

MACKENZIE VALLEY ENVIRONMENTAL

IMPACT AND REVIEW BOARD

ENVIRONMENTAL IMPACT STATEMENT (EIS)

ANALYSIS SESSIONS

GAHCHO KUE DIAMOND PROJECT

Mackenzie Valley Review Board Staff:

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Facilitator Chuck Hubert

HELD AT:

Yellowknife, NT

December 1st, 2011

Day 4 of 5



“When You Talk - We Listen!”



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1	List of Undertakings		
2	Number	Description	Page No.
3	2	Is the cumulative effect of climate	
4		change under-estimated? Section	
5		11.13.5 residual effects summary	
6		states that "all of the pathways	
7		for climate change were determined	
8		to have no linkage or minor(secondary)	
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11		biophysical environment." That	
12		appears to indicate that there were	
13		no primary effects of climate change	
14		only three secondary pathways. Given	
15		the 10 year period of construction and	
16		operation and predictions of further	
17		climate changes, is the proponent	
18		confident that a warming climate will	
19		not cause measurable changes with	
20		residual effects on a VC relative to	
21		baseline. There is no discussion in	
22		the EIS of the current rate of warming	
23		relative to the non-linear and	
24		unpredictable effects and increase in	
25		annual and seasonal variability	25

1 --- Upon commencing at 9:02 a.m.

2

3 THE FACILITATOR HUBERT: Okay, good
4 morning everybody. It's Chuck Hubert with the Review
5 Board. I'd like to get started this morning with some
6 -- some of the follow-up activities that De Beers was
7 going to present for us from -- from yesterday.

8 Just to remind everybody, I'm Chuck
9 Hubert, panel manager with the Review Board here. With
10 me is Alan Ehrlich, formerly known as the panel
11 manager, and assisting, hopefully, and as well as
12 Nicole Spencer.

13 Once again we are webcasting, and for
14 those participating remotely we are on day 4. You'll
15 find that on the Review Board website, a PDF.

16 And I -- I will talk about the agenda
17 for today later on, but for now I'd like to turn the
18 mic over to De Beers for the follow up from -- from
19 yesterday, please. Go ahead.

20 MS. VERONICA CHISHOLM: Veronica
21 Chisholm from De Beers. Thank you, Chuck. First off
22 I'd like to have Cathie Bolstad from De Beers, she
23 would like to provide some clarification from November
24 29th, 2011.

25 MS. CATHIE BOLSTAD: Good morning,

1 everyone. I had an opportunity last night to read the
2 transcripts from day 2 and saw there were two (2)
3 things I said on the record that I needed to correct
4 myself on. On page 180 I said I had met with the Mine
5 Training Society chairperson and executive director.
6 And I -- what I should have said was I met with the
7 Mine Training Society chairperson and general manager.
8 To be clear, I met with Ted Blonden, chair of the Mine
9 Training Society, and Hilary Jones the general manager.

10 On page 181 in my response to industry,
11 tourism, and investment, when they asked a question
12 about how we would deal with shutdowns and closure to
13 transition employees, I answered that we had outlined
14 in a meeting with communities and regulators in October
15 our approach to the temporary shutdowns. In fact, the
16 meeting was actually on November 1st and it was a
17 meeting between De Beers and a variety of GNWT
18 departments, including industry, tourism, and
19 investment. My apologies for those errors.

20 MS. VERONICA CHISHOLM: Veronica
21 Chisholm, from De Beers. Thank you, Cathie. So I'm
22 just going to provide some follow-up responses from
23 yesterday. That would have been November 30th, 2011.
24 So project GHDs (phonetic) and relative comparisons
25 with other diamond mine operations in the region, that

1 information will be provided Thursday, December 1st,
2 2011, or today in the afternoon.

3 I have a copy of the caribou health
4 report we mentioned yesterday for Madelaine, so I just
5 have it in hand as soon as she arrives. There was a
6 question by Fred Sangris from the Yellowknives Dene
7 First Nation regarding what is the existing and
8 forecasted traffic on the Tibbitt-Contwoyto winter
9 road. I'm going to read the response.

10 "Records of his -- historic traffic,
11 both commercial and noncommercial, on
12 the Tibbitt-Contwoyto winter road are
13 presented in Section 11.8.2.5 of the
14 EIS. Traffic forecasts for the
15 Gahcho Kue projects are provided in
16 11 -- Sections 11.8.3.2."

17 And we have a hard copy of that, so if
18 Fred shows up we would be delighted to show him those
19 sections and those numbers.

20 In response to James Hudson, CWS, on
21 Wednesday, November 30th, 2011, regarding the
22 ecological risk assessment and the deliverable timing,
23 and if the water management pond will be considered, a
24 detailed environmental risk assessment was not included
25 as a requirement of the TOR (phonetic). And as -- and

1 as the work related to compiling a detailed technical
2 background document was ongoing at the time of the EIS
3 submission. The document was not included at that
4 time.

5 In 2011, additional field data was
6 collected and is now being incorporated into the ERA as
7 well as some additional air information. Once this
8 information is collated the final ERA technical
9 background document will be produced. We anticipate
10 that it will be completed by the end of Q2 2012.

11 And in answer to the question was the
12 water management pond considered in the ecological risk
13 assessment, the answer is, yes.

14 There was a question from you, Alan,
15 regarding the relative change and abs -- the use of
16 absolute areas in the wildlife section or the wildlife
17 slides from yesterday.

18 Summaries of absolute changes from
19 direct effects and vegetation types are summarized for
20 the regional study area in Section 11.12.1, species at
21 risk and vegetation. For moose, musk ox, and birds we
22 provided areas per habitat quality, poor, low, good,
23 high, only for the reference landscape. However,
24 absolute numbers can be easily extracted per condition
25 or scenario.

1 For example, in Table 11.11-10 of the
2 EIS the amount of high quality habitat for the
3 reference condition is 274,213 hectares. And the
4 percent change for high quality habitat from reference
5 to baseline 2010 is 4.2 percent. That was what was
6 referenced on the slide, minus 4.2 percent. Thank you.
7 That's what was referenced on the slide yesterday.

8 Thus, the absolute area for the baseline
9 in 2010 is 274,213 hectares minus the product of 4.2
10 percent times 274,213 hectares. That's a lot -- a big
11 mouthful. And I think that is the response we have for
12 that one (1) unless there's a follow-up.

13 In response to Mr. Petr Comers'
14 questions from Wednesday, November 30th, the use of
15 significance in the assessment and the addition of TK
16 significance. In response to the question asked by Mr.
17 Comers regarding community impact rating, it's
18 important to clarify that the EIS presents predictions
19 made by De Beers on likely residual effects from the
20 project and then determines the significance of those
21 effects.

22 The use of this -- of the term
23 "significance" in the context of the environmental
24 assessment has a specific meaning. Significance in the
25 EA context is determined based on factors commonly used

1 in EAs such as magnitude, duration, direction,
2 geographical extent, and these factors are outlined in
3 Section 3.2.2 of the terms of reference. It is on this
4 basis that we arrive at our significance determination.
5 And we have made our significance determination in
6 accordance with the terms of reference.

7 We understand that people in the
8 community, and indeed people participating this week in
9 person, or via the web, may have different views of
10 significance to them. In the context of the project
11 EIS and the environmental impact review process, we
12 have made our significant determinations based on
13 proven EA practices and our predictions of likely
14 residual effects. We also are confident in our
15 approach of making predictions based on the
16 conservatism incorporated in our impact predictions and
17 resulting significance determination.

18 Now we only want to be clear on what we
19 understand. Just because the EIS determines something
20 as not significant, or not likely to be significant in
21 the EA context, this does not mean that these issue are
22 not important to people, or not significant to people
23 as that term is used in its every day meaning.

