July 2019 Environmental Update for SLEMA Board

August 6, 2019

Outline

1. Mine Update
2. SNP Report
3. Inspection Report
4. MVLWB Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update
5. Aboriginal Update
6. SLEMA's Activities

Acronyms

- AEMP – Aquatic Effects Monitoring Program
- ARD – Acid Rock Drainage
- DFO – Fisheries and Oceans Canada
- ECCC – Environment and Climate Change Canada
- ECM – Extended Care and Maintenance
- ENR – Department of Environment and Natural Resources, GNWT
- EQC – Effluent Quality Criterion
- GNWT – Government of the Northwest Territories
- INAC – Indigenous and Northern Affairs Canada (formerly Aboriginal Affairs and Northern Development Canada [AANDC])
- MVEIRB – Mackenzie Valley Environmental Impact Review Board
- MVLWB – Mackenzie Valley Land and Water Board
- PK – Processed Kimberlite
- SLEMA – Snap Lake Environmental Monitoring Agency
- SNP – Surveillance Network Program
- SSWQO – Site-Specific Water Quality Objective
- TDS – Total Dissolved Solids
- WEMP – Wildlife Effects Monitoring Program
- WTP – Water Treatment Plant
- WMP – Water Management Pond

1. Mine Update

- The Snap Lake Mine is currently under Extended Care and Maintenance (suspended operations);
- Snap Lake Mine resumed Care and Maintenance activities at site on March 4, 2019.

2. June SNP Report

Volumes Reported in the June SNP Report as follow:

- Fresh Water Volume Pumped: 1,136 m^3;
- Sewage Volume Disposed: 150 m^3;
- Effluent from Water Treatment Plant Discharged to Snap Lake: 4,458 m^3;
- Effluent from Water Management Pond to Water Treatment Plant: 12,029 m^3

2. June SNP Report

Volume of Runoff Pumped to Water Management Pond reported in the June SNP Report as follow:

- North Pile Sumps: 31,553 m^3;
- South Pit (to WTP): 100 m^3;
- Airport Deicing Sump: 2 m^3;
- Ammonium Nitrate Sump: 20 m^3;
- Fuel Berms: 60 m^3.

2. June SNP Report

Regulatory monitoring of Snap Lake Mine included the following:

- Air quality monitoring;
- SNP monitoring;
- Visual fuel tank inspections;
- North Pile, ditch and perimeter sump visual inspection;
- Building visual inspection;

2. June SNP Report

Regulatory monitoring of Snap Lake Mine included the following:

- North Pile thermistor and piezometer monitoring;
- Meteorological data downloads;
- Dam and Water Management Pond visual monitoring;
- North Pile ditch and sump visual monitoring;
- Wildlife surveillance.

2. June SNP Report

- Water Monitoring Analysis Results reported for:
  - **SNP 02-02,** North Pile Drainage Collection Ditch;
  - **SNP 02-03.1,** Core Facilities Area Collection Ditch near Water Management Pond;
  - **SNP 02-04.1 & 02-04.2 & 02-04.3,** Uncontrolled Surface Runoff at Culvert by Air Strip;
  - **SNP 02-05,** Uncontrolled Surface Runoff at Bulk Sample Mine Rock Pad;

2. June SNP Report

- Water Monitoring Analysis Results reported for:

  - **SNP 02-06,** Uncontrolled Surface Runoff at Quarry Site;

  - **SNP 02-07-1,2 & 3,** Uncontrolled Surface Runoff at Road to Bulk Emulsion Plant;

  - **SNP 02-8**, Uncontrolled Surface Runoff at Winter Access Road;

