



June 2015
Environmental Update
for SLEMA Board

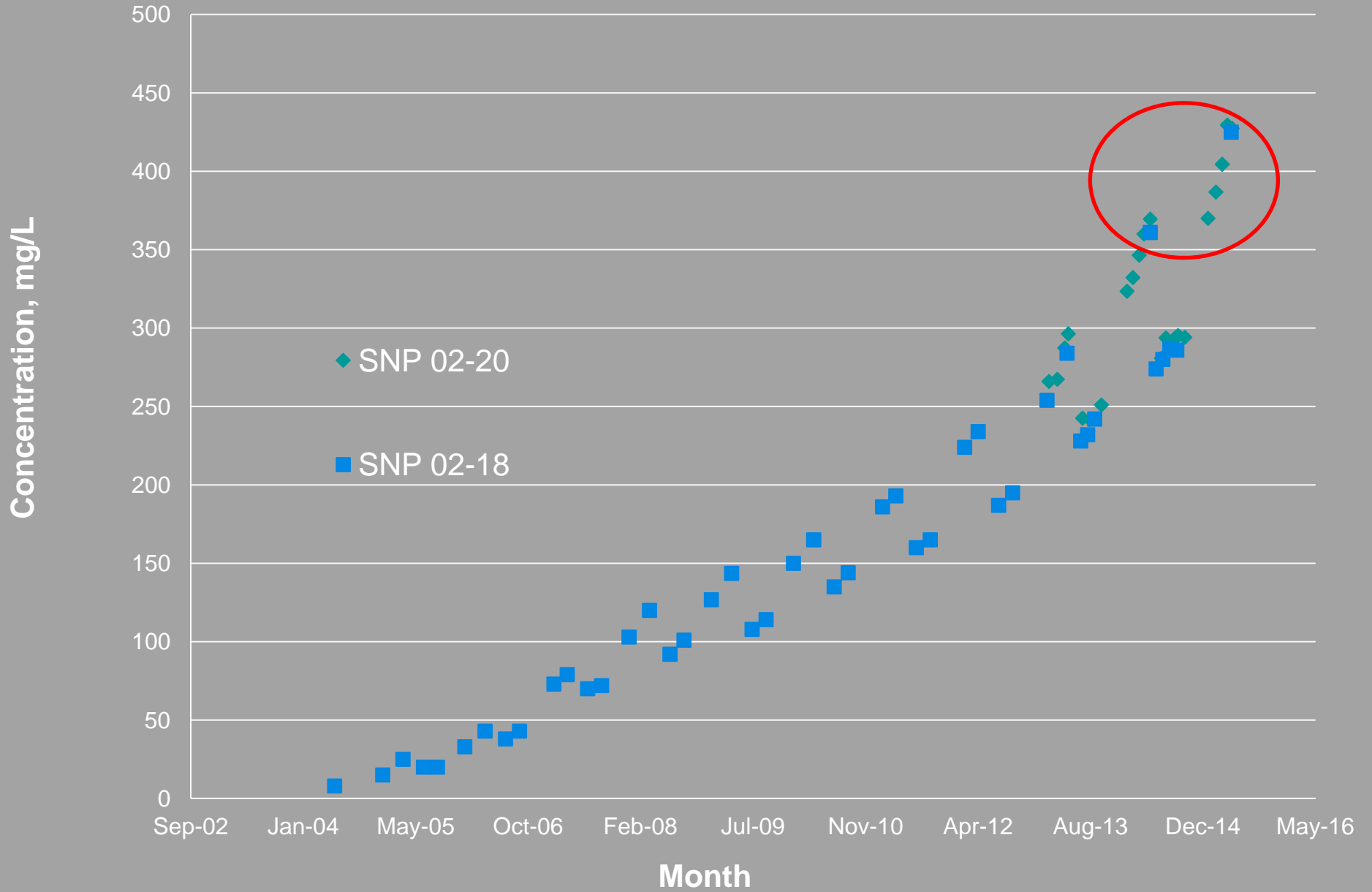
Zhong Liu
June 30, 2015

Highlights

- The MVLWB completed its regulatory process for the amendment of the De Beers Canada Inc. Type A Water Licence MV2011L2-0004 for the Snap Lake Mine, at Snap Lake, NT, submitted December 20, 2013. On June 8, 2015, a motion was passed by the Board to forward the amended Water Licence and Reasons for Decision to the ERN Minister for his approval
 - The MVLWB sent the amended Water Licence MV2011L2-0004 and Reasons for Decision to the ERN Minister for his approval on June 19
 - The MVLWB accepted De Beers proposed EQC with minor modifications



TDS Levels in Snap Lake



Outline

1. Mine Update
2. Inspection Update
3. Regulators' Update
4. Aboriginal Update
5. Stakeholders' Update
6. Agency's Activities
7. SLEMA Reviews
8. Water Licence Amendment Application



Acronyms

- AANDC – Aboriginal Affairs and Northern Development Canada
- AEMP – Aquatic Effects Monitoring Program
- ARD – Acid Rock Drainage
- DFO – Fisheries and Oceans Canada
- CCME – Canadian Council of Ministers of the Environment
- CEQG – Canadian Environmental Quality Guidelines
- EC – Environment Canada
- ENR – Department of Environment and Natural Resources, GNWT
- EQC – Effluent Quality Criterion
- GNWT – Government of the Northwest Territories
- 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



1.1 Mine Update – May 2015

- Production rate: 105.6% of its capacity (103,125 tonnes of kimberlite processed)
- 6,608 m³ of water withdrawn from Snap Lake
- 1,410,001 m³ of treated water discharged into Snap Lake
- 84,020 tonnes of coarse reject and 59,023 m³ of slimes deposited in the North Pile
- 1 reportable spill
- Water sampled in 15 monitoring stations
 - The monthly average for all parameters met compliance
- Toxicity testing
 - Algae tests – inhibitory effects did not occur
 - Ceriodaphnia tests – endpoints for mortality could not be calculated (no effect occurred); endpoints for reproduction calculated
 - Trout tests – no effect occurred
 - Daphnia tests – no effect occurred



1.2 Spill Reporting in June 2015

Date	Location	Waste Spilled	Amount (L)	Cause
June 3	Emergency slimes line next to the main haul road, 10 meters downstream of the first valve shack	Processed slimes	1000	Emergency slimes line disconnect and isolation valve wasn't effectively closed, allowing slimes to migrate to the surrounding area
June 8	5100-C11-Drive Southeast ramp	Emulsion	500	The emulsion tote fell off the back of the emulsion truck when a the hold-down strap on the emulsion tote broke due to mechanical failure



1.3 Proposed Amendments to the Response Framework for the North Pile Facility and Water Management Pond Dams

➤ Submitted on May 29, 2015

- Updated the response framework threshold criteria based on a data review undertaken as part of the 2014 Annual Acid/Alkaline Rock Drainage (ARD) and Geochemical Characterization Report



1.4 Downstream Water Courses Special Study Plan

- Submitted on June 3, 2015
 - Requirement from the Water Licence MV2011L2-0004, effective on May 5, 2015
 - Designed to incorporate the water quality monitoring as part of the existing Downstream Lake Special Study under the AEMP



1.5 De Beers Request to Modify Fish Early Stage Toxicity Tests

- Dated June 5, 2015
 - After one year of Fish Early Stage Toxicity (ELS) Tests, De Beers requested that the ELS testing changes from both 7-day Rainbow Trout embryo viability test and 7-day larval Fathead Minnow survival and growth test to 7-day larval Fathead Minnow survival and growth test, only



1.6 Thallium and Cesium in Fish Tissue Response Plan

➤ Submitted on June 30, 2015



2. Inspection Update

- Inspector – Jamie Steele
- Land Use Inspection – Winter Road
 - May 26, 2015
- Water Licence Inspection
 - May 27-28, 2015



2.1 LUP Inspection

- Inspection dated May 26, 2015, and report dated June 5, 2015
- Winter Spur Road portages and the clean-up site for the spill (#15-043)was inspected
- No immediate concerns were noted



Snap Lake Winter Spur Road – Transitions from lake ice to portages are clean with no evidence of sediment entering the lake



Location of the Spill #15-043



There is a very slight odor of diesel and a slight skim of oil on the surface of the water but not enough to saturate a spill pad.

Water and soil samples were taken at the spill site and an adjacent pool of water (to determine if there was any migration of hydrocarbon from the spill site)



Spill kits were on hand and fully stocked to aid in the clean-up efforts. The red drums are placed to contain contaminated soil that will be excavated by hand periodically over the summer



3. Regulators' Update – MVLWB (I)

- Approves the 2014 Emergency Response Plan v2, as submitted in accordance with the Water Licence, on May 7, 2015
- Invited reviewers to submit comments on AEMP - C. dubia low action level Response Plan, on May 8
 - Comments due on June 12
- Invited reviewers to submit comments on 2014 Annual Closure and Reclamation Plan Progress Report, on May 20
 - Comments due on June 19



3. Regulators' Update – MVLWB (II)

- Approved the AEMP Aesthetic TDS Drinking Water Guideline Low Level Exceedance Request, on June 8, 2015, and as such De Beers are not required to submit a Response Plan associated with this action level exceedance
- Approved the AEMP Aesthetic Chloride Drinking Water Guideline Low Level Exceedance Request , on June 8, and as such De Beers are not required to submit a Response Plan associated with this action level exceedance



3. Regulators' Update – MVLWB (III)

- Invited reviewers to submit comments on the Downstream Water Courses Special Study Plan, on June 11, 2015
 - Due on June 30
- Invited reviewers to submit comments on the North Pile Man. Plan Response Threshold - Nitrate Exceedance Memo, on June 11
 - Due on July 9
- Invited reviewers to submit comments on Request to change ELS requirements of SNP, on June 16
 - Due on July 7



3. Regulators' Update – MVLWB (IV)

- Acknowledged receipt of the WLAR 2014 and requests that the following corrections and changes be made as described in Table 1, on June 23, 2015
 - Updated report with corrections (1 comment from EC and 5 comments from SLEMA) due on July 20, 2015
- Clarified the direction provided in the February 12, 2015 letter regarding the use of freshwater as a mitigation measure, on June 23
 - “The Board approved the temporary use of freshwater as a mitigation measure until the December amendment application has been signed by the Minister. At which point De Beers can no longer use freshwater as a mitigation measure.”
- Board staff commented the Downstream Water Control Special Study Plan on June 30



3.1 Staff Comments on the Downstream Water Courses Special Study Plan

- Explain why hydrology monitoring is not needed at the station between the LCB Outlet Stations and King 01
- Explain how the required response framework was considered in the development of the DSW SSP. Describe which stations could be considered for the upstream action levels and response framework associated with Measure 1(d). Include rationale
- In Year 2, water quality sampling should be continued at potential locations for the upstream response framework in order to establish a baseline dataset for use in development and assessment of action levels
- Describe the statistical power of the proposed study design as required by Schedule 6, item 6



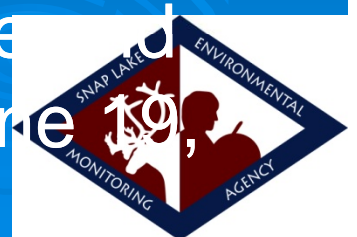
4. Aboriginal Update

- No comments received from Aboriginal parties in June 2015



5. Stakeholders' Update (I)

- Environment Canada (EC) requested an extension on the review of the AEMP – C. dubia low action level Response Plan, on June 11, 2015
 - The request was granted by the MVLWB on June 11, and the new due date for comments was June 17
- Environment and Natural Resources (ENR) and EC commented the AEMP – C. dubia low action level Response Plan on June 17
- ENR commented the 2014 Annual Closure Reclamation Plan Progress Report, on June 19, 2015



5. Stakeholders' Update (II)

- EC, DFO, ENR commented the Downstream Water Courses Special Study Plan on June 30, 2015



5.1 ENR Comments on the AEMP – C. dubia low action level Response Plan (I)

- ENR recommends that the response plan identify the authors of the document
- ENR recommends that the MVLWB consider requiring a priori response actions for medium and high action levels
- ENR recommends that the response plan should also include a toxicity identification evaluation (TIE) study to identify the causes of toxicity to cladocerans that frequently observed at the edge of the



5.1 ENR Comments on the AEMP – C. dubia low action level Response Plan (II)

- ENR recommends the response plan should include a well-designed study to evaluate the effects of effluent discharges on aquatic invertebrates in Snap Lake (i.e., a study that explicitly includes pre-determined critical effect sizes and has sufficient power to detect effects on species richness, abundance, and other biological metrics with a specified level of confidence)



5.1 ENR Comments on the AEMP – C. dubia low action level Response Plan (III)

- ENR recommends that the response plan should include management actions that will be taken to mitigate the effects of mine discharges on the zooplankton community
- ENR recommends the response plan include a monitoring component designed to evaluate the effectiveness of any actions taken to mitigate observed toxicity. Appropriate monitoring components (i.e., measurement endpoints) for each of the possible response actions needed to be identified in the monitoring plan that is required as part of the overall response plan



5.1 ENR Comments on the AEMP – C. dubia low action level Response Plan (IV)

- ENR recommends the response plan should include an assessment of the reliability of the toxicity data and include an evaluation of the negative and positive control results and those found in the literature
- ENR recommends all information required to interpret the results of the toxicity tests should be included in the report.



