

Guide to Altering Watercourses



Disclaimer: This guide contains general information that may not be applicable to all situations. Sometimes supplemental mitigation is necessary to resolve site specific problems. Following this guide does not exempt a person from adhering to any legislation, regulations, by-laws and other requirements, including regulations and requirements mentioned in the guide.

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Guide to Altering Watercourses

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WHY CREATE THIS GUIDE?

Nova Scotia Environment requires Nova Scotians to take great care when working in and near watercourses, such as rivers, streams, lakes, creeks, ponds, springs, lagoons, or other natural bodies of water. Requirements and restrictions for watercourse alterations aim to protect surface water resources and to ensure sustainable use.

An alteration is any change made to the bed or bank of a watercourse or to the water flow within it. Culvert and bridge crossings, wharf construction, utility crossings, dams, and removal of material from the banks or bed of a watercourse – all of these human activities can seriously alter or disturb our lakes, rivers, and streams. They can affect water quality, water flow, and aquatic ecosystems.

This guide, *Guide to Altering Watercourses*, explains why it is important to avoid and minimize disturbances to lakes, rivers, streams, and other watercourses. It also highlights activities that pose little or no environmental risk and that help to maintain healthy aquatic ecosystems. These lower-risk options will be easier for homeowners, forestry operators, and contractors to complete because they require little or no interaction with government.

Guide to Altering Watercourses explains the importance of avoiding and minimizing disturbances to watercourses. It describes what to do when alterations are necessary – how to do the work correctly to prevent or lessen damage and to maintain healthy rivers, lakes, streams and ponds.

The guide will help you

- avoid disturbing watercourses
- recognize when you need experts to properly alter watercourses

- navigate the requirements for activities that alter watercourses and pose a higher risk to the environment

For more detailed information about the requirements and standards for altering watercourses, please see novascotia.ca/nse/watercourse-alteration. There are also requirements for certified watercourse alteration professionals to be involved in certain types of alterations. For example, planning and installation of pipe culverts in streams require the involvement of certified watercourse alteration sizers or professional engineers.

Technical training modules are available through the Maritime College of Forest Technology, especially designed for people involved professionally in watercourse alterations.

WATER IS ESSENTIAL FOR LIFE

... and will be valued, kept safe, and shared

Good, clean, and abundant water is essential for people and for the environment to survive. And it is critical for many of the activities that help communities and ecosystems thrive. So when we shape our world to the way we live, work, commute, and play, we need to keep in mind principles for protecting our water:

Sustainability – We need to recognize the fundamental value of healthy water and ecosystems, and the social and economic importance of water to Nova Scotia. Today's decisions must consider tomorrow's effects, carefully balancing the water we use with the protection of natural ecosystems.

Stewardship – We all have roles to play in conserving and protecting water. Those roles are based on both individual and collective responsibilities to ensure safe, healthy water for future generations.

Partnership and Collaboration – Water is a shared resource. Protecting it is a shared responsibility among all levels of government, the private sector, communities, and individual citizens.

Online Links

Nova Scotia's vision for water resources:

<http://novascotia.ca/nse/water.strategy/>

<http://waterforlife.gov.ns.ca/>

Nova Scotia Environment's regulatory requirements:

Changes to regulatory requirements for watercourse alterations came into effect on October 1, 2014. Detailed information about the legislation and the requirements is available at these websites:

<http://www.novascotia.ca/just/regulations/regs/envactiv.htm>

<http://novascotia.ca/nse/watercourse-alteration/>

WHY SHOULD WE CARE ABOUT OUR LAKES, RIVERS, STREAMS, AND PONDS

Nova Scotia has more than 6,700 lakes and thousands of named and unnamed rivers and smaller watercourses. Healthy aquatic ecosystems and healthy communities rely on the sustainable use and protection of these water resources.

Healthy Watercourses and Aquatic Ecosystems

Care must be taken during all watercourse alterations to protect the living and non-living components of aquatic habitat, which are both critical to healthy ecosystems.

A healthy ecosystem is a community of plants and animals able to live, feed, reproduce, and interact. Aquatic ecosystems can get damaged by erosion, sedimentation, stream blockages, degraded water quality, and habitat loss. This damage can occur if the bed or bank of a watercourse, or the water flow therein, is altered. This damage can also occur when work is done close to a watercourse.

The natural home of a plant or animal within an ecosystem is its habitat. Aquatic habitat refers to the living and non-living components of the environment upon which aquatic life, including fish, depend directly or indirectly to carry out their life processes. Healthy watercourses contain habitat that can support aquatic life.

Potential Impacts of Altering Watercourses

Changes made to the form and characteristics of a watercourse may cause unstable channel conditions, leading to erosion that



Protecting our watercourses means

- maintaining water quality
- maintaining channel capacity and flow
- minimizing alterations to the bank and bed of watercourses and maintaining natural features of the watercourse
- maintaining and promoting habitat for aquatic life

Drinking-Water Supply Areas

Be aware that many Nova Scotians rely on surface water resources for potable water, agricultural practices, and commercial and industrial use. Watercourse alteration projects must take this into consideration and ensure that water flow and water quality are maintained so that other users are not affected.

In Nova Scotia, 25 Protected Water Areas designated in provincial regulations provide drinking water to communities. Regulations place restrictions on land and water uses within these designated areas and may have more requirements for work within them than for the province in general. If you are planning any activity within a water supply area, contact the municipality that oversees its protection.

A map of the protected water areas is available at Nova Scotia Environment's website: novascotia.ca/nse/water/docs/Protected.Water.Areas.Map.pdf.

Please note that the list of protected water areas is subject to change as regulations come into effect or are cancelled. For regulations in effect, see novascotia.ca/just/regulations/rxaa-1.htm#env.

changes the channel shape. These changes can affect water depth and speed, and therefore aquatic habitat and fish passage. For instance, too much water meandering and flooding and a lot of movement of watercourse bed material can lead to property damage along the watercourse and affect the habitat of aquatic life.

If bridges or culverts are improperly designed, they are unable to handle high water flows, leading to flooding, property damage, and watercourse damage upstream. Crossing structures can also result in increased water velocity, causing the movement of sediment, rock, and debris downstream – leading to sedimentation and changes to the channel shape.

Alterations may also cause substantial changes in the availability of water suitable for domestic and industrial consumption and for numerous other uses, such as agriculture, forestry, fishing, mineral development, tourism, outdoor recreation, and power production.

Fish and Fish Habitat

Fish habitat is a significant and important component of aquatic habitat. The federal Fisheries Act defines fish habitat as “spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes.”

Nova Scotia supports a healthy population of fish throughout its lakes, rivers, and streams. The best known members are in the salmonid family, which includes the Atlantic Salmon and many species of trout. A unique aspect of many salmonids is that they hatch and grow in fresh water, then migrate to the ocean to mature, and then return to fresh water to reproduce. Each species has different requirements for each stage in its life cycle. Besides the salmonid family, many other species of fish also live in Nova Scotian lakes, rivers, and streams; in order to successfully migrate and reproduce, they require healthy habitat to support different stages in their life cycles. These species include Alewife, American Shad and Rainbow Smelt.

Basic Needs for Freshwater Fish

Many freshwater fish, especially salmonids and other aquatic life are sensitive to the following conditions.

Water clarity and suspended sediment/silt

Turbidity, or the cloudiness of water, is a measure of the concentration of suspended sediment in water. Suspended sediment is undissolved matter ranging from clay-size particles to fine pebbles (2 to 4 millimetres). Most of this material is made up of soil particles released by erosion of the banks of a watercourse or disturbed upland areas.

Very turbid water interferes with the feeding habits of fish and other aquatic life. Many fish feed by sight, so water clarity is necessary for them to see their food. Turbidity can also cause an increase in water temperature and prevent sunlight from reaching the bottom of the watercourse, where most of the primary production in the food chain begins.

The suspended sediment in highly turbid water can interfere with the breathing processes and/or migration patterns of fish.

Dissolved oxygen

Freshwater fish require water with high dissolved oxygen content. It is especially critical during egg incubation and hatching, and in the first few weeks of life. The levels of dissolved oxygen in water are decreased by increases in temperature.

Temperature

Salmon and Trout prefer cooler water temperature of 12°C to 18°C. In fact, 24°C or more is considered lethal, as warmer water holds less dissolved oxygen than colder water. Fish migrations may be delayed by temperature in watercourses being either too warm or too cold.

Water temperature can increase when vegetation is removed from the banks of a watercourse. Temperature may also increase if the channel and water depth are shallow, which can be a result of changes to the channel shape or significant amounts of sediment deposited on the stream bed.

Protected Areas

Nova Scotia is working to legally protect at least 12 per cent of its landmass through parks and protected areas, including wilderness areas, nature reserves, and heritage rivers. Alterations to watercourses flowing into these areas or the watersheds above them must be completed with great care, to preserve the ecosystems found within the protected area.

For more information, visit:

<http://www.novascotia.ca/nse/protectedareas/>

Gravel substrate

Salmonids require clean gravel, approximately 1–15 cm in size, for successful spawning. They bury their eggs 15–35 cm in the gravel in the fall. The eggs remain there and develop over the winter, then hatch into the larval form called alevins. Alevins remain in gravel until their yolk sacs have dissolved. Then, in late spring, they emerge.

Sediment released into a watercourse can have significant impact on gravel beds adjacent to or downstream of the source of sediment. Sediment settles into the spaces between the gravel, preventing the burial of eggs. Or, if eggs or alevins are present in the gravel when sedimentation occurs, they can be smothered.

Passage

Adult fish migrate at different times of the year in response to a variety of needs. They may migrate to spawn and reproduce, to find food, to escape predation, or to reside in deeper pools before the winter freeze-up occurs. Juvenile fish migrate to rearing areas, often small creeks and channels. Unobstructed pathways and water characteristics conducive to swimming are necessary for migration to occur. Unobstructed migration routes are necessary for the life cycle of the population.

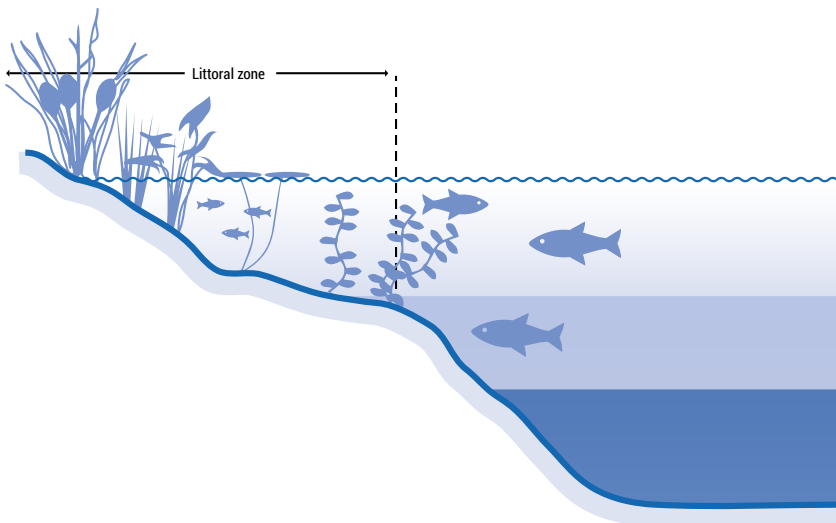
Adult salmonids must reach spawning grounds at the proper times and with enough energy to complete the life cycle. Swimming ability of fry (newly hatched fish) and juvenile fish are limited by their body length, making it more difficult for them to swim if confronted with an obstruction.