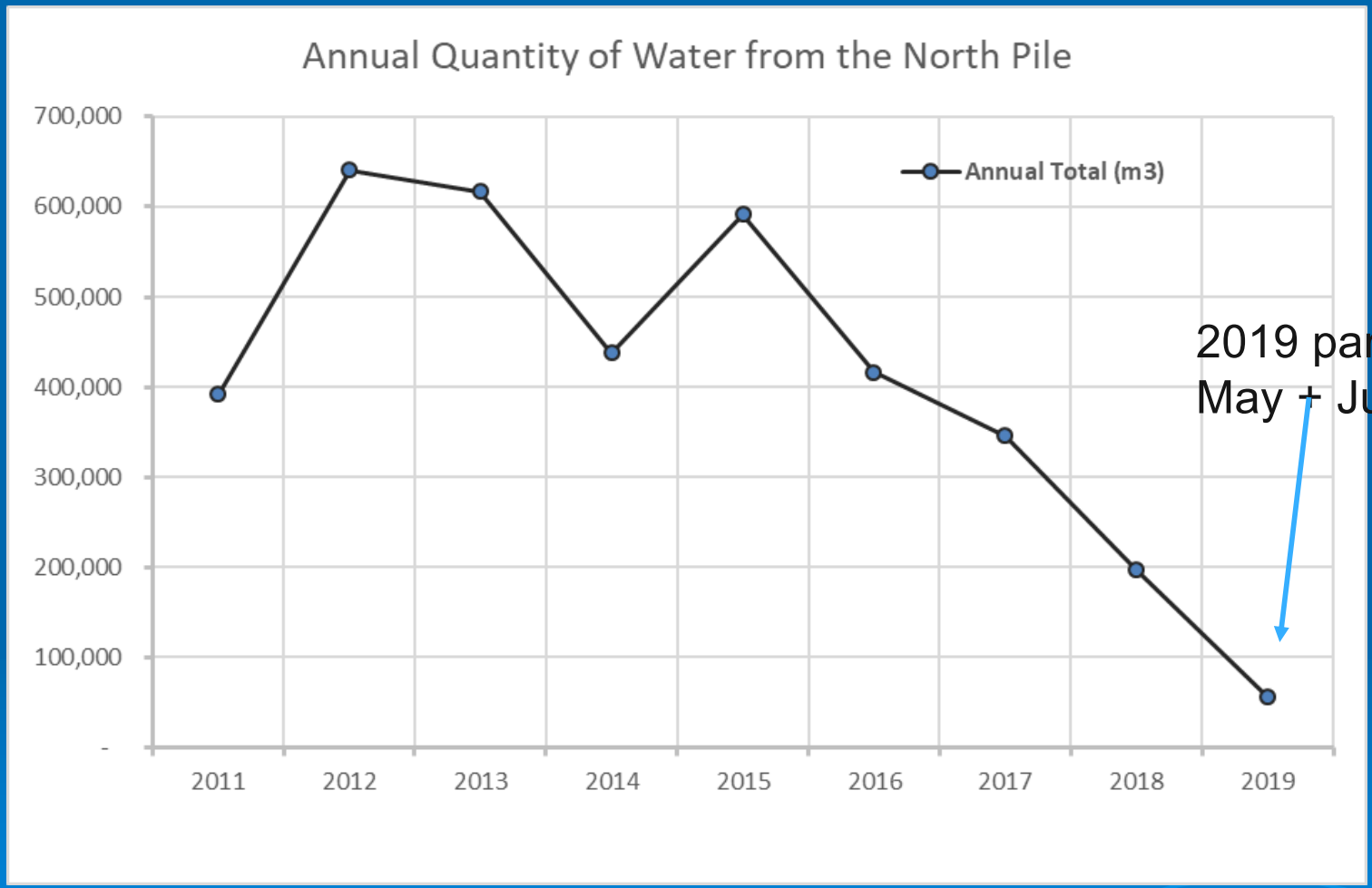
  - **SNP 02-09, 02-09.1, 2, 3, 4 & 5 Un**controlled Surface Runoff at Emulsion Plant Area;

