MACKENZIE VALLEY ENVIRONMENTAL

IMPACT REVIEW BOARD

and

MACKENZIE VALLEY LAND AND WATER BOARD

JOINT TECHNICAL SESSION

De Beers Canada Inc. - Snap Lake Mine, NT

Type A Water License Amendment

Application MV2011L2-0004

ENVIRONMENTAL ASSESSMENT

EA1314-02

HELD AT:

Yellowknife Inn

Yellowknife, NT

April 15, 2014

Day 1 of 2

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--- Upon Commencing

MR. SIMON TOOGOOD: ...a process for both the Land and Water Board and the Review Board. And it's where we have an opportunity to have face-to-face discussions and hopefully come to a resolution on any issues.

There's going to be opportunity during our breaks to have off-line dialogue and that's encouraged. But if there's any resolutions to any issues, please, let's get that on the record after the breaks. There's going to be transcription, so we have someone on line who's going to be recording everything that's said. And as I already made the first mistake, please state your name and who you're with at the beginning of -- of -- whenever you speak.

There's going to be breaks throughout the day and there's going to be lunch, not provided. And hopefully this gets wrapped up at five o'clock. It's two (2) days. The agenda -- we have an agenda that's -- we're going to try and stick to the -- at least the order of what's there. But hopefully the timing may be quicker, might be longer. We have two (2) days. We'll see how it goes.

Now, we're not the Board. The staff

here, we're not the decision makers. We work for the Review Board and the Land and Water Board. They're the ones who are going to be making the decisions. We're here to get evidence and information so that we can present that to the Board. So there may be Information Requests coming out of this process. Hopefully we'll have those ready and posted for tomorrow for the Developer to start working, I hope.

So without further ado we're going to have a bit of an introduction by the Executive Director of the Mackenzie Valley Land and Water Board, and the Mackenzie Valley Environmental Impact Re -- Impact Review Board and that's going to be Mark Cliffe Phillips and Zabey Nibitt -- Nevitt, sorry. So, yeah, you want to pass it along?

(BRIEF PAUSE)

MR. MARK CLIFFE PHILLIPS: Okay. Well, as Simon goes through his -- his computer here and try and -- and try and find the -- the work plan. I -- I'm Mark Cliffe Phillips, as -- as Simon said, the Executive Director with the Mackenzie Valley Environmental Impact Review Board. What Zabey and I are intending to do is just talk a little bit about our process. This is a little bit unique. This is the first time that the Land and Water Board and the Review Board have held a joint technical session and a -- and a joint process in any manner.

So it is a -- a learning curve for -- for both our organizations, but we wanted to talk a little bit about where we're at in our process and where the next steps are. Just so people understand the context of -- of where this particular technical session fits.

So as -- as Simon's still getting this up.

(BRIEF PAUSE)

MR. MARK CLIFFE PHILLIPS: Okay. Well, maybe I'll just speak to the process and as -- as things come up I -- I think we have copies of the work plan over at the desk where -- where Stacey Menzies, our logistical person from the Review Board is -- is sitting.

So in -- in terms of where we're at there was an application, a water licence application, as you all know for certain amendments to the De Beers Snap Lake water licence which was sent to the Mackenzie

Valley Land and Water Board.

Subsequently that -- that application was referred to the Mackenzie Valley Environmental Impact Review Board. The -- it's a unique referral in -- in the sense that there was an environmental assessment already conducted for the Snap Lake Mine previously. And -- and with that there were specific measures that came out of that, recommendations that were accepted by the -- the Federal Minister of -- of Indian Norther Affairs at the time.

With that the -- there was a specific measure or -- or measures that referred to a limit on the -- the amount of total dissolved solids that was then turned into conditions in the licence. The amendment -- one (1) of the amendments that was within the water licence application was looking to change that -- that number within the water licence to a number that was above what was considered in the measure of the envir -- the original environmental assessment. And with that, that was the -- the trigger for the referral to the Mackenzie Valley Environmental Impact Review Board.

So with the -- the unique nature that this wasn't a -- a referral of an entire mining project, it was for a specific component of that project, it's a -- it was a little bit different for us to come up with the process that we would normally do for a normally for an environmental assessment. So we had to set out scoping the development to limit what we're discussing, taking into consideration what has already been assessed previously under the last environmental assessment.

As of the coming into force of the Mackenzie Valley La -- or Resource Management Act amendments, there's actually a section within there now that says that we must consider the outcomes of the previous environmental assessments. So that's just formalizing the approach that we were already taking in -- in our scoping reasons.

So with that we did produce a -- a -- or we ended up doing a joint review process for the Land and Water Board and for the Impact Review Board leading up to this technical session. But prior to that we, at the Review Board, our Board made a decision on the scope of this particular environmental assessment and limited the scope to looking at the -- the changes associated with TDS and its constituent parameters. We also have copies of the reasons for decision available for -- for people at the back, and it's available on our registry.

So right now we've been running a joint review process because the information that is being garnered out of the review of the water licence application and the -- the review that the -- the Environmental Impact Review Board is doing is going to benefit both the Land and Water Board and the Review Board.

But there -- after the technical sessions, there is a point where our processes need to diverge. From the end of this -- this session here the Review Board will then undertake its public hearing process, which ultimately leads to a -- a report of environmental assessment with recommendations which ultimately become measures. And then the process would then return back to the Mackenzie Valley Land and Water Board. And I'll let Zabey speak to their process now.

MR. ZABEY NEVITT: Thank you very much. Zabey Nevitt with the Mackenzie Valley Land and Water Board. Before I do that I just want to talk to some very important administrative items that we might have forgotten about. The washrooms are out the back here. That's the way out. And the coffee might be at the back at some point. So you can walk around with a cup at the moment, but we'll get you some refreshments along the way.

Yeah, as Mark said this is the first time we've done this. This is a new process. It is allowed for in the Mackenzie Valley Resource Management Act. It's a -- it was part of the envisionment of an integrated resource management regime, and so we're -- we're doing what we can to -- to make this process as smooth and as effective as possible.

So Mark sort of explained where we got to in the EA decision phase. Following that we -- we essentially pick up again where we left off from at the end of this process, which is the -- is the -- will be the technical session Information Requests. Those get finalized from the Land Water Board's sort of side around April 30th. And then there's the pause on from our side as the -- the Review Board does their process.

And then we move back to the Land and Water Board after that with the -- the call for interventions and the -- the issuance of a draft water licence. And -- and then into the standard process that happens for every water licence proceeding we hold, coming towards a final hearing. And the -- the comments on the licence, closing arguments, and eventually the Board will make their decision for issuance to the Minister. That's just the brief summary of it.

I think all these work plans are available. There -- I think there are some paper copies at the front of the room. They're available on websites. All of the materials in terms of the record is being put to both the Land and Water Board and the Mackenzie Valley Environmental Impact Review Board websites. So you can find it -- the -- the record will be available so the Boards themselves will have all of the information available to them as we move forward.

Encourage any questions on the -- on this. There are some questions that we may ask for to be put in writing if they are substantial process questions. Other than that, I encourage everybody to have as much discussion and dialogue as they can. We're -- we're aiming here to make as much concordance, as much agreement, as we possibly can. What we can't resolve though, of course, we'll carry on into the process. And there's lots of process left to give people lots of time to provide input. So with that, thank you. I'll hand it back to Simon.

MR. SIMON TOOGOOD: Thank you very much. Before we get into the presentation by De Beers I thought it would be helpful to have a roundtable. I guess we could start off at -- we'll start off with me, Simon Toogood. And we'll go over to Kathy Racher and work our way around the room.

DR. KATHY RACHER: Okay. Kathy Racher on behalf of the Mackenzie Valley Land and Water Board.

MS. LINDSEY CYMBALISTY: Lindsey Cymbalisty for the Mackenzie Valley Land and Water Board.

MR. MARC CASAS: Marc Casas, also from the Mackenzie Valley Land and Water Board.

MS. ROSANNA NICOL: Rosanna Nicol with the Mackenzie Valley Land and Water Board.

MS. SARAH-LACEY MCMILLAN: Sarah-Lacey McMillan with Environment Canada. Anita Li is also dialling in. We're just having a little bit of technical difficulties. Is there any chance that the volume could go up? Okay. Great. Thanks.

MR. ALAN EHRLICH: Alan Ehrlich with the Review Board.

MS. SACHI DESOUZA: Sachi DeSouza with the Review Board.

MR. CHUCK HUBERT: Chuck Hubert with the Review Board.

MR. RICK WALBOURNE: Rick Walbourne, GNWT-ENR.

MR. PAUL GREEN: Paul Green with GNWT-ENR.

MR. SEAN WHITAKER: Sean Whitaker, GNWT-ENR.

MR. ZHONG LIU: Zhong Liu with SLEMA.

MR. MATT HOOVER: Matt Hoover, North Slave Metis Alliance.

(BRIEF PAUSE)

DR. KATHY RACHER: Did you want to get those guys again? Yeah. Kathy Racher for the Board. There seems to be a problem with the -- the mic for the North Slave. Could you -- Simon, could you just move the mic in the middle over to -- to them?

(BRIEF PAUSE)

MR. ED JONES: Ed Jones, North Slave Metis Alliance.

MS. ERICA BONHOMME: My name's Erica Bonhomme. I'm with De Beers Canada. I'd just like to introduce our whole team. My colleagues from De Beers here are Julie L'Heureux, David Putnam, Alexander Hood, Michelle Peters are in the back. And from Itasca, Houmao Liu. Peter Chapman, Alison Snow, Tasha Hall, and Hilary Machtans, and they're all from Golder

Associates.

(BRIEF PAUSE)

MR. LIONEL MARCINKOSKY: Lionel Marcinkosky with GNWT-ENR.

MR. PAUL MERCREDI: Paul Mercredi, GNWT-Lands.

MS. LINDSAY LUKE: Lindsay Luke, GNWT-ENR.

MS. STACEY MENZIES: And Stacey Menzies from the Mackenzie Valley Review Board.

MR. SIMON TOOGOOD: Okay. Is there anyone else on the phone? If you could please introduce yourself.

(BRIEF PAUSE)

MR. SIMON TOOGOOD: We'll -- if there's anyone on the phone will you please introduce yourself?

(BRIEF PAUSE)

MR. SIMON TOOGOOD: Okay. There's at least two (2) people on the phone. There's one (1) person from Environment Canada. I -- yeah, but they can't hear us at the moment, so we'll just give this about four (4) minutes, hopefully we can sort this out.

(BRIEF PAUSE)

MR. SIMON TOOGOOD: Hello, everyone. We have people back on the phone. It's Simon Toogood with the Review Board. If you could please take your seats and we'll get started.

(BRIEF PAUSE)

MR. SIMON TOOGOOD: Okay. Hi, it's Simon Toogood with the Review Board. So as everyone has taken their seat if the people on line, we're about to have a presentation by the -- by the Developer. And if you could -- I believe you should have an electronic version, and it's the first presentation. It's the Snap Lake water licence amendment application overview. If you could open that up and then I'll hand it over to De Beers.

And please, De Beers, when you're giving your presentation could you just indicate what slide you're on so people can follow along? Thanks. I'll hand it over to Erica.

PRESENTATION BY DE BEERS - OVERVIEW:

MS. ERICA BONHOMME: Good morning. My name's Erica Bonhomme. I'm with De Beers Canada, Snap Lake Mine. I'm the Manager of Environment. I'm going to begin with an app -- overview of the application as we've submitted it, as well as some supplemental information that was more recently filed. And that'll follow immediately by a presentation by Houmao Liu on the groundwater models. It's -- I don't think this thing's working.

(BRIEF PAUSE)

MS. ERICA BONHOMME: Slide 2 is an overview of the -- of our -- our -- some key infrastructure we're going to speak to in the presentations today. We'll refer to the Water Management Pond; freshwater intake; the place where all the pipes come out of the ground, we'll call that underground mine dewatering portal; the diffusers which is where mine effluent enters Snap Lake; and the water treatment plant.

We also in -- for those of you in the

building here we have a -- a map of the mine site. And should we re -- need to refer to it today I have a map showing all the SNP surveillance network program stations, as well as stations we use for monitoring under the Aquatic Effects Monitoring Program. So we can refer to that if we need to throughout the day.

Slide 3. The water licence amendment app -- application was submitted in December of last year. Generally, De Beers is applying to change the quality of water allowed to be discharged to Snap Lake. The application to amend the licence was initiated after a review of the recommendations that show that the current water licence water quality requirements may be overly protective.

The water licence also -- the -- the water licence amendment application also proposes a number of minor regulatory and administrative changes that are intended to provide more clarity to terms. Overall, the proposed amendments are intended to improve efficiency of mine operations and reduce costs in the long term, all -- all while ensuring that the water remains safe to drink and the aquatic life in Snap Lake remains healthy.

Slide 4. There have been a number of opportunities to learn about and discuss water quality at Snap Lake, including the proposed changes. Prior to the application being filed De Beers hosted site visits during May and June and, again, in July to review water management systems in place.

In September community members attended the annual fish tasting event conducted under the Aquatic Effects Monitoring Program. Since the application was filed De Beers hosted an information session on January 6th. De Beers also hosted government agencies, as well as the Sla -- Snap Lake Environmental Monitoring Agency technical staff for a site tour on March 11th. And, finally, the water licence was discussed as part of a meeting on project updates held in Mar -- on March 20th. De Beers again plans to host community site visits and fish tasting in 2014.

Slide 5. The application is supported by a number of studies and reports which will be summarized during the various presentations over the next two (2) days. These include a groundwater model; a site water model; and a Snap Lake mo -- water model; reports of toxicity studies; and the development of site-specific water quality objectives for TDS, fluoride, nitrate, and strontium; and a description of the methodology for developing associated effluent quality criteria.

Slide 6. There were three (3) specific plans required to be filed as part of the current licence. The TDS Response Plan, the Nitrogen Response Plan, and the Strontium Response Plan. Those are all included as part of the application.

There's also information that was filed on April 11th, including a memo regarding the site-specific water quality objectives for strontium, and a memo regarding a second toxicity test for daphnia magna, the re -- results of which is important and Dr. Peter Chapman will speak to that later today.

Finally, as also filed on April 11th, was additional information intended to specifically address the requirements of Section 117 of the MVRMA as they pertain to the aspects of the application within the scope of the environmental assessment.

Slide 7. I'm going to overview a -- a few of the key terms used in the application. There's also a glossary that we've dropped off at the back and -- and distributed around the table. Site-specific water quality objectives is a term we'll use. You'll see the -- the acronym SSWQO used. They -- they refer to -- they -- they refer to water quality appl -- levels that apply in the lake and that are protective of the aquatic life. It's a specific concentration of a substance beyond which detrimental effects to aquatic health may occur.

Water quality objectives can also be defined by EQCs, which are protective of aquatic life. What they mean is that there are concentrations below which there are no effects to aquatic life and they're measured in the whole lake. EQCs are concentrations that can be discharged to the lake without exceeding site-specific water quality objectives. They're measured end-of-pipe.

Effluent refers to the water discharged from the water treatment plant to Snap Lake through the diffuser. And the schematic here shows where we measure water quality objectives and where we measure against water quality objectives in the lake, and where we measure effluent quality -- against effluent quality criteria at the end-of-pipe.

There are two (2) SNP stations that are important: SNP 02-17B, which is the end-of-pipe measurement, and SNP 02-20 which refers to the mixing zone around the diffuser. You'll see Alison Snow speak to that in a little bit. And AEMP SNP station 02-18, which describes conditions in the Snap Lake receiving environment.

Slide 8. This is an overview of the proposed changes to the water licence EQCs. I wonder if someone can just focus that projector a little bit. Thank you.

Just some highlights here. A note that ammonia and nitrate limits are not proposed to be increased, but they're included here because the water licence required De Beers to recommend EQCs based on site-specific studies.

Slide 9. Before we go into Houmao's presentation I'm going to just give a brief overview of and an introduction to the groundwater and site models. I think everyone's aware that Snap Lake Mine is an underground mine. Very generally, the modelling predicts that loadings to Snap Lake of total dissolved solids, TDS, nitrate, and its constituents will increase over mine life; that is, to 2028.

Mining requires development of lower underground pro -- passageways for infrastructure and hauling of ore to support mining. We call this footwall development. The extraction of kimberlite ore occurs in the hanging wall, and that's the -- in the green zone above.

Footwall development encounters higher TDS concentrations in the groundwater, called connate groundwater; whereas hanging wall, and in some cases as well as the footwall, receive large volumes of water that make its way through geological structures directly from Snap Lake above.

Finally, during mining, nitrates enter water through the use of explosives. And we're going to get a -- into all of this in a lot more detail.

Slide 10. Snap Lake's water treatment plant currently treats for sediment, total suspended solids, and adjusts the pH of water. It does not treat for TDS, ammonia, or nitrates.

When we use the term 'clear water', it refers to water pumped from underground that has lower amounts of TSS. 'Dirty water', on the other hand, refers to water pumped from the underground that is high in TSS. It also includes high TDS connate water.

Currently, Snap Lake Mine treats and discharges up to 43,000 cubic metres of water per day. Mine effluent quality and quantity are monored -- monitored at SNP Station 02-17b, which I showed you on the earlier figure, which is an inline meter.

And finally, just a very generalized water balance model for Snap Lake Mine. It shows you that 9 -- 99 percent or more of the water that ends up in Snap Lake is generated in the underground. It includes clear water and dirty water that I mentioned. Less than 1 percent, respectively, come from freshwater withdrawn from Snap Lake for domestic use and for fire suppression. And less than 1 percent is derived from surface water, including seepage from the North Pile and runoff. All of that water reports to the water management pond and water treatment plant before it's discharged to Snap Lake.

And with that, I'll turn that -- I'll turn it over to Dr. Houmao Liu, who will speak to the under -- underground model.

(BRIEF PAUSE)

PRESENTATION - UNDERGROUND MODEL

DR. HOUMAO LIU: Houmao Liu. Thank you, Erica, for the introduction, and that's a very good introduction. Good morning. My name's Houmao Liu. I'm with Itasca Denver. I'm principal hydrogeologist. I have over twenty (20) year of experience in mining hydrogeology and groundwater flow model.

And this -- my topic here is the Snap Lake groundwater flow model update. And I'm doing the presentation, but that's team effort between Itasca and

Snap Lake hydrogeologist.

Now, slide 2, basis of model. Now, what the difference of this model over the previous model, I think I want to emphasize two (2) big bullet item here. One (1) is nine (9) years of operation data. And in that, we continuous understanding and mapping geological structure.

As Erica just mentioned, geological structure is a key feature that introduce the water into the mine working. And then continuous measurement of underground mine discharge rate over nine (9) years and the continuous measurement of total dissolved solids, or TDS, in the underground mine discharge.

The second bullet item I want to say here is Itas -- Itasca's accumulated knowledge since 2001. We start working on these projects since 2001.

Slide 3. I want to give a basic idea of groundwater flow. I know lots of here, you are, you know, technical sound words to them, (sic) but just give a basic concept of groundwater flows as -- as introduction.

Groundwater flow essentially flow by energy. So con -- it's follow the law called Darcy's Law. It's from flow -- flow from high energy to low energy. So the key item here, it's -- we have a flow rate. It's linear proportional to hydraulic conductivity -- that means how permeable rock is -- and then the area that groundwater flow will pass through.

And then delta 'H' over delta 'L' is hydraulic gradient. The gradient means how much energy drop over even distance. So this key item that control the flow rate. And the groundwater model is a three (3) dimensional realization of these basic concept.

Slide 3 (sic). As Erica just mentioned that Snap Lake has hanging wall that's above the dike, above the mining zone, and then the footwall that below the mining zone. And now the -- the upper one above the mining zone in the footwall, the water is quite clean. And below the mining zone in the footwall, the water could be connate water with high TDS.

As mining proceed, as you can see here, mining is down deep from the southwest to northeast corner. As mining proceed, the water from both hanging wall and the footwall will migrate or seep into the mine working. And those water is defined as underground mine discharge.

Slide 5. This is just a quick summary of what our current status of knowledge of underground mine discharge. And I want to summarize in three (3) key bullet.

The first key bullet is a -- it's about the mining beneath Snap Lake and the permafrost. As you know, mostly -- most of mining -- the current mining is under the Snap Lake. So the water of underground mine discharge under current condition originate from Snap Lake. And now we need to think about the future mining, because future mining -- large portion of future mining is under permafrost. And so the permafrost is frozen rock outside of lake. And it is about 200 metre thick. Permafrost is considered to be impermeable. So under these conditions, the future mining, you would expect the inflow to the mine working would be reduced or stabilized.

Now, second bullet item here, it's our current understanding of -- of geological structure has been improved a lot, as I will show in a later slide. And so extensive geological structure had been identified.

And the third, most of the groundwater that seeped to the mine working if -- it's through geological structure, based on the nine (9) years of observation.

Slide 6. As I just mentioned before, we have identified the key -- or the mine has identified an extensive geological structure in the cur -- under the current mine footprint, as you see this orange line, and then over the future mine working.

And also, you can see here -- now, the second point I want to show here is current mining. As you see here, the blue line here, that's a -- that's a Snap Lake outline. And the most of current mining, it's under the lake, or beneath the lake.

The third one I want to point out here, it's the future mining. Quite large amount of area that's outside of lake that's under permafrost.

Now, with these extensive structure, they all interconnected. And the -- the grouting has been tried at the mine, and the -- it seem like it's -- it's not physical to do the grouting, extensive grouting, with this extensive geological structure.

And the lastly, in our model, we incorporate nine (9) geological structure zone. As you can see here, different colour represent different geological structure zone. And it's also shown in the legend here, nine (9) geological structure zone, including the model, to -- to predict -- to calibrate model and to predict the future mine groundwater -- groundwater discharge.

Slide 7. As I just mentioned, the -- mostly the mining is under -- beneath Snap Lake. So you can see quite linear relation of mine ground -- underground mine discharge versus mining area. But please note, in the future mining, as I mentioned, the mining would be outside of Snap Lake under the permafrost. This relation will not hold, because it will be much less water or source of water that -- that discharge into the mine working.

So we -- we feel that we have a quite good understanding of data in the geological structure for the -- for the underground mine discharge. Now, what's our status of knowledge of TDS in underground mine discharge?

Essentially, there are three (3) main points that we want to make here. The first one is that two (2) different groundwater sources of TDS, as Erica mentioned: the hanging wall and the footwall. And hanging wall, usually it's quite clear water with low TDS concentration. And the footwall has a higher TDS concentration, depending -- from very shallow now, it can go up to 20,000 milligram per litre. It just based on the measurement.

And the TDS concentration has been monitored in seeps to both the hanging wall and the footwall during operation. And this monitoring data in the seep do not show the trend along the depth.

Third, the TDS concentration in underground mine discharge depend on the ratio of seepage rate to the hanging wall and to the footwall mine working. Certainly with -- with a footwall, has higher concentration, and the hanging wall has lower concentration. The volume would play an important role of how much TDS loading would be.

Slide 9. This just a conceptual model of TDS calculation. As you can see in this slide, we have a flow coming from hanging wall and a flow coming from footwall. Essentially, what we do here, just based on volumetric mixing of how much water coming from hanging wall, how much water coming from footwall, and with -- given the concentration of ambient TDS concentration, ambient groundwater, and mix them together, calculate how much -- how much TDS would be in mine groundwater discharge.

In the meantime, we mix with Snap Lake water. And then, from there, we calculate how much concentration -- TDS concentration change in Snap Lake then as a source again to apply to the hanging wall. So it's just very simple volumetric mixing calculation.

Slide 10. Using the mine plan and the geological data, the groundwater flow model has been updated. And at first it was calibrate to the measure underground mine discharge as -- as showed here, the blue dots. As you can see, the groundwater flow model essentially capture the behaviour of mine discharge rate over last nine (9) year. And based on that calibrate, groundwater flow model would predict the future inflow rate or underground mine discharge in the future mining. And the highest rate we'll get, it's about 60,000 cubic metre per -- per day.

And as you can see here, when it's mine under the permafrost, the inflow or the additional groundwater seepage to the mine working is -- essentially is not significant.

Now, the bottom line here, it's -- the green line, it shows the inflow to the waste drift or footwall. As you can see here, the -- the inflow to the waste drift or footwall, it's only small fraction of total underground mine discharge. That's what I said in -- before. That's the mixing. So you actually control how much -- how much of TDS loading would be.

Now slide 11. Based on the predict inflow to the -- both to the hanging wall, or seepage away from hanging wall and the footwall, then we did a calculation of measured TDS concentration in underground mine discharge.

As you can see, there are two (2) kind

of -- two (2) mode of -- based on this measured TDS concentration, the brown colour, there's two (2) mode of TDS concentration you can see here: the initial surge with high TDS concentration, then it start dropping down. And that initial surge is due to the development of footwall. And then as more hanging wall water coming in, it dilute the water, and the TDS concentration drop.

And during our calculation for the future underground mine discharge TDS concentration, we use two (2) different ambient TDS concentration. One use geometric mean; the other one use arithmetic mean as a TDS concentration of ambient hanging wall and the footwall groundwater. As you can see, those two (2) approach capture the -- the upper and the lower range of the major TDS concentration.

Slide 12. So to summarize from slides -- slide 11, and still three (3) key bullet item. As I mentioned before, the monitored TDS concentration shows two (2) modes: high value during the initial stage of footwall development, and a decreasing trend following that initial surge.

Now, second one is two (2) TDS concentration were assume for foot -- hanging wall and the footwall groundwater to capture such variation. As it show here, the -- the value I use -- we use.

Now, the third bullet item, as I just show in the last slide, it's a -- the predicted TDS concentration capture the possible range of future TDS concentration in underground mine discharge.

I want to summarize my -- our presentation with a -- just two (2) key item here, just about the certainty of the model. I think the model, it's a -- it's a -- has a quite high certainty. For first, model is calibrated nine (9) years of monitoring data related to underground mine discharge rate and also TDS rate in underground mine discharge. And the second is model incorporate updated structure data into the future mining.

With that, thank you for your attention.

(BRIEF PAUSE)

MR. SIMON TOOGOOD: Thank you very much for your presentations. It's Simon Toogood, with the Review Board.

So let's go into questions for -- from the room on these presentations. I see --

DR. KATHY RACHER: Just one (1) second. Kathy Racher, for the Board. So you just -- the presentation on the other models comes -- you wanted to do questions first. We -- we kind of organized it so the presentations were on all the models first, and then questions on all the models. But perhaps it is better this way.

MS. ERICA BONHOMME: Either way. If you want to do them, we're prepared to continue on with all the models.

DR. KATHY RACHER: Okay. Kathy Racher, for the Board. Actually, that was a lot of information. Very well presented, though. Thank you. So maybe we will do questions first on this. And Rick looks anxious to ask a question.