5.1 ENR Comments on the AEMP – C. dubia low action level Response Plan (V)

- ENR recommends the current study design should be reviewed and revised to ensure it provides relevant information for adaptively managing the project
- ENR recommends that the dilution water used for the testing be Snap Lake water
- ENR recommends the surface water chemistry data for certain major ions (e.g., nitrate, sulphate, and chloride) should be normalized to a common water hardness to facilitate comparison of the response data among samples. The response results should be re-analyzed using the normalized data



5.1 ENR Comments on the AEMP – C. dubia low action level Response Plan (VI)

- ENR recommends the correlation analyses be redone
- ENR recommends the effects assessment be revised
- ENR recommends that the report include a correlation analysis evaluating the presence of any trends between TDS concentrations and changes in zooplankton metrics



5.1 ENR Comments on the AEMP – C. dubia low action level Response Plan (VII)

- ENR recommends that a response plan be developed that describes the actions that will be undertaken to address exceedances of the low action level for toxicological impairment. The required elements of a response plan are described in Schedule 6, Item 5 of WL MV2011L2-0004. As the current response plan does not include many of the required elements (i.e., a description of the causes of toxicity, a description of follow-up studies, a listing of potential mitigation actions, a schedule for proposed and follow-up studies or mitigation actions, a monitoring plan, or a reporting schedule), the report needs to be revised to address mandatory requirements identified in Schedule 6, Item 5 of WL MV2011L2-0004



5.1 ENR Comments on the AEMP – C. dubia low action level Response Plan (VIII)

- ENR further recommends that additional monitoring should be evaluated and implemented in 2015 to more fully characterize toxicological impairment in Snap Lake



5.2 EC Comments on the AEMP – C. dubia low action level Response Plan (I)

- EC suspects that Golder is interpreting their toxicity results incorrectly as unacceptable variability
- The argument put forth regarding Type 1 errors or “false positives” is not applicable because the EC standardized test for C. dubia does not rely on hypothesis testing for the generation of test endpoints for survival or reproduction



5.2 EC Comments on the AEMP – C. dubia low action level Response Plan (II)

- Regarding “lack of consistency between corresponding water chemistry and C. dubia toxicity”, EC proposes that a portion of the variability in toxicity test results is real, but more related to the mixture of potential toxic components in the diffuser stations and WTP final effluent
 - The analysis into relationships between water chemistry parameters and toxicity was not overly convincing and we wonder if these analyses were completed by a qualified statistician



5.3 ENR Comments on 2014 Annual Closure and Reclamation Plan Progress Report

- ENR recommends that the MVLWB develop a work plan for the review of security for the Snap Lake Mine and request that De Beers be required to use Version 7.0 of the RECLAIM Model
- ENR recommends that De Beers be required to address these areas of uncertainty outlined in the BCL memo and account for potential closure and postclosure activities in an updated security estimate for the Snap Lake Mine
- ENR recommends that the MVLWB require De Beers to estimate the anticipated costs to conduct the various research plans



5.4 EC Comments on the Downstream Watercourses Special Study Plan

- Environment Canada (EC) recommends that consideration be given to sampling the Inlet, Node 22 and Node 11 at the same frequencies (5x) to better characterise seasonal variation. EC also recommends that the same sampling be done at the three MacKay Lake sites over the two years to start to characterise inter-annual variability



5.5 DFO Comments on the Downstream Watercourses Special Study Plan

- No comments



5.6 ENR Comments on the Downstream Watercourses Special Study Plan (I)

- ENR recommends that DeBeers identify priority sampling points that will provide information critical to ensuring conformity with Measure 1(d). All reasonable efforts should be expended in order to ensure that the required data is collected from these sampling locations at the set frequencies
- ENR recommends that priority be given to sample collection in the vicinity of Node 22, since this is the location where Measure 1.d is to be met. Select upstream stations that would be used for trend analyses and assessed against triggers should also be a priority



5.6 ENR Comments on the Downstream Watercourses Special Study Plan (II)

- ENR recommends DeBeers confirm whether the activities scheduled for freshet and spring of 2015 have been completed
- ENR recommends that DeBeers provide an update on any likely changes to the overall schedule if these activities have not been completed
- ENR recommends DeBeers provide a rationale for the lower sampling effort that is planned for the area around Node 22 and the inlet to MacKay Lake
- ENR recommends that De Beers explain how it will assess compliance with Measure 1 d with limited seasonal sampling of parameters such as nitrate



5.6 ENR Comments on the Downstream Watercourses Special Study Plan (III)

- ENR recommends that DeBeers review existing data and establish appropriate detection limits for sample analysis
- ENR recommends DeBeers confirm whether the proposed QA/QC measures related to the conductivity Sondes incorporate lessons learned from the 2014 field season
- ENR recommends that DeBeers confirm the intent of the water level survey



5.6 ENR Comments on the Downstream Watercourses Special Study Plan (I)

➤ ENR recommends that DeBeers:

- Define an acceptable level of precision around the desired percentile
- Decide on Type I and II error rates that are consistent with Environment Canada (2012) and INAC (2009) guidance; i.e. error rates are equal to one another and not greater than 20%
- Use nonparametric variants of the statistical decision rules to estimate sample sizes required to achieve the desired error rates. These sample sizes will be conservative in the event that parametric methods may be used. The sample sizes should be estimated using currently available data with the intent to update sample size calculations as more data become available
- The timeline for the Plan should be modified, as needed, such that data are collected until adequacy criteria are met
- Describe the statistical decision rules within the AEMP and demonstrate conformity with MVEIRB Measure 1 d



6. Agency's Activities

- SLEMA staff had a meeting for the coming mine site field trip with De Beers staff on June 5, 2015
- A comment letter on the 2014 Annual Closure and Reclamation Plan Progress Report was sent to the MVLWB on June 19
- SLEMA staff had a meeting about the Environmental Agreement and Liaison Committee with Monica Wendt (GNWT) on June 23
- SLEMA Board and TK Panel visited the Mine site on June 24
- TK Workshop and brief Core Group Meeting were held on June 25
- A comment letter on 2014 Stack Testing Results was sent to De Beers on June 29
- A comment letter on the Downstream Watercourses Special Study Plan was sent to the MVLWB on June 30



Traditional Workshop on June 25, 2015



Traditional Workshop on June 25, 2015



7. SLEMA Reviews

- 2014 Annual Closure and Reclamation Plan Progress Report
- 2014 Vegetation Annual Report
- 2014 AEMP Annual Report
- Proposed Amendments to the Response Framework for the North Pile Facility and Water Management Pond Dams
- Downstream Water Courses Special Study Plan



7.1 2014 Annual Closure and Reclamation Plan Progress Report

- ARKTIS Solutions Inc. (ARKTIS) was retained by De Beers to assist in the completion of the 2014 Annual Closure and Reclamation Plan Progress Report. The objective of this annual report is to summarize the closure and reclamation activities conducted during 2014



North Pile Development

- Development of the North Pile represents the vast majority of remaining project activities on surface at the project site
 - Deposition of PK and waste rock in the East Cell began in 2012 and is projected to continue through 2015 until January 2016
 - The initial phase of Phase I West Cell is expected to be available for tailings deposition in January 2016 and it is design to store sufficient coarse and fine PK and mine waste rock produced by the mine until 2021/2022
 - Conceptual studies for future expansion of the North Pile post Phase I West Cell are being initiated in 2015 and a pre-feasibility design is expected to be submitted to the regulators by end of Q1 2016



Variations in the Consolidated Project Description (CPD) Schedule and Activities

- Notable variations which occurred in 2014 to the original Project schedule outlined in the CPD include:
 - Delay of PK deposition in the underground mine workings.
 - Deposition of PK as a slurry into the North Pile rather than paste.
 - Deviation from the initial North Pile development schedule.
 - Site construction activities (i.e. Construction of new fuel tank area)



Implications to the ICRP from Variances in the CPD Schedule and Activities (I)

- Continuous difficulties in the production of paste for deposition in the underground mine in previous years has meant that the all processed kimberlite production has been and will likely continue to be delivered to the North Pile
- It is anticipated that selection of a desired option for expansion of the North Pile will occur in Q3 of 2015, which will allow deposition of PK within the North Pile until the projected end of mining date, 2028



Implications to the ICRP from Variances in the CPD Schedule and Activities (II)

- Revised timelines for the completion of progressive reclamation efforts at the Starter Cell and East Cell will be developed following confirmation of the desired approach for North Pile expansion (e.g. increased height, increased footprint, or combination of each)
- The increased size of the North Pile is not expected to require changes to the framework of the existing closure design (i.e. closure objectives, criteria, activities). However, the planned closure activities (i.e. placement of a rock cover) will require corresponding increases in the estimated timelines for completing work



Progressive Reclamation (I)

- The majority of the site infrastructure is required for mining operations until closure, which limits the number of prospective facilities that can be reclaimed before the end of the planned life of mine. This is primarily due to the exclusively underground mining activities at Snap Lake and relatively small footprint compared to nearby diamond mines



Progressive Reclamation (II)

- No further reclamation activities at the former AN Storage Pad were completed in 2014. The excavation site is proposed to support future revegetation field trials as part of its reclamation
- Development of a conceptual Rock Cover Design Report was done in 2013. Advancement of a Starter Cell cover options analysis and rock cover design to 50% design phase was completed
- A detailed reclamation plan for the South Pit area was developed in 2014. Limitations in available site resources resulted in this progressive reclamation work being postponed
- In 2014 a sampling and geochemical investigation plan²⁶ was developed for sediments deposited within the Water Management Pond and North Pile sumps and ditches in order to evaluate the degree of contamination present and assess if any stabilization or disposal measures are required



Bulk Sample Pit (South Pit) Reclamation Plan Developed



Reclamation Research Status (I)

- The purpose of reclamation research is to address uncertainty in the engineering and environmental elements regarding closure, obtain information that can lead to the development of appropriate closure criteria, and allow the ICRP to be continuously refined



Reclamation Research Status (I)

- Community Engagement and Traditional Knowledge ongoing
- The Seed Development Research Project commenced in 2014 and established a list of candidate species for use in revegetation at Snap Lake
- Desktop review was conducted for the metal uptake by plants and the development of closure criteria