2. June SNP Report

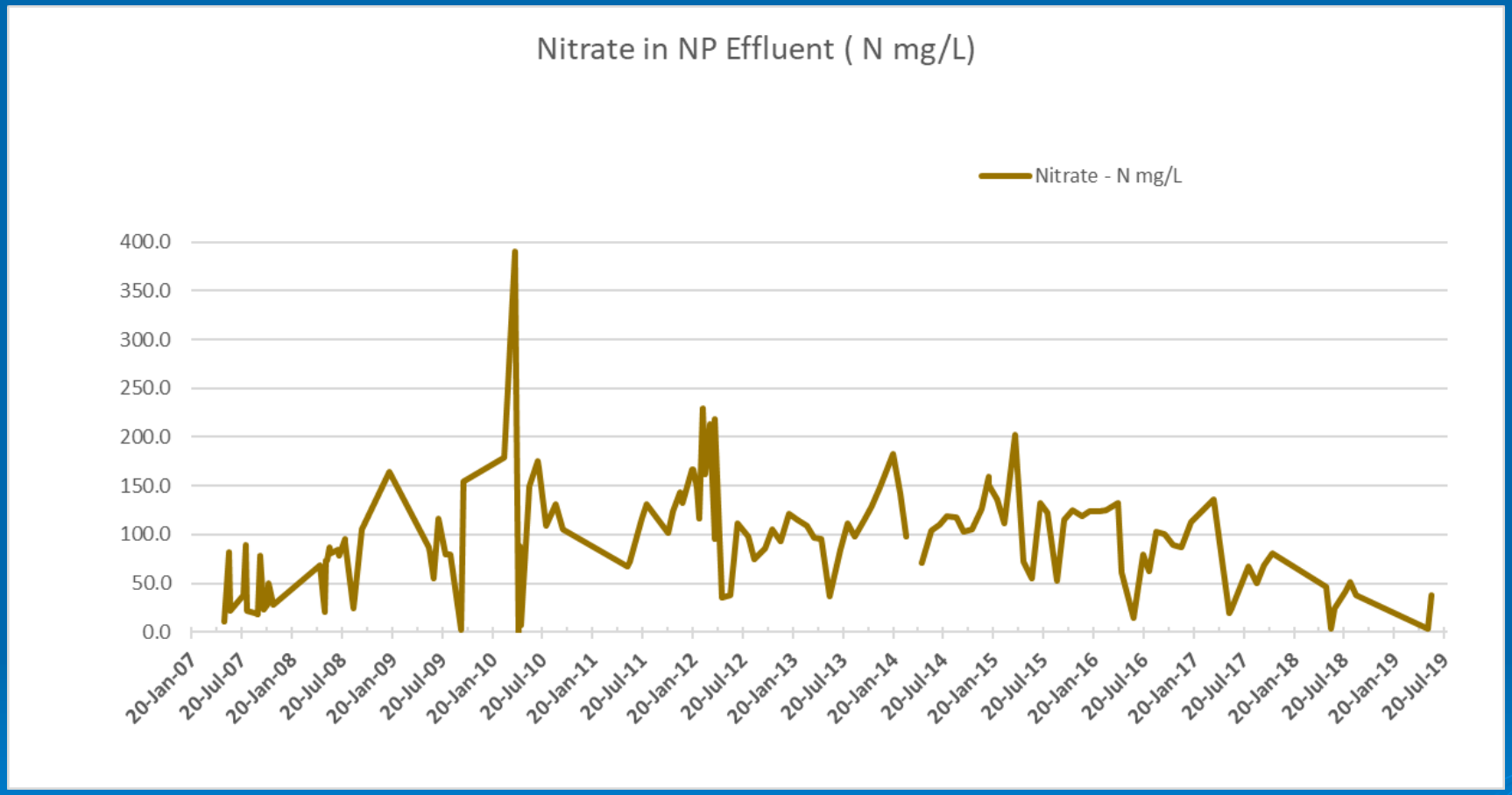
- Water Monitoring analysis results reported for:

  - **SNP 02-10,** any other observed flow to SL
  - **SNP 02-14,** Water Management Pond**;**
  - **SNP 2-15,** Water Intake from Snap Lake;
  - **SNP 02-16i**, Sewage Discharge from Sewage Treatment Plant;
  - **SNP 02-17b** Final Combined WTP

