Appendix E

Conceptual Fish Habitat Compensation Plan

PRELIMINARY DRAFT FOR DFO REVIEW

Sisson Project: Conceptual Fish Habitat Compensation Plan

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This preliminary draft is provided to the Department of Fisheries and Oceans Canada (DFO) for review and comment on its contents and completeness; it should be considered as subject to change as the environmental impact assessment (EIA) of the Sisson Project is completed. The official version of the Fish Habitat Compensation Plan will ultimately be submitted to DFO for approval as part of the Authorization for harmful alteration, disruption or destruction (HADD) of fish habitat for the Sisson Project, required under the former provisions of Section 35(2) of the *Fisheries Act*, following the completion of the EIA process.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

This document is the Conceptual Fish Habitat Compensation Plan (the "Compensation Plan") prepared by Stantec Consulting Ltd. (Stantec) for Northcliff Resources Ltd. (Northcliff) for consideration as part of the Sisson Project (the Project) near Napadogan, New Brunswick.

The Project consists of a conventional open pit tungsten and molybdenum mine, an ore processing plant, and associated facilities and infrastructure located on provincial Crown land approximately 10 kilometres (km) southwest of the community of Napadogan, New Brunswick, and approximately 60 km directly northwest of the city of Fredericton (see Figure 1 for the location of the Project area).

1.1 BACKGROUND

The Project will result in the direct loss of fish habitat in Bird Brook, Sisson Brook, McBean Brook, and a tributary to the West Branch Napadogan Brook due to the construction of Project-related facilities in the areas covered by these watercourses. Indirect losses of habitat or changes in habitat quality in West Branch Napadogan Brook, Napadogan Brook, and McBean Brook will also occur due to the sequestration of mine contact water in the tailings storage facility (TSF) for the Project, resulting in a reduction in flow in watercourses downstream of the Project. Both these losses are described in detail in the environmental impact assessment (EIA) report for the Project.

The *Fisheries Act* is administered by Fisheries and Oceans Canada (DFO) and is the main legislation protecting fish, fisheries, and fish habitat in Canada. Under Section 35 of the *Fisheries Act* prior to its being amended in summer 2012, a project or development could not cause the Harmful Alteration, Disruption, or Destruction (HADD) of fish habitat without authorization from DFO, and authorization was typically not granted unless the proponent of the project agreed to compensate for the HADD such that there was no residual net loss of habitat. Compensation projects were selected by proponents and evaluated by DFO following the guidance contained in the "Practitioners Guide to Habitat Compensation" ("the DFO Practitioners Guide"; DFO 2006). Although the *Fisheries Act* was amended in 2012, and further amendments are anticipated in 2013, it is assumed that the requirements of the *Fisheries Act* before the June 2012 amendments apply to the Project at this time.

In addition to requirements under the *Fisheries Act*, Section 19(1)(d) of the *Canadian Environmental Assessment Act* (*CEAA*) requires that the EIA must consider "*mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the designated project*". In this light, compensation measures that are technically and economically feasible may constitute part of the overall mitigation approach to minimize the potential for significant adverse environmental effects arising from the Project.

1.2 PURPOSE AND OBJECTIVE OF THE COMPENSATION PLAN

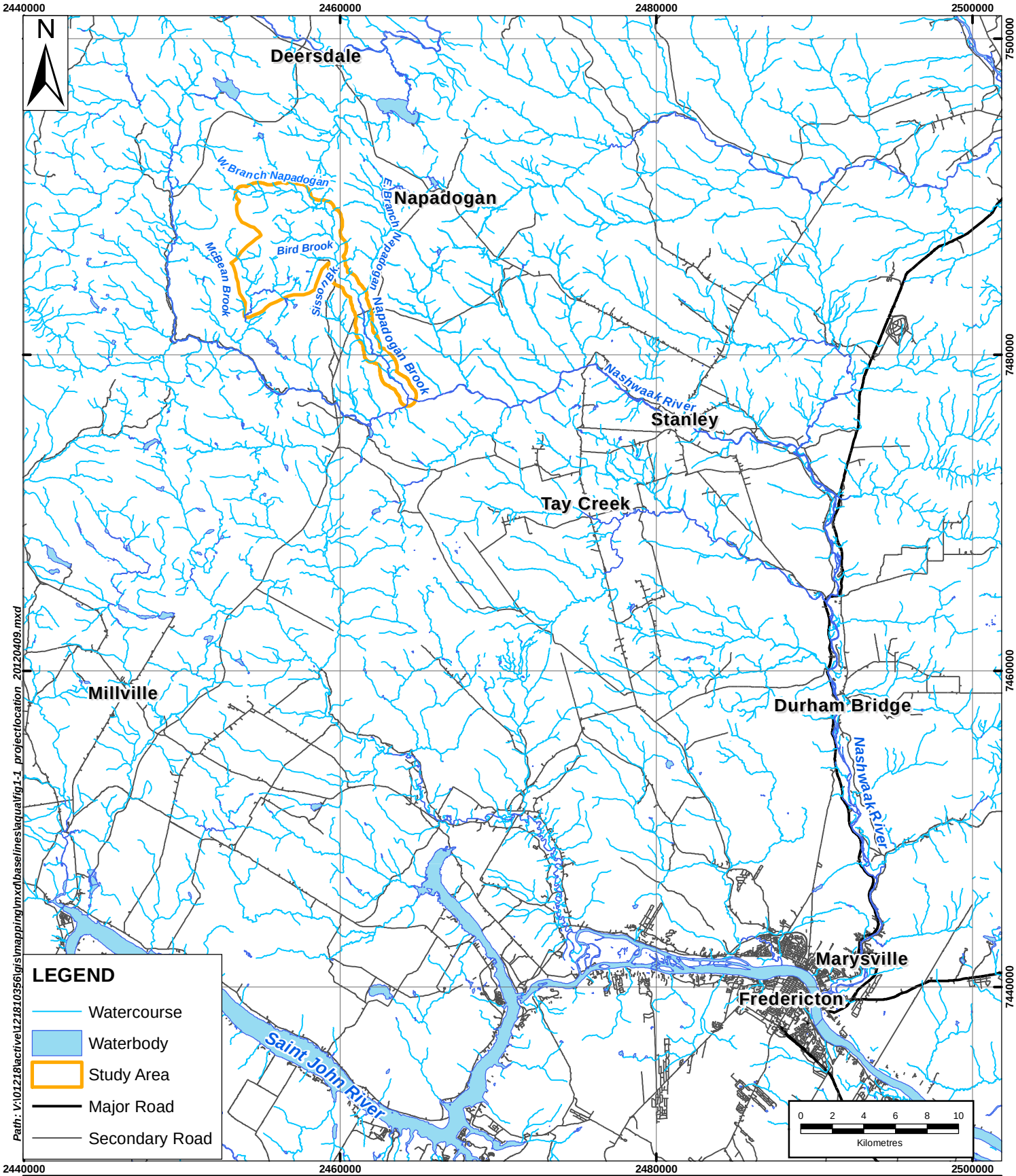
This purpose of this Compensation Plan is to support the conclusions of the EIA and to satisfy the requirements of Section 4.4.6 of the Final Terms of Reference for the EIA of the Sisson Project (Stantec 2012a). As stated in the Terms of Reference, "*the EIA Report will provide the conceptual approach to fish habitat compensation, with the details of the compensation program developed in parallel to the EIA. The final compensation program will be agreed with DFO prior to HADD*

