FINAL REPORT

POST CONSTRUCTION EVALUATION AND SUMMARY
OF HARDISTY CREEK
FISH HABITAT AND FISH PASSAGE RESTORATION IN
KINSMEN PARK REACH

Submitted to:

Foothills Model Forest
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DISTRIBUTION:

1 Copy Foothills Model Forest
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1 Copy Millennium EMS Solutions Ltd.
Edmonton, Alberta

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Edmonton, Alberta
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1. INTRODUCTION

The Hardisty Creek Restoration Project (HCRP) is a multi-stakeholder initiative with a mandate to restore the fish, wildlife, vegetation and overall health of the Hardisty Creek watershed. The HCRP comprises the Athabasca Bioregional Society, Foothills Model Forest, Town of Hinton, Alberta Sustainable Resource Development, Alberta Transportation, Fisheries and Oceans Canada (DFO), Hinton Fish and Game Association, Hinton Wood Products, a division of West Fraser Mills Ltd., and the public. Other stakeholders, such as Canadian National Railway, are also pursuing initiatives to improve the quality of the Hardisty Creek watershed.

The Hardisty Creek watershed is shown in Figure 1. The creek has a watershed area of 37 km² and falls from an elevation of 1650 m to 950 m as it flows approximately 16.5 km from its headwaters on High Divide Ridge to its confluence with the Athabasca River at Hinton. Its upper watershed is currently largely undisturbed. However, stream crossings and land development appear to have adversely affected fish habitat and fish passage in the lower watershed, and planned forestry activities are predicted to cause hydrologic changes in the future.

In October 2003, the Foothills Model Forest (FMF) retained Golder Associates Ltd. (Golder) to conduct fish habitat and fish passage assessments of Hardisty Creek and to develop corrective action designs for fish passage at the Hardisty Avenue crossing and for fish habitat in the Kinsmen Park reach. Golder’s (2004) report Hardisty Creek Fish Habitat And Fish Passage Assessments And Corrective Designs provides a review of Hardisty Creek hydrology, a fish habitat assessment of the Kinsmen Park reach, an assessment of the fish passage potential and flood capacity, remediation designs for fish passage, and corrective action designs for the Kinsmen Park reach of Hardisty Creek.

In October 2004, the FMF retained Millennium EMS Solutions Ltd. (MEMS) to facilitate the construction of fish habitat and fish passage rehabilitation structures at the Hardisty Avenue crossing of Hardisty Creek and for the Kinsmen Park reach of the creek. MEMS coordinated the procurement of construction materials and equipment, establishment of sediment and erosion control structures, fish salvage operations, environmental monitoring, riparian re-vegetation activities, and provided overall construction supervision.
Figure 1 – Hardisty Creek Watershed
2. PRE-REHABILITATION CONDITIONS

Fish habitat assessments were conducted in 2003 for the Hardisty Avenue stream crossing and for the reach of Hardisty Creek within Kinsmen Park. The crossing assessment was completed to provide fisheries information to assist with the development of fish passage remediation options. The Kinsmen Park assessment was completed to determine existing habitat conditions and to provide information required to develop restoration prescriptions.

The overall objective of the fish habitat assessments was to support the development of detailed plans to guide the implementation of restoration and remediation activities at a number of sites within the Hardisty Creek watershed. When completed, these restored and remediated sites will demonstrate practical and proven restoration techniques addressing the range of riparian and fish habitat impacts within the study area. These sites will also serve to provide educational opportunities to both public and professional groups.

2.1 Hardisty Avenue Crossing

The Hardisty Avenue crossing has two culverts, as shown in Figure 2. The smaller culvert is a corrugated metal pipe and the inlet is approximately 0.4 m higher than the larger culvert; it does not provide fish habitat. The larger culvert is a corrugated metal pipe-arch (2440 x 1750 mm) with a length of 40.55 m, and slope of 2.2%. The outlet is perched 9 cm above a 100 m² pool. The maximum pool depth was measured as 0.6 m deep and provides resting and limited cover habitat for fish. The substrate downstream of the culvert is predominantly cobble with some gravel and boulder. Fines are limited. The uniform nature of this culvert does not provide any resting areas along its length and velocities (especially at higher flows) limit the migration of resident fish. Riparian and floodplain condition immediately adjacent to the crossing is disturbed by maintenance of the road and sideslopes. Vegetation is limited to alder, willow and non-woody grass species.
Habitat mapping and evaluation was conducted for Hardisty Creek within Kinsmen Park between the Hardisty Avenue and the Switzer Drive crossings. The fish habitat assessment also extended 100 m upstream and downstream of the crossings.