2. June SNP Report



2. June SNP Report



3. Inspection Report

No Inspection Report was submitted in July

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- <u>UPDATE #1 July 3, 2019 DeBeers's Correspondence on Two Outstanding Items for Delivery Prior to the Technical Session</u>

1) Technical Memo of Updated Predictions for the Future Mixing Zone in Response to ENR and ECC Recommendation to Provide Updated Mixing Predictions for 50m, 100m and 200m from Shore Where Effluent Will Be Released Post-Closure;

2) An Update to Table 5.2 from the Final Closure and Reclamation Plan (Closure Objectives, Criteria and Method of Measurement to Evaluate Achievement of Criteria)

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #2 – July 11 MVLWB's Correspondence on Participation of Florence Catholique in Board Decision-Making

The MVLWB has indicated that it is of the view of the Board that no bias or conflict exists in the case of Ms. Florence Catholique acting as member of the MVLWB in De Beers' Snap Lake Closure Project.

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #2 – July 11 MVLWB's Correspondence on Participation of Florence Catholique in Board Decision-Making

Ms. Catholique is currently the Impact Benefits Agreement ("IBA") implementation coordinator for the Band Council in Lutsel'ke.

She has no direct responsibility in relation to the De Beers' IBA and was not responsible for negotiating the Snap Lake IBA between De Beers and Lutsel'ke.

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #2 – July 11 MVLWB's Correspondence on Participation of Florence Catholique in Board Decision-Making

Ms. Catholique plays no direct role in relation to socio-economic or environmental matters related the De Beers' Gahcho Kue mine.

Ms. Catholique and Board counsel have reviewed her involvement in matters related to the De Beers applications currently before the Board and concluded that no bias or conflict exists in this case.

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #3 - Technical Session

On July 17, 18 & 19 a Technical Session was held in YK hosted by the MVLWB in order to provide parties a place to discuss issues related to Snap Lake Mine Closure Project.

Outcomes of the Technical Session:

Parties discussed their concerns regarding the applications directly with the proponent and its consultants. The discussions helped to better understand the Project main issues as well as the perspectives of others;

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #3 - Technical Session

Outcomes of the Technical Session :

- Some issues were resolved during the session;
- Parties gathered information to submit evidence to the Board that can be used to establish water licence and land use permit conditions;
- A table with information request (IR) was elaborated with deadline on August 6 and 22 for DeBeers to answer the IR

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #3 - Technical Session

Topics discussed during the Tech Session:

- Final Closure and Reclamation Plan (FCRP)
  - Closure Objectives and Criteria;
  - Monitoring.
- North Pile and Water Management
  - Geochemistry;
  - Material Balance;
  - North Pile and Water Management

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #3 - Technical Session

Topics discussed during the Tech Session:

- North Pile and Water Management
  - Water quality;
  - Permafrost;
  - Influent Storage Pond;
  - Wetland;
  - Monitoring;
  - Climate Change.

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #3 - Technical Session

Topics discussed during the Tech Session:

- Water Modelling & EQC
  - Water Quality and Quantity;
  - Mixing Zone;
  - AEMP Benchmark;
  - Model Input & Results;
  - Wetland.

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #3 - Technical Session

Topics discussed during the Tech Session:

- AEMP
  - Re-evaluation Report;
  - Problem Formulation;
  - Method and Analysis;
  - Reporting

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #3 - Technical Session

Topics discussed during the Tech Session:

- Management Plans
  - Spill Contingency Plan;
  - Waste Management Plan;
  - Geochemical Characterization Plan;
  - Air Quality;
  - Wildlife and Vegetation.

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #3 - Technical Session

Topics discussed during the Tech Session:

- Licensing and Permitting
  - Term and Definition;
  - Camp;
  - Plans;
  - Security.

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #3 - Technical Session

Information Request

Topic	IR
1. Definition of Passive Water Treatment System	De Beers to provide an updated definition of Passive Water Treatment System to consider the possibility that constructed wetlands may not be used.
2. Diagram of Overlay of Underground Workings with SNP	De Beers to provide a diagram that overlays the underground workings with SNP Program stations. To provide a diagram that identifies the water discharge locations to underground mine. To provide a diagram that overlay structural geology (including the projection of faults) that contributed to mine water inflow during operations.