authorization". The objective of this Compensation Plan is therefore to describe, at a conceptual level, the process by which Northcliff will provide compensation for the HADD that is anticipated to result during the construction and operation of the Project, for consideration by DFO in their authorization of the Project.

1.3 ORGANIZATION OF THE COMPENSATION PLAN

The remainder of this Compensation Plan is presented in five sections, as follows:

- Following this introduction, Section 2 describes the process and methods for development of the Compensation Plan;
- Section 3 provides a summary of the anticipated HADD resulting from the Project, and the associated HADD compensation requirement;
- Section 4 describes the identified HADD compensation opportunities;
- Section 5 summarizes the Compensation Plan; and
- Section 6 provides references consulted as part of the work.



NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC PROJECT AND SHOULD NOT BE USED FOR OTHER PURPOSES.

Project Location Sisson Project: Baseline Aquatic Environment Technical Report Napadogan, N.B.	Scale: 1:325,000	Project No.: 121810356	Data Sources: ArcGIS World Topo NBDNR NHN	Fig. No.: 1.1	Stantec
Client: Northcliff Resources Ltd.	Date: (dd/mm/yyyy) 09/04/2012	Dwn. By: JAB	Appd. By: DM		

Map: NAD83 CSRS NB Double Stereographic

2.0 COMPENSATION PLAN DEVELOPMENT METHODS

The process and methods that were followed in the development of this Compensation Plan are described in this section.

2.1 OVERVIEW OF FISH HABITAT COMPENSATION PROCESS FOR THE PROJECT

The development of this Compensation Plan occurred in seven steps that overlapped in time, and that will continue until such time as it is accepted by DFO. The Compensation Plan is part of a larger fish habitat compensation program, the full extent of which is as follows:

- **Step 1**—Minimize the Project's environmental effects through Project design and optimization;
- **Step 2**—Estimate the HADD for the Project, and the required HADD Compensation;
- **Step 3**—Contact regulatory agencies, First Nations, and other stakeholders to identify fish habitat compensation opportunities;
- **Step 4**—Evaluate identified fish habitat compensation opportunities in consideration of regulatory consultation, guidance and documentation, and input received from First Nations and other stakeholders;
- **Step 5**—Develop a conceptual fish habitat compensation plan (*i.e.*, this Compensation Plan) to support the EIA of the Project and subsequent HADD authorization process;
- **Step 6**—Further develop the details of the selected opportunity(ies) for the fish habitat compensation program, and obtain regulatory approval to carry them out; and
- **Step 7**—Implement the selected compensation opportunity(ies), and monitor as appropriate.

2.2 DESCRIPTION OF METHODS

2.2.1 Step 1—Minimize the Project's Environmental Effects through Project Design and Optimization

Throughout the design process for the Project, Northcliff and its design consultants have considered various opportunities to minimize the magnitude and extent of the environmental effects of the Project on the aquatic environment and other valued environmental components (VECs), and further opportunities will continue to be considered as the detailed design and development of the Project are carried out. Design mitigation opportunities are described in detail in the EIA Report, with the key selected mitigation relating to:

- selecting the location of the TSF to avoid lakes, particularly in the McBean Brook watershed;
- minimizing the extent of the TSF, by reducing its size and adjusting its boundaries to avoid additional tributaries to the West Branch Napadogan Brook;

- use of water diversion channels to minimize the generation of mine contact water by diverting off-site run-off away from the Project Development Area (PDA), and the release of diverted water into the McBean Brook watershed to supplement its baseflow; and

- collection, storage, and treatment prior to release of mine contact water to minimize environmental effects on water quality in downstream waters.

