

FORT NELSON FIRST NATION

*TSA, AMISK*

BEAVER MANAGEMENT POLICY

September 2018



# Fort Nelson First Nation Beaver Management Policy

**Version: 1.0**

**Date: September 2018**

## **Who is this policy for?**

FNFN's Lands and Resources Department has prepared this Beaver Management Policy for all proponents who are seeking to use the lands and resources found within FNFN's territory. This policy provides direction to all proponents planning physical works and activities in FNFN territory, and must be considered and adhered to in advance of filing for permits, licenses or any other Crown permissions for land and water use activities. All proponents who are required to submit a development referral to the FNFN Lands and Resources Department must review this policy. Proponents with tenure in FNFN territory are recommended to develop a tenure-wide beaver management plan that complies with the requirements and recommendations of FNFN's Beaver Management Policy.

## **How should proponents use this policy document?**

Proponents should:

- a) contact FNFN to make sure you have the most recent version of this policy document;
- b) determine whether your proposed development is in beaver habitat;
- c) prepare a beaver management plan, using the information requirements and expectations laid out in this document; and
- d) submit your beaver management plan to the FNFN Lands and Resources Department, who will determine whether the plan is adequate.

If FNFN has follow up questions about your beaver management plan, we will get in touch with you for further discussion and review.

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# 1 Introduction

## 1.1 Beaver: A Culturally and Ecologically Important Species to FNFN

Beaver are a culturally important species to the people of Fort Nelson First Nation (FNFN), and are still hunted and trapped throughout FNFN territory. The spring hunt for beaver, timed for when the animals are fat and in good condition from winter, was and still is an important activity within the FNFN community, and all parts of the beaver are used. Today, beaver remains one of the primary furs that are sold and traded, providing income for FNFN trappers. FNFN community members value beaver for their role in maintaining the integrity of wetlands, and habitat for moose, caribou and waterfowl, which are also important FNFN traditional foods. Many of our members prize beaver as a food source as well.

FNFN has both a right and a responsibility to ensure that all facets of the ecosystem in our territory are managed in keeping with traditional laws and cultural practices. Recent industrial management of beaver with FNFN territory, based largely on the perception of beaver as a nuisance species to construction and roads, is not acceptable. FNFN members know there are better ways to manage beaver, to ensure that this valuable species can thrive while minimizing conflict with industrial development.

## 1.2 FNFN Beaver Management Vision, Goals and Principles

### **Vision:**

Beaver will remain an important ecosystem engineer and harvested species for future FNFN generations, throughout their natural habitat range and at population levels similar to historic levels in FNFN territory. FNFN will retain our critical role in stewarding the beaver population in our territory.

### **Goals:**

- Achieve effective collaborative management of beaver within FNFN territory that is in compliance with FNFN's vision and cultural knowledge and practices regarding beaver;
- Reduce or avoid beaver-human conflict, using non-lethal methods wherever possible;
- Increase clarity and reduce conflict between proponents and FNFN regarding the management of beaver populations; and

- Base decisions regarding beaver management in FNFN territory on research, monitoring, and traditional knowledge, to ensure that beaver remain accessible to future generations of FNFN members.

To achieve these goals and inform the development of this FNFN Beaver Management Policy, FNFN has conducted baseline research to document and map beaver habitat in the Liard watershed in BC. This information is summarized in the [2017 Beaver State of Knowledge Report](#).

FNFN has also researched a range of alternative beaver management methods (see Table 1 and Appendix 1), and the FNFN Lands and Resources Department (FNFN Lands) has developed internal referrals management tools that allow for timely and effective flagging of referrals whose activities and locations are most likely to impact on beaver.

This resulting policy provides direction to all proponents planning physical works and activities in FNFN territory, and must be considered and adhered to in advance of filing for permits, licenses or any other Crown permissions for land and water use activities.

The FNFN Beaver Management Policy is informed by the following **principles**:

- FNFN has both the right and the responsibility to be engaged in the development and implementation of tenure-level beaver management planning and site-specific action plans to resolve beaver conflicts in FNFN territory.
- Traditional and scientific knowledge must be used to make decisions about how to manage beaver, manage development, and monitor the effects of both.
- Proponents seeking to use resources from FNFN territory have a responsibility to contribute to FNFN's baseline data collection and research initiatives, in order to understand how development is affecting the resources and values of importance to FNFN members, including beaver.
- Beaver have an important role to play in the ecosystem, and as such, lethal control of beaver is typically the least preferred option on the list of possible management actions.
- In cases where lethal control is the only option, following approval by FNFN, proponents will be required to follow the 2017 MFLNRORD beaver removal permit for FNFN territory (Appendix 3).
- FNFN has the right to trap out beaver within the Territory according to cultural practices and timing.

The Beaver Management Policy will be reviewed and updated as required to ensure that FNFN can incorporate ongoing improvements into the policy, based on what we learn through the use of non-lethal control measures, and monitoring of potential and actual industry-beaver conflicts.

### 1.3 What does the FNFN Beaver Management Policy Do?

FNFN's Beaver Management Policy provides a set of steps for proponents to use in developing beaver management plans for their tenures. Proponents are encouraged to communicate early with FNFN Lands about developing a beaver management plan that adheres to this policy, preferably prior to filing for permits or licenses.

FNFN's Beaver Management Policy includes the following information:

- Requirements for proponents re: engaging with FNFN on beaver management planning, implementation and monitoring;
- Identification of the required contents of beaver management plans, to be provided to FNFN for review;
- Spatial identification of areas of high beaver habitat suitability in the Liard and Hay River watersheds in BC, to help proponents and FNFN identify areas at heightened risk of beaver conflict;
- A list of criteria to identify specific sites that are at high risk of beaver-human conflict, to focus monitoring efforts and management actions;
- Identification of several non-lethal approaches for managing beaver conflict that proponents must consider for a variety of beaver-human conflict scenarios; and
- Identification of minimum beaver population monitoring requirements for all proponents working in FNFN territory, including requirements to contribute to baseline information on beaver populations prior to development occurring.

## 2 Beaver Management Planning for Proponents Working in FNFN Territory

This section provides an overview of required beaver management planning steps for proponents working in FNFN territory. Please contact FNFN Lands to ensure you have the latest version of the Beaver Management Policy: call 250-774-6313 or contact us via our website at <http://www.fortnelsonfirstnation.org/contact.html>.