In addition to habitat features, the following criteria were also considered:

- Overall channel restoration options;
- Specific fish habitat restoration options;
- Specific stream bank and floodplain vegetation restoration options;
- Perennial surface flow restoration options;
- Opportunities for public involvement in restoration activities;
- Watershed aesthetics; and
- Flow conveyance requirements.
Channel habitat within the Kinsmen Park reach, (Figure 3), was predominantly riffle with several mid-channel gravel bars. One large pool was observed immediately downstream of the culvert outlet at Hardisty Avenue and several very small pools were observed throughout the reach. The channel is moderately to heavily incised and banks are considered stable except for the sub-reach extending 30 m downstream from the culvert outlet, which exhibits extensive erosion. Gabions line the banks along lower portion of this reach. Undercut banks or accumulations of Large Woody Debris (LWD) were only noted downstream of the pedestrian bridge. The low water channel width varied from 3 m to 15 m and the water depth was less than 0.2 m (except for the large pool below the culvert outlet). Generally, the channel decreased in width and depth from up to downstream. Substrate consisted of cobble (40%), gravel (35%), boulder (20%) and fines (5%). Riparian vegetation consisted of red osier dogwood, balsam poplar, balsam fir, black spruce and willow species.

Figure 3 - Hardisty Creek within the Kinsmen Park Reach
3. **FISH SALVAGE**

Prior to initiating any in-stream works, a salvage program was conducted to remove resident fish from Hardisty Creek within the Kinsmen Park reach from Hardisty Avenue to Switzer Drive. Collected fish were identified to species, measured for weight and fork length and released upstream of the reach.

Block nets were installed at the up and downstream limits of the reach. A Smith-Root Model 12B electroshocking unit was used to make three passes within the reach for a total of 2814 seconds. 13 fish were collected from Hardisty Creek as described in Table 1.

**Table 1 – Fish Salvage Data for Kinsmen Park Reach**

<table>
<thead>
<tr>
<th>Species</th>
<th>Weight</th>
<th>Fork Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brook Trout</td>
<td>125</td>
<td>237</td>
</tr>
<tr>
<td>Brook Trout</td>
<td>22.4</td>
<td>144</td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>26</td>
<td>143</td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>32.1</td>
<td>136</td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>43</td>
<td>153</td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>100.4</td>
<td>196</td>
</tr>
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<td>Rainbow Trout</td>
<td>193.4</td>
<td>184</td>
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<tr>
<td>Rainbow Trout</td>
<td>27.3</td>
<td>135</td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>19.4</td>
<td>118</td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>83.2</td>
<td>180</td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>122</td>
<td></td>
</tr>
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<td>Rainbow Trout</td>
<td>27.8</td>
<td>120</td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>43.5</td>
<td>143</td>
</tr>
</tbody>
</table>
4. **SEDIMENT AND EROSION CONTROL**

Sediment and erosion control measures were implemented to maintain water quality objectives as stipulated in the DFO *Fisheries Act* Authorization (ED-04-2284) and the Alberta Environment *Water Act* Approval (#00211360-00-00). Both documents are provided as Attachments.

Prior to initiating any in-stream activities, a turbidity fence was installed at the downstream limit of the reach at the Switzer Drive bridge crossing (Figure 4). The fence was constructed using 2X4 lumber to create eight “A” frame supports (each side approximately 1 m) that were spaced across the channel. The supports were connected using 2X4 lumber rails. A non-woven geotextile filter fabric (ProPex 4553) was attached to the frame supports and rails using roofing nails. The fabric extended upstream of the fence approximately 3 m to provide a “skirt” that was covered with cobbles to ensure flow passed through the structure rather than under or around it. Mid-way through the project, a second layer of filter fabric was added to the fence.

ProPex 4553 is a polypropylene non-woven needle-punched fabric stabilized to resist degradation due to ultraviolet exposure. It is resistant to naturally occurring soil chemicals, mildew and insects; is non-biodegradable; and is stable within a pH range of 2 to 13. Additional features of ProPex 4553 are provided in Table 2.

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Minimum Average Roll Value (English)</th>
<th>Minimum Average Roll Value (Metric)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile</td>
<td>ASTM-D-4632</td>
<td>203 lbs</td>
<td>0.900 kN</td>
</tr>
<tr>
<td>Grab Elongation</td>
<td>ASTM-D-4632</td>
<td>50 %</td>
<td>50 %</td>
</tr>
<tr>
<td>Mullen Burst</td>
<td>ASTM-D-3786</td>
<td>380 psi</td>
<td>2619 kPa</td>
</tr>
<tr>
<td>Puncture</td>
<td>ASTM-D-4833</td>
<td>120 lb</td>
<td>0.533 kN</td>
</tr>
<tr>
<td>Trapezoidal Tear</td>
<td>ASTM-D-4533</td>
<td>80 lb</td>
<td>0.355 kN</td>
</tr>
<tr>
<td>UV Resistance</td>
<td>ASTM-D-4355</td>
<td>70 % at 500 hrs</td>
<td>70 % at 500 hrs</td>
</tr>
<tr>
<td>AOS</td>
<td>ASTM-D-4751</td>
<td>100 sieve</td>
<td>0.15 mm</td>
</tr>
<tr>
<td>Permittivity</td>
<td>ASTM-D-4491</td>
<td>1.5 sec $^{-1}$</td>
<td>1.5 sec $^{-1}$</td>
</tr>
<tr>
<td>Flow Rate</td>
<td>ASTM-D-4491</td>
<td>110 gal/min/ft $^{2}$</td>
<td>4470 L/min/m $^{2}$</td>
</tr>
</tbody>
</table>