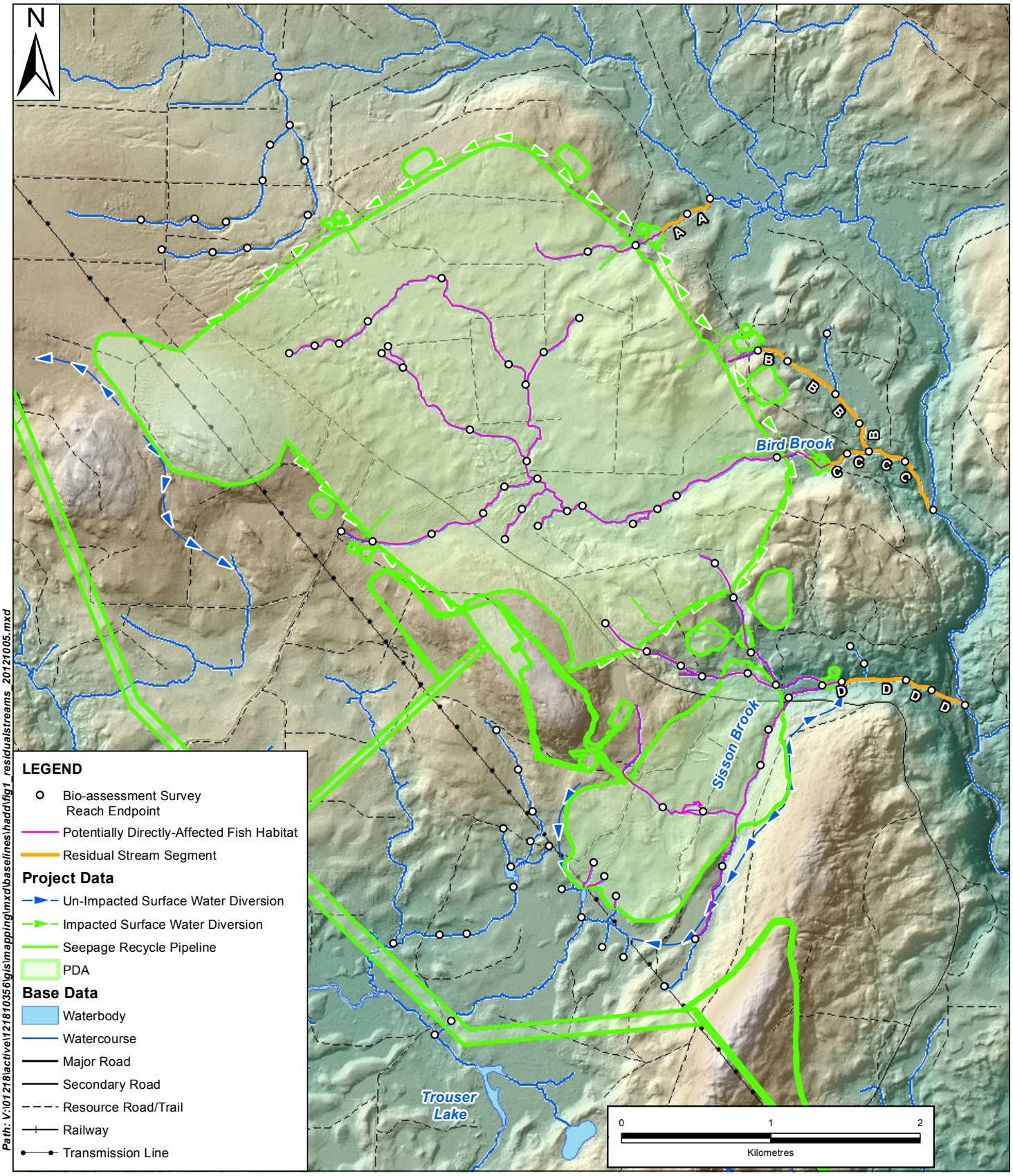
2.2.2 Step 2—Estimate the HADD for the Project, and the Required HADD Compensation

HADD can occur where existing habitat is affected directly within the PDA, or indirectly outside of the PDA.

The direct environmental effect to fish habitat in the PDA (Figure 2) is the loss of habitat arising directly from the destruction of watercourses by Project facilities. The geographic extent and quality of the fish habitat that will be directly affected was characterized through an extensive field program in 2011 (Stantec 2012d). As part of the field program, all watercourses existing within the PDA were walked in their entirety, and measurements of bankfull width and watercourse length were recorded for each reach, among the collection of other data in these watercourses. Supplemental field work in the PDA, and in the linear facilities corridor where the Fire Road will be relocated, was carried out in the summer of 2012. The total surface area of the watercourse—which represents the HADD from direct loss—was calculated using these field measurements, the detailed digital map base developed for the Project, and a geographic information system (GIS).

The indirect environmental effects to fish habitat arise primarily from changes to surface water hydrology in downstream watercourses that will result from the sequestration of water in the TSF once the Project is in operation. The indirect reduction of fish habitat in watercourses downstream of the PDA (Figures 2 and 3) was determined based on estimated changes in flow conditions or modelled changes to wetted perimeter, as appropriate, in residual stream segments of brooks situated in part within the PDA and the lower Napadogan Brook. In residual stream segments of Bird and Sisson brooks, and Tributary “A” to the West Branch Napadogan Brook, estimated changes in flow conditions were calculated based on the percentage change in catchment area for a particular residual segment. For the West Branch Napadogan Brook and the Main Branch Napadogan Brook, a computer-based model developed by the US Corps of Army Engineers (HEC-RAS; US ACE 2010) was used to estimate the change in wetted perimeter area (Stantec 2012l). Transects of 114 channel cross-sections of the lower Napadogan Brook were characterized through field work in late fall 2011, to support the modelling work. The model was run under a variety of flow conditions varying from extremely low to extremely high flows, and the resulting maximum change in wetted perimeter area was conservatively selected as the estimate of HADD.

In order to achieve the DFO management objective of “no-net-loss” of fish habitat, the required compensation amount is typically greater than the estimated HADD. For the Project, DFO (Parker, E. Personal communication, November 6, 2012) confirmed that compensation at an area ratio of 3:1 (compensation HADD : actual HADD) would be consistent with current DFO practice.