24 De Beers welcomes feedback from
25 stakeholders and the local communities on our EIS and

1 the predictions contained within and we look forward to
2 further engagement with stakeholders in hearing about
3 matters that are important to them in the IR process.
4 We understand that these issues are very important to
5 people and they are also very important to De Beers.
6 Because these issues are important to De Beers is why
7 the project has been designed proactively to integrate
8 environmental design features that protect the
9 environment and also avoid or reduce project impacts to
10 the greatest extent possible.

11 Question 2 -- oh, question.

12 MR. ALAN EHRLICH: Thanks for that
13 response, Veronica. It's Alan Erlich. I appreciate
14 the -- the -- the -- the obvious thought that's gone
15 into it and, you know, you raise a -- a compelling
16 argument.

17 It's the onus of each party to prove
18 their case, and of course the best judges on how
19 significant potential impacts might be to the
20 Yellowknives are, you know, the people who are -- are -
21 - are best able to describe that are probably the
22 Yellowknives when it comes to providing evidence to the
23 panel. Which means the question that was raised by Dr.
24 Petr Comers yesterday probably would be better put to
25 the Yellowknives than to De Beers. De Beers is only

1 responsible for providing its own views on -- on what
2 it thinks the predicted impacts are going to be, so
3 thank you for that.

4 MS. VERONICA CHISHOLM: Thank you.
5 Veronica Chisholm from De Beers. I -- I do want to
6 address Dr. Comers, I'll make that correction, sorry
7 about that. A second question regarding restoration of
8 pre-development vegetation types and reclamation
9 practices, just to provide some clarification on the
10 response from yesterday.

11 Reclamation for the project will be
12 progressive to determine the best approach. De Beers
13 will use lessons learned from current active mine site
14 including Ekati, Diavik, and Snap Lake. Part of the
15 reclamation/revegetation plan will include the use of
16 native species capable of supporting the overall goals
17 and objectives of the reclamation plan, such as
18 stabilizing soils, providing productive and functional
19 vegetation ecosystems to support wildlife species,
20 including caribou.

21 It's important to understand that the
22 assessment does not consider reversibility to mean the
23 landscape and vegetation ecosystems will be immediately
24 restored to predevelopment vegetation community types.
25 Arctic environments have slow processes -- processes,

1 and at closure vegetation are predicted to be in early
2 successional stages that will evolve into late
3 successional stages or climax communities over time.

4 As such, reclaimed areas will likely
5 provide different but similar function -- functional
6 vegetation community -- community types in the areas
7 that are not influenced by the project. The point is
8 that reclaimed areas are not expected to be the same as
9 pre-development conditions. Therefore, the assessment
10 results is not dependent on returning the reclaimed
11 areas to pre-development conditions for pre-development
12 vegetation types. Thanks. I have a couple more.

13 THE FACILITATOR HUBERT: Chuck Hubert.
14 Thanks for clarifying that. Please continue.

15 MS. VERONICA CHISHOLM: We're almost
16 there. Anne Gunn's question from Wednesday, November
17 30th, 2011. Yesterday.

18 First question:

19 "It is unclear how the developer has
20 consistently and thoroughly drawn on
21 the experiences of other mines."

22 Our response:

23 "Subject of note, waste management
24 and wildlife in Section 11.9 provides
25 a review of the wildlife effects

1 mitigation and environment dev --
2 design features used at Ekati, Diavik
3 and Snap Lake, as well as the Jericho
4 mine, including a review of all
5 wildlife incidents at these mines,
6 dating back to 1996. Through this
7 review, several improvements to the
8 environmental management were
9 identified, including redesign of the
10 inert solid waste facility, and plans
11 to enclose the incinerator. De Beers
12 will continue to liaise with other
13 operators on proven technology and
14 proven practices.

15 Wildlife effects miti -- effects
16 mitigation and management plan, in
17 Appendix 7.1, draws heavily on the
18 lessons learned at Snap Lake, Ekati,
19 and Diavik mines. All the mitigation
20 and waste management prin --
21 principles, management of toxic
22 substances, wildlife deterrent,
23 caribou production, and worker
24 education was developed and then
25 tested at Ekati, Diavik and Snap

1 Lake. Key lines of inquiry, caribou,
2 Section 7, makes extensive use of
3 monitoring -- of the monitoring
4 completed to date and the lessons
5 learned at Ekati, Diavik, Snap Lake
6 and Jericho. This section referenced
7 reports from Ekati, Diavik, Snap Lake
8 and Jericho over fifty (50) times.
9 The Meadowbank project is not
10 considered to be -- to be as relevant
11 information as Ekati, Diavik, Snap
12 Lake and Jericho, because it uses a
13 different monitoring protocols and
14 the access is from a new all-season
15 road from Baker Lake, while Ekati,
16 Diavik, Snap Lake, and Jericho access
17 from the seasonal Tibbitt-Contwoyto
18 Road, which has been operating for
19 thirty (30) years. Nevertheless, we
20 will continue to follow developments
21 in wildlife effects monitoring in the
22 region with great interest."
23 Anne Gunn's question on the cumulative
24 effects of climate change un -- underestimate --
25 underestimated, or the assumption that it was

1 underestimated in the EIS. De Beers would request that
2 this question be formally read into the record to
3 insure clarification of the question.

4 THE FACILITATOR HUBERT: Chuck Hubert,
5 Review Board. That question was, in fact, read into
6 the record and is on the transcripts from yesterday.
7 However, we can read it again.

8 MS. VERONICA CHISHOLM: Veronica
9 Chisholm, from De Beers. It would be great if you
10 could read it again.

11 THE FACILITATOR HUBERT: So, this --
12 you want to read it?

13 MR. ALAN EHRLICH: Just be -- it's Alan
14 Ehrlich. Just be one (1) minute. We're looking over
15 the transcript so we can provide you with a nice,
16 accurate read.

17 MS. VERONICA CHISHOLM: Veronica
18 Chisholm, from De Beers. Thank you very much.

19

20 (BRIEF PAUSE)

21

22 MR. ALAN EHRLICH: Hi there. Ready to
23 go. Thanks for waiting a minute there.

24 Here's what I'm reading off the
25 transcript yesterday and I'll -- I'll leave out

1 anything that I think makes it less clear.

2 "Dr. Gunn asked whether or not the
3 cumulative..."

4 I'm reading from the -- from yesterday's
5 transcript. I don't have a time on this, but if it
6 sounds like deja vu it's because these same words came
7 out of my mouth yesterday.

8 "Dr. Gunn asked whether or not the
9 cumulative effect of climate change
10 has been sufficiently estimated. She
11 notes at Section 11.13 -- in Section
12 11.13.5 the residual effects summary
13 of the environmental impact statement
14 states that 'all the pathways for
15 climate change were detire --
16 determined to have no linkage or
17 minor secondary changes to the
18 classification of effects from the
19 project on the biophysical
20 environment.' She writes: 'That
21 appears to indicate that there were
22 no primary effects of climate change,
23 only three (3) secondary pathways,
24 these being waterflow, processed
25 kimberlite storage, and the winter

1 road season.'

2 Given the ten (10) year period of

3 construction and operation and

4 predictions of further climate change

5 Dr. Gunn was interested in the

6 propoment -- the proponent's

7 confidence that a warming climate

8 will not cause measurable changes

9 with residual effects on a valued

10 component relative to baseline.

11 Dr. Gunn notes that: 'There was no

12 discussion in the EIS of the current

13 rate of warming relative to non-

14 linear and unpredictable effects and

15 increase in annual and seasonable

16 variability.' Her example regarding

17 caribou is: 'Population modelling

18 indicates a large effect on caribou

19 abundance from changes in the level

20 of insect harassment to which any

21 effects of the mine would be

22 additive. It's not -- it's -- to

23 which any effect would be additive.

