Community of Sambaa K'e Source Water Protection Plan

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ECOLOGY NORTH

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Introduction

In 2014 the Sambaa K'e Dene Band (SKDB) decided that a Source Water Protection (SWP) Plan was required to address the community's source water quality concerns and ensure that the water in the Trout Lake watershed remains protected forever. Concerns included the potential environmental effects of industrial development activities, historic waste sites, community waste facilities, fuel storage and climate change, which may impact local water quality. During 2014 and 2015 the SKDB adopted a collaborative partnership approach involving Ecology North (EN), a Yellowknife-based Environmental Non-Government Organization, and Environment and Natural Resources (ENR), Government of the Northwest Territories (GNWT) to develop a SWP plan aimed at addressing these concerns.

The SWP planning process undertaken in Trout Lake effectively builds on the recently completed state of the knowledge and vulnerability assessments that ENR and SKDB completed for Trout Lake. The state of the knowledge report summarizes the available information related to aquatic ecosystem health in the community of Trout Lake, while the vulnerability assessment report identifies related knowledge gaps and proposes approaches to fill such gaps with research and monitoring. Both reports provide important background information that was used in the development of this SWP plan.

The development of this SWP was largely guided by a planning guide and template developed by ENR in 2012 – *The Northwest Territories Source Water Assessment and Protection (SWAP) Guidance Document*[i]. The guidance document outlines a five-stage process to source water protection planning in the NWT (Figure 1[ii]): 1) establish a steering committee; 2) prepare a source water assessment; 3) develop a SWP plan; 4) implement the SWP plan; and 5) review the SWAP program. This SWP plan for Trout Lake addresses the first three stages of the SWP planning process outlined in the guidance document. It is important to note that while the planning process generally followed the same steps identified in

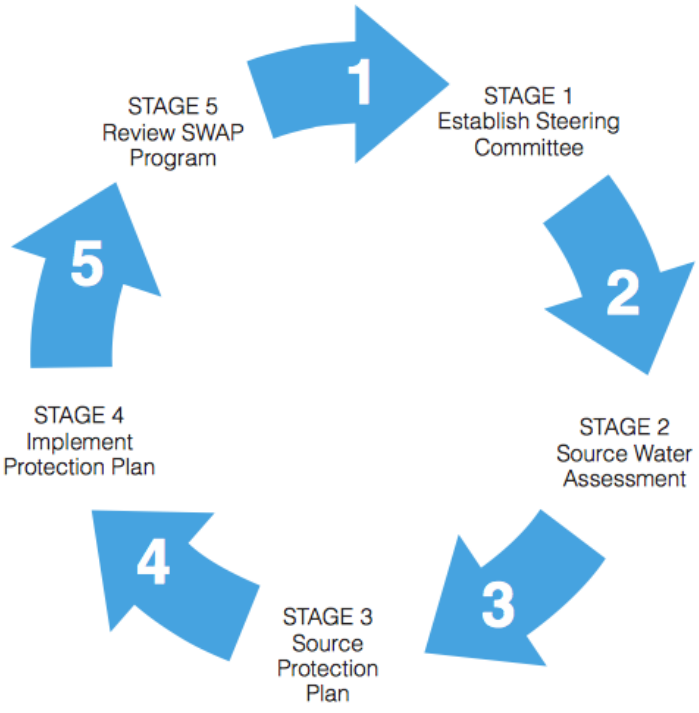

Figure 2: Stages of SWP Planning

the guide, there were cases where parts of the guide were tailored to reflect the needs and context of the community. These cases are summarized in a separate project reflection document that highlights the lessons learned and adaptations that were made throughout the project.

The structure of this SWP plan reflects the first three SWP planning stages identified in Figure 1. Section 1 describes the development and functions of the local working committee and technical advisory group (Stage 1). Section 2 presents a source water assessment for Trout Lake (Stage 2), including an overview of the source water protection planning area for the project, details about the community drinking water system, an inventory of potential drinking water contamination sources, and the outcomes of a risk assessment conducted for potential contaminant sources. Section 3 completes the SWP plan (Stage 3) by identifying a series of management actions aimed at reducing or eliminating source water risks.

1. STAGE 1: Establish a Steering Committee

1.1 Community Working Group

Based on the SWAP guide, the first stage in the SWP planning process is to establish a consensus driven steering committee to lead the development of the plan. During the fall of 2014, interested and concerned community members in Trout Lake were invited to join a local community working group ('working group') for SWP planning. Several community members joined the group, including community Elders, members of the chief and council, members of the community development corporation, concerned members of the community and the water treatment plant operator. Table 1 provides a list of the working group members.

The working group met twice during the development of this SWP plan. The first meeting was held over the course of two days in Trout Lake in December of 2014 (Figure 2). The purpose of the meeting was to introduce the working group to SWP planning, assess the group's interest in moving forward to develop a plan, establish a sense of commitment from the group, and begin the source water assessment process for Trout Lake (Stage 2).

The second meeting was held in Trout Lake in February of 2015. During this meeting the working group reviewed the outcomes of the Trout Lake source water assessment and discussed potential source water management actions for the community (Stage 3). The insight and recommendations that came out of these meetings laid the groundwork for this SWP plan.

Table 1: Working Group Membership List

Name	***Position***
Jessica Jumbo	SKDB Environmental Coordinator
Edward Jumbo	Elder
Dolphus Jumbo	Community Chief
Denelee Ekenale	SKDB Member
Arthur Jumbo	Elder
Valerie Lamalice	Council Member
Brenda Jumbo	Council Member
Terry Crothers	Water Treatment Plant Operator
Tanya Jeanbo	SKDB Member
Tony Jumbo	SKDB Member
Brian Kotchea	SKDB Member
Eric Kotchea	SKDB Member

Figure 3: Trout Lake Community Working Group Meeting – December, 2014

1.2 Technical Advisory Group

At the same time that the working group was being formed, a technical advisory group was also being established. The technical advisory group, which consisted of several voluntary water experts, provided scientific and technical support and oversight throughout the SWP planning process. A

range of water experts were invited to join the technical advisory group, including local and territorial government representatives, members of the Mackenzie Valley Land and Water Board, and university affiliates. Table 2 provides a list of the technical advisory group members.

The technical advisory group played various roles over the course of the project. Different members of the group reviewed various documents and reports during the planning process. Others provided technical advice on specific questions that arose during the project. For example, several members offered information on the specific types of pollutants associated with different contaminant sources identified by the working group. The technical advisory group also contributed to the source water assessment report by completing a risk assessment for potential water contaminant sources (Stage 2). Thus while the community working group was the primary driver behind this SWP plan, the technical advisory group provided instrumental support and direction along the way. Both groups were critical to the development of the plan.

Table 2: Technical Advisory Group Membership

Name	***Affiliation***
Bill Quinton	Wilfrid Laurier University, Department of Geography and Environmental Studies
Brian Sieben	GNWT ENR, Adaptation Planning Specialist
Bruce Hanna	NWT – Wilfrid Laurier University Partnership Project Liaison
Craig Murray	Trent University, Institute for Watershed Science, Hydrologist
Duane Fleming	Municipal and Community Affairs, Chief Environmental Health Officer
George Low	Dehcho Aboriginal Aquatic Resource and Oceans Management (AAROM), Coordinator
Heather Scott	Mackenzie Valley Land and Water Board, Technical Advisor
Jennifer Fresque-Baxter	GNWT ENR, Watershed Management Advisor
Leslie Collins	Trent University, Institute for Watershed Science, Training Coordinator
Robert Patrick	University of Saskatchewan, Department of Geography and Planning Regional and Urban Planning Program
Sara Brown	NWT Association of Communities, Chief Executive Officer

2. STAGE 2: Source Water Assessment

The second stage to SWP planning identified in the SWAP document is to develop a source water assessment report. The purpose of the report is to provide a detailed review of the source water protection area from which a SWP plan can be developed. The Trout Lake source water assessment is broken into five sections below (2.1 - 2.5). The sections provide an overview of the current 1) drinking water system; 2) the source water protection area; 3) a summary of existing water quality information for the area; 4) an inventory of existing and potential source water contaminants; and, 5) the results of a potential contaminant risk assessment.

2.1 Trout Lake Community Drinking Water System

The community of Sambaa K'e is a small and remote community in the Dehcho Region of the NWT with a population of approximately 90 people[iii]. The majority of the community receives potable water through a trucked water delivery system that was adopted in the early 1990's. Drinking water from the local water treatment facility is delivered to households and community buildings three times per week.

The Sambaa K'e water treatment facility is located approximately 250 metres from Trout Lake, and about 0.5 km west of the community (see Figure 3). The current system, which was installed by Corix Water Systems in 2013, is comprised of an earthen fenced reservoir (Figure 4) and a modular plant that is approximately 5 metres by 19 metres (Figure 5). In contrast to the original treatment facility in Trout Lake that did not have a filtration system and relied solely on chlorination for treatment, the new system includes coagulation and membrane filtration processes in addition to chlorination treatment.

