SLEMA
May 2011
Environmental Update

Zhong Liu

May 31, 2011

Outline

1. Mine Update
2. Inspection Update
3. Regulators Update
4. Stakeholders' Update
5. Reviews

Acronyms

- AEMP – Aquatic Effects Monitoring Program
- ARD – Acid Rock Drainage
- DFO – Fisheries and Oceans Canada
- EC – Environment Canada
- ENR – Department of Environment and Natural Resources, GNWT
- GNWT – Government of the Northwest Territories
- INAC – India and Northern Affairs Canada
- MVLWB – Mackenzie Valley Land and Water Board
- PK – Processed Kimberlite
- SLEMA – Snap Lake Environmental Monitoring Agency
- SNP – Surveillance Network Program
- TDS – Total Dissolved Solids
- WEMP – Wildlife Effects Monitoring Program
- WTP – Water Treatment Plant
- WMP – Water Management Pond

1.1 Mine Update – April 2011

- Production rate: 55.8 % of its capacity (52,755 tonnes of kimberlite processed)
  - Extended maintenance shutdown of the Process Plant from April 21 to 25, 2011
- 5,620 m^3 of water withdrawn from Snap Lake
  - 3,056 m^3 for site operations and 2,564 m^3 for Drilling Program
- 624,282 m^3 of treated water discharged into Snap Lake
- 45,047 tonnes of coarse reject and 22,282 tonnes of fine fragment solids deposited in the North Pile as slimes
- 6 spills (3 reportable)
- Water sampled in 5 monitoring stations
  - The monthly average for all parameters met compliance except
    - One grab sample exceeding the criteria for Faecal Coliform
- Construction of the East Cell continued
  - Deposition of PK grits for the rib-berms

1.2 Mine Closure Workshop

- May 4, 2010
- Participants
  - Staff from De Beers and De Beers consultant (Arktis Solutions Ltd.)
  - First Nations representatives from six communities, regulatory representative from INAC, MVLWB, DFO, Environment Canada and GNWT, and representatives from SLEMA
- Comments were made by stakeholders, and the consensus was that major revision to the submitted ICRP is required

1.3 Flumes

- Addressed to DFO on May 24, 2011
- De Beers installed flumes at two locations at outflows of Snap Lake to measure water balance in July/August 2010, and would like to leave the flume in place for another year
  - DFO policies on working in water will be followed
  - Following freshet in the spring of 2012, the flumes will be removed
- Comment from the Environmental Analyst
  - The impacts will be temporary and very limited

1.4 Response to Concern on the Landfarm

- Addressed to the INAC Inspector on May 24, 2011
  - The land farm has not been commissioned to date due to a lack of an operational manual and a lack of personnel to operate the facility
    - An operations manual is to be completed in draft by October 31, 2011
  - Until the land farm is commissioned, all contaminated soil will continue to be shipped off site

1.5 Ammonia Nitrate Pad Reclamation Risk Analysis Table

- Addressed to the INAC Inspector on May 24, 2011
- Six options briefly analyzed in the table
- “As per the risk analysis the most cost and environmentally effective method for use of ¾” gravel is concrete within the underground and use within the starter cell. The Inspector raised concerns over using gravel to create roads underground, so this option has been ruled out”

1.6 Update of 2010 Annual Mine Reclamation Status Report

- May 24, 2011
  - Added one section to address the Board and Regulator concerns
- Comments from the Environmental Analyst
  - Some new information provided, such as
    - Research results and future plans for PK paste development
    - Closure objectives for mine facilities (from 2011 ICRP)
  - Identified a lot of editorial problems, such as
    - Wrong page number of some sections in the Table of Contents

