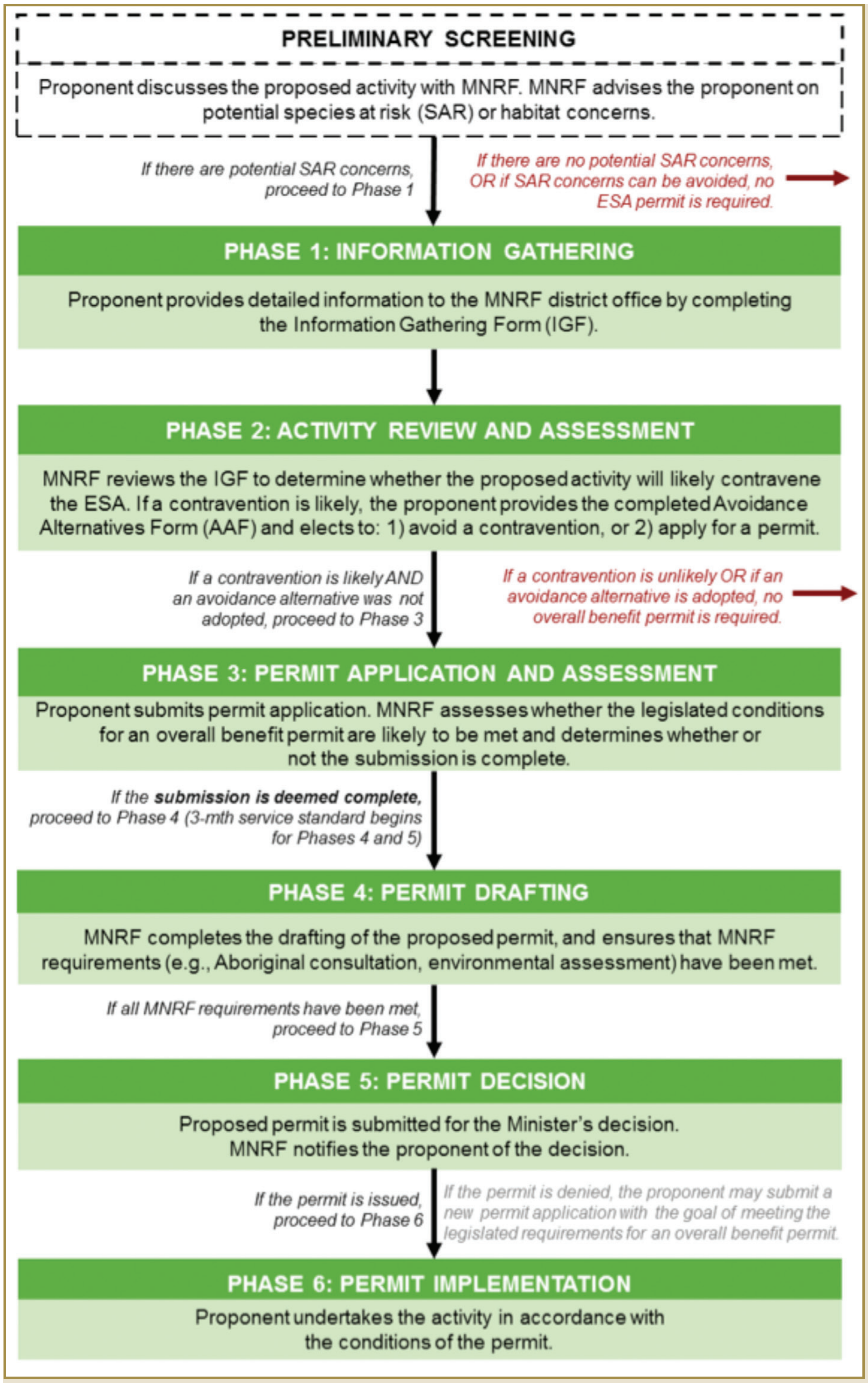


Figure 3. Overall benefit permit flowchart outlining the six phased process for activity review and assessment, and overall benefit permitting under the ESA.

Please refer to the *Endangered Species Act Submission Standards for Activity Review and 17(2)(c) Overall Benefit Permits*, which provides a detailed overview of the permitting process for overall benefit permits and includes a policy explanation and guiding principles for overall benefit.

In summary, to support an assessment of the eligibility of the proposed activity for an overall benefit permit, the specific information provided by the proponent must:

1. Demonstrate how reasonable alternatives have been considered, including alternatives that would not adversely affect the species, and provide the proponent's rationale as to why the alternative adopted is the best alternative[2];
2. Describe reasonable steps that will be taken to minimize adverse effects on individual members of the protected species. Mitigation measures may include, but are not restricted to, modifications to activity design, timing, and location of works; and
3. Describe the actions that will be taken to achieve an overall benefit within a reasonable time for each protected species for which a permit is being sought, and how the outcomes of these actions will contribute to the protection and/or recovery of the species.

Examples of **avoidance alternatives** for activities in Redside Dace habitat may include:

- Conducting activities at a different time of year (e.g., installing culverts in areas upstream of occupied reaches when these creeks are dry);
- Avoiding specific areas (e.g., moving upstream from occupied reaches to install a bridge); and
- Using different techniques such as directional drilling to install new infrastructure (e.g. pipelines, see Section 4.2.4 Best Management Practices: Installation of New Infrastructure).

Examples of actions that may be modified to **minimize adverse effects** include:

- Changes to the location of the proposed activity (e.g., move the location of a bridge so that it is outside of the occupied reach of Redside Dace); and
- Changes to activity design (e.g., phasing grading of sites which assist in ensuring that sediment and erosion control is in place during construction. For further information on this and other Best Management Practices see Section 4.0 Best Management Practices below).

2. An alternative may be viewed as the best alternative because it contains the best means of minimizing adverse effects on protected species or habitat but can also consider technical, social or economic perspectives. The best alternative may be different from the alternative that is considered best for the species or habitat. The Minister will refer to the rationale provided in forming an opinion as to whether the best alternative has been selected, as required under 17(2)(c)(ii).

Examples of potential **overall benefit actions** for Redside Dace may include:

- Retrofitting of existing storm ponds and/or effluents to improve water quality;
- Improving and securing habitat within the reach/subwatershed;
- Decommissioning artificial ponds connected to occupied streams to improve fish passage and/or water quality (e.g., temperature);
- Removing artificial barriers from streams to improve up/downstream fish movement; or
- Planting riparian vegetation to reduce bank erosion and create shaded stream conditions and insect habitat.

Please refer to Appendix C for examples of case studies that demonstrate the permitting process for an overall benefit permit related to Redside Dace.

4.0 Best Management Practices

The following Best Management Practices (BMPs) have been developed to provide guidance to development activities and have been based upon current requirements, guidelines and existing development practices in Ontario. For each BMP, links to current guidelines or other key reference documents are provided.

This section provides best management practices for six development-related activities. The first relates to planning development activities (i.e., subwatershed planning), whereas the other five focus on more development-based activities, including stream crossings, construction activities, stormwater management, installation of infrastructure, and stream realignments.

This list of BMPs is not intended to be an exhaustive list, but rather to cover the major construction activities that most commonly have an impact on Redside Dace and their habitat. Development of urban areas will typically involve all of these activities, while development in rural areas will typically only involve select suite of activities (e.g., stream crossings and installation of infrastructure). These BMPs have been developed to target the habitat conditions that Redside Dace require (as described in the Section 2.0) including water temperature and water clarity. The degree to which habitat conditions can be maintained will determine the relative impact on Redside Dace and their habitat. The BMPs listed for each activity are intended to act as suggested methods or techniques that can be implemented to protect habitat conditions for Redside Dace.