Figure 4: Map of the Community of Trout Lake

Raw water is pumped from the Trout Lake intake site (see Figure 3) into the earthen fenced water reservoir (11,200 cubic metres) (Figure 4) two times per year, usually late in the fall and in the early spring, using a 400 metre temporary fill line and a portable diesel pump. The raw reservoir water is then pumped into the treatment plant (Figure 3). Given that Trout Lake is relatively high in organic matter, the raw water is pre-screened through a 0.5 mm strainer and then pre-treated with a coagulant (aluminum chlorhydroxide). The coagulant is used to help treat the raw water by binding organic materials and solids to make them sink to the bottom. This helps to clarify the water for further filtration. This process is completed in the flocculation tank, after which the water flows into a membrane tank to be filtered a through a General Electric (GE) membrane. The membrane is made up of tiny pores that are designed to let water through but trap impurities. The filtered water is then chlorinated and pumped into a truck fill arm that is used to fill the community's 5000 litre water truck[iv].

The filtering membrane in the treatment facility must be backwashed after every 10, 800 litres that pass through it. Each backwash generates approximately 620 litres of wastewater, which is pumped into a wastewater tank that is eventually emptied into the community wastewater pump truck. The treatment plant is equipped with a backup generator so that it can continue to function during a power outage[v].

It is important to note that although water is routinely delivered to each household in the community of Sambaa K'e, some community members still prefer to use raw lake water, melted lake ice or rain or snow water for drinking water. There are several reasons that community members identified related to this: 1) it is a way of continuing a tradition; 2) there are concerns that the trucked water tastes too much like chlorine and leaves a film or scum in tea or water; and, 3) some residents are worried that wildlife is able to enter the reservoir and potentially contaminate the drinking water. In order to ensure that water from raw sources are safe to consume, the Department of Municipal and Community Affairs always recommends boiling and/or filtering raw water sources prior to consumption.

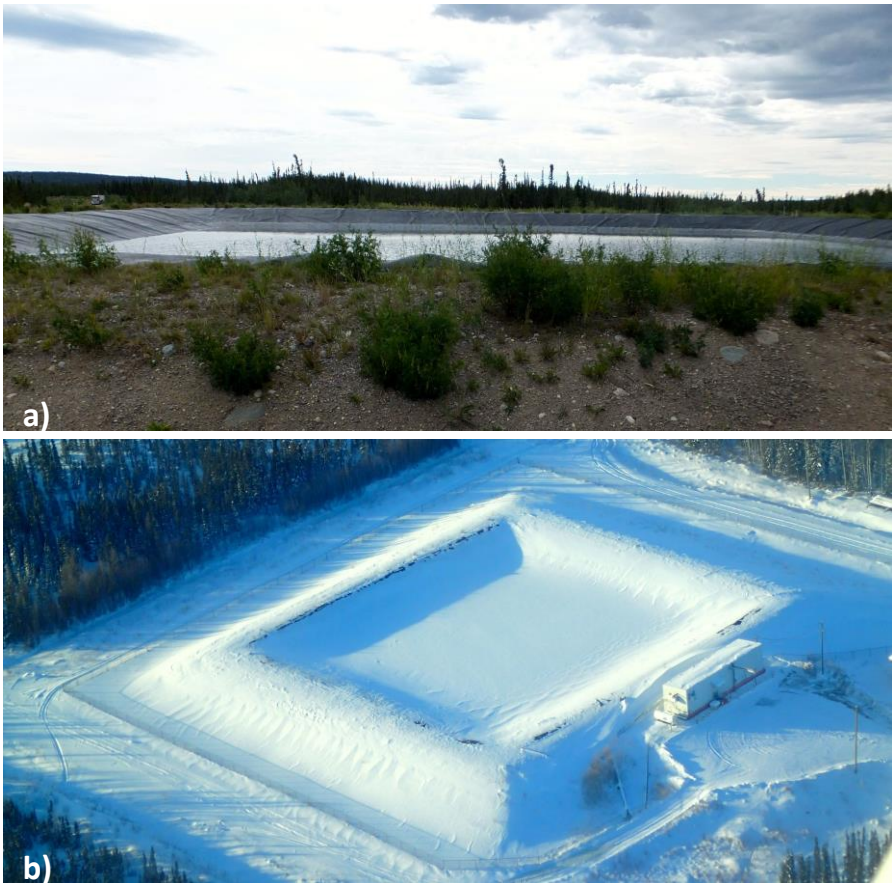

Figure 5: Trout Lake Fenced Reservoir in a) Summer 2013; and b) Winter 2014

Figure 6: Trout Lake Modular Water Treatment Facility

2.2 Source Water Protection Area

Trout Lake, the drinking water source for the community of Sambaa K'e, is the largest lake located in the Trout Lake watershed. The lake covers approximately 504 square kilometers, is about 15 kilometers at its widest point, and spans 51 kilometers in length. The lake has both permanent and intermittent tributaries flowing into it, the major ones of which include the Paradise River East, which enters Trout Lake from the east side; Island River, which enters the lake directly beside the community; and the Moose River, which enters the northern end of Trout Lake. The Trout River, which drains from the north end of Trout Lake, is the only drainage outlet for the lake[vi].

During the first working meeting, it was decided that the boundary for the Trout Lake SWP area would be drawn from the source water maps developed as part of the ENR Community Water Catchment Basin project in 2007. A boundary delineating the Trout Lake watershed was identified based on satellite imagery data, topographic data and data from the Atlas of Canada National Framework, specifically the National Scale Frameworks Hydrology Drainage Network Data (see Figure 6). The working group recognized that by adopting this watershed-level boundary, which encompasses an area of approximately 5,694 square kilometers, they would need to consider the full watershed when building the potential contaminant inventory and undertaking the associated risk assessment. The working group explained the importance of not limiting the source water area to the community-level because their livelihoods are dependent on the vast lands and waters that extend far beyond community limits. This perspective is similar to that of a broad SWP planning or ecosystem-based approach which encourage a wider planning scope to examine the source watershed as a whole, rather just the community.

Based on the NWT Ecosystem Classification Groups identified by ENR[vii], the identified source water protection area is located in the Trout Upland High Boreal Ecoregion, which is part of the Taiga Plains region. The ecoregion is characterized by flat and gently sloped uplands with peat plateaus, black spruce bogs and scattered upland forests. Labrador tea, lichen, fens and moss plateaus are also common throughout the region, although deciduous and mixed-wood forests are primarily limited to hill slopes where the temperature and moisture conditions are more favorable to tree growth. The area is primarily dominated by fine-textured till deposits that are covered by organic material such as thick layers of peat that have accumulated over time on most flat and low lying areas.

The closest operational weather station to the area is in Fort Liard, which is approximately 130 kilometers west of the community of Sambaa K'e. Based on the data available from the Fort Liard station, the source water area experiences long and cold winters with a mean annual snowfall of 153 centimeters. Summers are warm and short, and the mean annual rainfall is estimated to be 295 millimeters. The Trout Lake watershed is located in the discontinuous permafrost zone, which means that only patches of permafrost exist.

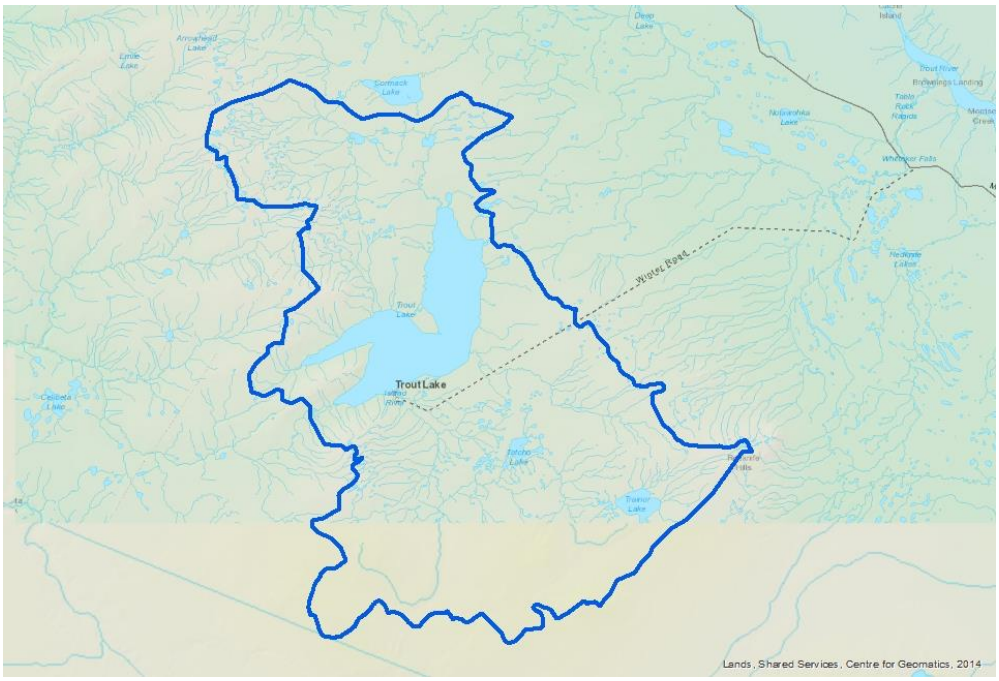

Figure 7: Trout Lake Source Watershed Boundary

2.3 Existing Water Quality Data

The SKDB is responsible for testing both treated water and raw source water from Trout Lake to ensure it is safe. The raw and treated water quality results from 1995 to present are available through the Northwest Territories Drinking Water Quality Database, which is maintained by the GNWT Department of Municipal and Community Affairs (MACA). Since the 1990's, various other agencies and researchers have also collected water quality data in the Sambaa K'e area. Given that is it beyond the scope of this assessment to report on all of these original data sources, the following section highlights significant conclusions from past water quality research results within the Trout Lake watershed.