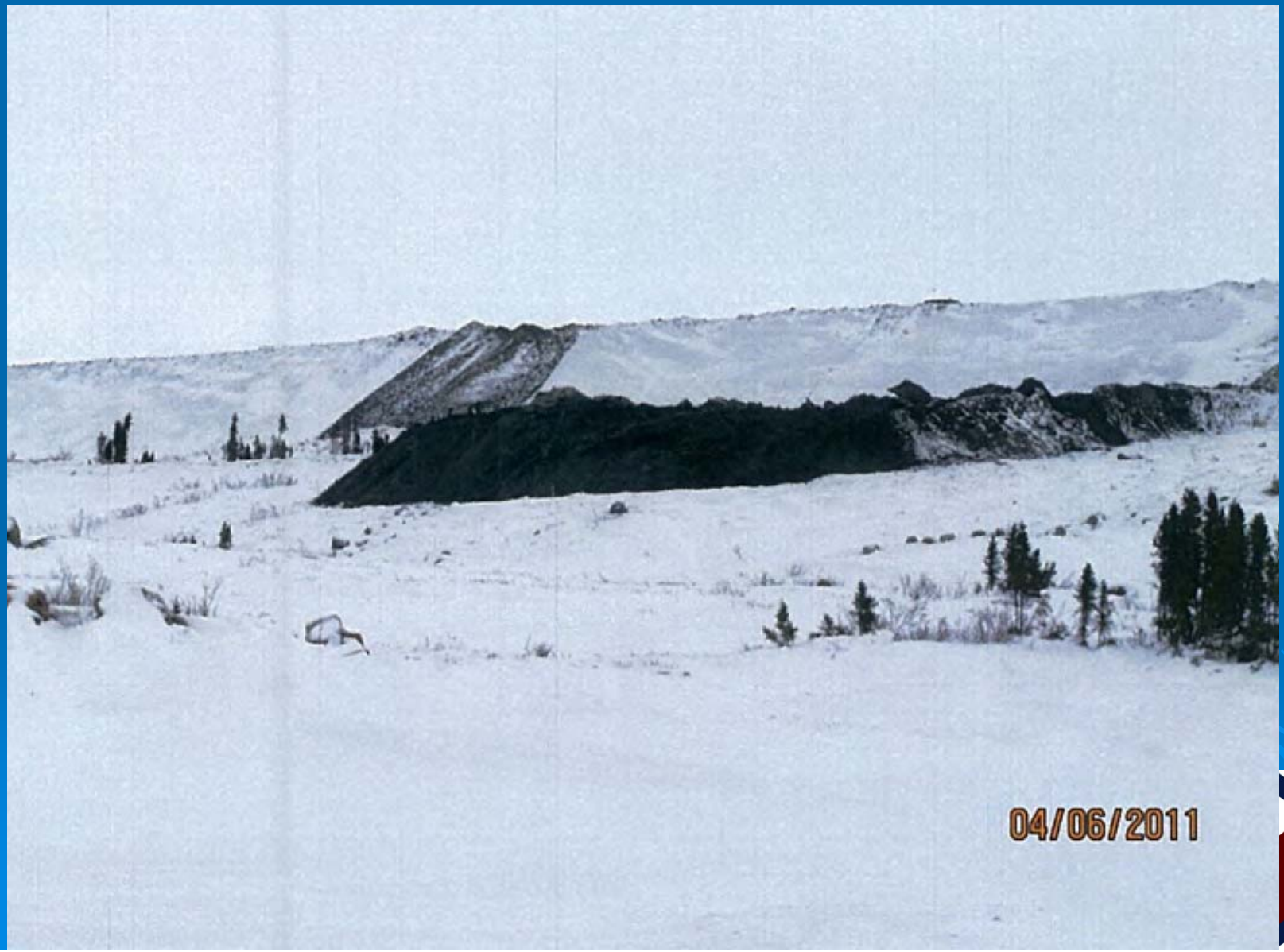
2. Inspection Update

- INAC Inspector – Tracy Covey
- Water Licence Inspection
  - April 6, 2011
- Land Use Permit Inspection
  - April 6, 2011

2.1 Water Licence Inspection

- Dated Arpil 6, 2011
- Inspected fuel storage, winter road, the North Pile, security requirements (water management), waste management, and Closure and Reclamation Plan
- Environmental risks identified in previous inspections remains
  - Landfarming practices
  - Reclamation research
  - Diffuser line
  - Elevated ammonia situation at the historic AN storage pad

Initial construction of internal walls of the East Cell



Removal of PAG rock identified through ARD monitoring from the test pit area

Diffuser (note the larger dispersion hole in the near-shore ice than at the ice above the diffuser end)

2.2 LUP Inspection

- Dated April 6, 2011
- Inspected the winter road, drill activity, waste management, and fuel storage, Closure Plan
- Two environmental risk noted
  - The storage of lubes adjacent of the Water Management Pond (WMP) should be relocated to a lined facility
  - 5 spills of drill water onto the ice at Snap Lake should be reported to the NWT Spill Line

Improved Traction and Driveability of Sections of Concern on Portage 1 and 4 of the Winter Road

Poly-Drill Separator (part of the closed-circuit drill system which allows cuttings to filter/settle out without the addition of chemicals

Only Approved Materials such as Cardboard and Wood was Observed in the Burn Pit

2.3 AN Pad Remediation and Reclamation

- Inspector letter issued on May 13, 2011
- The Inspector could not support the proposed option– transferring contaminated fill from the AN pad to the underground road surfaces
  - Recommendation – to know the nature of the AN fill through testing and then determine the fate of the material
  - Question – what are the alternatives

3. Regulator Update

- MVLWB
  - Report review – due on June 1, 2011
    - Interim Mine Closure and Reclamation Plan (ICRP)

4. Stakeholders' Update

- Preliminary Comments on Interim Mine Closure and Reclamation Plan (ICRP) by
  - Environment Canada (EC)
  - Environment and Natural Resources (ENR), GNWT
  - INAC
  - DFO

  On April 29, 2011
- YKDFN commented the ICRP on May 13

4.1 EC Comments on ICRP

- Overall, the plan was found to be lacking in detail and clarity, especially the section outlining the closure objectives and criteria
- The Water Treatment Plant is schedueld to be demolished approximately 1 year after the end of operations, before the North Pile is finished or underground has been allowed to flood, this seems ambitious

4.2 ENR Comments on ICRP

- No comments or recommendations at this time

4.3 INAC Comments on ICRP

- Preliminary comments on general content on the main issues that have not been addressed in the ICRP
  - The implication of extended periods of PK slurry discharge to the North Pile
  - The North Pile not included in the water balance discussion
  - Research plan lacking in detail

4.4 DFO Comments on ICRP

- Closure criteria should be developed for each mine component; closure options should be included for each mine component
- Minewater outlet and diffuser are not in the ICRP
- Information about the closure of the water management pond, roadways and airstrip should be detailed

4.4 DFO Comments on ICRP

- Timeframes for monitoring should be results based and not chronologically based
- Reclamation of aquatic habitat, and active re-vegetation should be incorporated in the ICRP
- De Beers and the other diamond mining companies could pool resources and work together to address common closure research objectives

4.5 YKDFN Comments on ICRP

- Dated May 13, 2011
- The submission found to be deficient and should not be accepted for review
  - Not contribute to the clarity or vision of the final closure
  - Too many outstanding deficiencies
  - No community input on the vision for the final mine site
- Comment Table (14 pages) attached

5. Reviews

- 2010 Water Licence Annual Report (WLAR 2010)
  - 2010 Acid Rock Drainage (ARD) and Geochemistry Monitoring Report (ARD 2010)
  - 2010 Dam Inspection Report
- 2010 Aquatic Effects Monitoring Program Report (AEMP 2010)
  - Submitted on March 31, 2011
- Interim Mine Closure and Reclamation Plan
  - Submitted on April 8, 2011