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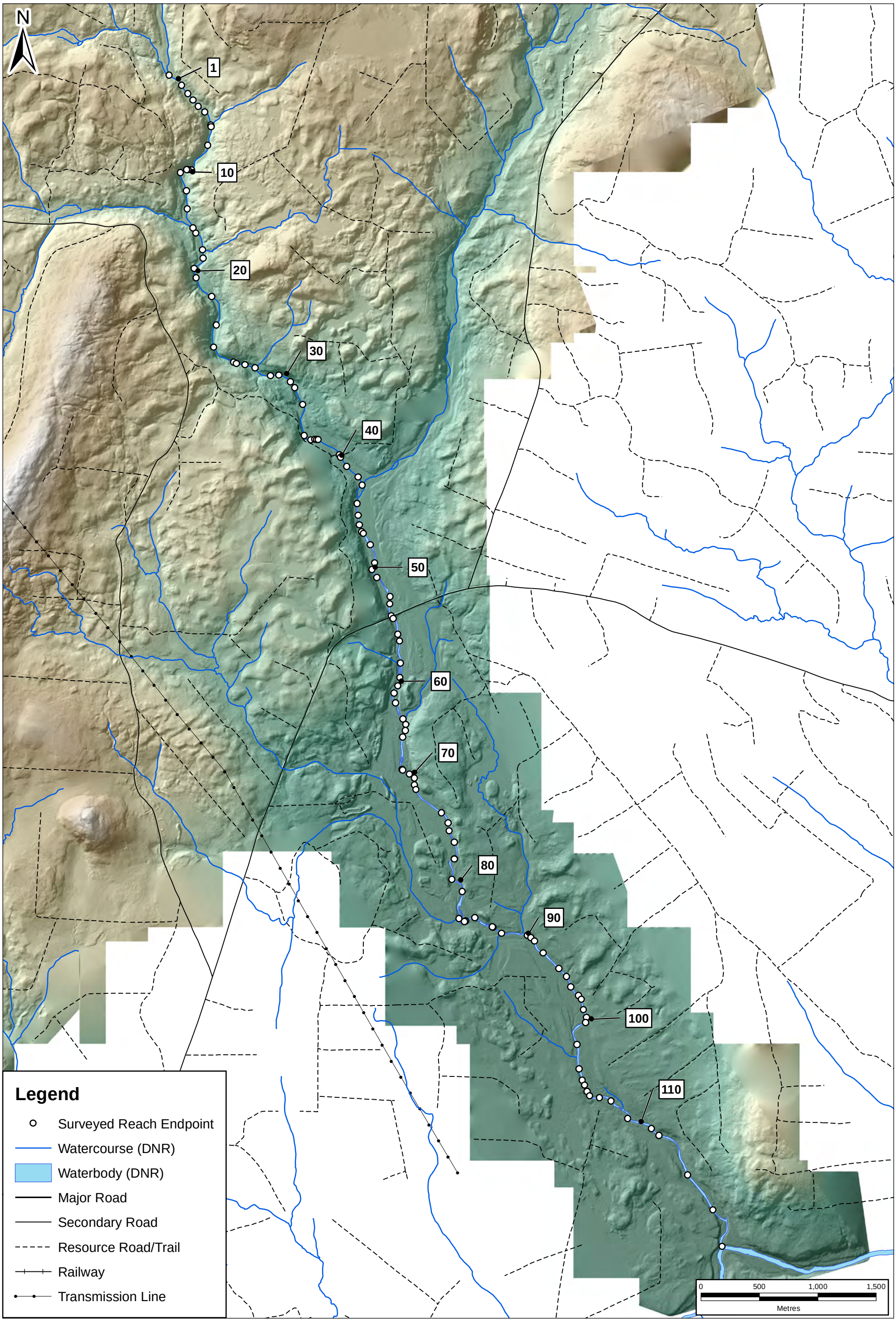
Residual Stream Segments of Bird, Sisson, and Tributary to WBN brooks Downstream of the PDA Sisson Project Napadogan, N.B.	Scale: 1:35,000	Project No.: 121810356	Data Sources: Leading Edge Geomatics NBDNR	Fig. No.: 1	Stantec
Client: Northcliff Resources Ltd.	Date: (dd/mm/yyyy) 05/10/2012	Dwn. By: JAB	Appd. By: GPY		

Map: NAD83 CSRS NB Double Stereographic



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Stream Reaches Surveyed on West Branch Napadogan Brook and Napadogan Brook

Sisson Project:
Baseline Aquatic Environment Technical Report
Napadogan, N.B.

Client: Northcliff Resources Ltd.

Scale:	Project No.:	Data Sources:	Fig. No.:
1:30,000	121810356	NBDNR, Leading Edge Geomatics	3.5

Date: (dd/mm/yyyy)	Dwn. By:	Appd. By:
10/04/2012	JAB	DM

Stantec

Map: NAD83 CSRS NB Double Stereographic

2.2.3 Step 3—Contact Regulatory Agencies, First Nations and Other Stakeholders to Identify Fish Habitat Compensation Opportunities

The Project is located in a rural setting that is relatively undeveloped except for historic and ongoing forestry activity, some cabins beside the West Branch Napadogan Brook, and supporting road network. In the lower portion of the Nashwaak River watershed (the "ecological unit"; see Section 2.2.4), residential density is slightly greater and there is some agricultural activity. Fish habitat compensation opportunities are not always readily available in rural settings, and therefore opportunities were initially identified in consultation with applicable federal and provincial regulators. Stakeholders and First Nations were also contacted to identify potential opportunities.

Consultation with federal and provincial regulators resulted in the identification of potential large-scale fish passage barriers—provided by DFO—primarily consisting of human-constructed dams. The potential large-scale opportunities were screened for their potential to provide substantive compensation credit and for their current existence (some were no longer present) in the ecological unit. The potential large-scale opportunities that passed the screening were evaluated for technical and economic feasibility as described in Section 2.2.4 of this report, below.

Contact with stakeholders to identify fish habitat compensation opportunities was initiated in 2012 through the Nashwaak Watershed Association Inc. (NWAI) to assist in the identification of potential opportunities. As part of this effort, the NWAI consulted with its members, solicited input from the public via an advertisement in a local newspaper, and identified a number of potential opportunities. In addition, Northcliff provided background information to First Nations on HADD issues seeking their views on possible HADD compensation opportunities.