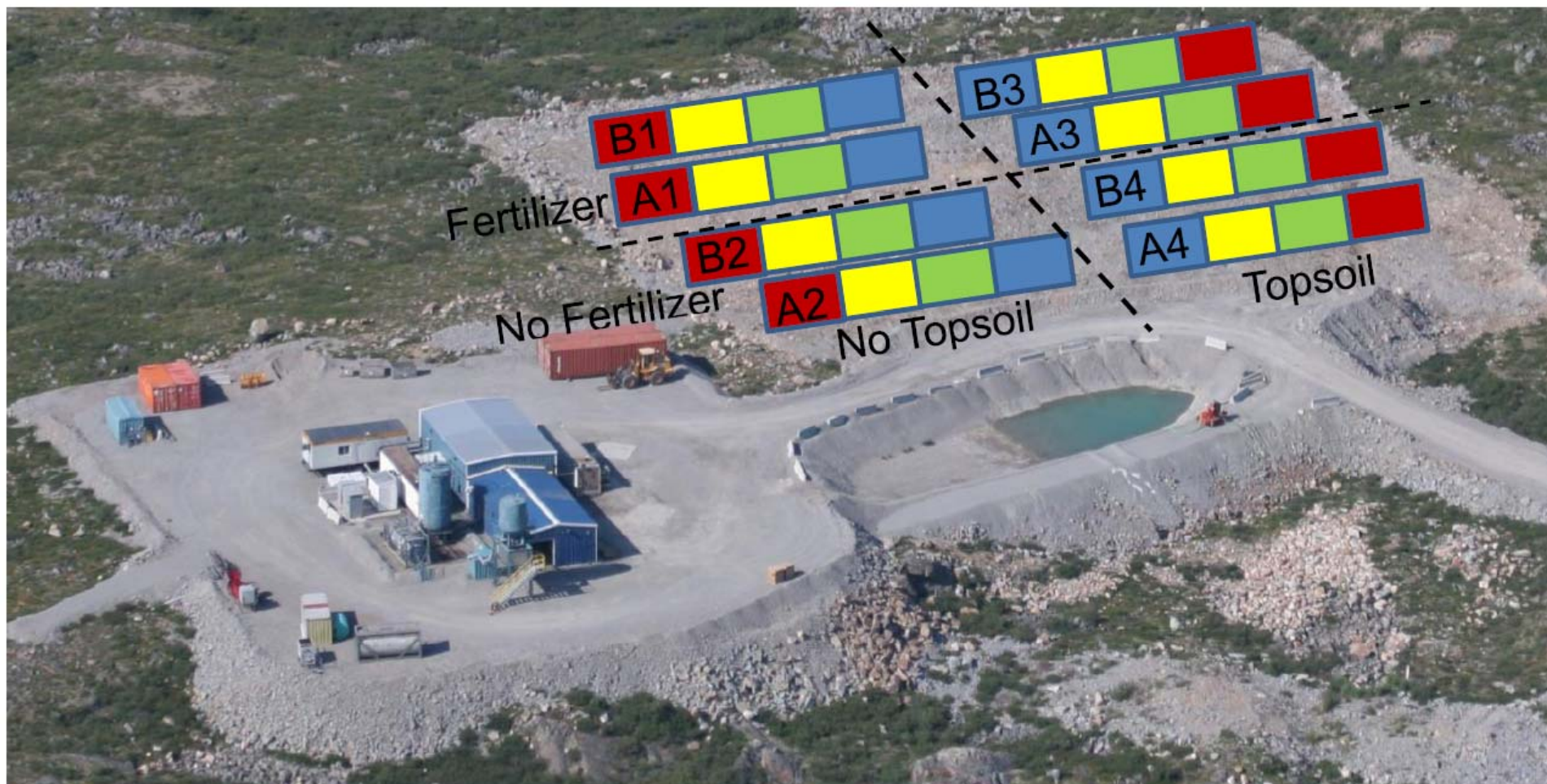


Figure 1. An aerial view of the Snap Lake Mine, with study site location (former AN storage site). Photo is facing north, taken August 4, 2010.



Revegetation Test Plots Experimental Design (II)

Figure 4. Test plot layout within the study site. Facing north.



Interim Closure and Reclamation Plan Status

- MVLWB approval of Version 3.2 was received on January 30, 2014. Reviewer comments included several recommended additions and modifications to the ICRP that were agreed upon by De Beers and will be included within the next ICRP revision, which is due for submission to the MVLWB by January 30, 2017



Financial Security and Reclamation Liability

- The summarized current security held at the end of 2014, with deposition of PK having occurred in both the Starter Cell and East Cell is as follows:
 - Type A Land Use Permit, \$19,878,84530;
 - Type A Water Licence, \$36,917,85631; and,
 - Environmental Agreement – Additional Security Deposit, \$20,000,00032.
- The total security held at the end of 2014 was \$76,796,701



Comments from the Environmental Analyst

- No concerns are raised

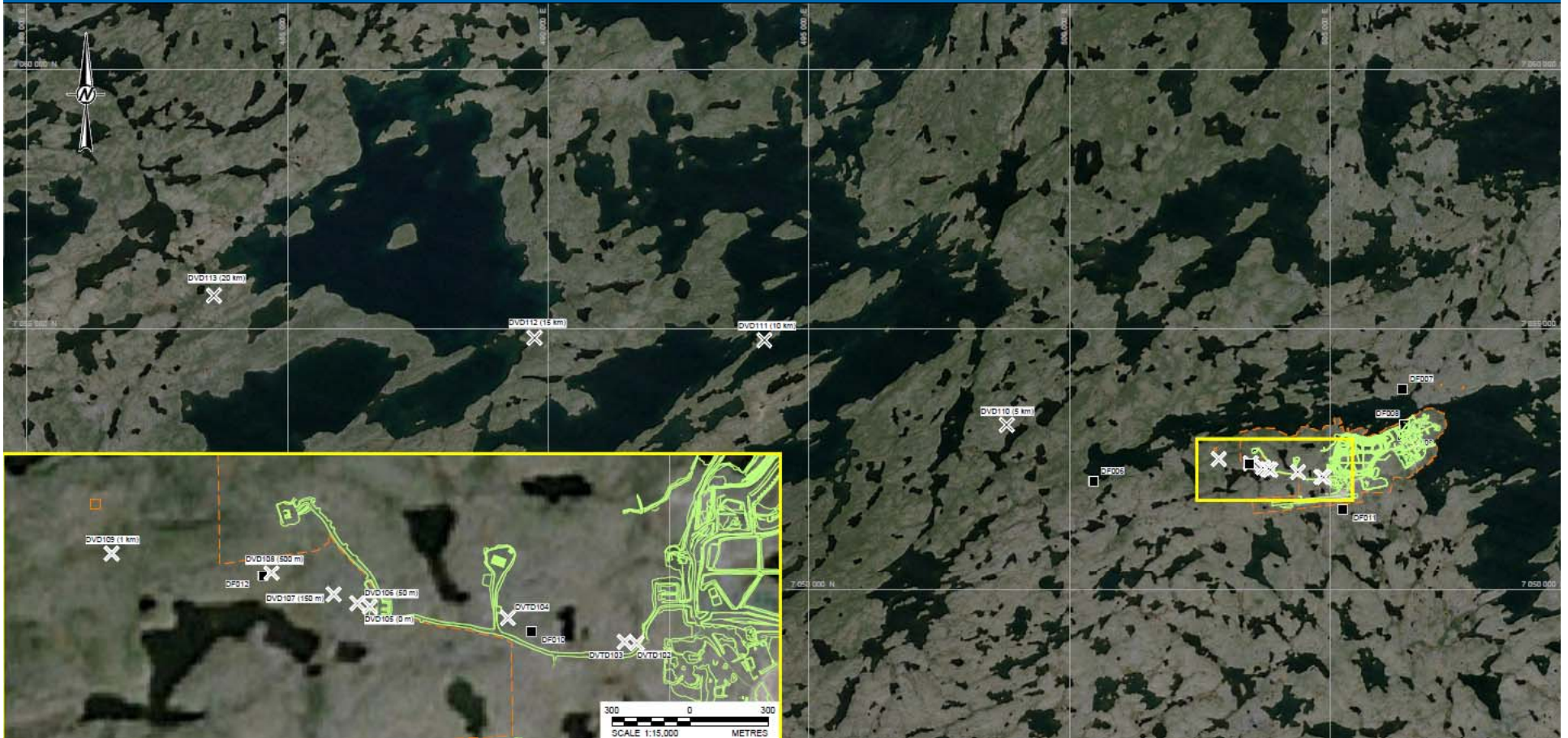


7.2 2014 Vegetation Annual Report

- A Vegetation Monitoring Program (VMP) is a requirement of the Mine's Environmental Agreement and provides support for the closure and reclamation monitoring requirements of the Mine's Water Licence
- A VMP was first prepared for the Mine in 2005. A subsequent VMP was prepared in 2008 and again in 2013. next one will be in 2018 and every five years thereafter
- Dustfall monitoring results in 2014 are presented in the Annual Report



Vegetation Dustfall Station Locations



LEGEND

- Company Managed Land
- Snap lake project infrastructure
- Vegetation Dustfall Sampling Location
- × Vegetation Dustfall Sampling Location Installed In 2013

NOTES

1. Grid is displayed in Transverse Mercator, Datum : NAD83,
2. Coordinate system : UTM zone 12.
3. Project site infrastructure is shown for information purposes only.

CLIENT

De Beers

PROJECT
SNAP LAKE MINE

TITLE
VEGETATION DUSTFALL STATION LOCATIONS

Dustfall Monitoring in 2014

- Total dustfall measurements did not exceed the Alberta Ambient Air Quality Guideline (AAAQG) for commercial and industrial (158 mg/dm²/30d) at any on-site location. The reference station DF006 did not exceed the AAAQG of 53 mg/dm²/30d for residential and recreational areas
- The maximum deposition rate of 112 milligrams per square decimetre per 30 days (mg/dm²/30d) was recorded at dustfall station DF011 in June/July 2014
 - In May/June, June/July, and July/August 2014, the off-site total dustfall samples exceeded the Alberta Ambient Air Quality Guideline of 53 milligrams per square decimetre per 30 days (mg/dm²/30d) for residential and recreational areas (AAAQG). Additional monitoring was not triggered



Report Conclusion (I)

- The average total dustfall rate in 2014 (41 mg/dm²/30d) was 2% lower than observed in 2013 (42 mg/dm²/30d), and 13% lower than observed in 2012 (47 mg/dm²/30d)
- These results cannot solely be used to determine whether dustfall is affecting vegetation communities
 - The Alberta dustfall guidance document was developed in 1975 to address aesthetic concerns associated with elevated dustfall levels
 - There are no scientifically defensible relationships between these dustfall guidance and discernible effects on vegetation communities



Report Conclusion (II)

- Vegetation is inspected visually to assess possible effects of dustfall on vegetation. Structured and focused visual inspections of dustfall on vegetation are conducted every five years as per the VMP.
- There were no signs of dust accumulation or impacts to vegetation in surveyed reference or exposure PSPs in 2013 or any other survey to date. Dust accumulation was observed around the airstrip, particularly on the west end of site. Signs or symptoms of stress were not observed on vegetation during qualitative assessments in 2013.
- Efforts are being made to reduce dust deposition around the airstrip through the application of water to the airstrip and surrounding area. De Beers is investigating the potential use of other approved dust suppressants.