Following the five development-based BMPs, is intended to improve outcomes for Redside Dace while enabling development proponents to better understand how to minimize impacts to the species and be better informed of exemptions and approvals that may apply to their work. If there are other methods or activities other than those proposed within this document, proponents are encouraged to discuss them with their local MNRF district office early on in the process. In some cases, adherence to the suggested BMPs will avoid impacts to the species or its habitat, whereas, in other situations, the BMPs will further assist in mitigating adverse effects to the species.

As described in the Activity Review, Registration and Permitting Process (Section 3.0), proponents are encouraged to seek the best available information in order to determine whether or not their actives will cause adverse effects to the species or its habitat. This could include consultation with MNRF staff or others with knowledge of the species and its habitat. If its determined that the proposal cannot be modified to eliminate adverse effects eligibility for exemptions requiring registration should be assessed or a permit may be applied for.

4.1 Comprehensive Planning for Subwatersheds

As described above, Redside Dace inhabit and move through subwatersheds of larger river systems. Through planning at a subwatershed level, the entire area that Redside Dace inhabit can be fully evaluated and assessed for potential cumulative effects of development across a broad landscape. Utilizing these subwatershed plans to inform the planning process will help ensure that consideration is given for Redside Dace upfront, when there is greater flexibility and more opportunities for avoiding or minimizing adverse effects (e.g., moving or redesigning activities and ensuring that activity timing conforms with the recommended construction timing window). Examining the impact of multiple potential activities on this comprehensive scale upfront can save time and money for all involved.

The following BMP is therefore recommended for planning:

> Municipalities should ensure that subwatershed plans that include consideration for Redside Dace are developed early on in the planning process and prior to any decisions being made that could impact their habitat. These subwatershed plans should therefore be completed prior to the Secondary Planning stage, so that Redside Dace requirements are fully incorporated into planning for areas (e.g., secondary, subdivision and site plans) and appropriate direction is provided for all development.

The development of subwatershed plans is generally led by the local conservation authority or municipality with input and advice from the MNRF and other planning agencies. By developing this clear direction early on in the planning process, municipalities will ensure that all developers within an area are provided with consistent direction that may streamline their approvals. In addition, subwatershed plans will also ensure several requirements of the Provincial Policy Statement (PPS; MMAH 2014) are met, including those pertaining to Redside Dace as follows:

2.1 Natural Heritage …

- *2.1.6. Development and site alteration shall not be permitted in fish habitat* *except in accordance with provincial and federal requirements;*

- *2.1.7. Development and site alteration shall not be permitted in habitat of endangered species and threatened species, except in accordance with provincial and federal requirements;*
- *2.1.8. Development and site alteration shall not be permitted on adjacent lands to the natural heritage features and areas identified in policies 2.1.4, 2.1.5, and 2.1.6 unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.*

2.2 Water …

- *2.2.1 Planning authorities shall protect, improve or restore the quality and quantity of water by:*
  - *c) Identifying water resource systems consisting of, ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas, which are necessary for the ecological and hydrological integrity of the watershed;*
  - *d) Maintaining linkages and related functions among ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas;*
  - *h) Ensuring stormwater management practices minimize stormwater volumes and contaminant loads, and maintain or increase the extent of vegetative and pervious surfaces.*

For a complete copy of the Provincial Policy Statement 2014, see the Ministry of Municipal Affairs and Housing's website.

For technical guidance on implementing the natural heritage policies of the PPS including the relationship of the PPS to the ESA, please see the second edition of the Natural Heritage Reference Manual.

Subwatershed plans are typically divided into three phases within the planning process:

Phase 1 – Characterization

- Characterize the existing subwatershed area in terms of the natural heritage features and linkages including the following that pertain to Redside Dace:
  - Natural cover and impervious or impenetrable cover;
  - Groundwater discharge and recharge zones, and direction of groundwater flow;
  - Vegetative cover (i.e., riparian habitat);
  - Wetlands and headwater stream network;
  - Fisheries; and
  - Current water balance or water budget (i.e., the way in which precipitation falling in an area is dispersed among evaporation, transpiration from plants into the air, infiltration and runoff) and water quality.

Phase 2 – Analysis

- Set the vision, goals and objectives for priorities that may include natural heritage, water management, and land management planning goals (e.g., protect and enhance the environment, community involvement).
- Set targets for water balance, stormwater management, fish community, and natural heritage features (e.g., targets for water

infiltration and stormwater management for the selected storm ranges, maximum percentage of impervious/impenetrable cover, maximum temperature increases based on needs of the fish, maximum total suspended solids, preservation and/or increase of wetlands to support Redside Dace, realignment of streams, etc.).

- Forecast possible development scenarios and implications to water balance and water quality. Subwatershed based impact analyses are closely tied with understanding the cumulative effects of predicted land use changes.
- Make adjustments to planned land uses to achieve targets for water infiltration, stormwater management, etc.

Phase 3 – Implementation

- Subwatershed plans when implemented:
  - Recommend a Natural Heritage System;
  - Provide recommendations for impact mitigation and adaptive management;
  - Provide policy direction to the planning process (i.e., secondary, subdivision and site plans) ; and
  - Provide comprehensive monitoring program recommendations.

The following checklist identifies content that subwatershed plans should identify to protect Redside Dace.

Subwatershed plans should identify the following items to protect Redside Dace:

- The protected habitat of Redside Dace (i.e., habitat as outlined in the Redside Dace habitat regulation – Appendix B).
- The water management targets that need to be achieved in order to protect and rehabilitate the local subwatershed population including for example:
  - Stormwater management targets designed to help mitigate the impacts of development (i.e., impervious cover) on water balance;
  - Recommended stream temperatures;
  - Recommended water quality parameters (e.g., concentration of total suspended solids); and
  - Criteria for minimizing impacts on in-stream erosion.
- Approaches to meeting targets, goals and objectives including for example:
  - Designating areas and low impact development approaches for stormwater management;
  - Minimizing the number of stream crossings (i.e., bridges, culverts, etc.) and directing the location and design of these crossings;
  - Identification of trail locations (i.e., proximity and impact on streams);
  - Identification of wetland and stream restoration areas;
  - Direction for Erosion and Sediment Control Plans/Environmental Control Plans and the development of related bylaws (e.g., topsoil bylaws to regulate/prohibit the removal of topsoil);
  - Location and design of infrastructure (e.g., watermains, pipelines, etc.); and
  - Enhancement opportunities via the removal or mitigation of existing impacts on Redside Dace (e.g., barriers, online ponds, etc.).

See Sections 4.2 - 4.6 for Best Management Practices for specific sediment, temperature, water balance, and water quality targets for Redside Dace, as well as preferred construction practices.

Subwatershed planning and the development of water related targets to be considered before official plan documents are formulated have been recommended as a BMP since the early 1990s. The value of subwatershed planning and the need to consider the cumulative effects of stormwater management is described in the Ministry of Environment and Climate Change's Stormwater Management Planning and Design Manual, 2003.

For further information on subwatershed planning consult with your local conservation authority or municipality. Some conservation authorities, including Credit Valley Conservation, have subwatershed plans posted on their website. For a list of conservation authorities, please see Conservation Ontario's website.

For a list of municipalities and information on the municipal planning process, please see the Ministry of Municipal Affairs and Housing website.

4.2 Stream Crossings

Roads constructed across or adjacent to streams can have significant impacts on the overall health of the stream and Redside Dace habitat. For example, the removal of riparian vegetation and the discharge of sediment into streams during construction can impact Redside Dace habitat by covering up important spawning areas, filling in pools and reducing the ability of the species to find food. Bridges and culverts associated with road and trail crossings can have varying impacts on the habitat of Redside Dace, depending on their location, design, size and placement in the streams, and method of construction. For example, some designs may restrict flows, prevent light penetration, and/or limit fish passage.

