Land and Water Boards of the Mackenzie Valley

Method for Determining Available Winter Water Use Capacity for Small-Scale Projects

April 7, 2021

Introduction

The Land and Water Boards of the Mackenzie Valley (Boards) regulate the use of land and water and the deposit of waste within the Mackenzie Valley through the issuance of land use permits and water licences. In order to ensure proposed water uses would not adversely affect existing users or the environment, the Boards require applicants to provide information regarding proposed water uses; including identification and location of proposed water sources, the timing and proposed volume of water to be used from each water source, and a comparison of the proposed water use volume to the available water use capacity calculated for each proposed source (see Item 7: Quantity of Water Involved of the *Water Licence Application Form*).

To demonstrate that the proposed water use will not exceed the capacity of proposed water sources, an applicant must first determine the available water use capacity for each proposed source. To calculate the available water use capacity of a potential water source, an applicant must first determine the total volume. Since volume information is not readily available for most waterbodies in the Mackenzie Valley, the 2010 Fisheries and Oceans Canada (DFO) *Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut*[1] (the DFO Protocol) requires water users to complete bathymetric surveys of most water bodies. The Board recognizes this DFO Protocol as best practice.

The DFO Protocol sets out 10% of the under-ice volume of a water body as the maximum total volume that can be used in a single ice-covered season by all users. The available water use capacity established by DFO is based on under-ice conditions since the removal of excessive water under ice cover could lead to oxygen depletion that may impact over-wintering fish. The DFO Protocol was established based on field observations with no effects on fish or fish habitat.[2]

Because detailed bathymetric methods require expertise and effort that may not align with the early stages or scope of smaller projects, the Boards and the Government of the Northwest Territories Department of Environment and Natural Resources (GNWT-ENR) have developed this *Method for Determining Available Water Use Capacity for Small-Scale Projects* (Method) in the event bathymetric data is not available or reasonable to obtain.

Applicants must be aware that this Method can only be applied to water sources with:

A minimum under-ice water depth of 1.5 m and a minimum total depth of 3 m

Water sources that do not meet these depth criteria should not be proposed as water sources unless the cumulative proposed water withdrawal is less than 100 m^3/day or can be proven to be non-fish-bearing.

[1] Fisheries and Oceans Canada, 2010, *Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut*.
[2] *Ibid.*

Application

The DFO Protocol remains the recommended standard for larger scale developments, as bathymetric data is more accurate and may subsequently provide for more water to be used. This Method has been developed to allow small-scale project (typically Type B) applicants, of early stage exploration or other limited scope projects, to conservatively estimate the winter[3] water use capacity of proposed water sources (lakes or ponds[4]) in the absence of bathymetric data and to later confirm these estimates through simplified measurements in the field. The applicability of this approach will be determined on a case-by-case basis where water use is required to be licensed (this is total water uses of 100 m^3 or more per day).

How this Method was Developed

In October 2019, all users of the Board's online review system (ORS) were invited to provide technical submissions recommending approaches for estimating water source capacity. A follow-up meeting was held in February 2020 to discuss the submissions received and to discuss other alternatives identified through a literature review conducted by a third-party consultant.

The technical submissions were tested against water sources with measured water volumes for their ability to provide accurate and protective estimates of water volumes in ice-covered waterbodies using the same protective assumptions and criteria identified in the DFO Protocol. Further background on the derivation of this Method is included in the accompanying *Technical Reference Document for the Method for Determining Water Use Capacity for Small-Scale Projects* (Technical Reference Document).[5]

Method

Using this Method, the applicant must first determine the total surface area of each proposed water source. This can be calculated in several ways, including existing physical or digital maps, air photos, Google Earth, or a geographic information system. The total available water use capacity (i.e., 10% of a water body's volume) is then calculated as a 10 cm drawdown across the total surface area of the waterbody:

Total Surface Area (SA) (m^2) * 0.10 m = Total Available Water Use Capacity (m^3)

---

[3] Since the 10% volume limit set by DFO has been demonstrated to be protective for under-ice conditions in water depths of 1.5 m or greater, the Boards consider it to be a conservative limit that could also be applied to annual or open-season water source capacity estimates as well. If applicants wish to use more water than that estimated using this Method or take water from shallow lakes, additional information, including bathymetry may be required.

[4] DFO have additional guidance on the use of waters from rivers or streams: DFO. 2012. Fisheries and Oceans Canada. 2012. "Review of approaches and methods to assess Environmental Flows across Canada and internationally."

[5] Hutchinson Environmental Sciences Limited, 2020. Technical Reference Document for the Method for Determining Available Winter Water Volumes for Small-Scale Projects.