Comments from the Environmental Analyst

- No concerns are raised

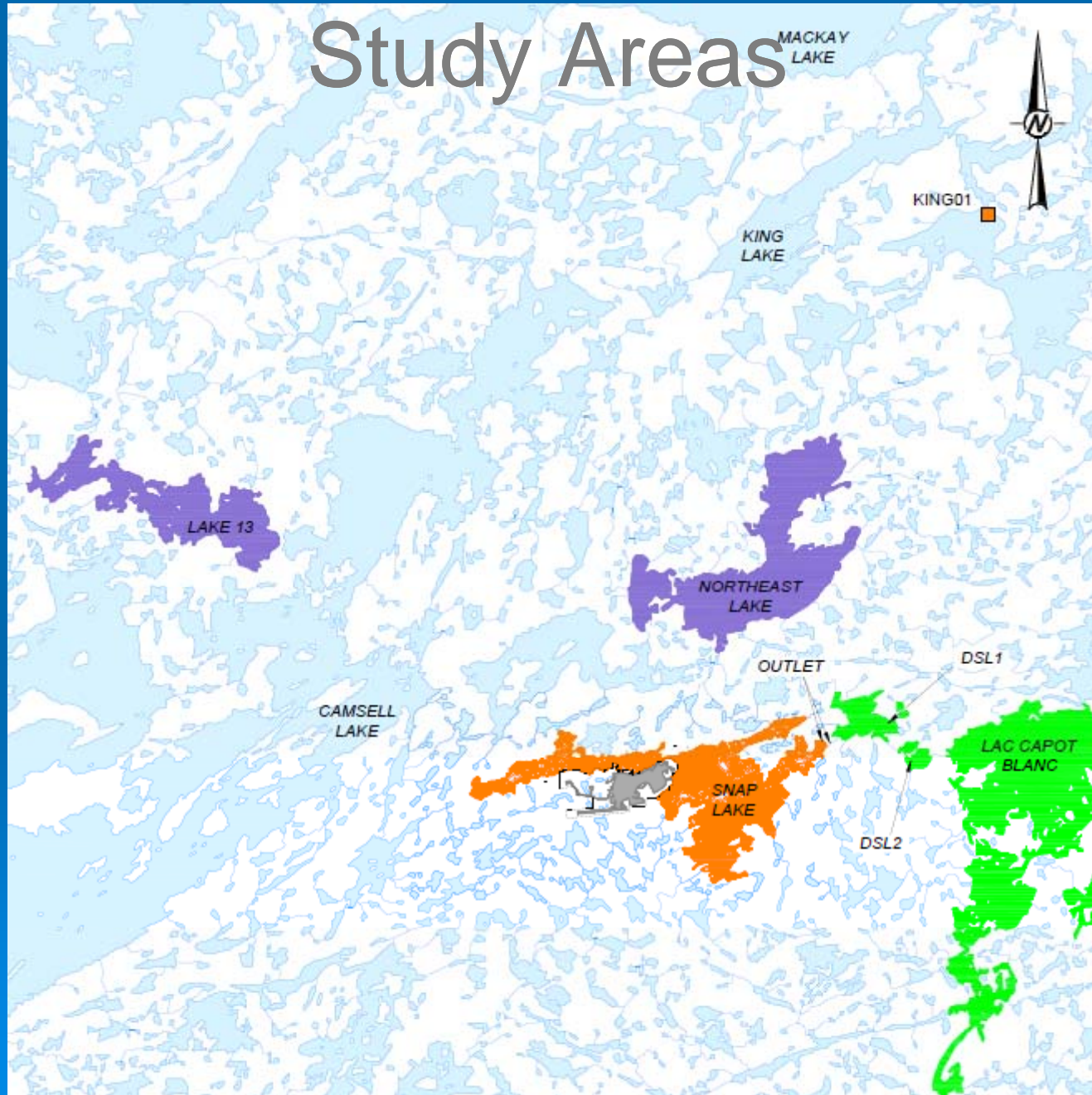


7.3 2014 AEMP Annual Report

- The core programs of the AEMP, completed every year, are: monitoring of water quality, plankton (the small plants and animals that live in the water), and sediment quality. Other components, which are completed every three years, were not conducted in 2014: benthic invertebrates (the small animals living in the mud of the lake bottom), fish community monitoring, tissue chemistry, and fish health. Three Special studies were completed in 2014: the Littoral Zone Special Study, the Picoplankton Special Study, and the Downstream Lakes Special Study



Study Areas



Water Quality Monitoring Stations

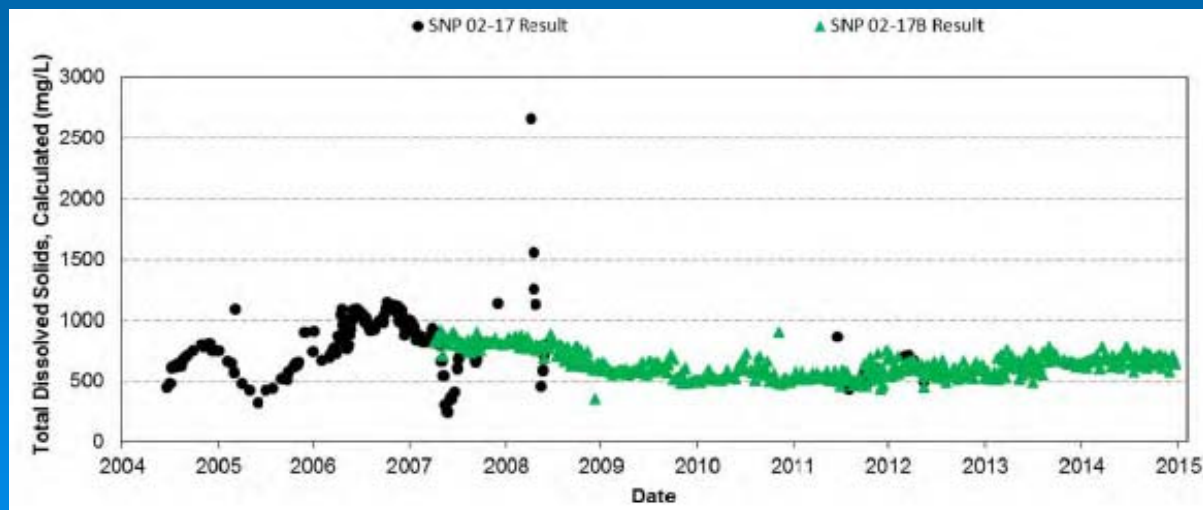
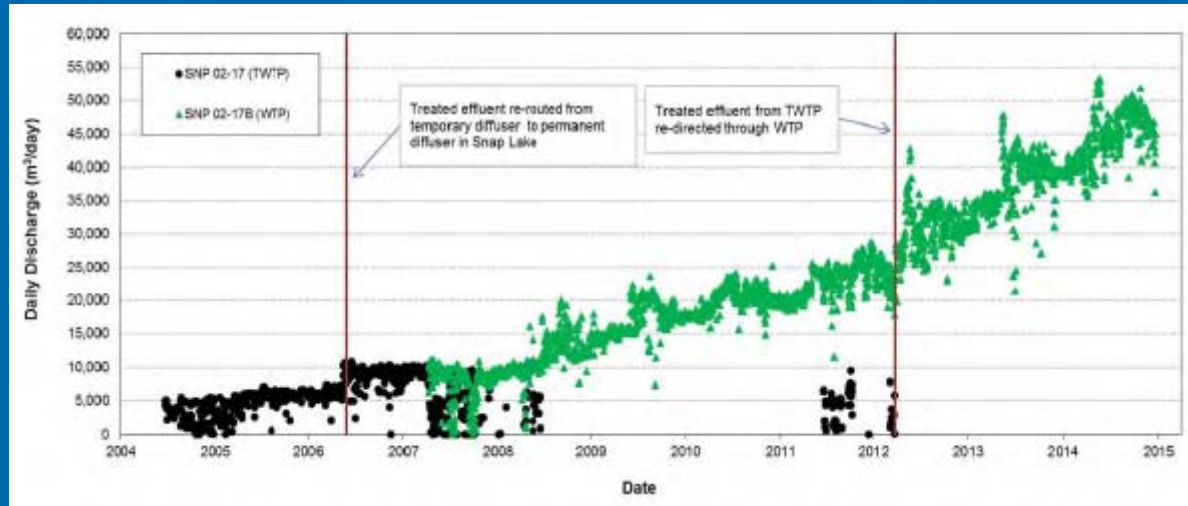


Water Quality (I)

- In 2014, the annual treated effluent volume was approximately 18 percent higher than in 2013
- Concentrations of total dissolved solids (TDS, dissolved salts in the water), nutrients (specifically nitrogen), and some metals have increased in Snap Lake from the discharge of treated effluent
 - However, increases in these parameters were accompanied by increased hardness, which is a parameter that reduces the toxicity of those parameters



Treated Effluent from the Mine



Water Quality (II)

- Concentrations of TDS were above the current Water Licence limit (350 milligrams per litre) in May 2014, but a request to increase this limit inclusive of chloride is being considered by the MVLWB

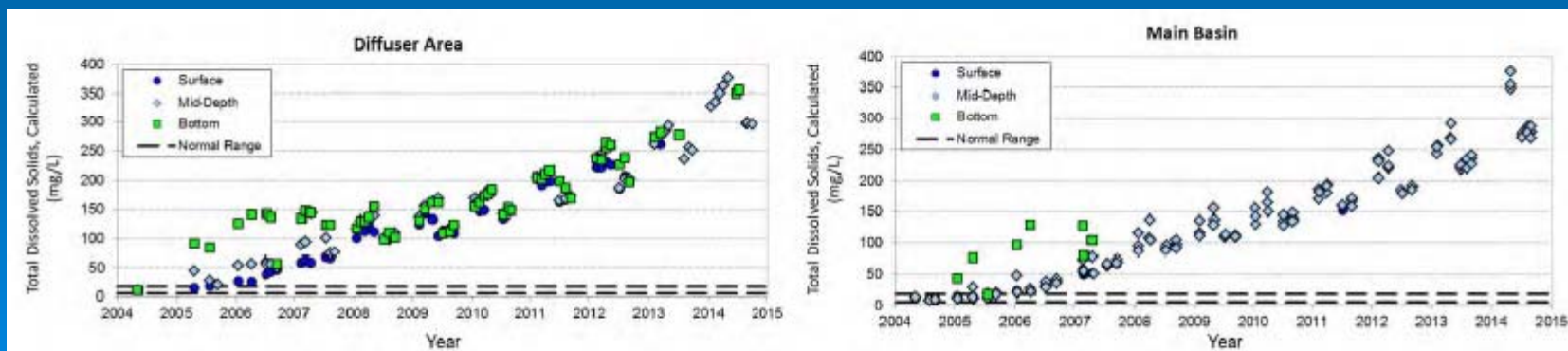
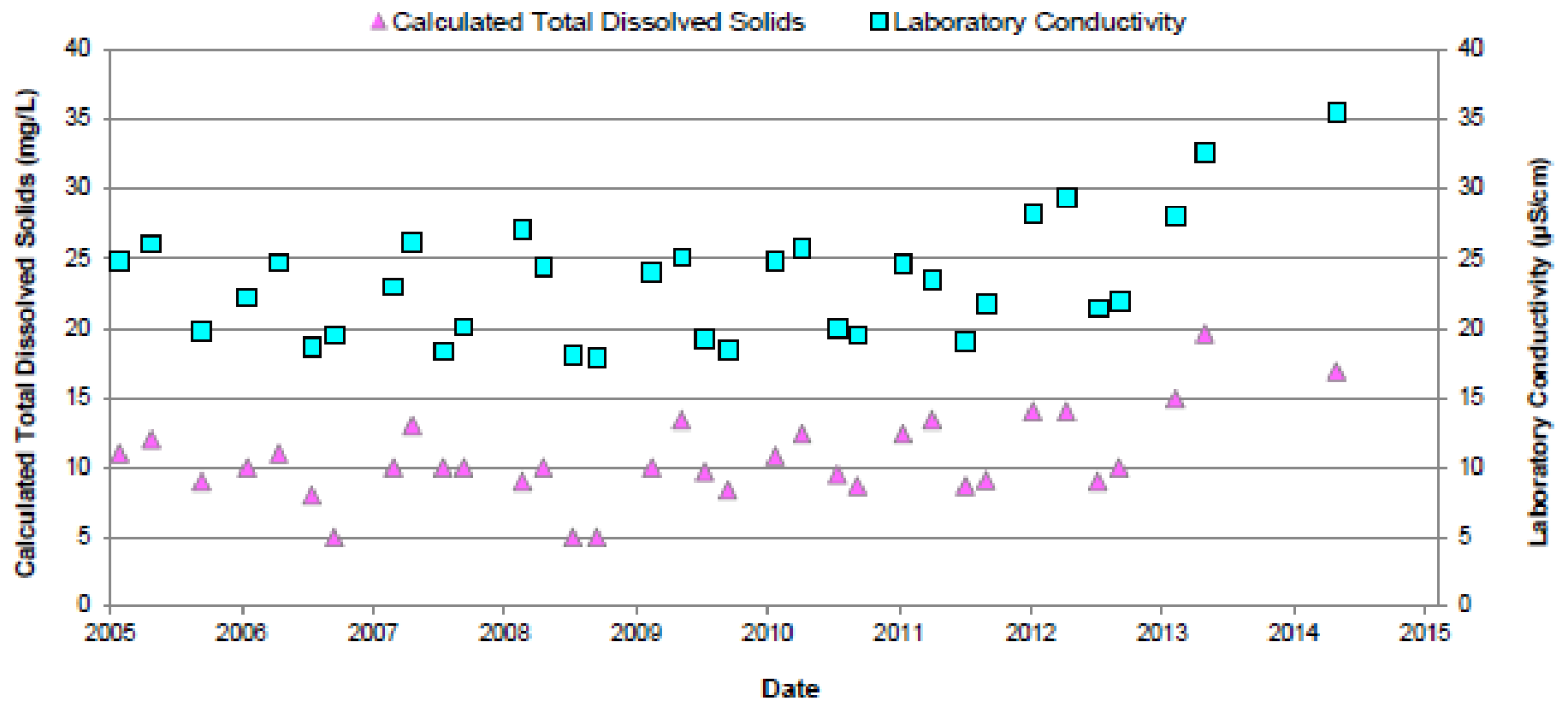