The following BMPs are therefore suggested for stream crossings to assist in minimizing the impacts on Redside Dace habitat.

For all Redside Dace habitat, crossings should be designed to avoid/mitigate impacts by adhering to the following:

- The proposed road networks for new crossings should be designed to minimize the number of stream crossings (e.g., stream crossings should generally be limited to one per kilometre of stream).
- In-water works must adhere to Redside Dace timing windows.
- The location of new stream crossings should be chosen to:
    - Avoid reaches known to be occupied by Redside Dace;
    - Minimize the width of the crossings;
    - Cross over straight sections of the

- stream where there is less likelihood for bank erosion; and
  - Cross at areas that have already been disturbed and avoid initiating disturbances in new areas of the stream.
- Construction methods used should attempt to minimize the amount of activity in protected habitat (i.e., including the stream meander belt and riparian habitat) and incorporate the following to maintain the natural flow and functions of streams:
  - For new/replacement crossings in confined valleys (i.e., defined valleys), stream crossings should be bridges that span the valley with any piers required placed outside of the meander belt of the stream, where opportunities exist (Figure 4, see Appendix D for example of how meander belt is calculated). Bridges should be high enough to maintain light penetration to the stream.
  - For new/replacement crossings in unconfined valleys (i.e., undefined valleys), stream crossings should be open bottom culverts designed to span the meander belt of the stream. The length of the culvert should be minimized by using retaining walls versus wider embankments, where opportunities exist, to minimize disruption to riparian habitat and channel bed.
  - For extension of existing structures, the footprint of the structure should be minimized by using retaining walls where technically feasible to minimize disruption to riparian habitat. Replacement of the existing structure should be considered as an alternative through the planning process.
  - Where appropriate, subsurface investigations should be undertaken to confirm the need and extent of dewatering to construct footings, to ensure groundwater resources are not impacted.
  - Developing a plan for managing the stormwater runoff from road crossings and where possible preventing it from entering the stream. For example, by retaining rural road cross-sections adjacent to the crossings, which do not have curbs or drains, stormwater will not be discharged directly into the stream. For further information on stormwater management BMPs, please refer to Section 4.4.
  - In addition to the BMPs listed above, any construction activity that must occur in the stream should also incorporate the BMPs outlined for indirect habitats (i.e., upstream areas) below. This includes restoring any temporary disturbances within the riparian habitat (i.e., 30 m on each side of the meander belt) by planting native, non-invasive species.
- For proposed road crossings in all indirect Redside Dace habitat (i.e., upstream of occupied reaches), there is more flexibility in the location and design of the crossings, as the impact on the habitat is lessened. If the form and/or function of these supporting features are maintained, a permit may be avoided. This can be achieved

through the following:

- In-water work should only be conducted during the recommended construction timing window of July 1 to Sept 15. This will ensure that Redside Dace and their habitats downstream are protected during the sensitive spawning period, as well as ensuring that the stream has stabilized and the riparian habitat is established before the winter months. Once construction is completed, the riparian habitat must be restored using native materials.
- Construction should be undertaken during periods when the channel is dry or with minimal flow. Although flows may be absent, contingency plans should be established to address potential flows resulting from unanticipated storm events.
- The length of time required for in-water work should be kept to a minimum.
- Watercourses should not be blocked or flows impeded sufficiently to limit fish movement (i.e., pumping or diversion of flows around the work site can be used to avoid blocking flow during construction).
- Appropriate sediment controls should be in place and measures taken to prevent sediment from exceeding 25 mg/L above background level during construction (see Section 4.3 BMPs: Construction Site Preparation).
- Exposed soil should be graded to a stable angle and revegetated in a manner that prevents erosion.
- Closed-bottom culverts should be installed so that the invert is embedded a minimum of 20 percent (of the culvert diameter) below the stream bed. This will facilitate fish passage by ensuring that the culvert is not perched during periods of low flow and help prevent flows from undercutting the culvert.
- Slopes of culverts should mimic the natural stream bed.
- Materials moved during construction activities should not be stockpiled where they can adversely affect drainage patterns and be a minimum of 30 m from the watercourse.

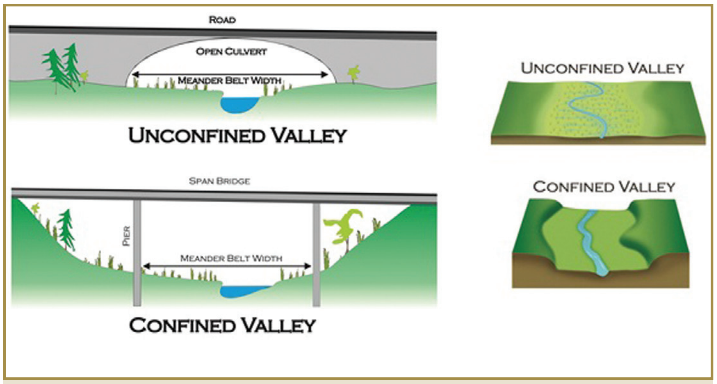


Figure 4. Examples of road crossings with respect to confined and unconfined valleys.

In determining if an ESA permit is required, the MNRF will work closely with local conservation authorities on stream crossing proposals. Local conservation authorities review stream crossing proposals in order to issue permits under their Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.

For an example of guidance that the conservation authorities may be looking for please see Crossing Guideline for Valley and Stream Corridors on the Toronto and Region Conservation Authority's website.

4.3 Construction Activities

While some soil erosion occurs naturally as a result of rain, wind and water dispersing soil, a good vegetative cover can prevent significant soil erosion. The substantial benefits of vegetative cover to control soil erosion are often lost during land development. For example, when trees and plants are removed natural drainage pathways are altered and stable topsoil aggregates are stripped away as part of the grading process. Studies have shown that suspended solid concentrations in untreated runoff originating from construction sites can be up to 30 times greater than in vegetated residential areas (SWAMP 2005; TRCA and University of Guelph 2006; TRCA 2006).

The damaging effects of excess sediment discharges on fish and aquatic life are well documented and may impact Redside Dace through:

- Impairment to respiratory functions;
- Lower tolerance to toxins or disease;
- Decreased reproductive success due to siltation of nests and impacts on spawning sites;
- Reduced vision, which inhibits their ability to find food; and
- Sediment accumulation on the banks of the stream may restrict light penetration and impede plant growth, which in turn reduces riparian cover and habitat for their prey (i.e., terrestrial insects).

Redside Dace are a sensitive species that require clean and clear water that allows them to detect their prey. Studies have shown that Total Suspended Solids (TSS) levels above 25 mg/L will begin to impact fish, as summarized in Figure 5.

