



Indicator 1.1.6

Adherence of Stream Crossings to Standards

[1] Foothills Model Forest value

Conservation of aquatic resources.

[2] Objective

To conserve aquatic resources while conducting land management activities.

[3] Statement of indicator

Adherence of stream crossings to standards.

[4] Indicator measure

Measures for this indicator are (a) level of participation (percentage of stream crossings included within an infrastructure management program); and (b) percentage of inspected stream crossings within the Hinton Wood Products forest management area (FMA) that are rated as high-risk.

Definitions:

- *Stream crossing*: The intersection of a stream with a road or railway.
- *Infrastructure management program*: A program that manages technical structures or physical networks that support society, such as

roads, waterways, sewers, etc.¹ For this indicator, an infrastructure management program will be defined as a program that manages stream crossings.

- *High-risk stream crossing*: A crossing that presents a concern for fish passage, sedimentation, and/or public safety.

[5] Rationale for indicator

a. Significance of indicator to landscape-level management

Throughout the forest regions of North America, the two impacts from land management activities that pose the greatest risk to the conservation of aquatic resources are obstruction of fish passage and sedimentation at stream crossings. Stream crossings (bridges and culverts) are key components of the modern transportation infrastructure and are used to convey water under roads and railways. To improve the status of stream crossings at the landscape scale, we need a widely adopted management

¹ Wikipedia. <http://en.wikipedia.org/wiki/Infrastructure> accessed April 14, 2009.

system that includes an inventory, statement of priorities, capital projects / maintenance program and follow-up monitoring.

There are approximately 2,070 locations where permanent roads cross streams within the FtMF. There are also several hundred railway crossings. Older crossings were built to the standard of the day, but for small streams, maintaining fish passage may not have been a requirement at the time. In addition, runoff from gravel roads can cause sedimentation which adversely affects aquatic invertebrates and fish. These factors warrant a system-based approach that looks for innovative and cost-effective solutions to manage environmental risks associated with stream crossings at the landscape scale.

b. Meaning of indicator

The construction and maintenance of stream crossings can affect the ability of fish to move up and downstream. Stream crossings can also have a bearing on the conservation of biological diversity, because barriers to fish movement can impact and fragment local fish populations.

Stream crossings can also affect water quality and public safety. Measure A, level of participation (percentage of stream crossings included in an infrastructure management program) provides an indication of how many crossings within the Hinton Wood Products FMA are included within an infrastructure management program. This measure is important as crossings that are not part of an infrastructure management program can negatively affect the aquatic habitat through

a lack of monitoring and lack of management for water quality, sedimentation, fish habitat/migration and public safety.

Measure B, the percentage of high risk stream crossings within the Hinton Wood Products FMA, identifies crossings that are part of an infrastructure management program, but are identified as high-risk, meaning the stream crossing poses fish passage, public safety, and/or sedimentation concerns. Essentially, this measure identifies crossings that would be a priority for management actions and/or remediation measures.

c. Relation of indicator to Foothills Model Forest and to sustainability

Protection of water quality and fish habitat is a key aspect of sustainable land management. The Stream Crossing Inspection Protocol (which was adopted in 2005) is an example of an infrastructure management program that allows for the identification of barriers to fish passage which may be fragmenting valuable habitat required by local fish at various life stages.

Using the Protocol, watersheds are prioritized based on inspection results and the potential for the presence of fish habitat. The Foothills Stream Crossing Program (FSCP) is a cooperative, voluntary effort which allows for integrated, watershed-wide remediation strategies involving many of the major stream crossing owners on the West Fraser FMA. The goal is to improve the conditions of stream crossings. The group was formed in 2004 and includes a group of energy companies, and Hinton Wood Products.



Athabasca rainbow trout inhabit many small streams within the Foothills Model Forest. Addressing fish passage and erosion risks is important to the long-term conservation of this native fish.

CRITERION 1 > OBJECTIVE 1.1

The resulting watershed-wide remediation plans are an important management tool for companies to manage their infrastructure in cooperation with competing companies who may have crossings on the same stream. This approach maximizes the ecological benefits to the watershed and allows companies to make investments based on sound scientific knowledge.



[6] Current status of indicator

a. Level of participation

(percentage of crossings included within an infrastructure management program): 75% of crossings in the Hinton Wood Products FMA are included in an assessment protocol procedure (1,559 out of 2,070 road stream crossings).

Participating companies include BP Canada Energy Company, Canadian Natural Resource Ltd., Devon Energy Corporation, Talisman Energy Inc., Petro-Canada, Suncor Energy, ConocoPhillips, and Hinton Wood Products (a division of West Fraser Mills Ltd.).

b) Percentage of inspected crossings that are rated as high-risk: 26% of inspected crossings were found to be high-risk crossings.

[7] Interpretation

More than 75 organizations own stream crossings in the FtMF. Only 12% of these are participating in an infrastructure management program, but these participants own 75% of the crossings in the FtMF. It should be noted that because participation is voluntary, not all crossings are included in an assessment protocol. To conserve aquatic ecosystems, a coordinated approach among these owners is important. The two measures for this indicator are new; therefore, it is not possible to directly compare them with the previous stream crossing measures from the *Local Level Indicators, Initial Status Report 2003*.