### 2.1 Developing a Beaver Management Plan

#### 2.1.1 Steps for Developing Beaver Management Plans

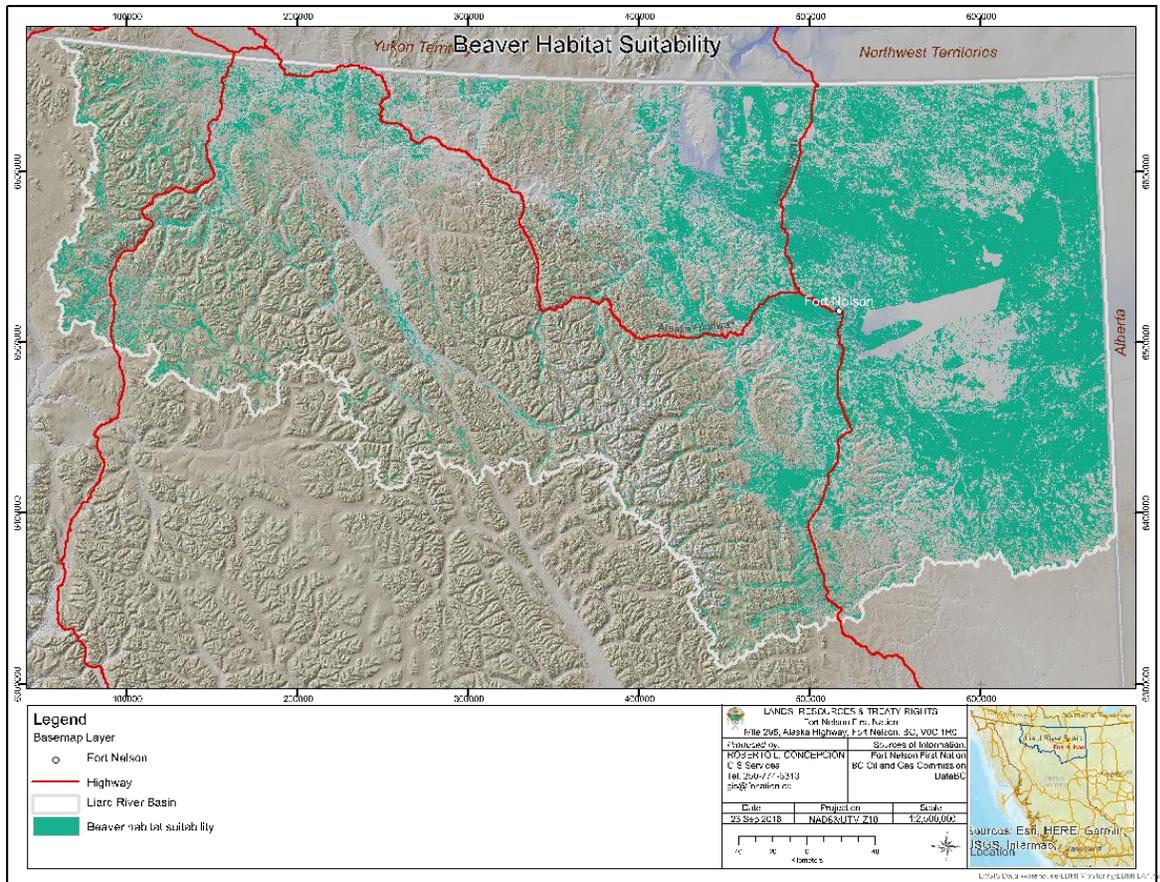
All proponents working in FNFN territory are requested to develop a beaver management plan for all operating areas. Proponents may develop one beaver management plan for all operating areas, or separate plans for each area. The resulting beaver management plan(s) will be applied to all physical works and activities proposed by the proponent.

Figure 1 shows a summary of the steps for developing a beaver management plan. Figure 2 shows suitable beaver habitat in the Liard Watershed. This map is available as a shapefile from FNFN Lands and should be used as a first step to identify areas of suitable beaver habitat within the operating area.

**Figure 1: Steps for Developing a Beaver Management Plan**

<p><b>Step 1:</b> Contact FNFN Lands for the latest Beaver Management Policy and beaver habitat suitability shape file.</p>
<p><b>Step 2:</b> Overlap operating area(s) with habitat suitability shape file to identify areas of high habitat suitability in the operating area(s).</p>
<p><i>**What if there's no suitable beaver habitat in the operating area?</i></p> <p>It is important to note that any area on this map not flagged as suitable beaver habitat may still merit site-specific investigation; some areas on the map are data deficient. For a definition of what is beaver suitable habitat, see FNFN's <a href="#">Beaver State of Knowledge Report</a>. If no suitable beaver habitat is present in the tenure, a beaver management plan may not be required; however, proponents are encouraged to file them as contingency plans in case of unforeseen beaver conflict.</p>
<p><b>Step 3:</b> Identify areas with high potential conflict with beaver:</p> <ul style="list-style-type: none"> <li>- Areas with existing or proposed development that overlap with suitable habitat should be considered to have high potential for beaver-human conflict.</li> <li>- Refine this analysis using the guidance and questions in Section 2.2 to identify specific areas in tenure that are at high risk for beaver conflict.</li> </ul>
<p><b>Step 4:</b> Prepare written beaver management plan (see section 2.1.2) and submit to FNFN.</p>
<p><b>Step 5:</b> FNFN will review the beaver management plan and may require changes before development can proceed. FNFN Lands will contact you if it needs more information or does not consider your plan adequate. A rationale for this finding will be provided.</p>
<p><b>Step 6:</b> Implement beaver management plan.</p>
<p><b>Step 7:</b> Communicate with FNFN on progress regarding beaver management.</p> <ul style="list-style-type: none"> <li>- During active construction, provide FNFN with updates regarding identified beaver-human conflict areas and any proposed management actions.</li> <li>- During operations, provide FNFN with yearly updates regarding results of monitoring and new actions required.</li> <li>- Adhere to any other communications requirements identified in the approved beaver management plan, including annual reporting to FNFN re: beaver monitoring (see Section 4 and Appendix 2).</li> </ul>
<p><b>Step 8:</b> Review FNFN's Beaver Management Policy on a yearly basis and provide updates to the beaver management plan as needed to FNFN Lands.</p>

**Figure 2: Map of the Liard River Basin showing areas of high beaver habitat suitability based on modelling. All of the green areas are ranked as highly suitable for beaver.**



### Required Content of Beaver Management Plans

Beaver management plans for proponents with physical works in FNFN territory should contain the following information:

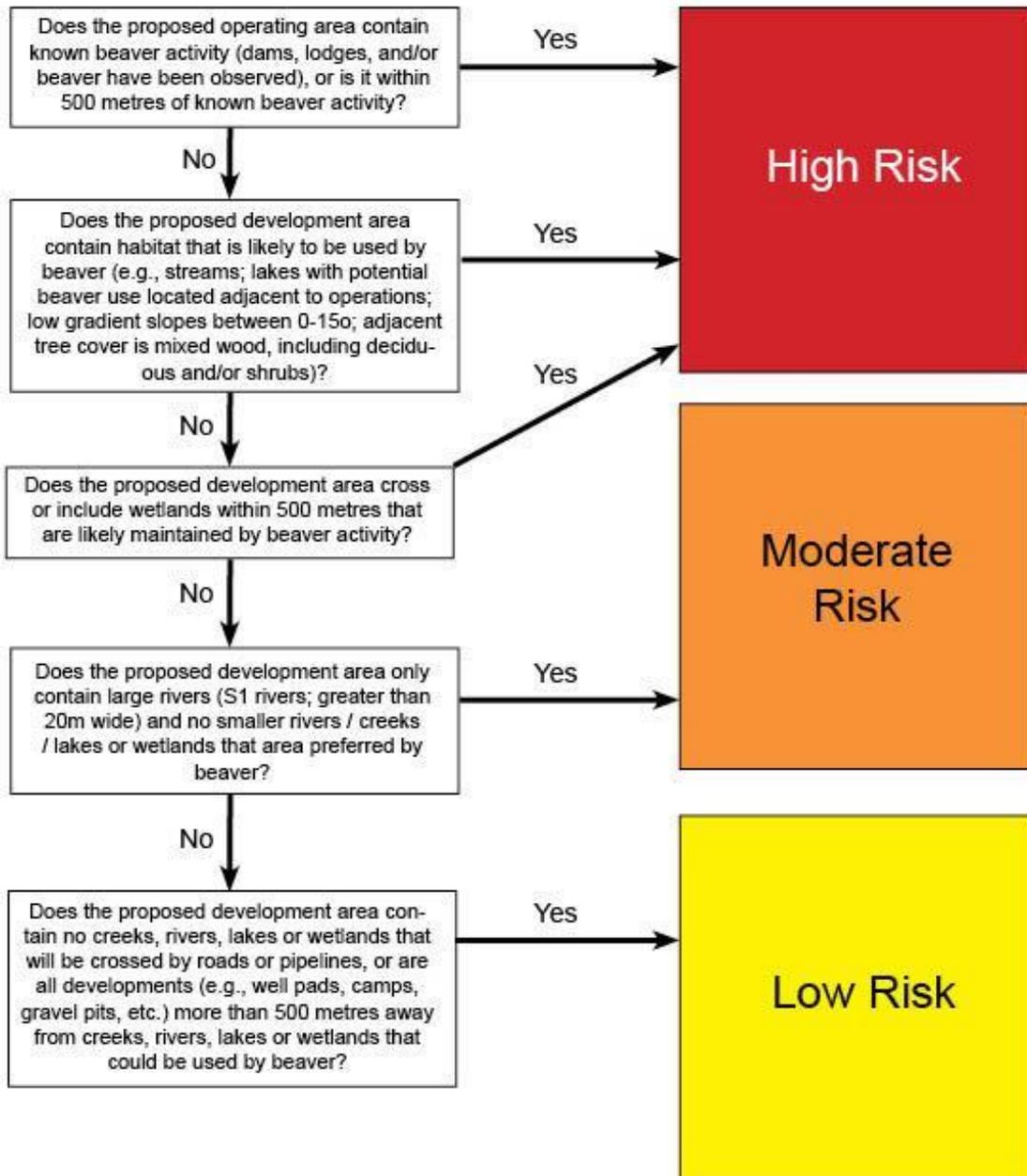
- The proponent's overarching principles of beaver management, including but not limited to:
  - Mitigation hierarchy for avoiding beaver conflict in areas of high beaver conflict potential;
  - Preferred non-lethal methods for various scenarios, using guidance in this policy document;
  - Circumstances when lethal methods would be used, with supporting rationale; and
  - Approach for working with FNFN members to trap out beaver if needed.
- A summary of the approach used to identify areas of high potential or known beaver-human conflict (see Section 2.2).
- A map showing the results of the analysis. The map should include areas with a) high potential for beaver conflict; b) known beaver-human conflict areas.