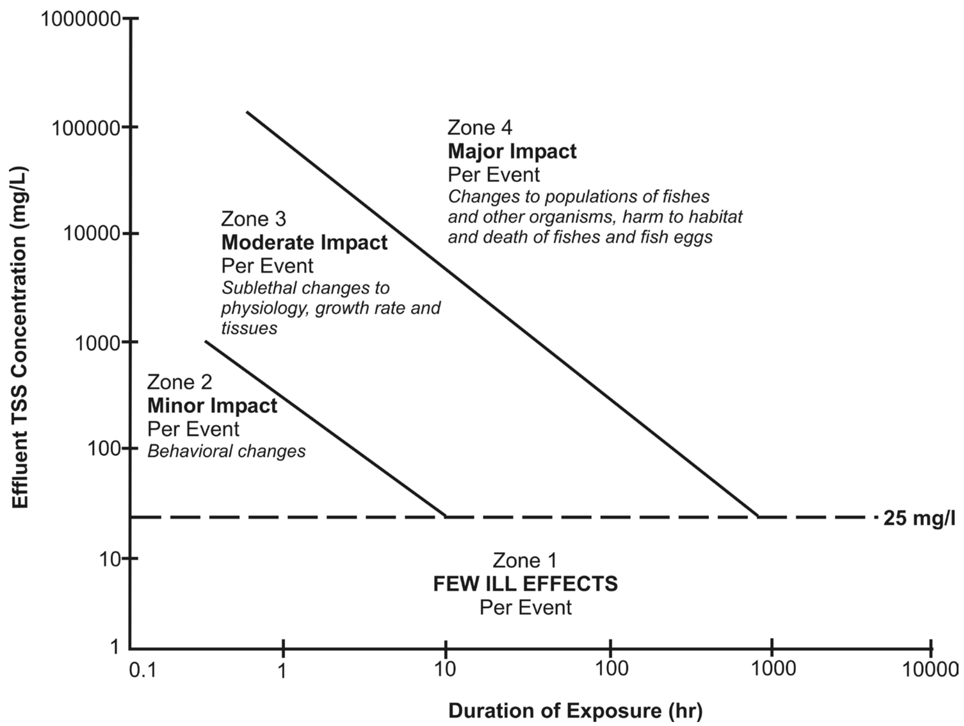


Figure 5: Relationship between sediment concentration and duration of exposure on fish health and habitat (Newcombe 1986).

The degree of impact increases as the amount and duration of total suspended solids that fish are exposed to increases. As these two factors increase, impacts intensify as follows:

- Minor impacts which result in behavioral changes (e.g., avoiding areas, changes in breathing patterns);
- Moderate impacts which have serious health implications including elevated stress and exposure to bacterial infection; and
- Major impacts causing destruction to habitat and/or death to fish and their eggs.

Construction should therefore be designed with a comprehensive Erosion and Sediment Control Plan and a treatment train approach to preventing and controlling sediment release from the source and through conveyance to the streams. Adopting a comprehensive approach offers many efficiencies including avoiding costly cleanup efforts if the entire train of sediment is not considered.

The following controls are suggested BMPs to use during construction to prevent erosion and reduce or eliminate increased sediment flowing into streams.

The discharge of water from urban development construction areas into Redside Dace habitat should not exceed 25 mg/L of TSS above the background stream level of total suspended solids in baseflow conditions. This is consistent with the level recommended by the Canadian Aquatic Water Quality Guidelines for the Protection of Aquatic Life for Total Particulate Matter (Appendix E). These guidelines recommend different parameters for high flow conditions and for measuring using Nephelometric Turbidity Units (NTUs) which are listed in Appendix A. Should proponents be able to control sediment and erosion on site without connection to adjacent Redside Dace habitat, they can avoid the need for a permit. If activities are to encroach into Redside Dace habitat (e.g., by connecting sediment and erosion control ponds to Redside Dace habitat) there is the potential to have significant negative impacts on the habitat which would require a permit.

For large construction sites over 25 hectares in size, the Silt Smart Protocol is recommended for consideration as a proactive means of monitoring instream turbidity. This Protocol is a cooperative communications tool that advises the project proponent and public agencies of erosion and sediment control issues in real time and also advises public agencies on the remedial actions taken. The Protocol is available on the Ontario's Streams website.

Construction activities that are to occur in or adjacent to Redside Dace habitat should adhere to Redside Dace timing windows, as specified by the local MNRF district office.

Erosion and Sediment Control Plans are often required by conservation authorities for permits under their Regulation for *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*. Erosion and Sediment Control Plans should be designed to meet the above objectives by incorporating measures such as the following:

- Erosion should be prevented by limiting the size of disturbed areas through such measures as:
  - Phasing grading and infrastructure installation;
  - Minimizing nonessential clearing and grading; and
  - Retaining existing vegetation.
- Erosion should be minimized through measures including:
  - Minimizing the time that any area is exposed to erosion;
  - Focusing construction during a time of year when flows are minimal (e.g., summer) will help mitigate against potential erosion;
  - Any surface left exposed should have the soil stabilized (e.g., erosion control blankets, lockdown netting, seeding, spraying, utilization of methods to roughen the surface);
  - Minimize the slope length and gradient of disturbed areas; and
  - Store/stockpile soil outside of direct Redside Dace habitat and at least 30 m away from indirect Redside Dace habitat.
- Sediment from the construction site should be captured through measures including:
  - A multi-barrier approach to prevent sediment entering the stream;
  - Effective sediment and erosion ponds (i.e., appropriate structure, size and type required for site);
  - Methods to trap sediment (i.e., filter berms, sediment traps, vegetation, etc.); and

- Monitor and maintain sediment and erosion controls at all times to ensure they are effective as well as monitor the receiving stream to ensure erosion and sediment controls are working effectively. Regular site meetings between the site inspector and contractors will ensure sediment and erosion controls are being emphasized and minor changes to improve effectiveness are being completed, as needed.

For further information on sediment and erosion control, consult the Greater Golden Horseshoe Area Conservation Authorities Erosion and Sediment Control Guideline for Urban Construction.

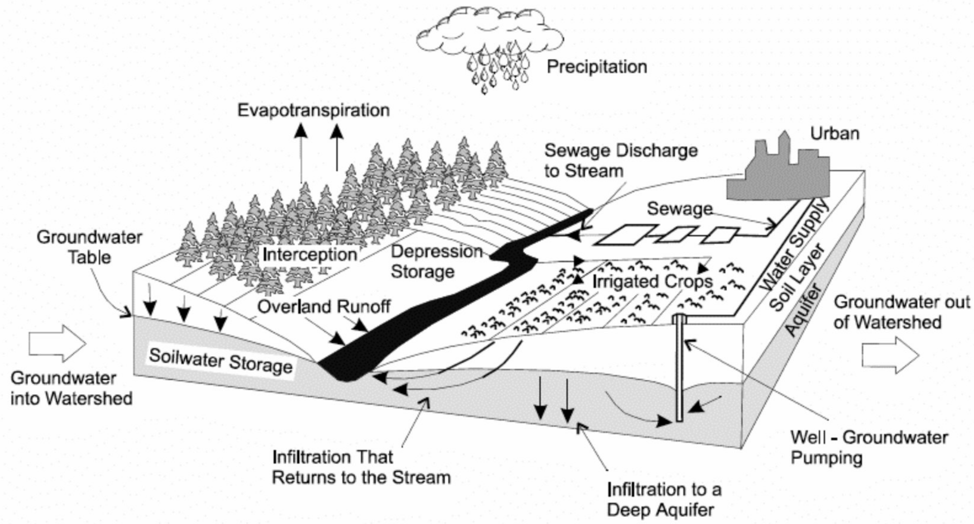
For an example of criteria that the conservation authorities will be looking for please see Erosion and Sediment Control Design and Submission Requirements on the Toronto and Region Conservation Authority's website.

4.4 Stormwater Management

As land changes from being used for agriculture purposes to urban uses, farmland is replaced by impervious or impenetrable surfaces (i.e., pavement for roads, buildings, etc.). This can result in increased rainfall entering a stream, as there is less land to absorb the runoff. Rainfall from urban areas is generally referred to as stormwater. In some cases, urbanization has caused a 3 - 5 fold increase in the amount of stormwater entering a stream with a corresponding reduction of water infiltration into the ground.

This results in dramatic changes to the habitat that Redside Dace require, including, but not limited to, increasing water temperatures, alteration of natural flow regimes and increased runoff, and reduced groundwater recharge. For example, untreated stormwater from pavement is much warmer and often carries pollutants (e.g., oil, chemicals). When deposited into Redside Dace streams, this stormwater can render the water too warm and change the water quality sufficiently to impact their survival. Untreated stormwater can also impact the flow and stability of water levels and have damaging impacts including reducing or eliminating spawning habitat and filling in pools, altering the riparian habitat as the streams widen and overflow and even flush fish downstream with high flows after large storm events.