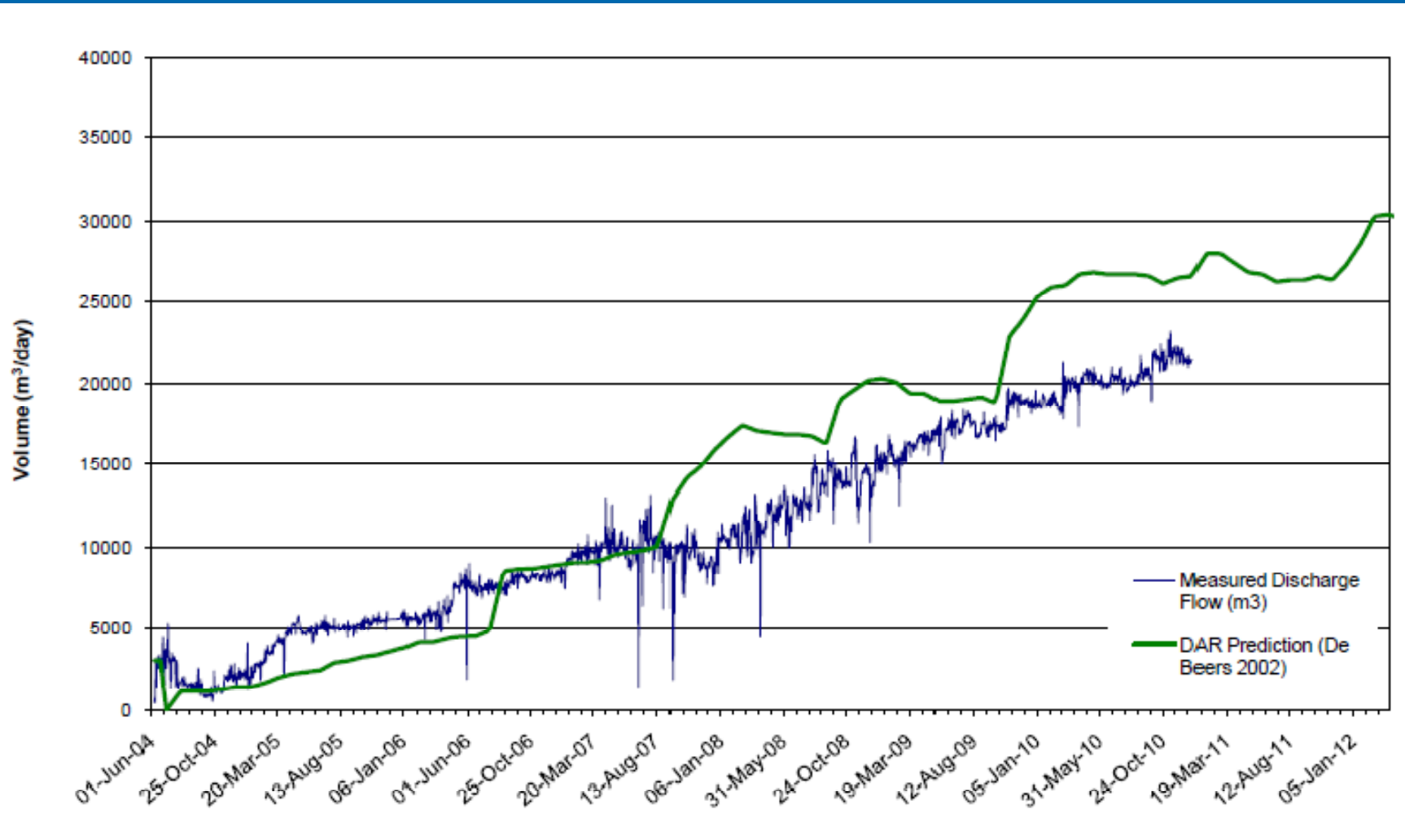
5.0 Documents Being Reviewed

- Adaptive Management Plan
  - Updated on April 29, 2011
- Update of 2010 Annual Mine Reclamation Status Report
  - Submitted on May 24, 2011

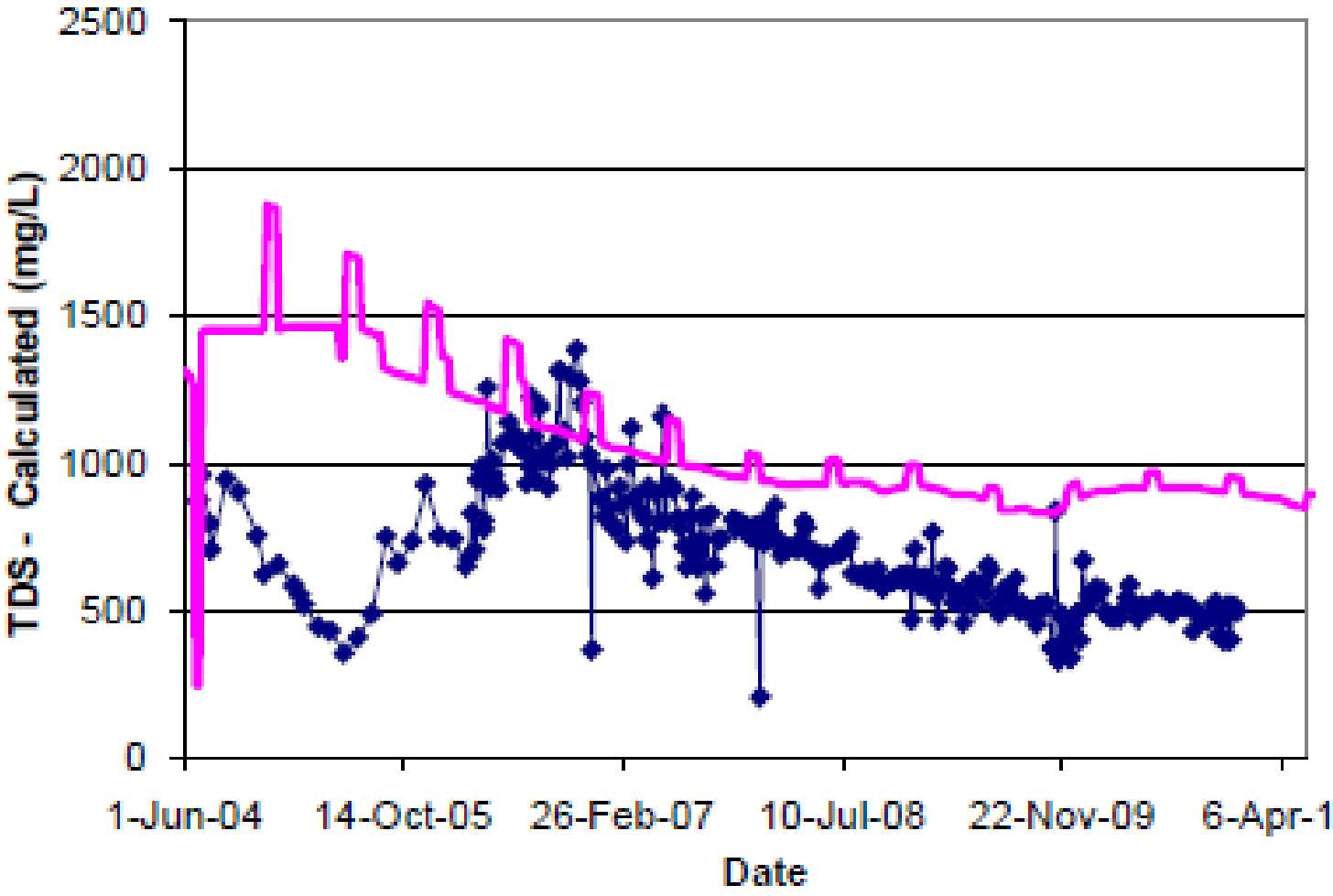
5.1 ARD 2010

- Total dissolved solids (TDS) loading trends were less than the EAR predicted values by the end of the 2010 monitoring period
- With the exception of rock observed at the Fresh Air Raise (FAR), no visible signs of sulphide oxidation or incipient ARD were observed in rock exposed in rock pads, roads, building foundations, and laydowns during the September 2010 site inspection. The results of geochemical characterization of mine rock samples were consistent with the observed ARD results and trends in mine rock/construction rock geochemistry in the EAR and previous annual reporting periods