The most extensive dataset (aside from the drinking water quality database) is from a series of water quality testing that was done by Indian Affairs and Northern Development (now Aboriginal Affairs and Northern Development Canada) during 1990 and 1991[viii]. These tests were conducted in response to several community members' experiencing a skin rash after swimming in Trout Lake. The study involved collecting physical, chemical and microbial data from seven sites in the Island River and Trout Lake along the shore near the community of Sambaa K'e. The study found several sites in Trout Lake to have high levels of iron and bacteriological parameters that exceeded Canadian Water Quality Guidelines and Guidelines for Canadian Drinking Water. Specifically, total coliform levels were above guidelines in all seven sites tested, with especially high levels at the Island River and Moose River locations[ix]. Although the results were deemed inconclusive, they indicated that the community's sewage lagoon and landfill site were likely the source of the bacteria that caused the

contamination. In response, the study recommended that the Black Dog Creek sewage lagoon and landfill be relocated.

Despite the relocation in 1993, samples analyzed in 1994 tested positive for fecal coliform bacteria. The samples were collected from the beach area of Trout Lake and Island River in October 1993. Results indicated that the Black Dog creek sewage lagoon across from Island River and individual pit privies were likely the source of the bacteria. The samples also showed high levels of turbidity and iron, which were attributed to nearby muskeg and swamp drainage carrying organic materials into Trout Lake.

Additional water quality tests were performed on the Trout River and Trainor Lake (located approximately 50 kilometers east of the community of Trout Lake) in 2002 as part of the Environmental Impact Statement for the Mackenzie Gas Project. The parameters tested included physical parameters, major ions, nutrients, metals and organic compounds. All of the parameters were found to be normal, with the exception of turbidity and total aluminum levels which exceeded the drinking water guideline. This trend was also consistent across all but three Dehcho water bodies, which may suggest high sediment loads in the region. In 2004, similar water quality tests were done in Trainor Lake as part of the Mackenzie Gas Project water license application[x]. The results indicated that all parameters were within guideline limits except for colour, cadmium and chromium, all of which were above the Canadian Council of Ministers of the Environment (CCME) guidelines for freshwater aquatic life.

In 2004, high algae levels were reported by both traditional knowledge and scientific-based studies. A traditional knowledge study in 2004 reported that Trout Lake community members were observing a correlation between higher algae levels in Trout Lake, and warmer water temperatures, longer ice-free seasons and lower water levels[xi]. These observations were consistent with results from two studies – one conducted by GNWT Public Works and Services and one by Vista Engineering – that reported seasonable problems with algae blooms in Trout Lake during the summer. The algae blooms were blamed for contributing to ongoing problems with water colour, turbidity, iron, and poor taste that Trout Lake community members reported[xii].

Furthermore, since 2010, Dehcho AAROM and the SKDB have been working together to conduct temperature, dissolved oxygen, and pH profiling of Trout Lake. The results indicate that the water temperatures at the bottom of the lake are well above the expected normal of four degrees Celsius[xiii].

ENR, AAROM and SKDB have also been collaborating with the community of Trout Lake on a community-based water quality monitoring program since 2012. Sample sites are located at various locations along and near the mouth of Island River, and in Trout Lake near the winter road, drinking water intake and other locations identified by the community. The parameters tested include physical (e.g., temperature), chemical (e.g., metal concentrations) and biological (e.g., chlorophyll)

parameters. The 2013 results for Trout Lake indicate that none of the parameters tested exceeded the CCME guidelines for freshwater aquatic life.

2.4 Potential Drinking Water Contamination Inventory

A key part of the source water assessment process is to prepare an inventory of potential contaminant sources that may be negatively impacting the source water supply. The purpose of the inventory is to ensure that all of the land uses, activities and natural processes that could degrade water quality are identified.

During the first working group meeting, the working group and community members compiled a list and mapped potential contaminant sources that they felt might be degrading the water quality in Trout Lake (Figure 7). As explained in section 2.2, participants acknowledged that there are potential contaminants that must be documented at both the community and watershed-level. Table 3 provides an inventory of all the potential contaminant sources that community members identified as a risk to the water quality in Trout Lake, including those at both the community and watershed level. The table also provides information about the approximate location of each source, its approximate distance to the nearest shore of Trout Lake, the associated contaminants of concern and the contaminant transport mechanism. The map in Figure 8 indicates the various locations of each potential contaminant source relative to the source water, Trout Lake.

Figure 8: Working Group Members Identifying Potential Contaminant Sources

Table 3: Potential Water Contaminant Sources for Trout Lake, as identified by Working Group

Potential Contaminant Source	*Location*	*Direct Distance to Trout Lake*	*Contaminants of Concern*	*Transport Mechanism*
1. Various Abandoned Wells Around Island Lake	Various locations around the lake: 121°7'4.792"W 60°9'42.608"N	28.5 km	Contaminated liquid	Leaching
2. Uncapped Well on Ridge	121°24'51.78"W 60°26'26.591"N	2 km	Contaminants, potent minerals	Leaching from leaking well
3. Sewage Lagoon	121 14.305' W 60 25.124' N	2.1 km	Effluent, wastewater chemicals	Flooding, leaching, overflow
4. Diesel Spill in Community (2008)	N 60 26.513' W 121 14.826' N 60 26.547' W 121 14.733'	0.06 km	Diesel	Flooding , Underground flow
5. Sour Gas Hole	121°29'33.257"W 60°30'40.052"N	15 km	Fuel, natural contaminants	Bubbling from underground and leaching
6. Enbridge Pipeline	Transect along points: 120°10'58.965"W 60°26'48.918"N 120°16'41.693"W 60°32'43.342"N	41.2 km	Contaminants	Leaching from leaking pipes, contaminants from corrosion
7. Old Cat Camp-Gravel Lake	121°14'7.836"W 60°15'20.974"N	16.3 km	Diesel, contaminants	Leaching, particularly during spring run-off
8. Crow Hill Oil Rig Site	120°37'7.563"W 60°18'2.24"N	34.2 km	Contaminants, chemicals left at the site	Leaching
9. Active Sambaa K'e Landfill	W 121 14.292 N 60 25.184'	2.01	Contaminants, batteries, appliances, hazardous waste barrels	Leaching, particularly during spring run-off
10. Waste Dumping at Black Dog Creek	121°13'8.308"W 60°26'9.698"N	0.04 km	Contaminants, batteries, appliances, insolation, carcinogens	Leaching, airborne ash from burning waste settling in nearby Island River

Potential Contaminant Source	*Location*	*Direct Distance to Trout Lake*	*Contaminants of Concern*	*Transport Mechanism*
11. First Abandoned Well South of Island Lake	121°11'8.284"W 60°1'54.379"N	40.5 km	Contaminants from sites not being cleaned up properly	Leaching from site
12. Second Abandoned Well South of Island Lake	121°9'10.636"W 60°0'55.244"N	43 km	Contaminants from sites not being cleaned up properly	Leaching from site
13. Shoreline Garbage Along Trout Lake	Various locations: 121°15'39.657"W 60°26'5.133"N	0 km	Contaminants from garbage	Leaching, direct transfer into water
14. Old Waste Site Near Baseball Diamond	121°14'26.507"W 60°26'32.852"N	0.06 km	Contaminants, batteries, appliances	Leaching
15. Great Slave Helicopters Fuel Cache	121°13'8.308"W 60°26'9.698"N	0.04 km	Diesel, chemicals	Leaching
16. Fuel Tanks in Community	121°14'26.943"W 60°26'28.69"N	0.1 km	Diesel	Leaching
17. Old garbage dump site behind trailers	121°14'37.289"W 60°26'27.385"N	0.03 km	Contaminants running off from old batteries, truck parts	Leaching
18. Submerged barrels and drums	121°14'23.963"W 60°26'35.491"N	0 km	Unknown contaminants leaking from submerged barrels and drums	Direct transfer
19. Diaper dump	121°13'32.734"W 60°25'44.928"N	1.8 km	Effluent leaching from old diaper disposal area	Leaching
20. Old Army Site at Lodge	121°8'32.449"W 6 0°29'27.211"N	0.05 km	Contaminants, old barrels, batteries, wires	Leaching
21. Contaminated Water Bodies From Past Forest Fires	Trainor Lake (120°17'41.823"W 60°25'37.638"N)	41 km	Mercury released from burned trees	Airborne ash settling in water bodies

