# Wabasca Area
## Source Water Protection Plan

Bigstone Cree Nation Administration
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In loving memory of
Clement Auger

His love of the environment and hard work
helped make this document possible

Content of the Wabasca Area Source Water Protection Plan was put together by the Wabasca Area SWPP Working Committee

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# FOREWORD

Water is essential to all life. The risk to human health and to the natural environment from the contamination of water sources is a concern to the Bigstone Cree Nation as well as the Wabasca-Desmarais community. As a result, the Bigstone Cree Nation, in collaboration with the M.D. of Opportunity, has developed this Source Water Protection Plan (SWPP) to protect drinking water sources from harmful contamination and to maintain a healthy environment.

Source water refers to the water from which a community gets its drinking water. Examples include rivers, lakes, or ground water. Source water protection is a vital first step in the protection of water supplies.

# INTRODUCTION

Located on the narrows between North and South Wabasca Lakes in north central Alberta, Wabasca-Desmarais serves as the headquarters for the Bigstone Cree Nation and the Municipal District of Opportunity (M.D. Opportunity). The name Wabasca originates from the Cree word *wapuskau* meaning "white rapid" the name for the Wabasca River. With a population of 3,300 split between MD residents and Bigstone Cree Nation members the area is rich with culture and small-town leisurely charm. The area covered in this plan falls within Bigstone Cree Nation's traditional lands.

The communities of Wabasca-Desmarais and Bigstone Cree Nation are a part of the Wabasca sub-watershed which in turn is a part of the Mighty Peace watershed. The Wabasca River is the largest tributary within the sub-watershed. It is considered to be relatively healthy due to its good water quality and strong fish populations (SWR 2015). However, it is important to note that there has been a decrease in water quantity recorded since the 2000s and in addition, over the same time period there has been a large increase in the number of steam assisted gravity drainage (SAGD) projects (SWR 2015). It is projected that there will be increasing pressure on both ground water and surface water resources within the sub-watershed with the development of additional in situ oil sands and heavy oil deposits in the area (SWR 2015). Other waterbodies identified within in this plan include North and South Wabasca Lake, Sandy Lake, Calling Lake and a number of other smaller lakes, rivers and creeks.

**Figure 1: a) Location of the Slave River Watershed within Canada. b) The Peace River Watershed within the Slave River Watershed. c) The sub-watersheds that make up the Peace River Watershed within Alberta.**

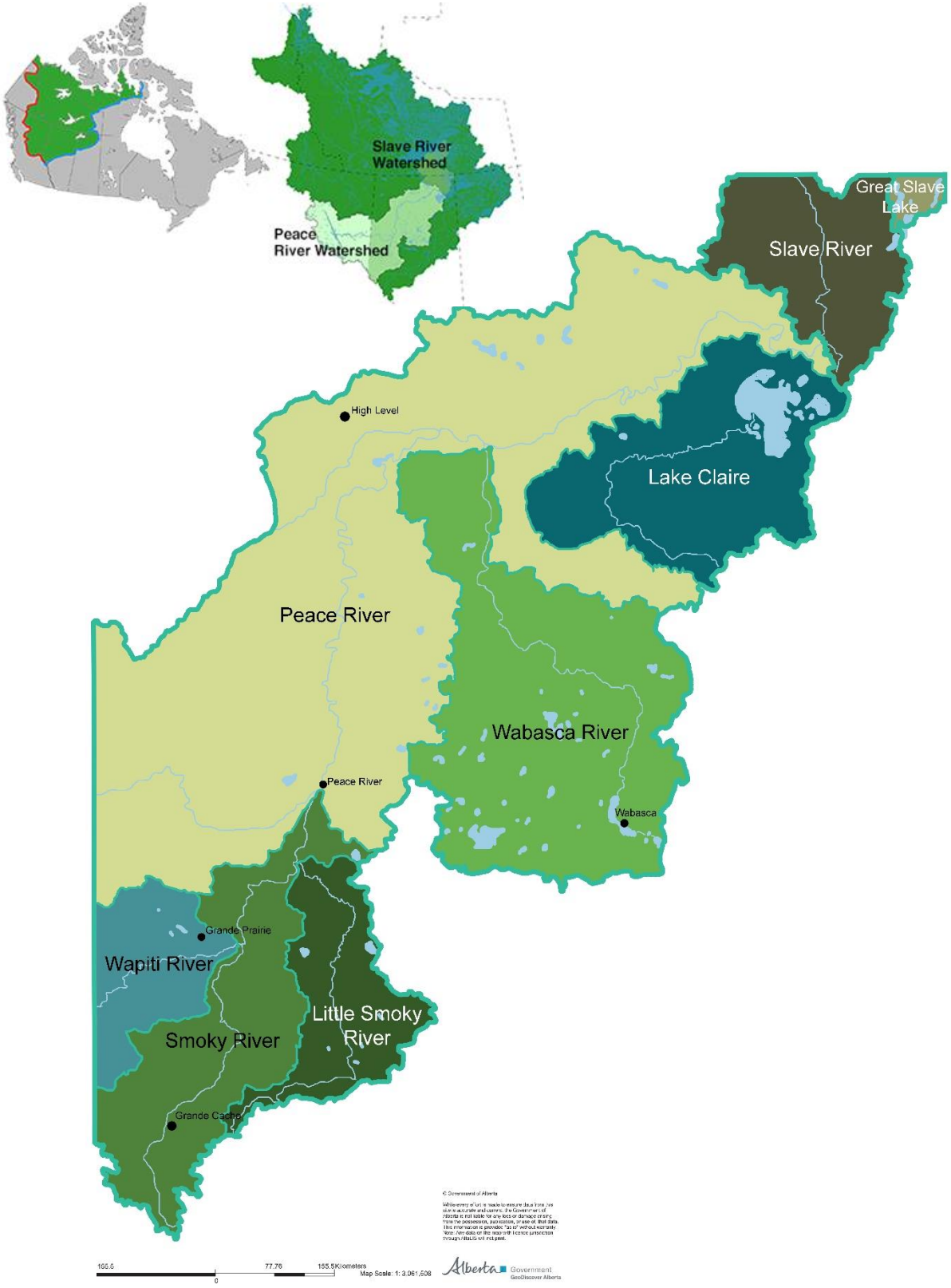


**Figure 2: Wabasca River Sub-Basin**

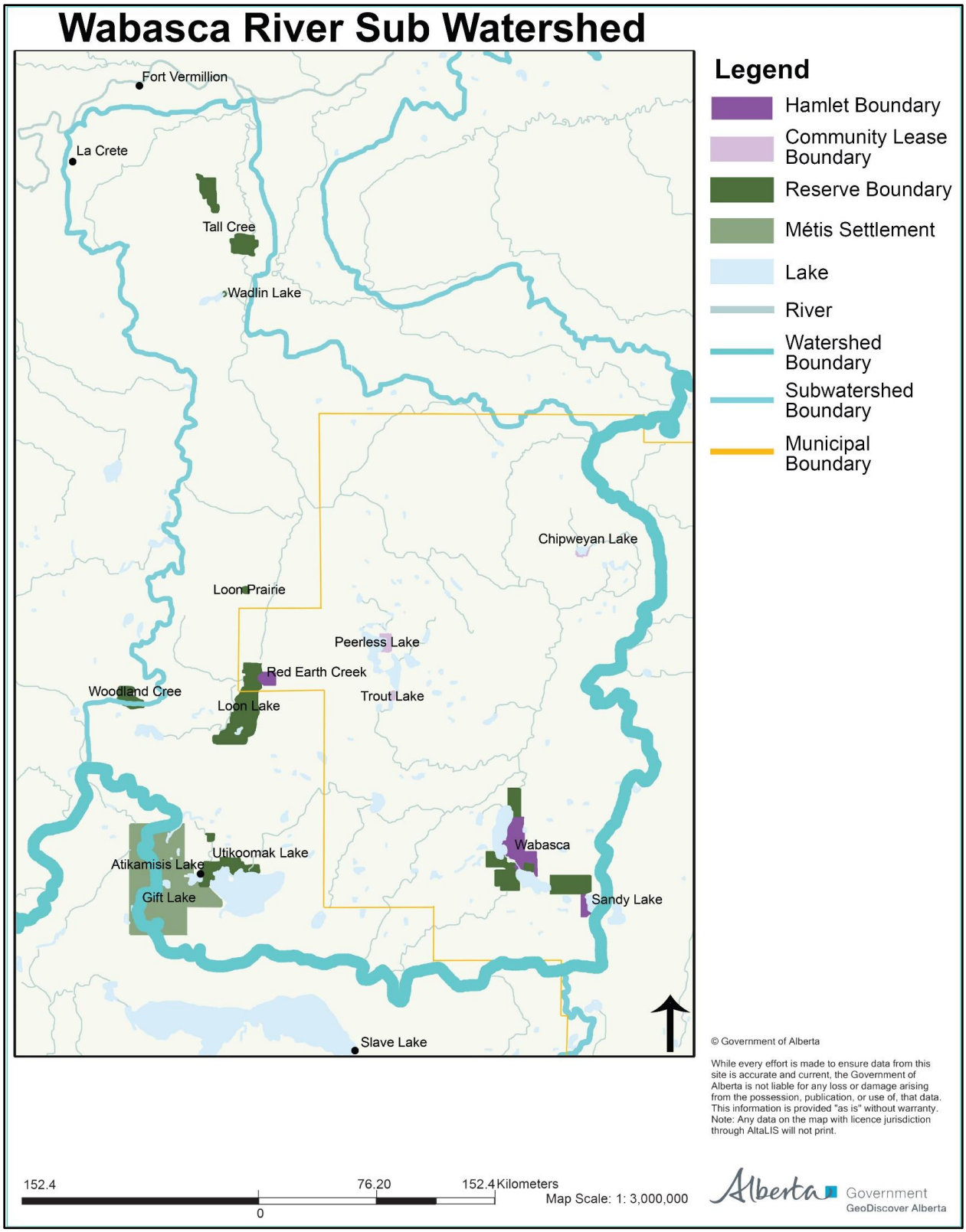
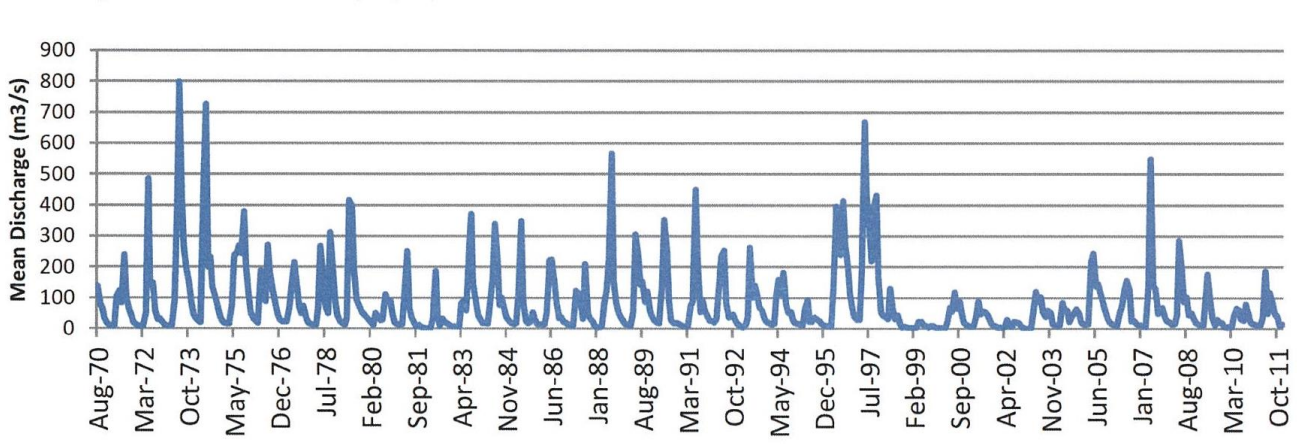