Blocked culverts, debris jams, or dams with no fishways present physical obstructions to fish passage. Other barriers, such as increased flow velocities, may not be immediately apparent. Barriers created by improperly designed or installed culverts are common. Such barriers are created by conditions that impede fish swimming ability, including

- culverts installed on watercourse slopes greater than 0.5 per cent without fish passage features
- perched outlets on culverts
- channelization of flow, leading to increased velocity

- inadequate water depth, caused by an oversized culvert
- long culverts
- reduced concentrations of dissolved oxygen
- high turbidity
- high temperatures
- extreme water temperatures

Importance of Shallow Areas of Watercourse



Disturbing Shallow Areas of Watercourses

Disturbance of the watercourse bed in shallow water – such as adding or removing material – will damage the littoral zone. These sensitive parts of watercourses near shore let light penetrate to the bottom where plant organisms can grow, creating part of the essential interconnections between organisms and their habitat. Through complex food chains, virtually all aquatic life depends on these rocky, silty, or sandy-bottomed areas during at least one stage of their life cycle. For example, littoral zones are ideal for spawning and nursery of many fish, with ideal hiding spots and food sources. Disturbance of this area and to riparian zone can also impact waterfowl nesting areas and habitat for some amphibians, aquatic insects, and reptiles.

REGULATED REQUIREMENTS

Protecting Watercourses

Nova Scotia has laws to protect watercourses – their physical characteristics, the water flow, and the quality of water flowing in them. The Nova Scotia Environment Act provides the overall authority to protect watercourses. Any activity that changes a watercourse, a water resource, or the flow of water therein requires an approval or a notification in accordance with the Activities Designation Regulations. Before any work can be done, an activity requires either

- an approval from Nova Scotia Environment, laying out the terms and conditions for doing the work, or
- a notification to the department, and work is carried out in accordance with the Nova Scotia Watercourse Alterations Standard

Great care must be taken when working in and near watercourses. The goal of having requirements and restrictions for watercourse alterations is to protect watercourses and water resources and to ensure sustainable use for all beneficial uses, including drinking-water supplies, habitat for aquatic life, and recreational, agricultural, and industrial uses. See how the process works on page 13.

In addition to provincial requirements, Fisheries and Oceans Canada (DFO) is responsible, under the Fisheries Act and the Species at Risk Act (SARA), for ensuring protection of fish and fish habitat.

Section 35 (1) of the Fisheries Act states, “No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery.” The act defines serious harm to fish as “the death of fish or any permanent

Forms and Help

For a notification form or application for approval, go to www.novascotia.ca/nse/watercourse-alteration. Also see the guidance document on how to complete a notification form. If you need more help, call the local Nova Scotia Environment office <http://www.novascotia.ca/nse/dept/offices.asp>

Working in Coastal Areas

Regarding activities involving coastal waters, contact the Nova Scotia Department of Natural Resources at www.novascotia.ca/natr/staffdir/offices.asp and the DFO Fisheries Protection Program at www.dfo-mpo.gc.ca/pnw-ppe/contact-eng.html.

You can also contact the Fisheries Protection Program

Attention: Referrals Secretariat
Fisheries and Oceans Canada

PO Box 1006

Dartmouth, Nova Scotia B2Y 4A2

Telephone: 902-426-3909

Fax: 902-426-7174

Email: ReferralsMaritimes@dfo-mpo.gc.ca

alteration to, or destruction of, fish habitat.”

Sections 20 and 21 of the federal Fisheries Act states that the Minister may take steps to ensure free passage of fish and prevent harm to fish. The Minister can request that obstructions be removed, fishways be constructed and minimum flows be maintained to enable the safe passage of fish.

Proponents of projects are encouraged to avoid or mitigate impacts to fish that are part of a commercial, recreational, or Aboriginal fishery, or fish that support such a fishery. If a project results in serious harm to fish, a Section 35(2)(b) Fisheries Act Authorization may be required. Permitting under Section 73 of the SARA may also be required. for activities that could kill, harm, harass, capture or take an individual species deemed to be at risk, or destroy any part of their critical habitat.

In some cases, your application will be forwarded to the DFO Fisheries Protection Program for review to ensure that there is no contravention of the Fisheries Act and Species at Risk Act.

Other provincial and federal requirements may also apply to your project.

What is a Watercourse?

The term *watercourse* is defined in the Nova Scotia Environment Act; it includes rivers, streams, lakes, creeks and ponds, and the water contained in them. Some water bodies are obviously watercourses, but other water flows may not be as definitive.

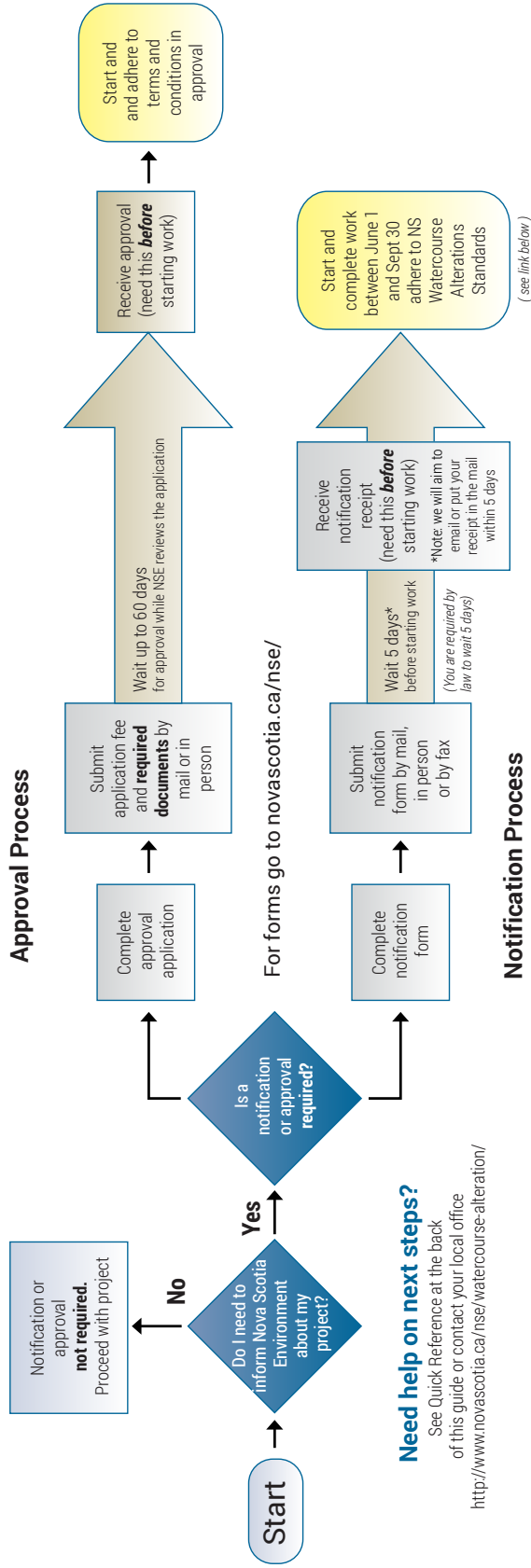
Important legal definitions

Watercourse means the bed and shore of every river, stream, lake, creek, pond, spring, lagoon, or other natural body of water – whether it contains water or not – and the water therein, within the jurisdiction of the province. It also includes all groundwater.

Bank means the portion of a watercourse between the ordinary high-water mark and the boundary of the watercourse in its fullest natural state, but does not include any area of overflow onto a flood plain.

Bed means the portion of a watercourse that is commonly submerged in water.

How the process works



Need help on next steps?
 See Quick Reference at the back of this guide or contact your local office of this guide or contact your local office <http://www.novascotia.ca/nse/watercourse-alteration/>

Nova Scotia Watercourse Alterations Standard
 Requirements in the Nova Scotia Watercourse Alterations Standard must be followed for watercourse alterations under a notification.
 See the standards here: www.novascotia.ca/nse/watercourse-alteration/

Wetland means land commonly referred to as a marsh, swamp, fen, or bog that either periodically or permanently has a water table at, near, or above the land's surface or that is saturated with water and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation (plants that grow partly or wholly in water), and biological activities adapted to wet conditions.

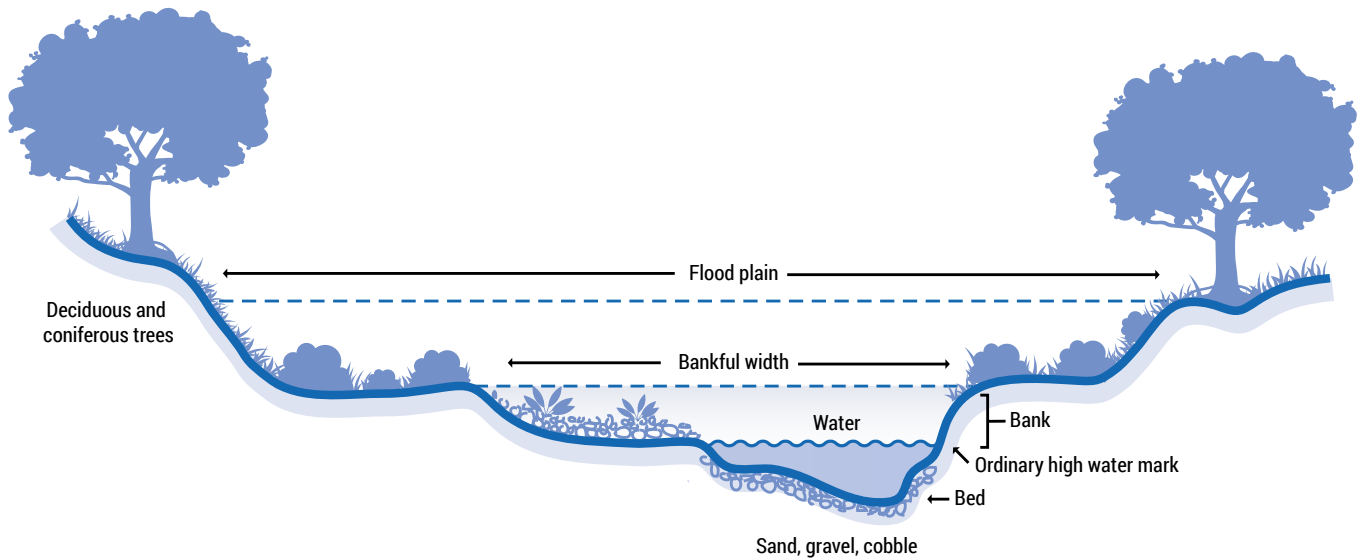
A few tips on identifying watercourses

- If a watercourse is drawn on a National Topographic Series (NTS) map, it is considered a watercourse by Nova Scotia Environment.
- If air photos less than 40 years old show evidence of a watercourse, it may be a watercourse. Evidence would include visible water, visible stream channel (riffles, eroded areas, bars, rapids, pools, etc.), and vegetation that indicates a watercourse.
- Look for a clearly defined stream channel. Is there a mineral soil channel? Is there sand, gravel, and/or cobbles evident in a continuous pattern over a continuous length, with little to no vegetation? Is there an indication that water has flowed in a path or channel for a length of time and at a rate sufficient to erode a channel or pathway? Is there water flowing in this channel? Are there pools, riffles, or rapids? Are there aquatic animals, insects, or fish? Are there aquatic plants? If two or more of these characteristics are present, it is a watercourse, unless otherwise determined by Nova Scotia Environment.