Figure 3.4-43 Concentrations of Total Dissolved Solids and Conductivity at the Downstream Station KING01, 2005 to 2014



Water Quality (III)

- Laboratory toxicity tests were performed exposing algae, water fleas, and fish to both treated effluent from the Mine and the water near the treated effluent discharge to Snap Lake
 - Neither the treated effluent nor the lake water were toxic to algae or fish
 - Although the waterfleas survived in all tests, some samples of both treated effluent and lake water reduced the reproduction of one of the species, *Ceriodaphnia*
- The changes to water quality in Snap Lake do not pose a human health risk, have not adversely affected the drinkability of the water, and are not expected to cause adverse effects to resident aquatic life



Comments from the Environmental Analyst

- No concerns are raised for the Water Quality Section



Sediment Quality

- The results of the 2014 monitoring indicated that concentrations of available potassium, available sulphate, antimony, calcium, mercury, selenium, silver, sodium, and strontium at the diffuser station are potentially being influenced by Mine operations. However, it is unlikely that these changes resulted in adverse environmental effects; the changes were not large enough that such effects would be expected



Plankton

- Small changes are occurring in the plankton community (small plants and animals living in the water) of Snap Lake and will occur in future due to the Mine and/or natural factors. However, these changes have not adversely affected this important component of the food chain for fish; the plankton community in Snap Lake remains healthy
 - Since 2011, the number of phytoplankton has increased in the northwest arm, but decreased in the main basin. Changes to the types of phytoplankton in Snap Lake since 2004 have not affected the food chain leading to fish
 - The zooplankton in Snap Lake have decreased in numbers from 2004 to 2014, and the types of zooplankton within Snap Lake have changed. Since 2012



Littoral Zone Special Study

- The littoral zone is the shallow near-shore area of a lake
- The Littoral Zone Special Study showed that the littoral zone of Snap Lake has not been negatively affected by the Mine; rather, the food quality of the algae and the amount of algae available for the littoral small animal grazers has improved since the Mine started operating. Thus, the food supply for fish has increased



Picoplankton Special Study

- The changes observed in the picoplankton (very small plants and animals in the water) community in the main part of Snap Lake (the main basin) are subtle and do not indicate a strong effect from the Mine. The changes in the northwest arm of Snap Lake, less affected by treated effluent, are greater than in the main basin. Other factors, such as changes to the regional environment and changes in predator grazing over time may be affecting the picoplankton community. Changes to the picoplankton and phytoplankton in the main basin of Snap Lake are not affecting the food chain upon which fish rely

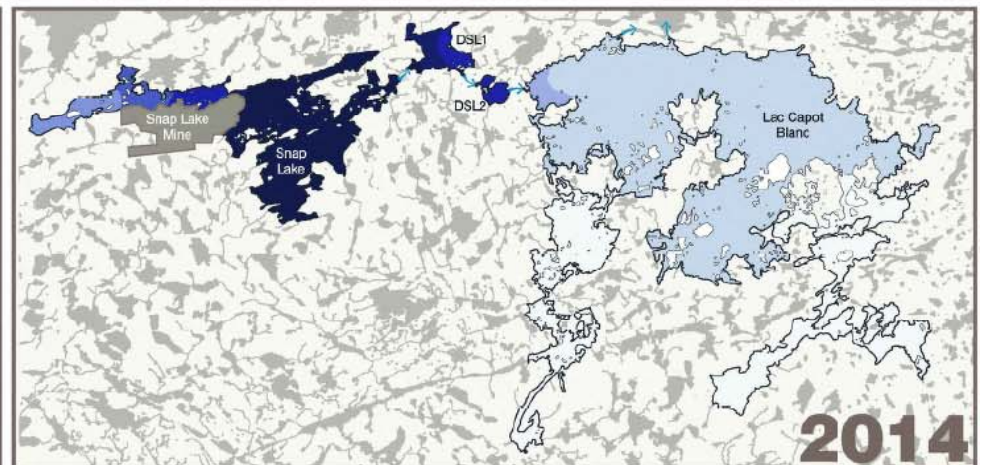
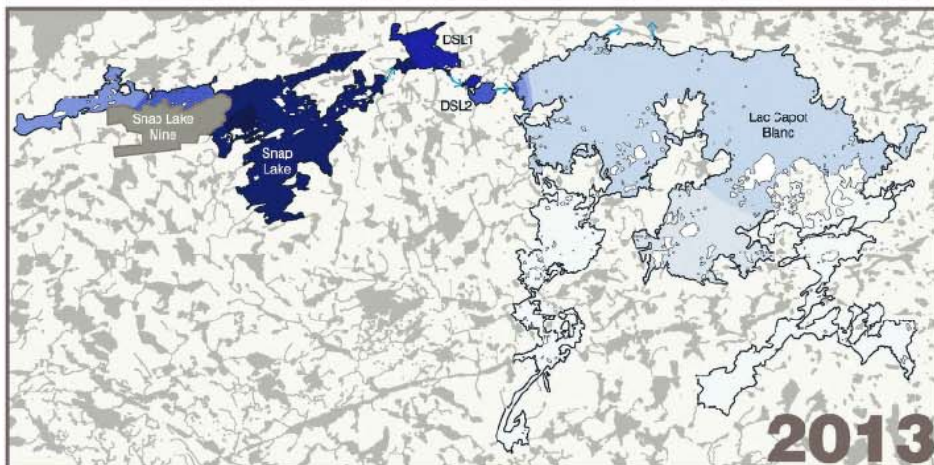
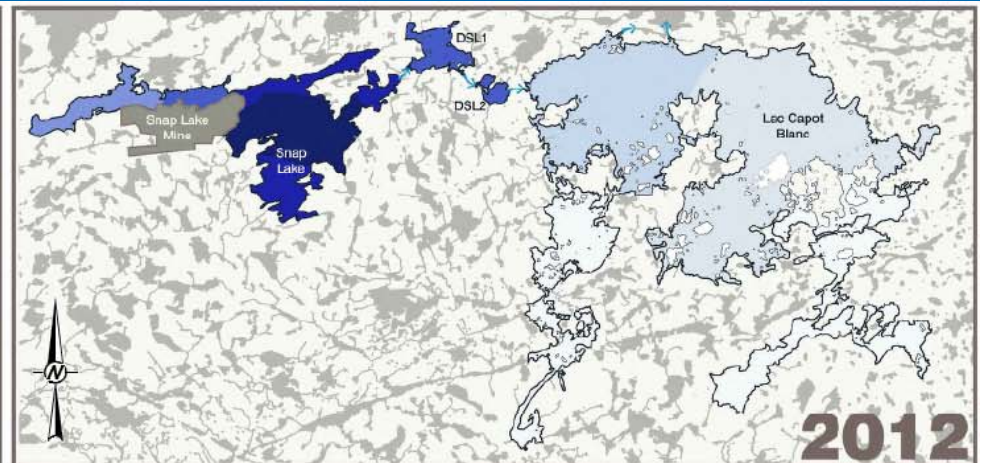
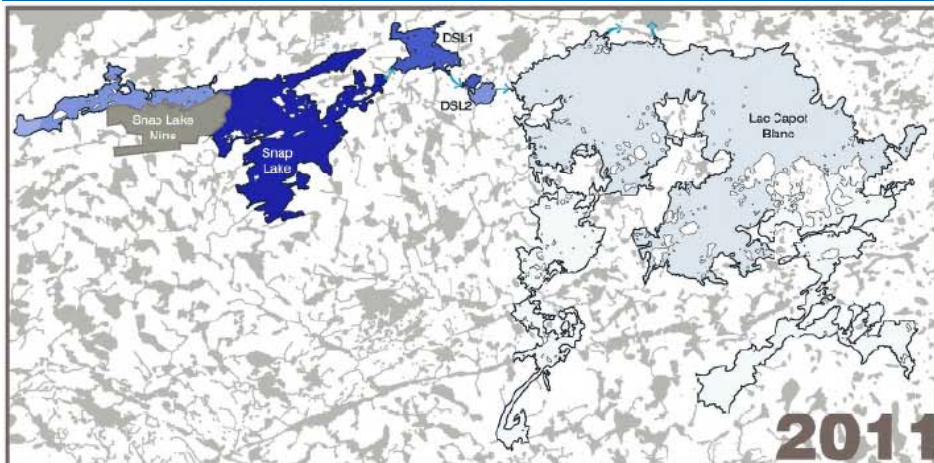


Downstream Lakes Special Study

- Three downstream lakes: Downstream Lake 1 (DSL1), Downstream Lake 2 (DSL2), and Lac Capot Blanc (LCB)
- Evidence of the treated effluent was detected throughout DSL1 and DSL2, less so in LCB in 2014
 - As predicted, there was evidence of low concentrations of treated effluent at the outlet of LCB in 2014



Extent of Plume 2011 to 2014 in Lakes immediately Downstream to Snap Lake



Weight of Evidence Integration

- In 2014, compared to previous years, there was a much weaker link between nutrient releases to Snap Lake as a result of Mine activities and enhancement of the phytoplankton community. Phytoplankton biomass (the amount of food available in the food chain leading to fish) and community structure in Snap Lake have returned to conditions similar to those observed pre-mining. There were subtle changes in the zooplankton (small animals living in the water), which could have resulted from toxicity but could also have resulted from more food for them from the phytoplankton or from greater feeding on them by fish. Although laboratory toxicity testing showed instances where the reproduction of waterfleas that do not live in Snap Lake was affected, the waterfleas that actually live in Snap Lake increased in numbers and biomass in the lake. There was no evidence of adverse effects to the structure and function of the Snap Lake ecosystem