QUESTION PERIOD:

MR. RICK WALBOURNE: Rick Walbourne. I'm going to let Sean go ahead here first, Sean Whitaker.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. The first one's actually to the Board. It's mostly because no one said where the significance determination is. Where -- what point in time are we starting from? The GNWT needs to know.

Are we starting from beginning of mine

life to determine the significance determination, or is it when the Proponent filed their application? So we're hoping for some clarification where significance determination is going to be determined from, what point in time.

MR. SIMON TOOGOOD: Thanks for the question. It's Simon Toogood. We're just going to have a brief discussion, and we'll get back to you on that one.

DR. KATHY RACHER: Kathy Racher, for the Board. In the meantime, does anyone have any questions? I'm going to ask the people in the room about the groundwater model first. And for you -- those on the phone, don't worry. I'll ask you as well after we go through the room.

Any questions on the groundwater model?

MR. RICK WALBOURNE: Rick Walbourne, GNWT. Actually, I have a couple of comments/questions on the overview presentation, if we can do that.

There was a comment regarding Snap Lake being safe to drink. My -- I guess an overarching question is: Is there a Canadian drinking water guideline for TDS, and what is it? And how does that compare to Snap Lake?

(BRIEF PAUSE)

DR. PETER CHAPMAN: Peter Chapman here. Basically, there is no environ -- sorry, Health Canada guideline in terms of, you know, a level of TDS that could adversely affect health. There is a guideline, and I can't remember what it is -- we can get back to you on that -- in terms of taste, because of course salty water will taste differently than freshwater.

MR. ZHONG LIU: I guess it's the 500 milligram per litre; 500 milligram per litre.

DR. KATHY RACHER: Kathy Racher for the Board. That was Zhong Liu, from SLEMA.

Do you have any follow-up questions, Rick?

MR. RICK WALBOURNE: Rick Walbourne, GNWT. So the 500 milligrams a litre is the taste, palatability? Okay.

I just had one (1) more question. There was mention of clear water versus dirty water coming from the underground. You did mention that there was trace amounts of TSS.

I was just wondering what the actual numeric value on that was, what kind of levels of TSS in lake clear water versus dirty?

MS. ERICA BONHOMME: In the clear -- we do measure the TSS in -- as using turbidity. So in the clear water, we have less than 7 NTUs.

DR. KATHY RACHER: Kathy Racher. Question from Sean?

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. Just in terms of your turbidity measurement, has that been correlated to the clean and dirty? Like is there a correlation between turbidity and TSS to calibrate your model, or is it an ASTM, or is it just based on an in-field measurement?

MS. JULIE L'HEUREUX: Julie L'Heureux. Can you repeat the question? I was busy.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. So you said that you're using turbidity as your measurement for clean and dirty water.

Has that been calibrated to TSS to have the positive correlation?

MS. JULIE L'HEUREUX: Julie L'Heureux. Yes. We do have the analysis from the lab, from the -- I mean for the -- the TSS, so we can pull it out for you and -- and give you -- for the moment, I don't have the data over my head, but we can certainly find it out before the end of this session today.

MR. ZHONG LIU: Zhong Liu, from SLEMA. Based on my observation, there is nowhere clear correlation, at least for the past few years, from my observation.

MS. ERICA BONHOMME: We do -- Erica Bonhomme. We do monitor TSS as part of our Surveillance Network Program, so I can get you that number. We don't actually specifically separate out clear water from our dirty water in our Surveillance Network Program. So maybe I -- I just -- I'm just trying to understand sort of the context of the question.

We do obviously treat for TSS all throughout, but maybe -- maybe give me a bit more to work with here, what you're -- what you're trying to -- what you're trying to get at here.

MS. JULIE L'HEUREUX: Just -- just a moment. Yeah, this presentation is about the groundwater flow. It's more like the quantity. So if you have question about the quality, there's another presentations going further. So we can probably answer your question on this -- on these ones.

MR. RICK WALBOURNE: Rick Walbourne, GNWT. Yeah. No, I understand that. It was -- it was mentioned in the overview presentation. That's where -- where this line of questioning came from. But obviously there's going to be a lot of conversations about water quality over the next couple of days. So, yeah, we can -- we can table that for now.

MR. TODD SLACK: Todd Slack, with the Yellowknives. Excuse me. I've -- I've got three (3) questions, and the first is a simple one.

This TDS for palatability limit, can you -- can somebody tell me where that limit or that guideline comes from?

(BRIEF PAUSE)

MR. TODD SLACK: Okay. Never mind. There -- our friends beside me here have provided it. It's from Health Canada. Thank you for that.

Turning to slide 4 in this model, this is just in the overview, in terms of the -- the engagement. Is the project's viewpoint that all of these engagements were relative to the -- the submission that we're talking about today -- or, sorry, were relevant, not -- relevant to this discussion that we're having today? Pardon me.

MS. ERICA BONHOMME: Erica Bonhomme.

They are all relevant to this discussion. They were not all specific to this discussion.

MR. TODD SLACK: I'm wondering if the -- in that case, I'm wondering if the project will be able to undertake an Information Request, if possible, to provide references from Volume I for these particular submissions in which TDS was discussed.

MS. ERICA BONHOMME: I -- I -- Erica Bonhomme. I don't think we need an IR. I'll -- I'll answer that right now.

So we did file an -- an engagement plan, which details all the engagement that was undertaken in -- last year and in prior years that's relevant to this. The specific engagement activities where not -- where the water licence amendment application was discussed is the January 6 session that you see there, one (1), two (2), three (3), four (4), five (5), sixth bullet down.

We did have a specific information session that De Beers hosted -- you were present, Todd -- on the -- on the application. And Dr. Chapman gave a very good overview of -- of the site-specific water quality studies that were done in support of that application.

And, more recently, we provided an -- an overview of the application, including the aspects related to TDS, at a -- a session we had here in Yellowknife, which you were also present at, on March 20th.

MR. TODD SLACK: Yeah. Thanks. And I -- I was at those. So would you say it's fair to say that the first few bullets on this list weren't particularly relevant to TDS or the issues that we're talking about today?

MS. ERICA BONHOMME: Erica Bonhomme. I -- I would disagree that they're not relevant. They were not specific to -- to TDS. At that time, we were still developing the studies that were -- that were going to support the application. What we've talked about consistently is water quality in Snap Lake, how we manage water at Snap Lake, the kind of challenges we have with managing large volumes in particular, and the kind of monitoring that we undertake to ensure that we stay within our -- our licence limits.

What has been discussed is the -- the kind of methodology that we use to do the tex -- toxicity testing, so specific to fish species. So we do need to get a research licence that allows us to take fish for scientific purposes. And that's all part of the work that was undertaken in 2013.

MR. TODD SLACK: And the -- I'll move on, the third point that I -- or third question that I have. So it seems like the geological base mapping that formed part of the modelling start-up phase, it seems like that may not have been the best mapping in the world.

What level of confidence should we have in the geological mapping for the future? And has De Beers undertaken additional effort, with this in mind specifically, to try and have a better idea of where these faults and structures are?

MS. JULIE L'HEUREUX: Julie L'Heureux. We have SRK, Wayne Barnett. He's a well-known geostructural engineer who's coming on site for a month, doing field work and do an update every year. So we're going to have an update for this year in a few -- few weeks -- few months.

So now what he's doing, it's on top of mapping everything that had been done for the last year and -- and confirming all those -- those structures. He's also taking, you know, geophysical data on surface to extrapolate the -- the structures that he sees, and map every year.

So we intend to keep this very technical team on board to help us with our structure at Snap

Lake.

MR. TODD SLACK: Todd Slack with the Yellowknives. I'm just wondering, can you clarify, is that new work that's being undertaken, or has that been undertaken in the last few years?

Can you give me some more information in terms of the level of effort, please?

MS. JULIE L'HEUREUX: Yeah. It's the third year in a row that they are coming on site on a yearly basis. The work was done in December this year, so we -- we're waiting for the report shortly. And, as mentioned, there's a fund for that on a yearly basis to make sure that our geologists are doing a good job, and they're a third-party reviewer on this specific work, scope of work.

MR. TODD SLACK: Thank you. And then one (1) last question. Would you say that the area of focus attached to that is an area like close in proximity to the mine or the active mine workings now?

Like, is it looking at what you're doing one (1) year in advance, or is it looking at five (5) -- like, I'm trying to understand the predictive value of the model and the level of uncertainty.

MS. JULIE L'HEUREUX: Yeah. Julie once again. So what -- you know, you saw those big structure, like the main fault, Crackle Fault and Snapple (sic) Fault. So he's going to go and assess, and then we can extrapolate.

So obviously, he's taking the core, the rock that the geologists and the -- the drillers have been doing for the year, and then he's going to go through all the core box and -- and then extrapolate the -- the structure, and also going on the face and then map directly.

So there's different ways to make sure that we are seeing a particular fault, and then we -- we can say, Okay, this is Snap Lake Fault, or Snap Fault, and then, you know, go from there. So there's some structures that are known, and then we're just confirming it, which sense, which estimate is going yearly just to get more confidence.

MR. TODD SLACK: Okay. Thanks. So, yeah, he's in the -- the known workings and the known activity. But is he also working in the -- in terms of the real aspects?

Is it outside of the blue line, that Snap Lake boundary, where the mine is going to go in the future, or --

MS. JULIE L'HEUREUX: Well --

MR. TODD SLACK: -- does it provide

value five (5) years down the road? Does it provide value ten (10) years down the road? That's --

MS. JULIE L'HEUREUX: The only value that we can have is with the drilling programs that we do. So we have the data that -- where we're drilling. So this is the -- the program that we -- we do on extra to understand where the structure are, the delineation programs. That's what we can do.

And then, if we looking for the life of mine area, obviously the 2028, the -- the drills cannot reach that far. And so what we do is we take the geophysical data and then add it as a layer to the physical interpretation.

DR. KATHY RACHER: Kathy Racher, for the Board. I guess I had similar questions to Todd with respect to the certainty of the model, obviously. The original model under-predicted the quantity of water and the quality of the -- of the mine water by -- by a fair amount.

And so I think, overall, there's just sort of a general -- what's different today? Why -- you know, so you've -- you've predicted out to, you know, 2028, you know. How much confidence should we have now versus, you know, the confidence we might have had later?

Like, what -- what is different?

DR. HOUMAO LIU: Houmao Liu. To answer your question, it's -- there's some assumption that in 2011's model used in the -- in the model, it's -- we assumed that --the other consultant who do the model assumed that all the grouting will be effective. So every structure you encounter would just achieve the grout, effective grouted.

And that's -- now we go back to the model, just see what's the history of the model. In 2001, a test got did of model. We assume everything will be grouted, all the structure will be grouted. We gather inflow rate of mine discharge about 25,000 cubic metre per day. And now, in 2011, the same assumption, we came up with 28,000 cubic metre per day.

Okay. Now, to go back to history of some other model, like 2005, 2006, when a test got did the model. You know, one (1) time we predict about 62,000 cubic metre per day. And at the other time, we predicted about, you know, fifty (50) to like 90,000 cubic metre per day. And it's all within the range of even this update model.

So the consistency of the model, I think you need to take into the consideration all the assumption they use in the model. The assumption just say grouting is effective, but it's -- it's proven it's not feasible or it's a challenging task.

MS. JULIE L'HEUREUX: Yeah. If I can just add to that, just to confirm, so we have two (2) different situation: a situation that all the structure would be grouted, so our full curtain. And we had two (2) different team of expert that assessed that this year and just give a conclusion that it's not feasible, it's not achievable.

We can -- let's say -- well, just as a -- an anecdote, they tell me that we can grow pineapple in Yellowknife and that we can also try to grout one (1) heading. So we have thousands of heading, and then we have nine (9) different structures that are all interconnected. So if we try to grout one (1), then the water will pressurize and then just pop to another heading. So we can go for years trying to seal those heading one (1) at a time, but it's not feasible on -- even for the life of mine. We will still be there in probably thirty (30) years try to grout all those different little cracks and fissure and fault everywhere.

So they -- we -- we brought up two (2) different expert in the world, one (1) South African teams and one (1) Canadian team, and they just conclude that we can't do a full curtain.

So if we're going back to the model, the assumptions why they're so different with the twenty-five (25) kind of megalitre per day, that was assuming a full curtain would -- would work. But if we going back and we see from 2001 to 2013, or last year, then we are in the same range. I mean, in 2005, 62 cubic metre per day. We are reaching sixty-three (63) this year. If we looking apple with apple and, you know, compare the same things, then the model prediction are not very different.

DR. KATHY RACHER: Kathy Racher, for the Board. Can you turn off your mic?

Thank you. I'd never heard that explained before, and that's very, very helpful. So -- so the model that -- that we're working with at this stage is not assuming that the grouting is going to work. So this is just -- this is just -- this is the straight goods.

MS. JULIE L'HEUREUX: Yeah. So just to add that, so these expert that we brought are coming in few months to try. We -- we're going to try to localize certain area to grout as another trial, because normal cement doesn't work because it's so salty.

So we're looking at different option of -- of material like liquid grouting and bismuth, what would also hold more than five (5) years. So we -- we look at one (1) heading that was very salty, very high TDS, and they're going to come and we'll try. We'll do a pilot test on this as well. So that's something that we -- we working on at the moment. So we'll try one (1), and then we'll see how effective, and then we can move on.

DR. HOUMAO LIU: Houmao Liu. Just quick one (1) to answer your question. Yes, the model assumes there's no grouting.

DR. KATHY RACHER: Kathy Racher, for the Board. Are there any questions on the model in the room? Paul...?

MR. PAUL GREEN: It's Paul Green, with ENR. Is there somewhere listed -- like, that's a fairly significant change in the model, and it's important for us to understand how these things have changed.

Is there a listing somewhere that describes, you know, how the assumptions -- how -- how the assumptions have changed in the more recent models compared to the original predictive models? Like this current model assumes the -- the grouting is ineffective compared to the original ones that assumed it -- it was very effective.

Is there a listing -- because I'm sure there may be other changes in the assumptions that you -- you -- that has evolved. Is that laid out somewhere in -- in the documentation we have?

(BRIEF PAUSE)

MS. ERICA BONHOMME: Erica Bonhomme. We did provide a response to that in -- in -- on March 28th, Mackenzie Valley Land and Water Board Number 7. And that gives a very general overview of what -- how the models differ from one another based on the information that was available at the time.

DR. KATHY RACHER: Kathy Racher, for the Board. Maybe, Paul, if you want to take a look at that, if you have further questions, you can bring them up at any time, or if you need further -- further clarifications.

MR. PAUL GREEN: Yeah. Paul Green. We'll -- I'll have a quick look at this. But in the meantime, I do have another question what was presented today on slide 10 of the hydrogeological model one. Yeah.

So post-January 2018, the green line, I guess, the inflow of the waste, the footwall inflows, they begin to decrease. And I'm wondering, why do they begin to decrease?

DR. HOUMAO LIU: Yeah. There -- there are two (2) issue here. One is now the development started from -- you can see that -- I can't follow that. I need to state my name. Houmao Liu.

Here you can see now it's almost corresponded to -- to flat line up there because we start developing or mining under the permafrost.

And the second is, when you start decreasing because we start -- you know, the development of haul drift or waste drift start development earlier and they stop early, too. So they -- they stop -- they stop development, and as Julie probably knows better on the mining, they stop development 2013.

MS. JULIE L'HEUREUX: No, '23.

DR. HOUMAO LIU: Or 2023, I'm sorry. So that's why it become -- like it start dropping down here because we don't have further development.

MS. JULIE L'HEUREUX: So just to confirm, footwall development will be ending in 2023, according to the -- the mine plan today updated.

MR. PAUL GREEN: It's Paul Green, with ENR Waters again. Thanks. That -- that helps provide clarity.

With regards to the -- the permafrost effects, I -- I just wonder about the magnitude of the change that we're seeing because as -- as the water -- as you follow the line up, you know, from 2004 to, say, 2015, you get a large inflow from -- from surface water, I guess, recharged. And -- and, you know -- and you get -- and you see some inflow or some increase as well with the footwall. And I guess that's driven a lot by -- by the volume of void (phonetic) development.

And so if -- if the primary driver for the footwall inflows is -- is development volume, and the volume's not going begin decreasing until 2023, the magni -- like, it's -- you begin to see a -- the magnitude of -- of the -- of the downslope post-2018 seems large. Like, it seems to mirror the -- the decrease in -- due to permafrost, but this is all groundwater below permafrost.

So I would -- wouldn't have thought that you would see permafrost effects on the footwall inflows so much. Is that --

MS. JULIE L'HEUREUX: Okay. Julie L'Heureux. So we have -- 10 percent of our water, of our groundwater, is from footwall, okay? That's a statement. So if we looked -- if we look at this boundary here -- how do you use it, this one?

So we already started to mine not under the lake. And then we can see the influence as we speak. Since we're not mining under the lake, every time we -- we open new headings or footwall that is not under the lake, then we have connate water for a few days, and then it just dries, you know.

So -- so that's why -- like if you want to recapture your question, because you see that we have 50 percent approximately of the -- of the mining plan that's going to be under the permafrost. And obviously, we're going to reach sixty-three thousand (63,000), but this inflow will always be coming from the lake, you know.

It's -- we're never going to be able to grout those structure that we've done in the -- in the past. So when we're going to just, you know, continue developing and mining under the permafrost, then we will not -- not have that much of inflow any more. We will only have the inflow that was -- that occur in the past that we're always going to have to deal with, since we can't block them or grout them.

So we will have to deal with the past

inflow, but at least going in the future under the permafrost in this area, we will only encounter the footwall water, the -- like what you were saying, the water that's come from the groundwater flow, not only from the recharge.

Does it clarify it or...?

MR. PAUL GREEN: It's Paul Green. I -- I think I understand. So then that would suggest that -- that there's actually a fairly significant contribution of the recharge water into the footwall water volume.

Is that so, or is -- is the -- I guess where -- look -- looking at slide 9, just sort of conceptually, yeah, like, you know, you get the water coming from above into sort of -- into the development headings. Then you've got the -- the --

MS. JULIE L'HEUREUX: So 10 percent is the -- from the groundwater that goes in the footwall of our total inflow.

MR. PAUL GREEN: So 10 percent goes into the open -- like the open -- the white line, the bottom white line.

MS. JULIE L'HEUREUX: Yes, yes. The footwall here.

MR. PAUL GREEN: Okay. So 10 percent

is connate and 90 percent is from recharge.

MS. JULIE L'HEUREUX: And then this 10 percent is represented -- whoops -- to the green lines, this one, okay?

MR. PAUL GREEN: Yeah.

MS. JULIE L'HEUREUX: So that's our footwall water. That's the total inflow, the pink one. So when we're going to arrive -- so also you have to understand that, you know, even though we stop development around this area, then the -- the mine plan, like the long-term planner's going to say, Okay, are we going to go back to this area and mine where we were mining five (5) years ago?

So it's all depending on the mine plan. You know, they have sequence of mining. So we all take that in -- in account to do our -- our predictions.

MR. PAUL GREEN: It's Paul Green. I think I understand. So the pink line is actually a summation of the footwall. So it's --

MS. JULIE L'HEUREUX: Exactly.

MR. PAUL GREEN: -- so it's not independent. It's a summation. I understand now.

MS. JULIE L'HEUREUX: Exactly.

MR. PAUL GREEN: Yeah. Thank you.

MS. JULIE L'HEUREUX: That was a

confusion when we tried to present that. I was worried about that, but it's just to show you that -- how minimal the 10 percent of the footwall. But the pink is the summation of the hanging wall and the footwall together.

DR. KATHY RACHER: A question from Sean?

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. So just one (1) more question about the model and its -- the level of conservatism with your permafrost.

Are you assuming 100 percent the permafrost will be maintained, or is there a level of conservatism? Will -- have you accounted for any degradation of that permafrost regime as you mine into it?

DR. HOUMAO LIU: Houmao Liu. We have not considered the degradation of permafrost. But as Julie just said, because here the water, majority of water, is coming from that recharge or from the lake. So whether permafrost would degrade or not, it will not -- it's not recharge into the mine working.

MS. JULIE L'HEUREUX: I mean, it's two hundred (200) -- Julie -- it's 200 metres of permafrost, so there would no way be any, you know, melting of -- of this structure.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources.

The only reason that I'm bringing this up is that there is an overall clima -- climatic change that's predicted for the Northwest Territories. And Steve Kocal (phonetic) and a few others have presented this, and that permafrost is expected to degrade over time.

So if you're mining into that permafrost, that regime might be changing, and you don't -- do you know what the ice wedge is and what the actual characterization of ice in that rock is at this time?

MS. ERICA BONHOMME: Erica Bonhomme. Two (2) things in response to that. One (1) is, you know, certainly by the time we stop advancing our footwall in 2023, we would not have those effects play a substantial role.

The second is that, when you're talking about ice wedges which are 1 to 2 metres extending from the surface, absolutely insignificant in the context of the 200 metres of permafrost that we -- we encounter in this area -- that we know to exist in this area.

MR. SEAN WHITAKER: Sean Whitaker,

Environment and Natural Resources.

Then the next part would be because -- what's the average temperature of your mine workings, and how many levels are you going into that permafrost? Because you might be affecting the thermal regime.

MS. JULIE L'HEUREUX: Just to let you know, we -- oh, sorry, Julie. We -- we did some testing. We have few bore holes on surface that -- that are still open because we have instrument. So we try to melt the -- for days, for five (5) days, with hot water of 90 degrees, tried to melt it to have access to the instrument.

And I failed last summer to reach those instrument because, by the time I was pulling the -- the tube of boiling water, it was just already too late. So the ice would go back. So I could even -- I could not even retrieve my instrument.

So I'm pretty confident. I mean, it's 200 metres. We have proof of that. So like Erica mentioned, maybe over a couple of metres around the surface it would affect, but it would -- I think we could probably define that 200 metres would never be -- be melting in -- in even a decade or like half a century.

MR. SEAN WHITAKER: Sean Whitaker,

Environment and Natural Resources.

The -- where this is leading me is to closure because this will be an open void unless you're planning on filling it at the end. You're going to have -- are you going to be mine -- flooding the mine? Like, what's the closure plan at closure for this?

MS. ERICA BONHOMME: Erica Bonhomme. As you know, our fill plans -- or maybe you don't know, but our fill plans are a combination of paste and water. So at the end of mine life, that void will be completely filled either by inflow water or a combination of inflow water and paste backfill.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources.

And this is -- again, the reason I'm concerned is the -- the amount of levels that are going into that permafrost regime. If you have -- if you've con -- considered 100 percent capture and then you fill it with water, what's the recharge back to Snap Lake once it's all reconnected?

Is it possible that -- that you're going to have recharge back to the bottom of Snap Lake?

MR. HOUMAO LIU: Houmao Liu. Under the Snap Lake, it -- it's -- there's no permafrost. So because the Snap Lake you can see the groundwater, it's

-- it's -- there's no permafrost. It's on the outside of Snap Lake there's permafrost.

And then, with the -- the gradient is downward gradient from Snap Lake, so you should not see much of a -- the back -- back -- you know, flow back into the Snap Lake.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. Thanks. Just -- thank you for the answers.

MR. TODD SLACK: Todd Slack with the Yellowknives. This hadn't really occurred to me, but one (1) concern that I have in listening to this exchange is, at Giant, the idea was to sequester all the arsenic trioxide underground in the permafrost.

And they found that, within a decade, that those chambers were no longer what you would be calling continuous permafrost. They were degrading within the time span that we're looking at.

Now -- and as it seems clear, that -- that's going to radiate out. And I don't know what the implications of a few metres around your -- your drifts and -- and your workings, I don't know what impact that'll potentially have. But I don't think that you can be simply dismissive of that potential concern.

So I guess, does that represent -- if

you had 10 metres surrounding it, does it represent a concern? What is the impact of -- are you going to see more connate water?

I guess I'd just like to hear a little more in terms of the Company's thinking there.

MS. ERICA BONHOMME: Erica Bonhomme. I -- I am going to suggest we're a little bit out of scope here, if -- if you wouldn't mind. But -- but just -- the whole issue around closure obviously is addressed in a whole different forum in the -- in the Company's closure plan.

And -- and I -- I would suggest that, in the context of what we've filed here, that -- that is information we -- we haven't presented as part of this model. It's not -- it's not, to my view -- in my view, it's not pertinent to, you know, the -- the application that we're -- that is -- that is before the Board right now.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources.

The reason that we're asking is to determine our sig -- level of significance, the significance determination. So that's -- because you're in changing the TDS, this potentially could affect other areas of the mine.

That's -- we're just -- this is where some of these questions are coming from. It's to determine our own level of significance.

DR. KATHY RACHER: Kathy Racher for the Board.

Yeah, I have -- I -- I've noticed that it's not specifically on topic, but this is the first opportunity people have had to discuss the -- the groundwater modelling and a lot of new information. And so I've kind of let it go a little bit because people need to -- to have a firm grip on the whole -- the whole thing.

I also know that Alan's ready to answer the question on -- on the significance scope, if -- if that's a convenient spot. Did you have something else to say, Erica?

MS. ERICA BONHOMME: Yeah. Erica Bonhomme. No, it's -- it's not that we -- we don't want to answer the question. I just -- I'm having a little trouble understanding where you're going with it, so I don't have the context. You're -- you're throwing a lot of questions at us, and I -- I'm not -- with the context.

And maybe the best places to look at the water quality that we're going to do, Alison's going to do a model -- a presentation on the water quality modelling. Maybe once we put all the models together, we have a chance to go through those, I'll better understand what you're -- what you're getting at.

At -- at the moment, it's not something I -- I feel that we're under -- understanding your issue properly and that we're providing the responses that are going to get us resolution to it. That's all.

MR. TODD SLACK: I -- I'm happy to provide a little context, and I'm also happy if the Company doesn't want to talk about it; that's their decision.

DR. KATHY RACHER: Sorry, Todd. Could I interrupt for a sec?

MR. TODD SLACK: Sure.

DR. KATHY RACHER: What I'd like to do is take -- Don Hart has a couple of questions on the groundwater model that -- that are specific. So I'd like to take those and take a short break, let Alan speak, and then, you know, the rest of the afternoon is for you, Todd. We'll -- we'll get -- we'll get back to your question after that.

So, Don Hart, if you're on the line, do you -- do you want to ask your question at this stage?

MR. DON HART: Mike Venhuis is going to

ask the question.

MR. MICHAEL VENHUIS: Yes. It's -- it's Mike Venhuis here at EcoMetrix. I've just got two (2) questions. It gets a little bit more into the details of the -- the model.

The first one sort of has to do with flow. Just -- just for my clarification, one (1) -- one (1) of the updates appears to be that, for example, the -- the hanging wall, the -- it's now been sort of separated into a number of different layers with -- with a change in hydraulic conductivity with depth. And the values used for hydraulic conductivity were sort of determined through calibration.

Is that correct?