Be aware that it is possible for a watercourse to disappear underground for a certain distance and reappear elsewhere. Some small streams may course through, or turn into, wetland in places. You will need to walk some distance up and downstream to view conditions as part of a determination and not be confined to evidence at one location.

Does the watercourse now exist in its present channel as a result of developments in the past, and has the watercourse established itself as habitat for aquatic plants and animals? There are lakes, for example, in the province that have been created or enhanced by man-made impoundments. If a watercourse has been altered by ditching, dredging, or other types of development, such as a stream that has been dredged or straightened, it is still a watercourse. If a channel has been diverted and the original channel is gone or dried up, the existing channel is a watercourse nonetheless.

Watercourse Features



A watercourse does not include non-natural bodies of water. A ditch for a highway, forestry road, or agricultural drainage, or ponds created by humans, are not watercourses.

Wetlands are also defined in the Environment Act. If any alteration of a wetland is being contemplated, refer to novascotia.ca/nse/wetland.

When Do I Need to Submit Information to Nova Scotia Environment?

There is no submission requirement for work that does not alter the watercourse.

The Activities Designation Regulations designate activities that require an approval from Nova Scotia Environment or a notification to the department. The Quick Reference at the back of this guide provides an overview of the requirements to help you determine your course of action – whether you need to notify the department or if you require an approval for some common types of higher-risk watercourse alterations.

First Choice – Do No Harm

There are levels to the environmental risk involved in any watercourse alteration. We encourage you to consider the column

QUICK REFERENCE: WATERCOURSE ALTERATION ACTIVITIES

Nova Scotia Environment's regulatory requirements for watercourse alterations came into effect on October 1, 2014. This grid describes submission requirements for various types of work. It is for guidance only. For more information and to see the Activities Designation Regulations, visit <http://novascotia.ca/nse/watercourse-alteration/>.

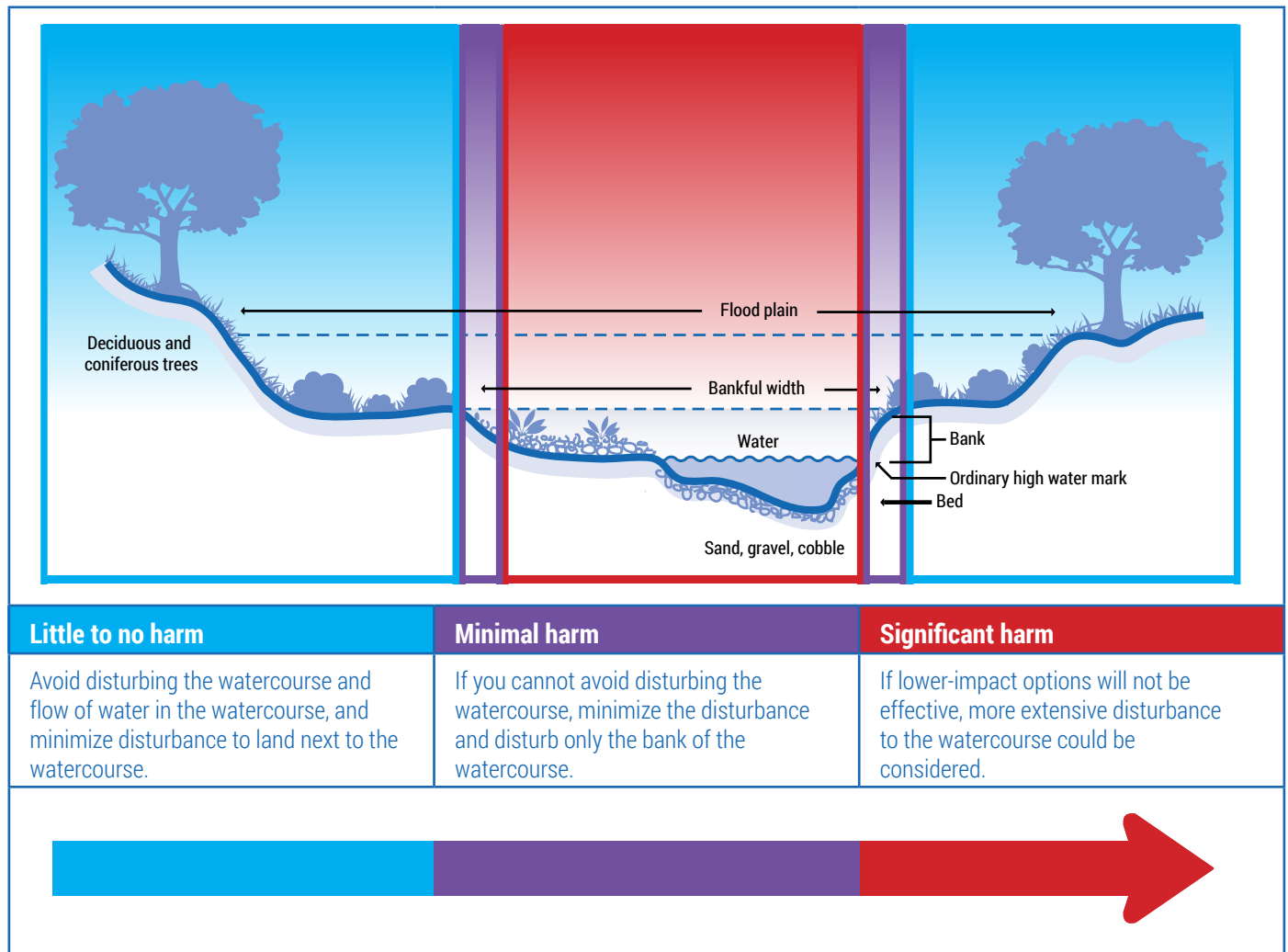
Watercourse Alteration Submission Requirements

Activity	No Submission	Notification Required	Approval Required
cutback or closed bottom openings for roads, railroad, trails, or footpath crossings	no option	watercourse has slope of less than 2:1 and structure is designed by certified sign; or watercourse has slope of less than 1:6 and structure is designed by professional engineer; and	notification conditions are received; or wetland is affected
new or modification		watercourse has slope of less than 2:1 and structure is designed by professional engineer; and	watercourse above crossing has a less than 2:1 and

Quick Reference

The Quick Reference at the back of this guide provides an overview of the requirements to help you determine your course of action.

Risk to the environment increases



Forms and Help

For a notification form or application for approval, go to www.novascotia.ca/nse/watercourse-alteration.

Also see [Guidance for Completing a Notification Form](#) on the same web page. If you need more help, call the local Nova Scotia Environment office <http://www.novascotia.ca/nse/dept/offices.asp>.

titled “no submission” in the Quick Reference. The activities described in this column are the best way to avoid damaging the watercourse, and they do not require a notification to the department or an application for approval.

Risk to the environment increases with different activities. Anyone involved in a project needs to understand the levels of risk and possible damage with each decision.

In this guide, you will find explanations of good practices for common activities near or in watercourses that do not require a notification or an approval. Good preventive practices are still needed even though notification or approval is not required. Good practices will lower the risk of harming aquatic ecosystems and affecting other watercourse users.

WATERFRONT ACTIVITIES

Protecting Lakes, Rivers, and Other Freshwater Bodies

Waterfront development on freshwater watercourses can be damaging to aquatic life and its habitats. The best way to prevent harm is to leave the land next to the water undisturbed. You may, however, want to make some changes to allow access to the lake, river, or other water body.

Importance of Riparian Lands and Shorelines

To protect important natural ecosystems, we need to protect more than just the watercourse itself. Riparian zones are areas adjacent to watercourses, including the banks. These zones are ecologically diverse. They provide a buffer that protects the watercourse from the impacts of lawns and gardens, agriculture, forestry, and development. They also reduce the severity of flooding.

Some benefits of riparian zones:

- provide travel corridors for wildlife
- provide shade – reducing water temperature in watercourses
- provide food for fish -- contribute insects and detritus, such as leaf litter, to the watercourse
- provide shelter – tall grasses, shrubs, and trees, for instance, protect fish from predators
- provide erosion control – root systems from vegetation help stabilize banks and intercept runoff, protecting fish habitat from the harmful effects of sedimentation
- provide filtration – vegetation and root systems sift out pollutants, such as pesticides, bacteria, fertilizers, heavy metals, sediment, and hydrocarbons

Species at Risk

Species at risk are often associated with watercourses, wetlands, and land next to watercourses.

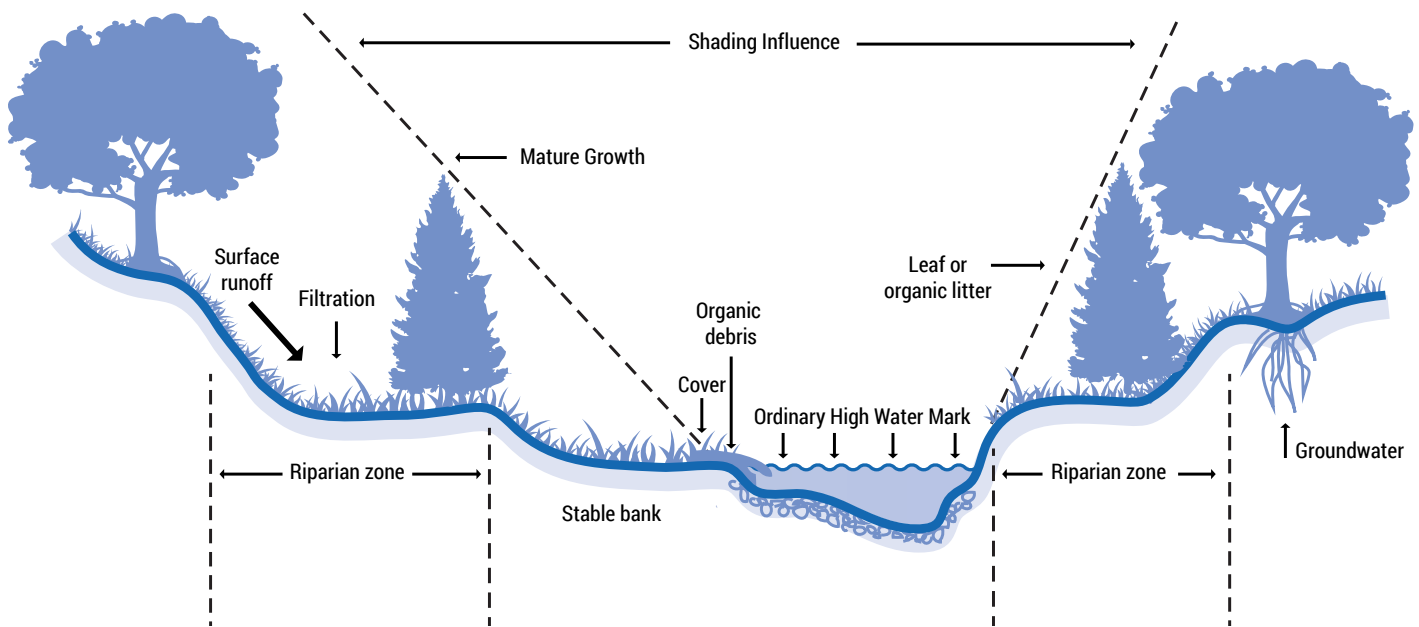
To ensure protection of endangered species, refer to

www.speciesatrisk.ca and contact the regional biologist with the Nova Scotia Department of Natural Resources. Also see www.novascotia.ca/natr/wildlife/biodiversity/species-list.asp

Healthy Lakes and Wetlands for Tomorrow: A Landowner Stewardship Guide for Species at Risk in Nova Scotia is available from the Landowner Stewardship Guide link at www.speciesatrisk.ca.