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

UPDATE #3 - Technical Session - IR

Topic	IR
3. Sensitivity Analysis of Inflow Concentrations to Underground	De Beers to provide a 3D model prediction to demonstrate the sensitivity to varying concentrations of water treatment plant residuals reporting to Snap Lake via the underground flow path during closure period.
4. Predicted Vs. Actual Water Volume	De Beers to provide a table that summarizes the modelled and actual volume of treated and untreated water discharged to Snap Lake and the underground in 2018 and 2019. Include the volume of water pumped to the water management pond, Snap Lake, underground, water treatment plant, and the volume of water treatment residuals that is pumped underground. De Beers to identify the number of days and months over which this occurred in 2018 and 2019.

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

UPDATE #3 - Technical Session - IR

Topic	IR
5, Water Treatment and Reverse Osmosis Residuals	De Beers to provide a table showing the range of analyte of water treatment plant and reverse osmosis unit residuals being deposited to the Snap Lake underground workings.
6. EQC Report and Water Quality Model Report	De Beers to provide updated Effluent Quality Criteria (EQC) Report and Snap Lake Water Quality Model Report that reflect the revised proposed EQC. The due date for this item is **August 20, 2019**.

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

UPDATE #3 - Technical Session - IR

Topic	IR
7. Rationale for Model Input	De Beers to provide the rationale as to why the lowest background concentration in Snap Lake was used for input into the model, instead of the highest background concentration in equation 3 of the supplemental information dated July 3, 2019. Discuss the modelling implications when using background concentrations at the start of the post-closure period. De Beers to provide the effects of density using the 5_{th} and 95_{th} percentile of TDS concentrations and how it affects dilution factors.

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #3 - Technical Session

Two of the issues discussed during the TS and raised by SLEMA will be incorporated to the WL as a condition as per MVLWB; they are:

1) Maintain current SNP monitoring stations and add some others aimed to reflect impact (if any) to the runoff water quality at site due to closure activities;

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #3 - Technical Session

2) The submission to the MVLWB of a Final Closure Reclamation Report at the time that De Beers finalize its closure activities at site.

This final Reclamation Report will be used to determine if the final reclamation of Snap Lake Mine is proceeding as predicted or if additional mitigation measures and more monitoring is required.

5. Environmental Agreement Update

- UPDATE #1 July 15, 2019 ENR's Letter Concerning Decreased Additional Security Deposit Adjustments

As consequence of De Beers request on August 8,2018 to ENR-NWT to review the securities held under the Agreement, on April 1, 2019 the GNWT informed that as per its review the Snap Lake ASD was over-secured and that adjustment would require amendment of the Agreement.

5. Environmental Agreement Update

- UPDATE #1 July 15, 2019 ENR's Letter Concerning Decreased Additional Security Deposit Adjustments

The GNT found that ADS could be reduced from $20 million to $17,743,333.08 based on a trough assessment of liabilities related to the mine site.

Without an amendment of the Agreement, the Minister does not have the authority to issue reasons for decision and thus cannot proceed with rectifying the ADS account.

5. Environmental Agreement Update

- UPDATE #1 July 15, 2019 ENR's Letter Concerning Decreased Additional Security Deposit Adjustments

The proposed amendment is to allow for returning funds associated with the Additional Security Deposit of Clause 12.1 (c) iii. , that as it is expressed does not allow for returning of funds.

The GNT has requested the Agreement signatories to review and sign the Addendum Agreement by August 16, 209.