Stormwater management has evolved since the mid-1980s and there has been increased emphasis on capturing more rainfall at the source rather than relying on end-of-pipe solutions. Modern stormwater guidelines adopt a comprehensive "treatment train" approach which means that stormwater runoff is treated at source, during conveyance, and at the end of the pipe. This comprehensive approach can provide a more effective reduction of runoff and pollutants from stormwater than end-of-pipe facilities alone. It is now recognized that end-of-pipe facilities on their own will not match the characteristics of the distributed infiltration from a natural hydrological cycle which occurred under pre-development conditions.



Source : After, M. L. Davis, D. A. Cornwell, **Introduction to Environmental Engineering**, 1991.

Definitions:
Overland runoff – water that travels over the ground surface to a channel
Streamflow – movement of water via channels
Groundwater flow – movement of water through the subsurface
Infiltration – penetration of water through the ground surface
Groundwater recharge – water that reaches saturated zone

Figure 6: The hydrological cycle (taken from CVC/TRCA 2010)

The natural hydrological cycle of streams (similar to the illustration above in Figure 6) includes: direct overland runoff to the stream, direct groundwater discharge to the stream, evapotranspiration from streambed and nearby vegetation, etc., and can generally be maintained by utilizing infiltration and other low impact development practices at the source or lot level. Some initial studies conducted by the United States Environmental Protection Agency (2007) on sites in Canada and the U.S. have shown that employing such approaches reduces the costs of stormwater management as less land is required to implement end-of-pipe solutions. Other potential benefits identified were enhanced property values and improved quality of life for residents as stormwater management is integrated into amenities in residential areas such as parks and artificial wetlands.

The following represent BMPs for stormwater management

As described in the previous BMP Section regarding Construction Site Preparation, the discharge of water from urban development stormwater management facilities into Redside Dace habitat should not exceed 25 mg/L of TSS above the background stream level of total suspended solids. Should proponents be able to control stormwater without connection to Redside Dace habitat, they can avoid the need for a permit. However, a permit would be required if direct connections are made between stormwater management ponds and Redside Dace habitats due to the potential for negative impacts (e.g., sediment release, increased water temperatures).

Discharge temperatures for stormwater management facilities connected to Redside Dace streams should be below 24°C and have dissolved oxygen concentrations of at least seven milligrams per litre. These thresholds represent the maximum temperature and preferred oxygen conditions for Redside Dace (MNR 2010a). Some examples of stormwater management techniques that may assist in mitigating thermal impacts on receiving watercourses include bottom draw outlets, cooling towers and cooling trenches, and floating islands.

Post development water balance (i.e., the hydrological cycle of the water including the flow and levels of surface and ground water) should match predevelopment water balance in order to protect the natural hydrological functions of Redside Dace streams. Therefore, there should be no storm run-off from rainfall events in the range of 5 – 15 mm (however, this may depend on the recommendations set forth in the subwatershed plan and on soil permeability).

To maximize the absorption of nutrients and contaminants and prevent them from entering streams, stormwater management facilities adjacent to Redside Dace habitat should be designed as hybrid extended detention wetlands/ wet ponds. These facilities are more effective than traditional ponds at removing pollutants harmful to Redside Dace including nitrates, phosphorous and copper.

The above objectives can be achieved by utilizing a low impact development strategy for stormwater management that treats stormwater as close to the source as possible and focuses on runoff prevention. This includes such measures as:

- Site design strategies to minimize runoff which involves:
  - Conserving natural features that absorb rainfall (e.g., wetlands, stream buffers, forested areas, permeable soil, etc.);
  - Locating and designing buildings/ infrastructure to reduce impact (e.g., clustering development in less sensitive areas, reducing footprints of buildings and roadways);
- Evaporation and infiltration practices (e.g., using native vegetation/trees, green roofs, soak aways pits, infiltration trenches, permeable pavement);
- Rainwater harvesting (e.g., rain barrels, cisterns);
- Runoff conveyance (e.g., perforated pipe systems or grass channels which treat and infiltrate runoff as it is being transported); and
- Runoff storage (e.g., woodland restoration, constructed wetlands which capture and then release water as evaporation into the air).

Several of these low impact development measures may be required, which will vary depending on site specific factors including the soil, geology, and groundwater level. These measures will reduce the amount of effort required to implement effective end-of-the-pipe solutions.

Municipalities routinely review stormwater management plans, often with the assistance of conservation authorities. The Ministry of Environment issues Certificate of Approvals and permits to take water for stormwater management facilities under the *Ontario Water Resources Act.*

For further information on Low Impact Design and Stormwater Management, consult the Low Impact Development Stormwater Management Planning and Design Guide by the Credit Valley and Toronto Region Conservation Authorities (2010) and the Ministry of Environment's (2003) Stormwater Planning and Design Manual.

4.5 Installation of New Infrastructure

The placement and maintenance of infrastructure such as gas pipelines, storm and sanitary sewers and watermains, and hydro conduits near streams has the potential to impact Redside Dace habitat. For example, open cut installations which excavate trenches into the stream bed may impact habitat by discharging sediment into the stream and disrupting the riparian habitat along the stream banks. Trenchless technologies, such as jack-and-bore and directional drilling are available that allow for the installation of the infrastructure that avoid or minimize impacts to the stream or stream corridor. These methods are now commonly used by utility companies and developers.

The following are BMPs for the installation of new infrastructure:

Utilities near streams should be located either over or under streams to avoid impact to Redside Dace habitat. By implementing these BMPs and avoiding impact to Redside Dace stream corridors, proponents can avoid the need for a permit.

Utilities should be planned to be built in conjunction with new or replacement road crossings as part of the planning process. When utilities need to be added after road crossings have been built or replaced or installed in areas outside of right-of-ways, they should be:

- Installed 2.5 m below the stream bed (where feasible), using trenchless techniques such as directional drilling and jack and boring (i.e., tunneling).

Site-based geotechnical studies are required to support the techniques to ensure that the location for drilling will not have indirect impacts on the stream, such as draining its groundwater and to ensure that the method is viable for that particular site (i.e., some sites have subsurface conditions, such as large boulders, which could mean that directional drilling has a high risk of failure or frac-out). These activities should be discussed with your local MNRF district office. MNRF works closely with the local conservation authority on these proposals. Generally, emergency frac-out response and contingency plans will be required by conservation authorities to obtain a permit under their Regulation of *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*.

- Have appropriate contingency plans established prior to address potential frac-outs or other unexpected situations.
- Adhere to MNRF timing windows for Redside Dace for activities in Redside Dace habitat.
- Place underneath existing road crossings (i.e., attached underneath the existing bridge) and above the streams, presuming the owner of the structure provides consent.

4.6 Stream Realignments and Relocations

Historically, some Redside Dace streams, like sections of Highland Creek in Toronto, were straightened into concrete lined channels, engineered storm channels or enclosed in large pipes through urbanization. In other areas, the improvement of land for agricultural purposes resulted in the straightening of streams into agricultural ditches or drains. As our understanding of stream functions has improved, the management of streams has shifted to maintaining natural channels to maintain the natural flow and functions of streams, thereby minimizing the impact on fish species including Redside Dace.

As planning for urban development is undertaken, there are opportunities to improve and increase Redside Dace habitat by:

- Realigning previously straightened streams to restore their natural forms and functions; and
- Relocating degraded streams to locations that are better linked to supporting features such as wetlands and areas of groundwater discharge.

The following BMPs for stream realignments and relocations have been taken from the Adaptive Management of Stream Corridors in Ontario guide produced by MNRF and many partners.