For critical habitat identified for a federal wildlife species that is classified as endangered, threatened, or of special concern as part of a Recovery Strategy, Action Plan, or Management Plan under the Species at Risk Act (SARA), see <http://www.sararegistry.gc.ca/>. For aquatic species at risk in Canadian waters see <http://www.dfo-mpo.gc.ca/species-especes/index-eng.htm>. For more information, contact Fisheries and Oceans Canada, Species at Risk Coordination Office at <http://www.dfo-mpo.gc.ca/species-especes/regions/Maritimes/maritimes-contact-eng.htm>.

Importance of Riparian Zones



Municipal By-laws

Some municipalities, such as Halifax Regional Municipality, have requirements or restrictions on riparian lands. You can learn more by searching the subject at this site: <http://www.halifax.ca/PlanHRM/>

Avoiding Environmental Damage

Avoid disturbing species at risk and habitat for species at risk. There are many species at risk in Nova Scotia, and many of them are associated with shorelines of watercourses and wetlands.

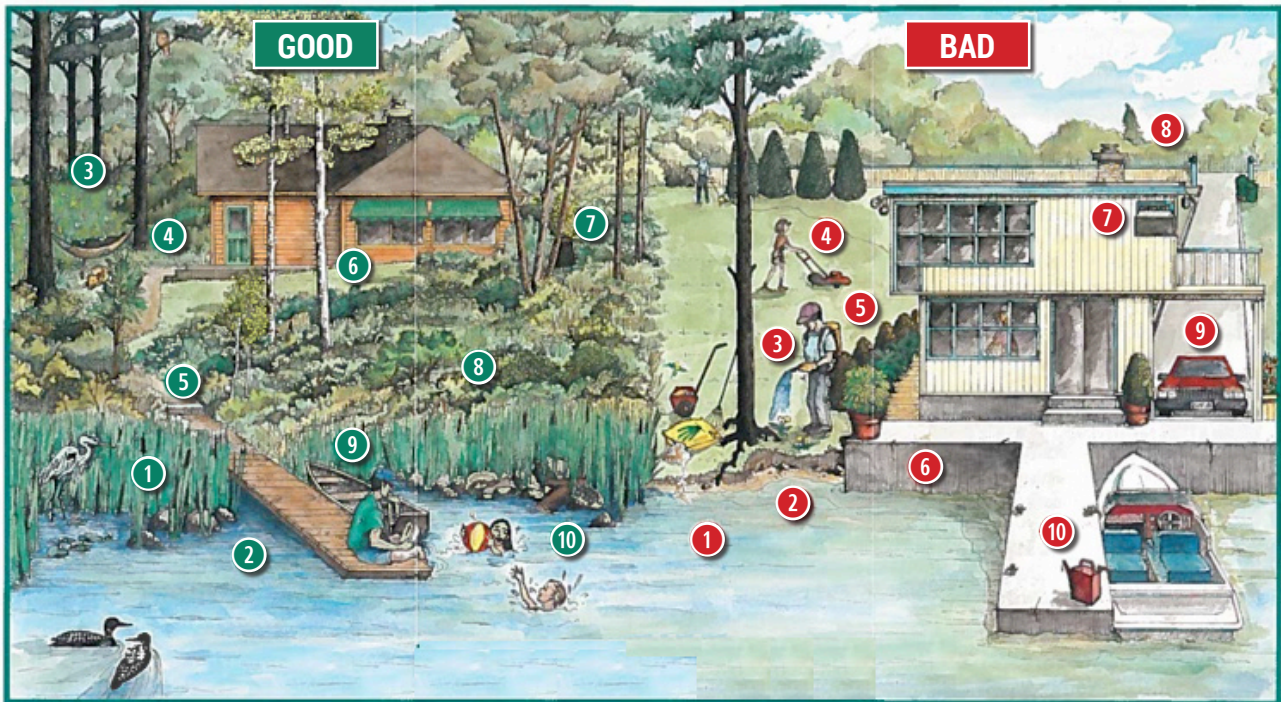
Maintain natural vegetation in the riparian zone of the watercourse, and limit access to the watercourse.

Avoid installing or constructing a structure that covers or disturbs the bed of the watercourse, and avoid dredging the watercourse to deepen areas next to a wharf or dock.

Disturbance of the bed in shallow waters or bordering the banks of a watercourse will threaten the sensitive littoral zone of the watercourse, a highly productive area for aquatic life. Adding material to or removing material from the bed of a watercourse will damage such areas, dangerously disrupting interconnections between living organisms and their habitat.

Structures in a watercourse or changes to a watercourse are difficult and costly to maintain. For example, a permanent solid structure used for a wharf will require significant and ongoing work to deal with damage resulting from ice and wave action. Using temporary structures that are removed from the water before winter may save you money over the long term.

Shoreline development practices



Good Side

1. Natural shoreline makes good wildlife habitat
2. Small floating docks will not intrude on the riparian zone and natural surroundings
3. Septic system and "meadow" far from the shore.
4. Less work and more relaxing time
5. Narrow mulched footpath causes no erosion
6. Natural air conditioning with a view, trimmed trees and adjustable awnings
7. Composting kitchen scraps for good soil fertility
8. Well-dressed waterfront full of native plants
9. Small motorboat for water travel, fishing, touring
10. Good water quality at the end of the dock

Bad Side

1. Fertilizer spills and runoff from the lawn
2. Erosion of bare shorelines
3. Excessive use of pesticides/herbicides near the water
4. Removal of natural vegetation— more work and more runoff
5. Ornamental shrubs need a lot of chemical help to survive
6. Hardened shoreline eliminates the natural filter and degrades water quality
7. On a bare lot, the air conditioner works overtime
8. Building too close to the water and out-of-character with setting
9. Paved lane carries pollution-laden runoff right into the lake
10. Boats and the environment: noise, wake, gas/oil consumption, spillage

Wharves (and Docks)

While maintaining a natural shoreline, you may want a wharf or dock to access the lake or river.

Little to no harm to watercourse

One way to avoid environmental harm is by installing a seasonal floating wharf, a seasonal wharf on posts, or a combination of the two that does not disturb the bed and bank of the watercourse. Cantilevered docks are also a good option. These types of wharves or docks do not alter habitat in the littoral zone of the watercourse or encourage bank erosion and they help maintain natural water currents and flow.

These seasonal structures can be removed for the winter, preventing damage to the structure and avoiding scouring the watercourse bed. A wharf can be anchored to the shore in various ways that do not harm the bank, such as bolting into large rocks or placing anchoring “feet” on the shore.

Sharing a dock or wharf with a neighbour is another way to reduce damage to the watercourse. Also, remember that wharves are not always needed for enjoyment of waterfront property.

Because seasonal structures present low risk to the watercourse, you do not need to submit any paperwork to Nova Scotia Environment.

More harm to watercourse

If you wish to construct a structure that alters the bed or bank of the watercourse, a notification or approval is required. For further detail, refer to the Quick Reference: Watercourse Alteration Activities at the back of this document, and also refer to the Watercourse Alterations Standard.

Consider these details when constructing a wharf or dock

Minimize the size of the wharf or dock.

Floating structures must be prevented from grounding during low-water periods. Grounding will scour the watercourse and will change the shape of the bed and distribution of materials due to altered water currents in the area of the structure.

Access ramps and walkways must be elevated above the surface of the water and should not be wider than 1.5 m.

If any part of the dock or wharf is on poles, do not embed the poles in the bed of the watercourse. The poles should be a minimum of 1.2 m apart.

Use materials that will not be harmful to aquatic life. The use of untreated lumber is probably the best environmental option. See the section in this guide on materials in or near watercourses. Old metal, which may introduce paint chips to the watercourse, and old drums that may have contained a toxic substance should not be

used. Also avoid the use of expanded polystyrene (such as Styrofoam), which can break up, enter the watercourse, and be ingested by aquatic life. Closed-cell extruded polystyrene is better than Styrofoam but should still be permanently encased inside the structure.

Ensure that your design will allow the structure to be removed every fall before high water and freeze-up. Wharves that are not removed will move or be damaged by ice.

For more ideas, see *Healthy Lakes and Wetlands for Tomorrow: A landowner Stewardship Guide for Species at Risk in Nova Scotia* at www.speciesatrisk.ca.

Boat Launch

Boat launches and slipways are areas along the bank of watercourses used to load and unload boats from trailers. To aid in preventing silt from entering the watercourse, the objective is to provide launch areas that have minimal disturbance on the watercourse and are stable.

Little to no harm to watercourse

To reduce environmental impact, the number of boat launches on a lake or other watercourse should be minimized.

The following suggestions are preferable to having a boat launch at every property surrounding a lake:

- Have a community boat launch or launch area open to the public.
- Share a launch with a neighbour or several neighbours.

More harm to watercourse

Boat launches and slipways should be located at stable sites along a watercourse to ensure that shoreline erosion and sedimentation can be controlled. Approaches should be fairly flat to reduce the chances of vehicle tires spinning and destabilizing the travel surface, and to minimize the excavation of material beside the watercourse and the shore or bank of the watercourse.

Minimize the amount of disturbance next to watercourses. This will reduce the risk of sediment entering the watercourse.

Maintain natural vegetation on the banks and next to the watercourse to maintain habitat for plant and animal life and to maintain wildlife corridors.

Absolutely avoid wet areas and areas with steep terrain.

Significant harm to watercourse

It is not permitted to place any gravel, concrete, or other material in the watercourse except under very exceptional circumstances, and only with an approval from Nova Scotia Environment.

Erosion Protection / Bank Stabilization

Maintaining the natural bank and vegetation along watercourses will in most cases prevent excessive erosion of the bank.

