4.0 PLANNING WATERCOURSE ALTERATIONS FOR THE CONSTRUCTION OF A NEW ROAD

Before a construction or development project begins, it is essential to identify both watercourses and wetlands located within proximity of the project area. The best-case scenario is that a watercourse and wetland alteration (WAWA) can be avoided. If an alteration must occur, then comprehensive planning is essential during the pre-construction phase. Environmental impacts, such as erosion and sedimentation, can be minimized through careful planning and design. Also, the reduction of these impacts will prove to be cost-effective for the construction and the long-term maintenance of the road system.

IT'S A FACT

A major cause of soil erosion and sedimentation from a construction project can be related to inappropriate planning.

4.1 ROAD LOCATION PLANNING

The use of mapping such as topographic, geologic, water table mapping, LiDAR, aerial photos, etc. for project planning is essential. These maps and photos can help identify natural and human-made features such as watercourses, wetlands, existing roads, and other structures that will assist in the planning of the proposed project.

4.1.1 Avoiding Sensitive Areas and Species at Risk

Before laying out the road, it is important to identify and outline all sensitive and unique areas or habitats such as:

- ecological reserves, game management areas, protected areas, domestic water supply areas, historic sites or areas of significant archaeological significance, sensitive areas such as species at risk habitat, deer wintering areas, salmon spawning and rearing areas, and waterfowl breeding areas
- wetlands and provincially significant wetlands (PSWs)
- species listed as endangered or threatened under the ***Species at Risk Act*** and/or their identified critical habitat or residences

Note: If these areas cannot be avoided, the project may require an application for a standard WAWA permit. See Section 2.4 *Permit Exclusions* for a list of alterations and areas that do not qualify under the Watercourse Alteration Certification Program and Section 2.5 *Wetlands* for permissible alterations in relations to wetlands.

Most of this data is available online at GeoNB from Service New Brunswick. See Table 4-1.

Table 4-1 GeoNB data available from Service New Brunswick

Service	Link
Map Viewer	http://www.snb.ca/geonb1/e/index-E.asp
Data Catalogue	http://www.snb.ca/geonb1/e/DC/catalogue-E.asp
Map Products	http://www.snb.ca/geonb1/e/map-prod/map-prod-E.asp
Applications	http://www.snb.ca/geonb1/e/apps/apps-E.asp
ArcGIS Services	https://geonb.snb.ca/arcgis/services (requires GIS Software)
Species at Risk Public Registry	https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html
Aquatic Species at Risk Map	https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html

Although not all sensitive and unique areas are identified on maps or photos, they must still be avoided. It is good practice to contact provincial or federal government agencies to ensure that all significant areas are identified during planning. These agencies may include, but are not limited to, the New Brunswick Department of Environment and Local Government (DELG), the New Brunswick Department of Natural Resources and Energy Development, Fisheries and Oceans Canada, and Environment Canada.

4.1.2 Field Inspection

A field inspection of the project site is essential in identifying any limiting environmental factors not apparent during the planning process. The field inspection may result in the need to adjust the project.

Field inspections should be scheduled during the spring or fall when potential water problems would be most evident. These problems may include springs, seeps, wet areas, etc., which are not always visible on a map or photo. Field inspections are most effective when each proposed alignment is visited. It should be noted that wetland identification is best done during the growing season, typically between June 1st and September 30th.

JUST A REMINDER

Any activity which disturbs soil has the potential to damage aquatic and wetland habitat.

4.2 ROAD PLANNING PROCESS

When considering any project, gaining access to the site can be a critical component. Often, the road itself is the project.

4.2.1 Road Layout Process

When designing a road system, respecting the following guidelines may prevent or reduce potential impact.