2.2.4 Step 4—Evaluate Identified Fish Habitat Compensation Opportunities in Consideration of Regulatory Consultation, Guidance and Documentation, and Input Received from First Nations and Other Stakeholders

Potential fish habitat compensation opportunities were evaluated based on several technical and economic feasibility criteria, and as per the DFO Practitioners Guide (DFO 2006). The DFO Practitioners Guide provides the following hierarchy for evaluating compensation options:

- those that create or increase the productive capacity of **like-for-like** habitat in the same ecological unit;
- those that create or increase the productive capacity of **unlike** habitat in the same ecological unit;
- those that create or increase the productive capacity of habitat in a **different** ecological unit; and
- as a last resort, those that use artificial production techniques to maintain a stock of fish, deferred compensation or restoration of chemically contaminated sites.

The Practitioners Guide defines "Ecological unit" as "*Populations of organisms considered together with their physical environment and the interacting processes amongst them*." For the Sisson Project, HADD is anticipated in Bird, Sisson, McBean, Tributary to the West Branch Napadogan, West Branch Napadogan, and Napadogan brooks. The habitat contained in these brooks, as described in the Baseline Aquatic Environment Technical Report (Stantec 2012d), forms the basis for applying these hierarchy criteria. In this case, the most desirable compensation option, other factors being equal, would increase the productive capacity of habitat that is similar to the habitat contained in the brooks affected by the Project (*i.e.,* "like-for-like") and within the same ecological unit. These brooks provide habitat for far-ranging diadromous fish like Atlantic salmon (*Salmo salar*) and American eel (*Anguilla rostrata*), other freshwater species which live within a limited spatial range such as slimy sculpin (*Cottus cognatus*) and those of the cyprinidae family (commonly referred to as "minnows"), and brook trout (*Salvelinus fontinalis*) which may be anadromous or may live their entire lives in a limited spatial range of freshwater habitat. Given the importance of the Atlantic salmon and American eel as Species of Conservation Concern (SOCC), the ecological unit is considered to be the Nashwaak River watershed.

The evaluation of fish habitat compensation opportunities was undertaken in consideration of the following factors:

- consultation with federal and provincial regulators;
- hierarchy ranking within the framework in the DFO Practitioners Guide (for HADD compensation opportunities);
- potential HADD credits (for HADD compensation opportunities);
- engineering feasibility;
- value to brook trout and Atlantic salmon populations in the ecological unit;
- value to stakeholders and First Nations;
- heritage resource status (where applicable);
- other regulatory constraints (*e.g.,* presence of wetlands or Species at Risk (SAR));
- recognition of regulatory/stakeholder/public concerns; and
- estimated magnitude of capital costs.

The process for estimating HADD compensation credits of selected opportunities followed methods previously accepted under the provisions of the *Fisheries Act* prior to it being amended in summer 2012, specifically:

- for a compensation option that **creates**/**restores** fish passage, the potential HADD compensation credit was assumed to be 25% of the total surface area of all the provincially mapped tributary watercourses upstream of that location; and

- for a compensation option that **improves** fish passage, the potential HADD compensation credit was assumed to be 25% of the total surface area of the provincially mapped main branch of the watercourse within which the structure is located, upstream of that location.

Total surface area was estimated using a GIS and geo-referenced provincial maps and aerial images when available. Area calculation (length x average width) was done for large reaches of watercourses, with reasonable assumptions made regarding average bankfull width based on field observations where available.

2.2.5 Step 5—Develop a Conceptual-level Fish Habitat Compensation Plan to Support the EIA of the Project and Subsequent HADD Authorization Process

The undertaking of Steps 1-4 led to the development of a conceptual fish habitat compensation plan (*i.e.,* this Compensation Plan) to support the EIA of the Project and subsequent HADD authorization process.

2.2.6 Step 6—Further Develop the Details of the Selected Opportunity(ies) for the Fish Habitat Compensation Program and Obtain Regulatory Approval to Carry Them Out

Following the selection of fish habitat compensation opportunity(ies), it will be necessary to undertake the conceptual and detailed engineering design processes in support of obtaining the required regulatory approvals, and in preparation for Step 7 to complete their implementation. Monitoring programs, where warranted, will be developed as part of the detailed engineering design process and as such it is expected that these will become embedded as conditions within the authorization process.

2.2.7 Step 7— Implement the Selected Compensation Opportunity(ies), and Monitor as Appropriate

Implementation and monitoring of the selected fish habitat compensation opportunity(ies) will occur as detailed in the engineering designs developed during Step 6, and will follow the conditions of the required regulatory approvals and authorizations.

3.0 ESTIMATED HADD RESULTING FROM THE PROJECT

This section describes the results of the estimation of HADD resulting from the Project. The methods that were used to generate the estimate are described in Section 2.2.2 of this report.

3.1 DIRECT HADD AS A RESULT OF CONSTRUCTION OF PROJECT FACILITIES

All fish habitat within the PDA, as shown in Figure 2, will be destroyed as a result of construction and operation activities. This includes habitat within the areas to be covered by the tailings storage facility, open pit, related infrastructure, and where the relocated Fire Road crosses watercourses. Details on these elements of the Project are provided in Chapter 3 of the EIA Report. Also included in this estimate are fragments of watercourses located between Project-related facilities, providing some conservatism in the estimates.

The estimate of direct HADD was based on the actual quantity of habitat as observed during field surveys in 2011 and 2012. A GIS was used to calculate the affected habitat surface area by the current Project design, following the method as described in Section 2.2.2 of this report. Table 1 provides the estimated HADD calculations for all directly affected watercourses, presented in 100 m^2 units as is typical for large scale compensation programs.

Table 1 Estimate of Direct HADD Within the PDA

Watercourse Name	Estimated HADD Due to Direct HADD (100 m^2 units)
Bird Brook	244
Sisson Brook	114
Unnamed tributary (Tributary “A”) to West Branch Napadogan Brook	6
McBean Brook (Open Pit)	2
McBean Brook (Fire Road)	6
Total	**372**

3.2 INDIRECT HADD DUE TO REDUCED FLOW IN DOWNSTREAM AFFECTED WATERCOURSES

This section provides the estimated indirect HADD due to reduced flow in downstream watercourses.