MR. HOUMAO LIU: Yes. This is Houmao Liu. It is based on the field omager (phonetic), the packer testing data. And in the meantime, for structure zone, geological structure zone, it also based on the model calibration.

MR. MICHAEL VENHUIS: Okay. Mike Venhuis again. So I -- I think you just answered my next question, that -- that you had. It's listed that you have like a hundred and fifty (150) hydraulic conductivity tests. So do you have some value to sort of compare against these -- the -- the values used in the model for each of these different layers?

So are there field values that sort of help verify or justify these values that you calibrated to?

MR. HOUMAO LIU: Yes, we do. If you see -- if you look into our -- our memo and -- it shows the -- the measure value, and also that, we know, we put as a probability line there. And the most of the structure zone, it's within that value, but it's with a higher -- you know, it's less proba -- probability happens, so it's larger than most of measure value.

So I -- we do compare it to the field data. And there are four hundred and twenty-six (426) packer testing data we incorporate in the model, and we analyse them.

MR. MICHAEL VENHUIS: Okay. Thanks. One (1) more question. This has to do with, I guess, the -- the TDS value for the -- the footwall. In -- in your memo, you sort of presented 2012 and 2013 data for TDS. And it looked like the -- the 2013 data was consistently higher than the 2012 data.

And in your model, you sort of looked at both the arithmetic and geometric mean values and held that constant throughout the model.

I just -- if you can sort of talk about

why -- I -- I guess I'm just thinking you've got your 2013 data, which is consistently higher, why that value wasn't used rather than a lower value of when you combine the 2012/2013 data.

MS. JULIE L'HEUREUX: Julie L'Heureux. So we started a dedicated underground monitoring in 2013. So we have much more confidence into the 2013 data. Even though they're higher, this -- that's what we see. So we have different location. We do it even still every three (3) weeks, so we have monitoring points in the footwall and in the hanging wall.

So that was also intended to -- to understand the -- the salinity of the water through deep -- I mean, with the different levels. That was an assumed point that we -- we actually -- we actually found that was not related to -- to deep aquifer zones.

So, yeah. So the difference in the 2012 and 2013 is we are just -- what we have at the lab, the -- the result of the lab. So that's why the update was also there in 2013 is to make sure that we incorporate the -- the proper data in our updated model.

MR. MICHAEL VENHUIS: Okay. Thank you.

DR. KATHY RACHER: Okay. One (1) last question from Zhong.

MR. ZHONG LIU: Zhong Liu, SLEMA. I'm

wondering so what you -- your modelling for the hydrogeological modelling considered the PK paste backfill?

MR. HOUMAO LIU: Houmao Liu. We did not consider any of backfill in effects. So there's no throttle impact incorporated in the model.

MR. ZHONG LIU: If there's -- if you consider what will be the -- the impact from back -- backfill?

MR. HOUMAO LIU: I think probably it will reduce the predicted inflow, but I think in general, based on our experience, that backfill usually does not have a significant impact to the inflow rate.

MS. JULIE L'HEUREUX: If I can just add -- Julie L'Heureux -- the backfill is not a structural -- it's not structural at Snap Lake, as you probably know. It's -- it's only a backfill. So water would still go through the backfill, so it would not affect the inflow at all.

Like, I mean, it's not like a cement backfill that would block or impermealize (sic) the structure. It's just to -- it's just an area that we -- it's just the backfill are just -- is just there. So even the water would have -- like the perm -- the hydraulic permit -- permeability would be lower in these area. The water will still -- would still run through the material by time.

DR. KATHY RACHER: Okay. Kathy Racher for the Board. I need a break, so we're going to take just ten (10) minutes and be back at 11:05, please.

MS. ANITA LI: It's Anita Li from Environment Canada. Can I ask a couple of questions?

DR. KATHY RACHER: Anita, I will definitely give you an opportunity right after the break at 11:05.

MS. ANITA LI: All right.

DR. KATHY RACHER: Thank you.

--- Upon recessing
--- Upon resuming

DR. KATHY RACHER: Kathy Racher for the Board. I believe there's one (1) follow-up question from -- from Mike from EcoMetrix, and then we're going to get to Anita's questions from Environment Canada.

So, Mike, do you want to go ahead with your follow-up question.

MR. MICHAEL VENHUIS: Sorry. Thanks. It's -- it's just following up with the question I had on the -- the TDS concentrations in the footwall. So just from what I got on my response was that there's a little bit more confidence in the 2013 data, you know, of TDS concentrations in the -- in the footwall.

Where -- where I'm going at is -- is, unfortunately, the -- the figure wasn't presented in the presentation. But in -- in the groundwater report, it shows the concentrations of -- of TDS in the footwall from 2012 and 2013. And you can see that the 2013 data is -- is significantly higher than the 2012 data.

And the -- the groundwater model has used a constant concentration of TDS in the footwall over the -- the time span. And it does sensitivity using both arithmetic and geometric mean over those two (2) years. And -- and the results show that there's -- the model is very sensitive to this concentration.

So I guess I just wanted a little bit of clarification on why, if -- if the 2013 data is -- is -- if you have more confidence in it and -- and it's possibly more accurate, why the 2012 data is included then in the -- in the pool of -- in order to determine the arithmetic/geometric mean?

DR. KATHY RACHER: Kathy Racher for the Board. And -- and before I forget, I've been reminded everyone needs to say their name. And we can't have discussions going on, no back and forth. You have to stop and say your name. And people can't have more than -- as soon as you're done with your mic, turn it off because it limits the ability of other people to get on.

MR. HOUMAO LIU: Houmao Liu. Yeah, you're talking about Figure 4 in our report, and as you can see, because the data -- the limit -- the data in 2013, it's actually within the range of 2000 -- 2012 data, too. And because they are limited data, that's why we incorporate 2012 data to do the -- it's just get the broader range that -- using our calculation.

MR. MICHAEL VENHUIS: Mike Venhuis here from EcoMetrix. All right. Okay. Thank you for your response.

DR. KATHY RACHER: Okay. Kathy Racher for the Board. Anita, do you have some questions for us from the phone?

MS. ANITA LI: Yes. I have a few questions. On page -- let me see -- page -- sorry, slide 8, you've shown the concentration from the hanging wall and the footwall. Those concentrations are from actual sampling of groundwater?

They're not from modelling, right?

MR. HOUMAO LIU: Houmao Liu. Yes,

that's from the actual sampling from -- from the sample.

MS. ANITA LI: Okay. And I understand the -- the underground mine collects about 60,000 cubic metres of water for -- per day. So what percentage of that is from the hanging wall, what percentage from the footwall, and what percentage is from the inflow water from Snap Lake?

MR. HOUMAO LIU: Houmao Liu. I think when you talk about sixty thousand (60,000), that would be the -- the maximum, right, not -- not under current condition. That's just to make it clear.

And it's about 10 percent is coming from the footwall and the 90 percent is coming from the hanging wall. And off those hanging wall, I would say probably 95 percent is coming out from the Snap Lake.

MS. ANITA LI: Okay. Thanks. But I got that sixty thousand (60,000) from that plain language summary that you have. What is the current I guess flow now?

MR. HOUMAO LIU: Houmao Liu. Current -- current flow rate is 43,000 cubic metre per day Erica presented in the introduction.

MS. ANITA LI: Okay. Sorry. I didn't have the -- the PowerPoint presentation yet. Thank you.

And I guess --

DR. KATHY RACHER: Can you state your name again, please?

MS. ANITA LI: Anita Li from Environment Canada. So how deep are you going when you reach that connate water?

MS. JULIE L'HEUREUX: At the current moment, we're around 600 metres under surface.

MS. ANITA LI: Okay.

MS. JULIE L'HEUREUX: So we going down 15 percent down.

MS. ANITA LI: Okay. And that's when you will hit the connate water, or do you have that now?

MS. JULIE L'HEUREUX: We have that now. We -- oh, Julie, sorry. We have that now. We always going to encoun -- encounter footwall water --

MS. ANITA LI: Okay.

MS. JULIE L'HEUREUX: -- until we finish the development of the footwall. So as we advance, obviously we're going to go deeper. I -- if I remember correctly, I think we're going to go around 1 kilometre above (sic) surface. So we're around six hundred (600) at the moment. It's rough numbers.

MS. ANITA LI: All right. Thank you. That's all for me.

DR. KATHY RACHER: Kathy Racher for the Board. Okay. Zhong has another question.

MR. ZHONG LIU: Zhong Liu from SLEMA. Could you go back -- go to slide 11? The title is the Calculated and the Measured TDS. Just here I need a clarification here because in our SNP report and also for calculate the TDS is a different idea because it's calculated from component of TDS.

Here, I guess the TDS -- calculated TDS is kind of -- you know, it's different. It's geo -- geometric mean or ari -- arithmetic mean -- mean, right? It's not -- because this idea in SNP report is cal -- calculated TDS and also measured TDS. So I guess that's a different idea, and I wanted clarification here.

MR. HOUMAO LIU: Houmao Liu. I just want to explain what is here meaning it says here, what does TDS calculating mean. We used the, as I said, volumetric mixing based on the predict of flow seepage rate to the footwall and to the hanging wall. And then we used the concentration that -- based on that measure, TDS concentration, from the groundwater in -- in footwall and of hanging wall, then do the calculation.

And because there are two (2) kind of approach to calculate the mean concentration, we used one (1) way to calculate the groundwater TDS concentration using geometric mean of all the measure, all the water sample that collect in the just ambient groundwater, and the other one, using arithmetic mean.

So this is actually that what we mean calculate. You can also say it's like predicted for the future. And the measure one is the one that -- that -- from the lab that measure from the -- the value actually from underground mine discharge.

DR. KATHY RACHER: Kathy Racher for the Board. So to answer your question, Zhong, it's -- the -- in this case, it's not calculated based on major ion concentrations as it would be from a lab sample.

Okay. I'd like to move on to the next set of presentations, but before I do, Alan wanted to answer the question that came from ENR earlier.

MR. ALAN EHRLICH: Thanks. I -- I had to clarify the question a bit on the break, just to make sure that I'm answering the right thing. So it's Alan Ehrlich for the Review Board, and I'm -- I'm responding to a question that was put out earlier by Sean Whitaker from GNWT.

As I understand the question, Sean -- I'm going to ask you to confirm that I've got this right, you're saying when the Board makes its significance determinations, is it going to be comparing what -- what is predicted to happen against the situation before this project - meaning the amendments that are being talked about here - against the world with the project, with these amendments in place; or is the Board going to be comparing this area before all of this development -- referring to everything that's affecting the same value ecosystem components -- against the world with all this stuff, including the amendment.

Tell me if I got the question right. So in other words, it seems to me like you're asking, are we going to look at project-specific impacts when we're doing our assessment, or are we also going to look at cumulative environmental impacts?

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. That is correct. That was the question as I stated it.

MR. ALAN EHRLICH: Okay. Thanks. That helps. The Board is going to do both, right? We're required to look at project-specific impacts. And so when we say 'project-specific' here, we're obviously not including everything having to do with the Snap Lake Mine, we're including the stuff that's defined as part of the project.

So we'll look at what are the changes that are going to be caused by this project, and in making significance determinations, there'll be some judgment of the acceptability of these things based on -- on the subjective, informed judgment informed by the evidence in the informed opinions of our Board members. So that's for this project.

But we're also going to look at the cumulative effects of this project in combination with all the relevant past, present, and reasonably foreseeable future stuff. Section 117 of the MVRMA says we've got to -- Appendix I think it's H of our EIA guidelines spells out how we do that.

And we're going to consider, you know, real-world overall changes, not just this project, but this project in context. Is it adding to things that are already going on there? Are there things already going on there that might reduce some of the impacts of what's proposed here? So we will look at big-picture stuff.

And you're nodding, so I think you just wanted that confirmed on the record. I'm pretty confident that De Beers has been clear on that, too. If anyone's unclear on it, it'd be great if you -- if you raised that right now. Thanks.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. Thank you for that clarification.

DR. KATHY RACHER: Okay. Kathy Racher for the Board. Are you ready to continue on with your presentations?

MS. ERICA BONHOMME: Absolutely. I'll just introduce Alison Snow from Golder Associates. She'll be talking about the site model and the lake model.

PRESENTATION - MODELLING

MS. ALISON SNOW: That's, Erica. Good morning, everyone. My name is Alison Snow. I'm a water quality modeller at Golder Associates, and I'm going to be discussing the modelling that Golder completed for the Snap Lake Mine.

The first presentation that I'm going to be discussing is the site water balance and water quality model. This is slide 2, and this slide shows the modelling work that was completed for the Snap Lake Mine and how the models link together.

And this slide is going to be repeated throughout each presentation, and the model that I'm discussing is going to be highlighted. So, as I said, I'm going to be discussing the site model and just the linkages to the site model.

So from the groundwater model, mine water is discharged to the water treatment plant. So that's the link from the groundwater model to the site model.

And then the purpose of the site model is to predict the quantity and quality of water that is discharged from the mine site to Snap Lake. So that's the linkage right here from the site model to the Snap Lake model.

Slide 3. This slide shows a diagram of the key components of the mine site and the main process flows that connect the components. And the water quality component of the site model calculates water quality at each of the key components of the site model.

So the key components include the underground mine, the water treatment plant, the water management pond, the north pile, the process plant, the sewage treatment plant, and Snap Lake.

So slide 4 shows some of the water

quality constituents that were included in the site model. And we're going to specifically focus on the parameters from the EA scoping document. So we have total dissolved solids, chloride, fluoride, sulphate, and nitrate. And I'd just to note that nitrite was not simulated in the site model or the Snap Lake model.

Slide 5. So this slide shows the four (4) scenarios that were simulated in the site model. The four (4) scenarios were based on two (2) mine water discharges and two (2) footwall TDS concentrations from the groundwater model.

So we've labelled the two (2) mine water discharges as the lower bound and upper bound. The lower bound mine water discharge had a predicted maximum discharge rate of approximately 60,000 cubic metres per day. And then we also have an upper bound discharge with a predicted maximum discharge rate of approximately 96,000 cubic metres per day.

And then the two (2) footwall TDS concentrations that were carried forward into this site model and discussed previously were 5,728 milligrams per litre, which represents the arithmetic mean of monitored TDS concentrations, and 3,490 milligrams per litre, which represents the geometric mean of monitored TDS concentrations. And these TDS concentrations are from below the dyke.

So the two (2) mine water discharges times the two (2) footwall TDS concentrations produces the four (4) model scenarios that we carried forward into the site model. And we just labelled these upper bound scenarios 'A' and 'B' and lower bound scenarios 'A' and 'B'.

Slide 6 shows the key findings of the water balance portion of the site model. And the key findings focus on inflows to the water treatment plant. And as you can see in the figures, mine water dis -- discharge accounts for the majority of flows to the treatment plant -- to the water treatment plant.

So at least 84 percent of the inflows to the water treatment plant originate from underground, followed by the clear groundwater and water pumped from the water management pond to the water treatment plant.

The water pumped from the water management pond to the water treatment plant includes discharges from the north pile. And the water pumped from the north pile sumps and the site runoff that is captured in the water management pond, those flows will peak during freshet.

Slide -- slide 7 lists the key findings of the water quality portion of the site model. And the key findings on this slide focus on TDS loadings to the water treatment plant.

And as you can see in the two (2) figures, mine water accounts for the majority of loading to the water treatment plant, specifically for total dissolved solids and its constituent ions. So you can see that mine water accounts for approximately 90 percent of the total dissolved solids loading to the water treatment plant.

And the loadings from the north pile sumps and from site runoff cap -- captured in the water management pond, those loadings will peak during freshet, but for the most part they represent approximately 10 percent of the loading in both cases to the water treatment plant.

And slide 8. This slide again lists some key findings from the water quality portion of the site model. And these key findings focus on nitrogen loadings to the water treatment plant.

And you can see from the figures that loadings from the north pile and from the site runoff captured in the water management pond in this case make up a larger percentage of the loading to the water treatment plant compared to total dissolved solids. So upwards of 30 percent of the loadings originate from the water management pond.

So the second presentation that I will be discussing is on the hydrodynamic and water quality model of Snap Lake. So slide 10. So again, this slide shows the modelling work that was completed for the Snap Lake mine and how the models link together.

As I said, I'm going to continue by discussing the Snap Lake model, just highlighted. So Snap Lake receives effluent discharge from the water treatment plant, runoff and seepage from the mine site, and also natural inflows from the Snap Lake watershed.

And all of these inflows are predicted by the site model. So that's the linkage from the site model to the Snap Lake model.

And then from Snap Lake, there is a discharge downstream to the downstream lake -- downstream lakes' model. There's also seepage from Snap Lake to the underground mine as predicted by the groundwater model. And the purpose of the Snap Lake model is to predict concentrations of total dissolved solids, major ions, nutrients, and levels in Snap Lake.

So slide 11. This -- this slide shows the Snap Lake model grid. So the Snap Lake model is a three (3) dimensional model, and the grid shows the -- the three (3) dimensions the model is divided into.

The grid is the geometrical representation of the water body that -- that's going to be modelled. And in this case, the horizontal grid resolution is approximately 200 metres by 200 metres, and the vertical resolution is 1 metre.

So Snap Lake is divided into two thousand seven hundred and forty (2,740) grid cells, and the model performs all of the calculations in each of the grid cells. And the grid also allows the user to specify where specific inflows enter the lake and where outflows leave the lake.

So slide 12. This slide shows inflows to Snap Lake, and these include the -- oh, sorry -- the effluent discharge, wetland seepage, north pile seepage, site runoff that's not captured in the water management pond, and there's also stream inflows. And the stream inflows represent water that flows into Snap Lake that does not come into contact with the mine site.

And as you can see in the figures on the right side, the effluent discharge to Snap Lake makes up the major proportion of inflows to Snap Lake. So greater than 80 percent of the inflow from Snap Lake is coming from the treated effluent discharge, followed by the stream inflows and then what I've put up here as --

as "Others" that would be the -- the discharge from the wetland from the north pile, from the site runoff, and from water management pond seepage.

Slide 13. So this slide shows the outflows from Snap Lake. These inclo -- include the outflow -- outflow from Snap Lake downstream; seepage from Snap Lake to the underground mine, which I haven't shown on the figure but it's in this area, it's where they're mining underneath Snap Lake; and water pumped from Snap Lake for domestic use.

And again, as you can see, based on the figures on the bottom of the slide the underground mine accounts for the majority of outflows from Snap Lake. So seepage, water from Snap Lake to the underground mine accounts for approximately or at least 75 percent of the outflow from Snap Lake. And then followed by outflow to the downstream lakes.

So Slide 14. This slide shows an example of the model calibration for total dissolved solids in chloride near the diffusers where the effluent from the water treatment plant enters Snap Lake and at the outlet of Snap Lake. So the figures on the left are for total dissolved -- total dissolved solids, the top figure is near the diffuser, the bottom figure is at the outlet of Snap Lake, and the figures on the right are for chloride concentrations. Again, near the diffuser station and at the outlet of Snap Lake.

So in the figures, the monitored lake water quality data is represented by dots and the model results are represented by the solid line. And the model calibration period as you can see was from 2004 to the end of 2012. And you can see that there is a cyclic -- a cyclical annual pattern present in the model results, so these low portion of the curves represent the open water season, and the high portions of the curve represent the ice-covered season. And that pattern repeats each year.

And this pattern is present because in the model as the water freezes, we assume that constituents, for example, TDS, we assume that they're rejected from the ice. So the water freezes as pure water and that mass stays in Snap Lake, so the concentration increases. And that is observed in the monitored data. As you can see we have a -- a really good calibration for totally dissolved solids and chloride.

So Slide 15. So I repeated the slide to remind everyone of the four (4) model scenarios that were simulated in the site model and subsequently carried forward into the Snap Lake model. So the four (4) scenarios were based on the two (2) mine water discharges. So we have an upper bound discharge with a maximum discharge of 96,000 cubic metres per day. And the lower bound discharge with a maximum discharge of 60,000 cubic metres per day. And two (2) footwall total dissolved solids concentrations, so 5,728 milligrams per litre and 3,490 milligrams per litre.

So Slide 16. So this slide shows the maximum predicted concentrations near the diffuser stations in Snap Lake for total dissolved solids, chloride, fluoride, sulphate and nitrate. These model results are based on predicted effluent discharge quality and quantity from the Snap Lake site model assuming that mitigation to control or limit the concentration of water quality constituents in the discharge does not exist.

So maximum predicted TDS and chloride concentrations near the diffuser stations in Snap Lake will exceed the proposed site-specific water quality objectives. And as Erica mentioned earlier, a site-specific water quality objective applies in the lake and they are protective of aquatic life. So it represents a specific concentration of a substance in water beyond which detrimental effects to aquatic life may occur.

The site-specific water quality objectives that are appearing in the table here were proposed in the Water Licence Amendment application that was submitted at the end of 2013. Dr. Peter Chapman will be discussing site-specific water quality objectives further in a presentation later in the technical session.

So Slide 17. This slide shows an example of model predictions. So the last slide had the maximum concentrations that would be observed and this slide shows model predictions for TDS and chloride, again, near the diffuser stations and at the outlet of Snap Lake. And this is a time series beginning in 2004 and going till the end of the mine life, which is the end of 2028. And this just shows -- you can see that the -- the site-specific water quality objectives for total dissolved solids and chloride will be exceeded.

Again, I'd just like to repeat that these model results are based on predicted effluent discharge quantity and quality from the Snap Lake site model assuming that mitigation to control or limit the concentration of water quality constituents in the discharge to Snap Lake does not exist.

So the key findings from this modelling in all four (4) scenarios TDS concentrations are predicted to exceed the proposed site-specific water quality objective to 684 milligrams per litre near the diffuser stations and at the outlet of Snap Lake.

Chloride concentrations are predicted to exceed the proposed site-specific water quality objective of 388 milligrams per litre in three (3) of the four (4) scenarios. However, concentrations of all nutrients, other ions, and total metals and metalloids in Snap Lake are predicted to remain below proposed site-specific water quality objectives. We didn't specifically present the model results in the presentation but you can look in our report that was submitted.

Okay, so Slide 19. So this slide shows two (2) model scenarios that were considered for the operational period of the mine assuming that mitigation exists to control the concentration of constituents discharged to Snap Lake.

So the model scenarios assumed that mitigation would be in place such that TDS concentrations in the effluent discharge to Snap Lake would not exceed 684 milligrams per litre. And we assumed that it would not exceed 684 milligrams per litre beginning on January 1st, 2015.

And we labelled the two (2) scenarios "Base Case A and B." Base Case A assumes the lower bound mine water discharge and Base Case B assumes the upper bound mine water discharge.

So Slide 20 shows an example of model predictions for TDS and chloride near the diffusers where the effluent from the water treatment plant enters Snap Lake and, again, at the outlet of Snap Lake for the two (2) model scenarios. So Base Case A is the lower bound scenario, and Base Case B is the upper bound scenario.

So with mitigation in place to meet the proposed average monthly limit for total dissolved solids of 684 milligrams per litre depth average concentrations of TDS and chloride were predicted to remain below proposed site-specific water quality objectives in Snap Lake.

And so the final presentation that -- that I will be discussing is on the downstream lakes' model, so Slide 22. So again this slide shows the modelling work that was completed for the Snap Lake Mine and how the models link together.

So the downstream lakes' model, which is highlighted, receives discharge from Snap Lake. And the purpose of the downstream lakes' model is to predict concentrations of total dissolved solids in lakes downstream of Snap Lake.

Slide 23. This slide shows current monitoring of lakes downstream of Snap Lake. So monitoring has occurred at downstream lake 1, downstream lake 2, Lac Capot Blanc, and then further downstream at King Lake.

And monitoring has shown that dissolved salts and nutrient concentrations are above baseline levels throughout downstream Lake 1, downstream Lake 2, and up to 5 kilometres from the inlet of Lac Capot Blanc and as predicted in the EAR. So there was evidence of effluent from the Snap Lake Mine moving downstream, and as a result the downstream lakes' modelling that was completed as part of the EAR was updated.

So Slide 24. This slide shows the lakes modelled in the downstream lakes' model. And again I would just like to repeat that the purpose of the downstream lakes' model was to predict concentrations of total dissolved solids in lakes downstream of Snap Lake.

So the downstream lakes' model includes -- we have a Mass-balance Model for downstream lake 1 and downstream lake 2. We have a hydrodynamic model for Lac Capot Blanc. And the hydrodynamic model is similar to the Snap Lake model that was developed. And then we have a Mass-balance Model for lakes downstream of Lac Capot Blanc. And the lakes downstream that we specifically looked at are represented by the model nodes and the figures, so the orange dots. So from Lac Capot Blanc all the way down to Great Slave Lake. And these nodes -- or the -- these model nodes that we modelled were the same that were modelled in the E -- in the EAR.

So this slide shows predicted concentrations of total dissolved solids in downstream lake 1, downstream lake 2 and Lac Capot Blanc assuming that mitigation would be in place such that TDS concentrations in the effluent discharge to Snap Lake would not exceed 684 milligrams per litre beginning on January 1st, 2015.

So essentially, the Snap Lake model results that I showed previously from Base Cases A and B, those results were carried downstream. And in downstream lake 1, downstream lake 2, and Lac Capot Blanc TDS concentrations were predicted to remain below the proposed site-specific water quality objective.

So Slide 26. So the maximum predicted

concentration at the outlet of Lac Capot Blanc for each model scenario, so for Base Case A and Base Case B, was carried downstream. This slide shows maximum predicted TDS concentrations in lakes downstream of Lac Capot Blanc. So the first column in the table is the downstream site, and these nodes -- or these node numbers are the same as the orange dots on the previous figure and we've just added the lake name where the model nodes lie.

The second column just shows the distance downstream from Snap Lake. The third column shows the baseline TDS concentrations. These baseline TDS concentrations were measured at each one of the model nodes and these are the same baseline TDS concentrations that were presented in the EAR.

And just to note, the baseline range a minimum TDS concentration of ten (10) to a maximum of 53 milligrams per litre. And then we have the EAR predictions and then finally our predictions for Base Case A and Base Case B.

And as you can see, I've got the first line shaded in blue and the shaded cells indicate where total dissolved solids concentrations are predicted to be outside of the baseline range. So as of Site 22, which lies on Mackay Lake, maximum TDS concentrations are predicted to lie within the baseline range, which ranges from 10 to 53 milligrams per litre. And as of Site 22 the maximum predicted concentrations downstream for Base Case A and B match well with the EAR predictions.

And then the -- the final slide, Slide 27, is just the key findings. So with TDS and the effluent discharge to Snap Lake less than or equal to the proposed effluent quality criteria of 684 milligrams per litre, TDS concentrations were predicted to decrease with distance downstream of Snap Lake. TDS concentrations in downstream lake 1 and downstream lake 2 and Lac Capot Blanc were predicted to remain below the proposed site-specific water quality objectives. And TDS concentration downstream of Lac Capot Blanc were predicted to be within EAR predictions and the baseline range at Site 22, which is located on Mackay Lake and is approximately 44 kilometres downstream of Snap Lake.