24 Insect harassment is temperature

25 dependent and is predicted to be more

1 severe under a -- under a warmer
2 climate.'"

3 The transcript reads "client", we do not
4 have a client of any warmth. A warmer climate.

5 "'In that case effects of the mine
6 additive to the effects of a warmer
7 climate would have residual
8 effects.'"

9 And that is the point from Dr. Gunn who
10 is participating remotely yesterday and I -- I believe
11 this morning that we've asked De Beers to comment on.

12 Does that reiterate it sufficiently?

13 MS. VERONICA CHISHOLM: Veronica
14 Chisholm from De Beers. I appreciate that, Alan.

15 Yeah, I think that does provide some
16 clarification on the question. De Beers at this time
17 would like to request that this be under -- be an
18 undertaking so that we have sufficient time to provide
19 the detailed response to this question.

20 THE FACILITATOR HUBERT: Chuck Hubert,
21 Review Board. Thanks very much. That's Undertaking
22 number 2, for the record. And December 16th is the
23 response date for for De Beers for these first two (2)
24 undertakings and any that might follow. Thanks.

25

1 --- UNDERTAKING NO. 2: Is the cumulative effect of
2 climate change under-
3 estimated? Section 11.13.5
4 residual effects summary
5 states that "all of the
6 pathways for climate change
7 were determined to have no
8 linkage or minor(secondary)
9 changes to the
10 classification of effects
11 from the Project on the
12 biophysical environment."
13 That appears to indicate
14 that there were no primary
15 effects of climate change
16 only three secondary
17 pathways. Given the 10
18 year period of construction
19 and operation and
20 predictions of further
21 climate changes, is the
22 proponent confident that a
23 warming climate will not
24 cause measurable changes
25 with residual effects on a

1 VC relative to baseline.
2 There is no discussion in
3 the EIS of the current rate
4 of warming relative to the
5 non-linear and
6 unpredictable effects and
7 increase in annual and
8 seasonal variability
9

10 THE FACILITATOR HUBERT: And were there
11 any other items? One (1) -- Veronica, please.

12 MS. VERONICA CHISHOLM: Thanks, Chuck.
13 It's Veronica Chisholm from De Beers. I just have one
14 (1) more.

15 De Beers requests clarification of -- on
16 the question from the Yellowknives Dene First Nation, I
17 think it was delivered by Stephen Ellis, on --
18 regarding the persistent organic pollutants with
19 reference to dioxins and furans. We would just like to
20 seek some clarification on the question so that we can
21 develop an appropriate response. Thank you.

22 THE FACILITATOR HUBERT: It's Chuck
23 here. Steve, would you like to respond to that?

24 MR. STEVE ELLIS: Well, only to divert
25 the -- the question. Steve Ellis here with the

1 Akaitcho Dene.

2 I can't really answer that question. So
3 maybe wait until Todd comes here this afternoon and
4 I'll ask him. I'll send him a little note right now
5 saying that's he's wanted. Okay.

6 THE FACILITATOR HUBERT: Chuck Hubert
7 with the Review Board. Thanks very much, Veronica, for
8 the responses to the follow-up homework from yesterday.
9 That's excellent.

10 So welcome everybody. We'll start with
11 today's agenda. Once again, I'm -- my name is Chuck
12 Hubert with the Review Board, with Alan, and Nicole,
13 and Paul, and Jessica in the back.

14 I'd like to remind everybody here that
15 there's a sign-up sheet in the back, and it helps our
16 transcription imme -- immeasurably, if that's -- people
17 do sign in with that.

18 Again, we have remote participation.
19 Remote participants are encouraged to check our website
20 for the day 4 topic, which is water, including
21 hydrology of groundwater, permafrost, and hydrology.
22 We have -- we have it listed as, Aquatics, I believe on
23 our -- on our website.

24 I'd encourage people with cell phones to
25 keep them off, or on vibrate, so please no sound. As

1 well, when -- when speaking if you can introduce
2 yourself -- self by name and organization prior to --
3 to speaking.

4 As far as presentations go, we'd prefer
5 if the presentation can run though in -- in its
6 entirety, and questions are held off until the
7 presentation is complete.

8 Also, we have a Tlicho terminology
9 handbook which has been prepared by De Beers.

10 MR. STEPHEN LINES: Sorry, Chuck, it's
11 Stephen Lines for De Beers. It -- flip the book over,
12 it's actually bilingual.

13 THE FACILITATOR HUBERT: Thank you for
14 that clarif -- Chuck Hubert. Thank you for that
15 clarification. And this -- this terminology handbook
16 can be found on the back table, and -- and we will have
17 copies as well in our office, the Review Board office.

18 As well, we -- we do have translators in
19 the room today, so if -- if required the translators
20 will be available to in both.

21 So with that, the agenda today is,
22 again, water and aquatics, and I'd like to request De
23 Beers to introduce their team, and -- and proceed as
24 they would like. Thanks.

25 MS. VERONICA CHISHOLM: Veronica

1 Chisholm from De Beers. John Faithful from Golder will
2 be presenting the introduction and overview, and he
3 will be introducing the aquatics team that will be
4 presenting today.

5

6 PRESENTATION BY DE BEERS CANADA RE INTRO

7 MR. JOHN FAITHFUL: John Faithful,
8 Golder Associates. Thank you, Veronica. I'm going to
9 provide a couple of slide intro before I introduce the
10 -- the aquatics team, if that's -- if that's okay.

11 So, good morning. I'm going to talk to
12 you today about the aquatics assessment for the Gahcho
13 Kue project. Thank you very much to all of you who are
14 attending, both in session today and also remotely.
15 We've very excited to share our work with you on the
16 aquatic's assessment. It represents a considerable and
17 comprehensive piece of work.

18 Initially, I'd like to first thank
19 Aboriginal Affairs, and their staff and consultant, for
20 some early feedback on the EIS. We'd also like to
21 thank the parties that provided questions and comments
22 at the October workshop. These comments are very
23 useful, and as appropriate, have contributed to the
24 presentation today, and probably tomorrow.

25 We're on slide number 2. The table that

1 we've presented, you've seen on a number of occasions
2 in presentations over the last few days. The table is
3 a guide for the location of all of the sections that
4 are rele -- relevant to the aquatic environment in the
5 EIS.

6 There are two (2) omissions to this --
7 to this table. One (1) is Section 5, particular
8 referencing Section 5.4, which describes how
9 traditional knowledge was incorporated into the
10 aquatic's assessment, and the aquatic's baseline data
11 collection.

12 The presentation today will specifically
13 focus on four (4) sections of -- of the assessment, two
14 (2) key lines of inquiry, which is Section 8 and
15 Section 9, that is water quality and fish in Kennady
16 Lake, and downstream water effects. And it will also
17 focus on two (2) subjects of note, those being Section
18 11.2, Impacts to Great Slave Lake, on Great Slave Lake,
19 and Section 11.6, Permafrost, groundwater, and
20 hydrogeology.

21 We're going to integrate the two (2) key
22 lines of inquiry in our presentation today, rather than
23 discuss them independently, so that there is natural
24 flow to the assessment. We'll not specifically focus
25 on the long term biophysical effects key line of

1 inquiry that is Section 10, as this section provides a
2 summary of the long-term assessment findings from
3 Sections 8 and 9. That is from the -- for res -- with
4 respect to the closure phases.

5 The only information that is not
6 addressed in Sections 8 and 9 within Section 10 is the
7 conceptual closure and reclamation plan. This was
8 presented by Veronica, from De Beers, on Monday as part
9 of the project description presentation.

10 Section 11.6, which details the work on
11 hydrogeology and groundwater, is provided within the
12 key lines of inquiry presentation that will be
13 initiated earlier through today.