- A mitigation plan for avoiding beaver-human conflict during new construction in areas with high potential for beaver-human conflict.
- A description of the tenure-wide monitoring plan for beaver conflict areas, required involvement from FNFN monitors, and proposed management actions when beaver conflict areas are identified (see Section 4).
- A description of plans for ongoing baseline data collection on beaver populations in tenure.
- The plan for ongoing communications and sharing of monitoring data with FNFN Lands. Proponents are recommended to provide to FNFN Lands the following information on an annual basis:
  - a map showing beaver-human conflict areas;
  - a table to accompany the map, describing how these conflict areas are being managed and monitored (see Appendix 2).

## 2.2 Beaver-Human Conflict Risk Assessment

In addition to overlaying the operating area with the map of beaver habitat suitability, proponents should use the criteria listed in Figure 3 and the following flow chart for identifying areas with high potential for conflicts with beaver.

# Beaver-Human Conflict Risk Assessment



All areas of high risk for beaver conflict should be identified on a map in the proponent's beaver management plan, and included in the table of potential / known beaver-human conflict sites. Sites classified as low risk should be subject to regular monitoring that is adequately scoped to identify and report on beaver activity.

Figure 3: Habitat types and risk for beaver-human conflict

<p><b>Low risk of conflict:</b></p> <ul style="list-style-type: none"><li>High ground</li><li>No streams or rivers in development area</li><li>No stream crossings</li><li>No wetlands in development area</li></ul>
<p><b>Moderate risk of conflict:</b></p> <ul style="list-style-type: none"><li>Muskeg / wetland with no observed beaver activity</li><li>Large rivers (&gt; 20 m in size) in development area but no streams / creeks that are suitable for beavers</li></ul>
<p><b>High risk of conflict:</b></p> <ul style="list-style-type: none"><li>Small streams / creeks and/or lakes in development area</li><li>Average slopes around streams/creeks/lakes is between 0-3°; up to 15° still suitable</li><li>Adjacent mixed-wood stands containing deciduous and / or shrub species</li><li>Specific locations with observed beaver activity in development area</li><li>Wetlands maintained by beaver dams in development area</li><li>Stream crossings are part of development plan</li></ul>

### 3 Beaver Management Options

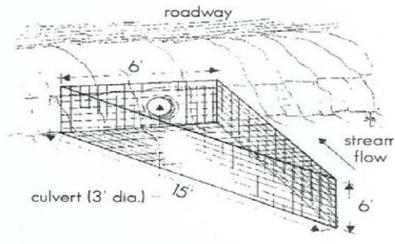
The table below provides a variety of non-lethal options available to resolve different types of conflict situations with beaver. Appendix 1 provides more detailed information about each option, including diagrams of different systems that can be built or are available commercially, and photos that show installations of these systems. Proponents should include the proposed approach for known conflict sites in the table included in their beaver management plan, and provide yearly updates on the results of these actions.

Based on FNFN's review of the available devices for addressing beaver-human conflicts, flexible levelers used in combination with diversion dams or fencing that allow beaver to dam upstream have had the highest success rates. That said, many different options may have value in different contexts. FNFN is willing to consider a variety of options, provided proponents have conducted an adequate consideration of alternatives and put forward an appropriate rationale for the preferred option.

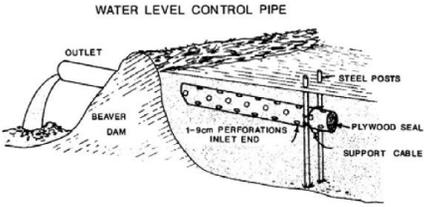
Proponents are requested to consider all available management options when developing action plans to resolve beaver conflicts and monitor results. Where a certain type of physical work and activity is proposed that is known to create conflict, the proponent is required to either adopt recognized best practices or provide a compelling rationale for an alternative, for FNFN's consideration.

Proponents are encouraged to work closely with FNFN Lands on research, monitoring and adaptive management to ensure that the option(s) that is/are implemented meets the desired outcome of FNFN beaver management planning: reducing beaver-human conflict using non-lethal methods wherever possible. Ongoing monitoring will inform further development of best practices.

Table 1: Types of Beaver Conflict and Possible Management Options

Management approach	Management Option	Description	Cost and maintenance
Avoiding conflict in construction	Use oversized, round culverts, bottomless arch culverts and clear span bridges to avoid restricted water flow	Beaver identify areas suitable for dam construction using sound of increased water flow; using culverts and bridges reduces likelihood	<ul style="list-style-type: none"> <li>- Initially higher cost</li> <li>- Reduces maintenance costs significantly</li> <li>- Recommended for permanent roads</li> </ul>
Preventing culvert damming: exclusion fencing options   <i>Beaver deceiver</i>	Exclusion fencing	Creates a space between the fence and the culvert inlet, effectively extending the length of damming required to stop flow through the culvert	<ul style="list-style-type: none"> <li>- Cost is low, effectiveness is high: Beaver Solutions (2015) claims 98% success rate</li> <li>- Maintenance costs are usually relatively low but monitoring is required</li> <li>- Recommended for temporary roads that are easily accessible</li> <li>- Can be used in conjunction with diversion dams to encourage dam construction elsewhere</li> </ul>
	Trapezoidal design	Use for larger channels	
	Full wire mesh fence	Lines bottom of enclosure with wire mesh	
	Complex fence	Shape adapted for particular upstream complex	
	Beaver Deceiver™	Commercial exclusion fencing product	