DR. KATHY RACHER: Okay. Oh, sorry, go ahead.

MS. ERICA BONHOMME: Erica Bonhomme. That -- that's it for our modelling presentations.

QUESTION PERIOD:

MS. KATHY RACHER: Okay. Kathy Racher for the Board. Thank you. That was a very good presentation.

At this stage I wanted to sort of limit the conversation just to questions around the models that have been presented and it may go back and forth through the groundwater model because these things are all connected.

I realize there's been predictions of what TDS or chloride, et cetera, will be in the future and we'll talk about that when we get to the Response Plan section, but at this stage I just wanted to make sure that everyone understands the -- the models that have been developed by the Company and to make sure we get all that evidence on the record.

So does -- in -- in that vein does anyone have a question? Rick from ENR?

MR. RICK WALBOURNE: Rick Walbourne, GNWT. Could you pull up Slide 3 for a second, I just have one (1) quick question on that. I can't re -- which presentation.

Yeah. Can you confirm that the -- it was my understanding that the sewage treatment plant discharged directly into the water management pond.

That's not accurate?

MS. ALISON SNOW: Yeah. Treated effluent discharges to the water management pond, correct.

MR. RICK WALBOURNE: All right. Well, thanks for that. Rick Walbourne, GNWT.

There were several references to mitigation -- that your modelling is based on mitigation, it's unclear to me what exactly you're proposing as mitigation to ensure that the TDS levels don't go above your proposed water quality objectives.

Could you explain to us what those measures are and if, whether or not, they are actually a part of this -- formally a part of this application?

MS. ERICA BONHOMME: Erica Bonhomme. We do have the results of studies into mitigation options in the TDS Response Plan which was filed as supporting information to this application. As you know, the TDS Response Plan needs to be approved by the Board as well.

We do have additional information in this presentation on the TDS Response Plan that will give a -- us an update on where we are with studying some of those mitigating options. Generally, I can say that we're -- we are looking at conceptual pilot offsite studies for treatment, different methods for treating effluent water for TDS, and we can also provide an update that, you know, we've done some initial -- we've done additional work on -- on grouting and -- and Julie has spoken to that a little bit earlier today.

You know, we -- we -- for the scale of the operation that we have it's largely going to be ineffective for us to use grouting as a mitigation. So what we are doing is pursuing mitigation that's based on treating a portion of the effluent, and I'll speak a little bit later as to where we are with that.

MR. RICK WALBOURNE: Rick Walbourne, GNWT. Okay, yeah, so I guess if you're going to provide some more information on the TDS Response Plan presentation maybe we can delve into that a little more.

My final question. You did mention some downstream modelling, downstream lake 1, 2, and the other, on Slide 26. Well, no, I guess my question is you -- your statement at the end there was that you would not be exceeding the water quality objectives of six-eighty-eight (688). But the six-eighty-eight (688) water quality objective is your proposal for Snap Lake.

Are you also proposing to apply that same water quality objective on those downstream water bodies; and if so, what is your rationale? Thanks.

DR. PETER CHAPMAN: Peter Chapman here. The six-eighty-four (684) that was proposed is based on site-specific testing with organisms that live in Snap Lake and would also be found in downstream lakes. So we're proposing a value that would be protective of organisms in Snap Lake and downstream.

MR. RICK WALBOURNE: Rick Walbourne, GNWT. That's all for me at the moment, but I might come back to that. Someone else might have some follow-up questions in that line.

DR. KATHY RACHER: Go ahead, Zhong.

MR. ZHONG LIU: Zhong Liu with SLEMA. I have follow-up questions about that sewage treatment plant effluent direct to water management pou -- pond. But I -- I -- so that's Slide 3.

Here I believe, based on the current water licence, that is right, the effluent from sewage treatment plant should charge to -- dis -- discharge to water treatment plant, but currently De Beers' practice is to discharge effluent from sewage -- sewage plant to water management pond. I believe that may not be consistent with the requirement of the current water licence. So I request a clarification from the Board -- from Water Board.

MS. ERICA BONHOMME: Erica Bonhomme. Yeah, we -- we have a requirement to monitor effluent at the discharge of the sewage treatment plant, which is at 02-16(I), we do that. The water does temporarily go to the water treat -- water management pond before going back through the water treatment plant prior to discharge. It -- it just gives us more effective control over the water that's handled in the water treatment plant.

Erica Bonhomme. And -- and we've previously discussed this with the inspector and with the monitoring agency.

DR. KATHY RACHER: Kathy Racher for the Board. I guess there is part of the other amendments requested for the water licence, we noted there is a request for change to the -- the condition related to the sewage treatment plant effluent. And -- and the Board staff also have questions on that that we'll also discuss tomorrow.

MS. ERICA BONHOMME: Yeah, we do have a map too of all our SNP stations so hopefully when we get to that we can -- we can pull that -- I think there's some confusion over where -- where we monitor certain things on site, so that might be helpful.

DR. KATHY RACHER: Todd, go ahead.

MR. TODD SLACK: Todd Slack with the Yellowknives. I have two (2) questions in terms of the monitoring.

I guess part of it relates -- or sorry, one (1) of these questions relates to the seepage coming off North Pile and I noted in the documents that this is based on the original values used in the EA.

Given the challenges that you guys have had with paste deposition and we're seeing a lot more slurry rather than paste being submitted, shouldn't we be using values that have been updated that reflect current conditions?

(BRIEF PAUSE)

MS. ERICA BONHOMME: Yeah -- Erica Bonhomme. We -- we are using the values from the EA. We have not updated it based on current seepage from the north pile. But as we -- if you look at the water balance overall, the -- the amount coming from the north pile generally is so insignificant that, you know, I mean, we're talking about fractions of a percentage of water that actually come from the north pile.

So, you know, we -- we do have current

numbers on that but, again, I -- I'm not sure then in the context of -- of the -- the water balance model or any of the predictions that -- that we would expect to have much of a difference in the result.

MR. TODD SLACK: Well, in terms of clarification, on Slide 8 you note - and this is the nitrogen loading - you note that the loadings from the north pile and site runoff are -- represent more, and it looks -- we're in the 30 percent range, 20, 30 percent range.

So are you suggesting that, (a), that's not significant; or (b), that the north pile component of that is so -- of that 20 or 30 percent is so small so that -- such that it doesn't matter?

If the latter, can you please provide clarification as to how much it provides to that level?

MS. ALISON SNOW: Alison Snow. I -- I think we're just a bit confused with what these numbers represent. So, the numbers that we're using from the EAR are for north pile seepage directly to Snap Lake, which is a very small proportion of the inflow to Snap Lake.

These loadings represent water that would flow through the north pile or run off the north pile and be collected in the north pile sumps, so those flow rights have been updated. They're not from the EAR. So we do have -- I didn't discuss it here because I didn't do the modelling, but we have a hydro-geological model for the north pile that we're working on, both 1-dimensional and 2-dimensional to look at seepage rates from the north pile that seep to the north pile sumps, and that's what this represents.

MR. TODD SLACK: Todd Slack. Thanks for that clarification. I'm just going to make sure I understand that both the flows and the expected concentrations have been updated for the water being captured?

MS. ALISON SNOW: Alison Snow. Yes, they have.

MR. TODD SLACK: Okay. Todd Slack. Thank you for that.

The -- the next question is: Has the project considered any changes in either of the explosives management or the amount of explosives that they're using? I -- I'm just looking to ensure that there's flexibility in these predictions. Should the project undertake an operational change that this operational change doesn't throw this model out of whack.

(BRIEF PAUSE)

MS. ERICA BONHOMME: Sorry, Todd, I'm just flipping -- Erica Bonhomme here. I'm just flipping through our Nitrogen Response Plan which does speak a little bit to what we do; our current practice is underground.

So our main -- main source of nitrogen is through explosives and so we've looked at various methods of decreasing the amount of explosives we use underground, so we've -- we've reduced the number of -- of holes that are used to blast each round.

The second thing that we've done is im -- improve the -- the -- the emulsion mixture for that so that there's less wastage of the explosive material.

I -- I'm not aware of any additional plans to change our explosive practices. Those are the best practices we have in place right now.

DR. KATHY RACHER: Kathy Racher for the Board. Could I just be -- just clarify, I'm not sure exactly what happened there, but the -- the models -- the -- the hydrodynamic water quality model that you presented is sort of -- it's not based on doing anything differently than today, right?

So all your predictions have been made

based on current practices and not involving any mitigations except for the last little bit that -- like, the models that you've submitted are just based on current practices? And presumably, you know, if -- if more details were to come out about potential mitigations, you could -- you'd redo the model accordingly.

Is that kind of what you were getting at, Todd? I had a "M-hm" from Todd.

MS. ERICA BONHOMME: Yeah. Eric Bonhomme. I mean, Alison has presented the -- the models with mitigation in place, for example, that would ensure that we stay below the water quality objectives that we've proposed. So any additional mitigation to that would -- would make the models right now conservative.

So, you know, we would -- we would expect that that -- the -- the models that we've predict -- the models predict a -- a situation where we treat or we mitigate to a certain level but anything beyond that is a bonus.

DR. KATHY RACHER: Kathy Racher for the Board. I'm going to go quickly to the phone, although there will be time for other questions if people have them, but I'm going to ask Anita first because I asked

Don first last time.

Anita, do you have any questions at this time?

MS. ANITA LI: Yeah, I have a couple of questions. The -- the north pile sumps also discharge through the underground workings, does it not?

MS. ERICA BONHOMME: Erica Bonhomme. No. The north pile discharges to our water management infrastructure which ultimately goes to the water management pond.

MS. ANITA LI: Okay. Because in the Site Water Balance Report I thought there was -- in one of the tables indicates that it also goes to the underground workings if it needs to be stored there.

DR. KATHY RACHER: And for the record, that was Anita Li from Environment Canada.

MS. ANITA LI: Sorry, Anita Li.

MS. ERICA BONHOMME: Erica Bonhomme. That's in an emergency situation, it is not part of our -- our normal practice. In -- in either case we would still have everything report back to our water management system.

MS. ANITA LI: Okay. In your tab -- I'm trying to find that table where you showed the numbers -- it's Anita Li from Environment Canada.

You showed that you wanted -- you would like a site-specific water quality objectives of 684 milligrams per litre. In your report, that's -- you indicated that you want an end-of-pipe discharge, right? You want this number at end-of-pipe.

So usually site-specific water quality objectives there's a mixing zone related to it, so I'm a little confused.

Are you asking for end-of-pipe limits or are you asking for site-specific water quality objectives?

MS. ERICA BONHOMME: Erica Bonhomme. It -- it's both. We're required to develop or recommend a site-specific water quality objective which is a level that's protective of the whole lake. We don't measure a site-specific water quality objective. We pick a place where we would measure water quality so as not to exceed that site-specific water quality objective. That's our effluent quality criteria.

So our EQC that we're recommending and proposing in this application is also six-eighty-four (684). So you'll see that number in some cases the same. For TDS it's the same. For -- for chloride and some of the other parameters the EQC is different from the site-specific water quality objective.

MS. ANITA LI: Okay. In this case it's the same. I'm sorry, Anita Li from Environment Canada.

In this case it's the same. So this six-eighty-four (684) that you're asking for is at the diffuser? Where are you intending to measure this?

MS. ERICA BONHOMME: Erica Bonhomme. Anita, I -- I think we -- we realize there's some confusion around this. There's a lot of terms, a lot of numbers. We will talk about it in the EQC section of our discussion.

But specifically on Slide 16, what you see is the proposed site-specific water quality objective. And the reason that this is being shown here is because we're using this to -- to model not only the water quality in Snap Lake but also the water quality downstream.

So this site-specific water quality objective refers to the water -- water as -- quality as it would occur in all of Snap Lake -- in -- in the whole Snap Lake. We do measure that under our aquatic effects monitoring program and we -- we report on that to the Board.

MS. ANITA LI: Thank you.

DR. KATHY RACHER: Did you have any further questions at this time, Anita?

MS. ANITA LI: No, that's all for me. Thank you.

DR. KATHY RACHER: Okay. Kathy Racher for the Board. Do you have a question from EcoMetrix?

MR. IAN COLLINS: This is Ian Collins from EcoMetrix. A couple of clarification questions about the modelling approach.

First one to do with slide number 12, and it's to do with the fact that one (1) stream inflow has been presented on the diagram and under "other inflows" other stream inflows are presented.

What's special about the one that's highlighted? Why is -- why is that one being singled out for -- for special treatment?

Like, it -- does it form the majority of the stream flow into the lake, for example?

MS. ALISON SNOW: Alison Snow. It was only highlighted because De Beers has a monitoring station where that stream enters the lake, so that -- that stream inflow is actually monitored. And then the other stream inflows represent the natural inflows to Snap Lake from the rest of the watershed. And I -- I applied the other stream inflows at various locations around the lake I just didn't show it on the diagram.

MR. IAN COLLINS: Ian Collins here.

Thanks for the -- the clarification.

In terms of the -- the approach to the model, am I right in thinking that those stream inflow inputs would be placed to match with actual stream inputs into the lake?

MS. ALISON SNOW: Alison Snow. Yes, they will. Or yes, they are.

MR. IAN COLLINS: Ian Collins. Thank you. Next, if you go to slide 15, although this effects several other slides as well.

I'm curious to know how these two (2) numbers for the footwall total dissolved solid concentrations were derived from the numbers that are actually given in the technical memorandum for the groundwater from Itasca because in the technical memorandum we have -- the footwall concentrations are given as 3,170 milligrams per litre and 6,188 milligrams per litre and not the numbers that are here.

So could -- is it possible for you to speak to how these numbers were derived from those other Itasca numbers?

MS. ERICA BONHOMME: Erica Bonhomme. We're just taking a pause here.

(BRIEF PAUSE)

DR. KATHY RACHER: Kathy Racher for the Board. Can I suggest that you can take a look for that over lunch and we'll -- we'll get back to Ian after lunch.

But in the meantime, Ian, did you have any other questions?

MR. IAN COLLINS: No, I think that's -- I think that's it. Thank you very much.

DR. KATHY RACHER: Kathy Racher for the Board. Okay. I'll -- I'll ask you guys about that later. We have a couple of hands up right now. Zhong first.

MR. ZHONG LIU: Yeah. I have a -- further questions of -- for drinking water quality, about TDS. The specific objective from Health Canada is the 500 milligram per litre. So because the De Beers right now takes water for domestic use from Northwest Arm, I'm wondering whether De Beers did some modelling for Northwest Arm part of the lake.

I notice that they only present the diffuser area and main body and outlet. So I'm wondering whether there's a mod -- modelling result for Northwest Arm.

DR. PETER CHAPMAN: Peter Chapman here. So I'm going to address the first part because you were talking about Health Canada and the aesthetic objective, right?

And I just want to point out that in the supplemental filing Section 2.1.4 we did provide a comparison to drinking water guidelines. And I just want to read into the record -- and this is also the same wording that's actually in the Health -- Health Canada page 2, September 1978 updated January 1991, that basically what happened was there was a panel of tasters that rasted -- rate -- that rated how well the water tasted, and anything less than 300 milligrams per litre was excellent; between 300 and 600 milligrams per litre was good.

And the reason they ended up with five hundred (500) is because at five hundred (500) you start to get scaling and these sort of effects, so they tied it back down to five (5) -- five hundred (500). Between nine hundred (900) and twelve hundred (1,200) is fair; and greater than or equal to twelve hundred (1,200) is unacceptable.

So the five hundred (500) doesn't mean that you can't drink the water by any means, it's based on that panel, and I think you'd agree with that. As far as the modelling goes and that, I'll pass that on to my colleagues here.

MS. ALISON SNOW: Alison Snow. So yes, we only predicted -- or we only presented concentrations near the diffuser in the main basin and at the outlet of Snap Lake, but we did model the entire Snap Lake, so the Northwest Arm and the main basin. So I do have model predications for total dissolved solids at the drinking water intake.

MR. ZHONG LIU: Zhong Lui, SLEMA. How much is?

MS. ALISON SNOW: Okay. So if -- if there's no mitigation in place the maximum TDS concentration that we see at the drinking water intake will be one thousand and twenty-four (1,024). And the minimum TDS concentration that we would see would be 510 milligrams per litre.

And then I also have numbers for the two (2) scenarios that we ran, Base Case A and Base Case B. So if mitigation was in place TDS concentrations would vary between 409 and 445 milligrams per litre at the drinking water intake.

DR. KATHY RACHER: Kathy Racher for the Board. If -- if you, Zhong, would like something more specific, maybe you could form that into a specific Information Request. You can provide that after lunch.

Did you have a follow-up? I'm just

wondering when to break for lunch here. How many more questions we -- do you have?

MR. SEAN WHITAKER: Sean Whitaker, Environment Natural Resources. I just have two (2) questions.

The first one is a technical one on Slide 14. You're showing a periodicity that's increasing. And have you done a statistical analysis to see -- so it's your gre -- it's your green line. It looks like it's getting -- increasing each year and it looks increasing by a statistical amount.

Have you done that prediction to see what that increase is on that cycle?

MS. ALISON SNOW: Alison Snow. No, I have not.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. I -- I would be interested to see that.

Is that possible to form that into an Inf -- I can come up with some wording on an Information Request. I'm just consi -- for -- because it's a model calibration, it could affect the model another -- 'til 2028, and I'm just curious what that'll look like at 2028. If it's even possible to extrapolate it to that point and just carry on that statistical analysis.

DR. KATHY RACHER: Kathy Racher for the Board. This is just the model calibration basically because it's just comparing to actual data. So -- I mean, they do have the -- all the graphs going out to 2029 that -- that carry that on and -- and it shows the same periodicity in --- in the figures. So I'm not sure what you're asking for.

MR. SEAN WHITAKER; Sean Whitaker, Environment and Natural Resources.

It looks like the peaks are increasing by a set amount each time and I'm wondering if that's just from the model. I -- I'm just trying to understand -- just trying to understand how that's happened. And it looks like that's by an amount each time and that might be significant. And I'm just trying to figure out in the calibration.

MS. ALISON SNOW: Alison Snow. I haven't done any specific stats on the calibration model results, but if you go back to 6 -- Slide 16 -- or sorry, what was it? The one where the calibration results? Yeah. Okay.

So the peaks that we're seeing they're influenced by the ice thickness on the lake each year, and from 2004 to till the end of 2012 we had measured ice thickness data so I included that in the model.

And the peaks also depend on the depth of the lake at the monitoring station that we're interested in. So near the diffuser or at the outlet. So you'll see different peaks in different areas of the lake.

So moving forward in the future we see the same periodicity and what I did was I just assumed an ice thickness of 1.3 metres from now until the end of mine life, which represents the average ice thickness that we've seen in Snap Lake.

MR. SEAN WHITAKER: Sean Whitaker, Environment Natural Resources. That's sort of what I was getting at. I was just trying to understand how it was calibrated, and what the -- some of the assumptions were.

Is there anywhere in that model that that's broken down, your assumptions that you've used in carrying it forward?

MS. ALISON SNOW: Alison Snow. In going forward making model predications I did specify that I used an ice thickness of 1.3 metres, but in terms of the cyclical pattern that we're seeing, I did not specifically say that it depends on ice thickness and the depth of the lake, I believe.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources.

If I could have that as an Information Request just to see the assumptions that you did make in that forward predicting in your calibration and why -- and how you've predicted the periodicity. And even if it's just getting back to me after lunch, I would appreciate that. Just a full detailed breakdown, just so I can understand it. It'll help my understanding of the model.

DR. KATHY RACHER: Kathy Racher for the Board. That seems like a reasonable request. Is that okay with you?

DR. PETER CHAPMAN: Yeah. Peter Chapman. We take that on.

--- INFORMATION REQUEST NO. 1: De Beers to show the assumptions that were made in that forward predicting in their calibration and how they've predicted the periodicity (see Slide 14)

DR. KATHY RACHER: Kathy Racher for the Board. Just while we've got this up here, I guess one (1) thing I noticed is that the -- the slope of the -- sort of what would be the calibrated area up to 2013 is one way and then it -- you know, especially for the upper bound it -- it seems like the -- the rate of increase of -- of TDS in the lake goes up quite a bit, the trend, and I'm just wondering if that's got something to do with the groundwater model or some prediction or if that's just an artefact of modelling in general?

MS. ALISON SNOW: Alison Snow. So the -- the rate of increase from -- to -- say the present till approximately 2016/2017, this is as a result of the mine water discharge increasing, like, it's going to peak under the lower bound scenario around 60,000 cubic metres per day in the near future and then it'll flatten out from there. So that's what that increase is from.

MS. ERICA BONHOMME: Erica Bonhomme. And -- and if you'll allow me to just skip all the way back through -- oh, that was quick, eh -- to Houmao's graph here where we see that levelling off at a certain point. So this is where the groundwater model ties to what's going on in the lake.

DR. KATHY RACHER: Sean's desperate to ask one (1) more question, so -- and then we're going to break for lunch.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. It's -- with respect to Slides 25 and 26 of the current presentation you provided numbers with mitigation for the downstream lakes.

What does that look like without mitigation?

MS. ALISON SNOW: Alison Snow. The model results without mitigation are presented in the supplemental filing. It's just submitted.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. Just because that was submitted on Friday I haven't actually looked in detail at it. I glossed over it fairly quickly on Friday and just a bit yesterday but ...

MS. ALISON SNOW: Yeah, they're -- they're in there.

MR. SEAN WHITAKER: That's in there?

DR. KATHY RACHER: Kathy Racher for the Board. Yeah, I think that was going to be a question I had too, so -- and maybe I missed it as well so I can take a look at lunchtime. Oh my God, Rick has got one

(1) tiny question.

MR. RICK WALBOURNE: Rick Walbourne, GNWT. Yeah, I, as well, have not had a chance to look at that information. Is there any way we can take a look at that after lunch? Or do you have any idea of what -- roughly what those numbers -- what range we're talking here? TDS in those models without mitigation.

MS. ERICA BONHOMME: Erica Bonhomme. I think we have a number of questions related to that. It is in the supplemental filing. If you give us a minute here we can -- we can -- we can get you back a series of answers around that.

DR. KATHY RACHER: Kathy Racher for the Board. It might be helpful if -- I don't know if you've got it electronically, if -- if we could put it up. Maybe -- maybe we can do that after lunch. I just want to respect lunch schedule more or less.

And at that time -- so at that time, we'll have those up because I -- I agree that it would be useful to see. And if there's further questions on the modelling we'll take them then and then move on to the TD Response Plan.

So it's 12:20 now and we want to give people an hour and fifteen (15) minutes for lunch, so -- or -- or so, so let's say 1:35 precisely, you know.

Because we do everything very precisely here. Maybe 1:36 if you're good.

So thank you very much.

MS. ERICA BONHOMME: Kathy, just -- it's Erica Bonhomme. If people are really chomping at the bit, we do have a Figure 2-15, 2-16, and 2-17 and 2-18 of the Supplemental Filing that talks about downstream lakes without mitigation.

--- Upon recessing at 12:20 p.m.
--- Upon resuming at 1:35 p.m.

DR. KATHY RACHER: Kathy Racher for the Board. Looks like everyone's here so we'll start off. There was a few things from the morning to -- to clean up first I believe. Erica had some answers to a few questions.

Do you want to go through each of those or do you want me to go one by one?

MS. ERICA BONHOMME: No particular order. It's Erica Bonhomme. We do have some numbers for -- the question around TSS and turbidity. I'll let Julie L'Heureux answer that.

MS. JULIE L'HEUREUX: Julie L'Heureux. So TSS we only have it on the dirty water side, we don't monitor just the -- the clean water, we monitor the effluent and the dirty. So from the dirty water, so most of the water, it was between 500 milligram per litre to 2000, okay. So I just give you a range for the last year, we look at -- we looked up the data so this was before the treatment in the water treatment plant.

MS. ERICA BONHOMME: Okay, Erica Bonhomme. The second question which Alison did answer a little bit before the break was the TDS concentrations at the drinking water intake. So Alison provided some numbers.

Did you want to point people to where they can find that information or -- so maybe the question is, Alison did provide you some numbers. Did you want -- did you need more information on that?

MR. ZHONG LIU: So far so good for that number, yeah. But if you could tell me where I can find for the information that would be better.

MS. ERICA BONHOMME: Erica Bonhomme. So we haven't filed that information which is why I'm asking if there is something specific that you would -- would want to see.

MR. ZHONG LIU: Zhong Liu from SLEMA. I -- I would like to see some written -- some information from De Beers for drinking water, water intake and watering results, yeah.

MS. ALISON SNOW: Alison Snow. I can provide, for example, a time series like I've provided for other stations in the lake. So I can provide a time series of TDS concentrations at the -- the water intake.

DR. KATHY RACHER: Kathy Racher for the Board. I think that's the second Information Request today?

MR. MARC CASAS: Marc Casas from the Mackenzie Valley Land and Water Board. I guess I sort of have one that was -- was sort of initiated as an IR but I think maybe was answered and -- and the first one that I have was to outline the assumptions made about the periodicity from that graph on page 14 of the presentation. So that's what we have right now as the first one and making this the next one Number 2, is that correct?

DR. KATHY RACHER: Kathy Racher for the Board. I believe that's correct and Sean is nodding his head, he was the one who asked for that.

--- INFORMATION REQUEST NO. 2: For De Beers to provide written

information for
drinking water, water
intake and watering
results

MS. ERICA BONHOMME: The next one on my list is we were asked also regarding the assumptions that were used in the -- the groundwater modelling and I -- I don't think we can answer that now so, you know, maybe you could formulate that as a specific Information Request if it's still valid and we'll be happy to answer that.

DR. KATHY RACHER: Kathy Racher for the Board. I think talking to Paul on the break, I think you were -- were assuming you didn't need anything more on that?

MR. PAUL MERCREDI: And then I was chatting with Julie afterwards and she said she had a fairly simple table she could provide. It didn't sound like it would be too much effort for her to provide that, so, if she can do that that would be --

MS. JULIE L'HEUREUX: Yeah, we will provide a summary table with all the different years the people that did the model and what was the flow -- predicted flow; that's we have it so. It's a summary table. It doesn't list all the assumptions because you have access to all the models but we can provide a summary table.

DR. KATHY RACHER: Okay, we'll take that as Information Request Number 3.

--- INFORMATION REQUEST NO. 3: De Beers to provide a summary table with all the different years the people that did the model and what was the predicted flow

DR. KATHY RACHER: And the next one I think had to do with the -- the numbers for the TDS in the -- the footwall contributions to the models.

MS. ERICA BONHOMME: Erica Bonhomme. So there were -- there was a question about the numbers used in the site models versus the numbers used in the Itasca 2013 -- 2012 report and what we'll -- I'll just Houmao to provide some clarification on -- on the numbers and where -- where they're reported.