Conclusions

- Treated effluent discharge from the Mine is increasing and, as a result, changes in Snap Lake water and sediment quality are occurring. Treated effluent can now be found in the two lakes immediately downstream of Snap Lake and, to a lesser extent, in LCB, the third downstream lake
- Changes continue to occur in the Snap Lake plankton (small plants and animals in the lake water). However, these changes have not adversely affected the food chain upon which fish depend on; there is evidence for positive enhancement of this food chain, particularly in the shallow areas of Snap Lake
- The small plant and animal communities in Snap Lake, which support the fish in the lake, are healthy and the water is safe to drink. Based on Aboriginal community members who tasted fish caught in Snap Lake, the fish are healthy



7.4 Proposed Amendments to the Response Framework for the North Pile Facility and Water Management Pond Dams

- Nitrate levels at the discharge from the North Pile (location SNP 02-02) were above the Response Framework threshold criteria of 44 mg/L in 2014, triggering an Orange (high risk situation) response
- Further data review indicates values at the site discharge location (SNP 02-17B) continue to remain within water licence limits
- Given that the currently observed concentrations at location SNP 02-02 are unlikely to cause an upset to site operations, it is appropriate to re-evaluate and revise the threshold criteria at SNP 02-02



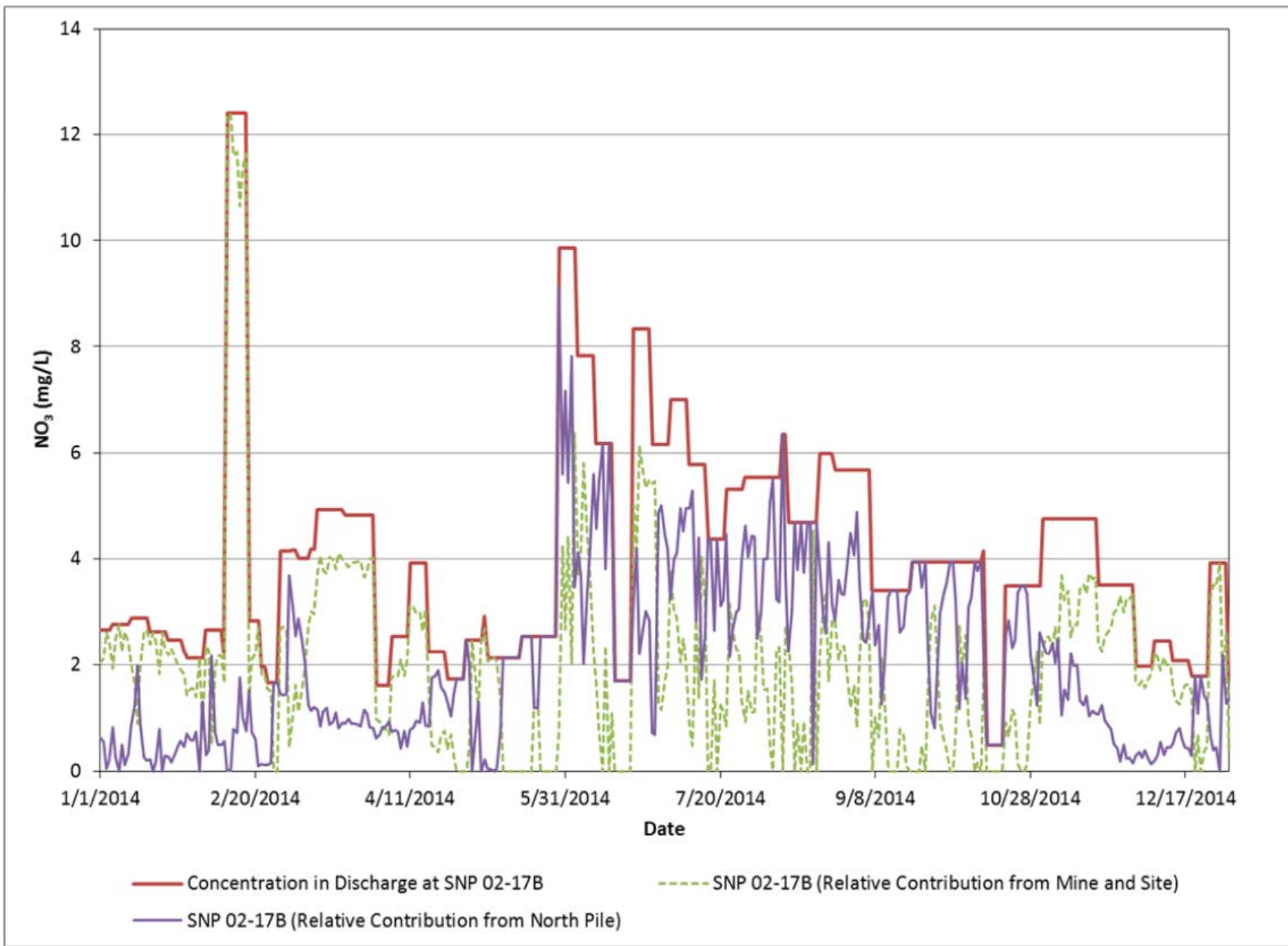
Proposed Trigger Level Values

Location SNP 02-17B

- A Yellow threshold criteria (Concern Situation) would be triggered if a grab sample at location SNP 02-17B (single sample) had a nitrate (as N) concentration of 75 % of the Maximum Grab EQC limit (44 mg/L)
- An Orange threshold criteria (high risk situation) would be triggered if a grab sample at location SNP 02-17B (single sample) had a Nitrate (as N) concentration of 100% of the Maximum Grab EQC limit (44 mg/L) OR if the average monthly concentration of Nitrate (as N) at location SNP 02-17B is within 75% of the Maximum Average EQC limit (22 mg/L)
- A Red threshold criteria (emergency situation) would be triggered if the average monthly concentration of (as N) at location SNP 02-17B is greater than 100% of the Maximum Average EQC limit (22 mg/L)



Figure 1: Weekly Concentrations at Discharge Location SNP 02-17B for 2014 and Relative Contribution from the Mine and North Pile



Comments from the Environmental Analyst (I)

- Nitrate levels at SNP 02-17B were lower than 14 mg/L. It is impossible to trigger any of the proposed thresholds for SNP 02-17B
- The threshold for the emergency situation at SNP02-17B may not be appropriate
 - Greater than 100% of the Maximum Average EQC limit (22 mg/L) means non-compliance, which should be prevented from
 - It is recommended that the Red threshold be set at greater than 90% of the Maximum Average EQC limit (22 mg/L)



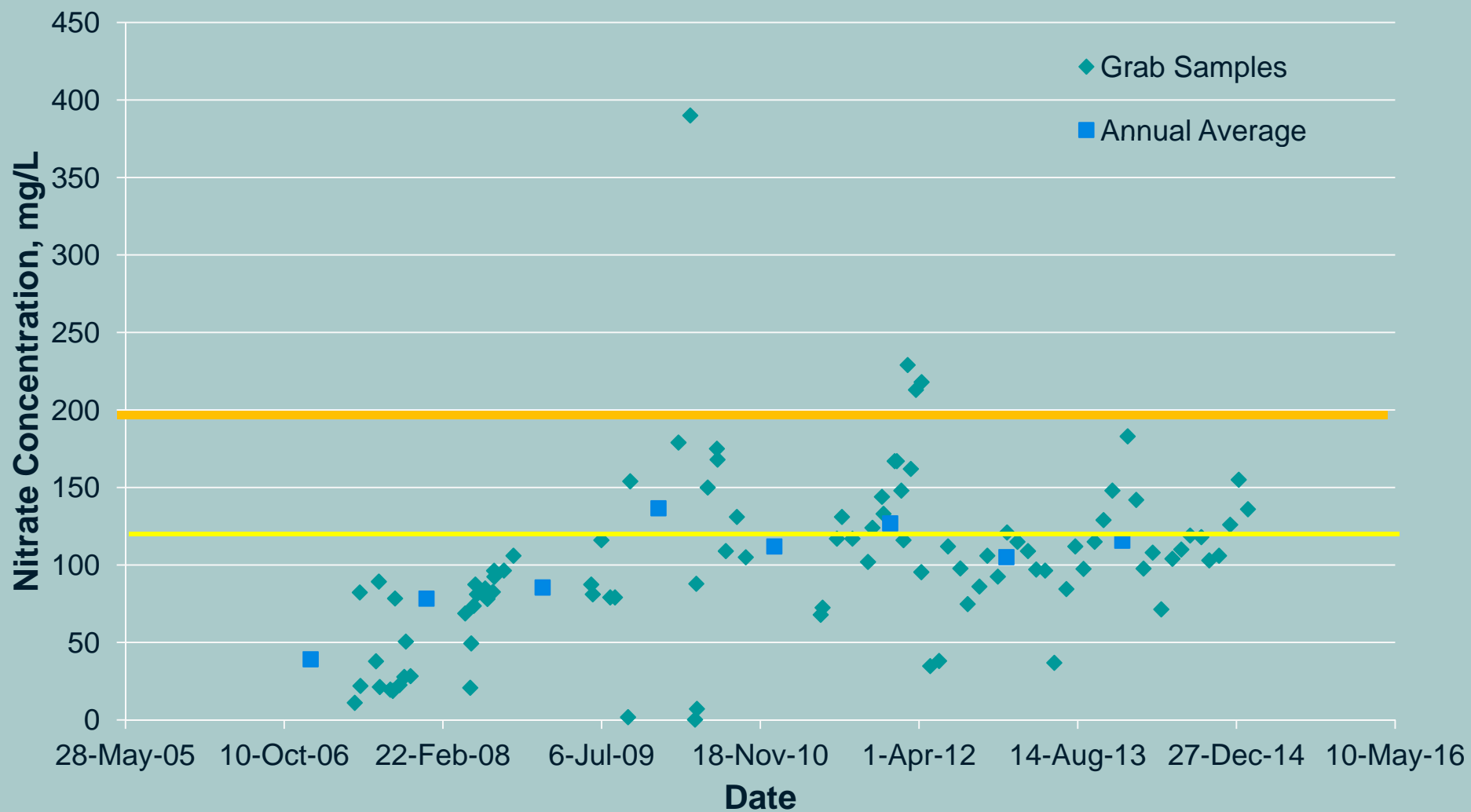
Proposed Trigger Level Values

Location SNP 02-02

- A Yellow threshold criteria (Concern Situation) would be triggered should a maximum grab limit of 200 mg/L as N nitrate is exceeded at location SNP 02-02 on any one occasion
- An Orange threshold criteria (High Risk Situation) would be triggered should an average annual Nitrate concentration of greater than 120 mg/L as N, at location SNP 02-02 be observed



Nitrate Levels at SNP 02-02



Comments from the Environmental Analyst (II)

- The two proposed trigger level values for SNP 02-02 are appropriate
 - For the past few years, there are only four grab sample with nitrate levels above the proposed Yellow threshold (200 mg/L), and two years (2010 and 2012) with Annual Average nitrate levels above Orange threshold (120 mg/L)