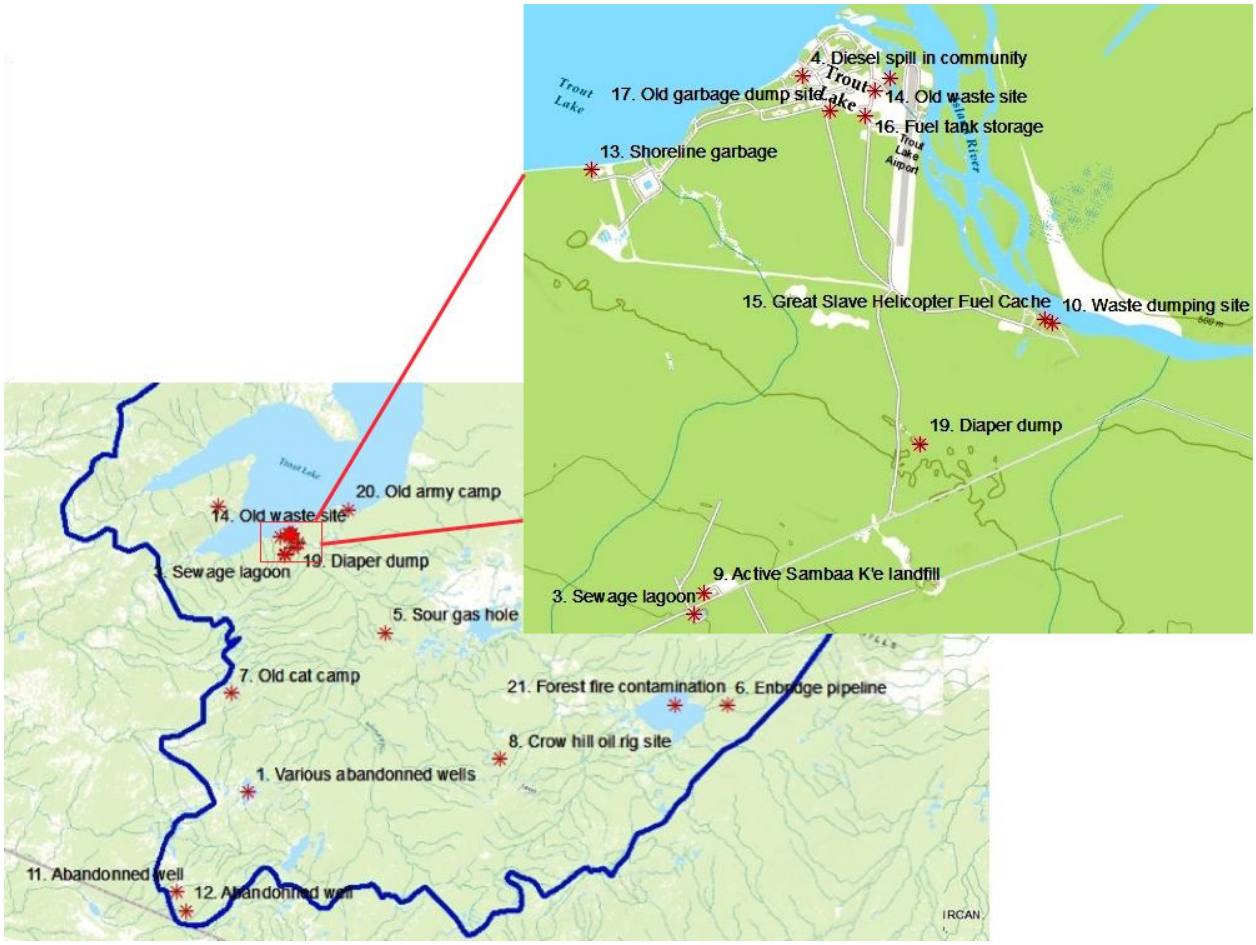

Figure 9: Map of Potential Source Water Contaminant Sources

As part of the contaminant inventory process, the working group agreed that it would be valuable to have additional information about the nature of each potential contaminant source and the different types of pollutants each source may be releasing into the water supply. For this reason, the working group sought additional expertise from the technical advisory group to provide more information about the contaminant sources identified by the community. This information will be very useful to the community as they move forward with SWP planning and decision-making in the future. Table 4 summarizes the input from advisory group members into a potential contaminant source and pollutant analysis matrix. The structure of Table 4 is based on a pollutant analysis matrix template provided in the SWAP guide[xiv]. The guide encourages the inclusion of the matrix in the SWP planning process in order to help interpret the identified potential contaminant sources and better understand the different types of contaminants entering the source water body.

Table 4: Pollutant Analysis Matrix for Identified Contaminants Based on Technical Advisory Group Input

X's' indicate that the pollutant is likely to be present with the associated potential contaminant source. The number of 'X's' indicates the number of experts that identified the pollutant as being present.

Potential Contaminant Source Identified by Community	Pollutant Analysis Matrix								
	Turbidity	pH	Nitrogen Phosphate	Viruses	Bacteria	THM Precursors	Heavy Metals	Iron, Manganese	Other
Various Abandoned Wells Around Island Lake	X	X		X	X	X			
Uncapped Well on Ridge	X	X		X	X				
Sewage Lagoon	XXX	XXX	XXX	XXX	XXXX	X			BOD/ CBOD (organic loading)
Diesel Spill in Community		X					X	X	Hydrocarbon pollutants (benzene and other carcinogens), petroleum Hydrocarbons
Sour Gas Hole		X					X	X	Hydrocarbons and sulphur dioxide
Enbridge Pipeline		X					X	X	Hydrocarbons and chemicals
Crow Hill Oil Rig Site	X	XX	X	X	X	X	XXX	XXX	Petroleum Hydrocarbons
Active Sambaa K'e Landfill	X	XX	XX	XXX	XXX	X	XXX	X	Petroleum Hydrocarbons, chemicals
Old Cat Camp-Gravel Lake		X					X	X	Petroleum Hydrocarbons, BTEX
Waste Dumping at Black Dog Creek		X	X	X	X		XXX	X	Petroleum Hydrocarbons
First Abandoned Well South of Island Lake		X		X	X				

Potential Contaminant Source	Turbidity	pH	Nitrogen Phosphate	Viruses	Bacteria	THM Precursors	Heavy Metals	Iron, Manganese	Other
Second Abandoned Well South of Island Lake		X		X	X				
Shoreline Garbage Along Trout Lake	X	X	X	X	X	X	XX		
Old Waste Site Near Baseball Diamond	X	XX	X	X	X		XXX	XX	Hydrocarbons, plastics
Great Slave Helicopters Fuel Cache		X					X	X	Hydrocarbons, BTEX
Fuel Tanks in Community		X					XX	X	Hydrocarbons, BTEX
Old garbage dump site behind trailers		X					XX	XX	Plastic
Submerged barrels and drums		X					XX	XX	Hydrocarbons, glycols
Diaper dump				XX	XXX				
Old Army Site at Lodge		X					XX	XX	Hydrocarbons, BTEX
Contaminated Water Bodies From Past Forest Fires	XXX	XX	XX			X	XX	X	Flame retardant residues

2.5 Potential Drinking Water Contaminant Risk Assessment

Once the inventory of potential contaminants was completed, the working group undertook a risk assessment to estimate the potential risks of contamination associated with each contaminant source identified in Table 3. The purpose of the risk assessment was to help the working group interpret the inventory data and prioritize the potential contaminant sources based on level of perceived risk. According to the SWAP guide, the potential level of risk for each contaminant source can be qualitatively determined by multiplying the **likelihood** that the contamination will occur by the **impact** that the contamination would have on the water supply and community health if it were to occur. The working group completed the contaminant risk assessment using a consensus-based approach. The process was completed in three steps: 1) determine the likelihood of occurrence; 2) determine the impact of occurrence; and 3) calculate the risk assessment score.

Step 1: Likelihood of Occurrence

The working group used the visual scale in Figure 9 to assess the likelihood that each potential drinking water contaminant (Table 3) would occur in the next five years. The scale was presented to the working group with prompts from the meeting facilitator who provided additional information about the different likelihoods of occurrence. For example, the 0-30% likelihood of occurrence was described as a case where the potential contaminant source has almost no chance of becoming a hazard to the source water in the next five years, and something that the community is not very worried about happening soon. The 30-70% likelihood of occurrence was described as a potential contaminant source where there is a slightly higher (moderate) chance of it becoming a threat to the source water in the next five years, and something that the community is more worried about than the previous option. Finally, the 70-100% likelihood of occurrence was described as a contaminant source that will almost certainly have a negative impact on the water quality in Trout Lake within the next five years, and something that the community is very worried about. These prompts and the visual scales were derived from the likelihood determination table included the SWAP guide (p. 14). The results from the likelihood of occurrence ranking process are included in the second column of Table 6. A more detailed results table is provided in Appendix B, which includes community comments that were made during the risk assessment process.

Step 2: Impact of Occurrence

Once the likelihood of each potential contaminant source was assessed, the working group used a separate visual scale (Figure 10) to assess the level of impact that each contaminant source would have on Trout Lake water quality and the community if it were to occur. The meeting facilitator provided the working group with brief descriptions of impact of occurrence ranking throughout the risk assessment process. The 'no impact' ranking was described as a case where the potential contaminant source would not have a noticeable impact on the source water, people would still feel comfortable drinking the water and eating the fish, and there would not be any direct impacts on human health. The 'moderate impact' ranking was described as a potential contaminant that

would cause noticeable changes to the source water, and would have some indirect, non-serious health concerns. The 'high impact' ranking was described as a situation where the contaminant would cause noticeable impacts to the water, compromise the drinking water and have serious human health impacts. These descriptions and the visual scale were derived from the Consequence Determination table included the SWAP guide (p. 14), which provides options for high, moderate and low consequence of occurrence levels. The results from the impact of occurrence ranking process are included in the third column of Table 6.