14 Section 11.2, the subject of note on
15 impacts to Great Slave Lake, will be provided at the
16 end of the presentation tomorrow.

17 The existing environment information or
18 baseline information is presented as annexes and
19 addenda within the EIS.

20 Some of that information will be
21 summarized by each of the presentations that you will
22 hear today from the discipline leads. These will
23 include hydrology, hydrogeology, hydrology, water
24 quality, and fish and aquatic resources.

25 Although not listed on this on this

1 table, the permafrost baseline information is also
2 provided in an annex, that is Annex D. This is the
3 bedrock geology, terrain, soil and permafrost baseline.

4 The addenda that you see in addition to
5 the annexes provide baseline -- supplemental baseline
6 information that was collected in 2010. That is it --
7 the -- the addenda contained more recently collected
8 baseline information. And as you see from the table,
9 they're presented for the hydrology, water quality, and
10 fisheries, and aquatic resources.

11 I'm now on slide 3. The terms of
12 reference for the aquatics assessment were very
13 comprehensive and stated that the EIS must detail any
14 effects of the project on Kennady Lake and downstream
15 waters. Rather than go through the large list of each
16 of the requirements within the terms of reference for
17 each key line of inquiry, and subject of note, we can
18 extract and summarize key elements of the terms of
19 reference requirements for the key lines in -- of
20 inquiry, and they're listed on this slide.

21 So, for example, the first bullet is
22 specific to Section 8, the key line of inquiry to water
23 quality and fish in Kennady Lake, which required a
24 detailed analysis of all impacts on fish abundance,
25 health and fitness for consumption, including a

1 comprehensive analysis of potential effects on water --
2 impacts on water quality, and that the emphasis must be
3 placed on the ability of the lake system, particularly
4 fish and fish habitat, to recover.

5 For Section 9, downstream effects, where
6 the analysis of water quality and fish in Kennady Lake
7 identifies potential impacts. Where uncertainty
8 exists, the EIS must provide an evaluation of the
9 potential downstream effects and the extent of the
10 impact.

11 I'm now on slide 4. This provides a
12 summary of the assessment findings for Sections 8 and
13 Section 9. We found that the impacts from the project
14 will not have a significant negative influence on the
15 assessments endpoints that were used for each of those
16 sections; i.e., that the suitability of water quality
17 to support a viable aquatics ecosystem in Kennady Lake
18 following its re-connection to the downstream
19 watersheds, and in the downstream waters during
20 operation and closure, and on the abundance and
21 persistence of desired populations of fish species in
22 Kennady Lake following its re-connection to the
23 downstream watersheds and in downstream waters. Fish
24 are predicted to return to Kennady Lake after its --
25 after construction and operations. They'll be healthy

1 and they'll be available for traditional and
2 nontraditional use.

3 This assess -- assessment, as John Virgl
4 pointed out on Tuesday and Wednesday, as part of his
5 assessment approach -- actually, it was Monday and
6 Wednesday -- is based on the weight of evidence from
7 analysis of primary -- primary pathways to effects on
8 valued components. The assessment that was undertaken
9 by the aquatic disciplines within the EIS was based on
10 multiple assessment approaches and endpoints for key
11 aquatic components. This was a requirement for the
12 terms of reference and was critical in reducing
13 uncertainty in the predictions.

14 The EIS considered a suite of
15 conservatisms through the assessment, and those will be
16 very clearly outlined in the assumptions that the
17 discipline leads present in their presentations today.
18 As a consequence the impacts should not be worse than
19 have been predicted in the assessments.

20 I'm now on slide 5. The slide that is
21 now presented provides an outline of the aquatics
22 assessment that you will -- that will be presented to
23 you guys -- presented to the parties and the audience
24 over the next two (2) days. I'll initially provide an
25 introduction to the aquatics team. I'll provide an

1 overview of the assessment. We'll speak specifically
2 to the two (2) key lines of inquiry, Sections 8 and
3 Section 9. We'll follow a format to the dis -- follow
4 a format similar to -- to the way that the disciplines
5 have presented their information in the key lines of
6 inquiry.

7 We will init -- start initially with the
8 hydrogeology presentation. That will be followed by hy
9 -- hydrology and geochemistry, then water quality, fish
10 and fish habitat, the recovery of Kennady Lake. I will
11 then provide a summary of the assessment conclusions
12 and we will finish up with a -- with a presentation on
13 the subject of note, impacts to Great Slave Lake.

14 I'd like to take this opportunity to
15 introduce the discipline presenters that you will hear
16 from today and tomorrow. I'll ask you just to either
17 raise your hand or stand up, whatever you're
18 comfortable with doing.

19 I'd like to introduce Don Chorley, who
20 will speak to the hydrogeology and groundwater
21 discipline. Nathan Schmidt, who will speak to the
22 hydrology. Ken De Vos who will speak to geochemistry.
23 Mike Herrell water quality, and Gary Ash fish and
24 aquatic resources and the recovery of Kennady Lake.
25 Within each of the -- the aquatic discipline

1 presentations the presenters will provide a discussion
2 of the enviro -- or a summary of the environmental
3 setting, describe their assessment methods, and provide
4 their assessment findings.

5 We're now on slide 6. It looks a lot
6 darker than I recall. The project area is located at -
7 - the proposed project area is located at Kennady Lake.
8 It's 140 kilometres northeast of Lutsel K'e and 84 --
9 84 kilometres east of the Snap Lake mine. The Diavik
10 and Ekati mines are approximately 120 to 130 kilometres
11 to the northwest of the project area.

12 Kennady Lake is a headwater drainage
13 with a drainage area of 32.5 square kilometres,
14 constitutes approximately .1 percent of the Lockhart
15 river watershed. Within the Kennady Lake watershed
16 about 35 percent of the surface area is water. From
17 Kennady Lake to the outlet of Kurt Lake, the drainage
18 are of 739 square kilometres constitutes approximately
19 3 percent of the Lockhart river watershed of which 25
20 percent of the surface is water.

21 The local topography is characterized by
22 rolling rocky ridges, low-lying muskeg, and numerous
23 shallow lakes. Kennady Lake and other lakes in the
24 local study area are typically low -- low subarctic
25 tundra lakes with ice cover extending for seven (7) to

1 eight (8) months of the year. There is a short-term
2 open water period that extends from four (4) to five
3 (5) months. This typically occurs between June and
4 October. These lakes are expected to have low
5 productivity.

6 The area is quite dry relative to most
7 of Southern Canada, with a main annual precipitation of
8 approximately 340 millimetres. Half is rain and half
9 is snow. Flows in streams and lakes are dominated by
10 spring runoff with lesser flows and water levels
11 through the subsequent open water season.

12 Much of the area is over -- is underlain
13 by permafrost with taliks underneath larger lakes.

14 A comprehensive understanding of the
15 existing environment has been developed through the
16 baseline programs that have been conducted for this
17 project. They continue to be undertaken for some of
18 the aquatics components and the terrestrial components,
19 including hydrogeology, hydrology, water and sediment
20 quality, and fish and fish habitat, those being the
21 aquatics components, not the terrestrial components.

22 I'm on slide 7, which presents a figure
23 showing the conceptual approach to the aquatic effects
24 analysis. John Virgl, on Tuesday, explained that the
25 assessment approach used in the EIS is a process that

1 identifies and assesses environmental effects from the
2 project and provides a determination of significance on
3 those effects to key aquatic assessment endpoints.

4 This is a similar figure that was
5 provided in John's assessment approach presentation on
6 Monday, and Cam Stevens' terrestrial presentation
7 yesterday. It provides a diagrammatic view of the
8 assessment concept that is being applied to the
9 aquatics key lines of inquiries.