3.2.1 Residual Stream Segments

The construction of facilities will result in small residual stream segments between the edge of the PDA and where the watercourses enter the West Branch Napadogan Brook (Figure 2). Though they will not be physically altered by construction of Project facilities, these residual segments will experience flow reductions and associated habitat alterations due to reduced catchment area within those sub-watersheds because of their loss to the construction of Project facilities.

The presence of the Project facilities will result in the following changes to those sub-watersheds:

- Segment A (Tributary "A" to the West Branch Napadogan Brook) = 91% reduction in catchment area;
- Segment B (Tributary to Bird Brook) = 26% reduction in catchment area;
- Segment C (Bird Brook) = 86% reduction in catchment area; and
- Segment D (Sisson Brook) = 76% reduction in catchment area.

Due to the relatively small size and flat bathymetry of these watercourses, the anticipated reductions to catchment area will significantly reduce the quantity and quality of fish habitat in these residual stream segments; therefore, all fish habitat currently in these segments is conservatively predicted to experience loss or alteration such that compensation is required, even though in some cases the amount of loss, or magnitude of alteration, will vary during the life-cycle of the Project and may ultimately be temporary. The consideration of these residual stream segments as being totally lost represents a conservative estimate of HADD in these segments due to the Project. Table 2 provides the estimated HADD calculations for each of these indirectly affected residual stream segments.

Table 2 Estimate of Indirect HADD in Residual Stream Segments

Residual Stream Segment	Watercourse Name	Estimated HADD from Loss of Residual Stream Segments (100 m^2 units)
A	Tributary "A" to West Branch Napadogan	10
B	Tributary to Bird Brook	13
C	Bird Brook	64
D	Sisson Brook	36
Total		**123**

3.2.2 Reduction in Wetted Perimeter in Lower Napadogan Brook

The indirect HADD to fish habitat in the lower Napadogan Brook was determined based on the change to the wetted perimeter of the affected watercourse channels, as recommended by DFO, following the method as described in Section 2.2.2 of this report. The computer-based flow reduction modeling predicts a reduction of wetted perimeter area of 67 units (100 m^2 units) for the Lower Napadogan Brook, which includes the West Branch Napadogan Brook below its confluence with Bird Brook and all of the Main Branch Napadogan Brook. Note that this prediction of HADD in Napadogan Brook is also conservative since it assumes zero discharge from the Project; in practice, there will be a discharge of surplus water, treated as may be required to meet regulatory water quality standards.

3.3 TOTAL ESTIMATED HADD DUE TO THE SISSON PROJECT

Table 3 provides a summary of the estimated direct and indirect HADD resulting from the Project. It is possible that there will be a reduction of habitat quantity or quality in McBean Brook immediately downstream of the open pit due to reduction of catchment area caused by infiltration of surface water and groundwater into the open pit. However, it is estimated that the diversion of non-contact surface water from the Sisson Brook watershed to the McBean Brook watershed will at least partially offset

these losses (Knight Piésold 2012f). In the event that follow-up or monitoring of McBean Brook following construction of the Project demonstrates that HADD has occurred, it is expected that additional compensation will be required at that time.

Table 3 Summary of Direct and Indirect HADD Resulting from the Project

Watercourse Name	Estimated HADD (100 m^2 units)	Description of HADD
Tributary "A" to West Branch Napadogan Brook	16 (6 + 10)	Loss of all habitat within PDA, and loss of all habitat within residual stream segment A.
Bird Brook	321 (244 + 13 + 64)	Loss of all habitat within PDA, and loss of all habitat within residual stream segments B and C.
Sisson Brook	150 (114 + 36)	Loss of all habitat within PDA, and loss of all habitat within residual stream segment D.
McBean Brook headwaters (Open Pit)	2	Direct loss of small portions of first-order habitat near the open pit.
McBean Brook (Fire Road)	6	Direct loss of habitat due to installation of culverts at road crossings.
Lower Napadogan Brook	67	Loss due to flow reductions in the West Branch of the Napadogan below Bird Brook, and on the Main Branch of Napadogan Brook.
Total	**562**	**Grand Total of HADD resulting from the Project (Direct and Indirect)**

3.4 ESTIMATED HADD COMPENSATION AMOUNT REQUIRED

The required quantity of compensation was estimating following the method described in Section 2.2.4. Applying the 3:1 compensation ratio to achieve the DFO management objective of "no-net-loss", the required HADD compensation for the Project is 1,686 units (*i.e.,* 562 units at a 3:1 compensation ratio).

4.0 FISH HABITAT COMPENSATION OPPORTUNITIES

Given the relatively large amount of required HADD compensation (*i.e.,* 1,686 units) for the Project, it is impractical to attempt compensation with typical industry standard small-scale compensation measures, or limiting their geographic extent to be near to the Project. Similarly, it is impractical to compensate exclusively in habitats that are like the small watercourses where direct HADD will occur. Therefore, large-scale opportunities are preferred, supplemented by small-scale opportunities if needed. Large-scale opportunities are considered to be significant physical works like dam removals, installation of fish passes around large natural barriers such as waterfalls, or other opportunities that offer major habitat compensation credit. Small-scale opportunities include replacement or modification of standard culverts, bank stabilization, or other opportunities that typically result in smaller habitat compensation credit.

4.1 LARGE-SCALE OPPORTUNITIES

This section describes the evaluation and selection of the large-scale HADD compensation opportunities.

4.1.1 Opportunities Evaluated

As described in Section 2.2.3 of this report, large-scale opportunities were identified on a map provided by DFO, which included input from provincial regulators and Ducks Unlimited Canada (DUC). Of the identified opportunities, the following three potential large-scale opportunities were selected for further evaluation in consultation with DFO:

- establishment of a Fish Pass at Dunbar Stream Falls;
- removal of Campbell Creek Dam; and
- removal of Lower Lake Dam.