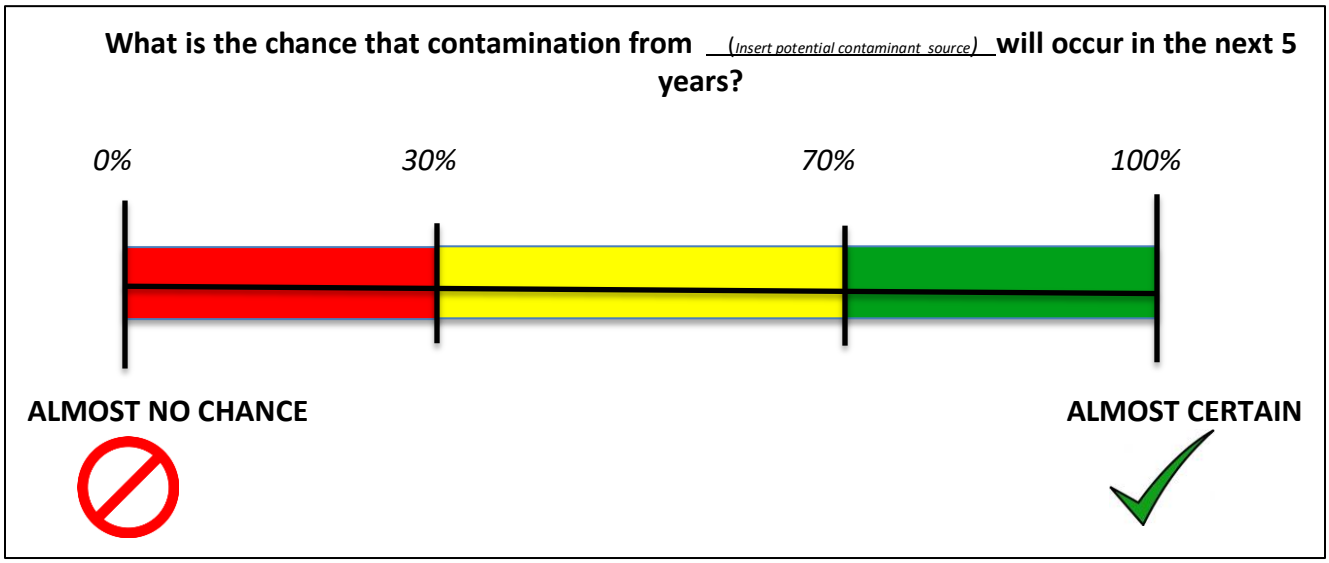

Figure 10: Scale for Likelihood of Contaminant Occurrence

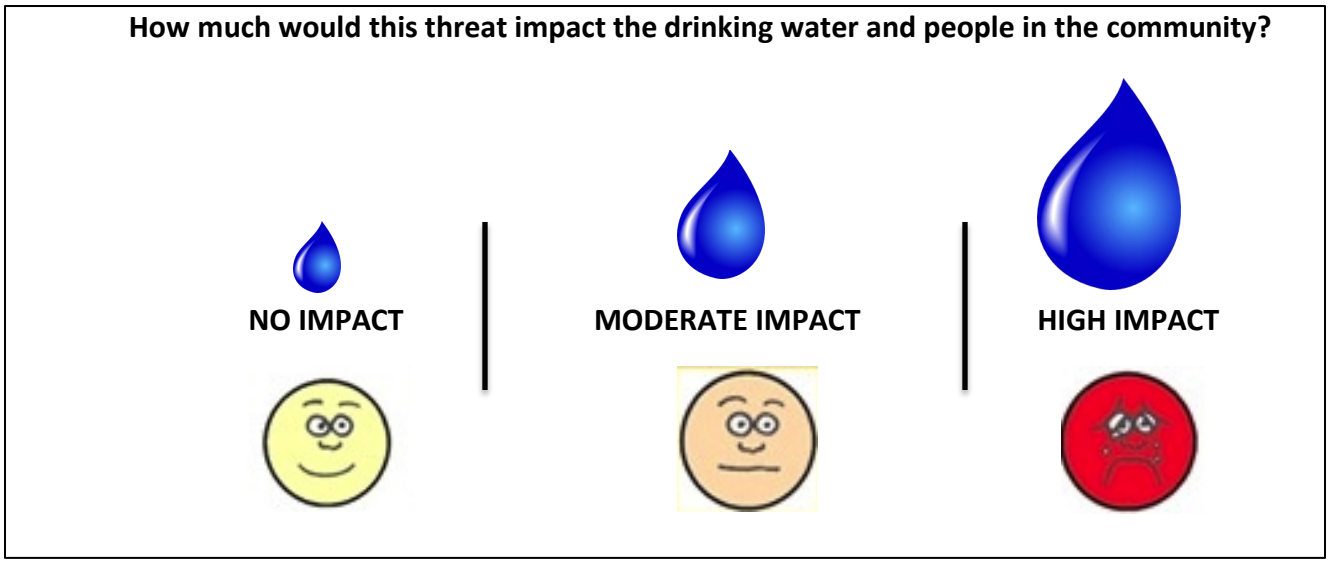

Figure 11: Scale for Impact of Threat Occurrence

Step 3: Risk Assessment Score

The final step of the risk assessment was to combine the likelihood of occurrence and potential impact of occurrence rankings that the working assigned to each potential contaminant. The purpose of combining the rankings is to determine the overall level of risk that community members associate with each potential contaminant source. The risk assessment analysis matrix (Table 3) that was used to combine the likelihood and impact of occurrence rankings was adopted from the SWAP guide (p. 15) (Table 5). The overall risk rankings that emerged are presented in the fourth column of Table 6, from highest risk to lowest.

Table 5: Risk Assessment Score Analysis Matrix

Likelihood	***Impact Descriptors***		
	High Impact	**Moderate Impact**	**No Impact**
	RISK LEVEL		
Almost Certain	*Very High*	*High*	*Moderate*
Moderate Chance	*High*	*Moderate*	*Low*
Almost No Chance	*Moderate*	*Low*	*Low*

Table 6: Community Working Group Risk Assessment Results for Potential Contaminant Sources

Potential Contaminant Source	Likelihood of Occurrence	Impact of Occurrence	Risk Assessment Score
18. Submerged barrels and drums	*Almost certain*	*High Impact*	*Very High*
15. Great Slave Helicopters Fuel Cache	*Almost certain*	*High Impact*	*Very High*
1. Various Abandoned Wells Around Island Lake	*Almost Certain*	*High Impact*	*Very High*
2. Uncapped Well on Ridge	*Almost Certain*	*Moderate Impact*	*High*
3. Sewage Lagoon	*Moderate Chance*	*High Impact*	*High*
4. Diesel Spill in Community	*Moderate Chance*	*High Impact*	*High*
21. Contaminated Water Bodies From Past Forest Fires	*Moderate Chance*	*High Impact*	*High*
16. Fuel Tanks in Community	*Moderate Chance*	*High Impact*	*High*
5. Sour Gas Hole	*Almost Certain*	*Moderate Impact*	*High*
6. Enbridge Pipeline	*Moderate Chance*	*Moderate Impact*	*Moderate*
7. Crow Hill Oil Rig Site	*Moderate Chance*	*Moderate Impact*	*Moderate*
20. Old Army Site at Lodge	*Moderate Chance*	*Moderate impact*	*Moderate*
8. Active Sambaa K'e Landfill	*Moderate Chance*	*Moderate Impact*	*Moderate*
9. Old Cat Camp-Gravel Lake	*Moderate Chance*	*Low Impact*	*Low*
10. Waste Dumping at Black Dog Creek	*Moderate Chance*	*Low Impact*	*Low*
13. Shoreline Garbage Along Trout Lake	*Almost No Chance*	*Low Impact*	*Low*
14. Old Waste Site Near Baseball Diamond	*Almost No Chance*	*Low Impact*	*Low*
17. Old garbage dump site behind trailers	*Almost No Chance*	*Low Impact*	*Low*
19. Diaper dump	*Almost No Chance*	*Low Impact*	*Low*
11. First Abandoned Well South of Island Lake	*Unknown*	*Low Impact*	*Unknown/Low*
12. Second Abandoned Well South of Island Lake	*Unknown*	*Low Impact*	*Unknown/Low*

Table 6 indicates the level of risk that the working assigned to each potential contaminant source. However, while completing the risk assessment process, the working group decided that it would be useful to have scientists and/or other field experts also comment on the level of risk associated with each potential contaminant source. Consequently, members of the technical advisory group were also contacted and asked to complete the three risk assessment steps (likelihood of occurrence, impact of occurrence, risk assessment score) for each potential contaminant source.

The risk assessment results from members of the advisory group are included in Appendix A. The results are not included in the body of the plan for two primary reasons: 1) the community working group did not have the advisory group risk assessment results in time to incorporate their input into the community working group discussions around risk; and, 2) there is no clear consensus among the advisory group risk assessment results. Therefore, while the technical advisory group risk assessment results provide useful information to the community at a high level, the results will likely be more relevant to the community as they move forward with implementing the plan. It is suggested that the community revisits the advisory group risk assessment results when evaluating community priorities for implementation.