When vegetation, such as trees, bushes, and grasses, or rock is removed, the scour and erosive forces can have devastating impacts that can be difficult and expensive to remedy.

Maintaining vegetation is also important because it stabilizes the soil and regulates water temperature and provides shade, cover, and food for fish and aquatic insects as well as wildlife along the shoreline. Vegetation also promotes terrestrial or aquatic habitat along the banks of the watercourse and in the watercourse.

If there is no evidence of erosion, the best course of action is to maintain the natural bank and vegetation along watercourses.

If erosion is evident, there are means of erosion protection:

- vegetative measures
- structural measures such as rip-rap (rock or stone), wire baskets, timber crib, retaining walls
- combination of rip-rap and vegetation

The method used depends on the magnitude of the erosive forces and economic feasibility as well as the availability of materials in the area.

Little to no harm to watercourse

Vegetation, such as trees, shrubs, vines, grasses, other plants, or combinations of different species, can be used to stabilize and protect the banks of a watercourse from the erosive action of waves, ice, and debris within the watercourse. Other erosion control measures should be avoided if vegetation can be used,

or they should be used in combination with vegetation whenever possible.

The degree of erosion protection offered by vegetative measures increases as the plants and root systems grow and spread.

Vegetative protection is less costly than other measures and requires little or no maintenance once established.

Plants chosen should require little maintenance and be suited for the soil and climate conditions of the site. Conditions may vary greatly across the province, and plans for stabilization must be adapted to each specific site. Plants must be capable of having dense growth and fibrous roots, which provide complete soil cover. The selected species should be easy to plant, fast growing, requiring little or no irrigation, fertilizer, or maintenance.

Plants should be native to the area. Examples of plants to use include alders, willows, poplars, shrubs, clover, timothy, and trefoil.

More harm to watercourse

Structural methods of erosion control at the bank of a watercourse requires the submission of a notification or an application for approval, depending on the extent of the work. For further guidance, see the Quick Reference: Watercourse Alteration Activities at the back of this guide.

Other methods include structural measures such as rip-rap, wire baskets, timber cribs, steel or concrete, and logs. The success of these structures in controlling erosion very much depends on the installation practices. Extensive bank stabilization, especially on flowing watercourses, requires careful engineering design and installation to avoid unintended scour and channel modification.

Water Intakes

A water intake is used to withdraw water from a watercourse for the purpose of irrigation, manufacturing, firefighting, aquaculture facilities, or other uses. The size of intake and extent of work to install varies greatly depending on the project.

Approval for water withdrawal

An approval from Nova Scotia Environment is required if you are withdrawing or diverting water in a volume greater than 23,000 litres per day from a source of surface water or groundwater, or

storing water in a volume of 25,000 m³ or more. If the withdrawal is a non-recurring use of water from the same watercourse for a total period of less than two weeks in the same year, an approval is not required.

Little to no harm to watercourse

Minimize the disturbance to the watercourse. If the withdrawal is seasonal and temporary (and in a secure area), you may be able to place the waterline over the bank and into the watercourse without any alteration to the watercourse.

More harm to watercourse

For permanent installations, you may need to trench through the bank of the watercourse if the depth of water at the bank is sufficient to prevent freezing of a permanent waterline or piping in the winter. A notification to Nova Scotia Environment is required for this work if there is an alteration to the bank of the watercourse. Trenching the bed of a watercourse or creating a sump in the watercourse should be avoided when possible. Alterations to the bed of the watercourse requires an approval.

Whether the water is withdrawn from a flowing watercourse such as a stream, creek, river, or brook, or a standing body of water such as a lake or a pond, the following concerns must be addressed before the project begins:

- Water withdrawal must not cause any fish or other aquatic life to be removed from their habitat. The intake must be screened to prevent aquatic life from entering the structure and to avoid killing fish. Sufficient screen area must be provided with openings to ensure that approach velocities do not impinge (fish is held in contact with the screen) or entrain (fish is drawn into the intake) fish. For screening guidance, see www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/measures-mesures-eng.html.
- The volume of water remaining in the watercourse must be adequate for the maintenance of aquatic life and fish passage.
- Water intake structures must be installed so that they do not present an obstruction to migrating fish.

CROSSING A WATERCOURSE

Careful planning and design can minimize the impact up and downstream.

Nova Scotians need to cross watercourses for many reasons, whether for a public road, driveway, access to agricultural land, access to woodlots, footpaths, etc. Fording of watercourses with vehicles should be avoided, to prevent damage to the bed and banks of the watercourse, to avoid sedimentation, and to avoid any release of petroleum products into the aquatic habitat.

Generally, the types of structures used in watercourse crossings include

- closed-bottom culverts, such as pipe culverts, box culverts, and pipe arches
- open-bottom structures, such as bridges, bottomless arch structures, and open-bottom box culverts
- temporary structures spanning the watercourse

All watercourse crossings affect the environment to some degree. Yet poorly selected and designed watercourse crossings can result in inadequate capacity, leading to flooding and to increased velocity or blockage followed by flooding, erosion, and washouts. The results can be damaging to aquatic habitat and property, endangering human life and preventing the use of upstream habitat. Effects of the crossings on riparian lands (flooding and scour, for example) can degrade habitat of riparian plant and animal species.

All watercourse crossings should be selected and designed to

- minimize any change to the water flow

Maintain Structures in Watercourses

Maintenance of crossing structures is very important to avoid blocking water flow. If water flow is blocked or the direction of flow is changed by a deteriorating or collapsed structure or by accumulated natural debris, scour of the natural watercourse can occur or the structure can be washed out. Blockages must be removed prior to the redirection of water flow or washout.

Pipe Culverts

Pipe culverts should be avoided for the following reasons:

- They are susceptible to ice and debris blockage and therefore at risk of washing out.
- They are difficult to install properly in order to maintain fish passage and the passage of other aquatic life. Movement of aquatic life is necessary to find food, to reach habitat suitable for reproduction, and to avoid extreme conditions (such as increased water temperature).
- They reduce the cross-sectional area, potentially increasing water velocity. This may cause undermining of the structure, scour of the streambed, and disruption of fish migration.
- They eliminate a portion of the natural watercourse.

Compared to pipe culverts, open-bottom structures can be a more cost-effective option over the lifespan of the structure. The costs of maintenance and replacement of pipe culverts tend to be higher.

- preserve aquatic habitat and fish passage
- retain natural stream morphology – with bank-to-bank width consistent with natural watercourse, similar substrate material as in surroundings, and maintaining existing meander pattern and pool/riffle sequence
- retain water depth and velocity comparable to conditions upstream and downstream

Best Crossing Structures: Bridges or Other Open-Bottom Structures

Bridges and open-bottom culverts, such as pipe arches or timber boxes, generally have less impact on aquatic habitat than pipe culverts and are the preferred method for providing access across a watercourse. Open-bottom structures also tend to have fewer debris blockages, thereby reducing maintenance work.

Open-bottom structures help protect the natural features of the watercourse and help maintain the habitat for many species of vertebrates and invertebrates living in or near the watercourse. Allowing unrestricted movement through the crossing and within the watercourse and watershed is essential for access to feeding areas and to breeding and spawning areas.

To minimize the impacts to a watercourse, construct or install open-bottom structures or temporary spans that

- do not require any excavation or disturbance of the bed or bank
- do not alter the water flow
- are in alignment with the watercourse and are in straight sections of the watercourse
- allow passage of flood water without changing the flooding of riparian lands, nor cause scour of the watercourse
- allow for the free passage of fish
- do not affect any wetland, such as wetland riparian areas or floodplains

The approaches to the crossing are as important as the crossing structure itself in preventing damage to the watercourse. The

approaches must be stable and must be able to withstand vehicle traffic without rutting and subsequent sedimentation to the watercourse.

Consider these details if constructing a crossing that completely spans a watercourse

Completely spanning the watercourse means that the structure itself, and the installation process, do not alter the bank or bed of the watercourse. The natural stream remains completely untouched. The installation of the structure includes any excavation needed to place the footings or abutments and the placement of the structure and any erosion protection material such as rock. Also, the use of the structure must not alter the banks or bed of the stream or the water flow. These types of structures do not require a submission to Nova Scotia Environment.

- Align the abutments or footings with the existing banks of the stream. Avoid placing the structure in a location where the stream may erode away the bank of the watercourse and undermine your structure.
- Abutments or footings should be installed on a solid foundation and be below the line of scour of the watercourse (the deepest channel of flow). This may prevent a wash out of your structure if the natural stream bank is eroded.
- Water must be able to pass under the bridge or open arch structure during very high flows and not cause flooding upstream or cause scour downstream. The water flow must not be altered.
- Avoid disturbing the bed or bank of the watercourse. If the design includes altering the bank or the bed of the watercourse, a notification or approval is required.
- A structure must be able to carry the intended load, to avoid compromising the structure and causing blockages and scour in the stream. When crossings are no longer needed, they should be removed.
- Avoid crossing close to the outlets of lakes, ponds, and wetlands. Avoid tidal areas.

Climate Change

Climate change is leading to increased risk of flooding, as extreme precipitation events become more frequent, erosion and sedimentation affect the watercourse flow, and sea level rise and storm surge endanger coastal communities. Flooding is of particular concern when it intersects with communities, putting people's health and prosperity at risk.

When considering watercourse alterations, it is important to design the alteration with climate change in mind. Future climate conditions can have a significant impact on the function, maintenance, and longevity of the alteration and can cause serious impacts elsewhere, if not designed properly. The most up-to-date climate scenarios for Nova Scotia should be used for understanding future climate conditions and what that means for the alteration. Learn more at www.novascotia.ca/nse/climate-change/.

Temporary and Portable Bridges

A temporary bridge is a portable structure that completely spans the watercourse and remains in place for a limited period of time, such as for a summer season. It can be a prefabricated structure, or it can be constructed for a specific crossing site and, if done properly, have minimal environmental impact.

Temporary bridges are good options when permanent bridges are not required or in areas that are shown to be environmentally sensitive and cannot be avoided. They are generally used to

- provide temporary access across a watercourse for short-term use
- provide heavy equipment access to a crossing under construction
- maintain traffic flow for the public while an existing structure is being repaired or replaced

Constructing a Temporary Crossing

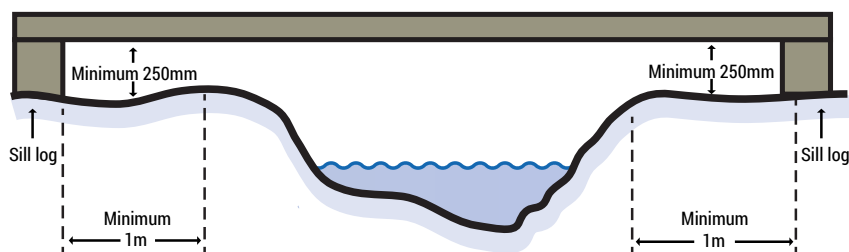
Construction of a temporary crossing should be influenced by the time of year during which it is to be installed and the length of time that it will be in use. Installation and maintenance must be considered carefully to avoid environmental damage.