The location of these three opportunities is shown on Figure 4.

Dunbar Stream Falls is a natural waterfall that is 3.35 m in height and completely prevents the passage of Atlantic salmon. Excellent Atlantic salmon habitat exists above and below the falls, so the opportunity for compensation is to provide upstream migratory access for adult Atlantic salmon to the spawning habitat located upstream of the falls. Through consultation with provincial regulators, it was determined that introduction of fish species into habitat where they have not historically occurred due to natural barriers is undesirable, and therefore this opportunity was not considered for this Compensation Plan.

Campbell Creek Dam, north of Fredericton, was built in the early 1900s to provide water to the Marysville cotton mill, and its presence is a complete barrier to fish passage in both directions. Campbell Creek above the new Route 8 likely provides good quality habitat for brook trout, Atlantic salmon, and American eel and so the opportunity for compensation is to provide the opportunity for improved/renewed use of this habitat by these species. During the evaluation process, it was

determined that the compensation credit for undertaking this opportunity is not sufficient (approximately 10% of the required HADD compensation total) to justify the considerable expense and other risks associated with the undertaking. Therefore this opportunity was not considered for this Compensation Plan.

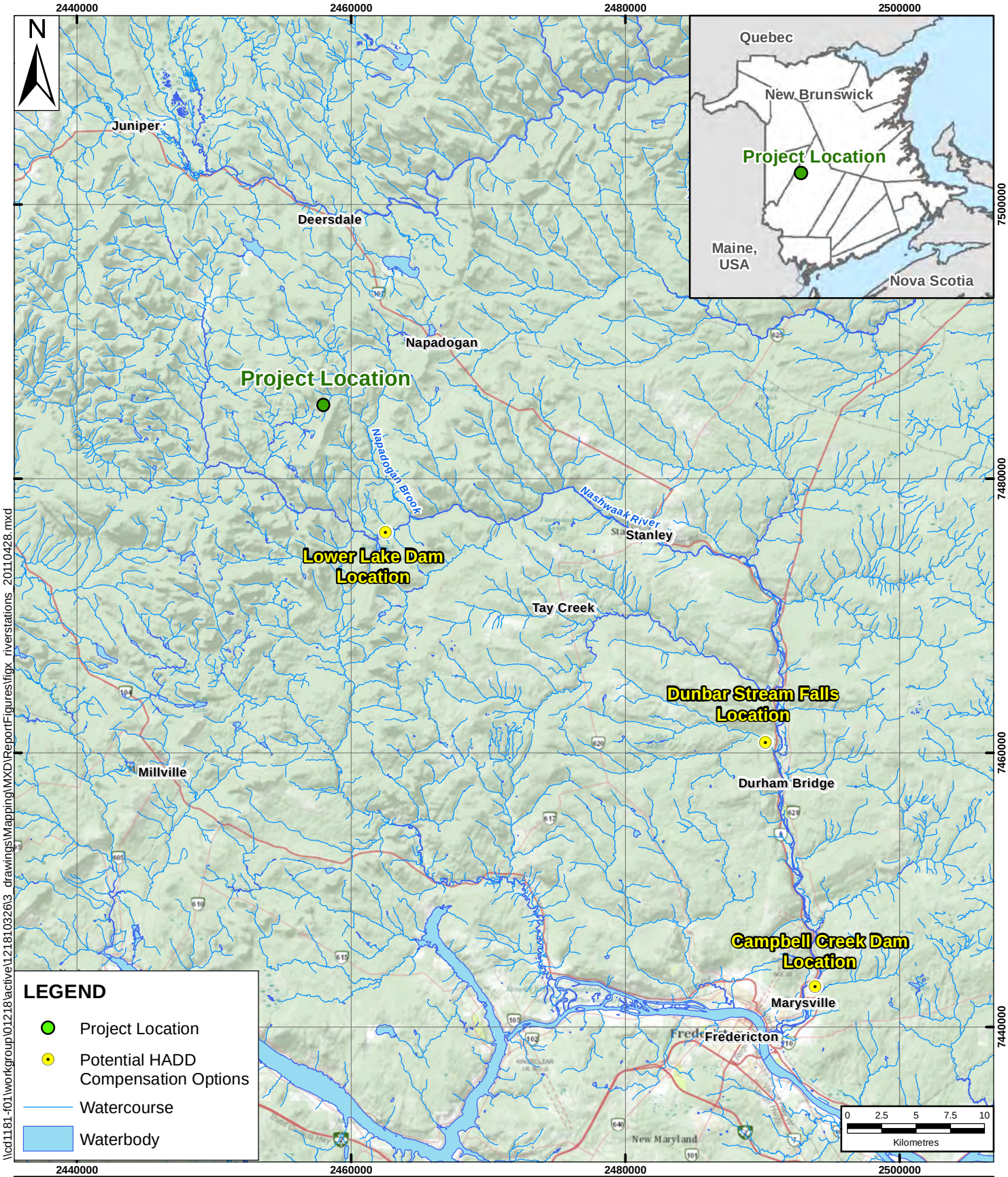
The Lower Lake Dam is located on the Nashwaak River, approximately 10 km southwest of Napadogan. It was constructed in the 1960s to facilitate log drives on the river to support lumbering activity in the area. The Lower Lake Dam is considered by DFO to be a partial obstruction to fish passage. Further details are provided in Section 4.1.2 of this report.

In consideration of the factors described in Section 2.2.4 of this report, only Lower Lake Dam was determined to be a viable potential opportunity to achieve suitable compensation for HADD.