In order to derive more value from the advisory group risk assessment results during future SWP planning, we recommend the following:

- Coordinate timing between working group and technical advisory group – Once the working group has identified potential source water contaminant sources, approach the technical advisory group to complete the risk assessment process. Only once the results from the advisory group have been compiled should the community working group begin the risk assessment process. This sequence of planning will ensure that the working group has an opportunity to review and understand the advisory group's input prior to completing their own risk assessment process.

- Work towards consensus – It will be valuable to spend some time working with the technical advisory group to reach consensus during the risk assessment process. Arriving at a consensus, or at least understanding why there are polarized discrepancies among advisory group responses, will make the risk assessment results more meaningful to the community working group. For this reason, it is suggested that future SWP planning initiatives provide an opportunity for advisory group members to meet in-person to complete the risk assessment process.

3. STAGE 3: Source Water Protection Plan – Management Actions & Recommendations

3.1 Management Actions

After completing the risk assessment process (part of Stage 2), the working group discussed different management actions to address the potential contaminant sources identified during the source water assessment.

The purpose of the discussion was to identify specific management actions aimed at reducing or eliminating the risks associated with each potential contaminant source. Members of the working group began by recording the management actions that are already being undertaken to reduce potential source water risks in Trout Lake. Members of the working group then considered ways that the community can build on the existing management actions, while also implementing additional short- and long-term actions. The management actions they identified are listed in column four of Table 7. Although different members of the working group contributed different ideas throughout the discussion, there was consensus for all of the management actions identified.

The final component of the risk management actions stage was to seek additional input from the technical advisory group. Members of the advisory group were asked to identify management actions to that could be implemented to reduce or eliminate the risks associated with each potential contaminant source. Given there was substantial overlap between the management actions identified by the working group and the advisory group, only the additional management actions that were identified by the advisory group are summarized in column 5 of Table 7.

The purpose of including Table 7 in this plan is to provide a raw overview of the potential management actions that the community of Trout Lake may want to consider pursuing as they move towards implementing the plan. The management actions are listed for each potential contaminant source, which are organized from high to low in order of the community risk assessment results. The following section (3.2 Recommendations) provides a checklist tool and general recommendations to help guide the community of Trout Lake towards implementing these actions.

Table 7: Management Actions for Potential Contaminant Sources

Potential Contaminant Source	Community Risk Assessment Score	Management Actions Proposed by the Community	Additional Management Actions Proposed by the Technical Advisory Group
18. Submerged barrels and drums	*Very High*	**Short-Term Actions:** - Pinpoint where the barrels are in the water, likely using technology - Once the barrels are located, dig them out of the lake and dispose of them properly	- Identify responsible party, file spill report, follow up with ENR
15. Great Slave Helicopters Fuel Cache	*Very High*	**Short-Term Actions:** - Inspect the fuel cache to determine if it is leaking - Install fuel pans and/or pads to protect against small drips and leaks **Long-Term Actions:** - Line the fuel cache with berm lining as a secondary containment area	- Ensure the responsible party maintains drums in secure condition and keeps spill response equipment in order - If possible a relocation may be desirable
1. Various Abandoned Wells Around Island Lake	*Very High*	**Short-Term Actions:** - Additional monitoring: conduct a site inspection to inventory what is in the wells and determine what is buried at the site **Long-Term Actions:** - Depending on outcomes of inspection, stabilize the site and decommission the wells	
2. Uncapped Well on Ridge	*High*	**Short-Term Actions:** - Begin monitoring: conduct a site inspection to determine contents of the well and risks associated with it - Monitoring should also include testing the surrounding soil and vegetation	- Cap the well as a precaution - Identify responsible party, research more information about potential contaminants

3. Sewage Lagoon	*High*	**Short-Term Actions:** - Additional monitoring to test all possible sewage pathways **Long-Term Actions:** - Develop an emergency spill plan in case of sewage overflow - Consider options to relocate the lagoon further away from the lake - Conduct a population and sewage capacity study to ensure the lagoon has the capacity to accommodate growing community	- Monitor lagoon levels - Monitor effluent quality at decanting - Work towards applying for a water licence. The water licence application will review the design of the current sewage lagoon and likely establish Surveillance Network Program (SNP) sites for monitoring potential impacts downstream of sewage outflow. - Establish an Operation and Maintenance Plan for the sewage lagoon to ensure the system is properly managed. - Establish a Spill Contingency Plan (if not already completed) for the community that includes an action plan for potential sewage spills.
4. Diesel Spill in Community	*High*	**Short-Term Actions:** - Follow up monitoring: re-test the affected area to know if the water and berries are safe - Clean-up the site and remove contaminated soil if tests show it is needed **Long-Term Actions:** - Develop an emergency spill plan in case of future spills - Train people in the community to do simple in-community water samples	- Confirm with ENR and Northland Utilities that remediation and spill clean up has taken place and that the site has been remediated. - KBL is operating commercial biopiles for the treatment of hydrocarbon contaminated soil in both Hay River and Yellowknife. If needed, contaminated soil can be shipped to either location for treatment.
21. Contaminated Water Bodies From Past Forest Fires	*High*	**Short-Term Actions:** - Expand AAROM monitoring program: work with AAROM to test the fish in Trainor Lake for increasing mercury - Follow up with Heidi Swanson regarding mercury testing results for Trout Lake	

		Long-Term Actions: - Work with ENR to discuss forest fire management and protection options for the Trout Lake watershed	
16. Fuel Tanks in Community	*High*	**Short-Term Actions:** - Consider potential locations to move the tank farm further from the community, school and lake	- Ensure all tanks have containment berms and fuel transfer protocols
5. Sour Gas Hole	*High*	**Short-Term Actions:** - Begin monitoring, especially during the spring run-off when the water table is high	
6. Enbridge Pipeline	*Moderate*	**Short-Term Actions:** - Continue monitoring **Long-Term Actions:** - Work with AAROM and ENR to train local community members to use simple water quality test kits that they can use while travelling on the land	- Contact Enbridge and National Energy Board that the pipeline is being maintained and inspected. - Ensure that the community is involved in any regulatory reviews of the project. Review plans that Enbridge submits to ensure they are protective of regional water bodies. Important plans to review include, but are not limited to: Closure and Reclamation Plan, Spill Contingency Plan, Waste Management Plan.
7. Crow Hill Oil Rig Site	*Moderate*		- Monitor, report to community - Identify responsible party, take pictures, inventory chemicals, file spill report
20. Old Army Site at Lodge	*Moderate*		- Proper clean up of the site is recommended - Identify responsible party, photograph site, file spill report

8. Active Sambaa K'e Landfill	*Moderate*	**Short-Term Actions:** - Continue cleaning up and sorting the landfill - Bring in pallets to keep the sorted waste off the ground while preparing to ship out - Install clear signage to indicate how waste should be sorted at the landfill - Look into options for installing a cage or mesh to prevent garbage from blowing out of the dump	- Ensure that vehicles are properly decommissioned, including removal of fluids, mercury switches. - Maintain inventories of hazardous waste at site. Get quotes for transportation and disposal of hazardous waste. Arrange for transportation and disposal of hazardous wastes including contaminated soil. - Work towards applying for a water license. The water license application will review the design of the current landfill and likely establish Surveillance Network Program (SNP) sites for monitoring potential impacts in regional ponded water or groundwater. - Establish security and signage at the site to limit illegal dumping of unacceptable waste. - Establish Operation and Maintenance Plan for the landfill to ensure the system is properly managed. An O&M Plan will help the community plan how to properly receive and sort acceptable waste and avoid hazardous waste from entering the site. An O&M Plan also helps to manage unacceptable waste. - Establish a Spill Contingency Plan for the community that includes potential spills that could occur at the landfill (i.e. fuel spills).
9. Old Cat Camp-Gravel Lake	*Low*		- Sample leachate and confirm contaminants, file spill report

10. Waste Dumping at Black Dog Creek	*Low*	**Short-Term Actions:** - Sample the run-off from the area and test for contaminants - Sort the dump site - Install clear, big and visual (not verbal) signage to explain that the site is only to be used for scrap lumber - Educate community members about why the site needs to be kept clean and restricted to scrap lumber **Long-Term Actions:** - Look into relocating the lumber scrap drop-off to the actual landfill so that is all in one spot - If site is moved, remove contaminated soil from Black Dog Creek area and remediate	
13. Shoreline Garbage Along Trout Lake	*Low*	**Short-Term Actions:** - Continue community cleanup efforts - Educate community members on the importance of not littering and taking responsibility for the lake	
14. Old Waste Site Near Baseball Diamond	*Low*	**Short-Term Actions:** - Dig out the old dump sites, sort and remove garbage - Remediate the soil and land at the old site	
17. Old garbage dump site behind trailers	*Low*		
19. Diaper dump	*Low*	**Short-Term Actions:** - Install clear signage to indicate that the dumping area is only for diapers	- A water licence application will review the location and management of the diaper dump and establish any required water quality monitoring to ensure it is not impacting regional water bodies

11. First Abandoned Well South of Island Lake	*Unknown/Low*	**Long-Term Actions:** - Determine who is responsible for cleaning up the sites - Contact companies responsible for the site and discuss cleanup options	
12. Second Abandoned Well South of Island Lake	*Unknown/Low*		

3.2 Recommendations for Implementation

This section provides a checklist (Table 8) and recommendations for the community of Trout Lake to move forward with implementing the SWP management actions listed in Table 7. The checklist is a tool designed to help the community track their progress towards implementing this SWP plan. The checklist is organized by potential contaminant source, in order of highest priority to lowest priority based on the community risk assessment scores. Short- and long-term management actions should be tracked and checked off as the action items are completed. The community may want to consider posting a large version of the checklist in the band office as a visual reminder of the important SWP work they are doing.