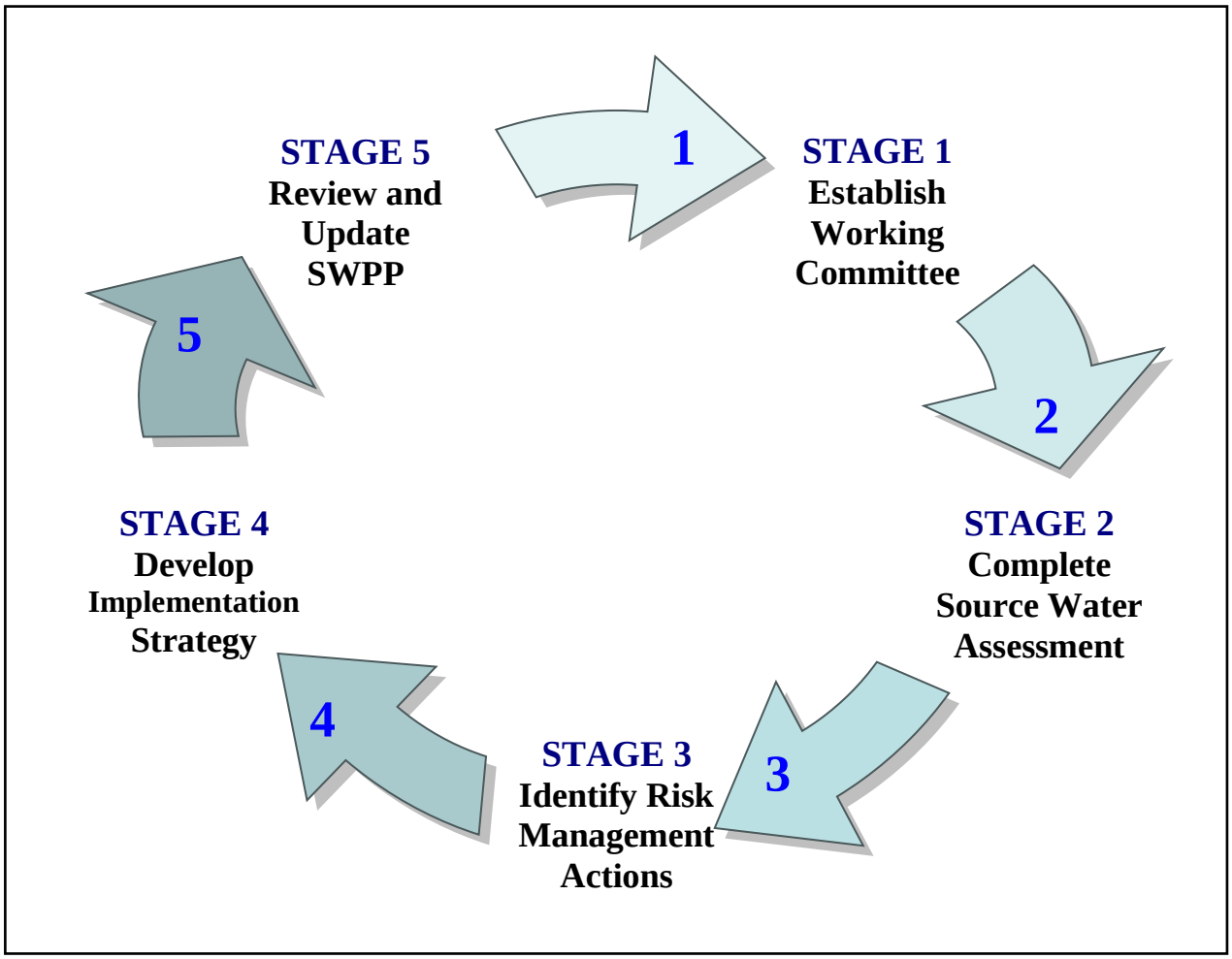
**Figure 3: Historical Discharge in the Wabasca River** (SWR, 2015)




Due to concerns about the water in the area, Bigstone Cree Nation, in partnership with First Nations Technical Services Advisory Group (TSAG), undertook the creation of a community source water protection plan in the fall of 2015. In the spring of 2016 the M.D. of Opportunity joined the project to create the Wabasca Watershed Source Water Protection Plan.

A five stage process was used to guide the creation this Source Water Protection Plan (see Figure 4).

**Figure 4: Source Water Protection Plan**




This SWPP recognizes the importance of taking a watershed scale approach to the protection of drinking water supplies. Although the Working Committee was aware of the larger watershed scale context for this plan, this document focuses on land and water areas that are in close proximity to the communities of Bigstone Cree Nation and Wabasca/Desmarais.

# THE PLAN

**STAGE 1: Establish a Working Committee**

This source water protection plan was initially undertaken by Bigstone Cree Nation in partnership with First Nations Technical Services Advisory Group (TSAG). As the plan progressed, the working committee felt strongly that participation from the neighboring community of Wabasca/Desmarais would be valuable. The resulting working committee consisted made up of people with technical and cultural knowledge of water from both communities. Bigstone Cree Nation members were a combination of appointed staff and volunteers from multiple band departments, with the exception of the Elders. Similarly, the working group participants from Wabasca/Desmarais were individuals employed by the M.D. of Opportunity. The Source Water Protection Plan (SWPP) Working Committee (the Working Committee) led the development of this source water protection plan. Table 1 provides contact information for the Working Committee members.

**Table 1: Bigstone Cree Nation source water protection plan working committee**

| Name | Role in Community | Affiliation | Contact Information | Membership Start/End Date |
|---|---|---|---|---|
| Alma Alook | Community Health Representative | Health Centre | E: alma.alook@bigstonehealth.ca<br>PW: 780-891-2000<br>PC: 780-891-0450 | Start: 20150915<br>End: |
| Clement Auger | Elder | | P: 780-773-0091 | Start: 20150915<br>End: |
| Clifford Auger | GIS Coordinator | Government Industry Relations | E: Clifford.auger@bigstone.ca<br>P: 780-891-0458 | Start: 20150915<br>End: 20151126 |
| August Beaver | Elder | | C: 780-773-1559<br>H: 780-891-4096 | Start: 20160420<br>End: |
| Trevor Bigstone | Emergency Services | Public Works | E: trevor.bigstone@bigstone.ca<br>P: 780-891-2422 | Start: 20160420<br>End: |
| Gilmen Cardinal | Environment & Lands Technician | Lands, Environment and Estates | E: Gilmen.cardinal@bigstone.ca<br>P: 780-773-7480 | Start: 20150915<br>End: |
| Simon Cardinal | Manager of Public Services | M.D. Opportunity | E: simon@mdopportunity.ab.ca<br>P: 780-891-8192 | Start: 20160511<br>End: |
| Donald Gladue | Supervisor Public works | Public Works | E: gladuedonald@yahoo.ca | Start: 20150915<br>End: |
| Shannon Gladue | Previously: BCN Water Treatment Plant Operator<br>Currently: TSAG Circuit Rider | TSAG | E: sgladue@tsag.net<br>P: 780-273-0321 | Start: 20150915<br>End: |
| Laura Machial | Community Liaison/ Biologist | TSAG | E: lmachial@tsag.net<br>P: 780-483-8601 | Start: 20150915<br>End: |
| Rosey | Environmental | TSAG | E: rradmanovich@tsag.net | Start: 20150915 |

| | | | | |
|---|---|---|---|---|
| Radmanovich | Liaison | | P:780-483-8601 | End: |
| Troy Stuart | Lands Officer | Lands and Estates | E: troy.stuart@bigstone.ca<br>P: 780-891-3836 | Start: 20150915<br>End: |
| Shawna Thompson | Environment Regulatory Affairs | Government Industry Relations | E: Shawna.thompson@bigstone.ca<br>P: 780-891-3836 | Start: 20160511<br>End: |
| Cindi Taron | Manager of Transportation | M.D. Opportunity | E: cindi@mdopportunity.ab.ca<br>P: 780-891-8719 | Start: 20160511<br>End: |
| Chad Tullis | Manager of Lands, Planning & Development | M.D. Opportunity | E: chad@mdopportunity.ab.ca<br>P: 780-319-9676 | Start: 20160511<br>End: |
| Albert Yellowknee | Elder | | P: 780-891-8029 | Start: 20150915<br>End: |

During the development of this SWPP the Working Committee held a total of 14 meetings to introduce the project, work through the guide and template, visit specific parts of the community, and complete the plan. The Working Committee's recommendations were incorporated into this SWPP and presented to the community for comment and discussion on November 22, 2016 in the context of a public Open House meeting. A summary of the Working Committee meetings is presented below in Table 2.

**Table 2: Summary of Working Committee Meetings**

| Date YYYY/MM/DD | Location | Purpose |
|---|---|---|
| 2015/09/15 | Bigstone Cree Nation Band Office | Community information session and formation of the working committee |
| 2015/11/04 | Bigstone Cree Nation Band Office | Tables 3 & 4 |
| 2015/11/18 | Public Works Building | Table 8 |
| 2015/12/09-2015/12/10 | Bigstone Cree Nation Band Office | Table 9 |
| 2016/01/13-2016/01/14 | Bigstone Cree Nation Band Office | Table 9 & 10 |
| 2016/04/20-2016/04/21 | Bigstone Cree Nation Band Office | Table 10 & planning youth outreach event on water conservation |
| 2016/05/11-2016/05/12 | Bigstone Cree Nation Band Office | Table 10. M.D. of Opportunity were able to attend the meeting |
| 2016/06/15-2016/06/16 | Bigstone Cree Nation Band Office | Complete table 10 and fill out missing information from past meetings. Plan open house |

The community members were notified of, and invited to, an open house to comment on a draft of this SWPP. The open house was held at Eagle Point Golf Course on November 22, 2016. Feedback from the open house was considered for incorporation into the final draft of this SWPP.

**STAGE 2: Source Water Risk Assessment**

Stage 2 of the SWPP provides an overview of the on and off reserve water systems, drinking water service area, source protection planning area, land uses and potential water contaminants, human health risks and management actions to reduce these risks.

**Sub-stage 2.1: Delineation of Water Sources and Systems**

This water system assessment was completed between November 4, 2015 and November 18, 2015. The area assessed includes the communities of Bigstone Cree Nation and Wabasca – Desmarais as well as the surrounding area. The communities are located on the narrows between North and South Wabasca Lakes. The on-reserve population of Bigstone Cree Nation is 1844 people and the population of Wabasca – Desmarais is 1456. Nearly all of the communities' populations are served by either Bigstone Cree Nation's or the M.D. of Opportunity's water treatment plant. The sources of water for these water systems are South Wabasca Lake, North Wabasca Lake and Calling Lake. A map of the source water protection area, as determined by the Working Committee, is attached to this plan on page 37 & 38. The map identifies all watercourses and their source, flow direction, community water system infrastructure, location of private wells, water intake location, outfall locations, wellhead location, water treatment plant, pump stations/chlorination stations, wastewater treatment plant, sewage lagoon, landfill, and other main land uses (including agriculture, fuel storage, housing, industry, commercial uses).

**Sub-stage 2.2: Description of Drinking Water Systems**

The Working Committee has compiled detailed source water information shown in Table 3A and Table 3B. This assessment provides an inventory of the source water information for the surface water source.