Fording and temporary pipe culverts should not be used because their installation results in impact to aquatic habitat and disturbance to the bed and banks, whereas a properly built portable bridge will avoid damaging the watercourse. Forging requires an approval if there is a disturbance to the bed of the watercourse, and a pipe culvert requires a notification or an approval (see Quick Reference: Watercourse Alteration Activities).

- Temporary crossings and approaches to the crossing must be stable and be able to withstand the planned use. For example, approaches must be stabilized to prevent rutting and subsequent sedimentation of the watercourse, and the structure and its supports cannot sink into the bank of the watercourse.
- No disturbance of the bed or banks of the watercourse is to occur. The bridge must completely span the watercourse,

with the sills or abutments placed on firm, stable ground back from the top of the bank (minimum of 1 m) so the bank is not destabilized and affected.

- No travelling can be allowed over a temporary structure unless approaches to the crossing are stable and the structure has a deck that will prevent debris from falling into the watercourse.
- The structure must be lifted into place – rather than dragging it – and removed in the same manner.
- The structure must not touch the water surface during operation and must be designed to carry intended loads.



Consider these details for temporary crossings

The structure should not touch the water surface during operation.

If using sill logs, place them parallel to the watercourse, to support the stringers on. Sill logs should be at least 4 m long and have a minimum diameter of 250 mm.

Flood waters are to pass under the bridge deck, avoiding the alteration of water flow and scour of the banks of the watercourse and avoiding washouts. The deck height should be a minimum of 250 mm above the bank height and there should be at least 450 mm between the water surface and the bottom of the bridge at the time of installation.*

*Hydraulic design for temporary structures should be based on a minimum of 1:2 year storm event based on the average flows for the period of time that the structure is to be installed. If the minimum criterion mentioned is not sufficient to allow the waters of the 1:2 year rainfall event, then additional clearance is required between the deck and water surface in order to prevent the structure from altering the water flow of the watercourse.

Bridges composed of a single sill log on each side of the watercourse have spacers attached to the underside of the stringers to maintain the span between the sill logs.

The width of the structure needs to be one lane.

Fully enclose bridge decks and keep free of erodible soil. Remove any soil on the deck in a manner that ensures it will not enter the watercourse.

Attach decking to make the structure more rigid and to prevent debris generated during travel or maintenance from entering the watercourse.

If there are unstable (muddy) or potentially unstable traction areas, once support logs are installed across the watercourse, use heavy-gauge plastic, geotextile, or other suitable material on the supports before the decking material is installed to prevent debris and mud from falling through the cracks of the deck (if there is spacing between decking) into the watercourse as vehicles cross.

Stable approach roads on both sides of the crossing prevent erosion. Brush mats or clean granular material, unless bedrock is exposed, is suitable to provide protection from rutting.

Stabilization extends back at least 30 m (100 ft.) on either side of the crossing.

Structure backfill material and fill for the roadbed must be clean coarse granular aggregate material, durable, non-ore-bearing, non-watercourse derived, and non-toxic to aquatic life.

Rock material must not be sulphide-bearing aggregate.

Use erosion and sedimentation control methods to ensure that silt or other harmful materials or substances are not discharged into any watercourse.

Maintain the structure to ensure that material does not build up on the runners/decking and that the stream banks remain stable.

For forestry operations, if using a cable skidder or dragging tree-length logs via a cable/grapple/clam bunk-type system, temporary structures should have vertical

posts along the side of the structure to ensure that trees are not being dragged through the watercourse when crossing.

Temporary Bridge Removal

When the temporary structure is no longer needed, the deck of the structure and approach materials are to be removed from around the watercourse so that the riparian area closely resembles its pre-construction cross-section. All the exposed erodible soil must be stabilized against erosion, either by rip-rapping or by hydro-seeding or seeding by conventional means and blanketing with straw/hay mulch.

- Clean off bridge surface. Dispose of material in an area where it will not migrate back to the watercourse.
- Completely remove the deck of the crossing structure and all construction materials from the crossing location, except the sill logs or abutment material.
- Sill logs and any other abutment material remain undisturbed during and after removal. The removal of abutments and sill will cause more damage than leaving them embedded.
- Stabilize the approaches and the banks immediately upon removal, with rock, erosion control matting, hydro-seeding or seeding and mulch (such as hay or straw).
- Use sediment and erosion control measures on the approaches.
- If the bed or bank of the watercourse has been affected, work must be undertaken to mitigate the impact, and Nova Scotia Environment must be notified.

REMOVAL OF MATERIAL FROM A WATERCOURSE

If it's not causing harm, leave it alone.

The removal of material from a watercourse may be any of the following:

- Removal of foreign material (such as recently deposited garbage) that is not embedded in the natural material of the watercourse
- Removal of foreign material (such as old vehicles, fridges, shopping carts) that is embedded in the natural material of the watercourse, where silt, gravel, etc. has been deposited by water flow around or over the material
- Dredging, removing, or moving natural substrate material in the watercourse

Little to no harm to watercourse

If the foreign material has been recently deposited and it is not embedded in the watercourse substrate, the material can be removed. Consideration of the removal technique, depending on the size of the material, is important. The material may be lifted out by hand, equipment, or machinery. The material is not to be dragged, dredged, or scraped out of the watercourse such that the natural watercourse is disturbed. Vehicles, such as excavators or trucks, are not to enter the watercourse.

More harm to environment

The removal of major obstructions or foreign material embedded in the watercourse should only be carried out when the benefits of the removal exceed the cumulative effects of the associated environmental impacts. Planning for this type of alteration must involve not only choice of machinery and timing but also an

analysis of the positive and negative environmental effects of removing the obstruction or material. These projects require an approval from Nova Scotia Environment.

Beaver Dam Removal

The Nova Scotia Department of Natural Resources must be contacted prior to the removal of beavers or beaver dams. A Nuisance Wildlife Permit is required for the destruction or removal of beavers.

Beaver dams are not to be removed under the following circumstances:

- Property damage is not demonstrated.
- The dam is on the outlet of a lake. The only exception would be if it can be demonstrated that the lower water level will be beneficial to wildlife and all property owners are supportive of the action.
- The impoundment has established a wetland that is being used by breeding waterfowl. Removal can take place only after the waterfowl broods have left.
- The Beaver Dam Removal Guidelines cannot be met. The guidelines are found in the Beaver Dam Removal Code of Practice.

For more information on the removal of beaver dams, please refer to the Beaver Dam Removal Code of Practice (NSE/ DNR/ DFO) at www.novascotia.ca/nse/wetland/docs/Beaverdam-Removal-Code-of-Practice.pdf.

In areas of recurring problems, use of beaver dam management devices such as pond levellers and culvert screening devices should be considered. These devices must maintain both water flow and fish passage. The careful selection of a watercourse crossing structure may reduce the occurrence of beaver dam blockages. Bridges and open-bottom culverts are less likely to be dammed as often as circular culverts.

Consider these details if removing a beaver dam

The beaver(s) must be removed before undertaking the removal of the beaver dam. Their removal must be done in compliance with all acts and regulations. Beavers may be destroyed or removed only as authorized under a **Nuisance Wildlife Permit** issued by Nova Scotia Department of Natural Resources.

Non-mechanical (by hand) removal of beaver dams is the preferred method. This method minimizes disturbances to the bed and banks of the watercourse and should be considered wherever possible.

Removal by hand can include using hand tools and winching the material out. No heavy equipment will be allowed in the water body or on its banks to do work. Material may be cabled or chained out of the channel by machinery or equipment stationed a minimum safe distance of 15 m from the immediately adjacent stream bank.

Removal of dams during the period from October 1 to May 31 should be avoided in order to reduce the risk of sediment transport downstream when fish eggs and juvenile fish are in the gravel.

Removal of the beaver dam will be limited to the debris used to build the structure. Original watercourse bed and bank material may not be removed or disturbed. If an alteration is planned, a **Watercourse Alteration Approval** must be obtained from Nova Scotia Environment before undertaking the work.

The pond should be drained by pumping down or siphoning. All water should be released into the same watercourse, downstream of the dam. This results in a reduced potential for suspended sediments, which is important for fish residing in the watercourse. If there is any silt-laden water, it should be directed away from the watercourse into heavily vegetated areas, settling ponds, or other filtering devices for treatment prior to entering any watercourses.

The impounded water should be released over an extended period so as to minimize silt flushing from the impounded area and to reduce channel erosion downstream due to the increased discharge and water velocities. The maximum allowable depth of water spilling over the structure at the drainage point is 10 cm. The width of the opening created is to be no greater than the width of the watercourse downstream of the dam. It is recommended that it take a minimum of 1 day per 0.5 ha of ponded surface area to drain the impoundment.

Any fish that become trapped in isolated pools or stranded in newly flooded areas are to be relocated to the main channel of the watercourse. A licence to collect and move fish may be required and obtained from DFO prior to the fish rescue. Please contact DFO through the National Online Licensing System at www.dfo-mpo.gc.ca/index-eng.htm.

In areas where beaver dams are recurring problems, it is recommended that culvert screens or guards be used.

Debris removed from the beaver dam must be placed above the high-water mark and disposed of in such a way that it does not get washed back into the watercourse by flood waters.

Once the pond has been drained, the exposed sediment should be seeded and mulched (e.g., blanketed with hay or straw) for stabilization. This will help reduce the amount of sediment washed downstream in subsequent runoff events. Revegetation by planting native trees and shrubs is important for restoring riparian areas.

If there is insufficient time in the growing season to germinate seeds, exposed soil must be stabilized to prevent erosion and revegetated the following spring.

Dredging or Removal of Natural Material from a Watercourse

Significant harm to watercourse

The possible negative consequences of dredging or removal of natural material from a watercourse can be significant. This type of activity has the potential to alter or destroy fish and fish habitat, negatively affect water quality and have an impact on private property. Dredging and removal of material from the watercourse should be avoided.

If dredging is absolutely necessary, an approval is required from Nova Scotia Environment. Every dredging proposal is unique, and the possible impacts must be carefully considered at the design stage, taking into account the potential for environmental impact of the dredging site and the disposal site. Consideration must also be given to neighbouring properties and other activities such as recreational and commercial operations.

BEST PRACTICES FOR ALL WORK IN OR NEAR A WATERCOURSE

Timing for Work

The best time to do work in or close to a watercourse is between June 1 and September 30.

The reason for this timing is that carrying out in-stream work at low flows minimizes potential impacts to the aquatic ecosystem and to other users, such as for recreational or commercial.

Care must be taken at all times to avoid impacts to the watercourse. Preventing sedimentation to the watercourse is a primary concern. Controlling erosion and sedimentation is difficult during seasons with prolonged rainfall events, and also during times of thaw.

Also, the environmental risk of using vehicles, such as excavators and forestry equipment, is greatly increased during times when soils are saturated with water, resulting in disturbance of vegetation, exposure of soil, and rutting. All of these actions increase the risk of sedimentation.