10 On the left hand side, you can see that
11 we have the project, which includes the environmental
12 design features and mitigation to negate or reduce the
13 potential for various effects to the environment, plus
14 the existing environment superimposed on the project --
15 or, with the project superimposed on the existing
16 environment.

17 Of most importance in this diagram, as
18 identified in the terms of reference, is the focus on
19 the assessment of effects to water quality in fish,
20 which were key components to be addressed -- key topics
21 to be addressed in the aquatics key lines of inquiry.

22 These are the assessment points -- these
23 are the assessment endpoints in the aquatics assess --
24 assessment, which are listed on the right. That is,
25 the effects -- suitability of water quality to support

1 a viable aquatic ecosystem, and the abundance and
2 persistence of key fish populations within the lakes,
3 and for use from a traditional and non-traditional
4 point of view.

5 What I would like you to note is that
6 there is a box in the centre of this diagram, which
7 provides a list of all of the other aquatic components.
8 This includes groundwater quality and quantity, surface
9 flows and water levels, water quality, aquatic health,
10 and fish and fish habitat.

11 The analysis of effects to these
12 components is an important element in the assessment of
13 each of the aquatic components, either directly or in
14 combination, and have a -- which have -- either
15 directly or in combination, have an influence on the
16 suitability of water quality to support a viable
17 aquatic ecosystem, and on the abundance and persistence
18 of fish in Kennady Lake and downstream waters.

19 Traditional knowledge has been
20 considered in the project design and considered in the
21 environmental assessment. Some of the aspects of the
22 assessment that traditional knowledge was applied was
23 associated with the habitat evaluation procedure in the
24 habitat compensation options planning process, which is
25 located in Sections 8 point -- Section 8.10, and

1 consideration of refilling Kennady Lake as quickly as
2 possible to facilitate a shorter time frame for lake
3 recovery.

4 These and other elements of traditional
5 knowledge that were used in this manner, are discussed
6 in Section 5.4. On the issue of traditional knowledge,
7 I responded to a question by Steve Ellis on -- on
8 Tuesday, on the incorporation of traditional knowledge
9 into the EIS. And I may have left the impression that
10 traditional knowledge was not incorporated. The
11 reference to this is page 35 of Volume II of the
12 transcript.

13 To clarify, although De Beers had not
14 received TK studies specifically undertaken by
15 communities for the project area, traditional knowledge
16 was incorporated into the assessment. I've provided
17 some of these examples above, and provided a reference
18 to the section where more detail is listed.

19 Now on Section 8 -- page 8 -- slide 8.
20 Consistent aquatic value components have been used in
21 the aquatic key lines and subject of note. This allows
22 for consistency and to carry potential effects through
23 from Kennady Lake to the downstream watershed.

24 These include, as outlined in the
25 previous -- as -- as -- as mentioned in the previous

1 slide, permafrost, groundwater chemistry and quantity,
2 water flows and water levels, water chemistry, sediment
3 chemistry, fish habitat, low atrophic organisms, which
4 include phytoplankton, which are small algae that exist
5 in the water column of the water -- of streams and
6 lakes, includes zooplankton, which are small
7 crustaceans, small animals that exist also in the water
8 column and its streams, largest -- larger benthic
9 organisms that exist in the substrate of the lakes and
10 streams, as well as forage and large bodied fish.

11 The selection of the key aquatic
12 components for the aquatics key lines of inquiry and
13 subjects of note were determined from various sources;
14 those include the issue scoping sessions with community
15 members, Federal and territorial regulators, and other
16 stakeholders, which provided the basis for identifying
17 and prioritizing issues and -- and important aquatic
18 components that are identified in the terms of
19 reference. As well, sources of information were
20 reviewed as part of the traditional knowledge study
21 program, which is outlined in Section 5.4.2.2 of the
22 EIS.

23 All the of the aquatic components were
24 characterized as being important components, but water
25 quality and fish were determined to be the most

1 important topics within the terms of reference for
2 these sections. Hence, their inclusion as key lines of
3 inquiry topics.

4 Therefore, for the -- for these key
5 lines of inquiry, the ultimate properties of water
6 quality and fish provided the basis of the assessment,
7 which resulted in the -- in the key -- in the key
8 assessment endpoints being the suitability of water
9 quality to support a viable aquatic ecosystem, and the
10 abundance and persistence of desired populations of key
11 fish species.

12 I'm on slide 10. The suitability of
13 water quality provides the basis for evaluating aquatic
14 ecosystems, to determine whether water quality during
15 each phase of the project, construction, operations,
16 and closure, and into the post-closure period, meets
17 acceptable levels for the protection of aquatic life.
18 Substantial changes to water quality may affect fish,
19 wildlife, and human health.

20 In order to determine the significance
21 of potential project effects to the suitability of
22 water quality, effects to the key aquatic components,
23 such as permafrost, groundwater quality and quantity,
24 water levels and flows, and water and sediment
25 chemistry, were evaluated. Its changes to these

1 components influence this assessment endpoint. For
2 example, changes in the quality and quantity of
3 groundwater provide measurement endpoints that they use
4 to assess effects to surface water quality, as an
5 example.

6 I'm now on slide 10. Fish are important
7 to traditional and non-traditional land users and also
8 provide a direct link between potential effects to
9 water quality and human health and wildlife health.

10 As for the suitability of water quality
11 assess -- as for the suitability of -- of water -- as to
12 -- as to the assessment endpoint that describes the
13 suitability of -- of water quality, the assessment of
14 potential effects to key aquatic components such as
15 water levels and flows, water and sediment chemistry,
16 lower trophic organisms, and fish habitat we use to
17 determine the significance of potential project effects
18 to the abundance and persistence of key fish
19 populations.

20 For example, fish habitat is important
21 to the sustainability and viability of fish, and
22 project activities that affect fish habitat will
23 ultimately affect fish. Similarly, measures, such as
24 environmental design features or mitigation taken to
25 reduce effects of fish habitat -- to a fish habitat, will

1 reduce effects to fish.

2 On slide 11. The key fish species that
3 we used in the key lines of inquiry as assessment
4 endpoints were Lake Trout, Arctic Grayling, and
5 Northern Pike. To focus this assessment valued fish
6 species were characterized as being important to
7 people, and these were selected from the list of fish
8 species that are present in Kennady Lake and downstream
9 waters.

10 The selection criteria that was used to
11 select these key fish species is outlined in Section
12 8.5 of the EIS. The cri -- criteria included
13 traditional importance of fish species to communities
14 which were indent -- which was identified through
15 traditional knowledge, as outlined in Section 5.4,
16 their current status with the Committee on the status
17 of endangered wildlife in Canada -- I think the acronym
18 is COSEWIC, COSEWIC -- the Species of Risk Act, SARA,
19 or the Government of the Northwest Territories. There
20 are no federally listed fish species in the local study
21 area, or regional study area, although Arctic grayling
22 are listed as sensitive -- as a sensitive species in
23 the Northwest Territory.

24 There are no other sensitive, or maybe
25 at risk species in the local study area, or the

1 regional study area.

2 Other criteria included evaluation of
3 the relative abundance and distribution of these fish
4 species in the project area, their unique life history
5 characteristics or requirements, and their current
6 ecological niche. Again, the detail around these
7 selection criteria are provided in Section 8.5.

8 There was another selection criteria,
9 which was the economic importance to traditional and
10 non-traditional land uses, such as commercial sport
11 fisheries.

12 At the time of the -- that the EIS was
13 submitted, there was no commercial fishery within the
14 regional study area. Therefore, the importance of a
15 fish species to commercial fishing was not included as
16 part of the selection process.

17

18 (BRIEF PAUSE)

19

20 MR. JOHN FAITHFUL: Lake trout is the
21 most abundant predatory fish species in Kennady Lake,
22 accounting for approximately 20 percent of the large
23 bodied fish community.

