

# Potash Mines and the Effects on Groundwater in the Lower Qu'Appelle River Watershed

## Source Water Protection Workshop

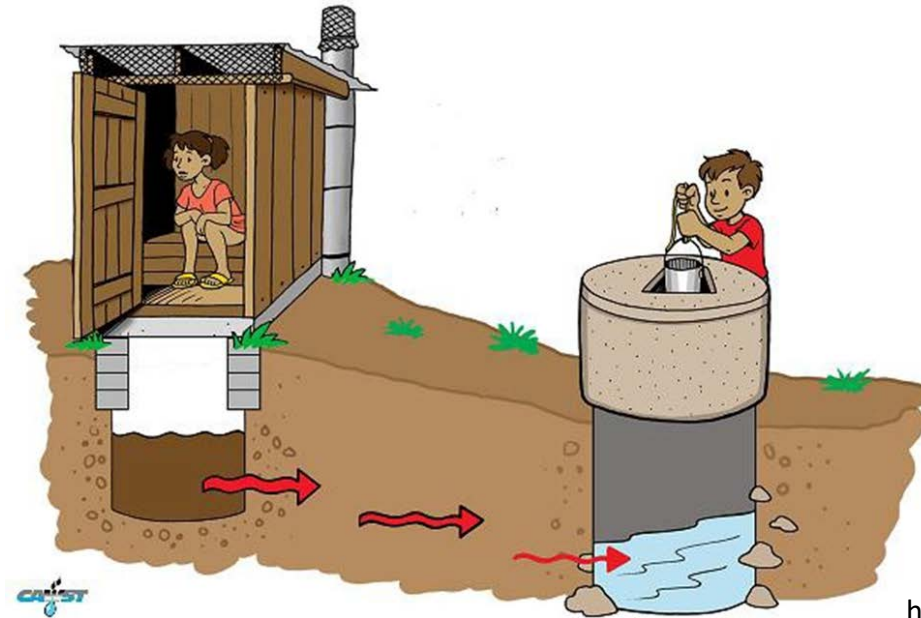
Friday, November 1

**Treaty 4 Building, Fort Qu'Appelle**

Presentation Prepared by:  
Robert Patrick, University of Saskatchewan

# Overview of Source Water Protection Planning

Dr. Robert Patrick  
robert.patrick@usask.ca



[https://en.wikipedia.org/wiki/Waterborne\\_diseases](https://en.wikipedia.org/wiki/Waterborne_diseases)

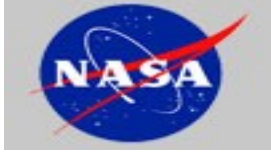


UNIVERSITY OF SASKATCHEWAN



Department of Geography  
& Planning

# First picture from NASA of water on Mars



....



# First picture from NASA of water on Mars



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[http://apod.nasa.gov/apod/image/0504/WaterOnMars2\\_gcc.jpg](http://apod.nasa.gov/apod/image/0504/WaterOnMars2_gcc.jpg)

# First Nation Source Water Protection Plans

MUSKOWEKWAN FIRST NATION  
SOURCE WATER PROTECTION PLAN


JUNE 2, 2014

Frog Lake First Nation  
ALBERTA, CANADA

## Source Water Protection Plan

Frog Lake First Nations 121 & 122  
General Delivery  
Frog Lake, Alberta  
T0A 1M0




## Lac La Ronge Multi-Community Source Water Protection Plan

Draft: December 2016

The Town of La Ronge  
Northern Village of Air Ronge  
Lac La Ronge Indian Band  
The Northern Municipal District