The work period was set from June 1 to September 30 to avoid sensitive life stages (egg and fry immobility) of the main salmonid species. There are some species with sensitive time periods during the work window – so take caution to avoid serious harm if these species occur near your project area. For example, juvenile Rainbow Trout can be immobile up until the end of June.

Working between June 1 and September 30 allows you to do the following:

- Avoid sensitive periods in the life cycle of fish, such as migration or spawning. Specific conditions will vary for different areas throughout the province depending on the number and species of fish involved.
- Facilitate water control. It is easier to isolate low water flows from your work. If you work with high flows, it could lead to

Section 36(3) of the Fisheries

Act states

No person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water.

Sign of Trouble

One way to know the project is not going well is if the watercourse is discoloured due to work being done in water flow or from soil runoff during a rainfall event. Try to anticipate and prevent problems before they occur.

Make sure that at the end of the project, any exposed soil is seeded and mulched, any disturbed areas are stabilized against erosion, and vegetation along the banks is restored.

If you run into problems, talk to the expert you have involved in the project (such as the certified watercourse alteration installer) or call your local Nova Scotia Environment office.

flooding and increase the risk of introducing sediment into the watercourse.

- Re-establish vegetation more easily on the disturbed footprint bordering the construction site, as there will be adequate warm weather after your construction period.
- Stabilize and transport soil at less cost during this period. Soils are often either frozen or saturated at other times of the year, making them more difficult and costly to move.
- Plan and minimize the timing of environmental impacts caused by erosion and sedimentation so as not to coincide with periods of increased sensitivity for fish, such as spawning and egg incubation periods.

All notifications for watercourse alterations will be valid from June 1 to September 30. When a notification is submitted to Nova Scotia Environment, the expiration date will automatically be set to the next September 30. Notifications cannot be extended beyond this date. If works are anticipated to extend beyond then, an approval will be required to continue the work.

If there is no alteration to the watercourse or the water flow, work can be undertaken at other times of the year, without a submission to Nova Scotia Environment. For example,

- installing temporary bridges that entirely span the watercourse, do not affect the water flow, and have stable approaches
- maintaining structures above the ordinary high-water mark of the watercourse

Controlling Erosion and Sedimentation

Take preventive measures during construction, as nearly all construction activities close to watercourses can introduce sediment into watercourses.

Some of the most common and serious consequences of an improperly planned watercourse alteration, or work next to watercourses, are caused by erosion and sedimentation. Erosion is the physical removal or detachment of soil particles by water, ice, gravity, or wind. Sedimentation is the deposition of soil

particles that have been eroded from an exposed surface and transported by water, ice, gravity, or wind.

In a natural setting, a balance exists between erosion of soil and the deposition of it. For instance, a section of land erodes and the eroded particles are deposited downstream, or deposition occurs during a low water flow period, followed by erosion at the same location the next time high flows occur.

Most alterations involve disturbance to the banks and adjacent land, or to the bed of the watercourse, or both. The rate of erosion of disturbed surfaces can be thousands of times the rate from an undisturbed setting. The result is that the natural balance between erosion and deposition cannot be maintained, and vast quantities of sediment may end up in our watercourses.

Sediment can vary in size between fine clay and small pebbles. The amount that remains suspended in water depends on the particle size and the flow and volume of water in the watercourse. The deposition of suspended sediment occurs when the velocity of water can no longer transport the sediment.

Damage from Sedimentation

Sedimentation of watercourses is destructive to aquatic habitat whether the sediment remains suspended in the water or settles out. The following conditions are the result of excess sediment entering the watercourse:

- Suspended solids entering the watercourse may coat and abrade the body surfaces of fish, including their sensitive gill areas. It may cause them to overproduce mucus, blocking the absorption of dissolved oxygen, or accumulating on the gill surfaces, causing them to hyperventilate or smother.
- Fine particles blanket the bed of the watercourse, filling in and eliminating the interstitial spaces in the gravel beds where eggs are incubating, or where the alevins are resting and feeding, eventually smothering and killing them.
- The turbidity caused by suspended sediments prevents sunlight from reaching the bottom of the watercourse, which reduces photosynthesis in algae and rooted aquatic plants, leading to a reduced food supply for all aquatic life.

- When sediment is deposited on existing clean gravel bottoms, it makes them unsuitable for spawning or resting grounds.
- Accumulation of suspended sediment can lead to a decrease in water depth, causing overheating of the water and leading to temperatures above the acceptable ranges for fish habitat. A decrease in channel depth can worsen flooding due to narrowing of the water channel.
- Increased turbidity can cause changes in fish feeding behaviour. Since salmonids feed by sight and prey are less visible, fish could starve in affected areas.
- Fish depend on bottom-dwelling organisms for food (aquatic insect larvae and other aquatic invertebrates), which may be smothered and killed or their habitats destroyed.
- Sediment may scour and detach invertebrates and aquatic plants. Deposition of sediment can lead to movement of bed material in the watercourse.
- Culverts may become plugged with sediment or other material resulting from slope failure, leading to flooding, road washouts, and introduction of debris into the watercourse.
- Introducing sediment into a watercourse may diminish drinking-water quality and reduce channel and reservoir capacity.
- If the flow capacity is lowered by a reduction of channel capacity, the potential for flooding is increased.

Effects of Erosion

- Erosion reduces the stability of the banks of a watercourse, which could lead to slope failure and loss of adjacent property.
- Erosion of the banks of a watercourse and adjacent areas may destroy the riparian vegetation.
- Eroded soil particles can get washed into the watercourse. These particles – particularly if they originate from agricultural land – contain nitrogen, phosphorous, and other nutrients. In the watercourse, they can lead to development of thick algal blooms, reducing oxygen content and water clarity for fish.

- Thousands of dollars every year may be spent on repairing badly eroded watercourse banks, washed out roads, and blocked culverts, or on fish habitat restoration projects.

Preventive Measures

A goal of the Watercourse Alteration Program is to avoid sedimentation, thereby requiring that preventive measures be taken during the construction phases of the project. Although construction outside the bed and bank of a watercourse does not require notification or approval, the impact of this activity should be minimized or avoided through proper planning. Poor planning on activities that take place outside the bed and bank of a watercourse could have significant adverse environmental effects on the aquatic environment – on fish, invertebrates, and many other users.

Even small projects that expose soil to rain (and ice and snow melt) can cause erosion and sedimentation to watercourses. For example, soil disturbance from a landscaping project or the tracks from a machine can be enough to cause sedimentation to a watercourse during the next rainstorm.

Construction activities and large earthmoving projects accelerate erosion dramatically, mainly by exposing large areas of soil to rain and running water. If erosion is not prevented, and runoff not properly treated, the result is often serious siltation of nearby watercourses. Therefore, general principles should be used for any project and a detailed plan developed for larger projects.

If basic principles for prevention of surface erosion and sedimentation are considered at the design stages of the project, potential problems will be minimized. These principles are as follows:

- Limit the size of the disturbed area.
- Limit the time the disturbed area is exposed.
- Plan construction to coincide with the low-flow period from June 1 to September 30 of any year.
- Retain existing vegetation wherever feasible. Erosion is minimal on a surface covered with natural vegetation.

- Encourage permanent revegetation of exposed areas, and replant riparian areas above the bankfull width of the watercourse to restore fish habitat whenever possible.
- Keep clean water clean by diverting upland surface runoff away from exposed areas. Dykes and constructed swales may be used to divert runoff.
- Keep the velocity of surface runoff low. This can be accomplished by limiting the slope and gradient of disturbed areas; covering erodible soils with mulch, vegetation, or rip-rap; and constructing check dams or similar devices in constructed swales and ditches.
- All exposed soils must be covered with grass seed and mulch, and all stockpiled soil should be covered with polyethylene or contained with a sediment control fence, or mulched as a temporary solution.
- Exposed soils must be managed until all erodible soils are permanently revegetated or stabilized with geotextile or rock.
- Silt-laden water must not be pumped directly into a watercourse. It must be pumped into a settling pond, behind a silt-filtering medium, or onto an adjacent vegetated area sufficient in size to filter any water returning to the watercourse, such that the concentration of suspended solids in the watercourse does not increase more than 25 mg/l above background levels.

Materials in or Near Watercourses

Only use materials that will not negatively affect water quality in watercourses or in close proximity to watercourses.

Fresh Concrete Is Toxic

Fresh/wet/uncured concrete and concrete dust must not come into contact with water flow in the watercourse or in contact with water that will flow into a watercourse.

- Concrete used in a watercourse that has not been isolated from water flow must be pre-cast and cured away from the watercourse. Concrete blocks must be cured for at least one

week before using at a crossing site.

- Concrete used in a watercourse that has been isolated from water flow must be permitted to cure long enough prior to releasing water flow so that it does not contaminate the water after the flow is released. Concrete must be cured for at least one week prior to form removal.
- Excess, unused concrete must not be permitted to enter a watercourse.
- Wash water contaminated with concrete must not enter a watercourse. Wash all equipment well away from any watercourse or drainage way to a watercourse.

Treated Wood

Some treated wood (wood containing preservatives) cannot be used in watercourses because it contains toxic substances that can leach into the watercourse. Untreated lumber is the best choice for use in a watercourse.

- Lumber treated with creosote or pentachlorophenol (PCP) must not be used in the construction, modification, or maintenance of any part of a structure in or close to a watercourse.
- Avoid using wood pressure treated with chromated copper arsenate (e.g., Wolmanized) below the ordinary high-water mark.
- Use these wood materials below the ordinary high-water mark:
 - untreated rot-resistant timber, such as hemlock, tamarack, juniper, or cedar
 - pressure-treated alkaline copper quaternary (ACQ) or chromated copper arsenate (CCA) treated wood, if treated in accordance with CAN/CSA-080 SERIES-08 (R2012), and as described in the *Wood Preservation Specification Guide* (Ottawa, ON: Wood Preservation Canada, 2014):
http://www.woodpreservation.ca/images/pdf/wpc_specifiers_guide.pdf

See the [Quick Reference](#) at the back of this guide to determine if a notification or an application for approval to the department is required. If you are still unsure, contact your local Nova Scotia Environment office. novascotia.ca/nse/dept/offices.asp

Rock Material

Rock material used in a watercourse or next to a watercourse must be clean, coarse granular aggregate material, durable, non-ore-bearing, non-watercourse derived, and non-toxic to aquatic life.

Rock must not be sulphide bearing. Some rock, commonly referred to as slate or shale, can be sulphide bearing and can be acid generating if disturbed and exposed to air and water. Slate and shale rock can be tested to determine its acid-producing potential.

WHEN ARE EXPERTS NEEDED?

If work will involve an alteration to a watercourse, you will need to find expertise to ensure the work is completed with as little impact as possible to the aquatic ecosystem and to other users of the watercourse. If you consider the cost of a structure or an alteration over its lifespan, hiring an expert can save you money. For example, the proper sizing and installation of a culvert or other crossing structure will reduce the risk of washouts and flooding. It will also reduce maintenance costs for blockages and for replacing scour protection material.