DR. HOUMAO LIU: Houmao Liu. In August 30th, 2013 memo the TDS concentration was used based on measured TDS concentration and after our submittal of that memo and -- the group decide that it's more reasonable to use the lab calculated TDS value.

And so -- so in October 3rd we issue another memo but that one was submitted to De Beers and also to Golder Associate so that's the number we used in -- in the October memo and it's slightly lower than what is used in Oct -- in August 30th memo. So that's the difference.

DR. KATHY RACHER: Kathy Racher for the board. I don't know if Ian Collins is on the line if -- if you have a comment on that or a follow-up question?

MR. IAN COLLINS: That's fine, thank you.

DR. KATHY RACHER: I believe -- it's Kathy Racher, Ian said that was fine, thanks. Okay, great.

MS. JULIE L'HEUREUX: Just to confirm all the slides that were presented was actually reporting those updated October data.

DR. KATHY RACHER: Kathy Racher for the Board. And I believe the way we left it before lunch was we were just going to take a look at some of the graphs and the supplemental material that was submitted last Friday with respect to the downstream concentrations of TDS in the absence of additional mitigation on site.

So, Erica, if you want to take that over.

MS. ERICA BONHOMME: Erica Bonhomme. Just for clarification this is the supplemental filing provided April 11th and we're on Figures 2-15 and 2-16, page 28. I'm just going to let Alison Snow speak to that further.

MS. ALISON SNOW: Alison Snow. So Figure 2-15 is showing predicted whole lake average total dissolved solids concentrations downstream lake 1 and, again, these are assuming that there is no mitigation in place to control concentrations of parameters such as TDS in the effluent discharge to Snap Lake.

So the four (4) scenarios, we have lower bound scenarios A and B and upper bound scenarios A and B. So that's for downstream lake 1.

And then similarly we carried that downstream to downstream lake 2 and I believe there is another figure Figure 2-7 -- down a bit further, Figure 2-19. Right. This one here shows the predicted whole lake average, total dissolved solid concentrations in

Lac Capot Blanc.

And then we -- we also carried that -- these results further downstream. Scroll down a bit. I can't remember the figure number. Figure 2-22, I believe, or -21. Okay, so that's the one we presented. Okay, so this.

We presented it in a figure as opposed to a table but this shows the results of the downstream lake modelling nodes for the four (4) scenarios. And it also presents the baseline range, the dotted black lines, from approximately 10 to 53 milligrams per litre of TDS.

So for those four (4) scenarios as we move downstream, again, it's by the first site on Mackay Lake, which I believe is Site 22, concentrations are back within the baseline range.

DR. KATHY RACHER: Kathy Racher for the Board. Are there any questions about the -- this information?

MR. ZHONG LUI: Zhong Lui from SLEMA. I'm wondering whether De Beers also could provide the modelling results for downstream chloride level change, you know, and also compare -- compare with the CCME guideline 120 milligram per litre.

(BRIEF PAUSE)

MS. ALISON SNOW: Alison Snow. So for the downstream lakes' modelling we currently only modelled total dissolved solids as it moved downstream.

What we did -- or what we could do is just take the -- assume that the percentage of chloride and TDS remains the same as it is in Snap Lake and present model results. So the chloride concentration is 46 percent of TDS.

DR. KATHY RACHER: Kathy Racher for the Board. I think that, yeah, if you could -- if you could do that. Even using that simplifying assumption of 40 percent chloride for the TDS rather than me running the model, I think that would be helpful.

And Zhong has asked for -- I mean a comparison to the CCME Guideline, but I think because you've proposed a water quality objective that's hardness-based, it would be helpful to have that information as well. I mean, we'll see both but the hardness-based one I'd have to pick up a calculator to do.

So maybe you could do that for us. Because it -- the hardness will change obviously in the lakes downstream and so the water quality objective is going to be different for -- for different scenarios and different lakes downstream. And we could have that as IR-4?

(BRIEF PAUSE)

DR. KATHY RACHER: Apparently, I can't count and this is probably IR-5.

--- INFORMATION REQUEST NO. 4: De Beers to provide the modelling results for downstream chloride level change and also compare with the CCME guideline 120 milligram per litre.

--- INFORMATION REQUEST NO. 5: To provide the calculations of chloride in the downstream receiving environment and also the hardness associated with those

downstream
environments.

DR. KATHY RACHER: Kathy Racher for the Board. We'll get our story straight on the numbering and get back to you, but we will take that as an IR, though.

DR. PETER CHAPMAN: And Peter Chapman here. Just to check, these IRs if we can do them sooner, great, but otherwise the deadline on the schedule is when the IRs are due, correct?

(BRIEF PAUSE)

DR. KATHY RACHER: Kathy Racher for the Board. Yeah, the -- the number on the schedule is April 30th and that would be the -- the deadline. You can submit them any time up till April 30th.

Okay. Kathy for the Board. Were there any other questions on the downstream water quality predictions without mitigations or other things about the water model?

I'll take questions in the room and then I'll ask people on the phone. So, Rick...?

MR. RICK WALBOURNE: Rick Walbourne, GNWT. I'm not sure if I missed it, but did you also show the effects or the predictions for Snap Lake without mitigation? I just caught the end there; I was reading something.

I saw the downstream lakes but was Snap Lake also provided or did I miss it?

MS. ALISON SNOW: Alison Snow. Yes, the down -- or sorry, Snap Lake with mitigation was provided. I could -- I'm just looking for the slide number.

DR. KATHY RACHER: Kathy Racher for the Board. I think Rick was asking for without mitigation.

MR. RICK WALBOURNE: Yes.

DR. KATHY RACHER: And -- it's Kathy Racher for the Board again.

So that's the -- the hydrodynamic model that's on the record is -- is all about Snap Lake without mitigation. So it just doesn't have any of the -- it doesn't have the downstream information in it, in that model, that's all.

MS. ERICA BONHOMME: Erica Bonhomme. And -- and in the presentations it's summarized on Slide 17 of the lake model presentation.

DR. KATHY RACHER: Kathy Racher for the

Board. Is there anyone on the phone? I'll ask -- I don't know if Anita's back on the phone from Environment Canada. If she has any further questions I'll ask her first.

MS. ANITA LI: I am on the phone. Anita Li, Environment Canada.

Sorry, I -- I missed that. The downstream you did the analysis with mitigation, right? And the -- up at Snap Lake you said it was page 17 -- Slide 17 that shows it with -- without mitigation?

MS. ERICA BONHOMME: Correct. So Slide -- slide 17 -- it's hard for you to see it in the -- because you're not in the room right now, what -- the title of -- the title of the presentation is "Snap Lake Mine Hydrodynamic and Water Quality Model Predictions."

MS. ANITA LI: Sorry. Okay, thank you. I just wasn't sure.

MS. ERICA BONHOMME: That was Erica Bonhomme speaking.

(BRIEF PAUSE)

MS. ERICA BONHOMME: Okay, do you -- do you have that, that slide? Okay. And then -- and then we move down and slide -- slide 20 of that same presentation provides the modelling wi -- with the mitigation in place. That was Erica Bonhomme again.

MS. ANITA LI: Okay. Anita Li, Environment Canada. This is the one showing the line graph, right? I'm on slide 20 and it says "Predicted Steps Average TSD -- TDS on Chloride Concentration"?

MS. ERICA BONHOMME: Erica Bonhomme. That's correct.

MS. ANITA LI: Okay. So seventeen (17) was without -- without mitigation and 20 is with mitigation? Sorry, I'm trying to figure... Is -- is that correct? Seventeen (17) is without --

MS. ERICA BONHOMME: Correct.

MS ANITA LI: -- mitigation?

MS. ERICA BONHOMME: Slide 17 presents the predicted concentrations without mitigation. So left -- left to their own devices this is how TDS and chloride concentrations would increase --

MS. ANITA LI: Okay.

MS. ERICA BONHOMME: -- within Snap Lake --

MS. ANITA LI: Okay.

MS, ERICA BONHOMME: -- at the diffuser and at the outlet of Snap Lake. And sli -- slide 20 presents how concentrations would -- would increase and then level out with the proposed EQC if -- if the proposed EQC were met.

So, you know, we would have mitigation in place that would ensure that the water quality would remain below the site-specific water quality objectives.

MS. ANITA LI: Anita Li, Environment Canada. Thank you.

What mitigation was used to develop the second graph on page 20? Like, what mitigation measures did you assume in your model?

MS. ERICA BONHOMME: Erica Bonhomme. It -- it's -- it doesn't really matter what mitigation is applied here. We do discuss that in the TDS Response Plan. The modelling simply assumes that that site-specific water quality objective will not be exceeded.

MS. ANITA LI: Okay, thank you. Anita Li, Environment Canada. That's all the questions I have.

DR. KATHY RACHER: Kathy Racher for the Board. Thank you for that.

If there's anyone on the line from EcoMetrix, do you have any further questions at this time?

MR. DON HART: No further -- Don Hart for EcoMetrix. No further questions.

DR. KATHY RACHER: Kathy Racher for the Board. Okay, Zhong...?

MR. ZHONG LIU: Zhong Liu from SLEMA. In slide 17 clear -- clearly indicated lower bound scenario A, B, upper bound scenario A -- A, B, and -- but in slide 20 there's no scenario. So I assume is scenario B or scenario A for slide 20?

MS. ALISON SNOW: Alison Snow. What I did on slide 20 is because we assumed the TDS concentrations in the discharge to Snap Lake would not exceed 684 milligrams per litre, I only ran two (2) scenarios. So from 2004 until January 1st, 2015 I only -- I ran two (2) scenarios: one with an upper bound flow and one with a lower bound flow and I assumed the lower TDS concentration. So scenario B concentration.

But past that point from January 1st, 2015 onward I usually had to reduce the concentration to 684 milligrams per litre in the discharge. So there are -- I could have ran four (4) scenarios but I think they would have been one on top of the other.

DR. KATHY RACHER: Kathy Racher for the Board. Great. So before we get on to the presentation of the TDS Response Plan, I think -- if that's where we're going next -- Mark wanted just to run through however many IRs we happen to have at this stage just to -- to check that we're on the right track.

MR. MARK CASAS: Thanks, Kathy. It's Mark Casas from the Land and Water Board. So I'll start with what I have as number 1 through to 5 and then we can clarify if we have to from there.

So the first one I have, as I mentioned earlier, was to outline the assumptions made on the periodicity, a graph on page 14, and that came from ENR. Sean Whitaker, I believe. The IR num -- so that's IR-1.

IR-2, I have here jotted down as -- as a time series for change in TDS at the water intake.

So IR-3, I have as summary table of predicted flows, which I guess you guys -- sorry, Julie L'Heureux was -- was speaking about as being able to submit that.

MS. JULIE L'HEUREUZ: Historical.

MR. MARK CASAS: Hist -- of historical, yeah. Sorry.

IR-4, I have the site models. That was a question raised by EcoMetrix about the 'A' and 'B' scenario concentrations and why they differed from the initial Itasca modelling. Now, I believe that one was

-- was confirmed as being answered by -- by Ian Collins on the phone. So maybe just after I'm -- I'm done going through we can just confirm that and then I'll -- I guess I'll just strike that one off.

And IR-5 was to provide the calculations of chloride and -- and downstream -- in the downstream receiving environment and also the hardness associated with those downstream environments.

So maybe first, so Eco -- EcoMetrix, can you just confirm that IR-4 has been responded to?

MR. IAN COLLINS: Ian Collins here from EcoMetrix. I actually would like to ask if it's possible for us to see the October Memorandum as opposed to the August Memorandum for Itasca. That will help clarify it.

MS. ERICA BONHOMME: Erica Bonhomme. Yes, it is.

MR. IAN COLLINS: That would be great. Thank you.

MR. MARK CASAS: Okay. Well, I guess for fun we'll make that IR Number 6. So De Beers will provide then the October memo in regards to the site model concentrations, TDS concentrations. And -- yeah.

So if -- if there was anything that I missed please mention it now so we can get it down and then move forward.

--- INFORMATION REQUEST NO. 6: De Beers to provide the October memo in regards to the site model TDS concentrations.

DR. KATHY RACHER: Okay. Kathy Racher for the Board. Just to let you know we will be writing these down and -- and giving them to you in writing as well. Sean has something to say.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources.

I just wanted to read it into the record -- because we are talking about downstream lake impacts, Section 12.6.4 water quality of the original environmental assessment in 2002. I'm going to read:

> "There is no valid linkage for cumulative impacts associated with water releases from Snap Lake diamond project for water quality."

I'm going to read that section:

> "The predicted impacts associated with the water releases from the Snap

Lake diamond project were restricted
to the LSA."

The near Snap Lake is what "LSA" was referring to.

"There are no other existing or
planned activities in the LSA that
could impact water quality.
Similarly, there are no other
existing or planned activities within
the RSA,
environment which RSA stands for]
that could impact water quality,
therefore, there are no valid linkage
for cumulative effects of water
releases on water quality and no
further assessment was required."

I just wanted to highlight that because we are talking about downstream changes to water quality away from the LSA.

MS. ERICA BONHOMME: Erica Bonhomme. We do address, I think, a -- a lot of the information you're speaking to in the Supplemental Filing that was filing -- filed on Friday, and we will -- we have a presentation on that that hopefully we can get to tomorrow.

DR. KATHY RACHER: Kathy Racher for the Board. Okay, that's fine. That's noted. And in going forward, you know, if there are things that, you know, we -- we can't resolve today, of course, you can -- you can take it up in your technical report to multiple boards as it turns out.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. I just wanted to have that read into the record so it is here for both Boards, as it is the technical session for both.

DR. KATHY RACHER: All right. Kathy Racher for the Board. Erica, we'll go back to you to carry on with the TDS Response Plan then -- and a reminder to say your name at the beginning of everything you say. It's -- it's just be -- for the purposes of transcription and the poor woman in Edmonton who has to figure out who said what at the end of the day.

PRESENTATION - TDS RESPONSE PLAN

MS. ERICA BONHOMME: Okay, the presentation on the TDS Response Plan follows from the presentations where we left off this morning. I'm Erica Bonhomme, I'm the manager of Environment, Snap Lake Mine, De Beers Canada.

Slide 1. The TDS Response Plan is being submitted as a requirement of the licence. The current water licence. It was required to be submitted by December 31st, 2013. We -- we included it as part of this application submission.

There's a couple of requirements within that licence that I draw your attention to. One (1) is the licence required us in the TDS Response Plan to develop and recommend appropriate water quality objectives for TDS chloride and fluoride in Snap Lake derived from toxicity testing. And it required us to recommend EQCs for TDS chloride and fluoride to be applied at SNP Station O2-17, that's end-of-pipe, that would ensure protection of aquatic life in Snap Lake.

A note that there currently are no national water quality guidelines for TDS. De Beers has conducted its own toxicity studies related to TDS, some of which are ground-breaking. And Dr. Chapman will speak to that in just a little bit.

The conclusions of these required toxicity studies has led us to recommend site-specific water quality objectives for Snap Lake and now higher EQCs for TDS, chloride and fluoride, which is the basis of our amendment application.

Slide 3. The full results of the

studies are provided in the following reports that were also filed with the application: Development of Total Dissolved Solids Chronic Effects Benchmark; and Development of Fluoride Chronic Effects Benchmark both for aquatic life in Snap Lake.

Recent supplemental toxicity testing specifically for daphnia magna suggests that even higher site-specific water quality objectives than proposed in the application for TDS may be appropriate. And those results are provided in a technical memo that was filed on Friday called "Technical Memo: Results of Second Daphnia -- Daphnia Magna Toxicity Test Results."

Now we believe that a TDS EQC which is inclusive of chloride, fluoride and sulphate would be protective of the aquatic environment. So TDS EQC all by itself in other words.

De Beers has high confidence that the current proposed EQCs and site-specific water quality objectives will ensure protection of the aquatic environment. However, we would like the opportunity to present additional evidence during these proceedings specific to TDS and as they relate to the additional testing that we've just completed.

I'll give a -- I'll -- I'll start with an overview of the other requirements of -- or how we've responded to the other requirements of the TDS Response Plan. In particular, the identification of TDS sources and how we'll manage those -- the -- the TDS from -- from those sources.

The assessment and quantification of sources of TDS loading in mine water is based on results from the Snap Lake water quality report and groundwater model scenarios which we discussed this morning.

The models are updated annually based on field monitoring data, which is collected as part of the surveillance network program and aquatic effects monitoring program. And we've already mentioned the -- the percentages of loading of TDS from underground and how it relates to mine development.

The current practices for minimizing groundwater seepage to the underground which are largely inconsequential in stopping loading of TDS are to conduct cover hole drilling to ensure we identify high flow -- potential high flow zones and grouting, which Julie has -- Julie L'Heureux has mentioned earlier this morning in terms of our efforts to use that as a -- a solution to provide temporary and partial reduction to flow.

The TDS Response Plan provides a summary of the investigations we've completed to date and to minimizing TDS loadings to the environment. De Beers commissioned pre-feasibility desktop studies of the effectiveness and possible capital and operating costs of known water treatment technologies. These are reported in the TDS Response Plan and they're listed there. I'm on Slide 5 for those on the phone.

We have also looked at reviewing the -- we've also looked at the possibility of targeting footwall water for treatment. And we've al -- while all this has been undertaken, DBC has wrapped up -- ramped-up -- De Beers Canada has ramped-up handheld and inline monitoring of groundwater and effluent to gain a better knowledge of the flow and quality of water.

In the end, the evaluation of the pre-feasibility studies concludes that some technologies, including micro-filtration, reverse osmosis, ion exchange, and evaporation crystallization processes alone or in combination are potentially feasible for Snap Lake.

We've also established that treatment of full mine effluent is not cost effective and that, as a result, reducing TDS in effluent in order to maintain the current whole limit which is a whole lake average below 350 milligrams per litre TDS is not economically feasible, nor is it necessarily practicable for Snap Lake mine.

We are currently in a concept pilot testing stage to evaluate -- to further evaluate options for treating effluent to meet the proposed site-specific water quality objectives for TDS that are both practicable and continue to be protective of the environment. That means that they will ensure that the water in Snap Lake remains safe to drink and the fish remain healthy.

Slide 6. So as I mentioned, the concept pilot testing is underway and we expect a feasibility decision by Q4 2014, end of this year. The feasibility will be based on detailed cost benefit analysis and a decision by this Board or these Boards on appropriate site-specific water quality objectives.

Generally, the more TDS we remove from water the higher the amount of waste generated, energy consumption, greenhouse gas emissions, operating cost, and infrastructure. Those are all things we're currently evaluating.

Other things we have to take into consideration when looking at possible treatment options are: The reliability of the system, the scalability of the system, effectiveness, considerations for temporary brine storage, and the seasonality of road access to Snap Lake mine.

Our initial findings show that treatment can be more than 90 percent effective at removing TDS from mine water. There is no need to target specific ions, but we can treat TDS as a whole.

Targeted footwall treatment is not practicable under our current mine operating conditions and, in fact, it may be most practicable to treat a percentage of our mine water outflow.

Slide 7. So when we are looking at the effectiveness of treatment in our pilot concept study we are looking at: TDS, nitrate, nitrite, chloride, and fluoride ions. As I mentioned before, we have a number of processes alone or in combination that may be feasible that we are evaluating, which includes membrane for: Filtration and micro-filtration, reverse osmosis, ion exchange, a combination of evaporation and crystallization, and a partial treatment of the effluent.

The initial treatability studies are being conducted using a numerical simulation and the pilot testing will involve a physical simulation away from the Snap Lake mine site. To do this, a reduced scale treatment plant will be used to evaluate the effectivenes of the treatment and the various processes to obtain critical design parameters for a full-scale system, and predict the system's performance.

Slide 8. This is what it looks like inside a -- a pilot testing facility. We have opportunities for clarifier gravity settling, micro-filtration, reverse osmosis, and ion exchange chemical softening.

Slide 9 just describes the var -- again, the various processes that -- that we would evaluate, micro-filtration. You'll see the acronyms that are used there in the slides that follow. So micro-filtration "MF"; reverse osmosis "RO"; ion exchange "IX"; and evaporation crystallization. In the end, we either end up with a concentrated brine or con -- or solid salts, or a combination of both.

There are four (4) pilot test options being considered. They're outlined in the next four (4) slides. I don't think I'll -- I'll go through these in detail except to mention again that micro-filtration -- "MF" stands for micro-filtration; "RO" stands for reverse osmosis. The little blue things there are -- are pumps, so they represent how we would take a portion of the mine water, a percentage of which we -- we don't know, that's part of -- part of the concept study, and then run it through various combinations of processes to blend it back with the final effluent discharge.

Slide 11 again shows a different combination of processes. Slide 12 and Slide 13. Julie L'Heureux can walk you through those if we have questions about how -- how those various processes might conceptually work.

On Slide 14 I want to walk you through a very, very generic timeline of -- of kind of the steps that we need to take to evaluate and potentially implemate -- implement any kind of treatment which is, again, currently in a conceptual pilot testing phase.

So, as I mentioned, we've completed the pre-feasibility work, we are now beginning the pilot concept testing, we're at the early stages. We will evaluate the results of that pilot concept testing to determine if it's feasible and whether we would proceed with a design on that basis. We'd then proceed to a detailed design, approvals, and finally implementation sometime in 2015.

Over the life of the mine to -- to improve our water management, we will continue to improve our understanding of structural influences on the hydro -- hydro-geological model as has been presented by Itasca.

We will improve our understanding of underwater flow rates, the variability and any influencing factors, and we also need to improve our water management capacity. As you've seen in the -- the various graphs that have been presented, we currently are discharging approximately 43,000 cubic metres a day. We will need to manage in the future up to 60,000 metres cube per day.

That involves improving our pumping system reliability and infrastructure in support of the life-of-mine plan. And -- and specifically that includes -- inclu -- increasing capacity for dewatering of the underground mine workings; increasing capacity of the water treatment plant; and increasing our capacity to discharge effluent.

Phase III at some point in the future will be -- will involve completing the life-of-mine dewatering design and implantation based on the evaluation of the Phase II.

Currently we're commissioning a modular water treatment plant to add 25,000 cubic metres of treatment capacity, which includes 10,000 metres -- up to 10,000 cubic metres a day of dirty water and up to 15,000 cubic metres a day of clear water.

Slide 16 is a schematic of our current water management system. Again, you'll see the differentiation between our -- our dirty water which is our -- a majority of our -- our underwater management is dirty water, and our upper dewatering system which is clear water.

All that flows through our water treatment plant before being discharged to Snap Lake. You'll see our two (2) compliance points there, SNP O2-17B which is at the discharge of the water treatment plant; final point before entering the lake. And SNP O2-O1 which is where we measure flows and water quality from underground.

I'm going to hand it over to Dr. Peter Chapman now who will speak to the part of the TDS Response Plan where we're required to talk about site-specific water quality objectives and EQCs.

(BRIEF PAUSE)

DR. PETER CHAPMAN: Peter Chapman here. Thanks, Erica. So what I'm going to do is I'm going to go through fluoride, chloride, and then TDS in order spending more time on TDS because it's the one of most interest.

(BRIEF PAUSE)

DR. PETER CHAPMAN: We're having a technical difficulty here in terms of changing...

(BRIEF PAUSE)

DR. PETER CHAPMAN: Okay, we're now to slide 2, one of my favourite -- actually, slide 18, sorry, second in my presentation, that shows a lovely picture I love, but there's the goal; basically, we want to protect the fish stocks. In protecting the fish stocks we want to protect what they eat, the habitat they have, and in doing so we're protecting the function of the lake.

Fluoride. Okay. What we did with fluoride -- and Erica said earlier, and I quite agree with her, that this is an interesting situation. It's, if you like, a unique situation. TDS, total dissolved concentrations, haven't changed for several years; the composition hasn't changed.

And realistically, there's no reason that we couldn't set EQCs solely based on TDS rather than on the individual components, because setting it based on the whole of TDS would protect against the individual components as they interact within that.

However, because there was a requirement to develop individual site-specific water quality objectives we've done so. For fluoride what we did is we followed the Canadian Council of Ministers of the Environment, the 2007 document. And for those of you not familiar with that document, what that document does is set out in Canada how you develop water quality guidelines for Canada and also how you develop regional or site-specific benchmarks or objectives.

So what we did is developed a species sensitivity distribution and if you look at the graph here on Slide 19, you can see percent of species affected going up from zero to a hundred percent. Fluoride concentration across the bottom and you simply graph on that all the data you have.

Now what we did is we looked at two (2) previous benchmarks or guidelines if you like: BC Ministry of Environment 1995. They have a benchmark that's actually based on hardness, it's quite interesting, but based on only one (1) value. CCME, Canadian Council of Ministers of the Environment, has a value from 2002 but as you can see it's now 2014. There's been a lot of work done since then.

So what we did is we followed the

Canadian Council of Ministers of the Environment 2007, developed a species sensitivity distribution and developed what's called an HC5; a 5 percent level, which is the level at which the 95 percent of the species will be protected and per Canadian Council of Ministers of the Environment that's where you can set a guideline or objective. So we set Guideline 2.46.

If you're wondering what's down here, that's a 2.25, that's fingernail clams that, in fact, are doing very well in Snap Lake. They've actually increased in abundance in the last AMP.

Chloride. In the case of chloride Ekati, as you -- most of you are aware, has developed a -- a chloride site-specific water quality objective. But, in fact, this was developed not just for Ekati, it was based on a publication Elphick et al in 2011 in the peer reviewed international journal Environmental Toxicology and Chemistry, that talked about chloride and the hardness effects more generally than just in Ekati. So base -- and so that's been accepted by the Wek'eezhii Land and Water Board as part of the Ekati renewed water licence. And because it's published in the primary literature it's also applicable.

We used the site-specific water quality objective from Ekati at a hardness of one sixty (160) and we got a value of 388 milligrams per litre chloride. So that's what we're proposing as the individual site-specific water quality objective for chloride.

Now, I'll move on to TDS. And I'm going to spend a fair bit more time on that because it's important. And you've seen a lot of these slides, some of you before, because we've gone through a whole process starting before the last water licence where we talked about TDS and how we were going to do testing. And it's taken us a few years to do the testing, because we have tested a large range of organisms and we wanted to do it technically defensible.

And it's interesting, because as I said, this is a unique situation. You can read up here how the Snap Lake TDS composition has been pretty stable. Look at that, chloride 45/46 percent, calcium 20/21 percent, and I apologize, this is slide 21 for those on the phone. You can read that and you can also see it in slide 22 in this figure, and you can see here from about 2005 onwards, very, very constant. So all the same.

This is very different than Ekati, where Ekati the chloride is decreasing. So they couldn't do a site-specific water quality objective on TDS because it was changing. We can. And every indication we have indicates that the TDS composition should not change over time. It should stay the same.