## Source Water Protection Plan

Mistawasis Nēhiyawak  
P.O. Box 250  
Leask, SK  
S0J 1M0






Photo obtained from www.mistawasis.ca



## Siksika Nation


### On-Reserve Source Water Protection Plan

DRAFT - December 21, 2012




P.O. Box 1580  
Siksika, Alberta  
T0J 3W0

June 24, 2015




## Source Water Protection Plan

Cumberland House Cree Nation  
P.O. Box 220  
Cumberland House, SK S0E 0S0



DRAFT: January 17, 2017



## Source Water Protection Plan

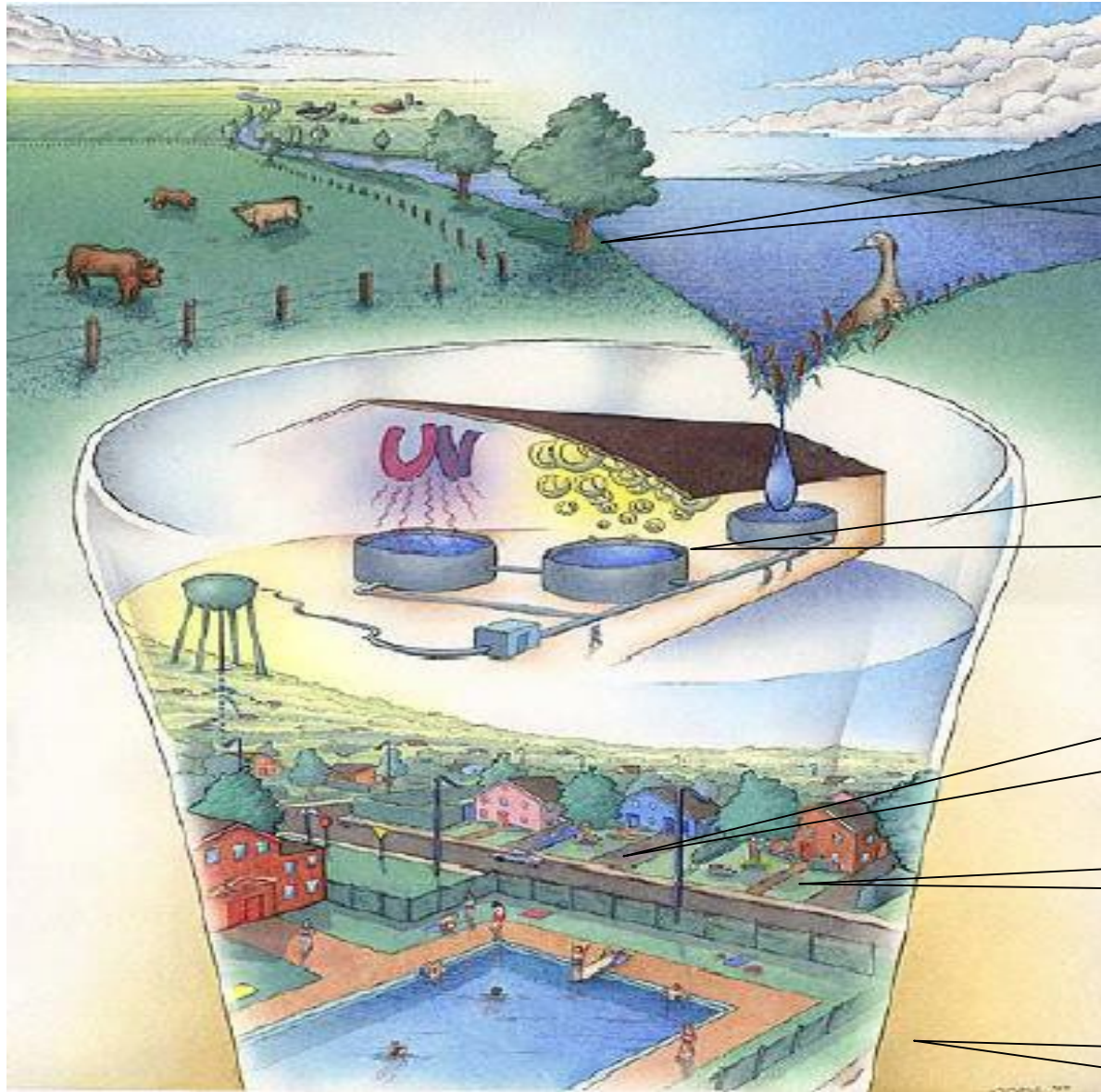
Beardys & Okemasis First Nation  
In cooperation and partnership with  
Town of Duck Lake  
RM of Duck Lake

PO Box 340 Duck Lake  
Saskatchewan, Canada  
S0K 1J0

Phone: 306.467.4523

DRAFT: August 2016

# Multi-Barrier Approach



**1. Source Protection**

**2. Water treatment**

- filtration
- disinfection
- UV

**3. Distribution**

**4. Monitoring**

**5. Response Plan**

# Multi-Barrier Approach (First Nation)

From source ...



Well-head

## Threats:

- unprotected well heads
- no back-up source
- agriculture, land uses



Infrastructure

## Threats:

- open access to fill hose
- pipe contamination
- Truck tank disinfection



Truck Fill Hose

## Threats:

- truck hose disinfection
- unsecure cistern cap
- cisterns cracked, contaminated



Water Truck

... to tap, almost!