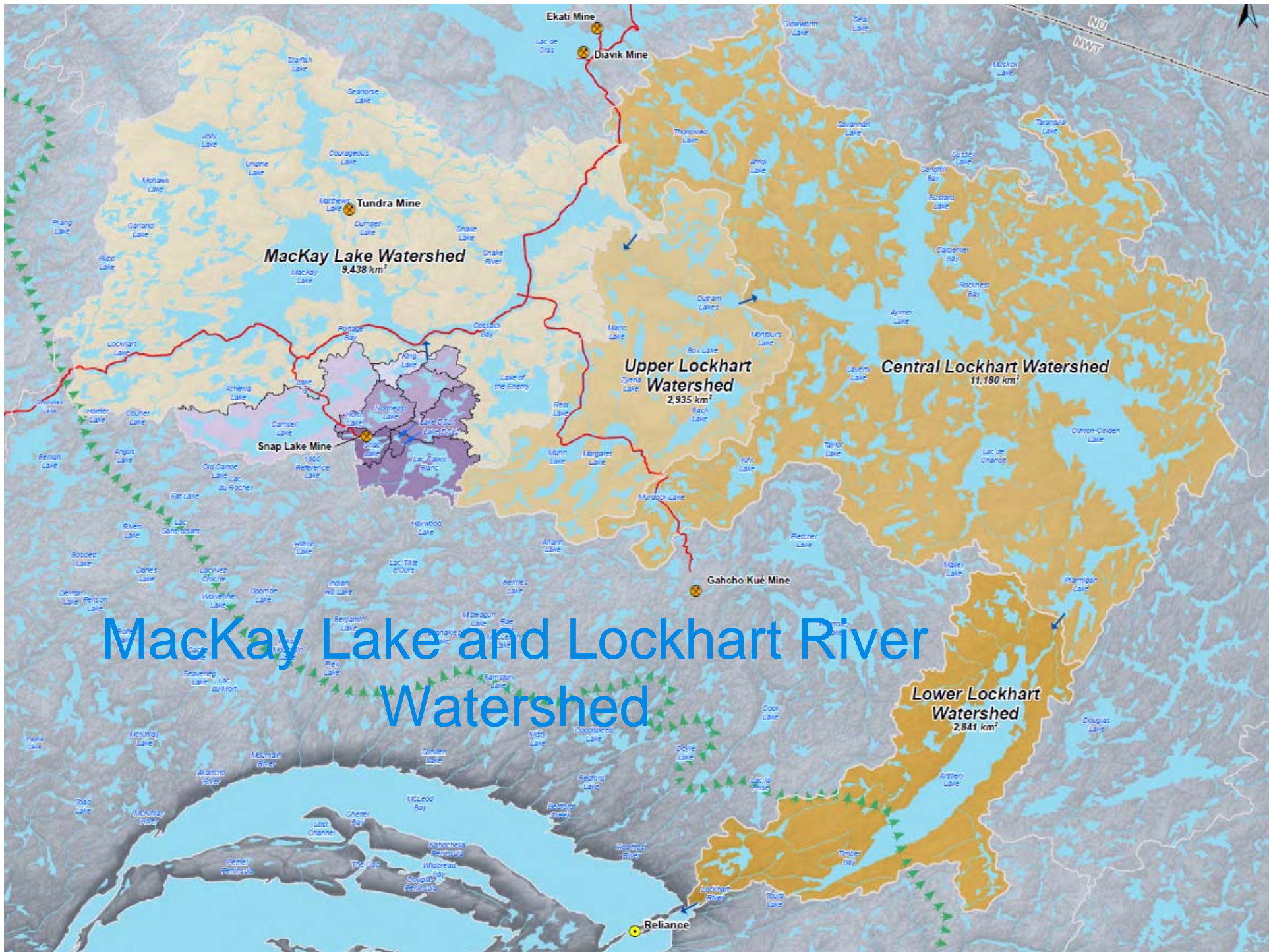


7.5 Downstream Water Courses Special Study Plan

➤ The purpose is to answer the following questions

- What is the range of natural variability downstream of Snap Lake including MacKay Lake?
- What is the appropriate location(s) for monitoring downstream of Snap Lake?
- How will monitoring information be used to assess conformity with Measure 1(d) of the EA1314-02?
 - *No Total Dissolved Solids or its constituent ions from Snap Lake Mine effluent will be detectable, relative to the range of natural variability, at the inlet to MacKay Lake, 44 km downstream of Snap Lake*





MackKay Lake and Lockhart River Watershed

Study Design

- Two-year field study with up to five seasons (Freshet, Spring, Summer, Fall, Under-ice)
 - Water quality and hydrological monitoring both on and off the potential flow path of the Snap Lake Mine treated effluent
- A stand-alone study, but with links to the AEMP and to modeling
 - The AEMP and the Plan will be conducted separately from 2015 to 2017 and then amalgamated into one AEMP in October



Reporting

- Downstream Model Report – Water quality and quantity (estimated December 31, 2015)
- Downstream Watercourses Special Study Report (due 90 days after study complete – anticipated study to be completed in May 2017)
- AEMP Re-evaluation Report (October 2017)
- AEMP Design Plan (October 2017)



Comments from the Environmental Analyst

- De Beers proposed 4 new “on the flow path” monitoring stations and 3 new “the flow path” monitoring stations, with current AEMP monitoring stations and 3 GNWT monitoring stations overlapped. It is a reasonable design.
 - It is stated that water quality data from GNWT monitoring stations in King and MacKay lakes will also be used in the Plan (Section 2.2, page 8). However, there are no further discussion on streamlining the monitoring schedule and parameters. Related information is requested



8. Water Licence Amendment Application (I)

- The MVLWB completed its regulatory process for the amendment of the De Beers Canada Inc. Type A Water Licence MV2011L2-0004 for the Snap Lake Mine, at Snap Lake, NT, submitted December 20, 2013. On June 8, 2015, a motion was passed by the Board to forward the amended Water Licence and Reasons for Decision to the ERN Minister for his approval
- The MVLWB sent the amended Water Licence MV2011L2-0004 and Reasons for Decision to the ERN Minister for his approval on June 19



8.1 Amended Water Licence MV2011L2-0004

- The MVLWB accepted De Beers proposed EQC with minor modifications



Final EQC at SNP 02-17/B

Parameter	EQC (mg/L)		Average Annual Loading Limit (kg/yr)
	Maximum Average Concentration	Maximum Grab Concentration	
Total Dissolved Solids (TDS) (calculated)	960	1253	n/a
Total Suspended Sediments	7	14	n/a
Ammonia as N	10	20	208,000
Nitrite as N	0.35	0.6	n/a
Nitrate as N	12	17	250,000
Total Phosphorous	n/a	n/a	229
Fluoride	1.3	2.0	n/a
Total Aluminum	0.1	0.2	n/a
Total Arsenic	0.003	0.01	n/a
Total Chromium	0.01	0.02	n/a
Total Copper	0.003	0.006	n/a
Total Lead	0.005	0.01	n/a
Total Nickel	0.05	0.1	n/a
Total Zinc	0.01	0.02	n/a
Extractable Petroleum Hydrocarbons – F1 Fraction (C6-C10)	4.6	n/a	n/a
Extractable Petroleum Hydrocarbons – F2 Fraction (C11-C16)	2.1	n/a	n/a
Faecal Coliforms	10 CFU/100mL*	20 CFU/100mL*	n/a

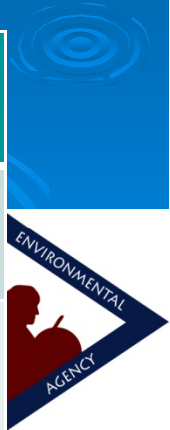
* CFU - Colony-forming units



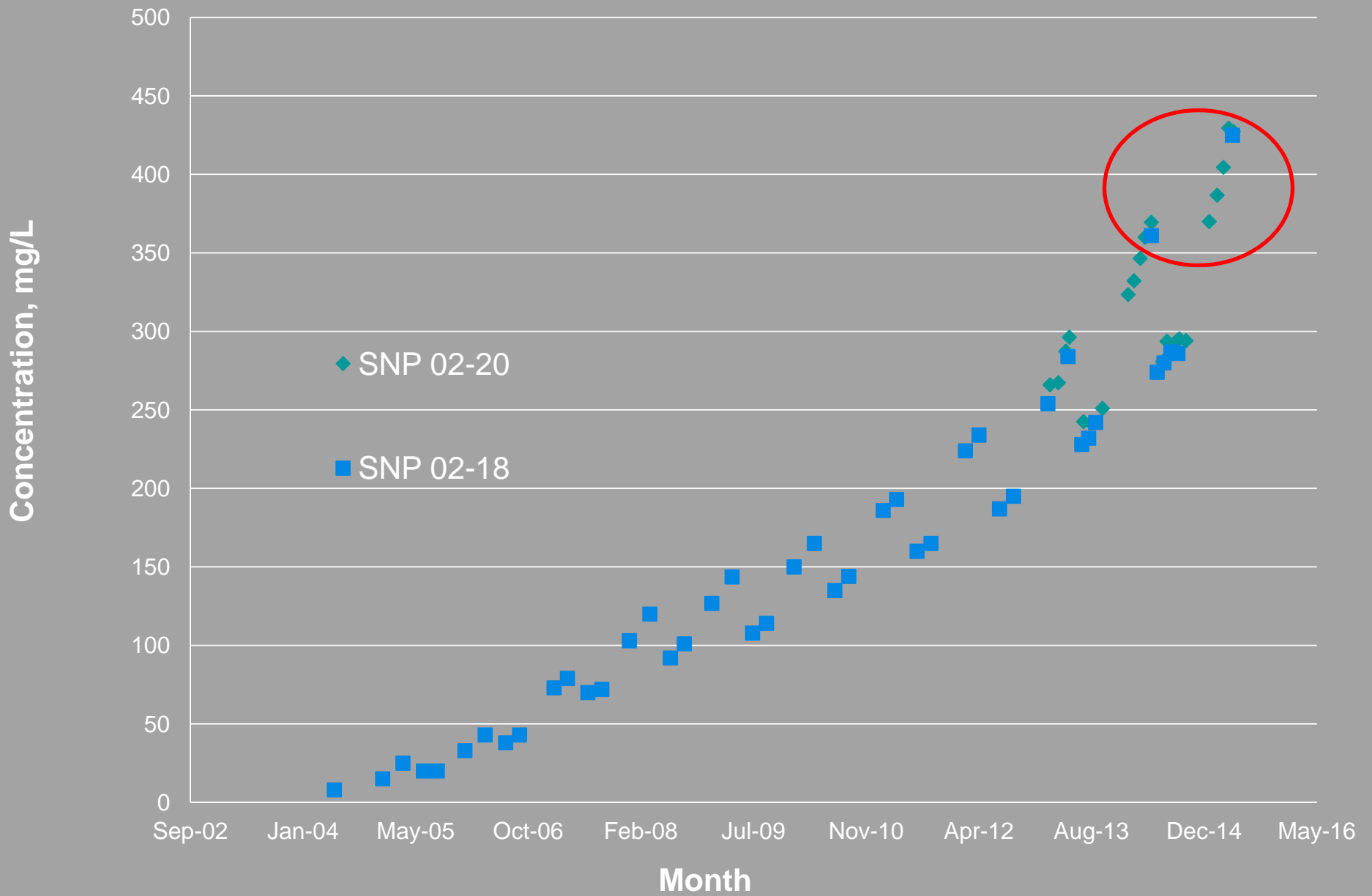
8.2 Revisit of SLEMA Modeling

- SLEMA model was calibrated with data up to April 2015
 - Correlation co-efficient: 0.997
- Back test results indicate that TDS levels in Snap Lake (SNP 02-18) may have been above 350 mg/L since January 2015

TDS in mg/L at Stations	Dec 2014	Jan 2015	Feb 2015	Mar 2015	Apr 2015	May 2015
SNP 02-18, predicted	338.8	354.6	364.6	375.2	386.4	390.8
SNP 02-20, observed		370.0	386.8	404.5	429.5	427.4



TDS Levels in Snap Lake



Comments from the Environmental Analyst (I)

- Technically, from January to April 2015, De Beers might be non-compliant with the Water Licence at SNP 02-18