Now, in terms of protecting, again, most of you have seen this. Just -- just to emphasize, slide 23, what we want to protect is not just fish, but the aquatic food web on which they depend. So what that meant was we had to test the plankton, the phytoplankton, the small animals that live in the lake. The zooplankton, the small animals that live in the lake. The benthic invertebrates, the animals -- the small animals that live in the mud, and fish. So we're protecting the food chain, as well as protecting the fish.

And we had three (3) purposes right here, first of all, indirect effects from the plankton. Okay. So if the fish are eating the small animals in the water that depend on the small plants, are those going to be okay?

Secondly, for indirect effects, if they're eating the critters that live on the bottom, are those critters okay?

And finally, direct effects on the fish. And many of you may remember there were a lot of discussions at technical sessions and at the last water licence hearing about what was the best thing to test for fish.

And there was general agreement that the most sensitive life stage of fish is the egg stage from fertilization onwards. So that's exactly what we tested. And I'll get to that shortly.

In terms of the lower food chain organisms, phytoplankton, we looked at growth inhibition, zooplankton, survival growth. You can read those here. The 'a', little 'a' that you can see against the midge, which is a little insect larvae, chironomids against the rotifer, here against the water flea, against the diatom, means the genus is found in Snap Lake.

And when you're doing a toxicity test in a laboratory, yes, we like to use laboratory white rats and certainly ceriodaphnia is a laboratory white rat as is daphnia. But daphnia is found in the lake. So you have more relevance if you're testing the organisms that are more similar to what's -- or they are the organisms that are found in the lake. And you can see a pretty picture of the organisms here.

In terms of the fish work, I've got at the bottom, this is slide 26, "See the poster." There's a poster on the wall and I apologize for those of you on the phone you can't see the poster. But the poster simply summarizes what's in our detailed presentation. Most of you will have seen this. This was presented in January at the fisheries conference. It was also presented previously at the aquatic toxicity workshop in October. And we hope ultimately to publish on this. We just need to find time to write it up.

Anyway, so basically as you can see up here the egg hardening stage is generally the most sensitive. Okay. And we looked at lake trout and arctic grayling, which is certainly important and found there. And we went from the fertilized egg right through to the early fry life stages.

Two (2) different exposures, one (1) prior to fertilization and one (1) after fertilization. We call them wet -- dry and wet. And dry is simply the fact that we fertilized them before we put them into the solution and wet is the fertilization occurred when they were in the test solutions.

And here's a picture. I couldn't resist this because unless you do toxicity testing you can't imagine how nervous one gets waiting to see what's going to happen, particularly for some of these tests that go on for months. And we were very happy, this is slide 27, to see some very nice grayling there that looked perfect and were doing very well, even at the highest test concentration.

Okay. I'm now going to have to hit you with data. I apologize. I'll take some time going through it. But what we've got here, this is slide 28, is a table. It shows test species, the endpoint and the concentration of TDS. And going down we go from water flea right through to trout and grayling.

The endpoint, IC, means inhibition concentration. In other words, it's the concentration at which we see an effect. Now, you'll see in some cases we have a ten (10); in some cases a twenty (20), ten (10), ten (10), twenty (20), ten (10), and so on. Ideally what you want to do is get to a 10 percent effect because that's low enough that it really is at the point that you're not going to see any effects on the individual. So -- and it's so low it's right at background.

The problem you get in toxicity tests and in real life is there's a lot of natural variability. And in some cases we couldn't get an IC 10, we could only do an IC 20 because of -- there wasn't that much difference between the controls. Because you will see some effects in the controls compared to that.

Is an IC 20 valid? Yes. If you go back to Canadian Council of Ministers of the Environment, they prefer a 10 percent level, but they certainly accept a 20 percent level. If you look at the USEPA water quality criteria, the last two (2) criteria they developed for ammonia and for selenium used a 20 percent effect level. So that's very reasonable.

Okay. Looking down, now let's go over to the TDS column. And notice, first of all, there's an awful lot of 'greater than'. And if you're wondering why the numbers are so different, greater than thirteen-seventy-nine (1,379), greater than the fourteen-seventy-four (1,474), the reason for that is that when we did the testing we tested -- we tried to test up to fifteen (15)...

(BRIEF PAUSE)

DR. PETER CHAPMAN: Whoops, sorry. I got carried away and turned myself off. But we -- we test nominals to start with. So what we do is we estimate that we've got up to fifteen hundred (1,500). But that's not good enough. Then we send it to the lab who measures it and determines what we actually have.

And that's why you'll see in some cases we've got thirteen-seventy-nine (1,379), fourteen-seventy-four (1,474), fourteen-eighty-seven (1,487), and so on. We came pretty close, but you know, in measuring out you're not going to get it quite right. But it's not too bad. Not too bad.

It's interesting here when you come to fish you'll see everything's fourteen-ninety (1,490), fourteen-eighty-four (1,484), fourteen-nineteen (1,419), fourteen-fourteen (1,414). There's one (1) with the dry fertilization fry survival nine-ninety-one (991). A little lower, that's interesting. But you do get variability and, in some ways, you can look at these as replicas, even though in this case dry fertilization -- fertilization occurred unnaturally. Because normally you get fertilization occurring in water. We did it outside water in that case.

The key ones here, down here, are the daphnia magna and the ceriodaphnia. So ceriodaphnia, the 10 percent is -- level is five-sixty (560), 20 percent seven-seven-eight (778), daphnia six-eighty-four (684).

Now, you look at these and you say, How are we going to work this out? Because ideally what we want to do is follow Canadian Council of Ministers of the Environment 2007 and do a species sensitivity distribution.

The problem we face is we have all these 'greater than' numbers. And with 'greater than' numbers you don't know what they are. You can't put them in. So CCME allows a different way of doing it which goes back to Canadian Council of Ministers of the Environment 2003. This is slide 29.

Basically you can go back to the old way where you take the lowest value and basically apply an application factor to it, or an uncertainty factor if you want to call it that. So, again, the SSDs weren't useful. We only had the three (3) unfounded values, the two (2) daphnid, and the nine-ninety-one (991) for the trout.

Now, ceriodaphnia found in Snap Lake, the IC 20, seven-seventy-eight (778). Daphnia found in Snap Lake, the IC 20, six-eighty-four (684). And we spent a -- an awful long time looking at this and trying to figure it out. And it seemed to us the most reasonable, particularly in the context that 500 milligrams per litre TDS is the default value below which, if you haven't done site specific, people say things are probably okay.

Take, for example, Diavik. Diavik, as

you may recall, has a -- a benchmark of five hundred (500) given by the Wek'eezhii Land and Water Board without any site-specific testing. Okay. So we're at six-eighty-four (684)? Daphnia make up about 2 percent of the zooplankton in Snap lake.

Copepods weren't tested, unfortunately. We would have liked to have test copepods. We tried. The problem we ran into is that there's no really way -- nobody's developed a good way to test them, so we'd have to develop a new way to test them in freshwater.

And I'm sorry, I should have mentioned that all the tests we did were based where they were available and Environment Canada accept the test protocols. Otherwise, where they weren't available, on test protocols that were out there in the literature. And that's all in our information.

We used an uncertainty factor of one (1) to get a site-specific water quality objective six-eighty-four (684). And that'd be the same as the TDS EQC because of the mixing of treated mine water. And we'll talk about the EQC more tomorrow.

Let me just go a little bit further, how we're doing with daphnia. This here is cladocerans. This is unnumbered slide. This is after slide 29, so it should be slide 30. I'm going to blame Gil -- Bill

Gates for no number, but that's another story. But if you look at these two (2) slides, this is the cladoceran, or if you like, daphnid biomass.

And then the daphnid abundance. And the year's on the bottom, you can see, and then the normal range is the dashed lines. See it went down? Now, it's coming up again. They went down. Now, they're coming up again. So daphnia don't seem to be -- if they were reacting to TDS increasing, you'd expect them to go down, but they've actually just varied. So they seem to be doing okay so far.

What about zooplankton in general? You know, basically, right through until 2013, mainly copepods. Okay. Or rotifers, which we did test. In the baseline, 74 percent calanoid copepods, 18 percent. So main -- seventy-four (74) plus eighteen (18) mainly copepods, small amount rotifers and cladocerans. And then it shifted. We've got changes. We're up to 39 percent cyclopoid, copepods, calanoid, rotifers, up to 29 percent. Cladocerans less than 1 to 7 percent, so very small proportion of the population.

Now, I'm going to have to do something now I never thought I was going to have to do. But I'm going to do it. I'm going to take a breath and I'm going to read it into the record. Todd Slack, you were right. God, that was hard. Okay.

Anyway, basically January 6th -- and I'll explain why he was right -- January 6th we had an information session. This was right after the fisheries conference. And we had a -- a lot of people there and we presented what we had going up six-eighty-four (684). And we presented that table I showed you that showed where everything was.

And Todd and others, but in particular Todd, asked a very good question. Okay. What about reproducibility? You know, how reproducible are they? And, you know, I've -- I believe my recollection is that I said, Well, you know, they should be pretty reproducible. There'll be some variation. Could they be lower? Could be. Could they be higher? They could be higher. And I pointed out that those greater than fourteen hundred (1,400) and that sort of thing, you really wouldn't expect that big a -- a deal because -- but you see -- you might see some differences at the lower end.

And so basically and as a result of discussion -- and I can't take credit for it because it was De Beers that suggested to me, Why don't we repeat the test and see what we get? So I said, Fine, expecting not to see much of anything. And I was surprised. Science is always full of surprises.

Basically, it's interesting because test 2, as you can see here on the graph, this is slide 33 for those of you on the phone. Test 2 is in red. Test 1, the first one (1) six-eighty-four (684) is in blue. Look at the dose response. Very, very similar dose response, but in fact it's very flat. And because it's so flat we actually ended up with two (2) different values. We got fourteen-seventy-seven (1,477) for the second test, compared to the first test which was six-eighty-four (684).

Now, if you take the geometric mean of these two (2) studies you get 1,005 milligrams per litre. Now, why take the geometric mean? The reason you take the geometric mean is because if you go back to the Canadian Council of Ministers of the Environment 2007, when you develop the species sensitivity distributions, you go back to the literature. You go through the literature, you sort out which studies are applicable. And in many cases, particularly for daphnias which are often tested, you'll find more than one (1) study.

So the advice from CCME, and you can see the two (2) quotes, the first two (2) dots there is, is basically take the geometric mean. Now, this was also done for Ekati when they were developing their site specific-water quality objectives. And for two (2) of those site-specific water quality objectives, they actually did exactly that for daphnia.

So, again, this was done. There's precedent. There's VCME -- VCC -- sorry, Canadian Council of Ministers of the Environment 2007, and precedent suggests that we should take the geometric mean. Now, if we were to take the geometric mean then we'd replace the six-eighty-four (684) with a thousand five (1,005).

Now, does that seem high? Well, you know, go back to Alaska. And I -- you'll see in the slide before, while although in different format, Alaska basically says slides 35, the TDS can't exceed a thousand, although there have been cases where they've given higher numbers and so on. So it's not out of scale if you put it -- this is slide 36. If I repeat this table that shows test species endpoint TDS, put a thousand five (1,005) here. It kind of fits a little more with all of these numbers than it did before.

Now, I'm not saying at this point that we should drop the six-eighty-four (684) and go to a thousand five (1,005). What I'm saying, and De Beers has agreed with this, that I think we need to look at this a little further. I think we need to follow-up on this and not just one (1) test. We need to do at least one (1) more daphnia test. Okay. To really figure out, because that's the lynchpin what the reproducibility is and what the geometric mean reasonably could be to protect that population.

And I think we need to go back to testing with copepods. We do have one (1) study in the literature that suggests copepods are relatively insensitive. But we'd really like to test with copepods. It's not going to be easy because we have to develop a test for that. But copepods to determine if that is correct.

And then, you know, if once we've done that provide a final recommended TDS site-specific water quality objective. And, you know, this isn't science. This is something that, you know, we talked about, you know, in terms of process. Maybe a phased review of, you know, starting out with six-eighty-four (684) and then seeing what we get from this.

If nothing else, this additional testing with daphnia certainly indicates very strongly that the six-eighty-four (684) is protective. It indicates it may be over protective, but it certainly does suggest it's very protective. And that's the end of my presentation. Thank you.

(BRIEF PAUSE)

DR. KATHY RACHER: Kathy Racher for the Board. What time have we got here? I think we should just start with some questions now and we'll take a break later. Sean's always ready for a question. Go for it.

QUESTION PERIOD:

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. Dr. Chapman, thank you for that presentation. As always, it's a pleasure.

I'm actually going to go into a few of the references that you had suggested, specifically the other jurisdictions and their applic -- applicable TDS standards, specifically the Alaska one (1) I'm going to start with.

You pointed out to the tech Red Dog Mine which is a coastal mine. It's only about four (4) or 500 kilometres off of the ocean. So they provided a thousand milligrams per litre as their TDS number. However, Alaska is also under that same guideline, been restrictive to another mine called Gold Creek Mine which is 300 parts per million in that same document. And they've always restricted chlorides to 200 parts per million in several of the mines in Alaska.

And I'm just wondering, did you account for that and why Alaska chooses to use those numbers?

DR. PETER CHAPMAN: Peter Chapman here. Basically we didn't go into every permit that was allowed in Alaska. My understanding of the permits, and it's a generic understanding not a specific because as I said I haven't got into it in detail, is that they look at the specific circumstances.

In some cases they did testing. For instance, the Kenston (phonetic) Gold Mine, we actually did the testing and that was probably in the literature. In other cases they simply look at what can be achieved by the mine and what may be coming out. Very similar to what happened with Snap Lake with the three-fifty (350). So it varies. But I can't speak about every last one (1) of them.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources.

I think I know where they got the two hundred (200) number for chloride. It's actually in, as of December 1st, 1999, in the USEPA's chronic toxicity value. They have a maximum acute criteria of

230 parts per million is where that number probably comes from.

DR. PETER CHAPMAN: Yeah. Peter Chapman. I'd agree with you. I was talking about TDS and it certainly likely comes from there. But then again, look at the work on chloride that's being done and published by Elphick et al with hardness. Science does advance, and we are moving forward.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources.

I'll actually refer you -- they actually used your numbers, the Alaska -- University of Alaska. They quoted Dr. Chapman, and they found that changes in the ionic composition will increase the toxicity, which is probably why we saw that original change after the original ionic composition change. We got more chlorides because you're having more -- 48 percent of your effluent is chloride; that's why we probably saw that initial change in 2005/2006.

However, in this report they then go to say that the LC 50, the lethal concentration 50 for ceriodaphnia dubia, daphnia magna, and fathead minnows is less than 1,000 parts per million. And I -- I'm going to provide all of this to the Board, all the primary references that I'm quoting today. But did you

-- it wasn't on your list of chosen numbers, and they did use your study when they compared it to theirs.

And I'm just wondering why did you exclude some, especially if they did quote you in your -- in their studies?

DR. PETER CHAPMAN: Yeah. Peter Chapman here. Just so to -- we're sure we're talking about the same thing, can I take a look at that and answer you after the break after I've made sure what you're looking at? Because I have been cited a couple of times. I just want to make sure it's the right study.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. I can -- I'm going to -- I'm going to provide it to the Board, even if it's -- we can take it as an Information Request and you can provide a written response after.

DR. PETER CHAPMAN: And, you know, yeah. No. Peter Chapman here. And, you know, again just to emphasize without seeing it. You know, what we're doing here is site specific, so I'll -- I'll take a look at that. But we are talking site specific based on an awful lot of testing here.

DR. KATHY RACHER: Kathy Racher for the Board. I think it would be good if -- if you could provide those references to -- to the Board and to Peter. I'm going to write that down as an Information Request for you to respond to his question because obviously you can't respond until you've seen it.

The data, if you can do that by tomorrow then -- then you can talk about it tomorrow. Other -- otherwise -- otherwise by April 30th in writing would be fine. But I'll -- I'll write it down as an Information Request so we don't forget, if that's all right.

DR. PETER CHAPMAN: Peter Chapman. That's -- that's good. Just can you give us the wording? And I believe that's IR-6, correct?

(BRIEF PAUSE)

DR. PETER CHAPMAN: I apologize. Peter Chapman. IR-7. You're right. We're all getting confused.

--- INFORMATION REQUEST NO. 7: Why did Dr. Chapman exclude some jurisdictions

MR. SEAN WHITAKER: Sean Whitaker,

Environment and Natural Resources. I'm going to go to some other jurisdictions in the United States that do have TDS limits for brine connate water.

Pennsylvania has a TDS number of five hundred (500), and it's actually based on Dunkirk Creek (phonetic). Well, it's a different operation. It was from hydraulic fracturing. It was brine water that was shown to be causing the impacts. And Pennsylvania now has a 500 parts per million limit for TDS for all discharges in the state.

Oh, US Ohio (phonetic). EPA is also inclu -- considering that. Just because we're using outside jurisdictions I just wanted to bring up that there are other jurisdictions in the United States that do have TDS numbers, and then also put a very explicit chloride number that isn't three-eighty-eight (388) in that licence -- in the licences.

DR. KATHY RACHER: Kathy Racher for the Board. I'm just going to step in here. Sorry, Peter. I guess -- I mean, it's kind of hard for -- for the Company to respond to those without having reviewed that.

So it would be helpful in your technical report to include those references and discuss how they're relevant versus the information that was provided by the Company. And then the Company can respond after that.

I took that first IR just because you -- you know, it was just a specific quote of Peter. And I thought he -- he should be able to -- to talk about that one (1) in particular. But, in general, that should be part of your technical report to the Board.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. It will be in the technical report. I just wanted to highlight that there are other jurisdictions that weren't included in the analysis.

DR. PETER CHAPMAN: Yeah. Peter Chapman. There's certainly range out there. And the issue, of course, often is that, you know, people just don't do the level of testing that's being done here. And TDS concentrations, you can't set a universal TDS concentration because it depends on the composition. So we're talking different compositions. We're talking apples and oranges.

(BRIEF PAUSE)

DR. KATHY RACHER: Kathy Racher for the Board. Do we have some more questions in the room?

Sean, you want to continue?

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. I'll let other people just ask some questions if they're on the line. I just want to confer with my colleagues.

DR. KATHY RACHER: Kathy Racher. Todd, go ahead.

MR. TODD SLACK: Yeah, just a point of clarification. On the bottom of slide 3, De Beers asked for the opportunity to present additional evidence specific to TDS as part of the Land and Water Board review process.

Can we get some more information, particularly as to when you could see this being submitted in terms of what -- to ensure that there's appropriate time for review? For instance, we just got the supplemental submission on Friday after 5:00. So I'm just looking for some clarity.

(BRIEF PAUSE)

MS. ERICA BONHOMME: Erica Bonhomme. So we -- we think we need about a couple of months to provide good substantial additional information that may support a higher site-specific water quality objective. We not -- we're not saying that it will necessarily. Because this is part of the TDS Response Plan we would expect that it -- to be included as part of the Land and Water Board's review process of the TDS Response Plan, and the associated parameters. I can't speak for the Board on that.

But we would ha -- we would -- we would need a couple of months to -- two (2) months from now to -- to have the opportunity to evaluate whether additional information supports a different site-specific water qu -- water quality objective, including potentially a different EQC.

MR. TODD SLACK: Todd Slack with the Yellowknives. Forgive me for being slow. Sorry. Come again?

We're going to look at six-eighty-four (684) in this EA process, but then you're suggesting that we aren't actually considering the six-eighty-four (684) and we might be considering something -- something entirely different that would be done through the Land and Water Board process.

Do I get that?

MS. ERICA BONHOMME: Erica Bonhomme. I -- I cannot -- absolutely not speak for the Board in terms of how our information's reviewed. I -- I'm just saying we do have additional information now. It's been provided on Friday. We may have additional information that will, you know, support a higher site-specific water quality objective. We would like it considered. How that is considered in this process I -- I don't know.

(BRIEF PAUSE)

MR. TODD SLACK: Todd Slack with the Yellowknives.

The bottom on page 5 you suggest that not -- that meeting the 350 milligram per litre limit is not economically feasible. During environmental assessments generally there's an alternatives assessment in terms of what can be done and why.

I'm wondering if De Beers is able to present evidence that suggests as to why they've considered to not be economically feasible?

(BRIEF PAUSE)

MS. ERICA BONHOMME: Erica Bonhomme. So in our TDS Response Plan we did give information about the pre -- the pre-feasibility evaluation of various options for treating effluent. One (1) of them included an evaluation of treating full mine effluent. The cost that was provided was a 188 million. We think that's an unfeasible alternative for treating effluent down to our -- our current value which would maint -- a value which would maintain a water quality within Snap Lake of 350 milligrams per litre TDS.

More recently the Mining Association of Canada has done an evaluation of treatment technologies. And that -- that is a -- a -- the pre -- preliminary report has just been released on that. And their conclusion is also that full effluent treatment is -- is unfeasible. And I'm -- I'm -- I apologize. Mining Association Canada participated in that so it was actually in an Environment Canada report that -- that was commissioned by Environment Canada.

(BRIEF PAUSE)

MR. TODD SLACK: Todd Slack with the Yellowknives. If, at the break, can -- I could ask you to provide the -- the pointer as to where that's found in the submission? I don't happen to see it, or recall seeing it. And then one (1) other question wi -- regarding that.

Is this the 2008 Snap Lake Water Management Alternatives Report that Golder did? Is that the one that you're referencing?

MS. ERICA BONHOMME: No, the -- the informa -- the information we've presented is summarized in the TDS Response Plan. I think we'd have to ask Environment Canada whether they're -- they are willing to release that report publicly. Certainly, the people are -- are -- who have been involved in the study have made it -- have -- it's been available to them. So if -- if you wouldn't mind, I'd have to ask them.

MR. TODD SLACK: Todd Slack with the Yellowknives. Yeah, sure. More information is always great, but what -- the one (1) I was referring to was the alternatives assessment where you came up with the $180 million per year. That, as a starting point, to establish the rationale as to why De Beers thinks that they can't go that way. I -- that would be interesting to see.

(BRIEF PAUSE)

MS. ERICA BONHOMME: Erica Bonhomme. Sorry for -- we -- I think we -- we'd be prepared to provide it if you give us an opportunity to go through it, make sure there's no proprietary information in that report. Or we can -- we can black line some of those pieces as required.

MR. TODD SLACK: Todd Slack with the Yellowknives. That'd be terrific.

Now, just to be clear, that is not the -- the Golder report, the Snap Lake Water Management Alternatives Report, correct?

MS. ERICA BONHOMME: That report is -- has previously been provided. It's a bit outdated. This is a report done for us by CMH2 (sic) Hill.

MR. TODD SLACK: I guess the question that I have then is, if Golder was doing this back in 2008, which is six (6) years ago, and we knew the TDS issue was coming down the road, why are we only now just getting to this -- this consideration? I know that the work from Golder has been underway, but even that seems like a relatively recent initiative.

Why so late in the day, I guess is the question?

MS. ERICA BONHOMME: The -- the first time we've really looked -- Eri -- Erica Bonhomme. The first time we -- we really started looking at some of these long-term predictions is after, you know, 2011 when we started getting more detailed information about our structures, as we've looked at in the under -- underground model. So, really, some of this pre-feasibility work wasn't initiated in earnest based on current and accurate information until 2012.

So I would say we haven't been waiting on anything. We've -- we've simply been, you know, looking at improving our understanding of the mine geological conditions of our mine plan and the long-term implications of -- of what that will do and where -- where we need to pay attention.

MR. TODD SLACK: And my -- my last question here, if the -- if that 2008 Golder report, the Water Management Alternatives, if that's already on the registry, would you guys be able to provide a link to it, or a registry? Pardon me.

(BRIEF PAUSE)

MS. ERICA BONHOMME: Yeah. Erica Bonhomme. I -- I believe that was submitted as a previous -- in the -- under the previous water licence amendment. So, yeah, we can certainly do that.

MR. TODD SLACK: Thanks very much. That's it for me on this one.

(BRIEF PAUSE)

MR. MARC CASAS: Marc Casas here. I'm just trying to get down what I have here is IR Number 8.

Is that -- is that correct. And if -- or is there...

MS. ERICA BONHOMME: I think -- I think we have IR-8 is to provide a -- a reviewed version of the CMH2 Hill report if it's appropriate. And the -- the IR-9 is to provide a link to the Golder report -- alternatives report.

--- INFORMATION REQUEST NO. 8: Provide a reviewed version of the CMH2 Hill report if appropriate

--- INFORMATION REQUEST NO. 9: Provide a link to the Golder Associates Water Management Alternatives Report

MS. ERICA BONHOMME: And -- Erica Bonhomme. I should just summarize that for -- for those that are not as well versed on -- on the history and what -- what's -- what all the information the current TDS Response Plan is based on, it is in Section 4. Some of the key findings of our studies is provided in Section 4 of the TDS Response Plan that has been filed as part of this application.

DR. KATHY RACHER: Kathy Racher for the Board. I'm just wondering if we should hit the phones briefly.

Is there anyone from EcoMetrix that has questions at this stage?

MR. DON HART: This is Don Hart for EcoMetrix. I have a -- a few questions.

DR. KATHY RACHER: Okay. Kathy Racher here. Go ahead, Don.

MR. DON HART: My first question would be for Dr. Chapman. I think you mentioned that it would be nice to have some toxicity test -- or sensitivity information for copepods given that they're a dominant zooplankton species in the lake. You also mentioned, I believe, that you had some indications that they were less sensitive.

Could you elaborate on that and -- and perhaps provide a reference?

DR. PETER CHAPMAN: Peter Chapman. The

reference and the details were provided in the submission when we went through the TDS Response Plan and looked at the literature. It's in there and if you have trouble finding it I can look through and find the right page for you.

MR. DON HART: Listed in there, but if you could provide the page that'll help me out.

DR. PETER CHAPMAN: Peter Chapman. We don't need to take it as an IR. I'll look at it at the break and find it.

MR. DON HART: Thank you. It's Don Hart for EcoMetrix. I guess this might be a question for De Beers, but:

How confident at -- at this stage is De Beers that the proposed EQC and -- and the currently proposed surface SSWQO can be -- can be met? How certain are we of this?

MS. ERICA BONHOMME: Erica Bonhomme. We have evaluated a lot of different information. We know that TDS treatment is not difficult. It's -- it's very successful. It's very common. What we need to evaluate is its practicability and cost effectiveness against those things I mentioned on -- I'm just going to find it here -- on slide -- slide 6.

So we know it's effective. We don't

know how much it's going to cost us and what it's going to mean in terms of our infrastructure requirements. Obviously, every time we want to add a -- a piece of something to our site we have to go through a permitting process. So, you know, those are all things we have to evaluate. Is TDS treatment effective? Absolutely.