Table 2 – Technical Data for ProPex 4553
Figure 4 – Installation of Turbidity Fence in the Kinsmen Park Reach
5. ENVIRONMENTAL MONITORING

Both Alberta Environment and DFO required that water quality be protected during the implementation of this project. In addition to the erosion and sediment control measures, the approvals/authorizations stipulated sediment guidelines. Specifically, the DFO Fisheries Act Authorization (ED-04-2284) required that turbidity values could increase a maximum of 8 NTU above background levels for any short-term (less than 24 hours) exposure.

Over the three days during which construction occurred, approximately 18 hours of in-stream work occurred. During this time, six background turbidity samples were collected upstream of the Kinsmen Park reach (upstream of the Hardisty Avenue crossing). The background levels ranged from 0.6 to 4.7 NTU with a mean of 1.4 NTU. This translates into a turbidity objective of 9.4 NTU during in-stream activities.

During construction, 41 water samples were collected downstream of the turbidity curtain. Sampling frequency was approximately twice per hour. Thirty-one of the samples indicated an exceedance of the 9.4 NTU objective. Construction protocols were modified in the field to alternate between in-stream and land-based activities and an additional turbidity curtain was added at the downstream limit of the Kinsmen Park reach. These actions had a limited effect on minimizing water quality impacts.

5.1 Severity of Ill Effects

A dose-response model developed by Newcombe and Jensen (1996) was used to assess the impact of sediment input on fish and fish habitat in Hardisty Creek downstream of the Kinsmen Park reach. Several sub-models describe the severity of Ill Effects Indices (SEV) for various species, groups and/or life stages, using sediment concentration (mg/L) and dose duration (hours). Using Alberta Surface Water Quality Guidelines (Alberta Environment 1999), a ratio of 8 NTU to 25 mg/L total suspended sediment was assumed.

A sub-model defining the potential impacts on salmonid eggs or larvae were used to describe potential effects on incubating brook trout eggs. Impacts on juvenile or adult rainbow and brook trout were assessed using a second sub-model.
The SEV analysis is based upon a worst case scenario. It was assumed that the maximum Total Suspended Solid (TSS) level recorded during each exceedance period was present from the previous to the subsequent sampling time. It was also assumed that brook trout eggs and juvenile or adult rainbow and brook trout were present within the downstream zone-of-influence and that the juvenile and adult stages did not move out of the zone of influence when turbidity readings increased.

The model results suggest that the water quality in Hardisty Creek during the construction of fish habitat and passage structures exhibited had only minor and sub-lethal effects on any fish downstream of work zone. The analysis indicates that the SEV on juvenile or adult rainbow and brook trout life stages ranged from 5 to 7, which equates to potential effects such as moderate physiological stress, moderate habitat degradation and impaired homing. For brook trout eggs and larvae life stages, the SEV ranged from 6 to 7 equating to effects ranging from minor to major physiological stress possibly leading to delayed hatching or reductions in feeding rates and feeding success.

Due to the short period of in-stream activities, the marginal habitat quality of the reach downstream of the work zone, and the assumed worst case dose durations, we conclude that fish and habitat resources were not significantly affected by the in-stream activities.
6. CONSTRUCTION MATERIALS AND EQUIPMENT

Four general habitat structures were constructed within the Kinsmen Park reach and at the Hardisty Avenue crossing of Hardisty Creek. These included the installation of riffles, boulder clusters, and meanders, and the construction of floodplain elements. All structures were constructed in accordance with the Golder (2004) report Hardisty Creek Fish Habitat And Fish Passage Assessments And Corrective Designs with allowance for “field fitting”.

6.1 Riffle Structure

Nine riffles were constructed between the Switzer Drive and Hardisty Avenue crossings to mimic natural rapids in form, materials and function. They will function to provide upstream pools for fish holding habitat and downstream turbulence to ensure oxygen saturation and energy dissipation along the stream profile. They will also provide appropriate substrate to support invertebrate prey populations.

The eight downstream riffles were constructed as per the designs prepared by Golder (2004). Each structure provides between 50 and 200 m$^2$ of pool habitat with an average depth of 0.4 m. Each pool provides backwater to an elevation just below the tail of the next upstream riffle. The downstream slope of each riffle provides between 20 and 80 m$^2$ of turbulent flow. A shallow “channel” was constructed on each downstream slope to provide fish passage during periods of low flow.

The riffle immediately downstream of the Hardisty Avenue culvert outlet was constructed to an elevation of 1 m above the pre-construction bed. The design elevation of 1.8 m was not constructed due to the lack of materials. This structure provides approximately 700 m$^2$ of pool habitat with an average depth of 0.8 m. The downstream slope of the riffle provides approximately 125 m$^2$ of turbulent flow.