However, recognizing that there are often many barriers to implementing these actions in practice, the list below provides suggested steps to help make implementation happen:

- Have the SKDB go through each contaminant source in the checklist (Table 8), classifying each as either 1) a contaminant source that the community is likely able to independently act on, or 2) a contaminant source that the community will likely require outside support to act on. This exercise will encourage the band to develop a realistic list of the actions that are within their capacity to achieve in the short- and long-term.

- Next, for each contaminant source, the SKDB will need to determine if they have any funding available to carry out the target management actions. For those that they lack funding to implement, it is important to start identifying potential funding sources and associated contacts.

- For those contaminant sources that will require outside support, including the support of external funders, consider hosting a stakeholder meeting to discuss potential funding and/or partnership options.

- After partnership and support options have been discussed, it is necessary to identify a project lead who will be responsible for the implementation of the target management items.

- Once the SKDB has reviewed each contaminant source, assessed the level of support and funding required for each, and identified a project lead, it is necessary to estimate timelines and set expected completed dates.

Table 8: Community of Trout Lake Checklist for Action Item Implementation

Potential Contaminant Source	*Risk Assessment Score*	*Target Management Actions*	*Overall Completion*
Submerged barrels and drums	*Very High*	**Short-Term Actions:** ☐ Identify responsible party, file spill report, follow up with ENR ☐ Pinpoint location of barrels ☐ Remove barrels from the lake ☐ Dispose of barrels properly	☐ *Date Completed:* _____
Great Slave Helicopters fuel cache	*Very High*	**Short-Term Actions:** ☐ Inspect the fuel cache to determine if it is leaking ☐ Install fuel pans and/or pads to protect against small drips and leaks ☐ Ensure spill response equipment is on site **Long-Term Actions:** ☐ Line the fuel cache with berm lining as a secondary containment area	☐ *Date Completed:* _____
Various abandoned wells around Island Lake	*Very High*	**Short-Term Actions:** ☐ Additional monitoring: conduct a site inspection to inventory what is in the wells and determine what is buried at the site **Long-Term Actions:** ☐ Take necessary action depending on inspection outcome	☐ *Date Completed:* _____
Uncapped well on ridge	*High*	**Short-Term Actions:** ☐ Begin monitoring: conduct a site inspection to determine contents of the well and risks associated with it ☐ Cap the well as a precaution	☐ *Date Completed:* _____

Sewage lagoon	*High*	**Short-Term Actions:** ☐ Additional monitoring to test all possible sewage pathways ☐ Monitor effluent quality at decanting **Long-Term Actions:** ☐ Develop an emergency spill plan in case of sewage overflow ☐ Conduct a population and sewage capacity study to ensure the lagoon has the capacity to accommodate growing community ☐ Apply for a water license ☐ Establish an Operation and Maintenance Plan for the sewage lagoon to ensure the system is properly managed	☐ *Date Completed:* _____
Diesel spill in community	*High*	**Short-Term Actions:** ☐ Confirm with ENR and Northland Utilities that remediation and spill clean up has taken place and that the site has been remediated. ☐ Follow up monitoring: re-test the affected area to know if the water and berries are safe ☐ Clean-up the site and remove contaminated soil if tests show it is needed **Long-Term Actions:** ☐ Develop an emergency spill plan in case of future spills ☐ Train people in the community to do simple in-community water samples	☐ *Date Completed:* _____
Contaminated water bodies from past forest fires	*High*	**Short-Term Actions:** ☐ Expand AAROM monitoring program: work with AAROM to test the fish and water in Trainor Lake for increasing mercury ☐ Follow up with Heidi Swanson regarding mercury testing results for Trout Lake **Long-Term Actions:** ☐ Work with ENR to discuss forest fire management and protection options for the Trout Lake watershed	☐ *Date Completed:* _____

Fuel tanks in community	*High*	**Short-Term Actions:** ☐ Ensure all tanks have containment berms and fuel transfer protocols ☐ Consider potential locations to move the tank farm further from the community, school and lake if necessary	☐ *Date Completed:* _____
Sour gas hole	*High*	**Short-Term Actions:** ☐ Begin monitoring for contaminants, especially during the spring run-off when the water table is high	☐ *Date Completed:* _____
Enbridge pipeline	*Moderate*	**Short-Term Actions:** ☐ Continue existing annual monitoring ☐ Contact Enbridge and National Energy Board to ensure that the pipeline is being maintained and inspected ☐ Ensure that the community is involved in any regulatory reviews of the project **Long-Term Actions:** ☐ Work with AAROM and ENR to train local community members to use simple water quality test kits that they can use while travelling on the land	☐ *Date Completed:* _____
Crow hill oil rig site	*Moderate*	**Short-Term Actions:** ☐ Identify responsible party, take pictures, inventory chemicals, file spill report **Long-Term Actions** ☐ Monitor, report to community	☐ *Date Completed:* _____
Old army site at lodge	*Moderate*	**Short-Term Actions:** ☐ Identify responsible party, photograph site, file spill report ☐ Proper clean up of the site is recommended	☐ *Date Completed:* _____

Active Sambaa K'e landfill	*Moderate*	**Short-Term Actions:** ☐ Continue to clean and sort the landfill ☐ Acquire pallets to keep the sorted waste off the ground ☐ Install clear signage to indicate how waste should be sorted at the landfill ☐ Look into options for installing a cage or mesh to prevent garbage from blowing out of the dump **Long-Term Actions:** ☐ Maintain inventories of hazardous waste at site. Get quotes for transportation and disposal of hazardous waste. Arrange for transportation and disposal of hazardous wastes including contaminated soil. ☐ Work towards water license ☐ Establish Operation and Maintenance Plan for the landfill to ensure the system is properly managed ☐ Establish a Spill Contingency Plan for the community that includes potential spills that could occur at the landfill (i.e. fuel spills).	☐ *Date Completed:* _____
Old cat camp-Gravel Lake	*Low*	**Short-Term Actions:** ☐ Sample leachate and confirm contaminants, file spill report	☐ *Date Completed:* _____
Waste dumping at Black Dog Creek	*Low*	**Short-Term Actions:** ☐ Sample the run-off from the area and test for contaminants ☐ Sort the dump site ☐ Install signage to indicating site is only for scrap lumber ☐ Educate community members about why the site needs to be kept clean and restricted to scrap lumber **Long-Term Actions:** ☐ Look into relocating the lumber scrap drop-off to the landfill	☐ *Date Completed:* _____

Shoreline garbage along Trout Lake	*Low*	**Short-Term Actions:** ☐ Continue community cleanup efforts ☐ Educate community members on the importance of not littering and taking responsibility for the lake	☐ *Date Completed:* _____
Old waste site near baseball diamond	*Low*	**Short-Term Actions:** ☐ Dig out the old dump site, sort and remove garbage ☐ Remediate the soil and land at the site	☐ *Date Completed:* _____
Old garbage dump site behind trailers	*Low*	**Short-Term Actions:** ☐ Dig out the old dump site, sort and remove garbage ☐ Remediate the soil and land at the site	☐ *Date Completed:* _____
Diaper dump	*Low*	**Short-Term Actions:** ☐ Install clear signage to indicate that the dumping area is only for diapers **Long-Term Actions:** ☐ A water license application will review the location and management of the diaper dump and establish any required water quality monitoring to ensure it is not impacting regional water bodies	☐ *Date Completed:* _____
First abandoned well south of Island Lake	*Unknown/ Low*	**Long-Term Actions:** ☐ Determine who is responsible for cleaning up the sites ☐ Contact companies responsible for the site and discuss cleanup options	☐ *Date Completed:* _____
Second abandoned well south of Island Lake	*Unknown/ Low*	**Long-Term Actions:** ☐ Determine who is responsible for cleaning up the sites ☐ Contact companies responsible for the site and discuss cleanup options	☐ *Date Completed:* _____

Appendix A: Technical Advisory Group – Raw Risk Assessment Results

Potential Contaminant Source Identified by Community	*Risk Assessment*									
	Likelihood of Contaminant Occurring *1 = low likelihood of occurring, 3 = high likelihood occurring*					***Impact if Potential Contaminant Occurred*** *1 = low impact if occurred, 3 = high impact if occurred*				
	Respondent 1	**Respondent 2**	**Respondent 3**	**Respondent 4**	**Respondent 5**	**Respondent 1**	**Respondent 2**	**Respondent 3**	**Respondent 4**	**Respondent 5**
Various Abandoned Wells Around Island Lake	1	3				1	3			
Uncapped Well on Ridge	1	3				1	3			
Sewage Lagoon	3	2	3	1	1	2	3	1	1	3
Diesel Spill in Community	2	2	3		3	2	3	1		2
Sour Gas Hole	1	2				1	3			
Enbridge Pipeline	2	2	3		1	1	3	1		
Crow Hill Oil Rig Site	1	2	3			1	3			
Active Sambaa K'e Landfill	1	2	3		1	2	3	2		
Old Cat Camp-Gravel Lake	1					1				
Waste Dumping at Black Dog Creek	2	3	3			3	3	2		