Management approach	Management Option	Description	Cost and maintenance
<p>Preventing culvert damming: protective devices for culvert openings</p>  <p><i>Beaver stop</i></p>	<p>Beaver Stop™ and Baffler</p> <p>A range of structures or screens fixed to the inlet end of the culvert</p>	<p>Excludes culvert inlet while allowing free flow of water; do not create much of a physical separation between the exclusion barrier and culvert opening.</p>	<ul style="list-style-type: none"> <li>- Initially low cost but high maintenance requirements</li> <li>- Not recommended for remote locations</li> </ul>
<p>Encouraging beaver dams in locations that are not in conflict with infrastructure</p>	<p>Diversion dam: use with exclusion fencing to encourage dams elsewhere</p>	<p>After installing exclusion fence, construct diversion dam approximately ten feet upstream of fence to encourage beaver to dam away from the fence</p> <p>Place stones in streambed; water noise will stimulate the beaver to dam on it instead of the culvert fence</p> <p>Use connected pipe to maintain flows across the new dam and control upstream flooding</p>	<ul style="list-style-type: none"> <li>- Diversion dams are likely the cheapest way of avoiding blocked culverts</li> <li>- Usually used with exclusion fencing in areas where a beaver dam upstream will not interfere with a culvert and flooding an area upstream will not create a conflict</li> </ul>
<p>Avoiding flooding of infrastructure: water control devices</p>	<p>Clemson Beaver Pond Leveler</p> <p>Flexible pond levelers (various designs)</p> <p>Dam siphon</p>	<p>Syphon constructed by inserting a pipe through the dam to drain water and maintain desired water levels</p>	<ul style="list-style-type: none"> <li>- Relatively inexpensive</li> <li>- Require periodic inspection and cleaning because silt deposit or beaver activity can block pipes</li> <li>- May not allow fish passage</li> </ul>

Management approach	Management Option	Description	Cost and maintenance
 <p data-bbox="205 511 443 544"><i>Water control device</i></p>	<p data-bbox="695 256 898 289">Perforated culvert</p> <p data-bbox="695 313 825 345">Log culvert</p>	<p data-bbox="968 256 1461 370">Devices vary in design of pipe intake, which is usually suspended within a cage. Efforts must be made to avoid water noise at intake</p> <p data-bbox="968 394 1446 548">Flexible pond leveller systems have culvert that passes over the dam and molds to the dam contour, rather than passing through the dam in a straight line</p> <p data-bbox="968 573 1346 605">Selecting pipe size can be difficult</p>	<ul data-bbox="1493 256 1948 370" style="list-style-type: none"> <li>- Should be used in small watersheds where regular monitoring allows for changes to design if needed</li> </ul>
<p data-bbox="205 626 611 691">Combination devices to protect culverts and allow dams to establish.</p>  <p data-bbox="205 1057 611 1089"><i>Pond leveler with exclusion fencing</i></p>	<p data-bbox="695 626 926 821">Small culvert protective fence with a flexible pond leveler system</p>	<p data-bbox="968 626 1404 740">Allows beaver to construct dam against fence; keeps culvert from becoming obstructed</p> <p data-bbox="968 764 1430 837">Pipe is set at desired pond level following installation, limiting pond size</p> <p data-bbox="968 862 1457 967">Temporary flooding will flow over dam and through culvert without impacting road integrity</p>	<ul data-bbox="1493 626 1990 878" style="list-style-type: none"> <li>- High success rate, requires almost no maintenance, and keeps beaver pond intact</li> <li>- Use if roadbed is high enough that small beaver pond does not pose a threat to the integrity of the road</li> </ul>

Management approach	Management Option	Description	Cost and maintenance
Beaver removal <i>Requires beaver removal permit; see Appendix 3.</i>	Lethal control	<p>Shooting and trapping are the only acceptable methods of lethal control in FNFN territory.</p> <p>Follow requirements of beaver removal permitting, including working closely with FNFN to trap beaver so they can be used by FNFN members.</p>	<p>Research suggests not as effective as non-lethal control and potentially more expensive</p> <p>Trapping may be preferred by FNFN where development occurs along existing traplines</p> <p>Trapping is preferred to be done in late winter/spring.</p>

## 4 Monitoring and Adaptive Management

### 4.1 Monitoring of Site-specific Actions to Manage Beaver

As part of the beaver management plan, proponents are required to develop a monitoring plan to determine the success of non-lethal beaver management methods or any beaver removals that are undertaken. This monitoring plan should include, at a minimum:

- Monitoring frequency for the initial year after installation or beaver removal;
- Monitoring frequency following the initial year;
- Actions to be taken if problems are observed; and
- Description of data to be provided to FNFN one year after installation of device(s) or removal of beaver.

### 4.2 Routine Monitoring to Identify Beaver Conflicts

Beaver management plans should include standard operating procedures for regular monitoring of potential beaver conflict areas to identify problems early. The monitoring plan should include:

- Monitoring frequency for potential conflict areas;
- Proposed actions and timeline for actions if problems are observed;
- Proposed yearly report back data to be provided to FNFN.

### 4.3 Beaver Population Monitoring

FNFN will be conducting monitoring of beaver populations in watersheds within FNFN territory with high percentages of beaver habitat. A list of these sub-watersheds is provided in FNFN's [Beaver State of Knowledge Report](#). FNFN will use the information on known and high risk beaver conflict areas within each proponent's operating area to support these monitoring efforts. Each proponent's annual update on beaver conflict areas within their operating areas will serve as a mechanism for reporting on the results of management actions that have been taken (see template in Appendix 2). These data will be incorporated into FNFN's broader beaver population monitoring program and will be used to inform the ongoing development of FNFN's Beaver Management Policy.

## **5 CLOSURE**

FNFN thanks you in advance for adhering to our Beaver Management Policy and for supporting our efforts to maintain balance between industrial development and the needs of wildlife and Treaty right holders in our territory.

For more information about our Beaver Management Policy, contact the FNFN Lands Department.

## Appendix 1: Descriptions of Beaver Management Options

*Proponents should use the information included in this appendix to develop tenure-level management plans for beaver (including commitments to preferred and secondary management options with supporting rationales and triggers for activation of alternatives), and site-specific management actions for specific beaver conflict scenarios. Meaningful consideration of this information will increase the likelihood proponents are in compliance with section 2.3 of this Beaver Management Policy: required contents of site-specific and tenure-level beaver management plans.*

### 1.1 Road construction options to prevent beaver conflict

Beaver prefer to construct their dams where there are natural constrictions in the stream flow and a nearby source of food and building materials. As a result, road crossing culverts often become prime targets for dam-building activities (Fisheries and Oceans Canada [cited 2015]).

Because beaver identify areas suitable for dam construction by the sound of increased water flow, oversized round culverts, bottomless arch culverts, and bridges that do not restrict the flow of water can all reduce the likelihood a beaver will build a dam (Partington 2002). Avoid paired, smaller culverts as these installations can restrict water flow, creating running water noise that might attract beaver. They are also easier for beaver to dam than larger culverts that provide comparable drainage. Clear-span bridges are preferred options for crossing areas of likely beaver activity, particularly if fish habitat is present.

### 1.2 Protective devices to prevent culvert damming

Various options have been developed to discourage beaver from blocking existing culverts. Most of these devices are attached to the culvert inlet and/or outlet to prevent direct access by the beaver to the culvert opening, thereby preventing beaver from placing sticks and other dam-building materials into the opening to block water flow.