The eight downstream riffles were constructed using boulders (750 mm diameter) installed perpendicular to the channel thalweg to create a “spine” (Figure 5). This spine was “keyed” into the channel bed and banks to ensure undercutting or side cutting could not occur. A crest height
of approximately 0.6 m above the existing channel bed was established and all other riffle dimensions were constructed from the spine.

![Figure 5 – Construction of Riffle Spine](image)

Well-graded fill material (250 mm minus pit run) was placed upstream of the spine to a surface slope of 25% (4H:1V) and a downstream to a slope of 5% (20H:1V). In order to provide a uniform transition of the existing bed to the riffle, some material was excavated from the upstream pool and placed on the up and downstream slopes of the riffle structure.

The riffle immediately downstream of the culvert outlet was constructed in a similar fashion to the other eight; however, two rows of boulders were placed along the spine to achieve a crest height of 1.0 m above the existing bed. While this elevation does not meet design specifications (due to lack of materials), the upstream pool is backwatered sufficiently to eliminate the perched outlet and provides limited flooding of the culvert (Figure 6). Future funding initiatives will allow for this riffle structure to be completed and provide full fish passage upstream of Hardisty Avenue.
6.2 Boulder Clusters

A total of 77 boulder clusters, in groups of three to five boulders (average diameter of 500 mm), were placed on the downstream slope of the nine riffle structures (Figure 7). Each cluster was separated approximately four meters and their configuration was staggered along the downstream slope to guide flows within the centre portion of the riffle. At higher discharges, boulder clusters
will provide in-stream cover and add stability to the riffle while transferring scouring forces to the next downstream pool. At lower discharges, pocket pools created downstream of the boulders provide areas of refugia for juvenile fish.

Figure 7 – Reach of Hardisty Creek Before (top) and After Boulder Cluster Placement
6.3 Meanders

Meander features were constructed in channel sections between riffle structures. These features were installed to encourage deposition along the inside bends and to protect eroding areas exposed to the thalweg on the outside of bends. LWD and boulder ballasting elements were utilized for both areas; however, the orientation of the structures conformed to the erosional or sedimentary tendencies of the banks.

Figure 8 – Reach of Hardisty Creek Before (top) and After LWD Placement
LWD incorporated into point bars was placed on top of the existing channel bed material and orientated at an angle between 30° and 60° from the downstream bank. Additional LWD was often placed on top of the base layer to provide increased complexity and mass. Ballast was provided by 500 mm boulders cabled to the LWD using the Hilti epoxy system (HIT-HY 150 Adhesive Anchor System), ½” galvanized wire rope and galvanized clamps to form a single aggregate complex. This complex was confined to the upper 1/3 of the point bar created between the bankfull and low flow elevations. The lower 2/3 of the point bar will remain exposed to natural aggradation and degradation under varying flow regimes. Live willow stakes were planted throughout the point bars to provide natural stability and further encourage the deposition of sediment during high flows.

LWD incorporated into the outside of the meanders was oriented parallel to the flow and trenched into the banks to maximise stability. Additional LWD was placed on top of the bank to provide additional protection during higher flows. All LWD was cabled to ballast using galvanized wire rope and all elements of each structure were connected using galvanized wire rope and clamps to form a single aggregate complex (Figure 9). Boulders were placed along the toe of unstable or eroding banks to provide additional protection and create cover habitat for fish. Live willow stakes were planted along the top of the banks and all disturbed soil was re-vegetated using a native grass seed mixture.
All LWD used in Hardisty Creek was collected from the floodplain areas of Kinsmen Park. These were generally live or dying trees that posed a safety risk to the public. Where possible, the root balls were left attached to the tree stems and the branches were not removed.

6.4 Floodplain Reconstruction

Floodplain reconstruction occurred along two sections of the right downstream bank (35 m and 75 m downstream of the culvert outlet) at locations were the bank had been eroded away. Rip-rap (250 mm) was placed along the proposed edge-of-bank and was “tied” into the existing up and downstream natural banks. Live willow cuttings were placed within the reconstruction area with less than 20 cm exposed beyond the rip-rap and into the open channel (Figure 10).

![Figure 10 – Floodplain Reconstruction Using Willow Cuttings and Coconut Blankets](image)

The willow cuttings were overlain with semi-permanent erosion control blanket (North American Green C125) constructed with a coconut fibre matrix having a functional life of approximately 36 months. The matrix is sandwiched between two heavyweight polypropylene nets having a mesh size of 1.6 cm square. Soil was placed to an approximate depth of 0.3 m and a native grass seed mixture (provided by West Fraser Mills Ltd.) was added. Additional layers of blanket wrapped the soil to reduce the potential for erosion until the vegetative cover (grasses and willows) can be established.
A second lift of willow cuttings, soil and blankets was added to bring the reconstructed floodplain section up to the surrounding native floodplain elevation. The top layer of blanket was pinned in place using staples. Additional willow cuttings were planted in any riparian and floodplain areas disturbed during construction or that had limited vegetative cover.
7. RECOMMENDATIONS FOR FUTURE WORK