6. Aboriginal Update: No Update

7. SLEMA UPDATE

- On July 8, 2019 SLEMA's Board ED via email asked the MVLWB whether the Board intends to hold a public hearing or any public session in the affected communities outside of Yellowknife

- MVLWB answered that they haven't planned to hold any public session outside of YK;

7. SLEMA UPDATE

- On July 17, 18 &19, 2019 SLEMA's ED and Technical Advisor attended the Snap Lake Mine Closure Project Tech Session;

7. Case Study: Lake Eutrophication

7. Case Study: Lake Eutrophication

1) The Issue:

- De Beers studies at Snap Lake Mine concluded that nitrate (NO_3^-) is the most likely chemical parameter in the final effluent requiring treatment at post closure;

- Therefore, a proposed Closure and Post Closure Effluent Quality Guideline was developed for nitrate

7. Case Study: Lake Eutrophication

- What are the effects of nitrate in lake water?

Main issue associated to nitrate concentrations in water bodies is *eutrophication.*

- What is eutrophication?

Eutrophication is an enrichment of water by nutrient salts (salts of nitrogen and phosphorus) that causes structural changes to the aquatic ecosystem.

7. Case Study: Lake Eutrophication

- Eutrophication consequences in a lake:

Increase production of algae and aquatic plants;

Depletes fish species;

Deteriorates water quality;

Plus other effects that reduce and preclude water use.

- Natural and Cultural Eutrophication

All water bodies are subject to a natural and slow eutrophication process

7. Case Study: Lake Eutrophication

- Natural and Cultural Eutrophication

The continue increases of nitrate and phosphate in water caused by men activities until they exceed the capacity of the water body or the capacity of a lake to purify itself triggering structural changes in the waters is called Cultural Eutrophication.

- Effects of Eutrophication

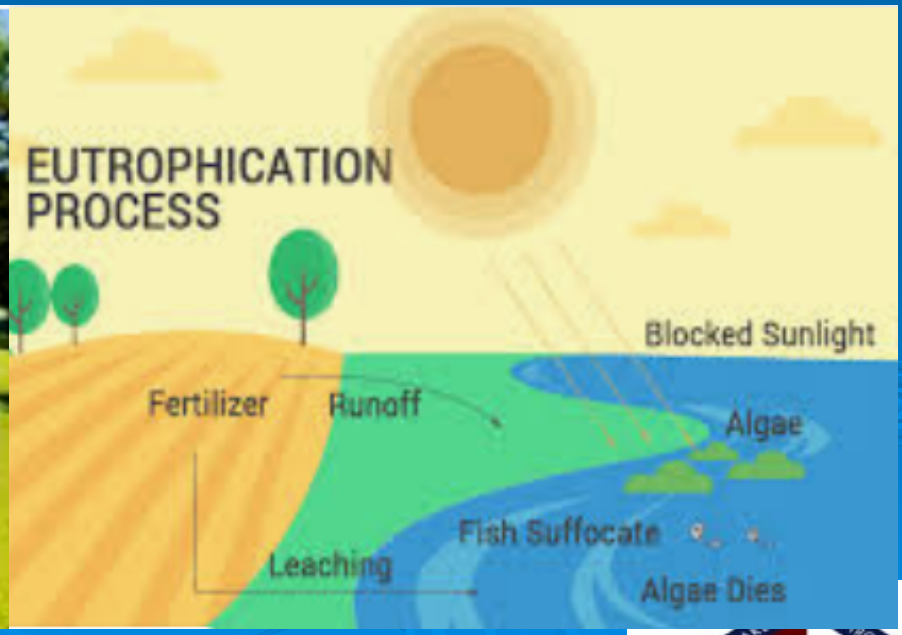
The two most acute effects are hypoxia in the deep part of the lake (or lack of oxygen) and algal blooms that produce harmful toxins, processes that can destroy aquatic life in the affected areas

7. Case Study: Lake Eutrophication

- Other Effects of Eutrophication

Disagreeable odor or taste of the water given by the abundance of organic substances;

Disappearance or significant reduction of quality fish, etc.



7. Case Study: Lake Eutrophication

- Example of Lake Eutrophication in Cold Weather

Winnipeg Lake

Meretta Lake, Cornwallis Island

The eutrophication of both lakes is the result of the discharge of untreated sewage effluent and therefore effluent with high content of nitrate and phosphorus.