#### *Exclusion Fencing*

This approach works by creating a space between it and the culvert inlet, effectively extending the length of the damming required to stop flow through the culvert. Various forms have been developed for different contexts (see Figures A)

- The trapezoidal design for larger channels (Figures A1 and A2): Beaver prefer to begin plugging culverts at the inlet, where the sound of running water is most evident. The trapezoidal fence creates a long perimeter against which the beaver must dam to block flow (often over 40 ft.). Provided the topography of the streambed allows water to surround the entire perimeter of the fencing, the trapezoidal shape discourages dam construction by beaver due to its length and the calming effect on water flow. When beaver dam along the fence, the

further away from the culvert inlet they dam, the wider the effective culvert ‘opening’ becomes (i.e., the rest of the fence length). This widening of the water inlet reduces water movement where the beaver is damming against the fence, thereby reducing the stimulus of running water noise that would encourage damming. Beaver Solutions (2015) claims trapezoidal designs have a 98% success rate.

- Full wire mesh fence (Figure A3): Establishes a long perimeter that beaver would be required to dam, presenting a similar challenge to the trapezoidal design. However, lining the bottom of the enclosure with wire mesh prevents beaver from digging underneath the fence to access the culvert. Complex wire mesh fences combined with a simple beaver pipe (Figure A4) are suitable if beaver have constructed another dam beyond the first wire mesh fence that is protecting the culvert.
- Complex fencing (Figure A5): similar to above; have shapes adapted to the particular upstream context.
- Beaver Deceiver™ systems for smaller channels (Figure A6): uses the trapezoidal fence shape, but in varied shapes adapted to the stream channel and normal floodplain area. This video describes how a beaver deceiver works: <https://www.youtube.com/watch?v=WT04GchSHBs>

MoELP (2001) and Fisheries and Oceans Canada [cited 2015] have developed design guidelines for exclusion fencing:

- To prevent the passage of beaver kits, the fencing mesh should have openings of no more than 15 cm.
- When using U-shaped fencing mesh, extend it at least 40 m upstream of a culvert opening.
- Use O-shaped fencing (Figure A5) only on upstream ponds, never on stream channels.

To encourage beaver to dam somewhere other than the culvert fence, diversion dams can be used in conjunction with exclusion fences (Rodvang and Hood 2015). After installing the fence to keep the culvert open, a diversion dam is constructed approximately ten feet upstream of the culvert’s protective fence to encourage beaver to dam away from the fence (Beaver Solutions [cited 2015]). Typically, the diversion dam starts with strategic placement of stones (collected from the area, if possible) in the streambed to cause some water noise and pooling at the diversion dam spot. The partial stone barrier will stimulate the beaver to dam on it instead of the culvert fence. If successful, installing a complex fence design with connected pipe will maintain flows across the new dam and control upstream flooding.



Figure A1: Trapezoidal fence design (Photo courtesy of G. Hood).



Figure A2: Trapezoidal designs (Beaver Solutions: )

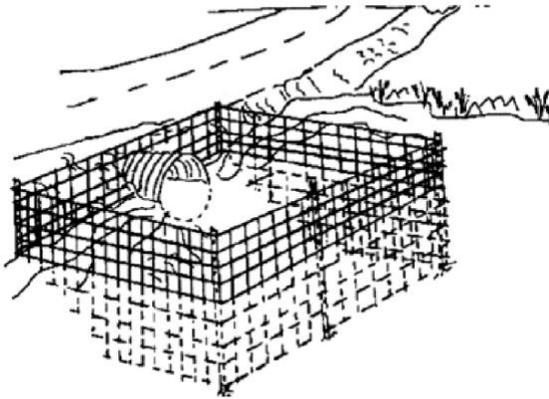


Figure A3: Full Wire Mesh Fence (Gerich [cited 2015])

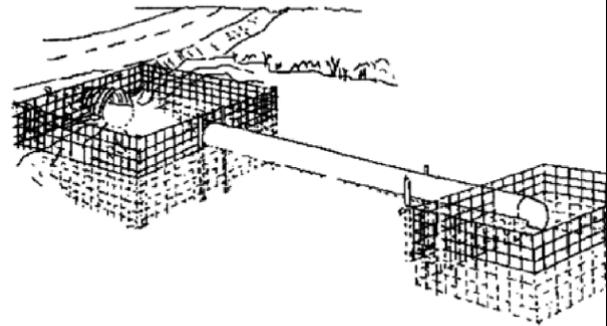


Figure A4: Complex Wire Mesh Fences with Simple Beaver Pipe (Gerich [cited 2015])

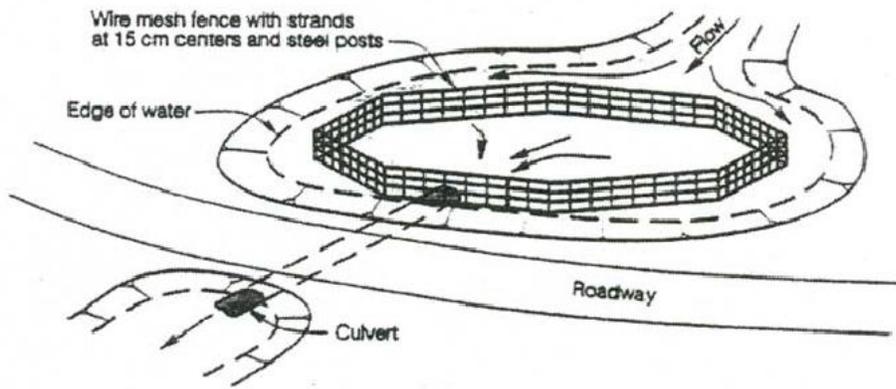


Figure 1. Example of "O" Shaped Fencing Layout  
 (Drawing Courtesy of Finnigan and Marshall, 1997)

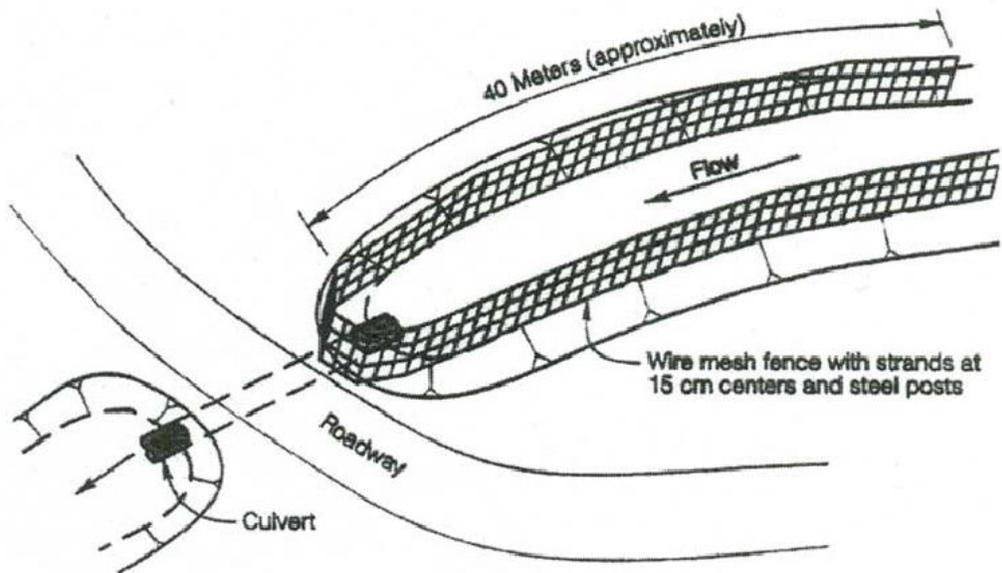


Figure 2. Example of "U" Shaped Fencing Layout  
 (Drawing Courtesy of Finnigan and Marshall, 1997)

Figure A5: Complex Fencing (Gerich [cited 2015])