Contact a certified Nova Scotia Watercourse Alteration Installer. For a watercourse crossing, contact a certified Nova Scotia Watercourse Alteration Sizer or professional engineer with knowledge in this area. See www.novascotia.ca/nse/watercourse-alteration for a list of certified watercourse alteration professionals.

There are many advantages to working with certified professionals, such as their

- understanding of all relevant acts, regulations, standards, and any guidelines and policies of Nova Scotia Environment and other government agencies
- consideration of best practices for environmental protection for all watercourse alteration sites and land next to the watercourse
- assistance to property owners and others in completing notification and application forms for watercourse alterations

Watercourse Alteration Installers are trained to

- plan and complete work in a manner to reduce the risk to the watercourse
- install appropriate water control measures and erosion and sedimentation controls

Protecting our watercourses means

- maintaining water quality
- maintaining channel capacity and flow
- minimizing alterations to the bank and bed of watercourses and maintaining natural features of the watercourse
- maintaining and promoting habitat for aquatic life

Restoring Fish Habitat

Restoration of fish habitat is clearly beneficial to aquatic ecosystems. It is not easy to assess and design restoration work that will improve or enhance fish habitat and not create unintended issues for aquatic habitat and other watercourse users.

Every watercourse and watershed has its own features and its own needs. The planning and design must consider habitat biology and stream hydrology and hydraulics. A notification or an approval from Nova Scotia Environment is required.

Planning Your Project

Getting good information and knowing when to bring in experts is a good starting point. Contact your local Nova Scotia Environment office for a list of Watercourse Alteration Certified Individuals. <http://novascotia.ca/nse/watercourse-alteration/>

- troubleshoot problems during work on a watercourse alteration, such as identifying issues before problems occur and making appropriate adjustments

Watercourse Alteration Sizers are trained to select the type and size of crossing structures for some crossings. A professional engineer with knowledge in this field must be involved in more complex structures, such as pipe culverts in steeper watercourses or bridges and arch structures in watercourses with large watersheds.

Bringing in Experts

What to Expect from a Watercourse Alteration Installer

A certified installer will discuss the project with a property owner and will promote best practices for work close to a watercourse. You can also discuss the best environmental options, such as how to avoid an alteration to a watercourse.

Once you have chosen an option, planning considerations include

- minimizing vegetation removal and soil disturbance next to the watercourse
- erosion control for any soil that is disturbed by the watercourse, such as supply of seed and mulch in the event of rainfall and permanent protection after work is complete
- preparing to isolate the watercourse from the work site, if excavating the bank and bed
- making sure wood, rock, and other materials used in the project are not toxic to aquatic life
- ensuring that work is completed between June 1 and September 30 and that it is not delayed once it has started

What to Expect from a Sizer or a Professional Engineer

A certified sizer or professional engineer with knowledge in this area will consider the best type of structure for the health of the watercourse and also help reduce your maintenance costs. Generally speaking, open-bottom structures are a better option because there is an opportunity to maintain natural water flows and to maintain healthy aquatic habitat. Moreover, open-bottom structures are less prone than pipe culverts to debris blockages (including beaver dams) and to flooding upstream of the structure during high flows.

Pipe culverts can be part of a good crossing but can be difficult to design and install properly to avoid affecting fish passage and to avoid changes in water flow leading to scour of the natural stream. Most culverts will have to be designed by a professional engineer.

A sizer or engineer will examine the watercourse to determine the best location for the crossing and, if installing a pipe culvert, the proper elevations for the culvert and the downstream energy dissipation pool. They will also need to calculate the proper size of the structure to accommodate a 1:100 year peak flow – in other words, to estimate the largest water flows and to design a structure to accommodate them. They will also consider the proper size and placement of erosion protection at the inlet and outlet of the crossing.

Our water resources and aquatic habitats – worth protecting

The alteration of watercourses and land nearby can have damaging impacts on aquatic ecosystems and our water resources. We hope this guide provides useful information on how you can minimize disturbances to watercourses.

If you need more information please contact the local Nova Scotia Environment office.

QUICK REFERENCE: WATERCOURSE ALTERATION ACTIVITIES

Nova Scotia Environment’s regulatory requirements for watercourse alterations came into effect on October 1, 2014. This grid describes submission requirements for various types of work. It is for guidance only. For more information and to see the Activities Designation Regulations, visit <http://novascotia.ca/nse/watercourse-alteration/>, www.novascotia.ca/nse/dept/offices.asp .

Watercourse Alteration Submission Requirements

Activity	No Submission	Notification Required	Approval Required
<p>culvert or closed-bottom crossing for roads, railbeds, trails, or footpath crossings</p> <p>new or modification</p>	<ul style="list-style-type: none"> not an option 	<ul style="list-style-type: none"> watercourse has slope of less than 0.5% and structure is designed by certified sizer, or watercourse has slope of less than 8% and structure is designed by professional engineer; and watershed above crossing site is less than 20 km²; and culvert is less than 25 m long; and work is completed between June 1 and Sept. 30 	<ul style="list-style-type: none"> notification conditions are exceeded, or wetland is altered

Activity	No Submission	Notification Required	Approval Required
<p>bridge or open-bottom crossing for roads, rail beds, trails, or footpaths</p> <p>new or modification</p>	<ul style="list-style-type: none"> if bank and bed of watercourse are not altered, and structure and associated works do not disturb watercourse <p>examples:</p> <ul style="list-style-type: none"> temporary crossings that entirely span watercourse bridges that entirely span watercourse work on bridges taking place above the ordinary high-water mark (installing decking on bridge) 	<p>bridge</p> <ul style="list-style-type: none"> span is 15 m or less, and bed of the watercourse is not altered, and abutments or associated works disturb banks of watercourse, and work is completed between June 1 and Sept. 30 <p>other open-bottom structure</p> <ul style="list-style-type: none"> span is 3600 mm or less, and arch is not more than 25 m long, and bed of watercourse is not altered, and bank of watercourse is altered, and work is completed between June 1 and Sept. 30 	<ul style="list-style-type: none"> notification conditions are exceeded, or bed of the watercourse is altered, or wetland is altered
<p>maintenance</p>	<ul style="list-style-type: none"> if maintenance is above ordinary high-water mark <p>please note: maintenance does not include modifications</p> <p>modification includes replacement, removal, or work that will change size of structure (making it larger or smaller)</p>	<ul style="list-style-type: none"> maintaining or restoring structure and work is below ordinary high-water mark, and work is completed between June 1 and Sept. 30 <p>examples: placement of rock to repair erosion protection at inlet or outlet of a culvert, or replacement of timbers on bridge abutment, and</p> <p>work is completed between June 1 and Sept. 30</p>	<ul style="list-style-type: none"> notification conditions are exceeded

Activity	No Submission	Notification Required	Approval Required
wharves, docks	<ul style="list-style-type: none"> if no excavation or disturbance is done to bed or bank <p>example: seasonal wharves that float or are on posts that rest on bed</p>	<ul style="list-style-type: none"> there is alteration of bank and alteration is less than 5 m along the bank, and work is completed between June 1 and Sept. 30, and bed is NOT altered 	<ul style="list-style-type: none"> notification conditions are exceeded <p>example: bed of watercourse is disturbed for cribwork or to drive pilings</p>
boat launches, slipways	<ul style="list-style-type: none"> not an option 	<ul style="list-style-type: none"> there is alteration of the bank and alteration is less than 5 m along the bank, and work is completed between June 1 and Sept. 30, and bed is NOT altered 	<ul style="list-style-type: none"> notification conditions are exceeded
water intakes (including dry hydrants, open loop geothermal heat pumps, lake water supplies)	<ul style="list-style-type: none"> if intake is placed on bank or bed of watercourse without any alteration or disturbance 	<ul style="list-style-type: none"> alteration of bank and alteration is less than 5 m along the bank, and work completed between June 1 and Sept. 30, and bed is NOT altered <p>example: burying pipe in bank of watercourse</p>	<ul style="list-style-type: none"> notification conditions are exceeded <p>example: if bed of watercourse is disturbed through excavation and/or infilling</p> <p>approval required if more than 23,000 L of water are withdrawn per day</p>
utility crossing (for example, pipelines or cable)	<ul style="list-style-type: none"> if there is no alteration or disturbance to bed or bank <p>example: aerial utility crossing</p>	<ul style="list-style-type: none"> alteration of bank and alteration is less than 5 m along the bank, and work is completed between June 1 and Sept. 30, and bed is NOT altered 	<ul style="list-style-type: none"> notification conditions are exceeded <p>example: if watercourse bed is disturbed</p>

Activity	No Submission	Notification Required	Approval Required
<p>removal of material from watercourse</p> <p>example: beaver dams, or foreign material</p> <p>NOTE: Always contact Nova Scotia Department of Natural Resources if you wish to remove a beaver dam</p>	<ul style="list-style-type: none"> if there is no disturbance to watercourse, especially if material has been recently deposited <p>example: if the material is removed by hand or with grapples</p>	<ul style="list-style-type: none"> not an option 	<ul style="list-style-type: none"> removal will result in disturbance to bed or bank of watercourse <p>example: if machinery is used to dig out material embedded in watercourse</p>
<p>placement of rock or other erosion protection material</p>	<ul style="list-style-type: none"> not an option 	<ul style="list-style-type: none"> placing rock to protect the bank of the watercourse, and protection is less than 5 m along bank, and work is completed between June 1 and Sept. 30 	<ul style="list-style-type: none"> erosion protection is more extensive than described under notification conditions <p>example: if bank disturbance exceeds 5 m</p>
<p>fish habitat improvement structures (including digger logs, rock sills, weirs, fishways)</p>	<ul style="list-style-type: none"> not an option 	<ul style="list-style-type: none"> work is being completed by hand (or with hand-held equipment) and does not extend more than 15 m along length of watercourse (bed and bank), and work is completed between June 1 and Sept. 30 	<ul style="list-style-type: none"> notification conditions are exceeded <p>example: machinery is being used</p>
<p>fishing equipment, counting fences, aquaculture cages, weirs for purposes other than fish habitat, or similar structure in a watercourse</p>	<ul style="list-style-type: none"> if no excavation or disturbance to bed or bank 	<ul style="list-style-type: none"> alteration of the bank and alteration is less than 5 m along the bank, and work is completed between June 1 and Sept. 30, and bed is NOT altered 	<ul style="list-style-type: none"> notification conditions are exceeded <p>example: bed of watercourse is disturbed or altered</p>

Activity	No Submission	Notification Required	Approval Required
other watercourse alterations	<ul style="list-style-type: none"> not an option 	<ul style="list-style-type: none"> not an option 	<ul style="list-style-type: none"> dredging or any other modification of a surface watercourse constructing and maintaining a causeway diverting a watercourse from its natural channel (including bypass ponds) any other alteration of a surface watercourse or the flow of water
dams, storage of water	<ul style="list-style-type: none"> not an option 	<ul style="list-style-type: none"> not an option 	<ul style="list-style-type: none"> constructing or modifying a dam, and storing water in amounts of 25,000 m³ or greater
wetland alteration	<ul style="list-style-type: none"> not an option 	<ul style="list-style-type: none"> not an option 	<ul style="list-style-type: none"> wetland is altered