In 2006, the energy companies that were involved completed initial inspections and Hinton Wood

Products continued their ongoing monitoring program. The crossings were then categorized with a high, medium, or low-risk rating for fish passage and sedimentation. These ratings were assigned based on the procedures outlined in the Stream Crossing Inspection Manual (http://clearlakeltd.typepad.com/clearlake/SCI_Manual_2dec07.pdf).

High-risk ratings for fish passage are given to culverts in fish-bearing streams that may obstruct upstream fish migrations. Sedimentation risk ratings are assigned based on estimated amounts of sediment entering the stream at the crossing point. The Stream Crossing Inspection Protocol was developed by a multi-stakeholder team consisting of Alberta Sustainable Resource Development, Fisheries and Oceans Canada, and a number of companies that own stream crossings within the FtMF.

Stakeholder participants worked together to develop a method that would complement their own management systems. The protocol applies across all road classes that cross permanent streams. The Stream Crossing Inspection protocol facilitates road owners' compliance with provincial and federal environmental regulations that require conservation of fish passage and minimization of sedimentation.

[8] Rationale for allowable variance (threshold)

There is no allowable variance for this indicator.

[9] Analytical considerations

a. Calculation of indicator

These indicators were calculated using data collected within the FtMF during the 2006 field season (May-September). Risk ratings were assigned based on the inspection protocols within the Stream Crossing Inspection Manual.

The measures for the indicator are calculated as follows:

Measure A:

$$\frac{\text{Percentage of crossings included within an infrastructure management program within the Hinton Wood Products FMA}}{\text{Total number of crossings within the Hinton Wood Products FMA}} = \frac{\text{Number of crossings included within an infrastructure management program within the Hinton Wood Products FMA}}{\text{Total number of crossings within the Hinton Wood Products FMA}} \times 100$$

Measure B:

$$\frac{\text{Percentage of inspected high-risk crossings within the Hinton Wood Products FMA}}{\text{Total number of inspected crossings within the Hinton Wood Products FMA}} = \frac{\text{Number of inspected high-risk crossings within the Hinton Wood Products FMA}}{\text{Total number of inspected crossings within the Hinton Wood Products FMA}} \times 100$$

b. Special considerations

It should be noted that not all stream crossings within the Hinton Wood Products FMA are part of the same infrastructure management program. For example, Hinton Wood Products tracks and assesses stream crossings independently of the Foothills Stream Crossing Association.

The Stream Crossing Inspection Manual was designed as a risk management tool for use by road owners. The risk categories do not necessarily indicate compliance versus non-compliance with regulations. High-risk crossings typically require site plans, whereas routine maintenance activities may address concerns at medium-risk sites.

Sedimentation risk levels were assessed based on observations and estimates of soil loss determined by field measures. To translate these ratings to other areas, actual values which represent high, medium, and low risks should be adjusted based on field calibrations.

The risk categories for fish passage are described in the Stream Crossing Inspection Manual (http://clearlakeltd.typepad.com/clearlake/SCI_Manual_2deco7.pdf) and are defined as follows:

Low-risk: Obstruction of fish migration is not an issue at this crossing. Future monitoring should be conducted to check for debris blockages, formation of an outlet drop, or the development of any other new obstructions.

Medium-risk: The crossing may impede passage of some species or life stages at various times of the year. A detailed fish passage assessment is recommended.

High-risk: The crossing presents a fish migration concern. A remediation or replacement design is recommended at this site. The stream will have a high probability for fish presence according to a fish probability model for the FtMF area.²

² McCleary, R. and M.A. Hassan, 2008. Predictive modelling and spatial mapping of fish distributions in small streams of the Canadian Rocky Mountain Foothill. *Canadian Journal of Fisheries and Aquatic Sciences*. 65, 319-333.

[10] Responsibility

Data are presented on behalf of members of the FtMF Stream Crossing Program.

[11] Monitoring

Crossing owners are responsible for monitoring status of their crossings. Participation in the FtMF Stream Crossing Program is voluntary.

[12] General discussion

Protection of water quality and fish habitat is an important aspect of all land management activities within the FtMF. A widely adopted management system that includes an inventory, statement of priorities, capital projects/maintenance program, and follow-up monitoring is required to improve the status of stream crossings at the landscape scale. The Foothills Stream Crossing Program is currently developing multi-stakeholder, watershed-wide remediation plans for six watersheds in the West Fraser Ltd. FMA. A monitoring and maintenance follow-up program will be implemented on a watershed level.

Jasper National Park also measures aquatic connectivity (the degree to which all naturally connected streams in an area are unaffected by human-created barriers such as culverts and dams).

For more information on stream crossings within the FtMF, see *Local Level Indicators, Initial Status Report 2003*. Note that indicators in 2003 included the percentage of stream crossings meeting standards on Weldwood's FMA and the density of stream crossings on the Weldwood FMA.