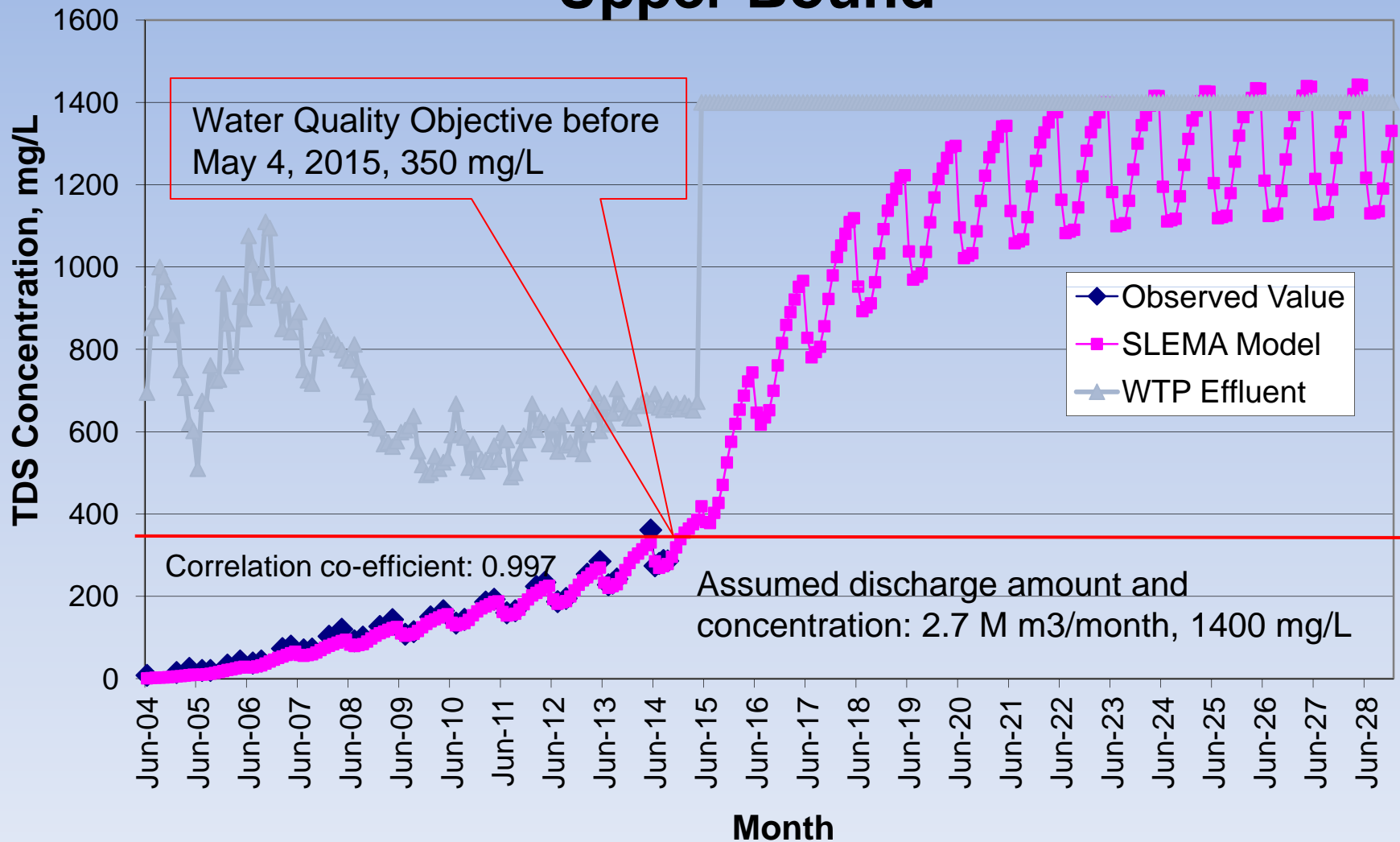
TDS Predictions

- Two scenarios proposed by De Beers (simplified) and one conservative scenario proposed by SLEMA were applied into SLEMA modeling prediction for Snap Lake

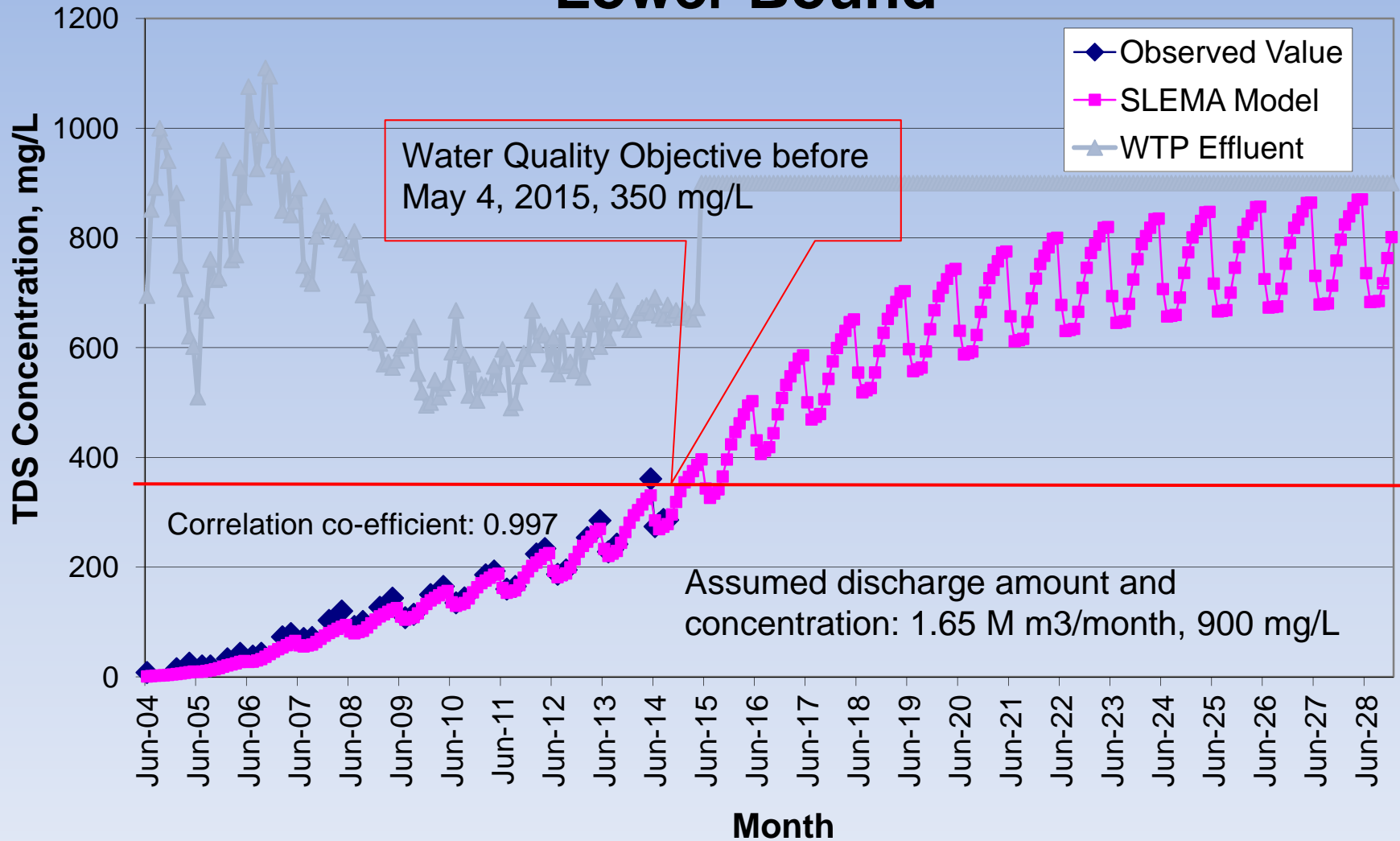
Scenario	Upper Bound	Lower Bound	Conservative
Discharge, m3/Month	2,700,000	1,650,000	1,400,000
TDS, mg/L	1,400	900	650



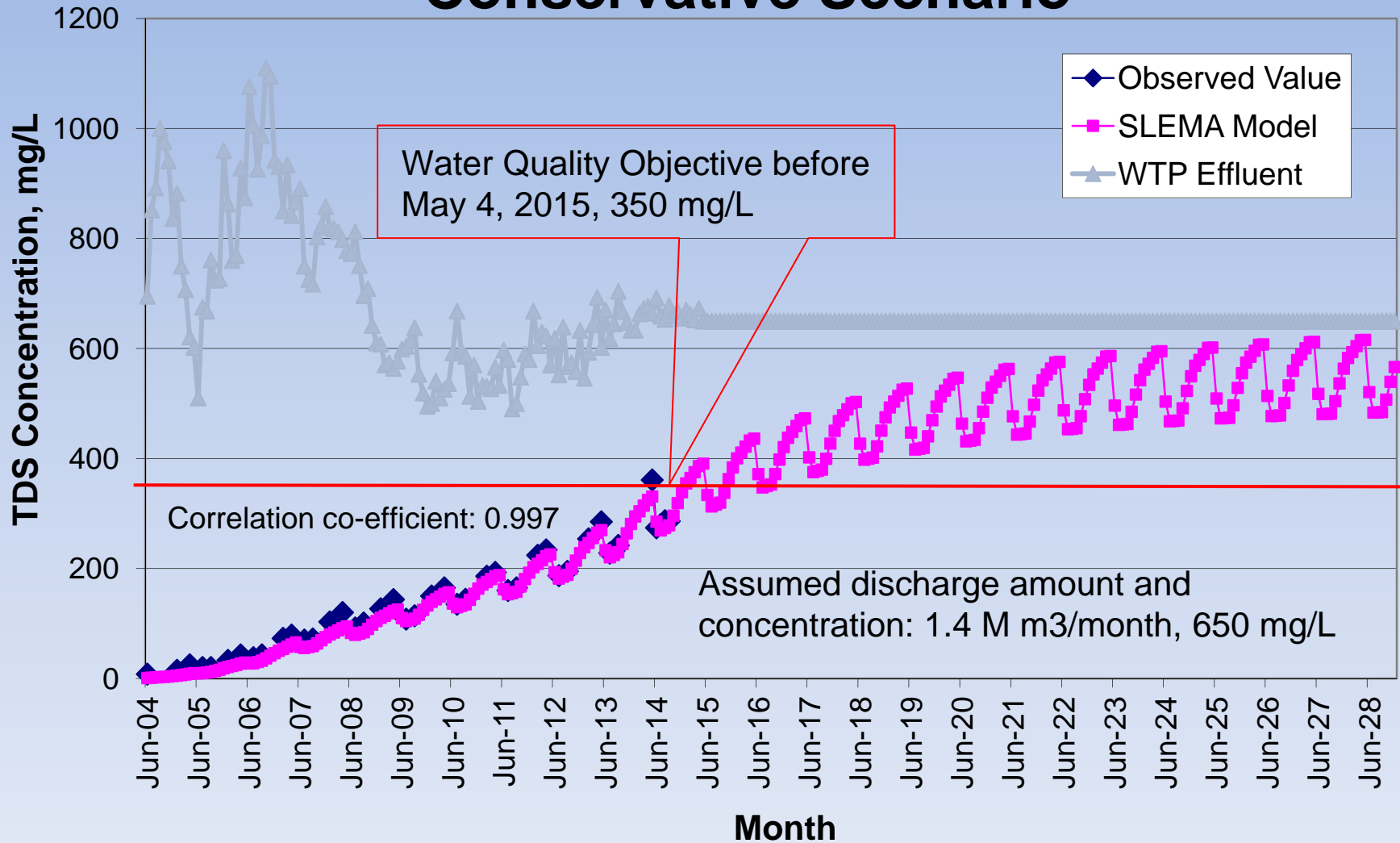
Water Quality Prediction of Snap Lake - Upper Bound



Water Quality Prediction of Snap Lake - Lower Bound



Water Quality Prediction of Snap Lake - Conservative Scenario



Comments from the Environmental Analyst (II)

- TDS levels are subject to the treated effluent from the Mine
- Lower Bound is the most likely scenario
 - Predicted TDS levels will be lower than the new Water Quality Objective (1,000 mg/L) under Lower Bound and Conservative Scenario