- Avoid all sensitive and unique areas, as outlined in Section 4.1.1 *Avoiding Sensitive Areas and Species at Risk*
- Use topographic maps and features to:
  - Identify potential watercourse crossing locations by considering measures outlined in Section 4.3.1 *Identifying Ideal Watercourse Crossing Locations*
  - Minimize the number of watercourse crossings by:
    - aligning roads along the contours or slope of the land
    - locating roads on high ground
  - Promote manageable roadside drainage by limiting road grades to between 3 and 10% where possible. Calculate road grade as demonstrated in Example 4-1.
  - Identify areas with natural grades greater than 10% and highlight them as potential problem areas, especially for runoff control, where ditches may be subject to increased water volume and velocities
  - Identify areas with long road sections with little to no slope and highlight them as potential problem areas that may be subject to deterioration due to ponding of water in the ditches
  - Identify side hill areas with slopes greater than 30% and highlight them as potential problem areas for cross drainages
- Identify all property boundaries
- Identify all existing roads
- Use existing roads and watercourse crossings where possible
- Locate landings on high, flat, dry areas with stable soil away from watercourses/wetlands
- Use geology maps to:
  - Locate roads in areas with stable soil.
  - Identify potentially unstable areas composed of fine sand, silt, or clay soil types, which are prone to erosion and should be avoided. See Table 4-2.
  - Identify borrow areas with suitable road surface material such as gravel. These areas should be located at least 30 metres (100 ft) from watercourses/wetlands.

Table 4-2 Standard soil types and sizes

Soil Type	Size (mm)
Clay	< 0.002
Silt	0.002 – 0.02
Sand	0.020 – 2.0
Gravel	5 – 15.0
Pebble/Rubble	25 – 75
Rock/Cobble	100 – 200

Example 4-1
CALCULATING ROAD GRADE (IN PERCENTAGE)

$$\text{Grade} = \frac{\text{Road Elevation Difference (A – B)}}{\text{Length of Road Segment (L)}} \times 100$$

Where:
A = 100.35 m (the elevation of the road at station 155.00 m)
B = 100.2 m (the elevation of the road at station 100.00 m)

Length (L) = 155.00 m – 100.00 m = 55 m

Therefore: Road Grade = ((100.35 m – 100.2 m) / 55 m) x 100 = 0.27%

The road grade is 0.27%.

4.2.2 Finalizing Road Location

The final road location must be confirmed on the ground to ensure there are no unidentified features during the planning process. Once completed, mark or flag:

- the center line of proposed roads and note natural features that may simplify construction and promote water drainage
- sensitive and unique areas as outlined in Section 4.1.1 *Avoiding Sensitive Areas and Species at Risk*
- potentially unstable areas that may be prone to erosion
- the location for off-take ditches where runoff can be directed to densely vegetated areas; off-take ditches must be at least 30 metres (100 ft) from watercourses/wetlands
- the location of landings, borrow pits, gravel pits, and turnarounds, which must be at least 30 metres (100 ft) from watercourses/wetlands

Be prepared to adjust the route if any obstacles or features were identified and not evident in the planning process.

4.3 PLANNING A WATERCOURSE CROSSING LOCATION

This section provides methods of identifying the ideal location for a watercourse crossing and what information should be gathered during a site visit in the planning stage.

4.3.1 Identifying Ideal Watercourse Crossing Locations

Establish and delineate the 30 metre (100 ft) line between the footprint of the proposed road and watercourses/wetlands. Any alteration proposed within this 30 metres (100 ft) requires a WAWA permit.

Align the road to cross the watercourse at right angles to help prevent the redirection of the channel flow. Locate road crossings within a straight section of the watercourse.

Road approaches should be straight and stable with a minimal slope for 30 metres (100 ft) on both sides of the watercourse crossing.

Avoid crossing watercourses at locations where valued fish habitat (pools, spawning riffles, etc.) are present. Whenever any of these features exist, move the crossing location upstream or downstream.

Locate the crossing where the channel is straightest (*i.e.* no braiding), and narrowest and the banks are stable.

The crossing should be located in a section of the watercourse with near-zero gradient and uniform flow velocity.