The construction of fish habitat and passage features within the Kinsmen Park reach of Hardisty Creek during the 2004 work session has provided a foundation upon which to develop future projects. Prior to initiating any new works, the costs and benefits of each project should be considered in light of the overall watershed values. A general sequence for restoration works is provided as follows:

1. Complete replacement of the culvert crossing with a single span bridge structure for the Haul Road within the West Fraser Mills Ltd. mill site;

2. Develop and construct fish habitat restoration prescriptions for the reach downstream of Switzer Drive to the West Fraser Mills Ltd. mill site;

3. Develop and construct fish habitat restoration prescriptions for the reach downstream of the West Fraser Mills Ltd. mill site to the Athabasca River;

4. Develop and construct fish passage prescriptions for the crossing structures at Highway 16;

5. Develop and construct fish habitat restoration prescriptions for the reach upstream of Hardisty Avenue to the Canadian National Railway crossing;

6. Develop and construct fish habitat restoration prescriptions for the reach upstream of the Canadian National Railway crossing to Highway 16;

7. Monitor fish use of completed habitat and passage restoration projects.
8. REFERENCES


9.  CLOSURE

This report provides a description of the fish habitat and fish passage restoration works completed within the Kinsman Park reach and at the Hardisty Avenue crossing of Hardisty Creek. Recommendations for future restoration works within the Hardisty Creek watershed have also been provided.

We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

Millennium EMS Solutions Ltd.

[Signature]

Senior Environmental Scientist
ATTACHMENT I - FISHERIES AND OCEANS CANADA,
FISHERIES ACT AUTHORIZATION
01 October 2004

Millennium EMS Solutions Ltd.
Jan den Dulk
Suite 208, 4207-98 Street
Edmonton, AB
T6E 5R7

Dear Mr. den Dulk:


The harmful alteration, disruption or destruction of fish habitat arising from the Town of Hinton’s Stream Remediation and Prescriptions on Hardisty Creek in Alberta is hereby authorized pursuant to Subsection 35(2) of the *Fisheries Act*. This Authorization shall be conditional upon implementation of measures specified on the attached document. The Authorization should be held on site and work crews should be made familiar with its conditions.

The environmental impacts of these undertakings have been reviewed by the Department of Fisheries and Oceans in accordance with the *Canadian Environmental Assessment Act*. These reviews concluded that the project is not likely to cause significant adverse environmental effects if the mitigation measures specified are implemented.

Failure to comply with any of the conditions specified on the attached Authorization may result in a contravention of Section 35 of the *Fisheries Act*. Please be advised that this Authorization does not imply authorization of these undertakings in accordance with any section of the *Fisheries Act* other than Section 35, nor does it supersede the requirements of any other federal, provincial or municipal legislation.

If you require additional information or clarification, please contact Ms. Sherry Nugent at (780) 495-8473.

Sincerely,

[signature]

John Englert, P. Biol.
District Manager, Edmonton District Office

cc: B. McCulloch (Impact Assessment Biologist, Edmonton)
    S. Nugent (Fish Habitat Biologist, Edmonton)
    R. Rath (C&P Supervisor, Edmonton)
    D. Borutski (SRD, Edmonton)
    G. Sterling (SRD, Edson)
Authorization for Works or Undertakings Affecting Fish Habitat

Authorization issued to: The Town of Hinton
c/o Millennium EMS Solutions Ltd

Autorisation délivrée à: Jan den Dulk

Name: Jan den Dulk

Nom: Jan den Dulk

Address: Millennium EMS Solutions Ltd.
Suite 208, 4207-98 Street
Edmonton, AB T6E 5R7

Adresse: Millennium EMS Solutions Ltd.
Suite 208, 4207-98 Street
Edmonton, AB T6E 5R7

Telephone No.: (780) 496-9049
No de Téléphone: (780) 496-9049

Location of Project/Emplacement du projet

Hardisty Creek – Tributary to the Athabasca River – Yellowhead County, in Hinton, Alberta. The stream remediation prescriptions will be constructed from Hardisty Avenue (upstream) to Switzer Drive (downstream) in Hinton.

Valid Authorization Period/Période de validité

From/De 04 October 2004
To/A 17 October 2004

Description of Works or Undertakings (Type of work, schedule, etc.)
Description des ouvrages ou entreprises (Genre de travail, calendrier, etc.)

The proposed works will involve the stream channel restoration of Hardisty Creek within the stream spanning from Switzer Drive (downstream) to Hardisty Avenue (upstream) in Hinton. In total, approximately 50 meters of floodplain will be reconstructed (i.e.: channel narrowing), 9 riffle structures, 40 boulder clusters (in 9 different areas) installed, and 7 inside and outside meander bank treatments will be constructed.

Prior to works commencing, the worksite may be isolated and fish salvage will be undertaken. Any fish in the area will be removed from the stream with a 3-pass electrofishing approach. Any pumps used in the isolation will be screened with an appropriately sized mesh to exclude any fish. Any sediment laden water in the excavation area will be collected and pumped into an upland area to prevent the introduction of sediment into any fish-bearing waters. All disturbed areas will be seeded and re-planted with appropriate seeding mixes and shrubs post-construction.