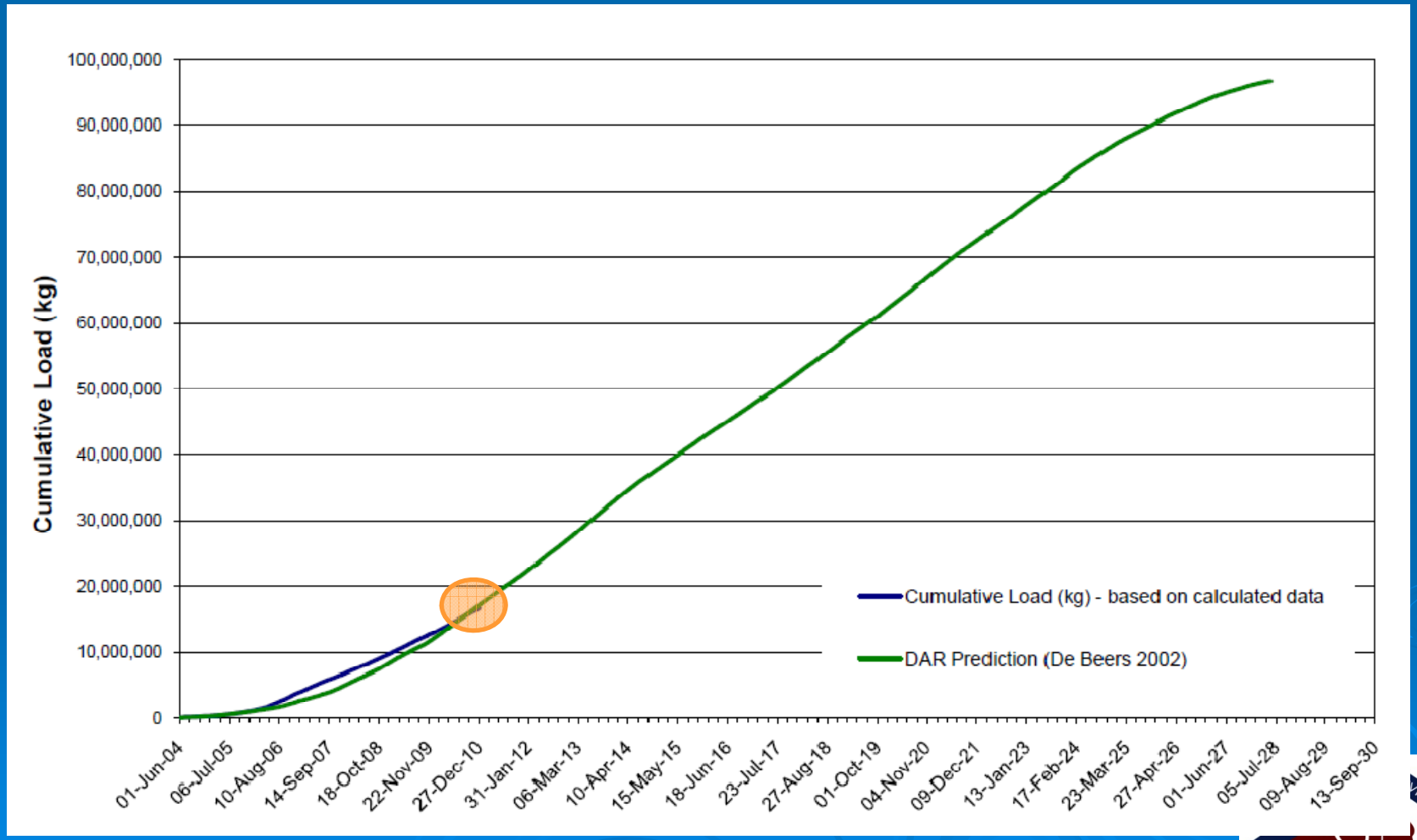
Minewater Inflow Rates



TDS in Minewater



TDS Loadings



Seepage from the North Pile could be resulting in elevated concentrations of Total Dissolved Solids (TDS), nitrate, nitrite, and ammonia measured in bogs downstream of the North Pile

Station Number	Bog TS1 North	Bog TS2 Northeast	SP 06-05 (North Pile Piezometer)	Bog Outfall Pipe Bench Southeast	Bog PS4 North
Monitoring Area	Starter Cell	Starter Cell	Starter Cell		East Cell
Date	19/09/2010	19/09/2010	10/08/2010	02/06/2010	08/08/2010
TDS, mg/L	1400	1490	2530	29	99.9
Ammonia-N, mg/L	5	12.1	7.7	0.0118	0.324
Nitrate-N, mg/L	128	149	263	0.003	1.76
Nitrite-N, mg/L	0.104	<0.050	5.12	0.001	<0.0020

Environmental Analyst Comments

- The effects of AN residuals from the former AN pad have been a concern of SLEMA
  - The discussion about the issue in ARD 2010 (Section 5.3.5.5) is lack in detail, especially the explanation of the elevated ammonia concentrations at the base of the sump at the former AN pad
  - It is recommended that SLEMA request further investigation about the issue
- In general, the submission is adequate and meets the annual ARD reporting requirement of the Water Licence (MV2001L2-0002)

5.2 2010 Dam Inspection Report

- Summary of August 2010 Geotechnical and Geochemical Site Inspection
- Geotechnical Inspection
  - North Pile (East Cell and Starter Cell)
    - The embankments and water control structures (ditches and sumps) appear to be performing and operating as per the design
  - Water Management Pond (WMP)
    - Both dams appear in satisfactory condition

North Pile Development

- "To date, De Beers had performed limited monitoring of the North Pile development. It is recommended that De Beers fully initiate and implement the monitoring program described by Golder in 2008."
- "De Beers stated that the production of paste is scheduled to occur; however, no specific timing or production rates could be provided. It is strongly recommended that all De Beers' stakeholders in the North Pile, including Golder, participate in a focused discussion/workshop regarding the development of the North Pile using its design basis—"*the Waste Management System can never interrupt or cause a shutdown of the mine or process plant operations*"—as the theme."