The relocation or realignment of degraded stream reaches should be based on an approved subwatershed plan as described earlier in these guidelines and adhere to MNRF timing windows for Redside Dace.

The design and function of the new streams should be based on the planning and design processes outlined in the Adaptive Management of Stream Corridors in Ontario document and the habitat requirements of Redside Dace, which includes:

- Connection to adjacent occupied Redside Dace reaches; and
- Stream conditions that Redside Dace require including:
  - Stream corridors consistent with the Redside Dace habitat regulation (i.e., meander belt plus 30 m of appropriate riparian habitat);
  - Channel design to emulate the natural meandering of the stream required for Redside Dace; and
  - Habitat that the Redside Dace require (e.g., overhanging vegetation, deep pool and riffle habitat, etc.).

MNRF is available for providing advice on these conditions which are outlined in the Recovery Strategy for Redside Dace in Ontario.

- Water quality and quantity targets appropriate for Redside Dace as described in these guidelines including:
  - Maintenance of natural flow and function of streams including water balance (i.e., the hydrological cycle of the water including groundwater, surface water, etc.)
  - Sediment that does not exceed 25 mg/L of total suspended solids over the background stream level during construction. Once construction is completed the creek should be stabilized to minimize erosion and ensure sediment is not being released into the stream.

Due to the potential impact to Redside Dace, permits will generally be required for realignments/relocations and MNRF would review proposals for consistency with the above.

MNRF works closely with local conservation authorities on stream realignments/relocations. Local conservation authorities review these in order to issue permits under their Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses. MNRF will also work closely with the DFO to coordinate activity review.

The Adaptive Management of Stream Corridors in Ontario provides further information on natural channel design.

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For a list of MNRF District Offices please see MNRF's website at: http://www.ontario.ca/government/ministry-natural-resources-and-forestry-regional-and-district-offices

Bankfull Width – the width of the stream or river at bankfull discharge which is the flow at which water begins to leave the channel and move into the floodplain (modified from the Ontario Stream Assessment Protocol [MNR 2010c]).

Base Flow – the volume of flow in a stream channel that is not derived from surface runoff or flow from stream regulation, water diversion or other human activities. Base flow is attributed to such natural storage sources as groundwater, lakes, and swamps (modified from Ontario Stream Assessment Protocol [MNR 2010c] and the Adaptive Management of Stream Corridors in Ontario [MNR 2001a]).

Best Management Practices (BMP) – methods that have been recognized as the most effective and practical means of preventing or reducing impacts from non-point sources.

Biodiversity – the variability among organisms from all sources, including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. (Adapted from Ontario's Biodiversity Strategy [MNR 2005]).

Coarse Sediment Supply – materials such as very coarse sand and gravel that are contributed into a watercourse which maintains habitat conditions, including providing an essential component of spawning habitat.

COSSARO – Committee on the Status of Species at Risk in Ontario; the committee established under section 3 of the Endangered Species Act, 2007 that is responsible for assessing and classifying species at risk in Ontario.

Cumulative Effects – the sum of all individual effects occurring over space and time, including those that will occur in the foreseeable future (taken from Ontario's Natural Heritage Reference Manual [MNR 2010b]).

Endangered Species – a species that lives in the wild in Ontario but is facing imminent extinction or extirpation (ESA 2007).

Erosion – the detachment of soil particles under the influence of water and/or wind (taken from Adaptive Management of Stream Corridors in Ontario [MNR 2001a]).

Government Response Statement (GRS) – summarizes the actions that the Government of Ontario intends to take in response to the Recovery Strategy and the Government's priorities with respect to taking those actions (ESA 2007).

Groundwater Discharge Area – an area in which there is lateral or upward groundwater flow in the subsurface, often escaping as a spring or seep.

Headwater Stream or Drainage Feature – small intermittent, seasonal and low-order permanent streams and other drainage features, such as tile drains, that occur at the uppermost reaches of a stream network (often referred to simply as Headwaters).

Hydrologic Cycle – the cycling of water from the atmosphere, onto and through the landscape and eventually back to the atmosphere (taken from Adaptive Management of Stream Corridors in Ontario [MNR 2001a]).

Hydrologic Regime – the characteristic pattern of precipitation, runoff, infiltration and evaporation affecting the hydrology of a system (taken from TRCA and CVC's [2010] Low Impact Development Stormwater Management Manual).

Impervious – a hard surface area (e.g., road, parking area or rooftop) that prevents or retards the infiltration of water into the soil (taken from CVC and TRCA's [2010] Low Impact Development Stormwater Management Manual).

Low Impact Development (LID) - stormwater management strategy that seeks to mitigate the impacts of increased runoff and stormwater pollution by managing runoff as close to its source as possible (taken from CVC and TRCA's [2010] Low Impact Development Stormwater Management Manual). LID approaches may include innovative site designs, or structural approaches such as soakaways, infiltration trenches, bioretention, permeable pavement, vegetated filter strips, etc.

Meander Belt – the land area on either side of a watercourse representing the furthest potential limit of stream channel migration. Areas within the meander belt may some day be occupied by the watercourse (taken from Parish Geomorphic 2001). See Appendix D for clarification as to how meander belt is calculated.

Mitigation – the prevention, modification or alleviation of impacts on the natural environment, and – specifically in the context of policies 2.1.4 and 2.1.6 and the definitions in the PPS – the prevention of negative impacts. Mitigation also includes any action intended to enhance beneficial effects (taken from Ontario's Natural Heritage Reference Manual [MNR 2010b]).

Occupied Reach – with respect to Redside Dace, a stream reach in which Redside Dace have been captured or observed in the past 20 years.

Overall Benefit – involves undertaking actions that contribute to improving circumstances for Redside Dace in Ontario, and is grounded in the protection and recovery of the species at risk and must include more than mitigation measures for potential adverse effects. Overall benefit is more than 'no net loss' or an exchange of 'like for like'.

Pools – a part of the stream having greater depths and slower flow velocities than the adjacent riffles (modified from Adaptive Management of Stream Corridors in Ontario [MNR 2001a].

Recharge Zone – an area of land where water can infiltrate into an Aquifer relatively easily.

Recovery Strategy – a document that identifies the habitat needs of a threatened or endangered species, a description of threats to the survival and recovery of the species and provides recommendations to the Minister of Natural Resources on objectives for the protection and recovery of the species and approaches to achieve these objectives, and the area that should be considered in a Habitat Regulation (modified from the ESA 2007).

Riffles – areas of relatively fast, turbulent flow, where the water's surface is typically broken and has an obvious slope (taken from Ontario Stream Assessment Protocol [MNR 2010c]).

Riparian – a vegetated ecosystem alongside a waterbody, characteristically have a high water table and are subject to periodic flooding (taken from CVC and TRCA's [2010] Low Impact Development Stormwater Management Manual).

Sedimentation – settling-out or deposition of particulate matter suspended in runoff (taken from CVC and TRCA's [2010] Low Impact Development Stormwater Management Manual).

Species at Risk in Ontario (SARO) List – the regulation made under section 7 of the *Endangered Species Act, 2007* that provides the official status classification of species at risk in Ontario. This list was first published in 2004 as a policy and became a regulation in 2008.

Stream Reach – a relatively homogeneous portion of a river that includes a consistent slope and bed materials, and at least two full meander wavelengths of channel repetition (taken from Ontario's Natural Heritage Reference Manual [MNR 2010b]). Reaches are delineated by MNRF using an Aquatic Resource Area (ARA).

Threatened Species – a species that lives in the wild in Ontario, is not endangered, but is likely to become endangered if steps are not taken to address factors threatening to lead to its extinction or extirpation (ESA 2007).