MR. DON HART: Okay. It's Don Hart, EcoMetrix. So it sounds like technically it's feasible. It may be a question of cost benefit.

MS. ERICA BONHOMME: Yeah. Slide 6 summarizes all the things we need to take into consideration. The generation of waste is one (1) of the biggest ones. Obviously, all of the treatment technologies or all of the possible ways of achieving TDS treatment generate waste of some sort.

And we will -- you know, Snap Lake mine being a remote site, we need to manage that waste and be able to dispose of it effectively; that's our biggest consideration. We need to take into a cost -- in -- into account energy consumption; that means fuel demands for us, greenhouse gas emissions. We want to evaluate what that adds, what -- what the offset then becomes. Whether we can recycle any of the energy that's used for this treatment.

We want to look at the overall capital expenditure to add infrastructure both for, you know, taking the amount of water that we need off the main flow as well as the infrastructure requirements for treatment.

And we need to look at all the things in the right -- in the green box there as well which is, is it reliable? Is it scalable? Is it effective? We -- we believe it's effective. Is it effective for TDS? Is it effective for -- do we need to look at its effectiveness for other parameters? Is it -- and -- and do we have -- does it work with the seasonality of our road?

MR. DON HART: Okay. Don Hart, EcoMetrix. Thank you for that. Just one (1) further question.

So if we don't end up meeting the proposed EQC, I see that predicted peak concentrations may be as high as 1,700 milligrams per litre for the up -- upper bound scenario, I believe.

It seems pretty clear that that would be sufficient to have appreciable effects on reproduction of the most sensitive species that we're aware of that seem to be the daphnids. The EAR, I believe, predicted that there could be minor changes in the zooplankton community, but no loss of species.

If we were to achieve those peak concentrations of 1,700 milligrams per litre, might this -- the threshold of significance, no loss of species, be crossed?

MS. ERICA BONHOMME: Erica Bonhomme. Yeah, we believe that. We've -- we've alway -- De Beers is committed to protecting the aquatic life within Snap Lake. We -- we believe strongly that the site-specific water quality objectives we proposed will protect the aquatic life within Snap Lake. We wouldn't intend to exceed any EQCs that are issued as a result of -- of accepting or modifying the proposal we've put forward.

I -- I don't expect we would ever achieve that -- the -- the modelling. The reason we -- the model predictions without mitigation -- the reason we've done the modelling without mitigation is to show how -- how the levels increase over the short to medium term so that we can look at, for example, by when do we need to have mitigation in place. So that -- that's why we've -- we've shown you both of those. It's not with the intent that we would ever leave everything unchecked to attain those levels.

MR. DON HART: Okay. Thank you.

MS. ERICA BONHOMME: I just want to -- Dr. Chapman has a response to the earlier question.

DR. PETER CHAPMAN: Yeah. Peter Chapman here. You wanted to know where that reference was to testing copepods.

MR. DON HART: Yeah.

DR. PETER CHAPMAN: If you go to the development of to -- total dissolved solids chronic effects benchmark for aquatic life in Snap Lake document dated December 2013. Go to page 7-4 and the reference there is Gallant and Robinson (phonetic) 1983. Predicted effects of increasing salinity on the crustacean zooplankton community in Permit Lake, Nevada (phonetic). This is in the journal Hydrobiologica (phonetic). And interesting enough, there -- they tested the dominant calanoid copepod species in Snap Lake. So it was very relevant.

MR. DON HART: Okay. Thank you.

DR. KATHY RACHER: Kathy Racher for the Board. Don, do you have additional questions?

MR. DON HART: No, that's it for me.

DR. KATHY RACHER: Kathy Racher for the Board. I think -- well, I have a few more questions and maybe others do as well. But I'd like to take a -- a short break till 3:30 please. Thanks.

--- Upon recessing
--- Upon resuming

DR. KATHY RACHER: Okay. Kathy Racher, for the Board. I'm just going to ask if Anita Li is on the phone and if she has any questions at this stage.

MS. ANITA LI: I -- I'm still on the phone, and I have a couple of questions. In slide 6, the -- De Beers have indicated that it's not practical to target footwall treatment.

And I was wondering, why is that?

MS. JULIE L'HEUREUX: Julie L'Heureux. So since the -- the headings in the footwall is so big, we can't segregate it properly. And I have a -- a reticulation system that could pump this water directly to surface. We would need a crew that would just install pipe on daily basis, and then we can't do this. We can't segregate this water in an operational side of -- of things.

MS. ANITA LI: Anita Li, from Environment Canada. Thank you. My second question is: In the presentations, I don't any -- I don't see any mention of the maximum daily limit of 1,003 milligrams per litre that De Beers is asking for.

Are you asking for this maximum daily

limit for TDS?

MS. ERICA BONHOMME: Erica Bonhomme. We will cover that in the EQC presentation. Yes, we are asking for a maximum daily limit.

MS. ANITA LI: Anita Li, from Environment Canada. That's all. Thank you.

DR. KATHY RACHER: Kathy Racher, for the Board. Go ahead, Matt.

MR. MATT HOOVER: Matt Hoover, North Slave Metis Alliance. So I just wanted to remind the Proponent that at the March 20th meeting at the Explorer Hotel, that we had requested a plain-language version of these studies and this report. And at the time, they told us it would be available prior to these meetings.

We haven't received one yet, so we would still appreciate receiving that, and ideally as soon as possible and with as much up-to-date information as is available. Thank you.

MS. ERICA BONHOMME: Erica Bonhomme. We did provide a plain-language summary as part of the supplemental filing on Friday. It's a plain-language summary of the application, including all of the models -- the models and all of the studies that went into developing the EQCs and the site-specific water quality objectives. It's the -- it's first attachment of the Friday submission.

MR. MATT HOOVER: Matt Hoover, North Slave Metis Alliance. Okay. Thank you very much. At the time, it was said that it would be two (2) weeks prior to this, but I didn't see that in that Friday submission. So thanks a lot, and we will proceed to review that.

DR. KATHY RACHER: Kathy Racher. Do we have some more questions in the room? Zhong?

MR. ZHONG LIU: Zhong Liu, from SLEMA. How about go -- go to slide number 10. Yeah. So -- so because here's it's the mine water directly to puddle the mine water. That's mine water effluent from the current water treatment plant to -- to be treated in that MF, RO, and evaporation process, the low water or low main water or after current treatment?

MS. JULIE L'HEUREUX: Julie L'Heureux. So mine water, we assume that that would be after our water treatment plant. So the same -- just before it would go, let's say, to the diffuser, SNB17-2b, then we would have a T-junction that would feed the -- whatever option we would have to -- to choose to -- to treat our water.

And then we would bleed the line. But

we don't know yet the percentage of this feed bef -- since the pilot tests are not done yet and the assimilation.

MR. ZHONG LIU: Thank you. My second -- my second ques -- Zhong Liu, from SLEMA again. My second question is slide 32.

So who did the first testing for daphnia, toxicity testing?

DR. PETER CHAPMAN: Peter Chapman here. You're asking who did the first test? It was done by Nautilus Environmental, who also did the second test.

MR. ZHONG LIU: Oh, okay. So who will be -- do the third testing?

DR. PETER CHAPMAN: Peter Chapman here. We'd like to have at least one (1) other -- have another lab do it, but we'd also like Nautilus to try and do it again. Ideally, we'd like to do more than one (1) test, so we'd like to have more than one (1) lab do the testing.

MR. ZHONG LIU: Thank you, because if the same lab did the same two (2) testing, so that meant -- also involves some kind of -- what kind of issue is that? So that's not a real repeatedly. I prefer see a third party from -- from the current.

DR. PETER CHAPMAN: Peter Chapman.

Noted.

DR. KATHY RACHER: Kathy Racher. We'll take a question from Rick first.

MR. RICK WALBOURNE: Rick Walbourne, GNWT. You mentioned, regarding the benchmark studies, that -- that data hasn't been published yet.

Can I conclude then that that has not been peer reviewed?

DR. PETER CHAPMAN: Peter Chapman. You're -- just so I understand the question, you're saying:

Have we sent things out for peer review and published from the site-specific water quality objective work?

Is that what you're asking?

MR. RICK WALBOURNE: Rick Walbourne, GNWT. Yeah. You mentioned that you were going to try to publish the site-specific water quality objective work, the benchmark studies. As it hasn't been published, that's my question.

Has it then been -- not been peer reviewed yet?

DR. PETER CHAPMAN: Peter Chapman. No, it hasn't. We recently, in fact on Thursday and yesterday, submitted two (2) papers to the journal

Environmental Toxicology and Chemistry to do with the strontium work.

One was submitted by Nautilus, which was relating to the testing they did, and the other was submitted by myself, related to developing a site -- a chronic benchmark for strontium for fresh waters globally based on the work we've done.

So that's in peer review, and it'll probably be a month and a half before we find out.

MR. RICK WALBOURNE: Rick Walbourne, GNWT. Okay. Thanks for that. Another question: Regarding the ceriodaphnia, can you clarify that data was disregarded because it was -- the species was not found in Snap Lake, or there was less weight applied to it?

Could you just run through that again briefly?

DR. PETER CHAPMAN: Yeah. Peter Chapman. The history of daphnia, ceriodaphnia, is this: Daphnia is a twenty-one (21) day test, and it was a standard test for a lot of years. And then EPA, US EPA was concerned that, gosh, it was too expensive, it was too hard to do, and cost too much.

So they thought they'd develop a test with ceriodaphnia dubia, which was developed by a fellow called Don Mount, as a seven (7) day test. And that's considered a more sensitive test than the daphnia. It's quite sensitive.

It's actually run in Perier water usually. And the reason it's run in Perier water, interestingly enough, is because US EPA wanted to find a water for the controls that could be run universally. And that's also, just by the by, as a little trivia, how they discovered benzine was a problem in Perier water on the control side. But anyway, that's how I get into trivia.

Todd, you like that, don't you? He likes trivia.

But anyway, you know, the bottom line is we just -- we -- we gave it less weight because the daphnia are found there. Is the twenty-one (21) day test. Daphnia found there, ceriodaphnia aren't.

MR. RICK WALBOURNE: Rick Walbourne, GNWT. Okay. That's -- that's fine.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. Just following up on Rick's question about the ceriodaphnia, I know you quoted that the CCME protocols were used as part to develop the SSWQOs.

Do either the 2003 or 2007 CCME

documents describe procedures for deriving the SSWQOs that permit the exclusion of toxicity data for taxonomic groups that are present in low abundance in a receiving water body?

DR. PETER CHAPMAN: Peter Chapman. They -- basically, when you're developing the -- the 2007 -- I haven't look at the 2003 for a while. But the 2007 certainly does clearly say that when you're developing regional and so on, you want to focus on the ones that are present that are most likely to be affected. You exclude the ones that are going -- not going to be present or not relevant.

So that's certainly something that can be done. It's something that's done universally in the literature when looking site specifically.

MR. SEAN WHITAKER: Sean Whitaker, Environment and Natural Resources. Thank you for that. I'm just -- I'm trying to read and digest it all at the same time, so I'm sorry.

I did have one (1) other question about chloride. And I -- forgive me, I've been back and forth between the presentation and my documents and trying to compile everything, because there's a large stack of paper that you guys submitted with this application, which is appreciative, but it's a lot to digest all at the same time while we're going.

But the CCME water quality guideline for chloride is not hardness dependent. What evidence has been provided to demonstrate that the toxicity of chloride is hardness dependent at Snap Lake?

DR. PETER CHAPMAN: Peter Chapman. If you go back to the CCME chloride document, what they say in there -- and I'm paraphrasing; I don't have it in front of me. But basically, what they say is that there is a relationship with hardness. But there wasn't a sufficient relationship that they could develop hardness as an exposure toxicity modifying factor for all of Canada.

But in that document, it does say that, you know, regions, et cetera, are free to try to develop it and if they can show it works. And, basically, you know, in terms of the work that Elphick et al did in 2011, that's pretty conclusive. And certainly, that went through a fair bit of review during the Ekati water licence technical sessions and hearings and was accepted.

(BRIEF PAUSE)

MR. SEAN WHITAKER: Sean Whitaker,

Environment and Natural Resources. I'm going to see if anyone else has any questions for now. I just have to keep synthesizing the information as we go, but thanks.

MR. TODD SLACK: Todd Slack, for the Yellowknives. So many questions from the other questions have spurred two (2) new thoughts for me.

And the discussion around slide 6 -- this is the -- the feasibility testing -- I'm just wondering if the project can explain -- I -- I note -- note that greenhouse gas emissions are one (1) up there. And I don't understand, 1) how they're going to be valued, or 2) how they trade off against TDS, even in a -- a short, conceptual phase.

I'm wondering if you can talk about that for one (1) sec.

MS. ERICA BONHOMME: Erica Bonhomme. It's a good question. Whether or not we would base a decision on -- or whether we would base a decision solely on increased greenhouse gas emissions due to a treatment, it -- it's unlikely. It would be part of a package of things.

But given -- taking into consideration that we have to transport fuel to site, we have to transport all the infrastructure needed to implement a facility on site; to run the facility, which we would expect -- we have no numbers at all, but -- but to run the facility itself in terms of fuel consumption; as well as to potentially reduce the waste stream to a manageable level through the generation of a -- a crystal product; as well as then to take that off site for disposal; I think that we -- we know that, particularly the -- the piece of the project that would be on site would have a contribution to greenhouse gases.

We would -- that is part of what we would ask the -- to be evaluated in the concept study, so we will have a number for that. Like I said, it's -- it's unlikely to be a sole consideration in a decision on what technology to implement.

MR. TODD SLACK: Thanks. Todd Slack for the Yellowknives. And hearing what you've said, it sounds like this isn't actually an issue about greenhouse gas emissions. This is an issue about dollars: cost to get fuel there, cost of construction.

So would it be fair to -- to condense this list down to operating costs and like costs of purchasing, costs of transport? Because the -- the question that is really of interest to me is: What value does water quality have then as -- as part of this? Why would you go 1 -- 1 microgram/litre of TDS removal more if the benefits are only being assessed in costs? And that's what I want to try and understand.

How do environmental factors fit into this cost-benefit analysis?

MS. ERICA BONHOMME: Erica Bonhomme. So again, the site-specific water quality objectives that we've proposed are protective of the aquatic environment. So that's bottom line. We -- so that takes care of the benefit side of the equation. We're not proposing to, you know, monkey with -- with those numbers in any way.

A hundred and eight (108) -- 188 million, which is our -- our previous estimate for the capital and operating cost of a -- of a -- a full treatment solution, is uneconomical. That's -- that's, you know, bottom line.

However, we would -- cost is always a consideration for us. These are all the things that are going to have to be considered. We -- given the -- given that we know we -- if the Board accepts our proposal, that we will have a level to treat to, we will look for the most cost-effective solution to get there.

(BRIEF PAUSE)

MS. ERICA BONHOMME: Erica Bonhomme. And -- and just a clarification, that 188 million was not an operating cost estimate. It was only a capital cost estimate.

MR. TODD SLACK: Thanks for the clarity on that. That's pretty direct, and that's well appreciated. My -- my last thought here is, so the Health Canada guideline is an aesthetic guideline: 500 millilitres -- no, not millilitres -- milligrams per litre.

The closure objectives for this site also includes an aesthetic issue -- or an aesthetic objective: that the -- the landscape will match the aesthetics of the surrounding natural area.

So two (2) questions then: 1) How long after the -- the cessation of operations will Snap Lake exceed this aesthetic guideline; and then 2) Does the project view this exceedance of the aesthetic guideline as acceptable within that closure objective?

MS. ERICA BONHOMME: Erica Bonhomme. Just maybe, Todd, provide some clarification. Do you mean the aesthetic objective for the water quality that we're talking about?

MR. TODD SLACK: There are two (2) aesthetic issues here: the Health Canada 500 mil --

milligrams per litre; and then, within your closure objectives set forth by the Land and Water Board, there's a landscape aesthetic objective attached to that.

So if you're exceeding the Health Canada guideline, does the project believe that they are meeting the closure objective that is set out by the Board? That's question number 2.

MS. ERICA BONHOMME: Erica Bonhomme. The -- the closure plan does not address water quality from an aesthetic objective. I'm -- I -- I think you're -- you're mixing things up. The -- the -- and I apologize. I may just be misinterpreting what you're -- you're getting at, but the -- the closure plan refers to an on-site visual aesthetic objective.

The aesthetic objective from a Health Canada perspective and water quality deals with water. Our closure plan does not address water quality, in terms of an aesthetic objective.

MR. TODD SLACK: Todd Slack, with the Yellowknives. Okay. Just to be clear, the project doesn't view Snap Lake as part of the landscape?

MS. ERICA BONHOMME: Erica Bonhomme. I -- it is. I would argue that it would be difficult to establish that Snap Lake would exceed an aesthetic objective based on a visual observation.

DR. KATHY RACHER: Kathy Racher, for the Board. I'm just going to intervene because I -- I think this is a little off topic. If -- if you think that the objective should be the aesthetic objective, then you should present that case to the Board.

Do you have further questions, Todd? Okay Then -- then it's my turn.

(BRIEF PAUSE)

DR. KATHY RACHER: Kathy Racher, for the Board. Okay. On the -- the slide number 6, where it says the initial findings targeted footwall treatment is not practicable under current mine operating conditions, I just want to confirm for the record that in -- in your TDS response plan in Section 2.4(2), it -- it did make it sound like that was the preferred option, was source -- treatment at the source of the footwall water.

And so -- but you've done work subsequent to this submission to determine that. So that's new evidence, but that's -- that's your current understanding?

MS. JULIE L'HEUREUX: Julie L'Heureux.

That's correct. We were still investigating at the time, and then we have confirmation that operational is not -- we -- we couldn't do it under the operational mining sequence at the moment.

We can't close the ramp every day to install pipes, so, yeah. It's more like an operational than a cost for that purposes, actually.

DR. KATHY RACHER: Kathy Racher, for the Board. Okay. Thank you. One (1) of my -- if we go to slide 14 on this presentation, it's about the timeline of, really, the analysis for the mitigation options for TDS.

And -- so I'm looking at the time lines, and I'm a little concerned. Going in -- I mean, one (1) of the -- one (1) of the basic principles of the Mackenzie Valley Board's water and effluent quality management policy is that -- that we set effluent quality criteria that are reasonably and consistently achievable. And I think what I'm seeing here is we're not going to know what's reasonably and consistently achievable by the end of this year.

So, I -- I mean, you've asked for an EQC and -- and you've said that that's -- that's the one you're going to meet. But in the absence of information that you can actually achieve that --

because currently I'm not seeing any information. You haven't done predictions on what the treatment -- if you did treat a fraction of -- of your water for TDS, if it would work.

I -- I know you say -- I'm -- I'm well aware of treatment technologies TDS, so I understand they are effective. But because of the practical considerations, it sounds like you -- you haven't committed to doing anything in particular. You're still -- you know, you're still evaluating, which is fair enough.

But I'm just wondering how we're going to set an EQC for you when we really have no evidence that you can meet it?

MS. JULIE L'HEUREUX: Julie L'Heureux. So, yeah, we actually undergoing the pilot tests as we speak, but it's still a long process. So to determine what's the volume that we will need to treat, we need to do those pilot tests first because we -- we brought some mine water off site. So we, you know, filled some totes of actual mine water, and then they're doing the test with -- really with our water.

So in -- in order to understand the parameters, and -- and then after they -- let's say we -- we do a first pass, and then the RO can reach a recovery of 95 percent. Then the result will then apply to the simulation. And then we'll be able to say, Okay, by Q4, we know that we need to -- to treat, let's say, 15 percent of our total outflow of our discharge. And then for -- we need this kind of unit to treat this water.

So we are doing the -- the tests, but in order to have the real numbers -- we will achieve the -- the EQC -- EQC, but we just need to know the percentage of it by doing the pilot tests. Is it going to 10 percent, 12 percent, 15 percent?

But RO's been on the market for the thirty (30) last year, and we know it's effective for TDS. So for the -- for us, it's not a problem. It's just to understand with our water how it's going to -- how it's going to actually be achievable and in which sense.

So the work is undergoing, and we will be -- it's just a matter of the percentage of the -- the bleeding after the test is completed.

MS. ERICA BONHOMME: Erica Bonhomme. So -- but one (1) of the things -- chicken and egg perhaps. But, you know, we're assuming -- we're doing this work with the assumption that we have a site-specific water quality objective of six eighty-four

(684).

If you say -- if you tell us -- in the end, the Board says, No, six eighty-four (684) isn't going to work, then we're back to square 1.

So we have to take some steps to move that process forward with some assumptions. One (1) of our key assumptions is that the site-specific water quality objectives we proposed will be implemented. That helps us with that cost-benefit analysis that we have to undertake.

So it's not -- but it's not the overall -- we -- we believe, as Julie as has said, the treatment will be effective. It's all the different combinations of processes that get us to that final treatment that we have to sort out.

The site-specific water quality objective, as Alison has pointed out, will be exceeded sometime after 2016. So this timeline shows that by -- we will -- we will be ready with implementation in 2015 if we take through these steps.

So we know that we can have something in place prior to the point when we would exceed that site-specific water quality objective. We just can't tell you exactly what that is right now.

DR. KATHY RACHER: Kathy Racher, for

the Board. With -- with reference to the time of when the water quality objective is expected to be exceeded, is that -- that's the time when it's exceeded in Snap Lake. What about the time that it's exceeded at the -- the EQC that you've proposed is -- is going to be exceeded?

Because some of the graphs I've seen of mine water in the predictions show it could be like any moment. So can you -- I haven't been able to find a really specific graph that showed me exactly when the effluent, which is what you're proposing, as -- as an eff -- as an EQC, is going to exceed the water quality objective because that -- that times into the -- the timing as well.

MR. ZHONG LIU: Zhong Liu, from SLEMA. In January, SLEMA issue a letter about this issue, EQC achievability. We identified at least two (2) instance in 2013 that -- that were above De Beers's proposed EQC.

That's why we recommend it's just -- the -- met your timeline for the EQC, not the -- because if -- what the Board approve, if that six eighty-four (684) milligram per litre is the EQC, still, in 2015, before De Beers is start any TDS removal for solidity, that -- there's a high chance of possibility De Beers will exceed that EQC.

That -- that's published in our -- in -- in the Board website, and that's dated January -- that's a letter dated January 16.

DR. KATHY RACHER: Kathy Racher, for the Board. Right. And, I mean, I -- I mean, the transient -- it's a transient one. So I guess what I'd -- exceedances. So I do take your point, and it is part of my concern, for sure.

So that's why I guess what I'd like to see is a comparison of your -- of your time line, both of -- of designing your potential options, implementing and commissioning against the predictions of the effluent water quality.

I just want to know like, going forward, especially for the Land and Water Board process, where -- you know, how we're going to make decisions and when we're going to make decisions. And, you know, should we wait on a certain piece of information? Because, you know, we don't want to get in the position where we assign an EQC, and then six (6) months later we've got to do this all over again, because I've got better things to do.

So if you could comment on that, or if -- is that something you could undertake as an IR, just to spell that out for us just very clearly?

MS. ERICA BONHOMME: Erica Bonhomme. We can do that. We can match some -- some modelled values against this stepped process. But something to keep in mind for us is that we do have some fairly restrictive limits that come into effect January 1st, 2015, in our current licence. And for us, I mean, we've presented a lot of evidence here that suggests that those are -- those are not practically achievable for us.

DR. KATHY RACHER: Kathy Racher, for the Board. Yeah, point taken. One (1) of the other things I -- I noticed in your -- in your supplemental information that you provided on April 11th, you -- in -- in sort of the accidents and malfunctions section, you accounted for the possibility that there would be sort of a malfunction for a year, say -- I think it was 2017 or something, and another year, that if -- if you discharged unmid -- untreated -- 'untreated' meaning not -- not including specific TDS mitigations, what would be the effects? And you went through the magnitude and severity and reversibility and whatnot, which was -- which was helpful.

But I guess what I'd like to see is that done for the unmitigated case going forward right now.

You -- you have predictions of what the water quality's going to be in Snap Lake. Just -- I think -- I think it would be helpful, especially for MVEIRB, frankly, to understand what the effects would be if none of those mitigations pan out.

I mean, given that we haven't -- we don't have substantial information saying, These are the mitigations specifically that we are committed to doing at this cost, and they're going to work in exactly this way. We don't have that information. What we do have is a lot of data showing us the direction of where things are going right now. And -- and it shows that they're going to exceed water quality objectives. Exceeding water quality objectives in themselves doesn't -- is not an end to the lake. We know that.

So -- so where in the spectrum of -- of effects would that lie if -- if you didn't treat at all, if you didn't do additional mitigations? I'm not suggesting that that's the right thing to do. I'm -- I'm just saying that it would helpful for the Board to know what that would look like.

And -- and I say this because I don't want to lead us all in a direction where, you know, the Review Board comes out with another number that in two

(2) years you can't meet for some reason that you don't know about yet. And then, you know, again we'll end up back here because they said a num -- say they accept six eight-four (684). Maybe they'll call that number as the number, and then we'll be back in the EA again.

Do you see what I mean?

MS. ERICA BONHOMME: Erica Bonhomme. Yeah, that -- that's helpful. And -- and certainly, you know, we'd like the opportunity to present -- you know, I think that's a good question. We can do that.

As well, though, I think we can -- we'd like to have the opportunity to present information that -- that might suggest that the aquatic life within Snap Lake can -- can tolerate a higher level of TDS and potentially other parameters that have been compared to what's been proposed here.

But I should emphasize that this work is proceeding. We are committed to developing technology that will meet the current proposed EQCs. As Julie said, you know, people can come to us and say they can grow pineapples in Yellowknife. We -- we believe that. They -- and anything's possible.

What we need to evaluate is -- is, from a -- a business perspective, what makes the most sense for us.

DR. KATHY RACHER: Kathy Racher, for the Board. Okay. So, Marc, did you capture the two (2) IRs, then? One is to compare the timeline for the development of the TDS potential mitigations to end of pipe achievability of effluent at the site.

--- INFORMATION REQUEST NO. 10: De Beers to compare timeline for the development of TDS potential mitigations to end of pipe achievability of effluent at the site

DR. KATHY RACHER: And the second was to provide evidence -- well, what do we call it -- an assessment of what the potential effects to Snap Lake and -- and relevant water bodies downstream if -- if the -- if no additional mitigations are in place at the Snap Lake Mine.

--- INFORMATION REQUEST NO. 11: De Beers to provide an assessment of potential effects to Snap Lake and

relevant water bodies
downstream if no
additional
mitigations are in
place at the Snap
Lake Mine

DR. KATHY RACHER: Peter...?

DR. PETER CHAPMAN: Yeah. Peter Chapman here. April 30th is the deadline to submit IRs. Based on the testing to date that we've shown as -- we're not looking -- we've never tested as high as seventeen hundred (1,700). We tested up to about thirteen (13), fourteen hundred (1,400).