Spill #2010-458

- It is stated that the water control structures (ditches and sumps) of the Starter Cell appear to be performing and operating as per the design
- However, one spill occurred on December 10, 2010 indicated a problem in the water control structures of the Starter Cell
- It is recommended that SLEMA request further detail about the spill investigation and related future mitigation measures

Geochemical Inspection

- Observations were made for each of the main site facilities
  - North Pile, WMP, Ammonia Nitrate (AN) Storage Area, Air Strip, and Site Infrastructure east of the WMP
- Rock samples were also collected from the site

Replacement of SNP 02-03

- The water license requires monitoring of site runoff reporting to the WMP at SNP 02-03. SNP 02-03 was formerly located on the eastern perimeter of the WMP
  - Permanently suspended on December 3, 2009, owing to the proximity of the kimberlite stockpile relative to the WMP
  - Since December 2009, the kimberlite ore stockpiles located on the northeastern perimeter of the WMP have been removed
- A potential location for monitoring site runoff to the WMP was identified on the east side of the WMP
- It is recommended that SLEMA support the recommendation of the above location as monitoring station for site runoff and recommend to MVLWB to resume SNP 02-03

Effects of AN Residuals

- Golder collected a total of five rock samples from the former AN storage pad, and would evaluated the presence of soluble AN residuals through short-term leach testing. The results are said to be compared to the results of down-gradient bogs water monitoring in a stand-alone technical memorandum.
- It is recommended that SLEMA request one copy of the aforementioned technical memorandum and get to know the effects of AN residuals in the former AN storage pad.

Environmental Analyst Comments

- In general, this submission is adequate and meets the reporting requirement of geotechnical and geochemical inspection for the Mine site (Water Licence MV2001L2-0002)

5.3 AEMP 2010

- Water Quality
  - Based on the laboratory results from Snap Lake in 2010, there does not appear to be potential for aquatic or human health effects from water quality in Snap Lake. Concentrations for most parameters were below aquatic life and drinking water guidelines, and acute toxicity was not observed in samples collected in 2010

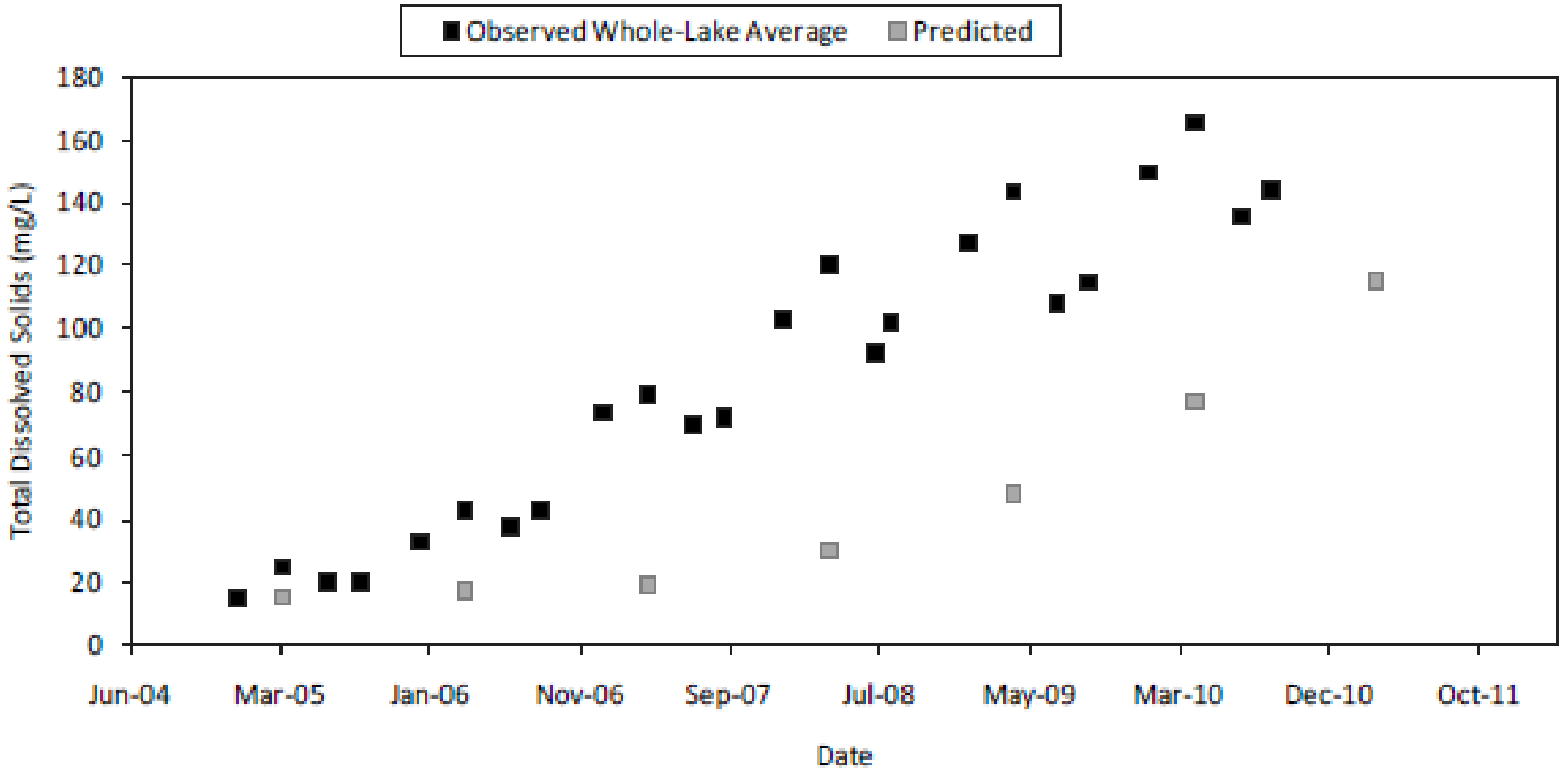
AEMP 2010

- Sediment Quality
  - Evaluation of spatial and temporal trends in sediment quality did not provide clear evidence of an effect on Snap Lake sediments in areas exposed to treated effluent
- Plankton and Benthic Invertebrate Community
  - The 2010 plankton and benthic invertebrate monitoring programs show trends in results that are consistent with slight nutrient enrichment effects to Snap Lake. Slight enrichment effects to Snap Lake are consistent with EAR predictions and are not expected to result in adverse effects to aquatic life in Snap Lake