**Table 3.1: Surface Water Source Information**

| Surface Water Sources | | | | |
|---|---|---|---|---|
| **Assessment Questions** | **Source No. 1** | **Source No. 2** | **Source No. 3** | **Source No. 4** |
| Location (local reference) | 309 Peeweemow Drive Bigstone I.R 166C | North Wabasca Lake Alook Drive (Library) Water Treatment Plant & Raw Water Reservoir | Neewatin Drive Raw Water Supply Pumping Station for the North Wabasca Water Treatment Plant | South Wabasca Water Treatment Plant and Raw Water Pumping Station and Reservoir (Stony Point Road) |
| Name of source water (lake, stream) | Wabasca River | North Wabasca Lake | North Wabasca Lake | South Wabasca Lake |
| Intake location | In the river between lots 304 & 360 Peeweemow Drive | | NW-32-80-25-4 | NW-14-25-80-4 |
| Backup intake available? | No but backup pump is | N/A | Yes | Yes |
| Frequency of intake inspection? | Never inspected | N/A | Annual | Annual |
| Intake screened? | Yes | N/A | Yes | Yes |

| | | | | |
|---|---|---|---|---|
| Population served | Approximately 200 | 1,500 > 15,000 as per approval | N/A | 1,500 > 15,000 as per approval |
| Date of construction | Original Plant built 1990 (carbon filter), New treatment unit in 1999 (flocculent clarifier) | 1987 with microfiltration upgrades in 2007 | 2015 | 1984 with microfiltration upgrades in 2007 |
| Is water treated? | Yes | Yes | N/A | Yes |
| Treatment type | Conventional Treatment | Microfiltration | N/A | Microfiltration |
| Backup source available | No | Yes | N/A | Yes |
| Raw water monitored? | Yes (Grab Samples) Turbidity, Apparent Color, pH, Total Iron & Total Manganese | Yes metered | N/A | Yes metered |
| Yes - Frequency, parameters? | Daily (when plant is running) weekly for iron & manganese | Continuous | No | Continuous |
| Intake protection zone in place? | No | No | N/A | No |

**Table 3.2a: On-Reserve Population Size, Number of Houses and Type of Water Distribution**

| Reserve | Total Population | Total # Houses | Houses on Main Line | Houses w/ Cisterns |
|---|---|---|---|---|
| **Reserve A** MD water treatment plant Source: South Wabasca Lake | 472 | 197 | 166 | 31 |
| **Reserve B** MD water treatment plant Source: South Wabasca Lake | 244 | 53 | 0 | 53 |
| **Reserve C** BCN water treatment plant Source: North Wabasca Lake | 122 | 62 | 27 | 35 |
| **Reserve D** MD water treatment plant | 871 | 250 | 174 | 76 |

| | | | | |
|---|---|---|---|---|
| Source: South Wabasca Lake | | | | |
| **Reserve 166 Sandy Lake** MD water treatment plant Source: South Wabasca Lake | 135 | 131 | 0 | 52 |
| **Calling Lake/ Jean Baptist Reserve** Calling Lake water treatment plant Source: Calling Lake | **TBD** | 79 | 0 | 79 |
| **Total** | **= 1844** | **= 693** | **= 367** | **= 326** |

**Table 3.2b: Off-Reserve Population Size, Number of Houses and Type of Water Distribution**

| Hamlet | Total Population | Total # Houses | Houses on Main Line | Houses w/ Cisterns |
|---|---|---|---|---|
| **Wabasca** MD water treatment plant Source: South Wabasca Lake | 1412 (2015 census) | 642 | 638 | 4 |
| **Total** | **= 1412** | **= 642** | **= 367** | **= 326** |

**Sub-stage 2.3: Inventory and Description of Potential Contamination Sources**

The Working Committee, in consultation with the community, has provided an inventory of all on-reserve land uses and activities with the potential to degrade water quality. This inventory is listed below in Table 4A.

The Working Committee, in consultation with the community, has also provided an inventory of known off-reserve land uses and activities with the potential to degrade water quality. This inventory is listed below in Table 4B. It should be noted that other potential risks may exist.

Additional information in Table 4 includes: hazard type, contaminant source, owner, distance to source water, contamination of concern, and transport mechanism.

**Table 4: Potential contaminants affecting Bigstone Cree Nations' source water**

| Potential Contaminant Source | Owner/ Contact | Location | Distance to Source (m) | Contaminants of Concern | Transport Mechanism |
|---|---|---|---|---|---|
| 1. Decreasing water levels | N/A | • The water levels in all lakes and rivers are rapidly decreasing<br>• Including: North Wabasca, Sandy Lake river, Pelican river, Sandy lakes (2), South Wabasca, Calling Lake (though less so) | • Within source | • Blue green algae<br>• All contaminants present become more concentrated as water levels decline | • Algae – wind and water<br>• Contaminants - water |
| 2. Open sewage discharge/ shoot outs/outhouses by lake | Bigstone Cree Nation, individual residents, private home owners | • All over, but most shootouts are in reserve D along main road, Sandy Lake & Cee-too road. In addition, within the hamlet of Calling Lake there are old outhouses<br>• Contact Public Works & Health Centre for specific houses with shoot-outs | • Discharging directly into waterbodies | • Effluent; nutrients, pharmaceuticals, bacteria, increased turbidity | • Leaching<br>• Direct discharge<br>• Overland flow |
| 3. Bigstone CN sewage lagoon 166B | Bigstone Cree Nation | Between reserve D and B | • 2 km to North Wabasca Lake | • Effluent; nutrients, pharmaceuticals, bacteria, increased turbidity | • Direct discharge via wastewater effluent release |
| 4. Bigstone North end/reserve C sewage lagoon | Bigstone Cree Nation | Reserve C north of North Wabasca Lake | • Direct discharge into Wabasca River, ends up in North Wabasca Lake | • Effluent; nutrients, pharmaceuticals, bacteria, increased turbidity | • Direct discharge via wastewater effluent release<br>• Overland flow/flooding because under capacity<br>• Leaching |
| 5. Cistern/water tank contamination | Bigstone Cree Nation | • Contact Health Centre for specific cisterns with concerns | • N/A | • Biohazards (dead animals, bacterial etc…) | • Direct into house |
| 6. Logging | • Various | • Marten hills<br>• Pelican hills<br>• Wabasca river | • Buffer:<br>- on-reserve = 200m<br>- off-reserve = 50 m, but may be | • Increased turbidity<br>• Increase nutrients (spray program)<br>• Pesticides (Triclopyr) & herbicides (Garlon XRT) | • Erosion<br>• Overland flow |

| Potential Contaminant Source | Owner/ Contact | Location | Distance to Source (m) | Contaminants of Concern | Transport Mechanism |
|---|---|---|---|---|---|
| | | | increased | | |
| 7. Change in water flow at location of sewage lagoon outflow | N/A | • Change in direction of flow in Wabasca River north of North Wabasca Lake at wastewater lagoon discharge point. Water treatment plant intake close by | • Within source | • Effluent; nutrients, pharmaceuticals, bacteria, increased turbidity | |
| 8. Bigstone Cree Nation's transfer station | • Bigstone Cree Nation | • Reserve C, north end of reserve | • 2-3 km from lake, in a muskeg area | • PHC, VOC, PAH, PCB, metals, pesticides, SAR, sodium, methane, nitrates, biohazards | • Leaching into groundwater<br>• Overland flow during rain events |
| 9. Bigstone Cree Nation's landfill | • Bigstone Cree Nation | • Reserve D | • < 1 km lake, clay lined – built ~1992 | • PHC, VOC, PAH, PCB, metals, pesticides, SAR, sodium, methane, nitrates, biohazards | • Leaching into groundwater<br>• Overland flow during rain events |
| 10. Agriculture | • Various | • Reserve D highway 754<br>• Reserve A along South Wabasca lake<br>• Horses and cows all over<br>• Sandy Lake (Taron's ranch) | • Cattlemans is right by the creek<br>• Cows and horses roam freely | • Manure (bacteria)<br>• Nutrients | • Leaching<br>• Overland flow<br>• Directly into water when cows and horses allowed to entire water |
| 11. Beavers | N/A | • All over | • Within source | • Mobilizes contaminants in newly flooded areas | • Direct |
| 12. Local business/ facility clean-up | • Various | • See Appendix III for a list of businesses and locations | • Varies. Some within 25 m | • Metals, PHC, VOC, PAH, drilling wastes, salinity, EC, barite, barium, elemental sulphur, methane | • Leaching<br>• Overland flow |
| 13. Industry withdrawals resulting in muskeg drying | • Various | • Entire region | • Within source | • Dropping water levels results in concentration of contaminants and nutrients that are present | • Direct |

| Potential Contaminant Source | Owner/ Contact | Location | Distance to Source (m) | Contaminants of Concern | Transport Mechanism |
|---|---|---|---|---|---|
| 14. Industry related ground disturbance | • Various | • Entire region | • Closest = 200 m (provincial reg.)<br>• Actual distances vary | • Drilling wastes | • Erosion<br>• Overland flow |
| 15. Oil and gas pipelines | • Various | • Entire region | • Varies - some go under/cross lakes (e.g. in Grassy Narrows) | • Natural gas and oil pipeline related contaminants. E.g.: metals, PHC, VOC, PAH | • Leaching from leaking pipes - slow leaks, big leaks, blowouts |
| 16. Tank farms | • Various | • One in north end/reserve C for last 30 years (rusted out)<br>• Rusted out tank/contaminated soil at Gordon's gas station, reserve D<br>• Eugene Kotash's tank<br>• Crescent Point tank farm, reserve 166<br>• Most located off-reserve on oil field (Winhouse, North East South and West Brintnell, Liege, Seleski, Husky (Houle plant), Cenovus). | • Varies | • Metals, PHC, VOC, PAH, salinity, EC, barite, barium, elemental sulphur, methane | • Leaching<br>• Overland flow |
| 17. Water truck hose contamination | • Bigstone Cree Nation | • Entire region | • Not applicable | • Biohazards | • Directly deposited into cisterns via water hose<br>*Weekly samples usually clean |
| 18. Illegal dumping | • Various | • Entire region | • Varies | • PHC, VOC, PAH, PCB, metals, pesticides, SAR, sodium, methane, nitrates, biohazards | • Leaching<br>• Overland flow |

| Potential Contaminant Source | Owner/ Contact | Location | Distance to Source (m) | Contaminants of Concern | Transport Mechanism |
|---|---|---|---|---|---|
| 19. Log jam on Willow river | N/A | • Near reserve D bridge, downstream towards lake | • Direct | • Increased turbidity - due to flooding washing out roads<br>• Coliforms – due to flooding causing water tank backups | • Directly into lakes from flooding<br>• Overland flow into cisterns |
| 20. Improperly installed culverts | • MD of Opportunity | • Mistassniy road | • Direct | • Increased turbidity due to flooding resulting from culverts being too small to deal w/ spring runoff | • Direct deposit |
| 21. Winter fishing village on Wabasca lake | • MD of Opportunity | • Directly on the lake | • On the lake | • Household garbage, PHC, VOC, PAH, PCB, metals, coolant, burnt tires, propane, cigarette butts | • Direct deposit when ice melts |
| 22. Skidoo/ATV | • Various | • All over – ATVs more a concern than skidoos due to mud bogging | • Right beside, in lake/creeks | • Damage to creek crossings (erosion)<br>• Fuel drained into lakes/rivers (PHC, BTEX, PAH, lead, MTBE) | • Overland flow<br>• Direct deposit |
| 23. Golf course | • MD of Opportunity | • By North Wabasca Lake close to the MD dump | • 20-30 m from the lake (closest hole) | • Fertilizers, pesticides | • Overland flow |
| 24. Development close to lake | • MD of Opportunity<br>• Industry | • All over, close to North Wabasca Lake<br>• Golf course<br>• Development of rodeo grounds & arbor by lake, near golf course<br>• Large, existing homes on lake, off-reserve | • Golf course is on lake<br>• Proposed rodeo grounds about 100 m from Laurie lake<br>• Large homes on lake | • Effluent<br>• Household garbage<br>• Lack of culverts causing decreased/ unnatural flow | • Overland flow<br>• Direct deposit |
| 25. Industrial withdrawal | • CNRL<br>• Husky | • CNRL<br>• Husky on c-road | • Directly from tributaries that | • Decreased water flow/levels, resulting | • Direct deposit |