This Method has been shown to provide a conservative estimate of a water withdrawal that will not exceed 10% of the volume of water sources with an under-ice water depth of a minimum of 1.5 m and a minimum total water depth of 3 m.

More information on how this Method was evaluated and the assumptions used in this calculation are available in the accompanying Technical Reference Document. Unless exempt from the DFO Protocol, applicants should not propose water sources that do not meet the above-noted depth criteria, and must provide data, or plans to collect data, to verify the depth of each proposed water source.

Submission Requirements

When providing estimates of available water use capacity for proposed water sources without detailed bathymetry, applicants must explain why the DFO Protocol cannot be met and provide the following information to the Board in support of any application package:

1. Calculated Water Use Capacity Estimate
   a) The total surface area for each proposed water source, including a map and table identifying all proposed water sources, providing geographic coordinates and Total Surface Area calculations for each;
   b) A description of how total surface area was calculated (i.e., existing physical or digital maps, air photos, or a geographic information system);
   c) A calculation for Total Available Water Use Capacity for each proposed water source:

      Total Surface Area (SA) (m^2) * 0.10 m = Total Available Water Use (m^3); and

   d) The total amount of water being proposed for use from each source compared to the total available capacity calculated in (c), above.

Table 1: Water Use Calculation Table

Water Source ID	Calculated Surface Area (m^2) (SA)	Total Available Water Use Capacity (m^3) (SA*0.1 m)	Proposed Annual Water Use Volume (m^3)
e.g., 1	45,000	4,500	Any amount ≤ 4,500

2. Field Verification of Water Use Capacity Estimates and Water Use Volumes

Using the assumed ice depths identified in the DFO Protocol that are based on locations in the NWT (see Table 2), provide a description of field verification plans or results demonstrating that under-ice water depth is, at minimum, 1.5 m. Field verification should occur prior to each season of use, avoiding freshet. This must be measured in at least three locations >20 m from shore and approximately 20 m apart.

Table 2: Assumed Ice Depths by Location[6]

Region	Maximum Expected Ice Thickness (m)	Minimum Waterbody Depth Required* (m)
North NWT: Above the Tree Line	2.0	3.5
Mid NWT: Fort Simpson to the Tree Line	1.5	3.0
South NWT: Dehcho – South of Fort Simpson	1.0	3.0

*Minimum water body depth is equal to the maximum expected ice thickness plus 1.5 m of water below the ice, or 3.0 m, whichever is greater.

Example

Applicant Z proposes to use water from Lake A, Lake B, and Lake C for winter exploratory drilling in the Dehcho region, 30 km northeast of Wrigley. Drilling duration will vary from site to site based on results. Water withdrawal will be monitored and will not exceed the volumes identified below. Through pre-engagement activities, Applicant Z identified several local cabin owners and trappers that withdraw water for domestic purposes from Lake A. Total annual water use by local users is estimated to be approximately 200 m^3/year.

Lake surface areas were derived through a graphing method applied over local topographic maps at a 1:5,000 scale. Edge of lake squares were included only when the water source was found to cover more than 50% of the square. Using the map scale, it was determined that each graphing square was equivalent to 50 m^2. Maps identifying all proposed water sources are provided in the Water Licence Application.

Water Source ID	*Calculated Surface Area (m^2) (SA)*	*Total Available Water Use Capacity (m^3) (SA*0.1 m)*	*Other users of the Water Source*	*Proposed Maximum Daily Water Use Volume (m^3)*	*Proposed Annual Water Use Volume (m^3)*
Lake A	*45,000*	*4,500*	*Cabin owners and trappers*	*100*	*4,300*
Lake B	*6,000*	*600*	*N/A*	*100*	*600*
Lake C	*100,000*	*10,000*	*N/A*	*200*	*5,000*

Lake depth field verification will occur prior to initiating source use. This will be completed by measuring total source depth in at least five locations within 20 m of the proposed withdrawal site to ensure the minimum lake depth is 3 m. Depth measurements will be taken prior to freeze-up or under the ice using a sonar depth finder. It is assumed that maximum ice depth in this area will be 1.5 m. GPS coordinates of all

[6] Fisheries and Oceans Canada, 2010, *Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut.*

test locations will be recorded and submitted to the Inspector and the Board with depth associated measurement results. Water withdrawal will only commence following written confirmation from the Inspector.

Conclusion

Following the 10% water withdrawal and minimum source depth limitations set under the 2010 DFO Protocol, the Land and Water Boards of the Mackenzie Valley present this Method as an alternative approach for identifying safe water withdrawal limits for small-scale developments in the Mackenzie Valley in the absence of bathymetric data. The applicability of this approach will be determined on a case-by-case basis where water use is required to be licensed.