24 In addition, lake trout is one (1) of
25 the most highly valued fish species for food by communi

1 -- local communities who have fished in the Lockhart
2 River watershed. It is a prized fish species in the
3 Northwest Territory for resident and nonresident sport
4 anglers.

5 Its suitability as a key fish species is
6 that it completes all of its life history in lakes, so
7 it is appropriate for assessing changes to lake
8 environments on fish.

9 Lake trout is a cold water fish species,
10 sensitive to changes in temperature, dissolved oxygen,
11 and water quality. As it is a long-lived predatory
12 species, it's suitable for assessing the effects of
13 metals or other substances that have the potential to
14 bioaccumulate.

15 Also as a predatory species at the top
16 of the food chain, it's suitable for -- for assessing
17 changes in lower trophic levels in the forage fish
18 community.

19

20 (BRIEF PAUSE)

21

22 MR. JOHN FAITHFUL: Northern pike was
23 also selected as a key fish species. It's pop --
24 population is relatively small within Kennady Lake and
25 the downstream waters, and it's restricted to areas

1 where aquatic macrophytes exist.

2 It's also important to communities and
3 to Northwest Territories sport fishery. Its
4 suitability as a valued fish species is because it is
5 dependent on aquatic macrophytes for spawning, rearing,
6 and foraging, so it is an appropriate species for
7 assessing effects on fish from potential water level
8 fluctuations.

9 As pike are primarily a predatory fish,
10 it's appropriate for assessing changes in forage fish
11 communities in lakes and streams.

12 The project has the potential to affect
13 water levels in these small lakes, in addition to the
14 water level in Kennady Lake. Water level fluctuations
15 may increase or decrease on the -- the abundance of
16 aquatic vegetation in these lakes, and also their
17 distribution, hence its suitability as a valued fish
18 species.

19 Arctic grayling is an abundant large
20 bodied fish. It has an effluvial life history, which
21 means that it lives its life in lakes, but uses the
22 streams for spawning and rearing. It's rated as a
23 sensitive fish species in the Northwest Territories,
24 and it is important to communities and the Northwest
25 Territories sport fishery.

1 Its suitability as a valued fish species
2 is based upon its dependence of stream habitat for
3 spawning and rearing, so it is appropriate for
4 assessing effects from changes in physical and
5 hydrological characteristics of streams on fish, that
6 being changes in flows, water levels, channel regime,
7 water quality, and drift.

8 As juvenile Arctic grayling feed on
9 zooplankton, which are small crustaceans that live in
10 streams and in lakes, and adults primarily -- primarily
11 feeding on insects, it's appropriate for assessing the
12 effects on the lower trophic organisms.

13

14 (BRIEF PAUSE)

15

16 MR. JOHN FAITHFUL: I'm now on slide
17 12. It provides an overview of the pathway analysis.
18 As John Virgl presented on Tuesday, the evaluation of
19 project effects to the key aquatic components included
20 a screening level assessment which considered design
21 feat -- environmental design features and mitigation,
22 experience, traditional knowledge and science to
23 distinguish no linkage secondary, which are minor, and
24 primary pathways.

25 The pathway analysis considered

1 potential link -- linkages between the project and the
2 key aquatic components so that there is a project
3 activity. The pathways effectively show that work
4 between a project activity through to a change in -- in
5 the environment where -- where it is observed and an
6 effect to a valued component.

7 No linkage in secondary pathways are not
8 predicted to have significant residual effects on the
9 key aquatic components. The rationale for the -- for
10 their -- for their characterisation as a no linkage in
11 secondary pathway is provided in the EIS and they
12 cannot consider it further in the effects analysis part
13 of the assessment.

14 An example of a no linkage pathway is an
15 impediment. The pathway would be an im -- impediments
16 to fish passage as stream crossing may affect fish.
17 The environmental design feature that would limit or
18 mitigate that effect would be the installation of a
19 culvert across the stream.

20 When the culvert is installed over fish
21 bearing -- when the culvert is installed over fish
22 bearing streams that would allow fish passage upstream
23 and downstream across that -- between that culvert.

24 An example of a secondary pathway, the
25 pathway would be the release of sediment to Area 8

1 during the construction of a dike which may change
2 water and sediment quality and affect -- affect fish
3 habitat and fish.

4 The environmental design feature to
5 mitigate those effects of potential elevated suspended
6 sediment to area -- to the water in Area 8 would be the
7 use of silt curtains and monitoring to reduce the
8 potential for elevated total suspended solids extending
9 through Area 8.

10 There may be a minor change to -- and
11 localised change to total suspended solids around the
12 Area 8 where the silt curtain is presented, so it
13 presents a minor change relative to baseline conditions
14 or guideline levels; however, it would have a negli --
15 negligible residual effect on water quality.

16 Primary pathways require further effects
17 analysis and a classification to assist potential
18 significance of impacts to -- to the va -- valued
19 component assessment endpoints. This is consistent
20 with the assessment approach that John provided on
21 Tuesday and that which Cam and John described yesterday
22 for the terrestrial environment.

23 I'm now on slide 13. The next two (2)
24 slides are just going to provide an overview of the
25 study areas that have been used for the aquatics

1 assessment. They're typically consistent between some
2 of the aquatics components. However, there'll be
3 aquatics components, such as hydrogeology, that have a
4 -- have their own study area, and I'll leave those
5 discipline leads to -- to actually present the -- the
6 study areas as appropriate as they move through their
7 presentations.

8 It is common practice in environmental
9 assessments that regional and local study areas are
10 established. The study areas that -- that are common
11 amongst the aquatics disciplines are similar in size to
12 those that are used at other mine locations in the
13 region.

14 For the regional study area in this
15 assessment and for the majority of the aquatic
16 components in the assessments presented today, as I've
17 mentioned, the regional study area represents the
18 entire Lockhart River watershed to its outlet into
19 Great Slave Lake.

20 The regional study area was selected to
21 capture any effect that may extend beyond the local
22 study area that could potentially interact with other
23 existing and proposed development projects to
24 cumulatively affect hydrology, water quality, fish and
25 aquatic resources.

1 For those remote attendees, I'm pointing
2 to the slide -- pointing to the regional study area.
3 I'm pointing out the location of the Gahcho Kue project
4 area in relation to the -- the regional study area.
5 Flows from the -- the Kennady Lake watershed move
6 northwards to Aylmer Lake. They then exten -- extend
7 eastwards -- eastwards before moving south towards
8 Artillery Lake and then into Great Slave Lake.

9 The Lockhart River drains into the east
10 arm of Great Slave Lake. The area of the Lockhart
11 River system is 26,600 square kilometres and the area
12 of the Kennady Lake watershed is 32.5 square
13 kilometres, which represents .1 percent of the Lockhart
14 River watershed.

15 I'm now on slide 14. The local study
16 area extends from the outlet of Kennady Lake, which is
17 to the northwest side of the red watershed located at
18 the la -- the bottom of that diagram -- of that figure.

19 To the outlet of Kirk Lake to the north.
20 I think the outlet is just to -- in the second last
21 cell on the top right-hand side of the figure and
22 includes all of the associated watersheds such as the
23 end watershed, which is the watershed immediately to
24 the north of Kennady Lake watershed, as well as the 'L'
25 and the 'M' watersheds that drain to the northwest --

1 northeast, I should say, of Kennady Lake through Lake
2 410 into the P Lake watershed and then into the Kirk
3 Lake watershed.

4 This area was selected to capture direct
5 effects from the project with respect to hydrology,
6 water quality, and small scale indirect effects on the
7 environment such as changes to water quality from
8 deposition of air emissions and, therefore, represents
9 an appropriate study area for most of the surface
10 water-based disciplines.