| Potential Contaminant Source | Owner/ Contact | Location | Distance to Source (m) | Contaminants of Concern | Transport Mechanism |
|---|---|---|---|---|---|
| permits for dust control | | | flow into Wabasca River<br>• Potentially taken from dugouts now? | algae blooms, concentration of contaminants, etc. | |
| 26. Road dust | N/A | • All over | • Varies | • Increased turbidity, metals and other contaminants bound to particles | • Wind<br>• Airborne |
| 27. SAGD | • CNRL<br>• Cenovus (existing & proposed)<br>• Husky proposed project | • Husky = muskeg area south of south Wabasca Lake<br>• CNRL, Cenovus = in muskeg area by Horsetail | • Direct – in muskeg areas | • SAGD fluid chemicals<br>• Lowering water levels<br>• PAHs | • Leaching<br>• Directly deposit into groundwater and muskeg<br>• Contributes to water level declines, muskeg drying |
| 28. Calcium/oil on roads for dust control | • MD of Opportunity | • On all MD operated roads | • Directly next to lake | • Calcium chloride and other contaminants found in road oil | • Leaching and overland flow |
| 29. Stagnant creeks | N/A | • Various areas within and around community of BCN & MD | • Within source | | |
| 30. Old dumps | • BCN<br>• MD of Opportunity | • Various | • Various | • PHC, VOC, PAH, PCB, metals, pesticides, SAR, sodium, methane, nitrates | • Leaching<br>• Overland flow |
| 31. Original Wabasca car wash/ Big rock car wash | • MD of Opportunity | • Wabasca North, by Big Rock | • Within source | • | • |
| 32. Residential school dump | • MD of Opportunity | • Under the police station | • | • PHC, VOC, PAH, PCB, metals, pesticides, SAR, sodium, methane, nitrates | • Leaching |

| Potential Contaminant Source | Owner/ Contact | Location | Distance to Source (m) | Contaminants of Concern | Transport Mechanism |
|---|---|---|---|---|---|
| 33. Fracking | • N/A | • Not currently happening, but is being discussed and may happen in the future | • N/A | • Methane | • N/A |
| 34. Wabasca's landfill | • MD of Opportunity/ Wabasca-Desmarais | • By North Wabasca Lake heading toward reserve C | • Less than 1.5 km from North Wabasca Lake<br>• Drainage ditch located at landfill | • PHC, VOC, PAH, PCB, metals, pesticides, SAR, sodium, methane, nitrates, biohazards, asbestos | • Leaching<br>• Wind<br>• Open pit design as a result water needs to be pumped out in the summer |
| 35. Old MD of Opportunity lagoon | • MD of Opportunity | • On Neewatim road (stinky stretch) | • 500 m to North Wabasca Lake | • Effluent; nutrients, pharmaceuticals, bacteria, increased turbidity | • Leaching |

**Sub-stage 2.4: Source Water Risk Assessment**
The potential risk associated with each contamination source in Table 4 were determined by multiplying the **Likelihood of Occurrence** by the **Impact of Occurrence**. Three steps were followed by the Working Committee to complete the risk assessment.

**Step 1 Likelihood:** The Working Committee used Table 5 showing the Likelihood of Occurrence and associated value (1-5).

**Table 5: Likelihood of Occurrence**

| Likelihood | Value |
|---|---|
| **Most unlikely**<br>Extremely small chance of happening in the next 4 to 5 years | 1 |
| **Unlikely**<br>Is possible to occur in the next 4 to 5 years | 2 |
| **Likely**<br>Evenly split between likely and not likely to happen in the next 4 to 5 years | 3 |
| **Probable**<br>Is expected to happen in the next 4 to 5 years | 4 |
| **Almost certain**<br>Confident this will happen at least once in the next 4 to 5 years | 5 |

**Step 2 Impact:** The Working committee used Table 6 showing the Impact of Occurrence and associated value (1-5).

**Table 6: Impact of Occurrence**

| Impact | Value |
|---|---|
| **Insignificant**<br>No health risk; water system interruption less than 8 hours | 1 |
| **Minor**<br>Short term or localized non-compliance, non-health related (e.g., aesthetic) | 2 |
| **Moderate**<br>Widespread aesthetic issues or long term non-compliance, not health related | 3 |
| **Severe**<br>Actual illness or potential short-medium term health effects (human or ecosystem) | 4 |
| **Catastrophic**<br>Actual illness or potential long term health effects (human or ecosystem) | 5 |

**Step 3 Risk Assessment Score:** The Working Committee combined the Likelihood of Occurrence (Table 5) and the Impact of Occurrence (Table 6) to produce a Risk Assessment Score Analysis Matrix as shown in Table 7.

**Table 7: Risk Assessment Score Analysis Matrix**

| Likelihood of Occurrence | Impact of Occurrence | | | | |
|---|---|---|---|---|---|
| | **Insignificant** | **Minor** | **Moderate** | **Severe** | **Catastrophic** |
| **Most Unlikely** (in next 4 -5 years) | 1 | 2 | 3 | 4 | 5 |
| **Unlikely** (in next 4 -5 years) | 2 | 4 | 6 | 8 | 10 |
| **Likely** (in next 4 -5 years) | 3 | 6 | 9 | 12 | 15 |
| **Probable** (in next 4 -5 years) | 4 | 8 | 12 | 16 | 20 |
| **Almost Certain** (in next 4 -5 years) | 5 | 10 | 15 | 20 | 25 |

The Working Committee used the 25 point ranking system in Table 7 to determine the numerical value above which the risk scores should be interpreted as "high risk" and would trigger the need for risk mitigation actions.

**Sub-stage 2.5: Risk Ranking**

The Working Committee applied the risk analysis matrix (Table 7) to rank (or prioritize) each of the risks associated with contamination sources previously identified in Table 4. The ranking of those risks is indicated in Table 8 from highest to lowest. Priority for action will be decided based on ranked levels of risk and availability of resources (financial/time) (Table 8).

**Table 8: Source Water Risk Assessment Results**

| Potential Contaminant Source | Likelihood of Occurrence | Impact of Occurrence | Risk Assessment Score |
|---|---|---|---|
| 1. Open sewage discharge/ shoot outs | 5 | 5 | 25 |
| 2. Cistern/water tank contamination | 5 | 5 | 25 |
| 3. Industry withdrawals resulting in muskeg drying | 5 | 5 | 25 |
| 4. Industry related ground disturbance | 5 | 5 | 25 |
| 5. Oil & gas pipelines (leaks or spills) | 5 | 5 | 25 |
| 6. Decreasing water levels | 5 | 5 | 25 |
| 7. Industrial withdrawal permits for dust control | 5 | 5 | 25 |
| 8. Calcium used on roads for dust control | 5 | 5 | 25 |
| 9. Stagnant creeks | 5 | 5 | 25 |
| 10. Log jam on Willow river | 5 | 5 | 25 |
| 11. Logging | 5 | 5 | 25 |

| Potential Contaminant Source | Likelihood of Occurrence | Impact of Occurrence | Risk Assessment Score |
|---|---|---|---|
| 12. Winter fishing village on Wabasca lake | 5 | 4 | 20 |
| 13. Golf course | 5 | 4 | 20 |
| 14. Agriculture | 5 | 4 | 20 |
| 15. Old dumps | 5 | 4 | 20 |
| 16. Skidoo/ATV rallies | 5 | 3.5 | 17.5 |
| 17. Water truck hose contamination | 4 | 4 | 16 |
| 18. Illegal dumping | 5 | 3 | 15 |
| 19. SAGD | 3 | 5 | 15 |
| 20. Original Wabasca car wash/Big rock car wash | 5 | 3 | 15 |
| 21. Bigstone Cree Nation's landfill (reserve D) | 3 | 4 | 12 |
| 22. Development close to lake | 4 | 3 | 12 |
| 23. Improperly installed culverts | 4 | 3 | 12 |
| 24. Bigstone north end/Reserve C lagoon | 2 | 5 | 10 |
| 25. Road dust | 5 | 2 | 10 |
| 26. Bigstone Cree Nation's transfer station | 3 | 3 | 9 |
| 27. Local business/facility clean-up | 3 | 3 | 9 |
| 28. Bigstone Cree Nation sewage lagoon 166B | 2 | 4 | 8 |
| 29. Old MD of Opportunity lagoon | 2 | 4 | 8 |
| 30. Tank farms | 1 | 5 | 5 |
| 31. Change in water flow at the location of the lagoon outflow | 2 | 2 | 4 |
| 32. Beavers | 2 | 2 | 4 |
| 33. Library residential school lagoon | 1 | 2 | 2 |
| 34. Wabasca's landfill | | | |

**Fracking was not assigned a risk ranking because it is not currently occurring in the area. However, if fracking is to happen it should immediately be fully incorporated into the plan.

**STAGE 3: Identify Risk Management Actions**

Upon completion of the on-reserve source water assessment (Stage 2), the Working Committee proceeded to identify management actions to address identified potential risks. On board conservation management action purposed for the M.D. of Opportunity is to designate all wetlands as conservation areas.

In response to the risk ranking (Table 8), the Working Committee has identified on-reserve management actions for each of the identified risks with the goal to eliminate, or at least reduce, these risks. Table 9A provides a list of existing measures and proposed measures as identified by the Working Committee in consultation with BCN membership and Wabasca community members to help reduce risk levels.

**Table 9: Risk Management Actions**

| Num. | Risk Ranking High – Low | Potential Risk to Source Water | Existing Management Actions | Proposed Management Actions |
|---|---|---|---|---|
| 1. | 25 | Open sewage discharge/shoot outs/outhouses by lake | - Identifying who has shoot-outs<br>- Shoot-outs are currently grandfathered in but are no longer being installed<br>- Guidelines in place to make sure only certified individuals are installing PSDS | a) Develop community plan to de-commission and move away from shoot-outs to collection system/low pressure systems<br>b) Follow best practices for PSDS installation (e.g. certified installers, inspection after installation)<br>c) Develop an education program about homeowner responsibility and health risks regarding shoot outs. Include preventative measures (e.g. water conservation)<br>d) Establish sub-committee to identify and deal with shoot out issues<br>e) Develop an enforcement plan<br>f) Establish policy with Chief & Council that if people are not paying for vac truck service for proper waste disposal, Public Works will not deliver water<br>g) Establish system for record keeping for frequency of vac trucks visits. Flag homes with shoot outs to ensure they are visited |
| 2. | 25 | Cistern/water tank contamination | - Weekly routine water sampling of the water treatment plant, end of the line and water trucks<br>- Semi-annual testing of all cisterns (goal is once/yr., more realistically once/ 5 yr.) | a) Build distribution lines<br>b) Establish a cistern cleaning crew<br>c) Create an education program including one-on-one training materials, school programs on cisterns/ water conservation, newsletter article<br>d) Organize meeting with health centre, Public Works, and housing to discuss cisterns, solutions, and to collaborate to seek funding |

| Num. | Risk Ranking High – Low | Potential Risk to Source Water | Existing Management Actions | Proposed Management Actions |
|---|---|---|---|---|
| | | | - People can request to have their cistern tested<br>- PW has been shock chlorinating cisterns at people's request. Not an official program | e) Enforcement of homeowner responsibilities, have homeowners go through housing training course before signing and moving in |
| 3. | 25 | Industry water withdrawals resulting in muskeg drying | - Off-reserve AB energy has permits and regulatory process, no process on reserve | a) Establish permit process for water withdrawals on-reserve<br>b) Increase enforcement process (off-reserve)<br>c) Develop a stronger partnership between the Lands dept. and GIR to coordinate processes on and off-reserve |
| 4. | 25 | Industry related ground disturbance | - 50 m buffer from the high water mark around lakes and rivers (on-reserve)<br>- Off-reserve – minimum buffer set by AER (45 m), but municipalities, WPACs can set greater buffer sizes (up to 200m) | a) Establish a 100 m buffer from the high water mark on and off-reserve<br>b) Improve communication with industry about processes – increase honesty and transparency |
| 5. | 25 | Oil & gas pipelines (leaks or spills) | - Regulated by IOGC, process in place<br>- Husky and Alta Gas give Nation their ERP every year for their gas plants – contains evacuation plan<br>- Off-reserve – WCSS (spill response, closest is in Slave Lake) handles spill containment and clean up<br>- Nation receives e-mails when small spills happen<br>- Have on-site environmental monitors (on-reserve) | a) Obtain the pipeline leak or spill process/ERP from IOGC/TransCanada<br>b) Improve communication and flow of information between Nation and pipeline companies<br>c) Large-scale spill emergency response equipment closer than Slave Lake |