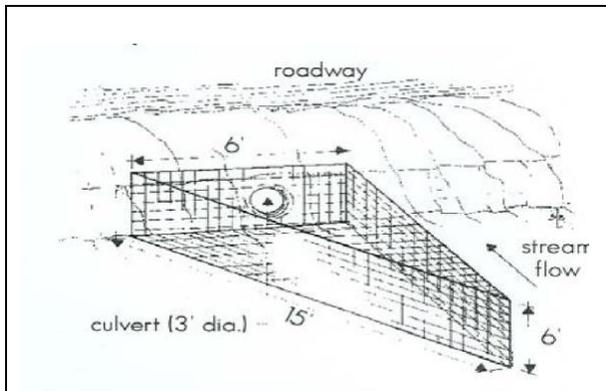


Figure A6: Beaver Deceiver Design for tight spots (Gerich [cited 2015])

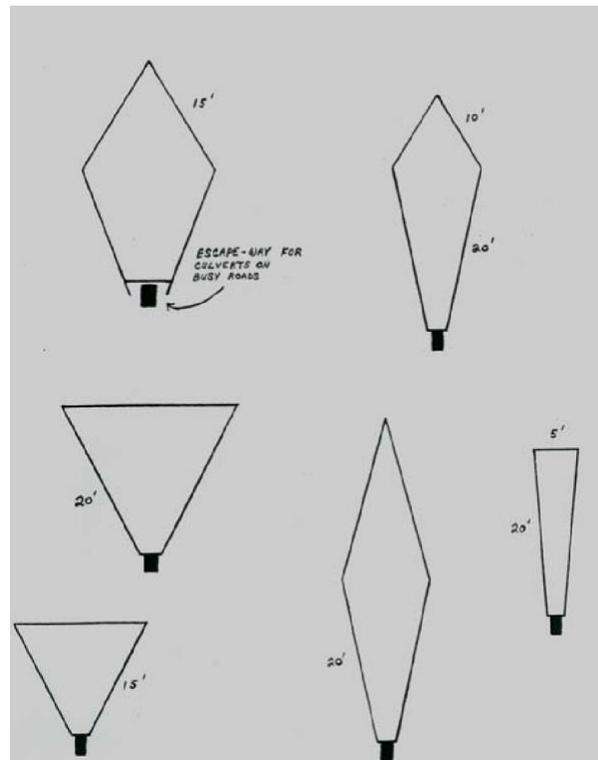


Figure A7: Variations of the Beaver Deceiver Design

### *Beaver Stop™ and Baffler™*

Beaver Stop™ and Baffler™ structures include a range of structures or screens fixed to the inlet end of a culvert (Figures A8 and A9; Lisle 2003, Rodvang and Hood 2015). The Beaver Stop/Baffler excludes beaver from blocking a culvert inlet while still allowing free flow of water, but they do not create much physical separation between the exclusion barrier and the culvert opening. As a result, beaver can still dam around the structure, or use it as a framework to construct a plug around the structure that blocks water flow through the culvert. Although this option is initially low cost, regular maintenance is required to remove accumulated debris from the screen or structure (Partington 2002).

To ensure optimum efficacy of these protective structures, MoELP (2001) recommends the following criteria for their design and construction:

- Extend the culvert through the road or other impoundment plus at least 1 m into the upstream pond with the cage fixed to its end.

- Size the cage to fit the appropriate culvert and protrude far enough from the end of the culvert to remain submerged and to prevent the beaver from plugging the wire mesh.
- Construct the cage of a durable material that will provide service for a period of not less than that expected for the culvert.
- Suspend the cage at least 0.5 m above the pond floor to deter anchoring of dam materials to the bed of the pond by the beaver.
- The wire mesh should have openings of about 15 cm, as this will allow fish passage but hinder attempts by the beaver to plug the gaps and should enclose the intake end.
- Design the culvert and mesh assembly to withstand a 1:10 year storm event and ensure mesh is sized to allow fish passage.



Figure A8: Beaver Stop™ device installed on a culvert outlet (photo courtesy of G. Hood)



Figure A9: Beaver Stop/Baffler (WRAP 2001)

### 1.3 Water control devices to reduce flooding from existing beaver dams

Water control devices are mainly used to maintain wetlands created by a dam to protect biodiversity value, or where there is a need to prevent flooding of human use areas (e.g., agricultural or forest land). These devices have been shown to be more cost effective and require less maintenance than dam removal (Beaver: Wetlands and Wildlife, accessed Dec. 1 2017; <http://www.beaverww.org/>) and the lethal trap and shoot methods.

Generally, a water control device is a syphon constructed by inserting a pipe through the dam to drain excess water and maintain the desired water level. Devices vary mainly in the design of the pipe's inlet, usually suspended within a cage. Once the cage and inserted pipe are submerged, the inlet draws water without creating the noise of running water that can attract beaver. Suspending the inlet above the pond floor avoids siltation of the pipe and the cage prevents beaver from blocking the

inlet (should they discover its role). To keep beaver at the site, ensure that final water level (established by the elevation of the pipe bottom in the dam) allows about three feet of water to remain around the lodge or bank burrow.

Some water control devices:

- The Clemson Beaver Pond Leveler (Figures A9, A10): Uses a rigid PVC pipe to allow continued water flow through dam; various changes in pipe diameters can accommodate for different flow rates to ensure water passing thorough is adequate for the desired pond level. Careful positioning of the syphon is required in the dam to ensure the intake device remains below water after lowering the water to the desired level. If the inlet is exposed and near the dam, the beaver may be stimulated to construct a new dam on the upstream side of the device (Clemson University 1994, ICWDM 2005). Most effective in smaller watersheds where a smaller pipe will work; flexible pipes are easier to install where the pipe diameter needs to be large (<http://www.beaverww.org/solving-problems/manage-flooding/>). May be built ([http://files.dnr.state.mn.us/assistance/backyard/privatelandhabitat/clemson beaver pond leveler.pdf](http://files.dnr.state.mn.us/assistance/backyard/privatelandhabitat/clemson_beaver_pond_leveler.pdf)) or purchased ready-made (<http://www.minncor.com/outdoor-recreational-beaver-pond-leveler>).
- Flexible leveler systems (Figures A11 – A14): They have been used in Gatineau Park since the 1970s, and are currently in place at many locations across North America (<http://www.beaverww.org/solving-problems/manage-flooding/>) In this design, the culvert section passing over the dam is flexible and molds to the dam contour, rather than passing through the dam on a straight line. Note that debris can enter the pipe in this design and collect at the bend, which would then plug the pipe (Gerich [cited 2015]); scheduled monitoring is recommended. Based on FNFN review, these devices seem like the best compromise between effectiveness and cost, particularly when used in combination with a diversion dam. Guidance on how to build a flex leveler is available from the Snohomish County, Washington State Public Works Surface Water Management (e.g., see <http://www.beaverww.org/assets/PDFs/How-to-build-a-Flexpipe.pdf>). Most of the devices used by this agency, which did not have to remove any beaver from roadside sites for over ten years, are flex levelers.