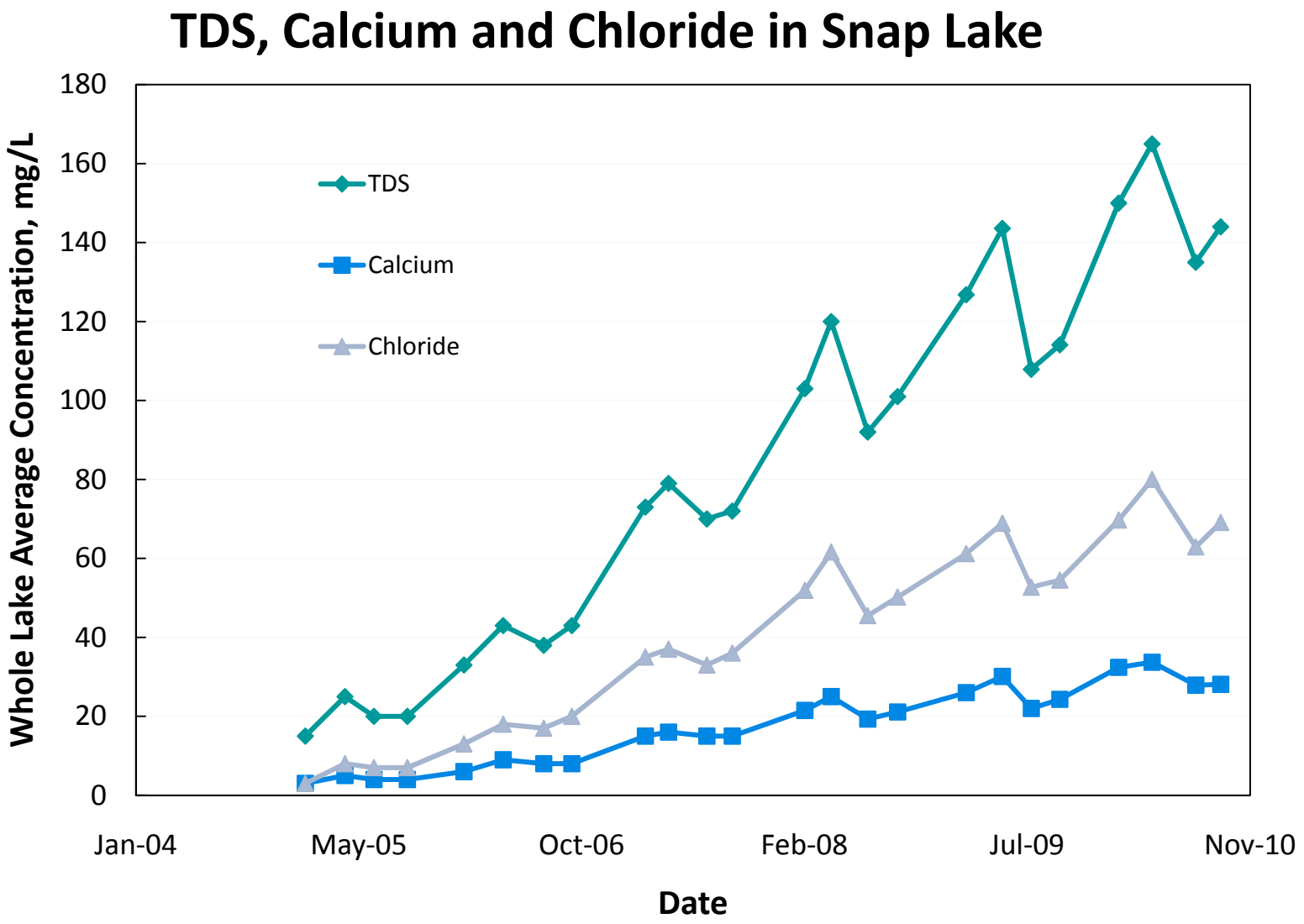
AEMP 2010

- AEMP Effectiveness
  - The 2010 monitoring results demonstrated that the AEMP is able to detect subtle changes in early warning indicators, and allows evaluation of the environmental consequence of changes by comparing them to the EAR predictions and relevant effects benchmarks