| Num. | Risk Ranking High – Low | Potential Risk to Source Water | Existing Management Actions | Proposed Management Actions |
|---|---|---|---|---|
| 6. | 25 | Decreasing water levels | - Public works is very aware of water leaks and fix them in a timely manner<br>- M.D. does not flush hydrants during low water years | a) Designate all wetlands as conservation areas<br>b) Develop an education program on water conservation and climate change for all ages<br>c) Increase use of rain barrels<br>d) Install water meters on homes for leak detection<br>e) Communication plan with golf course and other MD projects around water conservation<br>f) Environmental monitoring program<br>g) Develop education information for fire department about water conservation |
| 7. | 25 | Industrial withdrawal permits of water for dust control | - Alberta Energy Regulator/MD has a permitting system off reserve | a) BCN develop a permit process for water withdrawals (MD currently has a permitting process in place as well as a rate charge. This could be used as a template for BCN)<br>b) Enforcement of process for withdrawals |
| 8. | 25 | Calcium used on roads for dust control | - WHIMS sheets<br>- Record keeping of application timing and quantity | a) Research how much can be used without negative impacts on lakes. Follow guidelines |
| 9. | 25 | Stagnant creek | - Engineering report on one culvert crossing on the creek (approx. year and a half) | a) Inspect creek looking for causes, including beaver dams, culverts and crossings. Fix issues as needed<br>b) Monitor fish populations |
| 10. | 25 | Log jam on Willow River | - Public works clears out culverts<br>- Public works tried to clear it once but it was too muddy | a) Monitor water levels<br>b) Research best practises for removing log jam<br>c) Get water flowing following best practises (e.g. remove log jam, stream diversion)<br>d) Determine if preventative actions can be taken |
| 11. | 25 | Logging | - Buffer – 50 m on-reserve, 200 m off-reserve<br>- Monitors do site assessments for logging | a) Develop a protocol for working with industry on permit approvals, especially close to residences and lakes (off-reserve)<br>b) Develop a system for better communication between BCN, industry, and the MD<br>c) Determine the best logging practices and make sure they are followed, e.g. avoid clear cutting (off-reserve)<br>d) Create a protocol to ensure that the Nation has a stronger voice when traditional territory is being logged. Include: |

| Num. | Risk Ranking High – Low | Potential Risk to Source Water | Existing Management Actions | Proposed Management Actions |
|---|---|---|---|---|
| | | | | 1. Process for increasing transparency regarding permitting<br>2. Process for recording concerns and knowledge of elders<br>e) Organize a Chief & Council field trip of logged areas so the extent of logging and changes made to the landscape are visible (on & off-reserve)<br>f) Organize a meeting with Chief & Council as well as MD to voice concerns - Address issues around roads and other infrastructure associated with logging |
| 12. | 20 | Winter fishing village on Wabasca Lake | - AEP currently tracks impact on fish population/set catch limits | a) Monitored village for garbage removal, fires, oil etc.<br>b) Develop education program about fishing limits, garbage removal, caring for the lake, impaired drivers (create a list of dos/don't)<br>c) Monitor number of shacks for increases<br>d) Literature/TEK review into effects of ice fishing on lakes. Based on findings revisit:<br>• Have set area for fielding skidoos/ vehicles<br>• Wash station to remove salt/dirt from vehicles before going on ice<br>• Charge fee/rental for shacks<br>• Permitting process for shacks<br>• Limit size of village<br>e) Meet with DFO to determine regulations/limits on fisheries as well as the impact of the village on the lake |
| 13. | 20 | Golf course | - Golf course has protocols in place that are contentious of water use | a) Meet with the golf course to discuss:<br>• Water conservation<br>• Potential impacts/mitigation of fertilizers and other chemicals |
| 14. | 20 | Agriculture | - 100 ft. setbacks from development (MD)<br>- When a concern arises AEP is called to do an inspection<br>- MD has zoning bylaws | a) Bylaws: buffer/distance from water<br>b) Education campaign that educates public about health risks, environmental impacts, etc. and awareness around potential alternatives (provincial off-site water trough program, etc.) |
| 15. | 20 | Old dumps | - Decommissioned to different degrees (e.g. some capped) | a) Research project around decommissioning of dump. Determine:<br>- Location of dumps and mapping of old dump sites<br>- Condition of dump. E.g. to what extent was it reclaimed?<br>- Type of waste that was dumped<br>- Sime of dump site<br>b) Conduct testing to figure out impact |

| Num. | Risk Ranking High – Low | Potential Risk to Source Water | Existing Management Actions | Proposed Management Actions |
|---|---|---|---|---|
| | | | | - Bore test wells to test for leachate |
| 16. | 17.5 | Skidoos/ATVs | - Put out garbage cans and porta potties at certain checkpoints<br>- Laws that machines aren't allowed to cross creeks or rivers, not well-enforced | a) Create a document outlining organizers responsibilities. Include information on:<br>1. Numbers of garbage cans<br>2. Providing participants with garbage bags<br>3. Mandatory machine checks prior to racing<br>4. Rules and responsibilities of participants<br>5. Sensitive areas to be flagged off and avoided<br>6. Rules and responsibilities for participants. To be distributed race day<br>b) Create bylaws on:<br>1. Fining machines that break down or spill<br>2. Fining people that cross water ways<br>3. Keeping rallies away from lakes<br>4. Organization being responsible for clean-up after an event. If they fail to do a good job, charge environmental fee to hire a clean-up crew |
| 17. | 16 | Water truck hose contamination | - Water truck drivers have guidelines/requirements to follow: cap hoses, have chlorine solution and spray bottles inside trucks to clean hoses, not supposed to drag hoses, etc.<br>- Health inspector inspects trucks and does training<br>- Trucks are supposed to be shock-chlorinated every week (on Fridays) | a) Enforcement of guidelines and requirements<br>b) Host a driver education/training course<br>c) Buy updated technologies when replacing trucks, e.g. trucks with a retractable hose<br>d) Install a full distribution system - reserve C, B, A, Sandy |
| 18. | 15 | Illegal dumping | - Currently people are told to clean up, but no real enforcement<br>- Community clean-up in May (garbage bags are provided | a) Create bylaw that will cut off services if people do not keep yards clean<br>b) Increase the level of organization for community clean up. E.g. Specifically tell people the area that is their responsibility<br>c) Include spring cleanup in the land code so it can be enforced<br>d) Investigate illegal dumps to find and fine perpetrator |

| Num. | Risk Ranking High – Low | Potential Risk to Source Water | Existing Management Actions | Proposed Management Actions |
|---|---|---|---|---|
| | | | to residents)<br>- Band does pick-up of large and bulky items, people just have to call | e) Create and enforce contract between tenants and housing regarding maintenance of their property (e.g. 3 strike rule)<br>f) Create awards/prizes for best kept yard, most improved, etc. |
| 19. | 15 | SAGD | - Provincial regulations followed<br>- MD currently requests water logs from industry | a) Engage province to consult w/BCN & MD on water extraction, chemicals used etc...<br>b) Develop a better communication plan/pathway in the case of an oil spill |
| 20. | 15 | Original Wabasca car wash/Big rock car wash | - Car wash built in town | a) Put up signage at location<br>b) Develop public education materials (include info on how the community can become involved in enforcing)<br>c) Develop and enforce by-law against washing vehicles directly in lake |
| 21. | 12 | Bigstone Cree Nation's landfill (reserve D) | - Fenced, but people can still sneak in. If closed, will drive down the road and dump illegally<br>- Some garbage sorting occurs<br>- Operator present | a) Start (improve/overhaul) recycling program**<br>b) Place a dumpster outside of the landfill to collect waste when the landfill is closed<br>c) Install test well to investigate if landfill is seeping<br>d) Create an education campaign focused on proper solid waste practices (drugs etc.)<br>e) Organize drug round up |
| 22. | 12 | Development close to the lake | - 50 m buffer/set back has been extended to 100 m – passed and in writing | a) Plan and invest in proper project design<br>b) Have open competitions for hiring certified contractors<br>c) Develop protocol for new developments that include input by the health inspector/EHO |
| 23. | 12 | Improperly installed culverts | - Replace culverts when severely damaged/reported<br>- Crews go in and thaw culverts in the spring and do some maintenance | a) Develop guidelines to ensure best practices are used when installing culverts. Include info on screening sides, flow, and installation.<br>1. Ensure MD, BCN and industry all follow the guidelines<br>b) Have annual inspections to note condition/which ones need maintenance and/or repair<br>c) Create a schedule to ensure culverts are repair/replace regularly |
| 24. | 10 | Bigstone North end/reserve C lagoon | - Following federal wastewater system effluent regulations (WSER) – monitoring | a) Upgrade lagoon<br>b) Drill test wells to investigate seepage<br>c) Develop a plan to decommission lagoon and to build a new wastewater treatment system |

| Num. | Risk Ranking High – Low | Potential Risk to Source Water | Existing Management Actions | Proposed Management Actions |
|---|---|---|---|---|
| | | | - Installed new chain link fence that is locked<br>- Every summer, grass gets cut<br>- Clay-lined<br>- Monthly inspections by operator<br>- Health Canada (health inspector) does annual inspection | |
| 25. | 10 | Road dust | - Water roads to control dust MD uses calcium and road watering<br>- Alternatives to asphalt paving are being explored | a) Reduction in grader maintenance near lakes, where appropriate |
| 26. | 9 | Bigstone Cree Nation's transfer station (Reserve C) | - Access to two garbage bins<br>- Burn pits<br>- Utilize contractors like GEEP, etc.<br>- Gets cleaned up when too messy | a) Hire a transfer station attendant<br>b) Host community round-ups of hazardous waste as part of the spring clean-up<br>c) Increase the number of bins and separate out different types of waste<br>d) Close the transfer station |
| 27. | 9 | Local business/facility clean-up | - Provincial and federal regulations<br>- Have oil bins<br>- Have spill response kit | a) Conduct site inspections using TSAG/Lands dept. developed template to assess which sites need to be cleaned up<br>b) Discussion of how to incorporate problem sites into the community clean-up |
| 28. | 8 | Bigstone Cree Nation sewage lagoon 166B | - Cleanup around cells, grass cutting, etc.<br>- Work plan for maintenance of soil/veg to prevent erosion<br>- Chain link fence with sliding gate (left open for vac truck access)<br>- Monthly inspections (but vac truck operators are there every day) | a) Continued clean up, and clearing of brush and vegetation around the four treatment cells<br>b) Drill test wells/take samples to make sure liner is functioning properly<br>c) Determine if lagoon is evaporative or leaching. (e.g. in summer, do a walk around to see if vegetation is different close to lagoon) |

| Num. | Risk Ranking High – Low | Potential Risk to Source Water | Existing Management Actions | Proposed Management Actions |
|---|---|---|---|---|
| | | | - Health Canada does annual inspection | |
| 29. | 8 | Old MD of Opportunity lagoon | - | a) |
| 30. | 5 | Tank farms | - Provincial legislation<br>- Containment area is supposed to be designed to contain a spill if the tank were to rupture when full<br>- Have spill cleanup kits<br>- Have container for used oil<br>- MD is currently working on incorporating in the land use plan a strategy for moving industrial sites farther away from residential | a) Enforcement of existing legislation and regulations. E.g. Petroleum Tank Management Association of Alberta (PTMAA)<br>b) Conduct site visits<br>c) MD is currently working on incorporating in the land use plan a strategy for moving industrial sites farther away from residential. |
| 31. | 4 | Change in water flow at location of lagoon outflow | - Time raw water intake with lagoon releases<br>- Testing of raw water prior to treatment | a) Conduct a study to determine why flow reverses<br>b) Do flow tests on the river to establish baseline and annual flow variability<br>c) Develop a backup plan for intake placement |
| 32. | 4 | Beavers | - Band pays bounty of $50/tail<br>- MD pays $50 bounty for problem beavers near roads<br>- MD uses cone cages to prevent beaver dams | a) Research current regulations concerning beaver culls<br>b) Regular general inspection of problem areas<br>c) Hire band members to trap problem beavers |
| 33. | 2 | Library residential school lagoon | - | a) |

| Num. | Risk Ranking High – Low | Potential Risk to Source Water | Existing Management Actions | Proposed Management Actions |
|---|---|---|---|---|
| 34. | | Wabasca's landfill | - | a) |

**STAGE 4: Develop Implementation Strategy**

In response to the management actions that were identified previously in Stage 3, the Working Committee has developed an Implementation Strategy outlining the necessary stakeholders and timelines.