Treatment Train Approach – a combination of lot level, conveyance, and end-of-pipe stormwater management practices (taken from CVC and TRCA's [2010] Low Impact Development Stormwater Management Manual).

Trenchless Techniques – methods of installing infrastructure such as pipelines, conduits, and cables beneath a watercourse by drilling or tunneling rather than excavation of open trenches. Common methods include directional drilling and jack and bore techniques.

Water Balance – the accounting of inflow and outflow of water in a system according to the components of the hydrologic cycle (taken from CVC and TRCA's [2010] Low Impact Development Stormwater Management Manual).

Watershed – means an area that is drained by a river and its tributaries (taken from Ontario's Provincial Policy Statement [MMAH 2005]).

Wetlands – means lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface. In either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic plants or water tolerant plants. The four major types of wetlands are swamps, marshes, bogs and fens (taken from Ontario's Provincial Policy Statement [MMAH 2005]).

The current definition of Redside Dace habitat is set out in Ontario Regulation 242/08 and is summarized below. Please refer to elaws for the most up to date version of the regulation.

29.1 For the purpose of clause (a) of the definition of "habitat" in subsection 2 (1) of the Act, the following areas are prescribed as the habitat of redside dace:

1. Within the cities of Hamilton and Toronto, the counties of Bruce, Grey, Huron, Simcoe and Wellington, the regional municipalities of Durham, Halton, Peel and York, the Townships of St. Joseph, Jocelyn and Hilton, and the Village of Hilton Beach,

i. any part of a stream or other watercourse that is being used by a redside dace,

ii. any part of a stream or other watercourse that was used by a redside dace at any time during the previous 20 years and that provides suitable conditions for a redside dace to carry out its life processes,

iii. the area encompassing the meander belt width of an area described in subparagraph i or ii,

iv. the vegetated area or agricultural lands that are within 30 metres of an area described in subparagraph iii, and

v. a stream, permanent or intermittent headwater drainage feature, groundwater discharge area or wetland that augments or maintains the baseflow, coarse sediment supply or surface water quality of a part of a stream or other watercourse described in subparagraph i or ii, provided the part of the stream or watercourse has an average bankfull width of 7.5 metres or less.

2. Within the City of Hamilton, counties of Bruce, Grey, Huron, Simcoe and Wellington and the regional municipalities of Durham, Halton, Peel and York,

i. any part of a stream or other watercourse used by a redside dace at any time in the past that is located in the same or adjacent sub-watershed as the area identified in subparagraph 1 i or ii that provides suitable conditions for successful stream corridor rehabilitation and for natural recolonization of redside dace,

ii. the area encompassing the meander belt width of an area described in subparagraph i,

iii. the vegetated area or agricultural lands that are within 30 metres of an area described in subparagraph ii, and *iv. a stream, permanent or intermittent headwater drainage feature, groundwater discharge area or wetland that augments or maintains the baseflow, coarse sediment supply or surface water quality of a part of a stream or other watercourse described in subparagraph i, provided the part of the stream or watercourse has an average bankfull width of 7.5 metres or less.*

The first two case studies provide examples of how an activity can be modified to avoid any adverse effects to Redside Dace. Case Study #3 illustrates an example of an activity where an overall benefit permit would be required. Case Study #4 provides an example of a more complex activity, having multiple components that may affect Redside Dace.

Case Study #1

Activity: Installing a new watermain by digging an open-cut trench through existing occupied Redside Dace habitat.

Potential adverse effects: By digging a trench (i.e., open-cut) through the stream, the instream and riparian habitats would be disturbed. The adverse effects of an open-cut trench may include: i) altering the bed and banks of the stream (e.g., affecting spawning or feeding habitat); ii) removing potential food supply to the fish (i.e., Redside Dace feed on insects that live on the vegetation on the banks); iii) removal of bank vegetation/cover may result in increases in water temperature; iv) construction of trenches may result in sediment entering the stream which may adversely affect the water quality and clarity; and v) has the potential to directly harm Redside Dace during construction and/or fish removal/salvage activities.

How can the activity be modified to avoid adverse effects: Changing the method of installing the watermain so as not to enter the Redside Dace habitat will reduce the potential for adverse effects. This can be done by conducting directional drilling that occurs beyond the 30 m of the riparian habitat of the stream and goes underneath the stream. Geotechnical studies are required to ensure that the location of drilling will not have indirect effects on the stream (e.g., impacts to groundwater) and to ensure that this method is viable for that particular site (i.e., some sites contain subsurface conditions, such as large boulders that would compromise the success of trenchless techniques). This should be discussed with your local MNRF District Office.

Case Study #2

Activity: Installing a closed-bottom culvert in an area upstream of an occupied reach of Redside Dace.

Potential impacts: Installing a closed bottom culvert would require instream work which could impact the flow and function of the water to the occupied Redside Dace reach downstream.

How can the activity be modified to avoid adverse effects: Undertake this activity in July/August when this portion of the creek is generally dry so there would be no adverse effects to the flow and function of the stream. Subwatershed studies for the area will usually document these conditions. In the event that the stream is flowing at this time, methods that pump or divert the water around the installation site could be used to ensure that the stream flow is maintained.

Case Study #3

Activity: Road widening, including the removal of an existing 40 m steel pipe culvert in a reach of a stream occupied by Redside Dace and replacement with a new structure.

Alternatives: Design alternatives include: i) open span bridge; ii) new closed-bottom, corrugated steel pipe culvert (CSP); or iii) an open bottom culvert. These three options were considered, documented and presented for evaluation; however, technical constraints limit the potential for completely avoiding an adverse effect on Redside Dace regardless of the alternative chosen. It is geotechnically not feasible to build a bridge that arches above the unconfined (not defined) valley given the sandy soils and high groundwater in the area. A closed-bottom CSP culvert would require additional channel length (20 m) to accommodate the road widening thereby covering existing habitat and may further limit fish passage. An open-bottom culvert can be incorporated that matches the existing culvert length and will not limit fish passage as would the CSP culvert. Therefore, the option of an open bottom culvert was chosen.

Adverse Effects: The construction of the preferred alternative (open-bottom culvert) will still result in some adverse impacts to Redside Dace habitat, including the temporary disturbance and damage of some habitat via construction activities to remove the existing culvert. In addition, there is the potential to harm or harass the species through de-watering of the construction area and fish salvage activities.

Mitigation:

- Flows are diverted around the construction area using dam-pump operations; a fish rescue plan is put in place within the construction area to remove and relocate the fish downstream.
- Insertion of a new open bottom culvert that spans the channel will restore the natural flow of the stream including that of potential groundwater inputs.
- Retaining walls are used (compared to traditional embankment areas) to support the road which eliminated the need to lengthen the culvert over a further 20 m of the stream (i.e., the new culvert is the same length as the culvert being replaced).
- Work within the stream to remove the existing culvert is conducted within the construction timing window recommended for Redside Dace (i.e. July 1 to September 15th so as to avoid the spawning season and to stabilize the stream corridor before winter).
- Effective sediment and erosion control is in place to prevent sediment from entering the stream.
- Maintain style of existing rural road for road expansion that has no curbs or drains to prevent stormwater runoff from the road into the stream.

Overall Benefit: The incorporation of an open-bottom culvert will restore overall stream function, as the existing culvert was impairing natural channel processes including sediment transport and groundwater flow into the channel and limiting fish passage. In addition to the open-bottom culvert, overall benefit included the removal of an existing barrier (i.e., small dam) to Redside Dace movement located upstream of activity site. Removal of the barrier upstream provided access to 1.5 km of good quality habitat located upstream. The increase in the extent of the species' habitat is expected to be sufficient to support an increase in the local population.