11 As I mentioned before, some spatial
12 study area boundaries for other disciplines such as
13 groundwater and hyd -- hydrogeology are different. And
14 those study areas will be presented in -- in those
15 groundwater -- in those appropriate aquatic's
16 presentation.

17 That provides an overview and
18 introduction for the aquatics presentations that are
19 going to follow today.

20 Don Chorley with hydrogeology will be
21 the first aquatics discipline lead to present his
22 information. Thank you.

23 Chuck, if I may, I'll just make some
24 clarification. I think I alternated between describing
25 when John Virgl provided his assessment approach

1 presentation. I think I alternated between Monday and
2 Tuesday. It was, in fact, on Monday.

3

4 QUESTION PERIOD:

5 THE FACILITATOR HUBERT: Chuck Hubert.

6 Thanks for that clarification. Thanks -- and thanks
7 very much for the aquatics overview presentation, as
8 well. Perhaps we can entertain a -- a question or two
9 (2) if there are any from people in the seats. Go
10 ahead.

11

12 (BRIEF PAUSE)

13

14 MR. JULIAN KANIGAN: Good morning.

15 It's Julian Kanigan with Aboriginal Affairs. I just
16 had a question about the local -- well, the study areas
17 in general. So the local study area, did I hear you
18 say that it's meant to capture potential effects from
19 the air leading into water, basically, that pathway, so
20 any dust or air emissions that -- that could lead into
21 water quality effects?

22 MR. JOHN FAITHFUL: Thanks for your
23 question, Julian. John Faithful, Golder Associates.
24 From -- from a project -- project-based emission
25 source, Julian.

1 MR. JULIAN KANIGAN: It's Julian
2 Kanigan again. So what I -- I guess the gist of my --
3 where I was going with it was is -- to me it looks like
4 the local study area heads north and that's where the
5 water flows.

6 In terms of air though, it's not bound
7 by where the water's flowing. So could you maybe
8 discuss how -- or if the local study area is large
9 enough to capture, say, those concerns you might have
10 from air going to the south?

11

12 (BRIEF PAUSE)

13

14 MR. JOHN FAITHFUL: John Faithful,
15 Golder Associates.

16

17 (BRIEF PAUSE)

18

19 MR. JOHN FAITHFUL: John Faithful,
20 Golder Associates. Thanks, Julian. The air emissions
21 effects would be considered from the regional study
22 area point of view.

23

24 MR. JULIAN KANIGAN: It's Julian
25 Kanigan again. Just one (1) more followup. So I -- I
believe and -- and I'm thinking in terms of cumulative

1 effects now, that the Avalon project is in the same
2 general area?

3 I'm not sure, though, if it's in the
4 same watershed. So I'm wondering in terms of -- of
5 aquatic effects if that's been factored into your
6 assessment. They both flow into Great Slave Lake,
7 though, I believe.

8 MR. JOHN FAITHFUL: John Faithful,
9 Golder Associates. The local study area was defined by
10 the watersheds of the lakes and streams that may be
11 directly affected by the proposed project, and it
12 includes Kennady Lake downstream to K -- Kirk Lake.
13 Existing and planned projects in the Northwest
14 Territory are located outside the local study area. As
15 such, there is no opportunities for releases of those
16 projects to interact with those within the Kennady Lake
17 watershed downstream to Kennady Lake.

18 Consequently, there is no potential for
19 cumulative effects to water and fish in Kennady Lake
20 and downstream of Kennady Lake, as per our assessment.

21 THE FACILITATOR HUBERT: Chuck Hubert.
22 Thanks very much for the question and answers. Any
23 further questions from parties?

24 If not, I'd like to ask De Beers to
25 proceed then, with the next presentation topic, please.

1 PRESENTATION BY DE BEERS CANADA RE PERMAFROST,
2 HYDROGEOLOGY, AND GROUNDWATER:

3 MR. DON CHORLEY: Thank you, John. My
4 name is Don Chorley. I'm with Golder Associates, a
5 senior hydrogeologist there with thirty (30) years of
6 experience in hydrogeology, much of that in Canada and
7 much of the work in Canada in northern Canada.

8 I will be speaking about subject of note
9 permafrost, hydrogeology and groundwater. If we go to
10 slide...

11

12 (BRIEF PAUSE)

13

14 MR. DON CHORLEY: Okay. I'm on slide
15 18. And this is the introduction and it describes why
16 an understanding of hydrogeology is important to
17 protect the environment at this project.

18 The project will res -- result in
19 temporary changes to the local groundwater regime --
20 regime. An under -- understanding of these changes and
21 the quality and quantity of groundwater inflow to the
22 mine is required, so that the project can be developed
23 to be protective of the environment.

24 The projections of groundwater inflow
25 quality and quantity provide inputs in addition to

1 precipitation and surface water flow in the development
2 of the water management plan for the project, which is
3 also developed to be protective of the environment.

4 So the purpose of the hydrogeological
5 investigation and analyses is to assess these changes
6 and the groundwater inflow's qual -- quality and
7 quantity.

8 I'm on slide 19 now. This slide pro --
9 provides a summary of what our findings are and also
10 our approach. The rest of my presentation will look
11 into this in greater detail, provide the methods, and
12 detail on the findings.

13 Conservative assumptions were built into
14 our assessment to provide a high degree of confidence
15 that effects on groundwater quantity and quality and
16 surface water quality as a result of changes to the
17 groundwater have not been underestimated. And I'll
18 show you what those conservative assumptions are.

19 Mining will result in temporary changes
20 to the local groundwater regime. However, we have
21 found that no measurable differences in lake volumes
22 outside of the immediate Kennedy Lake area -- it's been
23 called the controlled area in the project description,
24 are projected to occur due to groundwater flow to the
25 mines. And we've also found the following mining

1 groundwater levels in quality will return to conditions
2 similar to those of current or baseline conditions.

3 I'm now on slide 21. This shows the
4 local study area for the hydrogeology. And as John
5 stated earlier it's different than the -- for the
6 surface water. The reason why is that in the North, in
7 areas of continuous permafrost, the catchment, if you
8 like, for the groundwater is different from the surface
9 water and that will become a little bit clearer when I
10 -- as we go through the slides. The area -- local
11 study area includes enough of larger lakes so we can
12 assess the regional flow directions.

13 I'm now on slide 22. The environmental
14 setting or the baseline is defined by published work
15 and various surveys in site investigations. Here
16 provides a list of the investigations that have
17 occurred on site basically from 1996 to late 2005.

18 I'm on slide 23. This is a map showing
19 the location of some of the boreholes. These are the
20 boreholes that are most important for us in terms of
21 the hydrogeology. There was a lot more boreholes than
22 this, but I want to just point out some of the ones
23 that are important.

24 Those of you that are not here, I'll
25 just say that there's four (4) Westbay instruments at

1 the site there on both sides of the Kennady Lake.

2 These are important monitoring wells because they have
3 multilevels, average about eleven (11) levels per well
4 and you can sample water at different elevations. So
5 it provides you depth and locations of chemistry and
6 you can see the variation of chemistry with them.

7 These ones are located -- oops, sorry.

8

9 (BRIEF PAUSE)

10

11 MR. DON CHORLEY: These wells are
12 located here at -- it's 136, which is north of the
13 campsite which is where the Gahcho Kue symbol is.
14 There is 238 which is mainly west, 24 -- 240 which is
15 southwest, and 239 which is close to the campsite.

16 In addition to this, the red triangles
17 are -- are deep thermistors so we can determine the
18 depth to the bottom of the permafrost and those are
19 located in the -- to the southwest of the camp. And
20 this -- this bisomber (phonetic) -- this thermistor is
21 to estimate the depth of the permafrost that is not
22 influenced by large lakes, and then we have one (1) in
23 each of the two (2) islands within Kennady Lake.