Details concerning the necessary stakeholders and implementation timelines have been identified by the Working Committee in Stage 4 and listed in Table 10A.

**Table 10: Implementation Strategy**

| Num. | Risk Ranking High - Low | Potential Risks to Source Water | Recommended Management Actions (What we would like to see happen) | Timeline (When to start?) 1= immediately 2= within 3 yrs. 3= within 5 yrs. | Stakeholders/ Partnerships |
|---|---|---|---|---|---|
| 1. | 25 | Open sewage discharge/shoot outs/outhouses by lake | a) Develop community plan to de-commission and move away from shoot-outs to collection system/low pressure systems<br>b) Follow best practices for PSDS installation (e.g. certified installers, inspection after installation)<br>c) Develop an education program about homeowner responsibility and health risks regarding shoot outs. Include preventative measures (e.g. water conservation)<br>d) Establish sub-committee to identify and deal with shoot out issues<br>e) Develop an enforcement plan<br>f) Establish policy with Chief & Council that if people are not paying for vac truck service for proper waste disposal, Public Works will not deliver water<br>g) Establish system for record keeping for frequency of vac trucks visits. Flag homes with shoot outs to ensure they are visited | a) 2<br>b) 1<br>c) 1<br>d) 1<br>e) 1<br>f) 1<br>g) 2 | a) Environmental damages fund, Housing dept., Chief & Council, Public Works Capital Projects, INAC, Health Canada<br>b) Housing dept., Contractor, Health Canada<br>c) Housing dept., Public Works, Chief & Council, Health Services, Schools<br>d) Lands dept., Public Works, Housing dept., Health dept.<br>e) DFO, Chief & Council<br>f) Chief & Council, Lands dept. (Bylaw Officer), Public Works, Housing dept., Health dept.<br>g) Public Works, Housing dept., Lands dept./ Bylaw Officer, Health dept. (EHO) |

| Num. | Risk Ranking<br>High - Low | Potential Risks to Source Water | Recommended Management Actions<br>(What we would like to see happen) | Timeline<br>(When to start?)<br>1= immediately<br>2= within 3 yrs.<br>3= within 5 yrs. | Stakeholders/<br>Partnerships |
|---|---|---|---|---|---|
| 2. | 25 | Cistern/water tank contamination | a) Build distribution lines<br>b) Establish a cistern cleaning crew<br>c) Create an education program including one-on-one training materials, school programs on cisterns/ water conservation, newsletter article<br>d) Organize meeting with health centre, Public Works, and housing to discuss cisterns, solutions, and to collaborate to seek funding<br>e) Enforcement of homeowner responsibilities, have homeowners go through housing training course before signing and moving in | a) 1<br>b) 1<br>c) 1<br>d) 1<br>e) 1 | a) MD, Chief & Council, INAC, G of A, infrastructure fund<br>b) Public Works, Youth Program, Health dept., ASSETS (band funding agency), housing dept., home owners, Melvin Stuart (trained, private contractor)<br>c) TSAG, Health dept. (EHO), Lands dept., home owners<br>d) Housing dept., TSAG<br>e) Chief & Council, Housing dept., TSAG, MD Housing Corporation<br>**Funding:** infrastructure fund, LEDSP, ASSETS, |
| 3. | 25 | Industry water withdrawals resulting in muskeg drying | a) Establish permit process for water withdrawals on-reserve<br>b) Increase enforcement process (off-reserve)<br>c) Develop a stronger partnership between the Lands dept. and GIR to coordinate processes on and off-reserve | a) 1<br>b) 1<br>c) 1 | a) Lands dept., Chief & Council<br>b) GIR, MD, industry<br>c) GIR, Lands dept., MD |
| 4. | 25 | Industry related ground disturbance | a) Establish a 100 m buffer from the high water mark on and off-reserve<br>b) Improve communication with industry about processes – increase honesty and transparency | a) 1<br>b) 1 | a) Lands dept., GIR, industry, AER, IOGC<br>b) GIR, industry, MD, IOGC, Lands dept. |
| 5. | 25 | Oil & gas pipelines (leaks or spills) | a) Obtain the pipeline leak or spill process/ERP from IOGC/TransCanada<br>b) Improve communication and flow of information between Nation and pipeline companies<br>c) Large-scale spill emergency response equipment closer than Slave Lake | a) 1<br>b) 2<br>c) 1 | a) Lands dept., TransCanada, IOGC<br>b) Lands dept., GIR, NEB, AER, IOGC, Husky, AltaGas, TransCanada, Public Works<br>c) NEB, pipeline companies, Lands dept., GIR |

| Num. | Risk Ranking<br>High - Low | Potential Risks to Source Water | Recommended Management Actions<br>(What we would like to see happen) | Timeline<br>(When to start?)<br>1= immediately<br>2= within 3 yrs.<br>3= within 5 yrs. | Stakeholders/<br>Partnerships |
|---|---|---|---|---|---|
| 6. | 25 | Decreasing water levels | a) Designate all wetlands as conservation areas<br>b) Develop an education program on water conservation and climate change for all ages<br>c) Increase use of rain barrels<br>d) Install water meters on homes for leak detection<br>e) Communication plan with golf course and other MD projects around water conservation<br>f) Environmental monitoring program<br>g) Develop educational information for fire department about water conservation | a) 1<br>b) 1 – before the end of the school yr.<br>c) 1<br>d) 3<br>e) 1<br>f) 1<br>g) 1 | a) M.D.<br>b) Health centre, Public Works, Lands dept., TSAG, schools, elders<br>c) Health centre, Public Works, Lands dept., TSAG, schools, elders, Ecotrust<br>d) Chief & Council, Public Works<br>e) MD, Lands dept., golf course<br>f) AEMERA, GIR, Lands dept., AEP Fish & Wildlife, ALMS<br>g) Lands dept., Fire dept., MD |
| 7. | 25 | Industrial withdrawal permits of water for dust control | a) Develop a permit process for water withdrawals involving PW (MD currently has a permitting process in place as well as a rate charge. Could be used to develop one for BCN)<br>b) Enforcement of process for withdrawals | a) 1<br>b) 1 | a) Partnership between PW, Lands dept., GIR, Chief & Council, MD<br>b) Partnership between PW, Lands dept., GIR, Chief & Council, MD, bylaw officer |
| 8. | 25 | Calcium used on roads for dust control | a) Research how much can be used without negative impacts on lakes. Follow guidelines | a) 1 | a) MD transportation, Public Works, TSAG |
| 9. | 25 | Stagnant creeks | a) Inspect creeks looking for causes, including beaver dams, culverts and crossings. Fix issues as needed<br>b) Monitor fish populations | a) 1<br>b) 2 | a) Public works, Lands dept.<br>b) Elders, Public Works, Lands dept., AEP Fish & Wildlife, Alberta Conservation Association |
| 10. | 25 | Log jam on Willow River | a) Monitor water levels<br>b) Research best practices for removing log jam<br>c) Get water flowing following best practices (e.g. remove log jam, stream diversion)<br>d) Determine if preventative actions can be taken | a) 1<br>b) 2<br>c) 2<br>d) 2 | a) Lands dept.<br>b) AEP Fish & Wildlife, TSAG, Lands dept.<br>c) Public Works, AEP Fish & Wildlife, Lands dept.<br>d) AEP Fish & Wildlife, industry, Elders, trappers |

| Num. | Risk Ranking<br>High - Low | Potential Risks to Source Water | Recommended Management Actions<br>(What we would like to see happen) | Timeline<br>(When to start?)<br>1= immediately<br>2= within 3 yrs.<br>3= within 5 yrs. | Stakeholders/<br>Partnerships |
|---|---|---|---|---|---|
| 11. | 25 | Logging | a) Develop a protocol for working with industry on permit approvals, especially close to residences and lakes (off-reserve)<br>b) Develop a system for better communication between BCN, industry, and the MD<br>c) Determine the best logging practices and make sure they are followed, e.g. avoid clear cutting (off-reserve)<br>d) Create a protocol to ensure that the Nation has a stronger voice when traditional territory is being logged. Include:<br>3. Process for increasing transparency regarding permitting<br>4. Process for recording concerns and knowledge of elders (SEE A & B)<br>e) Organize a Chief & Council field trip of logged areas so the extent of logging and changes made to the landscape are visible (on & off-reserve)<br>f) Organize a meeting with Chief & Council as well as MD to voice concerns - Address issues around roads and other infrastructure associated with logging | a) 1<br>b) 1<br>c) 1<br>d) 1<br>e) 1<br>f) 1 | a) Lands dept., GIR, GoA, industry, Elders, Chief & Council, land user representatives, MD<br>b) See a<br>c) GIR, Lands dept., industry<br>d) See a<br>e) Lands dept., GIR, Chief & Council, Alberta Trappers Association, Elders, local trappers group<br>f) MD, Chief & Council, Lands dept., GIR, local trappers group |
| 12. | 20 | Winter fishing village on Wabasca Lake | a) Monitored village for garbage removal, fires, oil etc.<br>b) Develop education program about fishing limits, garbage removal, caring for the lake, impaired drivers (create a list of dos/don't)<br>c) Monitor number of shacks for increases<br>d) Literature/TEK review into effects of ice fishing on lakes. Based on findings revisit:<br>• Have set area for fielding skidoos/ vehicles | a) 1<br>b) 1<br>c) 3<br>d) 2<br>e) 1 | a) AEP Fish & Wildlife, community volunteers<br>b) AER, MD, AEP Fish & Wildlife, Lands dept.<br>c) MD Lands, Lands dept.<br>d) MD Lands<br>e) MD, Chief & Council, AEP, DFO |