The stream bed should be composed of a stable, coarse granular substrate.

Stream banks should have stable slopes with stable soil/rock conditions and abundant vegetation.

Stream flow must not be altered to facilitate a watercourse alteration.

4.3.2 Information to Gather During the Field Inspection

Information about the selected watercourse crossing sites should be recorded and maintained (this applies to new crossing sites or for existing sites where a crossing needs to be modified):

- Location of crossing (UTM coordinates (northing and easting) or Lats and Longs)
- Photos of the crossing site and photos of the watercourse upstream and downstream of the crossing site
- A summary of why the site was selected for a new crossing or why a modification to an existing crossing is needed
- Features of a watercourse at crossing site, including bed material, bank material, and width and depth of the channel. Diagrams of the watercourse in plan and profile view should be completed for new crossings.

4.3.3 Measuring Watercourse Features

As a minimum, 5 measurements should be taken at least 5 metres (1.6 ft) apart upstream of the location of the proposed alteration, from the top of both stream banks (the shoulder of the banks).

Width: The width of the channel at the bankfull height. Find the bankfull height by observing the points of vegetation change on the banks of the watercourse, where algae has been scoured from the boulders, where sediment texture changes abruptly, or where tree roots have been exposed.

Depth: The depth is the height of the watercourse channel from the stream bed to the bankfull height. The depth can be measured as follows:

- From the bankfull width, height to the bed of the watercourse
- Take channel measurements for three to six times along the channel
- Measurements should be averaged to get the watercourse channel depth at the crossing location

Thalweg: The line joining the lowest points lengthwise of the bed of the watercourse defining its deepest channel. The lowest channel of flow within a watercourse. Also known as the current.

Riffle: Shallow water extending across the bed of a flowing watercourse with rapid current and with surface flow broken into waves by submerged obstructions such as gravel and cobble. The water flow is rapid and usually shallower than sections above and below. Natural watercourses often consist of a succession of pools and riffles (or steps).

Pool: A deep, slow-moving, quiet portion of a watercourse.

See Figures 4-1 and 4-2 for a depiction of the various watercourse characteristics.

Figure 4-1 Watercourse characteristics (plan view)