And at that level, the main issue is really daphnids, Cladocerans. So we can reply by April 30th, absent Cladocerans, because we'd like to do some more testing to complete the answer for them. We can put it in perspective, as we did in the documentation we provided about what percentage -- which is a very small percentage of the zooplankton they comprise related to food for fish.

But, you know, we can't give a complete answer, in my opinion, by April 30th without doing some additional testing.

DR. KATHY RACHER: Kathy Racher, for the Board. Just -- you know, what you have at the moment to evaluate, I think, would be fine. Based on that point as well, though, I know that, your TDS results notwithstanding, there's a lot of evidence on the record separately for chloride.

And so that assessment should be done with respect to anything that's going to exceed a water quality objective, including chloride, which is currently pre -- predicted to exceed the water quality objec -- its water quality objective, the hardness-dependent one, which is already relatively high, the one that was developed by Elphick et al.

So I'd like to see the assessment in that -- in that frame, too. And there's a lot more data, I know, on other organisms, such as fish, et cetera, for that water quality objective.

MR. MARC CASAS: Yeah, Marc Casas here, from the Board. I just want to -- I'm just trying to get these IRs sort of worded maybe correct. And I just -- in terms of what I have down as IR 10, which is I guess the graph of the EQC timeline compared to -- to when the exceedance is going to occur, I'm wonder if that -- was that only for TDS, or did you also want that for chloride?

DR. KATHY RACHER: Kathy Racher, for the Board. I -- I think it's the same. It's the same time line because it's the same treatment, so it's fine. Just for TDS is fine.

(BRIEF PAUSE)

DR. KATHY RACHER: Okay. Any follow-up questions? Zhong...?

MR. ZHONG LIU: One (1) more question about water quality issue, because we are talking about the impacts from the mining on the quality of life and human being. Now our Elders is concerned about whether they will have some impacts on wildlife from drinking the water of Snap Lake.

So I'm wondering whether De Beers could provide some information about drinking water quality for wildlife, and also some research on impacts on caribou, bears, something like that.

DR. PETER CHAPMAN: Peter Chapman here. The main issue is really total dissolved solids -- in other words, salinity -- which wouldn't be a factor that would harm the animals directly. It's a matter of taste. The interesting thing is, I think most people are aware, that elk, caribou, and so on like salt licks. Salt licks are fairly important for them, you know, to get salt in.

So we don't have any direct research. We haven't done any research on wildlife. But certainly, given the fact that those animals seek out salt licks, seek out those, we don't think there'd be any inhibition of them drinking. And there certainly isn't an effect -- you know, a problem of them being hurt by drinking the water.

(BRIEF PAUSE)

DR. PETER CHAPMAN: Peter Chapman here. And I just got reminded that there is a guideline for cattle that's much higher, at 1,000 milligrams per litre.

(BRIEF PAUSE)

DR. PETER CHAPMAN: Peter Chapman. I'm going to be corrected.

(BRIEF PAUSE)

DR. PETER CHAPMAN: Peter Chapman.

I've got it wrong twice. I'm going to let Tasha Hall get it right.

MS. TASHA HALL: Tasha Hall, with Golder Associates. Just a correction that it's -- the CCME guideline for livestock watering is 3,000 milligrams per litre.

MR. ZHONG LIU: Zhong Liu with SLEMA. I notice that in your report, the cut -- the cut line for cattle is 1,000 milligram per litre TDS.

DR. KATHY RACHER: Is there any further questions on -- on the -- this section? It's 4:15 and we're all excited about TDS.

(BRIEF PAUSE)

DR. KATHY RACHER: I think, just to make sure that we've got enough time tomorrow, we're going to force you to go on with the -- the Nitrogen Response Plan presentation. I -- I realize that we made a mistake in the agenda, and we had -- we had two (2) -- two (2) spots where you're presenting it.

So actually, if you present it today, we'll be relatively on time. If we don't get to questions or through all the questions, that's fine. We'll take that up tomorrow, but we will end today at

4:30, or -- no. 4:30? Wait a sec. 4:45, sorry.

(BRIEF PAUSE)

PRESENTATION - NITROGEN RESPONSE PLAN:

MS. ERICA BONHOMME: Erica Bonhomme. This presentation begins on the second -- second attachment that was provided. It's dated April 16. It's the first presentation on the April 16 attachment.

So again, the Nitrogen Response Plan is a requirement that was required to be provided as part of the water licence. Again, similar to the TDS Response Plan, it required that De Beers develop and recommend appropriate water quality objectives for ammonia and nitrate in Snap Lake derived from toxicity testing, and that De Beers recommend EQCs for ammonia and nitrate to be applied end of pipe, SNP station 02-17, that would ensure the protection of aquatic life in Snap Lake.

The conclusions of these required studies has led De Beers -- no, we're not recommending higher EQCs. There's an error on that presentation. We're not recommending higher EQCs for nitrogen. My apologies. We -- we'll refer back to the table where we -- where we present the EQCs, because there's -- it varies.

The full results are provided. The full results of the site-specific water quality objectives are provided in the report called, "Development of Nitrate Chronic Effects Benchmark of Aquatic Life in Snap Lake."

So in terms of nitrogen, again, as part of the requirement of the TD -- of the Nitrogen Response Plan, we needed to talk about the sources of nitrogen and the management practices for nitrogen.

The primary source of nitrogen at Snap Lake is from blasting activities conducted underground. The predicted loading is presented in the model scenarios. It's derived from the Site Water Quality Model report and the Upper and Lower Bound Groundwater Model scenarios.

The majority of nitrate loading to Snap Lake is from underground. Oh, sorry, I haven't changed my slides. Slide 3. Seventy-two (72) -- about three (3) quart -- 72 to 77 percent, about three-quarters (3/4s) of the ammonia loading to Snap Lake is from underground. The remainder of the nitrate and ammonia loading comes from deposition of processed kimberlite to the North Pile. Nitrogen loading, along with the other parameters, is expected to increase over life of mine.

Since nitrogen loading is primarily due to the use of explosives, the primary means to manage nitrate load -- nitrogen loading is to reduce -- is to improve blasting efficiency underground. Since over the last couple of years we have reduced the number of holes per blast round, we've reduced emulsion overloading in those blast holes, and we've engaged in a practice to remove and reuse old emulsion from underground for surface blasting activities. Temporar -- we can also temporarily reduce the concentration of nitrogen in mine water through controlled dilution.

Slide 4. The studies we've done to minimize that -- that investiga -- minimizing nitrogen loadings to the environment include a pre-feasibility comparison of certain effluent treatment technologies, similar to the ones for TDS; a pre-feasibility screening which will include an expansion of the system to treat for TSS; a capital and cop -- and operating cost estimate; and evaluation of technologies similar to that required to treat for TDS.

We've also looked at implementing potentially a targeted treatment at the water management pond where most of the nitrate -- nitrates collect.

I'll pass it over to Dr. Peter Chapman.

(BRIEF PAUSE)

DR. PETER CHAPMAN: Peter Chapman here. So we're now looking at slide 6, and I'm going to be fairly brief, about six (6) slides.

Basically, what we did in terms of nitrate is the Ekati mine has developed a site-specific water quality objective for nitrate that's based on hardness. They haven't published that, and we wanted to make sure that this was applicable to Snap Lake.

So what we did is we did testing with two (2) of -- there were three (3) sensitive species. We did testing with two (2) of the sensitive species, most sensitive species that Ekati found, using Snap Lake water and adding nitrate to see whether the Ekati would apply to Snap Lake.

And basically, what we found -- I'm showing now Figure 7. And on Figure 7, you can see nitrate concentration up the left-hand side, hardness up on the right. This figure is taken right from the Ekati submission for their water licence and how they've developed their site-specific water quality objective.

The only difference is, if you look at the legend in the square box at the bottom, the red box that says, "Invertebrate Data - Snap Lake," you can see two (2) square boxes here that are above the dashed line. And then the second one, you see the diamond, the blue diamond, fish data for Snap Lake. You'll see the blue diamonds here.

So basically, what we showed was that with Snap Lake water, this also applied. And basically what this is, is as hardness increases up to a level of a hundred and sixty (160) -- and they didn't test higher than that, so we just go up to one sixty (160) -- as long as you're above this line, you're fine. You're not having an effect.

So we found that sensitive species. And basically what we've set out at 160 milligrams per litre hardness is a nitrate site-specific water quality objective of sixteen point four (16.4). To put that in perspective, the maximum nitrate concentration in May of last year was three point o (3.0), and the maximum predicted nitrate concentration is ten (10).

And I'm just going to show you a couple of graphs that Alison produced that we didn't -- we pulled out of her presentation. And this shows nitrate concentration, left-hand side, in years following along the bottom for both of them. One is near the diffuser, the other is the outlet.

You can see the top line in both of them would be the site-specific water quality objective which is based on hardness. And hardness does increase past one sixty (160), so it levels out. At the lower level -- this is without mitigation -- you can see the predicted nitrate concentrations. And they're well below the site-specific water quality objective.

Ammonia, very simple. We really didn't do anything that fancy with it. We know ammonia's toxicity is modified by pH and temperature, the cold exposure toxicity modifying factors by the Canadian Council of Ministers of the Environment. We basically set the site-specific water quality objective based on the CCME water quality objective. Five point two-one (5.21) is the chronic, and the maximum predicted ammonia concentration is two point seven (2.7). So again, we're not looking at an exceedance there.

And that's the end of my presentation.

MS. ERICA BONHOMME: It's Erica Bonhomme. I just wanted to provide a clarification on slide 8, Peter, if you can scroll me back, please. One (1) more back. No, keep going, yeah. Right in the front end of the -- keep going. The ta -- yeah. Keep going. Okay.

So my apologies. On slide 2, I -- I just want to clarify that De Beers is not seeking a change in the ammonia EQC. It's seeking an increase in the nitrite EQC, and it's seeking a -- it -- it's recommending a -- a decrease in the nitrate EQC.

(BRIEF PAUSE)

QUESTION PERIOD:

DR. KATHY RACHER: Kathy Racher, for the Board. Okay. Thank you for that. We've got some lights on. That's good.

I think I'm going to go to the phone first and -- in deference to our colleague in Ontario, who probably wants dinner. Don Hart, are you there? Do you have any questions about the Nitrogen Response Plan?

MR. DON HART: Don Hart, EcoMetrix. Just a couple of questions. First question pertains to the site-specific toxicity testing that was done to verify the nitrate objective for Snap Lake waters, and I guess this might pertain to slide number 7, where the -- the data are shown, including the site-specific test data.

Testing was done at two (2) water hardness levels, 140 and 350 milligrams per litre, as calcium carbonate. I believe under upper bound scenarios, the hardness may get even higher, to levels of around nine fifty (950). I stand to be corrected. That's reading from graphs.

But I guess what my question is, is: How confident are we that the testing at three fifty (350) is representative, or at least conservative, as compared to the results we might get at a hardness much higher, around nine fifty (950)?

The -- the reason I would bring this up is I look at the testing that was done for the most sensitive species, the ceriodaphnia zooplankton reproduction test, the IC-20 was 26 milligrams per litre nitrate nitrogen at a hardness of one fifty (150), down to 16.7 milligrams per litre at a hardness of three fifty (350).

Does it keep going down at higher hardness levels such that we would have detect levels below the proposed site-specific objective?

DR. PETER CHAPMAN: Peter Chapman. We didn't test at the higher levels. Frankly, we don't know because it levels out at that point. And you're right, the ceriodaphnia is down there right on the line. The fathead minnow is way up there, however. So we don't have those testing points.

MR. DON HART: Yeah, it's -- I mean, basically, we're assuming that it levels out. I'm just questioning whether it really does. And the -- I'm -- when I say this, I'm thinking of the -- the BC guideline for sulphate, which is also hardness dependent. And they define it up to a hardness of two fifty (250).

They have concerns about higher hardness levels and whether we may be getting those combined toxic and -- and hardness effects at -- at those high levels. So it's -- it's a concern.

DR. PETER CHAPMAN: Peter Chapman. It's a potential issue. I go back to TDS. The TDS we did test up to fifteen hundred (1,500), nominal fourteen hundred (1,400), and we did see no effects on most everything except the daphnids again.

DR. KATHY RACHER: Kathy -- Kathy Racher, for the Board. Don, did you have a follow-up question for that?

MR. DON HART: Yes. Well, I'm -- I'm trying to -- I'm trying to understand the -- the -- your response about TDS there, Peter.

Are you saying that it helps us to

answer the question about nitrate at high hardness levels?

DR. PETER CHAPMAN: Peter Chapman. No, I'm saying it -- it helps address the issue of hardness by itself. It doesn't address the issue of hardness and nitrate together.

MR. DON HART: Don Hart, EcoMetrix. Okay. Understood.

Don Hart, EcoMetrix. I have one (1) other question. We've done -- or you've done site-specific toxicity testing with a number of species, including the daphnid invertebrates and fathead minnow, the daphnid invertebrates being the more sensitive species.

Again, we know that's not the dominant zooplankton out in the lake. Those would be rotifers and copepods. Do we have any information about nitrate sensitivity for either of those species?

DR. PETER CHAPMAN: Peter Chapman. I'm going to have to take that as IR and look that up and get back to you on that, if I may.

MR. DON HART: Don Hart, EcoMetrix. Thank you.

DR. KATHY RACHER: Kathy Racher, for the Board. Don, could you just repeat what that IR would sound like for us, please?

MR. DON HART: To find information about nitrate toxicity to rotifers and copepods as dominant zooplankton in Snap Lake.

--- INFORMATION REQUEST NO. 12: De Beers to provide information on nitrate sensitivity for rotifers and copepods

DR. KATHY RACHER: Kathy Racher, for the Board. Thank you. Do you have any further questions right now, Don?

MR. DON HART: No, that's it.

DR. KATHY RACHER: Okay. Thank you.

Anita Li, from Environment Canada, do you have any questions at this time?

(BRIEF PAUSE)

DR. KATHY RACHER: Apparently she's not there. I'll take that as a no.

In the room here, who's lively enough to at this stage -- oh, Todd's lively enough. Excellent.

MR. TODD SLACK: Thanks, Kathy. Todd Slack, for the Yellowknives. Excuse me. All my questions are going to focus on the amount of explosives used and the source control efforts.

What has the explosives per tonne monitoring shown us? I didn't -- I see that you are monitoring this information, but I don't see where it's reported. Can we get some information on that?

(BRIEF PAUSE)

MS. ERICA BONHOMME: Erica Bonhomme. We -- we currently don't have any, you know, information we provide regularly to the Board. I'd have to go back and see what kind of records on that we -- we would provide -- we could provide.

MR. TODD SLACK: Todd Slack, for the Yellowknives. And perhaps this is helpful. On page 11, Section 2.3, the project states that you will continue to monitor trends in the amount of explosives used per tonne -- per tonne of ore mined.

Should I -- if this information is not available, is this a misprint here?

(BRIEF PAUSE)

MS. ERICA BONHOMME: Erica Bonhomme. Sorry. The reason I'm hesitating is -- is I don't have that information. None of us do here. We do hire a -- a third party that manages our explosives, so we obtain information from them. So I need to go back and -- and see in what format that information exists. We do have that information. It's just through a third party.

MR. TODD SLACK: So -- sorry. Todd Slack, for the Yellowknives. I'm wondering if we can have as an IR that looks at both what this monitoring shows us and how this monitoring is going to be done, both now and in the future.

DR. KATHY RACHER: Kathy Racher, for the Board. And to clarify, that's for monitoring of the amount of explosives used during mining?

MS. ERICA BONHOMME: Yeah. Erica Bonhomme. I'll be a little more specific than that. We -- we will have numbers on the amount of emulsion that's used based on amount that's -- that's purchased and shipped to site, and trends based on that, so specific to emulsion.

MR. TODD SLACK: Todd Slack, for the Yellowknives. And if that can be -- the key here is on a per-tonne basis, because -- and I'll explain my -- my intent here. In the last -- in the water licensing process, there was an awful lot of discussion in terms of source control, and we're going to reduce the amount of stuff that we use, and all these sort of things.

And what I'm trying to understand is have these initiatives been successful in reducing the amount of nitrogen loadings in the last few years?

MS. ERICA BONHOMME: Yeah. Erica Bonhomme. We will -- we'll provide some information that helps to answer that question.

MR. TODD SLACK: Todd Slack. Thank you. That's terrific. And I'm wondering if I might push that a little further. In -- throughout Section 2 in this plan, you talk of all these initiatives. And so there -- there is some -- some metrics there, in terms -- like if you use less drill holes, you therefore use less emulsion.

But what we aren't getting at is understanding whether -- which of these initiatives have been successful, in terms of reducing or improving the -- the blast mechanics or the blast efficiency.

So I don't know if you wanted to add it -- add on to that or -- or create a separate question, but that -- that's the -- the bigger goal, not just explosives per tonne, but how each initiative has worked to effect that -- that ratio or that value, metric, whatevs (sic).

(BRIEF PAUSE)

MS. ERICA BONHOMME: Erica Bonhomme. We -- one (1) thing -- one (1) thing is we can't -- we can't break down to just assess which one of those practices is more effective than the other. They're all effective at reducing loadings to the environment.

Now, when you look at figure -- the figures provided in the -- in the Nitrogen Response Plan -- I just want to make sure I have the right ones -- these ones, they do continue to show an increase. And then historically -- and -- so I'm looking at Figure 2-3, Figure 2-4 of the Nitrogen Response Plan, which deal with nit -- nitrate and ammonia loading in the final mine water collection sump. So that's where water comes from underground and is monitored.

So you see for example Figure 2-4a, we still continue to see an increase. What it doesn't reflect is the fact that we continue to open new areas to mining. Our -- our mining increases. We continue to get inflows. We continue to have more areas opened up to mining.

So there's a -- there's a balance

between reducing bla -- improving blast efficiency and -- and reducing loading, and the fact that we're -- we're increasing the rate of mining.

MR. TODD SLACK: Todd Slack, with the Yellowknives. I guess if we take that and if you could provide that information, both how the -- sorry, I need to think this through a little and not chill off like that last one.

So if the issue is that the loading is going up because of a rate of mining increase, can the project provide, complementary to these other data in something that is -- we can see the relationship, can the project provide metrics that show that rate of increase, rate of mining increase, and whether that is the root source of the nitrate increases?

(BRIEF PAUSE)

MS. ERICA BONHOMME: Oh, I left my mic on. Erica Bonhomme. Yeah, I think we can provide something like that. I'm -- I'm not giving an exact of what we can provide, because we need to go back and look at how we would answer that question.

What we do have is a mine plan. We do have all our groundwater and site models, which are based on that mine plan. They don't separate out nitrogen currently. We've done mining, and -- and the Groundwater Model has -- has taken into account TDS.

So how -- you know, we increase our loadings based on the mine plan. We need to take that back and see what that will look like.

The amount of explosives that we use, like I said, that's information we can get quite easily. It's the part about correlating it over the long term to the -- to the loadings. Should -- should be fairly straightforward, but I don't want to commit to providing any one (1) specific graph or -- or, you know, correlation, because I -- we need to take that back and see what...

But my -- I think your question is: How will nitrogen loading -- maybe -- maybe I don't understand the question. Maybe -- maybe you could just rephrase the question for me --

DR. KATHY RACHER: Kathy --

MS. ERICA BONHOMME: -- so just so I'm clear what you're looking for.

DR. KATHY RACHER: Kathy Racher, for the Board. Maybe I could try something here. Have you got it?

MR. TODD SLACK: I -- I had -- Todd

Slack, for the Yellowknives. I had the good fortune of a few extra seconds there to think about it. So the question is: If -- if the project's explanation is that it is the rate of mining that is driving the increase in loading, can they please provide information that pro -- explains that rationale or that justification?

Is that a fair request?

MS. ERICA BONHOMME: Erica Bonhomme. Yeah, we can do that.

DR. KATHY RACHER: Kathy Racher, for the Board. Just before we go on, I just want to clarify. So that -- the IR about the amount of emulsion per tonne, is that still something you're looking for as well? Okay. You're nodding your head.

MR. TODD SLACK: Yes, please.

--- INFORMATION REQUEST NO. 13: De Beers to provide information on amount of emulsion per tonne

--- INFORMATION REQUEST NO. 14: De Beers to provide information supporting the explanation that it

is the rate of mining
that is driving the
increase in loading

DR. KATHY RACHER: Okay. Did you have another question, Todd? And I think we'll -- we'll end it after that.

MR. TODD SLACK: I have one (1) last question. Sorry, Todd Slack, with the Yellowknives. And that last question is: Section 5 in -- in the Nitrogen Response Plan talks about what you could do, further source control issues.

And I guess the question that I have is: Why are we considering moving the goal posts for this again without looking at these source control issues and seeing how they implement -- or how they can be implemented prior to further consideration, in terms of allowing additional contamination of the -- the receiving environment?

MS. ERICA BONHOMME: Erica Bonhomme. I -- I should clarify again, we're not actually increasing our limit. So if you look at the concordance table in the water licence application, we're not looking for an increase in the EQC for ammonia. We're looking for a dec -- we're recommending actually a decrease in the EQC for nitrate and a minor increase in -- in the EQC for nitrite.

MR. TODD SLACK: Todd Slack, with the Yellowknives. You'll have to forgive me that I don't understand the -- the interplay between these various nitrogen values.

My -- my sense is that, hey, if you're blowing more stuff up, that's where the nitrogen's coming from. And whether it be nitrite or nitrate or ammonia or some other 'N' value, the root cause is the -- or the root source is the explosives.

And while I don't want to belabour this...

DR. KATHY RACHER: Kathy Racher, for the Board. I -- I think I had a question that was along the same line as what I think you're getting at, Todd. In terms of the EQC, the EQCs are set to lower for nitrate in 2015 to a lower level than what they're currently proposing. But that was based on the water quality objective that we dealt with at the time of the renewal, so that's -- that's what the EQC was based on.

But it's -- I think it -- for me, in terms of ongoing nitrate management, I mean, that's -- we identified during the renewal that the rate of explosive use was much higher than we'd seen at other mine sites. It was like a rate of 25 percent sort of wastage. And -- and there's -- you know, it's -- there's a lot of water, and I get that, et cetera.

So -- and -- and what you've outlined in your Response Plan is a number of things that you could do, you are doing, you're working on. And -- and in your recommendations, as Todd pointed out, it says:

> "To continue to monitor trends in the amount of explosives used per tonne of ore mined as a means of monitoring the effectiveness of explosives management measures."

And -- and I guess what we're trying to incorporate more into water licences is -- is that kind of -- how do you know you're doing better? So how do you know anything that you're doing is actually worthwhile? And, you know, you go down a certain path; maybe that doesn't work. You go down another path.

So how as you as a -- how do you as a mine -- how are you going to monitor going forward that you're doing the right things at the right times? And, you know -- and -- and we have begun to ask for that information in the annual reports, just, you know, not a -- a big, detailed report, but just a -- a general indication.

So what would you monitor and how would you -- how -- how do you know that anything you do is effective? And -- and could you either talk about that or provide a -- a recommendation for how that could be incorporated in the water licence? And that might help with Todd's questions.

MS. ERICA BONHOMME: Yeah. I think the Response Plan is a perfect place to -- to look at that. It's something that, you know, we want to -- it is before the Board for review now.

If there is -- if that's the recommendation that is -- is the best one for reporting on that, I think that we -- we can provide you with numbers annually on the -- the amount of emulsion used versus the tonnes of ore mined.

However, I want to be clear, we would not want to see that as a compliance point. We are committed to improving our blast efficiencies and reduce the nitrate loadings where we can. But we -- we most certainly would hope that we wouldn't have our feet held to the fire over that.

DR. KATHY RACHER: Kathy Racher, for the Board. Paul tells me he has two (2) questions, but we did commit to ending it at 4:45. I don't know how people feel, if they're okay with -- with two (2) very short questions from the young man at the end.

Okay. Go ahead.

MR. PAUL GREEN: It's Paul Green with ENR. For blasting, do you use 100 percent emulsion or an ANFO/emulsion mix underground?

MS. ERICA BONHOMME: Erica Bonhomme. Let's be clear, I'm -- I'm not a -- a blasting expert. Yes, we use ANFO, as well as a -- an emulsion mix underground.

MR. PAUL GREEN: Have -- just going back to other mine sites, they've done a fair bit of work looking at, you know, the emul -- the emulsion/ANFO blend. Do you know if much of that type of work has occurred at -- at Snap?

Like I think an 80:20 emulsion/ANFO seemed to be kind of the magic number, as far as minimizing leachate -- leaching of ammonia and nitrogen compounds.

MS. ERICA BONHOMME: Erica Bonhomme. I mean, one (1) -- one (1) thing I would just say off the bat is we're a very different mine. We have a lot of water underground. I can't say that what would work at other mines would work -- necessarily work at Snap Lake.

If we go back to Todd's point of it's

all about cost, the same would apply here. We -- we don't want to waste any explosive residue -- explosive; we don't want to waste emulsion. It's expensive for us. It's expensive for us to bring it in, and it's expensive for us to manage it.

So just on that basis, we definitely want to be as efficient as we can. We also want to ensure that every blast round is as effective as it can be. So if we have an incomplete blast, it means we have to wait till a shift change and do it again.

So, you know, I -- I believe that our -- our blasting techniques are continuously improving and, you know, are -- are designed to be as effective as they can be.

MR. PAUL GREEN: Thank you. Another quick one about residence times. You have a feel for how long the explosives remain in the hole after they're charged, like hours, days, less than a week kind of...?

MS. JULIE L'HEUREUX: Julie L'Heureux. It's a few hours. It's just the -- the day shift prior to the blast at four o'clock in the afternoon.

DR. KATHY RACHER: Kathy Racher, for the Board. Okay. Then I think we should wrap it up here. And we'll start again at nine o'clock in the morning. We'll -- if we have any follow-up questions, we'll -- we'll take care of them then and then get on with the presentation on the Strontium Response Plan.

Question from Peter?

DR. PETER CHAPMAN: Peter Chapman. Just first thing in the morning, could we review the IRs just to make sure we're all on track in the morning?

DR. KATHY RACHER: Kathy Racher, for the Board. Yeah, we'll -- we'll take a look at them tonight and see if we can write them -- you know, have something written down to see if they -- they match. So we'll try to do that in the morning.

(BRIEF PAUSE)

DR. KATHY RACHER: Kathy, for the Board. I -- I think we can -- I -- I wouldn't recommend leaving anything valuable in here, but -- I'm not saying that your application is not valuable. It is. But we can probably leave our big binders here in the -- in the -- in this room until tomorrow if -- if you don't want to lug them around town.

So thanks, everyone, for a great session today. Thank you for the great presentations and --

and the questions and answers. See you tomorrow.

--- Upon adjourning

Certified Correct,

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Wendy Warnock, Ms.

J