Conditions of Authorization/Conditions de l’autorisation

Fish and Fish Habitat

1. All works shall be undertaken as described in “Application for Authorization for Works or Undertakings Affecting Fish Habitat” submitted by Millennium EMS Solutions Ltd, dated August 12, 2004, and a Report written by Golder Associates Ltd. entitled Hardisty Creek Fish Habitat and Fish Passage Assessments and Corrective Designs dated May 2004; and including measures specified below.

2. Work shall be undertaken in accordance with the “Fish Habitat Manual: Guidelines & Procedures for Watercourse Crossings in Alberta” (Alberta Transportation, 2001).

3. To mitigate further harmful alteration, disruption or destruction of fish habitat, the proponent shall carry out the following:

3.1. Every reasonable effort shall be made to minimize the duration of instream works. Construction shall be halted during heavy rains.
3.2. Clean granular material shall be used for fill and clean rock free of silt and clay shall be used for riprap, riffle, and/or boulder treatments.

3.3. The remediated creek bed shall provide fish passage at low flow as good as or better than the natural channel immediately above and below the portion of the watercourse affected by these works. Surface flow over the affected streambed and the associated riprap shall be maintained at low flow.

3.4. Sediment and erosion control measures shall be implemented prior to work and maintained during the work phase, and until the site has been stabilized, to prevent entry of sediment into the water. All disturbed areas of the work site shall be stabilized immediately and re-vegetated as soon as conditions allow. Sediment and erosion control measures shall be left in place until all areas of the work site has been stabilized.

3.5. If flows exist at the time of construction, the worksite maybe isolated during construction. Fish shall be salvaged from the isolated areas prior to construction within the isolated areas, and released upstream. Downstream flow shall be maintained at all times. If a pump is used to maintain downstream flow, the intake shall be screened in accordance with DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines. The outlets shall have a diffuser or shall be placed in a location that is not subject to erosion from the outflows.

3.6. The stream remediation prescriptions of Hardisty Creek may take place in a non-isolated construction zone due to potential isolation problems within such a large creek section. If the structures are installed in a non-isolated manner, they shall adhere to the following:

3.6.1. A turbidity curtain shall be installed at the downstream extent of the construction zone (specifically under the Switzer Drive bridge) prior to the commencement of construction. The curtain will be used to trap sediment and shall be removed at the end of the construction activities.

3.6.2. Work schedules shall be implemented to reduce the duration of continuous instream works by alternating instream activities in (riffle creation) and out (floodplain works) of the stream.

3.6.3. The construction of the habitat features shall proceed from down to upstream to minimize siltation.

3.6.4. If deemed a sufficient threat to fish and fish habitat, DFO may have the works stopped or isolated to prevent further damage to fish and fish habitat.

3.7. Turbidity readings will be collected at the start of each day prior to initiating any in-stream work to establish background levels. Background turbidity readings will also be taken once per hour upstream of the zone of influence of construction. For activities not in the flow of water (re-construction of the floodplain immediately downstream of the Hardisty Avenue culverts), turbidity readings will be taken once per hour immediately downstream of construction. For activities directly in the flow of water (construction of riffles, boulder cluster placement) turbidity readings will be taken once every 1/2 hour downstream of construction zone (downstream of Switzer Drive). If readings are deemed by DFO to fall consistently within acceptable ranges, the sampling may be done once per hour.

3.8. Unless otherwise required by DFO, construction activities will continue provided that:

3.8.1. For clear flow - Maximum increase of 8 NTU from background levels for any short-term exposure (e.g., 24-h period). Maximum increase of 2 NTU from background levels for any long-term exposure (e.g., inputs lasting between 24-h and 30-d).

3.8.2. For high flow or turbid waters - Maximum increase of 8 NTU from background levels at any one time when background levels are between 8 and 80 NTU. Should not increase more than 10% of background levels when background is >80 NTU.

3.8.3. If turbidity levels exceed the above guidelines, all in-stream works will be ceased and the only activities to be implemented will be mitigation measures to reduce turbidity and protect water quality. Once turbidity levels return to within the aforementioned guidelines and additional mitigation measures have been completed, in-stream works can be resumed.

3.9. Materials used in the restoration prescription shall be clean and shall not introduce clay or silt into the watercourse.
3.10. If the construction sites need to be dewatered, then the water shall be released into a well vegetated area or settling basin and not directly into the watercourse. Water returning to the watercourse shall be screened with a properly maintained screen of silt filter cloth such that all returning water is of equal or better quality than the water in the watercourse.

3.11. Equipment shall be refuelled and serviced in a way that prevents any deleterious substance from entering any watercourse. Equipment operating near any watercourse shall be free of external grease, oil and mud. Appropriate precautions shall be taken to ensure that deleterious substances do not enter the watercourse.