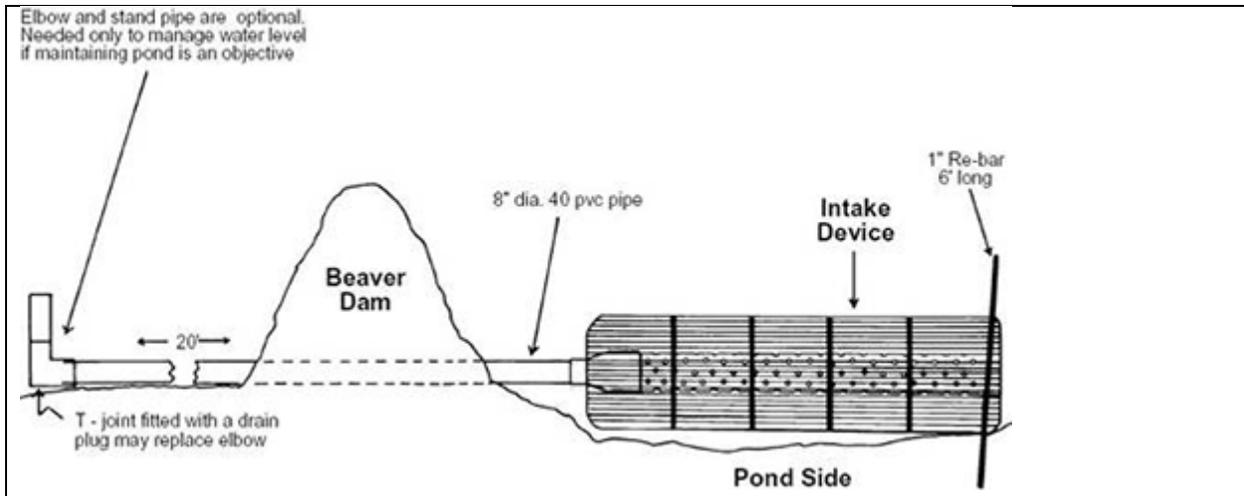


Figure A9: Clemson Beaver Pond Leveler (NCWRC 2015)



Figure A10: Clemson Leveler being installed (from <http://www.beaverww.org/solving-problems/manage-flooding/>).



Figure A11: A pond leveling device installed through a dam, with an outlet protection exclusion fence (photo courtesy of G. Hood)



Figure A12: Upstream cage of a pond leveler device, prior to installation (L) and during installation (R, photos courtesy of G. Hood).

Watch this timelapse video showing Mike Callahan of Beaveroultions.com, installing a Beaver Pond Leveler: <https://www.youtube.com/watch?v=LVfpRBzk5PM>

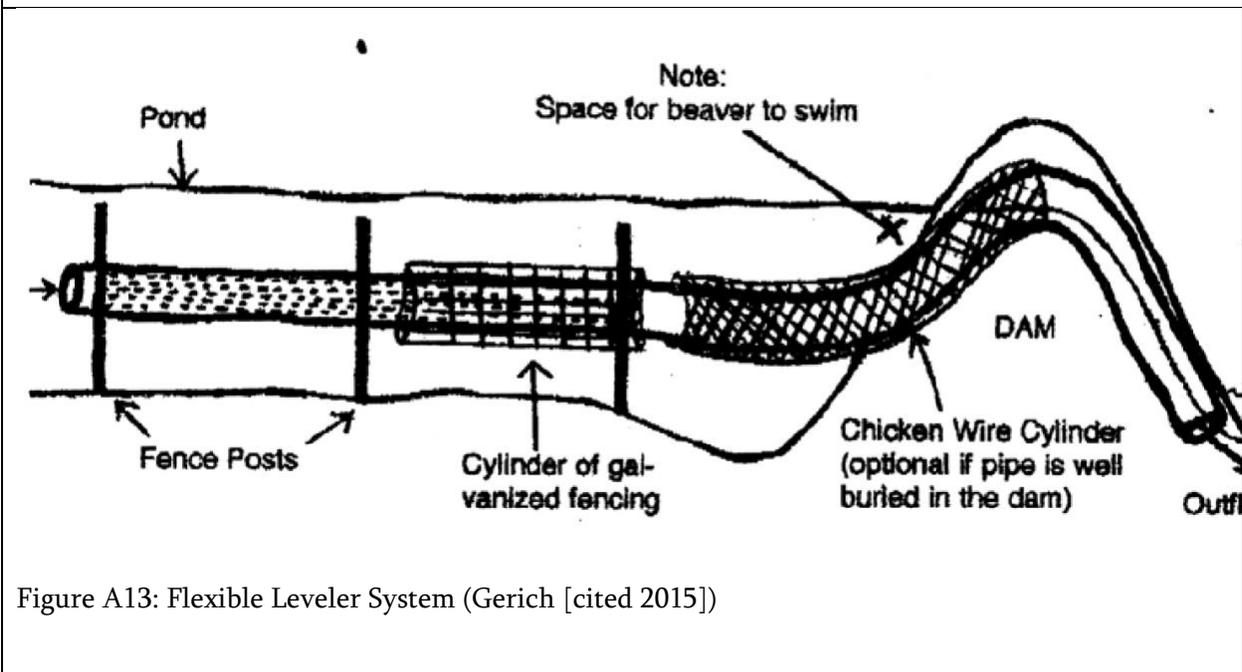


Figure A13: Flexible Leveler System (Gerich [cited 2015])

## Building a pond leveller at a bridge site



1. Building the cage



2. Attaching pipe to cage



3. Joining the pipes



4. Floating the cage



5. Dropping cage and pipe



6. Protecting the end

Figure A14. Steps for building and installing a pond leveller (photos courtesy of G. Hood).

Reference: Jacobson J. (no date). How to build and install a flexpipe. Snohomish County, Public Works Department. Retrieved from: <http://www.beaverww.org/assets/PDFs/How-to-build-a-Flexpipe.pdf>

Figures A15 – A20: Other Pond Leveling Devices:

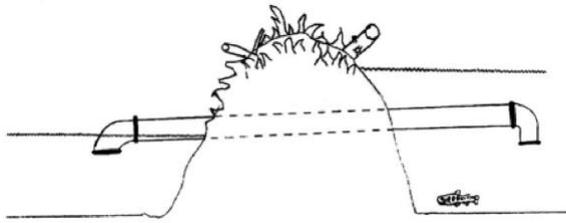


Figure A15: Dam Siphon (BC MoAFF 2005)

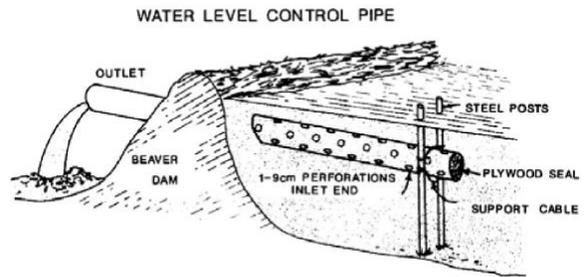


Figure A16: Perforated Culvert (BC MoAFF 2005)

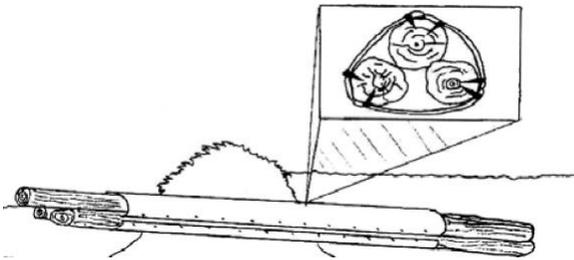


Figure A17: Log Culvert (BC MoAFF 2005)

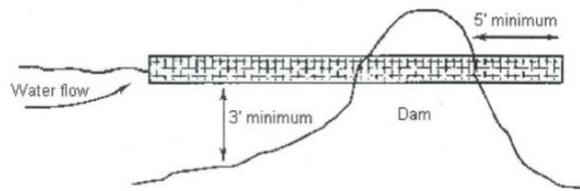


Figure A18: Wire Mesh Culvert (Gerich [cited 2015])