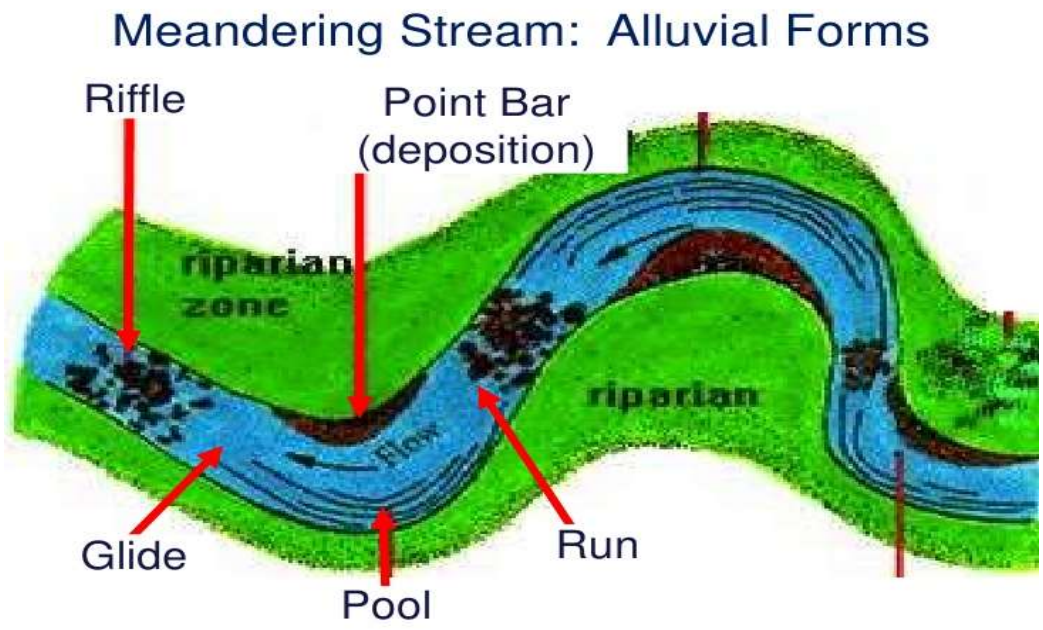
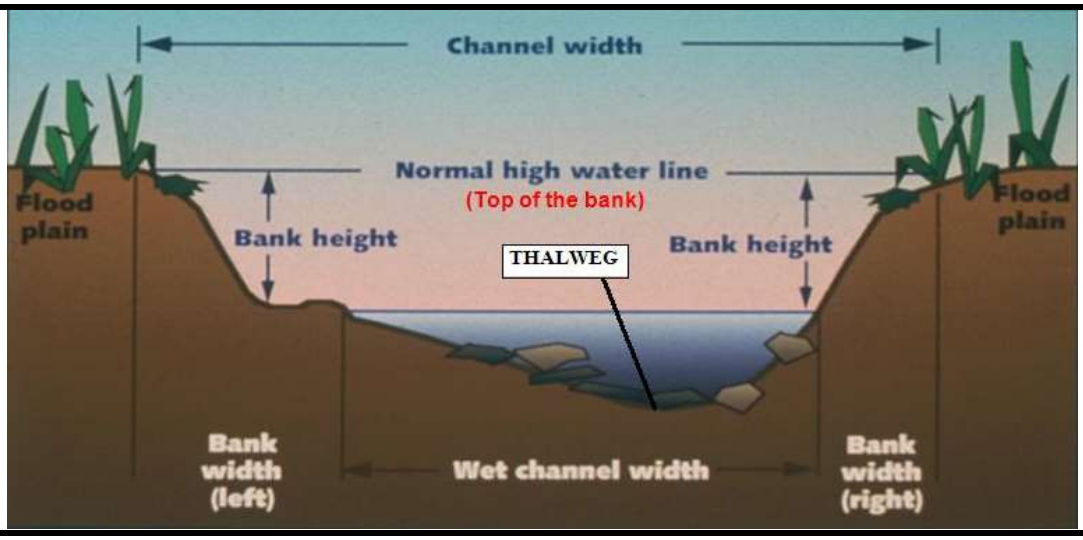


Figure 4-2 Watercourse characteristics (cross-section view)



4.4 FISH PASSAGE

Fish passage must remain unobstructed for successful migration to occur.

During the installation of a watercourse crossing, the slope of the culvert must be considered. Installing closed-bottom culverts within high sloped watercourses has been known to create fish passage issues. To determine stream slope, see Section 7.4.1 *Watercourse Gradient/Slope and Fish Passage*.

Open-bottom culverts and bridges are the preferred crossing structures for fish passage simply because the natural stream bed is maintained. These structures are not constrained by watercourse slope and choosing one of these options will expedite the approval process as less review is required.

During the planning stage of a watercourse crossing installation, it is important to consider how fish passage will be provided throughout all stages of the project.

4.5 TIMING OF AN ALTERATION

All watercourse alterations involving instream (*i.e.* below the bankfull width of a watercourse, whether wetted or not) must be carried out during the low flow period between June 1st and September 30th of the same construction season. This period is often referred to as the “fish window”, the “construction window”, or the “work window”. Work and project extensions outside of this window will not be approved through the Watercourse Alteration Certification Program. If there are unforeseen issues that prevent the project from being completed prior to the September 30th deadline, DELG should be contacted as soon as possible to discuss next steps.

Carrying out work during low flows helps minimize potential environmental impacts resulting from erosion and sedimentation by:

- avoiding sensitive periods in the life-cycle of fish such as migration and spawning
- facilitating working in isolation of the stream flow
- providing the opportunity for vegetation to quickly re-establish following completion of the project