3.12. Any disturbed banks shall be revegetated with species recommended for the area by Alberta Transportation.

3.13. All debris from construction shall be removed from the site.

4. A monitoring program shall be designed and implemented to the satisfaction of DFO to address the following:

4.1. Pre-construction photos shall be taken of all areas to be modified and submitted to DFO, along with species and fork length data for any fish salvaged from the exclusion area, referencing file #ED-04-2284. On site construction monitoring shall be implemented to ensure adherence to recommended mitigation measures.

4.2. Post-construction photos shall be taken of all modified areas and submitted to DFO, referencing file #ED-04-2284, immediately following construction and reclamation.

4.3. A post-construction assessment of the project area shall be conducted and submitted to DFO in the fall of 2005 to identify any problem areas that require remedial action. The program shall assess the physical stability of the new streambed, instream remediation prescriptions, and of the creek bed and banks for 500m upstream and 500m downstream of the works. Fish passage shall also be assessed. Post-construction monitoring reports including photos shall be submitted to DFO, referencing file #ED-04-2284, within one year following completion of the works. The monitoring report shall also include photographic documentation on the survival of riparian vegetation plantings. If less than 85% of the vegetation survives, then the Town of Hinton shall replace the lost vegetation.

5. All mitigation and compensation measures shall be implemented to the satisfaction of DFO.

All changes in plans, specifications, or operating conditions that have the potential to adversely affect fish or fish habitat shall be submitted to DFO for approval in writing prior to implementation.

The holder of this authorization is hereby authorised under the authority of section 35(2) of the Fisheries Act, R.S.C., 1985, c. F. 14, to carry out the work or undertaking described herein.

This authorization is valid only with respect to fish habitat and for no other purposes. It does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

Failure to comply with any condition of this authorization may result in charges being laid under the Fisheries Act.

This authorization form should be held on site and work crews should be made familiar with the conditions attached.

Le détenteur de la présente est autorisé en vertu du paragraphe 35(2) de la Loi sur les pêches, L.R.C. 1985, ch. F. 14, à exploiter les ouvrages ou entreprises décrits aux présentes.

L'autorisation n'est valide qu'en ce qui concerne l'habitat du poisson et pour aucune autre fin. Elle ne dispensa pas le requérant de l'obligation d'obtenir la permission d'autres organismes réglementaires concernés ou de se confronter à leurs exigences.

En vertu de la Loi sur les pêches, des accusations pourront être portées contre ceux qui ne respectent pas les conditions prévues dans la présente autorisation.

Cette autorisation doit être conservée sur les lieux des travaux, et les équipes de travail devraient en connaître les conditions.
AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON

Date of issuance: ____________________________

Approved by: ____________________________

Title: ____________________________

Date de délivrance: ____________________________

Approuvé par: ____________________________

Titre: ____________________________
ATTACHMENT II - ALBERTA ENVIRONMENT, 
WATER ACT APPROVAL
September 30, 2004

Jean Ann Fraser
Town of Hinton
2nd Floor
131 Civic Centre Road
Hinton, Alberta
T7V 2E5

Dear Ms. Fraser:

RE: APPLICATION UNDER THE WATER ACT FOR AN APPROVAL FOR THE PURPOSE OF CONSTRUCTING A STREAM CHANNEL RESTORATION AT 24-051-25-W5

Enclosed is Approval #00211360-00-00 authorizing the construction of works to stream channel restoration on Hardisty Creek in Kinsman Park including Floodplain reconstruction, riffles, boulder clusters and inside/outside meander bank treatments.

The Water Act provides a right to appeal this decision. Notice of appeal must be submitted not later than 7 days after receipt of this notice to:

Dr. William A. Tilleman, Chair
Environmental Appeal Board
3rd Floor, Peace Hills Trust Tower
10011 – 109 Street
Edmonton, Alberta
T5J 3S8

Telephone: (780) 427-6207 Fax: (780) 427-4693

Also enclosed is the "Certificate of Completion" to be submitted upon completion of the operation.

Please ensure that a copy of this approval is available at the site of the activity.

In order to reduce the potential spreading of Whirling Disease in fish we ask that all equipment and machinery that has been used in the United States be washed clean of all mud and dirt before being used again in any activities in or near streams in Alberta.

This approval should not be taken to mean that you have an authority under federal legislation. You should contact the...
Fisheries and Oceans
Habitat Management
Whitemud Business Park
4253 - 97 Street
Edmonton, Alberta  T6E 5Y7
(telephone:  [780]-495-8468)
(fax:   [780]-495-8606)

relating to the application of federal laws relating to the Fisheries Act (Canada) and the:

Canadian Coast Guard
Navigable Waters Protection
Whitemud Business Park
4253 - 97 Street
Edmonton, Alberta  T6E 5Y7
(telephone:  [780]-495-6325)
(fax:   [780]-495-8607)

relating to the Navigable Waters Protection Act.

Please call Doug Yeremy at (780) 963-6131 ext. 255 if you have any questions.