| Num. | Risk Ranking High - Low | Potential Risks to Source Water | Recommended Management Actions (What we would like to see happen) | Timeline (When to start?) 1= immediately 2= within 3 yrs. 3= within 5 yrs. | Stakeholders/ Partnerships |
|---|---|---|---|---|---|
| | | | • Wash station to remove salt/dirt from vehicles before going on ice<br>• Charge fee/rental for shacks<br>• Permitting process for shacks<br>• Limit size of village<br>e) Meet with DFO to determine regulations/limits on fisheries as well as the impact of the village on the lake | | |
| 13. | 20 | Golf course | a) Meet with the golf course to discuss:<br>• Water conservation<br>• Potential impacts/mitigation of fertilizers and other chemicals | a) 1 | a) Lands dept., MD Lands, golf course (Jim Fraser, golf pro; Albert Bassette, maintenance) |
| 14. | 20 | Agriculture | a) Bylaws: buffer/distance from water (100m)<br>b) Education campaign that educates public about health risks, environmental impacts, etc. and awareness around potential alternatives (provincial off-site water trough program, etc.) | a) 1<br>b) 2 | a) Lands dept., MD Lands<br>b) Lands dept., MD Lands |
| 15. | 20 | Old dumps | a) Research project around decommissioning of dump. Determine:<br>- Location of dumps and mapping of old dump sites<br>- Condition of dump, e.g. was it reclaimed?<br>- Type of waste that was dumped<br>- Size of dump site<br>b) Conduct testing to figure out impact<br>- Bore test wells to test for leachate | a) 1<br>b) 2 | a) MD GIS dept., elders<br>b) MD Lands, Lands dept., GIR |
| 16. | 17.5 | Skidoos/ATVs | a) Create a document outlining organizers responsibilities. Include information on:<br>1. Numbers of garbage cans<br>2. Providing participants with garbage bags<br>3. Mandatory machine checks prior to racing<br>4. Rules and responsibilities of participants | a) 2<br>b) 2 | a) Chief & Council, MD, Lands dept., DFO, AEP<br>b) Lands dept., MD, Chief & Council, DFO, AEP bylaw officer |

| Num. | Risk Ranking High - Low | Potential Risks to Source Water | Recommended Management Actions (What we would like to see happen) | Timeline (When to start?) 1= immediately 2= within 3 yrs. 3= within 5 yrs. | Stakeholders/ Partnerships |
|---|---|---|---|---|---|
| | | | 5. Sensitive areas to be flagged off and avoided<br>6. Rules and responsibilities for participants. To be distributed race day<br>b) Create bylaws on:<br>1. Fining machines that break down or spill<br>2. Fining people that cross water ways<br>3. Keeping rallies away from lakes<br>4. Organization being responsible for clean-up after an event. If they fail to do a good job, charge environmental fee to hire a clean-up crew | | |
| 17. | 16 | Water truck hose contamination | a) Enforcement of guidelines and requirements<br>b) Host a driver education/training course<br>c) Buy updated technologies when replacing trucks, e.g. trucks with a retractable hose<br>d) Install a full distribution system - reserve C, B, A, Sandy | a) 1<br>b) 1<br>c) 3<br>d) 3 | a) Public Works, Health dept.,<br>b) TSAG, Health Canada (EHO), INAC, Public Works,<br>c) Public Works, INAC<br>d) INAC, Public Works, engineers |
| 18. | 15 | Illegal dumping | a) Create bylaw that will cut off services if people do not keep yards clean<br>b) Increase the level of organization for community clean up. E.g. Specifically tell people the area that is their responsibility<br>c) Include spring cleanup in the land code so it can be enforced<br>d) Investigate illegal dumps to find and fine perpetrator<br>e) Create and enforce contract between tenants and housing regarding maintenance of their property (e.g. 3 strike rule)<br>f) Create awards/prizes for best kept yard, most improved, etc. | a) 1<br>b) 1<br>c) 1<br>d) 1<br>e) 1<br>f) 1 | a) Lands dept., Public Works, Chief & Council<br>b) Lands dept., Public Works, Housing dept., Health dept., Schools, Chief & Council, community<br>c) Lands dept. (process in place)<br>d) Lands dept.<br>e) Housing dept., homeowners/tenants<br>f) Lands dept., Housing dept., MD & BCN community members, bylaw enforcement at MD |

| Num. | Risk Ranking High - Low | Potential Risks to Source Water | Recommended Management Actions (What we would like to see happen) | Timeline (When to start?) 1= immediately 2= within 3 yrs. 3= within 5 yrs. | Stakeholders/ Partnerships |
|---|---|---|---|---|---|
| 19. | 15 | SAGD | a) Engage province to consult w/BCN & MD on water extraction, chemicals used etc...<br>b) Develop a better communication plan/pathway in the case of an oil spill | a) 1<br>b) 1 | a) AER, MD Lands, Lands dept., GIR, Chief & Council, MD council<br>b) MD Lands, Lands dept., GIR, industry |
| 20. | 15 | Original Wabasca car wash/Big rock car wash | a) Put up signage at location<br>b) Develop public education materials (include info on how the community can become involved in enforcing)<br>c) Develop and enforce by-law against washing vehicles directly in lake | a) 1<br>b) 1<br>c) 2 | a) MD Lands, MD Transportation, (GIS develop sigh, transportation install)<br>b) MD legislative services |
| 21. | 12 | Bigstone Cree Nation's landfill (reserve D) | a) Start (improve/overhaul) recycling program<br>b) Place a dumpster outside of the landfill to collect waste when the landfill is closed<br>c) Install test well to investigate if landfill is seeping<br>d) Create an education campaign focused on proper solid waste practices (drugs etc.)<br>e) Organize drug round up | a) 1<br>b) 1<br>c) 3<br>d) 2<br>e) 1 | a) Health, Public Works, MD, INAC, Health Canada (funding), EWMCE<br>b) Public Works<br>c) Public Works, Lands dept.<br>d) Lands dept., Public Works, Health dept., schools<br>e) Health, Bigstone Apple Drugs, schools |
| 22. | 12 | Development close to the lake | a) Plan and invest in proper project design<br>b) Have open competitions for hiring certified contractors<br>c) Develop protocol for new developments that include input by the health inspector/EHO | a) 1 (ongoing)<br>b) 1<br>c) 1 | a) Lands dept., Public Works,<br>b) Lands dept., Housing dept. (already started), Public Works, Contractors<br>c) Lands dept., Health (EHO) |
| 23. | 12 | Improperly installed culverts | a) Develop guidelines to ensure best practices are used when installing culverts. Include info on screening sides, flow, and installation.<br>1. Ensure MD, BCN and industry all follow the guidelines<br>b) Have annual inspections to note condition/which ones need maintenance and/or repair<br>c) Create a schedule to ensure culverts are repair/replace regularly | a) 1<br>b) 1<br>c) 1 | a) Lands dept., homeowners, Public Works, Housing dept., DFO<br>b) MD, Public Works, Alberta Transportation (GoA)<br>c) MD, Public Works, Alberta Transportation (GoA) |

| Num. | Risk Ranking High - Low | Potential Risks to Source Water | Recommended Management Actions (What we would like to see happen) | Timeline (When to start?) 1= immediately 2= within 3 yrs. 3= within 5 yrs. | Stakeholders/ Partnerships |
|---|---|---|---|---|---|
| 24. | 10 | Bigstone North end/reserve C lagoon | a) Upgrade lagoon<br>b) Drill test wells to investigate seepage<br>c) Develop a plan to decommission lagoon and to build a new wastewater treatment system | a) 1<br>b) 1<br>c) 3 | a) INAC, Public Works, engineers, TSAG (CRTP), Chief & Council<br>b) Public works contractor, Chief & Council, TSAG (CRTP)<br>c) See a & b |
| 25. | 10 | Road dust | a) Reduction in grader maintenance near lakes, where appropriate | a) 2 | a) MD transport, Public Works |
| 26. | 9 | Bigstone Cree Nation's transfer station (Reserve C) | a) Host community round-ups of hazardous waste as part of the spring clean-up<br>b) Hire a transfer station attendant<br>c) Increase the number of bins and separate out different types of waste<br>d) Close the transfer station | a) 1<br>b) 2<br>c) 1<br>d) 1 | a) Alberta Recycling, Public Works, Contractors, Schools, notify all depts.<br>b) Public Works, Chief & Council<br>c) Public Works<br>d) Public Works, Chief & Council |
| 27. | 9 | Local business/facility clean-up | a) Conduct site inspections using TSAG/Lands dept. developed template to assess which sites need to be cleaned up<br>b) Discussion of how to incorporate problem sites into the community cleanup | a) 1<br>b) 1 | a) Lands dept.<br>b) Lands dept., Public Works |
| 28. | 8 | Bigstone Cree Nation sewage lagoon 166B | a) Continued clean up, and clearing of brush and vegetation around the four treatment cells<br>b) Drill test wells/take samples to make sure liner is functioning properly<br>c) Determine if lagoon is evaporative or leaching. (e.g. in summer, do a walk around to see if vegetation is different close to lagoon) | a) 1<br>b) 1<br>c) 1 | a) Public Works<br>b) Public Works<br>c) Public Works, TSAG |
| 29. | 8 | Old MD of Opportunity lagoon | a) | a) | a) |