Case Study #4

Activity: Proposed plan of a 100 acre subdivision adjacent to existing Redside Dace occupied stream, with 950 low density residential homes, roads and underground utilities including sanitary and storm sewers, water main, hydro and communications. The storm sewer system is to be connected to a stormwater pipe that is proposed to discharge into a Redside Dace stream. A 60 m stream crossing is proposed for a 4 lane arterial road across an unconfined valley with a meander belt width of 12 m. Location of proposed road passes through former pasture area. Subwatershed plan was completed in advance of subdivision; no contributing habitat features are adjacent to the stream corridor.

Potential impacts: Loss of riparian vegetation, topsoil removal and grading of land adjacent to stream. Possible harm to the species with release of sediment into the watercourse from grading activities. Loss of riparian habitat through construction of connecting stormwater headwall and connecting discharge channel through the stream corridor into creek. Increased storm runoff from impervious surfaces potentially damaging spawning and pool habitats and water quality. Loss of riparian habitat through the construction of the road and installation of utilities.

Mitigation: In discussions between the municipality and the proponent, the proposed plan of subdivision was amended to exclude individual lots and site grading from regulated habitat per recommendations of the subwatershed plan. Road crossing and stormwater discharge could not be relocated or re-designed to avoid potential impact to habitat and species. Proponent consults with MNRF regarding ESA requirements and it was determined that mitigation was not sufficient to avoid impacts and an overall benefit permit would be required.

Comprehensive preventative sediment and erosion control plan in place for tablelands to avoid discharge into Redside Dace habitat (e.g., grading and infrastructure installation phased over several months with disturbed areas being graded flat and stabilized with hydroseed, sediment control fences and sediment control pond in place, conveyance channels lined with sod and catch basins covered with filter fabric to filter sediment, regular inspections and maintenance of measures). Instream monitoring of turbidity through the use of the Silt Smart Protocol to demonstrate effective protection of Redside Dace habitat during construction phase.

Application of recommended stormwater management strategies and targets from subwatershed plan to match, as close as possible, to pre-development seasonal water balance:

- Lot level infiltration from rooftop runoff designed to achieve infiltration/attenuation of first 8mm of storm runoff.
- Conveyance controls designed to achieve infiltration/attenuation of first five mm of storm runoff from roads and sidewalks.
- End-of- pipe extended detention wetland designed to accommodate quality and quantity control for 25mm storm events with 72 hour detention per the recommendations of the subwatershed plan.
- Sub-surface cooling trench used at outlet of stormwater wetland to mitigate anticipated 3.5°C increase in temperature of storm runoff.
- Conveyance channel discharges to valley floor without direct connection to stream; conveyance channel stabilized with erosion blanket, seed, native shrubs and trees.
- Level spreader used to spread storm flows across a wide area of meadow floodplain.
- Five year monitoring program proposed for stormwater practices to evaluate and report effectiveness.

Geotechnical studies completed for proposed crossing of stream which find that trenchless techniques are technically feasible with minimal risk of failure; studies used to support directional drilling for installation of the watermain perpendicular to the stream corridor to avoid impact. Jack and bore techniques used to install the sanitary sewer perpendicular to the stream corridor to avoid impact.

Minimizing Impact:
Road crossing of unconfined stream valley could not be avoided. Impacts to stream corridor minimized by:

- Use of prefabricated open bottom culvert for 12 m meander belt of stream;
- Retaining wall system used to minimize footprint of road crossing through stream corridor; and
- Stormwater from road crossing conveyed to extended detention wetland storm pond.

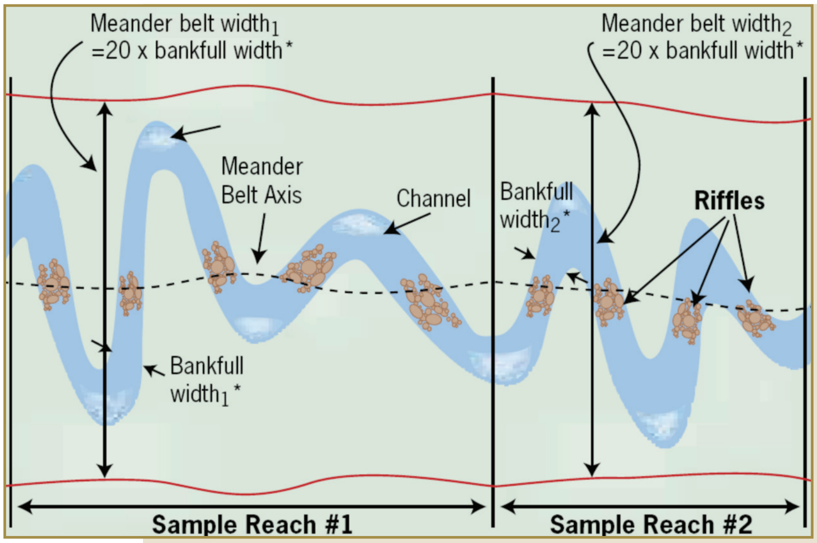
Overall Benefit:
Plan devised for residual loss of 0.36 ha of riparian habitat as a result of eliminating riparian habitat with road crossing. Proponent includes proposed 600 m long livestock fencing project for rural site located upstream of occupied habitat. Overall benefit expected from the improved water quality for the occupied reach.

Appendix D – Calculation of Meander Belt Width

The text below and approach to defining the meander belt width has largely been taken from the Ministry of Natural Resources and Forestry' 'Understanding Natural Hazards Manual' (MNR 2001b).

The meander belt allowance (herein referred to simply as meander belt), is normally used when planning authorities are considering development along unconfined river and stream systems. The allowance is determined to ensure that development is not placed in harm's way, but also to ensure that the flow of water and its associated natural processes, including erosion, are maintained.

The term meander belt is the maximum extent that a water channel migrates. A meandering channel is a series of interconnected reaches. A reach is a length of channel over which the channel characteristics are stable or similar. For each reach, the meander belt should be centered on a line of axis drawn through the middle of the meanders or riffle zones (see pictorial below), a line that essentially divides each of the meanders in half. The width of a meander belt can be determined by analyzing the average bankfull channel width of the largest amplitude meander. The meander belt allowance is defined as 20 times the bankfull channel width of the reach and centred on the meander belt axis. When determining the meander belt for these relatively straight reaches, the meander belt should be centred on the mid-line of the channel.



Pictorial showing how meander belt width is calculated (taken from MNR 2001b).

Appendix E – Canadian Water Quality Guidelines *

Table 1. Water quality guidelines for total particulate matter for the protection of aquatic life (Caux et al. 1997).

Aquatic life — Freshwater, estuarine, and marine	Guideline value
Suspended sediments	
clear flow	Maximum increase of 25 $mg \cdot L^{-1}$ from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 $mg \cdot L^{-1}$ from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
high flow	Maximum increase of 25 $mg \cdot L^{-1}$ from background levels at any time when background levels are between 25 and 250 $mg \cdot L^{-1}$. Should not increase more than 10% of background levels when background is >250 $mg \cdot L^{-1}$.
Turbidity	
clear flow	Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).
high flow or turbid waters	Maximum increase of 8 NTUs from background levels at any one time when background levels are between 8 and 80 NTUs. Should not increase more than 10% of background levels when background is >80 NTUs.
Deposited bedload sediment	Insufficient information to derive guideline.
Streambed substrate *	
fine sediments	The quantity in streambed substrates should not exceed 10% <2 mm, 19% <3 mm, and 25% <6.35 mm.
geometric mean diameter	Geometric mean diameter should not exceed 12 mm.
Fredle number	Fredle number should not exceed 5 mm.
intergravel dissolved oxygen	Minimum of 6.5 $mg \cdot L^{-1}$.

* Guideline values apply to actual and potential spawning sites.

* Taken from Canadian Council of Ministers of the Environment (2002)