Water cistern

# What is Source Water Protection Planning?



**Community-based activity aimed at protecting potable water sources  
(surface and groundwater supplies)**

- map water system**
- identify risks to your water system**
- design management actions**
- implement the actions to reduce risks**



Identify the threat to drinking water ...

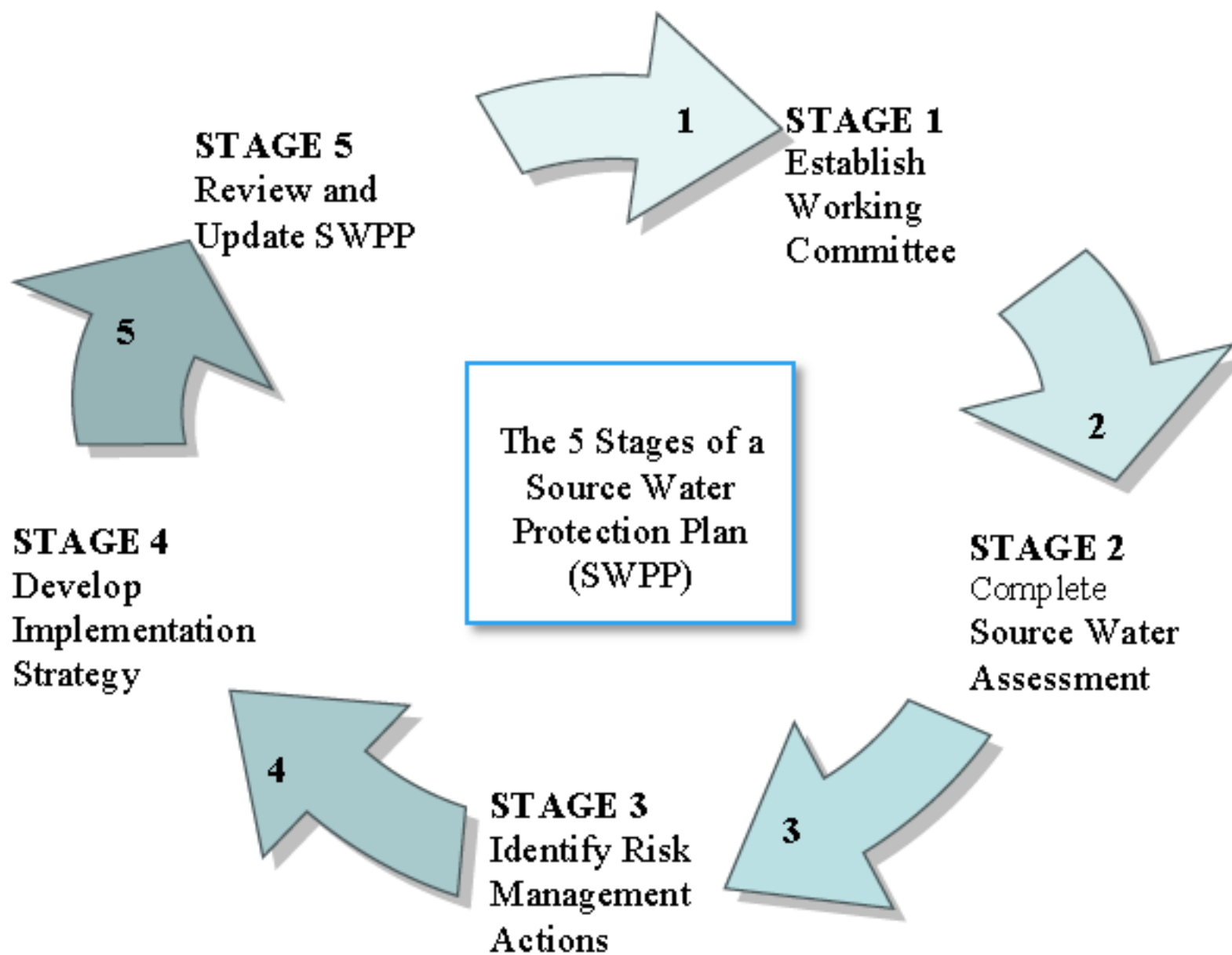


# Identify the threat to drinking water ....



# Identify the threat to drinking water ....





# Typical planning schedule

- Band Council Resolution to start a Source Water Protection Plan
- Open Call for Steering Committee volunteers (Elder, Lands, Health, WTP Operator, Youth, Councillor, etc) – about 6 members.
- Six meetings of the Working Committee
- 2 site tours in the community
- Presentation to Chief and Council
- Open House to community