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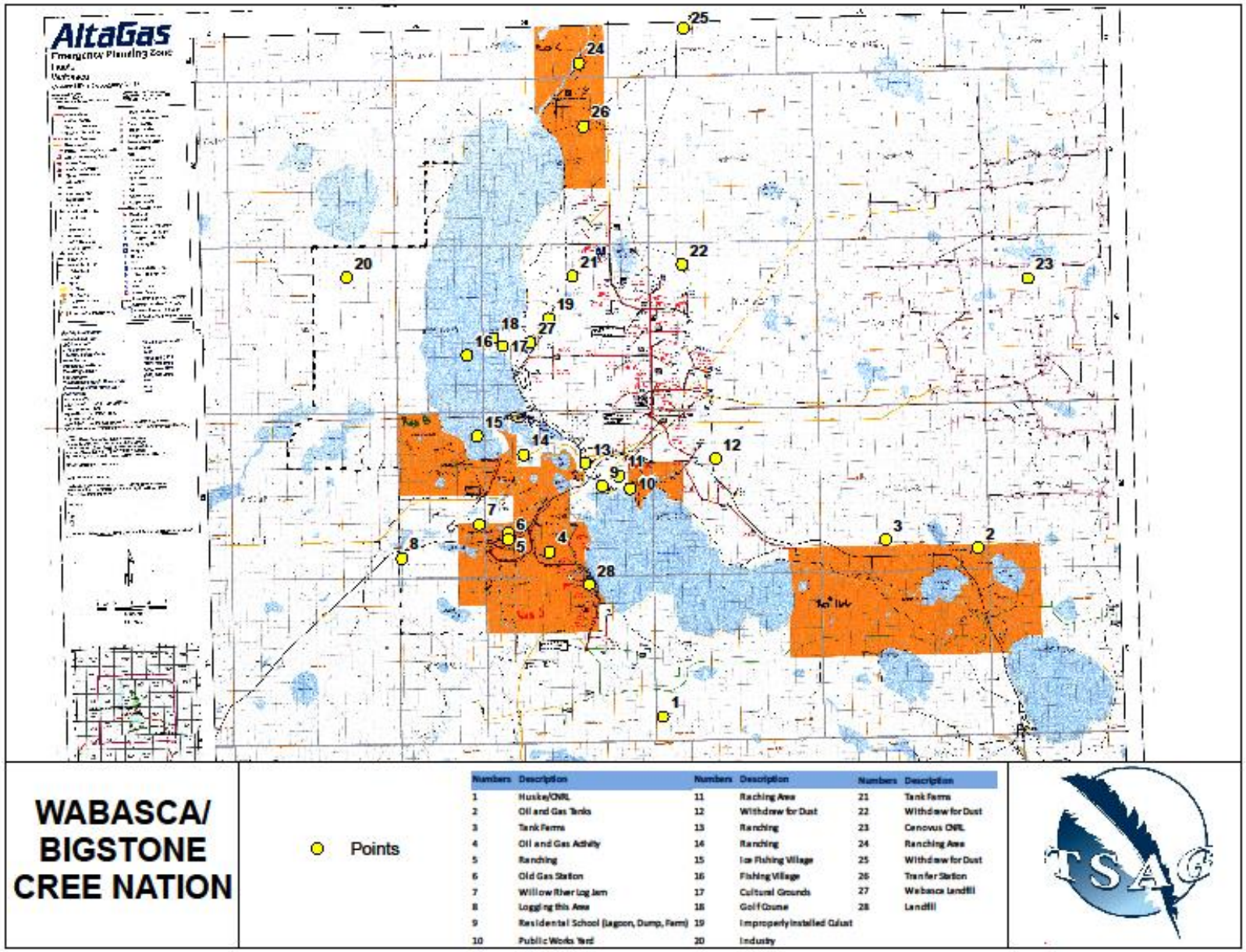
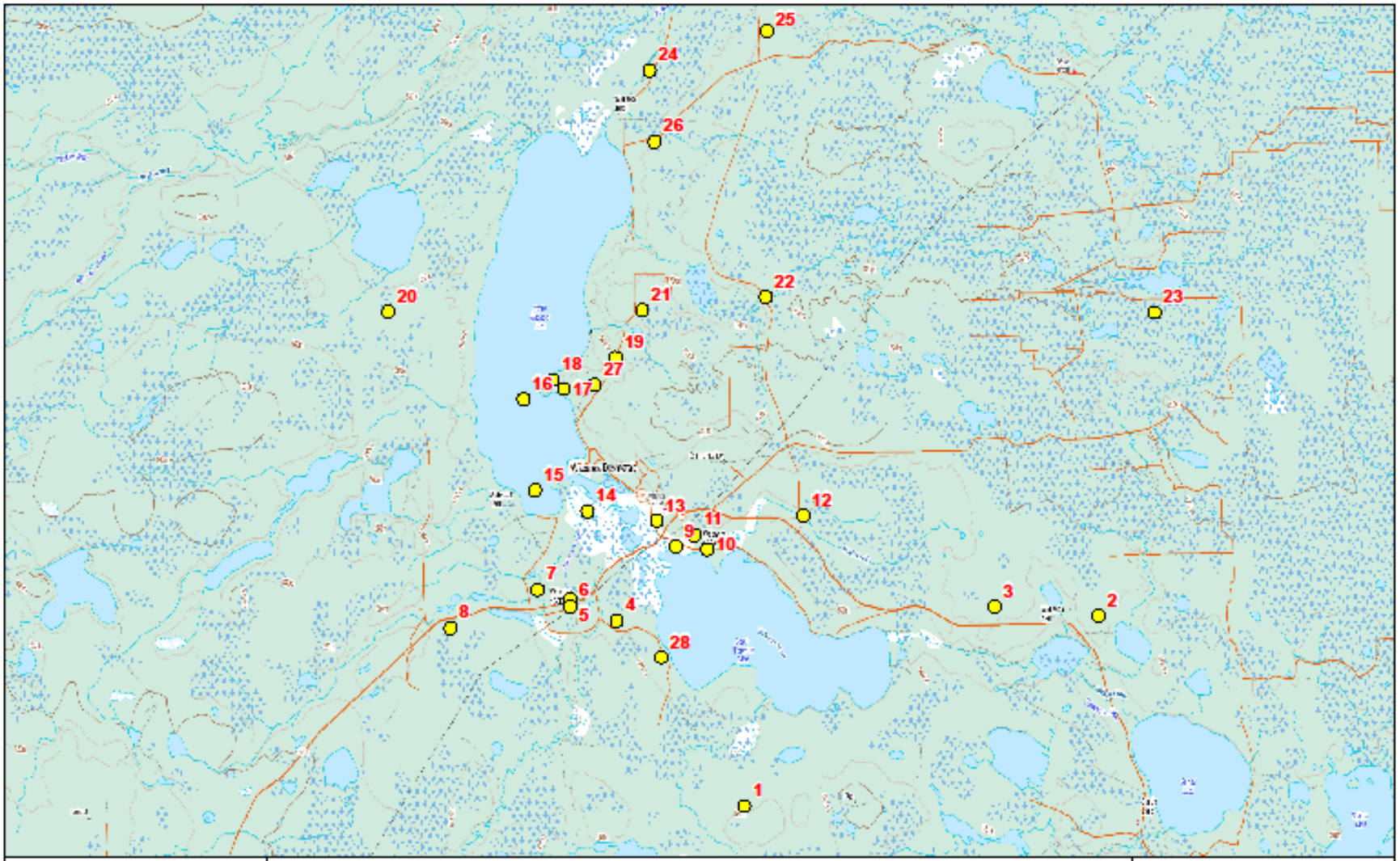
|---|---|---|---|---|---|
| 30. | 5 | Tank farms | a) Enforcement of existing legislation and regulations. E.g. Petroleum Tank Management Association of Alberta (PTMAA)<br>b) Conduct site visits | a) 1<br>b) 1 | a) Lands dept., GIR, Industry<br>b) MD, AEP |
| 31. | 4 | Change in water flow at location of lagoon outflow | a) Conduct a study to determine why flow reverses<br>b) Do flow tests on the river to establish baseline and annual flow variability<br>c) Develop a backup plan for intake placement | a) 1<br>b) 1<br>c) 2 | a) Public Works, Lands dept., UofA Engineering, TSAG<br>b) Public Works, Lands, UofA Engineering, TSAG<br>c) Public Works |
| 32. | 4 | Beavers | a) Research current regulations concerning beaver culls<br>b) Regular general inspection of problem areas<br>c) Hire band members to trap problem beavers | a) 1<br>b) 1<br>c) 2 | a) AEP Fish & Wildlife, Lands dept.<br>b) Industry, AEP Fish & Wildlife, Lands dept.<br>c) Lands dept., trappers |
| 33. | 2 | Library residential school lagoon | a) | a) | a) |
| 34. | | Wabasca's landfill | a) | a) | a) |

**STAGE 5: Source Water Protection Plan Review and Update**

On a five-year cycle, the Working Committee will undertake a full review of the SWPP. This review will commence with the appointment of a Working Committee followed by revisions of Stages 2 through 4. While some aspects of the SWPP may not change, the Working Committee will be open to new membership and to any revisions that may occur to the source water assessment (Stage 2) and to the development of risk management actions (Stage 3). As a result, any revisions may necessitate modifications to the implementation strategy (Stage 4).

## On-Reserve Source Water Protection Plan Maps





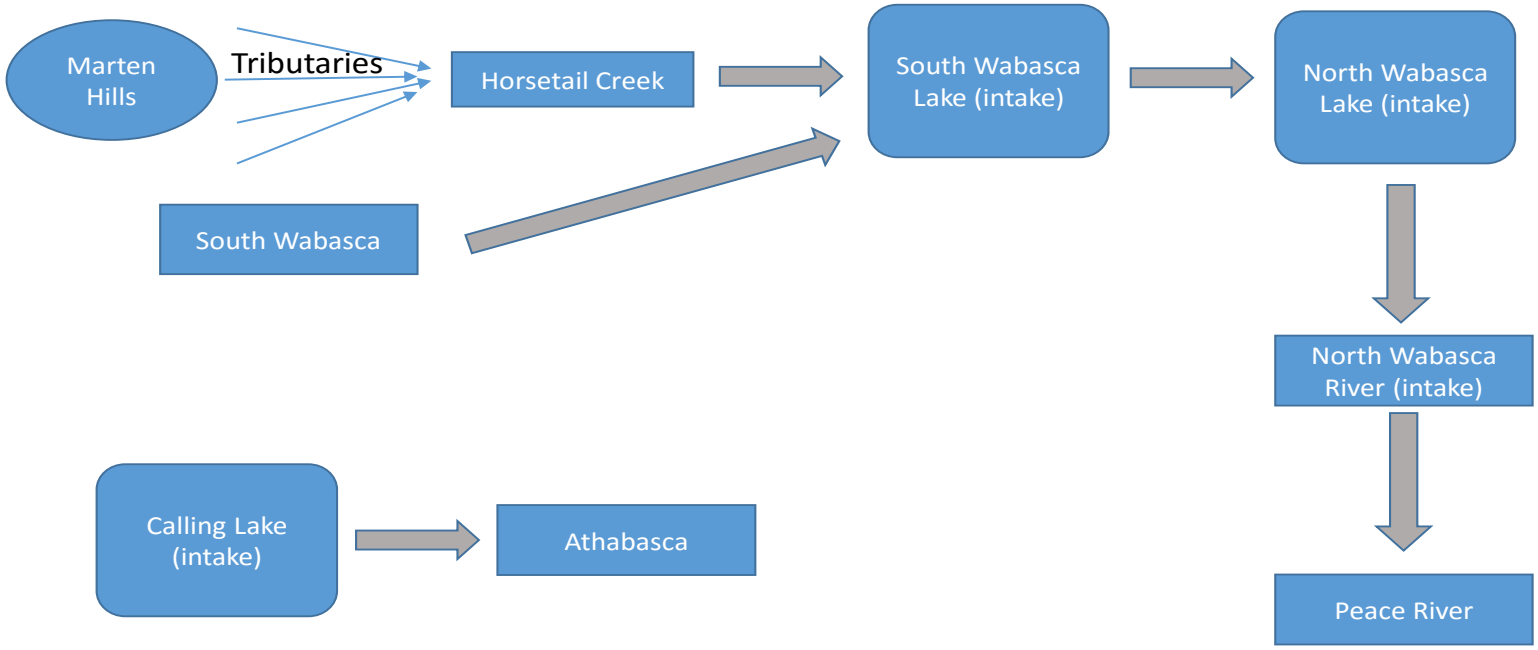

# WABASCA/ BIGSTONE CREE NATION

Points

| Numbers | Description | Numbers | Description | Numbers | Description |
|---|---|---|---|---|---|
| 1 | Huske/CNRL | 11 | Raching Area | 21 | Tank Farms |
| 2 | Oil and Gas Tanks | 12 | Withdrew for Dust | 22 | Withdrew for Dust |
| 3 | Tank Farms | 13 | Ranching | 23 | Cenovus CNRL |
| 4 | Oil and Gas Activity | 14 | Ranching | 24 | Ranching Area |
| 5 | Ranching | 15 | Ice Fishing Village | 25 | Withdrew for Dust |
| 6 | Old Gas Station | 16 | Fishing Village | 26 | Transfer Station |
| 7 | Willow River Log Jam | 17 | Cultural Grounds | 27 | Wabasca Landfill |
| 8 | Logging this Area | 18 | Golf Course | 28 | Landfill |
| 9 | Residental School (Lagoon, Dump, Farm) | 19 | Improperly installed Culvat | | |
| 10 | Public Works Yard | 20 | Industry | | |

# APPENDICES

**Appendix I:** Water flow diagram for the Wabasca area



**Appendix II:** Cree names of important water ways in the Wabasca area

| English Name | Cree Name | Meaning | Pronunciation |
|---|---|---|---|
| Still Lake | Kicimak sakahikansis | Small lake | Ki-chi-mack sah-kah-hee-ghan-sis |
| Still Creek | Kicimak sepes | Small creek | Ki-chi-mak see-pees |
| Sandy Creek | Ekawskaw sepes | Sandy creek | Ee-gow-skow see-pees |
| Little Sandy Lake | Ekawska sakahikan | Little Sandy Lake | Ee-gow-skah sah-kai-ee-ghan |
| Drowned Horse Creek | Mistacimos kakohcik sepes | | Miss-ta-chi-mos kah-goh-tsik see-pees |

**Appendix III:** Local business/facilities that would benefit from yard clean up (including some individual properties):

- Auger and Sons
- CJ Trucking
- Shroeder Oil Field Services
- Laurie Lake Contractor
- Chief Gordon Auger
- Ernie Auger – does not have a company name, uses a private number/name
- Allan Beauregard
- Allison Carlson – shop along road, unsure of company name
- Osawa Muskwa
- Baldy's Gas Station
- Johnny Jackson's Gas Station and Garage – located across from Baldy's Gas Station
- Gordon Gladue – old gas station with fuel tanks
- Old sawmill yard
- Bernie Carlson –sawmill
- Tervita

# REFERENCES

Mighty Peace Watershed Alliance. 2015. State of the Watershed Report. Retrieved from the World Wide Web: http://mightypeacesow.org/pdf/MPWA-SoW_Full.pdf