First Abandoned Well South of Island Lake	1	3	3			1	3			
Second Abandoned Well South of Island Lake	1	3	3			1	3			
Shoreline Garbage Along Trout Lake	3	1	3		3	2	2	1		1
Old Waste Site Near Baseball Diamond	2	2				1	3			
ENR Fuel Cache	2	3	2		1	3	3	1		2
Fuel Tanks in Community	2	2	3		1	3	3	3		3
Old garbage dump site behind trailers	2	3	3			1	3	1		
Submerged barrels and drums	3	2	3		1	3	3	3		1
Diaper dump	1	1				1	2			
Old Army Site at Lodge	2	3	3			2	3	1		
Contaminated Water Bodies From Past Forest Fires	1	3			2	1	3			

Appendix B: Community Comments During Risk Assessment Process

Potential Contaminant Source	Likelihood of Occurrence	Impact of Occurrence	Risk Assessment Score	Community Comments During Risk Ranking Process
18. Submerged barrels and drums	*Almost certain*	*High Impact*	*Very High*	- Almost certain likelihood ranking because there is visual evidence of the barrels rusting in the submerged in the water - The impact of contamination is high because the rust in the water would have very negative impacts on the fish and micro organisms
15. Great Slave Helicopters Fuel Cache	*Almost certain*	*High Impact*	*Very High*	- Almost certain likelihood ranking because the fuel cache does not have a berm lining, and thus fuel is likely leaking
1. Various Abandoned Wells Around Island Lake	*Almost Certain*	*High Impact*	*Very High*	- Island Lake is part of traditional hunting territory, so there are increased concern about potential impacts of water contamination on animals that are hunted - Island Lake flows into Island River, which flows directly into Trout Lake, adjacent to the community, so increased concern about potential impacts of water contamination on Trout Lake health and community health (direct pathway to Trout Lake, close proximity to community) - There are stories of community members getting sick from consuming water at Island Lake in the past, hence increased likelihood of contamination - There are large pits of liquid around the lake, which are suspected by the community to have contaminants in it – concern about contamination of Island Lake through spring run-off and leaching - Island Lake is surrounded by 6 old wells, so it is a high density area for industrial activity
2. Uncapped Well on Ridge	*Almost Certain*	*Moderate Impact*	*High*	- There is visual evidence of water-like liquid leaking out of the old well, and thus a high likelihood of contamination occurring - A dead rabbit was found near the well, sparking concerns about what type of substance is seeping out of the well

				- Some uncertainty originally about the potential impact level due to lack of knowledge about substance leaking, but ranked as high impact due to close proximity of the site to Trout Lake, and the fact that the site drains into Trout Lake
3. Sewage Lagoon	*Moderate Chance*	*High Impact*	*High*	- Primary concern is that run-off from the sewage lagoon may be reaching Trout Lake - There have been tests done on two potential pathways north of the sewage lagoon, and the results were clear. However, there are remaining concerns about sewage lagoon effluent escaping into other creeks nearby. - The output of these creeks are located very close to the water intake location, and thus would have a high impact on the quality of Trout Lake - Community feels that the likelihood of sewage contamination happening is also impacted by community actions (i.e., proper management of the facility). - Potential impact of contamination was ranked as high because the effluent would include all of the community's wastewater, including sewage waste and other chemicals used in households, which would have a serious impact on Trout Lake water quality
4. Diesel Spill in Community	*Moderate Chance*	*High Impact*	*High*	- There is visual evidence of an oily substance on top of the water in the muskeg behind the community where fuel spill occurred - The vegetation in the fuel spill area still looks slightly different - Moderate likelihood that the fuel is impacting the water because although you can see and smell an oily sometimes, the frogs and other species are returning to the area. - However, the impact of contamination would be high given that the spill area is very close to Trout Lake and is an area that is used to harvest berries
21. Contaminated Water Bodies From Past	*Moderate Chance*	*High Impact*	*High*	- Likelihood of occurrence ranked as moderate given that the likelihood of contamination will be different for different size water bodies. Smaller lakes are more likely to have contamination issues

Forest Fires				- There are concerns that the ash from burning trees will increase the mercury in the fish occupying the lake
16. Fuel Tanks in Community	*Moderate Chance*	*High Impact*	*High*	- Moderate likelihood ranking due to the possibility of the fuel tanks not being on proper pads. - The impact of contamination would be high due to the close proximity of the fuel tanks to the lake and the muskeg area behind the community that is used for berry picking.
5. Sour Gas Hole	*Almost Certain*	*Moderate Impact*	*High*	- Likelihood ranked as almost certain because the area was described as a hole, slew, or little pond that smells like fuel. Occasionally there is also visual evidence of the hole bubbling. - The site has not been tested, nor has the nearby muskeg, thus there is heightened concern. - If contamination is occurring, the site would have a moderate impact because it is located just off Island River, which flows directly into Trout Lake, so there is increased concern about potential impacts of water contamination on Trout Lake health and community health (direct pathway to Trout Lake, close proximity to community) - However, the impact wouldn't be high because the scale of the site isn't that big compared to other places like Alberta.
6. Enbridge Pipeline	*Moderate Chance*	*Moderate Impact*	*Moderate*	- The pipeline is a concern because people have observed changes in the fish and beaver in the lake. - Trainor lake beside the pipeline is used as an indicator for the health of nearby waterways and land - Likelihood is moderate because the pipeline is underground and it is hard to tell if it is leaking or contaminating the water without a visual - Moderate impact ranking because any contamination would quickly impact the water quality in Trout Lake
7. Crow Hill Oil Rig Site	*Moderate Chance*	*Moderate Impact*	*Moderate*	- Moderate chance that contamination is occurring because it has occurred in the past – there was a leak at the site in 1987 - The site has not been tested, thus there is heightened concern about possible contamination.

				- The water in the area flows towards Trout Lake, and there are concerns that residue from the old structure may be moving into the lake - There is uncertainty about whether the well is capped properly or not at the site.
20. Old Army Site at Lodge	*Moderate Chance*	*Moderate impact*	*Moderate*	- Chief concern is leaching from camp materials that were abandoned, such as pieces of lead and old stoves.
8. Active Sambaa K'e Landfill	*Moderate Chance*	*Moderate Impact*	*Moderate*	- Chief concern is that contaminants may be leaching or running off from the landfill into Trout Lake - There is a moderate chance contamination is occurring because the garbage is not put in berms, and there is no lining under the waste barrels or car batteries, so contaminants may be leaking - Much of the garbage also escapes the dump when it is windy because there is no wall/enclosure to prevent it from blowing out - However, the community is working on collecting old waste barrels and getting them sent out to reduce potential impact of contamination
9. Old Cat Camp-Gravel Lake	*Moderate Chance*	*Low Impact*	*Low*	- There is visual evidence of an oily, greasy substance on top of a muskeg-like, mossy area - Chief concern is that rain is causing this oily, greasy substance to run-off into nearby surface water bodies - The site is about 1 km from the old oil rig-like structure
10. Waste Dumping at Black Dog Creek	*Moderate Chance*	*Low Impact*	*Low*	- The site is an active waste dump for scrap wood, but other waste gets dumped there too (i.e., old insulation, plastic, etc.). - The pile of waste then gets burned, so there are concerns about the contaminated ash ending up in the Island River (flows into Trout Lake) and the effects it might be having on water quality.
13. Shoreline Garbage Along Trout Lake	*Almost No Chance*	*Low Impact*	*Low*	- Likelihood of contamination is low because the SKDB hires people to pick up garbage along the shorelines, and because community members often pick up garbage as they boat around the lake
14. Old Waste Site Near	*Almost No Chance*	*Low Impact*	*Low*	

Baseball Diamond				
17. Old garbage dump site behind trailers	*Almost No Chance*	*Low Impact*	*Low*	- Almost no chance ranking because the items dumped were solids (not liquids) and they would have already contaminated the area. - The contamination would have also already shown up in past tests done in the area
19. Diaper dump	*Almost No Chance*	*Low Impact*	*Low*	- Almost no chance ranking because the site is on high ground, and because testing has been done on the muskeg in the area. There are no visual signs of contamination in the area.
11. First Abandoned Well South of Island Lake	*Unknown*	*Low Impact*	*Unknown/Low*	- Potential impact of contamination ranked as low because the sites are relatively far away from the community and Trout Lake, and because they are not located close to any major water bodies - Likelihood of contamination was ranked as unknown because the community feels uneducated about this site, but would like to learn more about the potential risks to water quality.
12. Second Abandoned Well South of Island Lake	*Unknown*	*Low Impact*	*Unknown/Low*	

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[iv] James Zippel, personal communication, September 2014

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