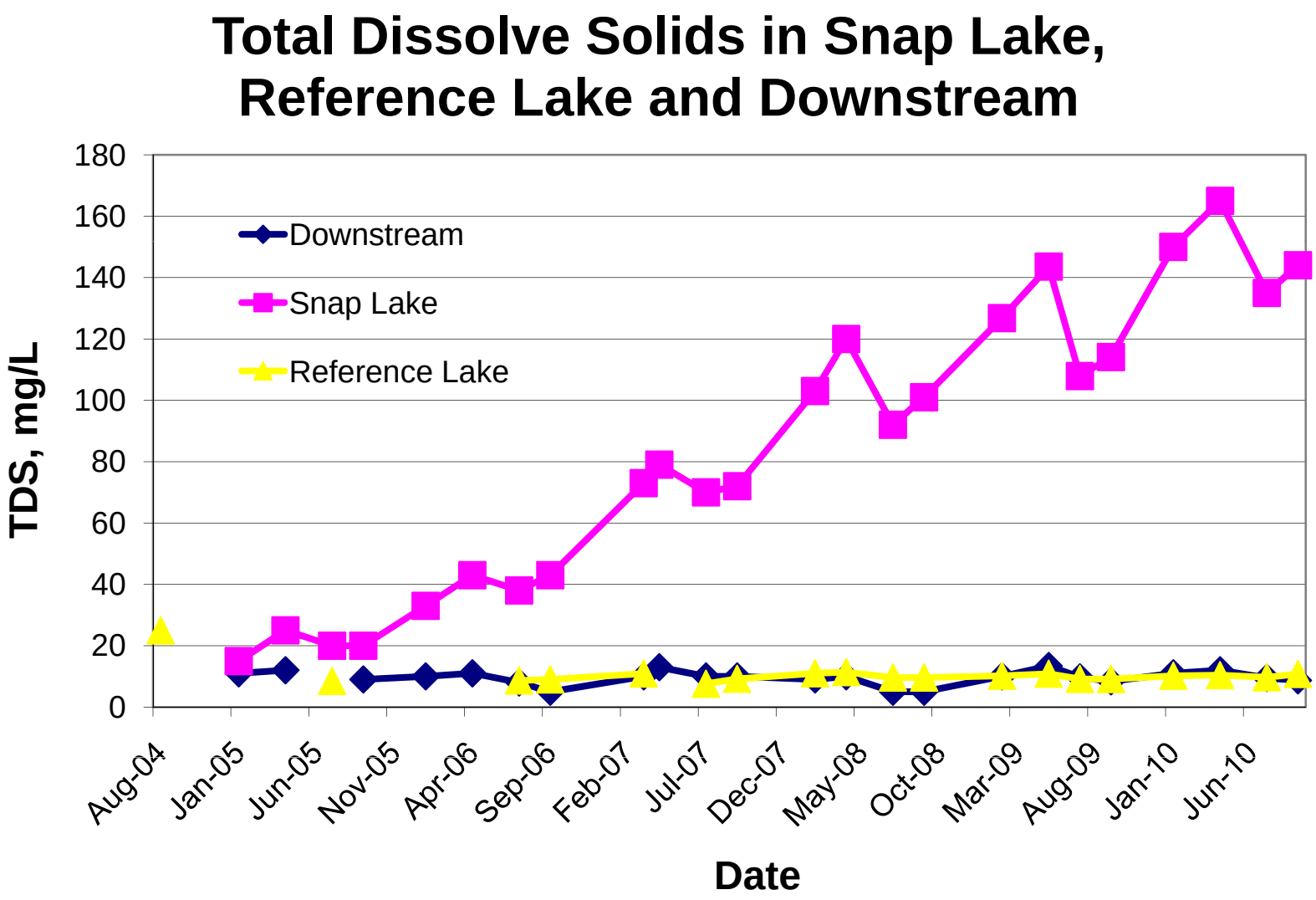
Comparison to EAR Predictions



The levels of calcium and chloride follow the trend of TDS



Comparison with Downstreeam and Northeast Lake



Environmental Analyst Comments

- Section 6 Fish Tasting refers to the 2010 Annual Water License Report (WLAR 2010) for the results of the 2010 Fish Tasting. However, there is no such a section or appendix in the WLAR 2010. It is requested that De Beers provide a report for the results of the 2010 Fish Tasting Program.
- Overall, the Water Quality Section is of good quality, and presents reasonable details on water quality

5.4 Interim Mine Closure and Reclamation Plan

- Submitted on April 8, 2011
  - Update of 2006 version
- Two closure scenarios are considered in this ICRP: temporary closure and permanent closure and reclamation
- The projected environmental conditions after the closure will be
  - Physically altered immediate area of the Mine site due to the mine development
  - Minimal impact on the biodiversity and sustainability of the natural renewable resources of the region and no lasting effect on traditional and non-traditional land use activities in the area

Environmental Analyst Comments

- The terms about objectives used in Section 2.1 seem too many and may confuse readers
  - Macroscopic objectives
  - The goal of reclamation
  - Specific objectives of landscape reclamation
  - Global objectives of reclamation
  - Three categories of site specific reclamation objectives
    - Physical stability, chemical and biological stability, and future land use compatibility
- Some objectives look like reclamation tasks/activities, such as “decommission site roads”

Role of Traditional Knowledge

- Traditional Knowledge should be incorporated into the development and the implementation of the ICRP, and elders could play an important role during the process. Some examples are:
  - Development of the objectives: elders can provide opinions on what they want to see at the mine site 5, 10, 20, 50 and 100 years after the mine closure
  - Development of reclamation options: elders can provide opinions on their preference between natural re-vegetation and active re-vegetation
  - Closure performance evaluation: elders could act as judges and tell whether mine closure is a success through site inspections conducted by elders

Progressive Reclamation

- North Pile is the only facility for progressive reclamation?
- Other potential areas
  - AN pad
  - ARD sites – metavolcanic rock
    - Fresh Air Raise (FAR)
    - Bulk Sample Mine Rock Pad (BSMRP)
  - Underground mine – backfill paste to fill the mining voids