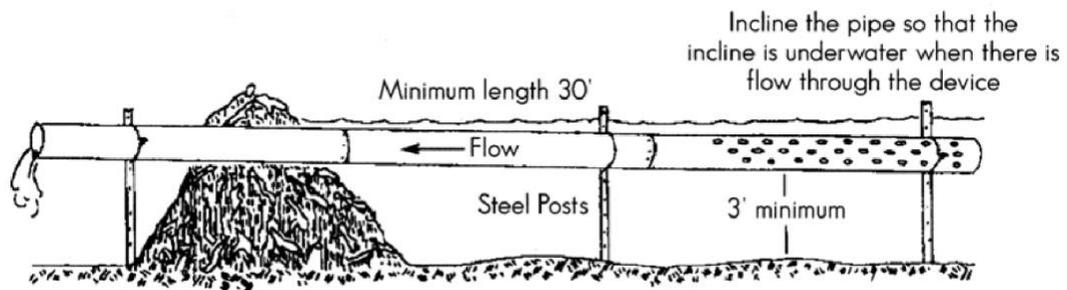


Figure A19: Pond Drain Pipe (Gerich [cited 2015])

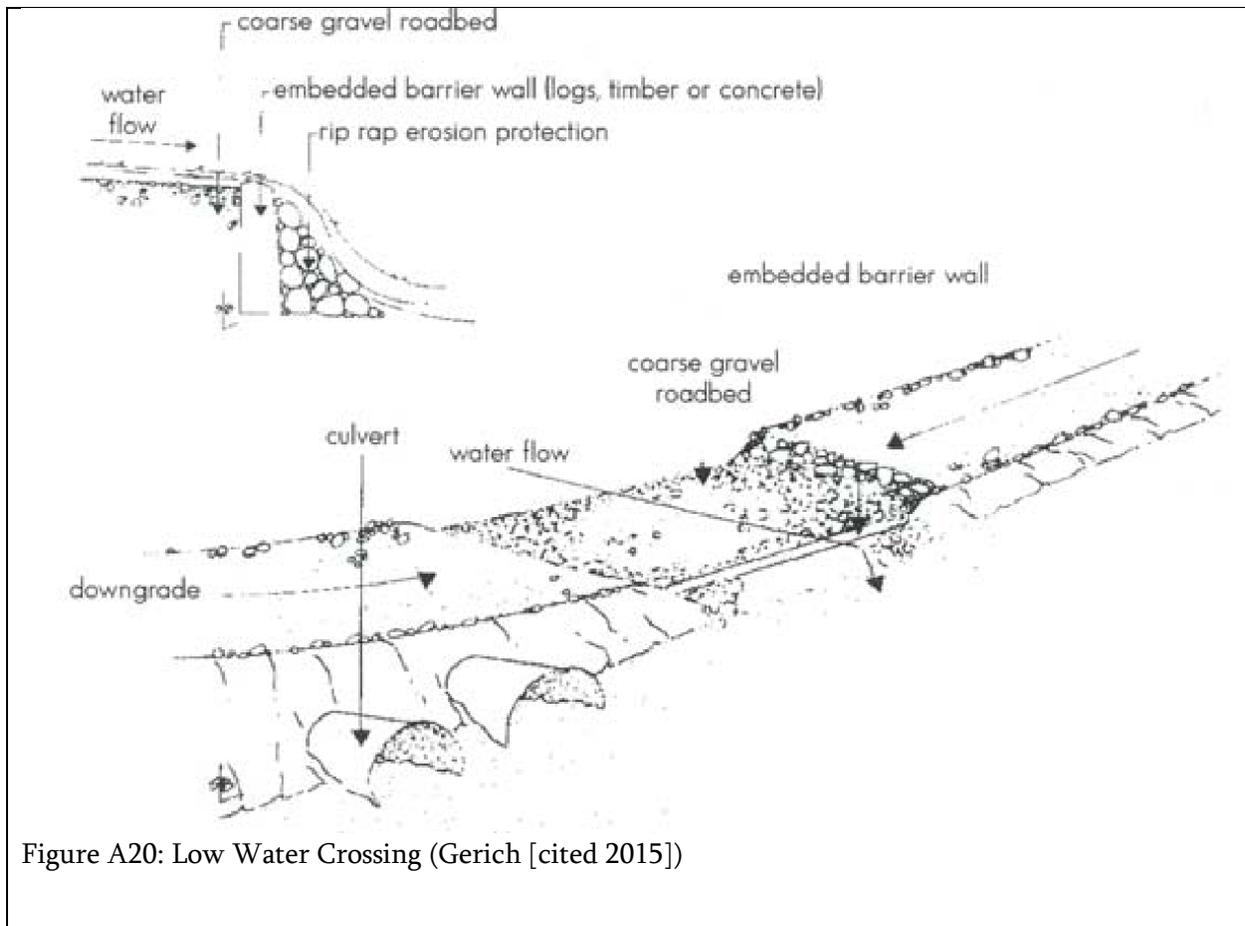


Figure A20: Low Water Crossing (Gerich [cited 2015])

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## Appendix 2: Template for Reporting Known and Potential Beaver Conflict Areas within Operating Area

*This table should be used by proponents to report all known and potential beaver conflict sites within the operating area, as well as actions taken by the proponent and the results of these actions.*

Requested format: excel spreadsheet or .csv file to accompany shapefile of known and potential conflict areas.

Fields:

- Location (description)
- UTM's: zone; easting; northing
- Known or potential conflict (use dropdown: known or potential);
- Type of conflict;
- Number of beaver observed in location;
- Other signs of beaver observed in location (e.g., gnawed trees, beaver dam, lodge, etc.);
- Monitoring frequency;
- Management option for known conflict area: (use dropdown: avoidance, exclusion fencing, beaver stop, beaver baffler, diversion dam, pond leveler, combination device, trapping out);
- Date of implementation;
- Date of site visit <multiple fields based on monitoring frequency>;
- Results of site visit <multiple fields based on monitoring frequency>

### **Appendix 3: Beaver Removal Permit (full version to be inserted in final document; or could link to url)**

*Proponents must use this beaver removal permit for any instance in which lethal control is the preferred option.*

*WILDLIFE ACT*

**PERMIT FJ15-**

<b>PERMIT HOLDER</b>	<p>ATTENTION: PHONE:</p>
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**IS AUTHORIZED UNDER** s. 2(c)(iii) of the *Permit Regulation*, B.C. Reg. 253/2000,

<b>TO</b>	Hunt, trap or kill <b>Beaver</b> ( <i>Castor canadensis</i> ) during the open or closed season as the regional manager considers it necessary for the proper management of the wildlife resource.
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**AND**

**IS EXEMPT UNDER** s. 3(1)(a) of the *Permit Regulation*, B.C. Reg. 253/2000,

<b>FROM</b>	The prohibition in s. 9(1) of the Act against destroying beaver dams.
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**SUBJECT TO THE FOLLOWING:**

<b>TERMS OF PERMIT</b>	<p>This permit is only valid in Peace region, specifically XXXXXX, as shown on the map attached in Appendix C.</p> <p>The permit holder must comply with the terms in Appendix A.</p>	
<b>COMPLIANCE ADVISORY</b>	<p>Failure to comply with any term of this permit is an offence under the <i>Wildlife Act</i>, and may result in any or all of prosecution, suspension of the permit, cancellation of the permit, ineligibility for future permits, and denial of future permit requests.</p>	
<b>PERIOD OF PERMIT</b>	<p>This permit is only valid from xxx to xxx</p>	
<b>DATE OF ISSUE</b>		
<b>SIGNATURE OF ISSUER</b>	<p>Chris Addison Regional Manager Recreational Fisheries &amp; Wildlife Programs Peace</p>	<p><b>PERMIT FEE</b> \$500.00</p> <p><b>HCTF SURCHARGE</b> \$50.00</p>