4.1.2 Selection of Large-Scale Opportunity: Lower Lake Dam Removal

Based on the evaluation conducted and the regulatory consultation carried out to date, the selected large-scale opportunity as compensation for the Sisson Project is the removal of the Lower Lake Dam (Photo 1), which is located on the Nashwaak River, approximately 10 km southwest of the community of Napadogan, New Brunswick, the community located nearest to the Project. The Lower Lake Dam, which is so named because it is just downstream from the body of water known as Lower Lake, is also commonly referred to as the “Irving Dam” in reference to the original owner and operator of the dam.

The Lower Lake Dam, along with other dams located along the Nashwaak River, was constructed to facilitate log drives on the river to support lumbering activity that has been ongoing in this area since the early 19th century. The Lower Lake Dam was reportedly constructed in 1962 for the purpose of controlling water level for log driving, and this derelict dam is now owned by the Province of New Brunswick. Though flow and fish passage at this location are only partially obstructed by the presence of the remaining concrete piers and sill of the dam, removal of this dam would improve upstream fish passage at this location, especially during high flow conditions when the downstream water velocity is increased by the narrow gate openings, and during low-flow conditions when water flowing over the apron is potentially too shallow for upstream passage of some fish species. Although it is a partial barrier, a recent study suggests that that the removal of small in-stream weirs can substantively alter the upstream migration behaviour of adult Atlantic salmon, even where the weirs were acting only as a partial barrier to fish passage (Fjeldstad 2012). In the Fjeldstad study, the peak migration period occurred one month earlier after the weirs were removed. Removal of the Lower Lake Dam may have a similar effect on the timing of upstream Atlantic salmon migration in the Nashwaak River, and will also restore a more natural hydrologic condition in both the upstream and downstream reaches that may improve fish habitat quality in those areas.



NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC PROJECT AND SHOULD NOT BE USED FOR OTHER PURPOSES.

Location of Project and Potential HADD Compensation Options Sisson Project Napadogan, New Brunswick	Scale: 1:375,000	Project No.: 121810356	Data Sources: ArcGIS World Topo NBDNR SNB	Fig. No.: 1	Stantec
Client: Northcliff Resources Ltd.	Date: (dd/mm/yyyy) 27/08/2012	Dwn. By: JAB	Appd. By: DM		

Map: NAD83 CSRS NB Double Stereographic

Photo 1: Lower Lake Dam

The Lower Lake Dam consists of a concrete trapezoidal column structure constructed on a concrete sill and is approximately 8 m in height. The concrete deck that spans between the columns likely supported a gantry system for removal of gates and/or stop logs. An overflow spillway is located on the left back and consists of a concrete cap overlying earthen fill supported by sheet piling driven to bedrock. Currently direct access to the dam via the left bank is not possible other than by foot, though this would be the preferred access point given the closer proximity to the existing former access road. The old road near the right bank is in very poor condition for approximately 2.0 km. Upgrades to approximately 500 m of access road leading to the left bank would be required to accomplish demolition activities.

The configuration of the Lower Lake Dam (*i.e.*, with no impounded water) lends itself to staged removal as water can flow freely through one gate opening while others are removed. Demolition activities would consist of breaking up the concrete with the use of an excavator equipped with a rock breaker, and debris would be loaded on haul trucks for disposal at a suitable site. Following removal of debris, the stream bed and shoreline will be restored to match the existing conditions, and to provide long-term stability against erosion.

A review of records on the current Lower Lake Dam indicates it was constructed in 1962 for the purpose of “controlling water level for log driving” (NB Water Authority 1961). As the structure dates less than one hundred years, it is not a heritage resource (Archaeological Services 2012).

The Lower Lake Dam is located within the same ecological unit as Bird, Sisson, McBean and Napadogan Brooks. The habitat of the main branch of the Nashwaak River upstream of this location is different than the potentially directly affected habitat in Bird, Sisson, Tributary "A" to West Branch Napadogan, and McBean brooks, though is similar to the habitat that will be indirectly affected in Napadogan Brook. Given the considerably greater amount of habitat potentially directly affected in Bird, Sisson, Tributary "A" to West Branch Napadogan, and McBean brooks as compared to the lesser amount of potentially indirectly affected habitat in Napadogan Brook, the removal of Lower Lake Dam will create or increase the productive capacity of unlike habitat in the same ecological unit.

The total surface area of the main branch of the Nashwaak River was estimated using polygon delineation for most of its length. The uppermost 6 km, immediately below the outfall from Nashwaak Lake, was estimated by multiplying the length by an estimated average bankfull width of 3 m. The total length of the main branch of the Nashwaak River from Nashwaak Lake to the Lower Lake Dam is 45,365 m, resulting in a total estimated surface area of 819,026 m^2.

The estimated HADD compensation credit, based on 25% (Walmsley, J. Personal communication, December 16, 2011; Parker, E. Personal communication, November 6, 2012) of the total estimated surface area of the main branch (204,760 m^2), is **2,048 units**. This large-scale compensation opportunity alone is sufficient to compensate for the 1,686 units of HADD compensation that are required for the Sisson Project as part of the HADD authorization required under the *Fisheries Act.*

4.2 SMALL-SCALE OPPORTUNITIES

As noted in Section 4.1 of this report, the Lower Lake Dam opportunity will provide sufficient compensation (2,048 units) for the 1,686 units of HADD compensation that are required for the Sisson Project as part of the HADD authorization required under the *Fisheries Act.* Therefore, no small-scale opportunities were considered for this Compensation Plan.

5.0 CONCEPTUAL FISH HABITAT COMPENSATION PLAN

The Compensation Plan is based on a total Project-related HADD of 562 units, and a 3:1 compensation requirement of 1,686 units. The removal of Lower Lake Dam is expected to provide a HADD compensation credit of 2,048 units, and to be sufficient for authorization of the Project under the *Fisheries Act* by DFO and thereby satisfy the objective of this Compensation Plan as defined in Section 1.2 of this report. Details of the removal of Lower Lake Dam and how it will be funded and implemented will be agreed with DFO before Project authorization.

6.0 REFERENCES

6.1 LITERATURE CITED

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6.2 PERSONAL COMMUNICATIONS

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