Cumberland House. Photo Bob Patrick

# Likelihood X Impact = RISK

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

# STAGE 2: Source Water Assessment

- Likelihood of Occurrence

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

# STAGE 2: Source Water Assessment

- Impact of occurrence

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

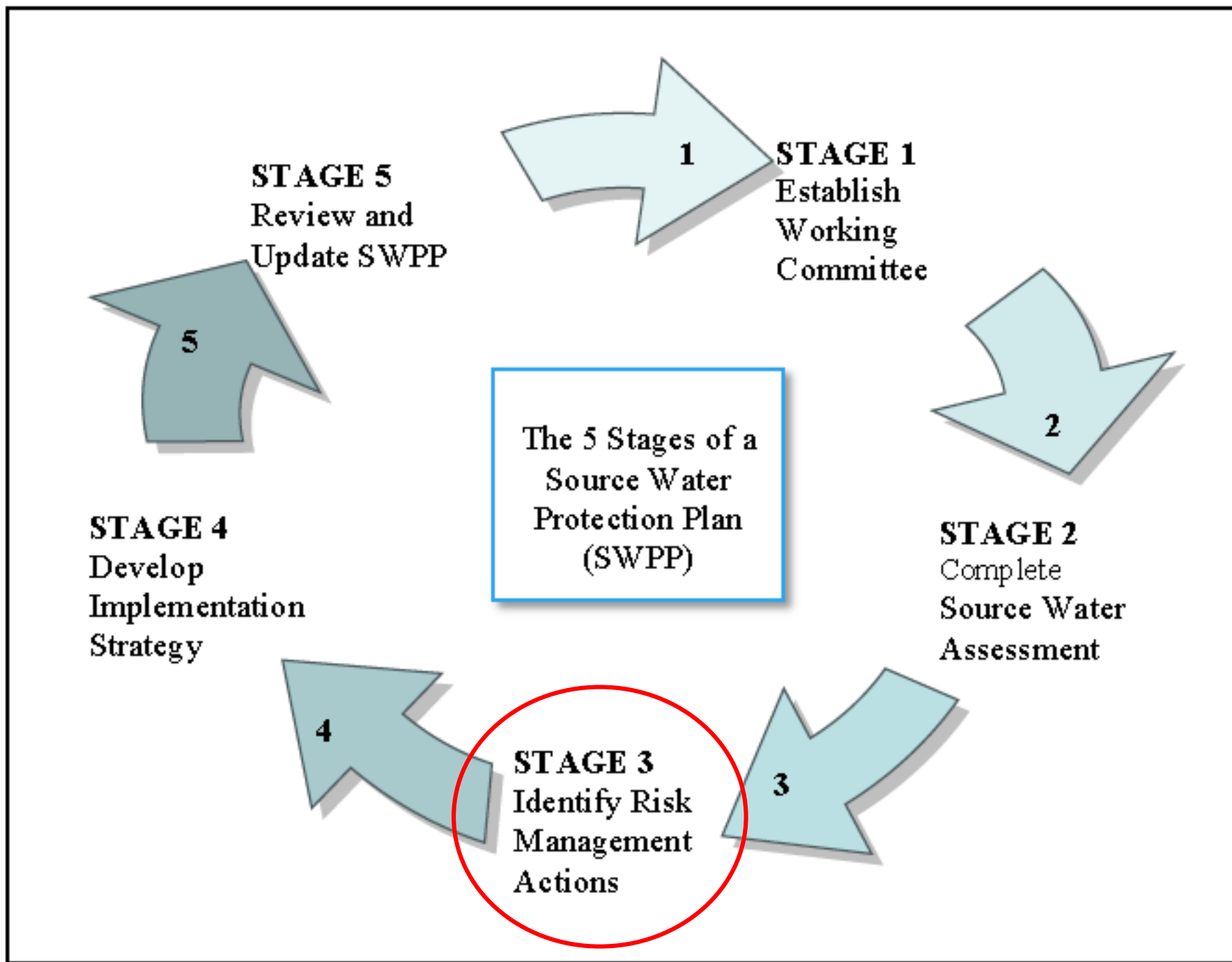


# Typical drinking water risks

RISK	Ranking
Sewage Lagoon	High (10-25)
School Lagoon	High
Private Wells -	High
Old train fill site	High
Cisterns Septics	High
Flooded Wells	High
Uncapped Wells	High
Water treatment plant fill hose	High
Old household heating tanks	High
Town of Lestock sewer pipes	High
Outside contractors	High
Trains - derailments	High
Grass burning	High