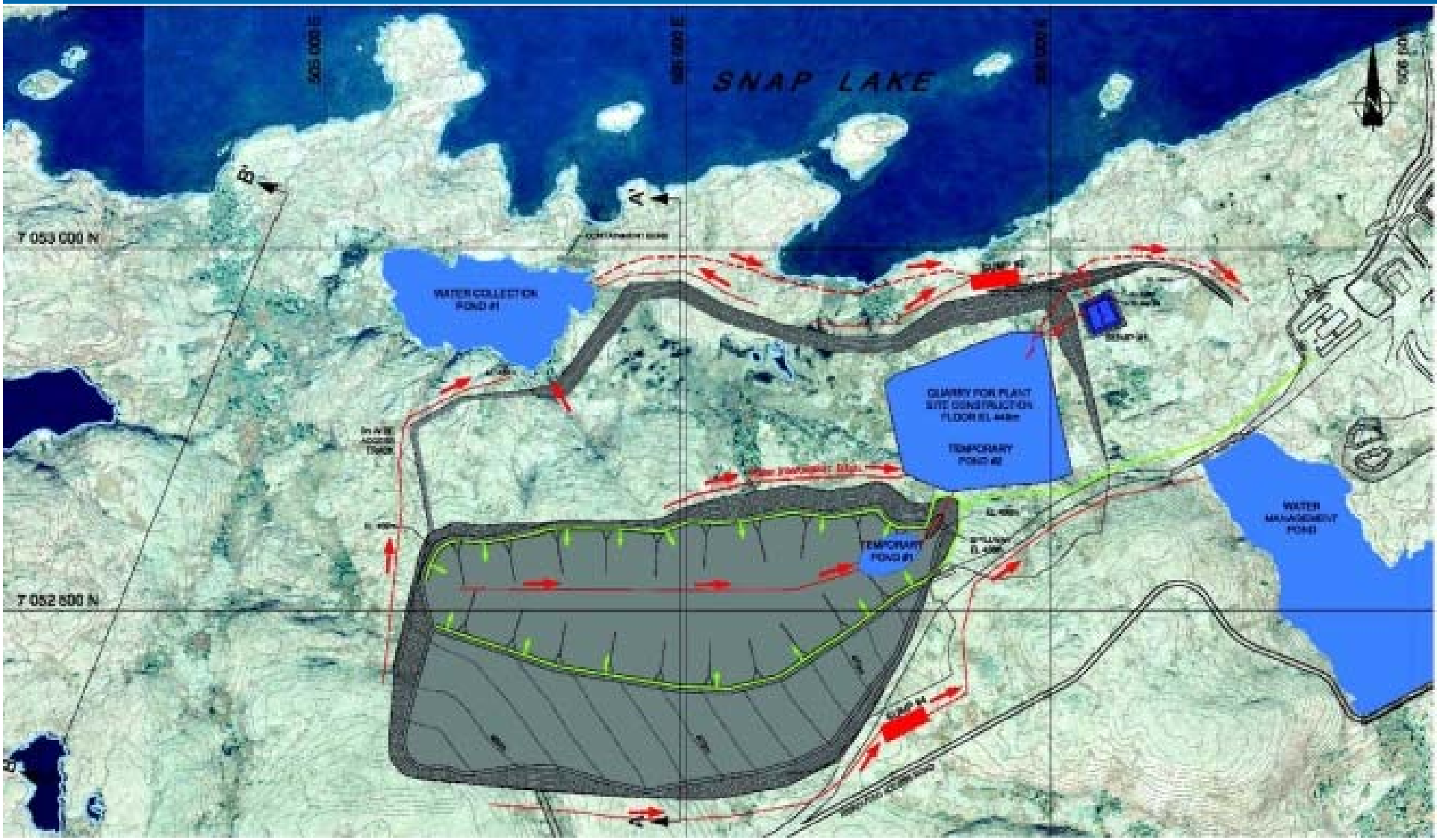
Other Concerns

- Current progressive reclamation practices are not displayed in Figure 12 to 18 . The figures must be updated to represent the changes
- Water management/treatment before and after mine closure
- Schedule conflict within the closure process and post-closure process

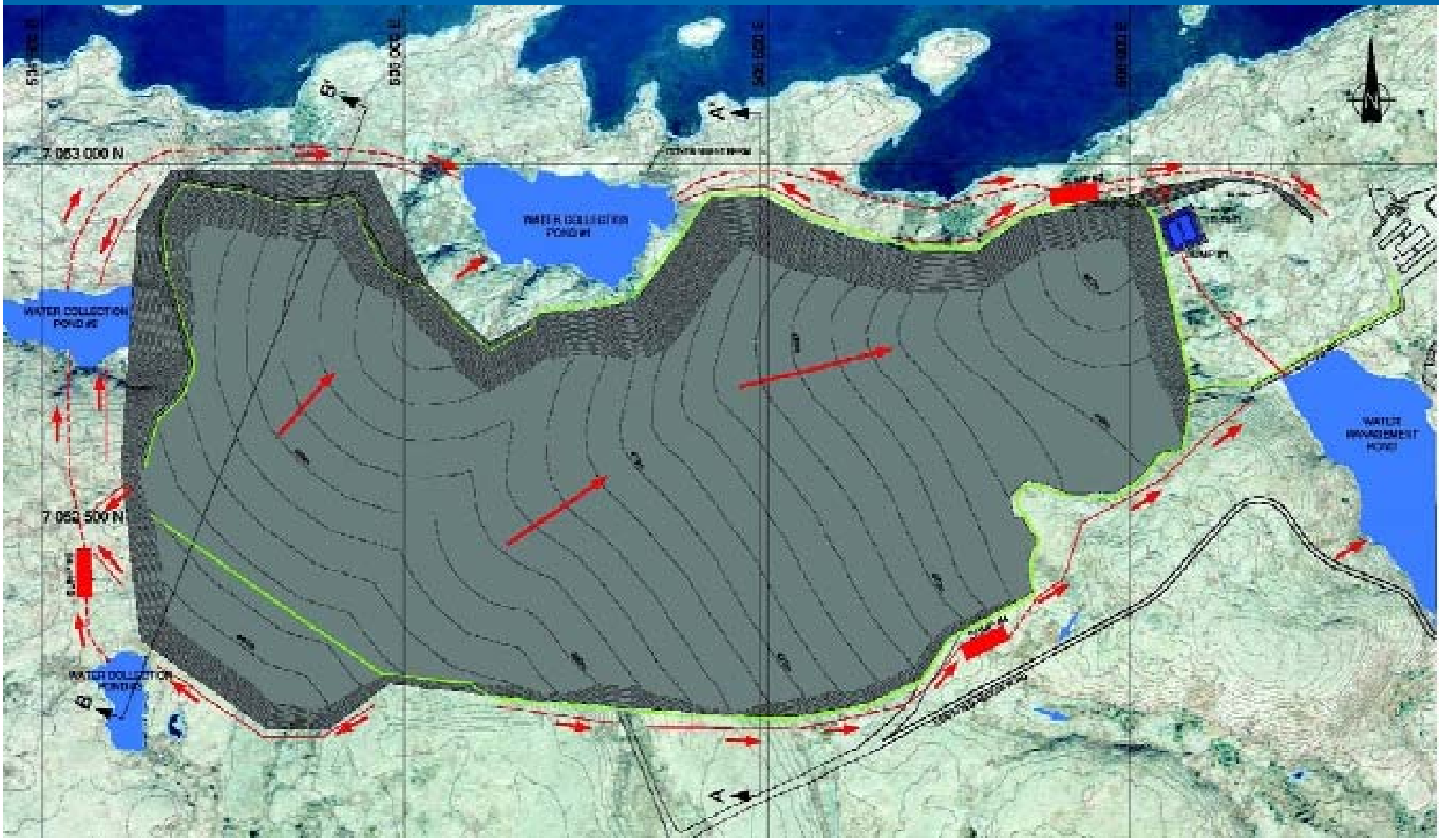
North Pile

SNAP LAKE
SP5
(under construction)
IL5
SP4
(under construction)
SP3
(under construction)
TS3
TS2
EAST CELL
(future development)
TS4
Landfarm
TS1
STARTER CELL
Apron Quarry
South Quarry
(previous development)
SP2
SP1
Organic stockpile

North Pile – Year 2



North Pile – Year 22



Environmental Analyst Comment Conclusion

- The submission looks like a draft. The goal, objectives and criteria should be clearly defined, more details such as progressive reclamation should be added, and updates such as figures of the North Pile closure process should be done