Sincerely,

Tom Slater, P.Eng.
District Approvals Manager

ab/

Enclosure

cc:  Jan den Dulk - Millenium EMS Solutions Ltd, Edmonton
APPROVAL No. 00211360-00-00

FILE No. 00211360

Town of Hinton
2nd Floor
131 Civic Centre Road
Hinton, Alberta
T7V 2E5

is authorized to construct, operate and maintain works for stream channel restoration including floodplain reconstruction, riffles, boulder clusters and inside outside meander bank treatment on Hardisty Creek on the reach of the creek in Kinsman Park on the 24-051-25-W5 subject to the attached conditions.

2014 09 29
Expiry Date (Y/M/D)

Designated Director under the Act

2004 09 30
Dated (Y/M/D)
ACTIVITY

1. This approval is appurtenant to 24-051-25-W5.

2. The approval holder shall undertake the activity in accordance with the plans and/or reports filed in the following Departmental records:

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>00211360-P001</td>
<td>Hardisty Creek at Hinton Kinsmen Park Stream Remediation Prescriptions Figure 1</td>
</tr>
<tr>
<td>00211360-P002</td>
<td>Hardisty Creek at Hinton Stream Remediation Prescriptions Figure 2</td>
</tr>
<tr>
<td>00211360-R001</td>
<td>Hardisty Creek Fish Habitat and Fish Passage Assessments and Corrective Designs</td>
</tr>
</tbody>
</table>

3. The approval holder shall confine the activity to the work area designated on the plans or to areas as prescribed in the approval.

4. The approval holder shall reclaim any disturbed bed and banks of the water body and areas associated with the activity to the original contours that existed prior to the commencement of the activity.

5. The approval holder shall not deposit any substance that will adversely affect the water body.

6. The approval holder shall prevent siltation and erosion of the water body resulting from the activity.

7. Where applicable, the approval holder shall only release water to a water body when the quality of water is equal to or better than the quality of water in the receiving water body.

8. The approval holder shall not conduct activities in Hardisty Creek between September 1 and July 15 unless the water body is dry or the approval holder has a report from a Qualified Aquatic Environmental Specialist.

GENERAL

9. The activity authorized under this approval shall be completed by September 29, 2005.

10. The approval holder shall hold harmless the Minister of Environment or any other agent of the Government of Alberta for damage or damage claims arising out of the activity.
CONDITIONS

11. The approval holder shall retain a copy of this approval at the site of the activity.

12. On completion, partial completion of the activity, or when requested by the Director, the approval holder shall submit to the Director a certificate of completion which includes:

   (a) a statement that the activity or that part of the activity has been completed in accordance with the approval, and

   (b) any other information required by the Director.

[Signature]

Designated Director under the Act

2004 09 30
Dated (Y/M/D)
CERTIFICATE OF COMPLETION

PURSUANT TO THE PROVISIONS OF THE WATER ACT

APPROVAL No. 00211360-00-00

FILE No. 00211360

Town of Hinton
2nd Floor
131 Civic Centre Road
Hinton, Alberta
T7V 2E5

certifies the activity was completed in accordance with the conditions of Approval No. 00211360-00-00.

Approval Holder’s Signature

Dated (Y/M/D)

Form WA ACC1 (1999)
8 March 2005

Foothills Model Forest
Box 6330
Hinton, Alberta T7V 1X6

Attention: Mr. Rich McCleary

RE: HARDISTY CREEK RESTORATION – KINSMEN PARK REACH

Dear Mr. McCleary:

The stream restoration works at the Kinsmen Park reach of Hardisty Creek in Hinton, Alberta were constructed in October, 2004. The works included all prescriptions contained in the design report for the project (Hardisty Creek Fish Habitat and Fish Passage Assessments and Corrective Designs, Golder Associates Ltd. Project 04-1370-045, May 2004), with the exception of the final riffle downstream of the Hardisty Avenue culvert crossing.

The stream restoration works were laid out by Nathan Schmidt of Golder Associates Ltd. and Jan den Dulk of Millennium EMS Solutions Ltd. on 5 October 2004. The works were laid out in accordance with the designs presented in the project design report, with some field fitting of riffle locations to natural features in the creek.

The stream restoration works were constructed under the supervision of Jan den Dulk over the period 7 to 9 October 2004. During this period, the site was visited by representatives of Fisheries and Oceans Canada, as well as members of the Hardisty Creek Restoration Project steering committee. The works were constructed to specification, including ballasting of large woody debris in accordance with industry standards (Large Woody Debris Fish Habitat Structure Performance and Ballasting Requirements, B.C. Watershed Restoration Program, Management Report No. 8, 1999). Ballasting procedures were discussed in detail in correspondence from Jan den Dulk to Richard McCleary and Chris Spytz dated 27 October 2004.

The stream restoration works are expected to function as designed within the project design hydraulic and hydrologic parameters.

Yours truly,

GOLDER ASSOCIATES LTD.

Nathan Schmidt, Ph.D., P.Eng.
Associate, Senior Water Resources Engineer