# Muskowekwan drinking water risks

RISK	Ranking
Abandoned houses	Medium (5-9)
Abandoned vehicles	Medium
Illegal dumping	Medium
Animal carcasses	Medium
Agriculture TLE lands	Medium
Horses, dogs	Medium
Hide plant	Low ( less than 4)
Diesel shed	Low
Backyard mechanics	Low
Former cattle feedlot	Low
Garbage sites (unlined)	Low
Decommissioned Garbage site	Low
Transport trucks	Low



# Stage 3: Management Actions

CONTAMINANT SOURCE	CONTAMINANT OF CONCEN	MANAGEMENT ACTION
1. Sewage lagoon	<ul style="list-style-type: none"> <li>- Effluent overflow</li> <li>- Chemicals</li> </ul>	<ul style="list-style-type: none"> <li>- Build new lagoon, possible partner with potash mine, cost share with Lestock</li> </ul>
2. School Lagoon	<ul style="list-style-type: none"> <li>- Effluent overflow</li> </ul>	<ul style="list-style-type: none"> <li>- Relocate, rebuild, in-progress</li> </ul>
3. Private Wells	<ul style="list-style-type: none"> <li>- Poor water quality</li> <li>- Bacteria</li> </ul>	<ul style="list-style-type: none"> <li>- Do not consume water advisory</li> <li>- Shock treatment of well</li> <li>- Consider install of small water treatment systems at each house, \$8K per house</li> </ul>
4. Cisterns	<ul style="list-style-type: none"> <li>- Truck fill pipe</li> <li>- Animals</li> </ul>	<ul style="list-style-type: none"> <li>- Annual cleaning, repair cracks, truck operator training, install low pressure system</li> </ul>



Sewage Lagoon, R. Patrick



Household cistern, R. Patrick

# Stage 3: Management Actions

CONTAMINANT SOURCE	CONTAMINANT OF CONCEN	MANAGEMENT ACTION
5. Household Sewage	- Improper jet out location	- Extend pipe; switch to septic system
6. Uncapped Wells	- Groundwater contamination - public safety	- Undertake an inventory of all wells; decommission wells; cap wells
7. Treatment Plant truck filling hose	- Public use	- Monitor, signage, reduce hose length
8. Outside contractors	- Building material	- Information to contractors; enforcement



Uncapped well  
R. Patrick



Contractor's garbage  
R. Patrick

# Multi-Barrier Approach (First Nation)

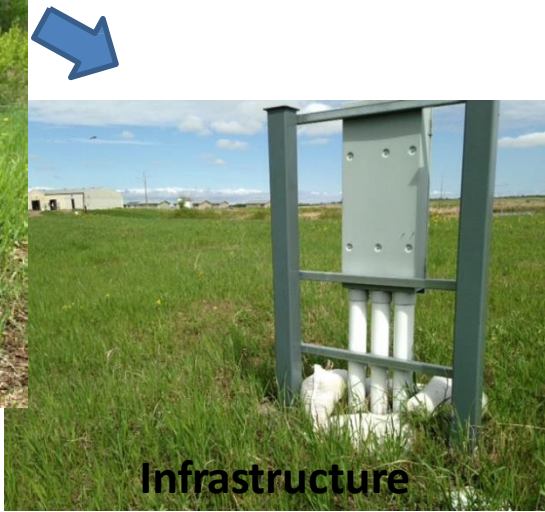
From source ...



Well-head

## Threats:

- unprotected well heads
- no back-up source
- “Indian lawnmowers”
- agriculture, land uses



Infrastructure

## Threats:

- open access to fill hose
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Truck Fill Hose

## Threats:

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Water Truck

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Water cistern

# Benefits of source water protection planning

- Community dialogue and communication
- Inventory of perceived drinking water risks
- Financial leverage to other government
- Easier and cheaper to protect source water than to remediate
- Promotes good land use and infrastructure planning
- Sends the right message to youth, membership, industry
- Community empowerment
- Advances Indigenous planning, sovereignty, Treaty rights

# Barriers of source water protection

- **Human capacity on reserve**
  - Who will be the plan champion?
  - Who will be the implementation champion?
- **Limited control outside reserve boundaries**
  - Agriculture; Rail and road transportation; Airborne contaminants
- **Lack of source protection planning examples in Canada**
  - Early application of this planning template in Saskatchewan
  - Opportunity for First Nations to be leaders in source water protection



*“There is no greater medicine than water – it is foundational, our very beginnings, it reminds us where we came from, our first environment in the womb.”*

Elder, Chiefs of Ontario 2006

Feel free to send me an email  
**robert.patrick@usask.ca**