24 I'm on slide 24 now. In areas of
25 continuous permafrost the hydrogeology is controlled by

1 permafrost characteristics, distribution, and spatial
2 and temporal dynamics.

3 There is generally two (2) primary flow
4 regions in the -- in the Arctic in continuous
5 permafrost, and there is at this site. There's a
6 shallow groundwater regime, and this consists of an
7 active layer that is up to 4 metres deep -- thick at
8 the -- at the surface, and this is only unfrozen during
9 the warm months during the summer. And then there's a
10 deep groundwater regime that's below the permafrost,
11 and this is laterally continuous. And at this site
12 it's about -- the depth to the permafrost that is not
13 influenced by lakes is about 300 metres.

14 There is little hydraulic connection
15 between these two (2) regimes, and that's because of
16 the very low hydraulic conductivity of the permafrost.
17 I think a definition of hydraulic perma -- conductivity
18 would be appropriate here.

19 Hydraulic conductivity is the ability of
20 soil or rock to transmit water. So if you have a high
21 hydraulic conductivity you'll have -- you'll transmit
22 more water than a low hydraulic conductivity. Also,
23 permeability is often used interchangeably with
24 hydraulic conductivity, so if you have a high
25 permeability you'll transmit more water than a low

1 permeability.

2 Also important for flow -- groundwater
3 flow in the north is the taliks. This is unfrozen
4 ground below --beneath lakes -- large lakes. A lot --
5 taliks will develop under large -- large and deep lakes
6 that extend right down to the deep groundwater flow
7 regime, that regime that's below the permafrost.

8 I'm on slide 25. This is a schematic
9 that shows the groundwater regimes in the -- at the
10 site. What you can see is that -- whoops -- areas
11 located away from -- from the -- from the influence of
12 lakes, they have the deep permafrost; it's about 300
13 metres deep. Hearne Island, or one (1) of the islands
14 within Kennady Lake, it's influenced by the thermal
15 regime of the lakes, and so it's only about 100 metres
16 deep to the bottom of the permafrost.

17 Groundwater flow in the -- in the deep
18 groundwater regime is basically controlled by the --
19 just the elevations -- relative elevations of the lake,
20 so it flows from higher elevation lakes to lower
21 elevation lakes. Shown on here also is the active
22 layer. This very thin layer, the red layer.

23 I'm on slide 26. The shallow
24 groundwater, as I said before, is a seasonal flow.
25 It's about 4 metres thick. It basically follows the

1 topography of the -- surface topography, so
2 basically it flows downhill to -- to lakes in the area,
3 generally at rates of a few centimetres per day.
4 Shallow groundwater has very low salinity. Basically
5 it's fresh water, and is relatively uniform throughout
6 the local study area.

7 The deep groundwater, this is the
8 groundwater regime located below the permafrost, is
9 predominately controlled by lakes that have taliks that
10 extend through the -- through to the deep groundwater
11 flow regime. Laterally extensive, very slow because of
12 the low -- relatively low permeability. We're talking
13 about half a metre per year, so very slow.

14 On -- on this map, there's some
15 elevations. The elevations on the lakes on this map is
16 only lakes that have -- have taliks that extend down to
17 the deep groundwater regime, so for example there's a
18 lake towards the east of -- of Kennady Lake, and that -
19 - that lake is not large enough to have a talik that
20 extends down to the deep groundwater regime.

21 Based on this, as I said, the
22 differences in groundwater, the groundwater flow
23 directions are controlled by the differences in water -
24 - water levels in the lakes. Basically the flow from
25 Kennady Lake goes towards the east, or southeast on a

1 regional scale.

2 I'm now on slide 27. And this is --
3 this slide shows the hydrostratigraphy in -- at the
4 site. Hydrostratigraphy is really just soil or rock
5 units that are of importance to groundwater flow. And
6 so we've divided it in a number of zones here.

7 First there is a till which is at the
8 bottom of the lakes and on the surface, a thin veneer
9 of -- of till. Then there is the shallow exfoliated
10 rock. Now, exfoliated rock developed because this area
11 was covered by a thick sheet of glacial ice, and when
12 the glacial ice melted a portion of the outer surface
13 of the bedrock, because of release of pressures, is a
14 little bit more fractured than the -- than the deeper
15 bedrock. So this is more permeable than the deeper re
16 -- at -- at the site it's -- we estimated it's about 60
17 metres deep, this exfoliated rock.

18 Then we have the deep competent bedrock
19 below this exfoliated rock. And what we have found is
20 that the bedrock, generally this is -- we see this at
21 all places. It -- it generally becomes less permeable
22 with depth, and this is because the way the rock on top
23 tends to squeeze the -- the fractures. So we have seen
24 this at this site too.

25 The next one (1) is the kimberlite,

1 which is relatively low permeability. The contact
2 zone. The contact zone around kimberlites tend to be
3 higher permeability than the -- than the competent rock
4 and the kimberlite, and they are here.

5 And structures. I -- the next slide,
6 slide 28, talks a little bit more about these
7 structures. There's some structures -- primary and
8 secondary structures have been identified by geophysics
9 but also confirmed by boreholes.

10 Primary structures are considered to be
11 -- are interpreted to have continuous strike extensions
12 greater than tens of kilometres. So that means they're
13 continuous over that. Those areas where it is
14 secondary tends to be a little bit more local, so
15 they'd be in kilometres.

16 There was -- there's two (2) secondary
17 faults in the structures in the -- at the site that
18 have been identified, and those are the ones through
19 the Hearne pit and through the 5034 pit. A primary
20 structure has been identified through the Tuzo pit.
21 There was a number of boreholes intersected the --
22 these structures at this site, but they found that the
23 permeability was very similar to the competent rock.

24 Slide 29. Slide 29 presents a graph
25 showing that the -- how the TDS increases with depth in

1 the north. Basically, all over the Canadian Shield,
2 which extends from Ontario, Quebec, Manitoba, up into
3 the north, this has been found, that there's TDS
4 increases with depth, basically related to very ancient
5 water that has diffused up.

6 The shallow groundwater samples
7 collected from water wells in the active layer, this is
8 basically freshwater in the local study area. The deep
9 groundwater, we produced a profile here, and you can
10 see on the graph that the TDSs along the top increasing
11 and depth is along the left side.

12 So as you increase the -- the depth of
13 the project is about here, 300 metres. The pit's about
14 300 metres. It's about four thousand (4,000) -- a TDS
15 of four thousand (4,000). What we -- we produce this
16 profile so that we can actually simulate it in the
17 numerical values, and I'll discuss how we do that a
18 little bit later on.

19 How we defined this profile is based on
20 data from the site if it goes down to about 500 metres
21 depth. And then we tied it into data from other sites.
22 It's pre -- pretty consistent in -- in the Canadian
23 Shield that you get this profile. There's a number of
24 profiles here, Diavik, Lupin, a lot of data from Lupin,
25 Meadowbank. But the -- the one (1) that we have chosen

1 is that one (1) to the -- the black line.

2 Also what we do is -- the relationship
3 of other water quality constituents are -- are -- that
4 change with depth are correlated to this TDS, so we can
5 use that. Some of the constituents don't vary with
6 depth.

7

8 QUESTION PERIOD:

9 THE FACILITATOR HUBERT: Chuck Hubert,
10 Review Board. I'm going to stop you right there. It's
11 about twenty (20) after 10:00. Thanks for the
12 presentation. I especially liked your defining of
13 terms, very good, and I'm sure that's very helpful.

14 But before we break I'd like to
15 entertain a few questions from parties, if they're out
16 there, on this latest segment of the presentations.

17 MR. STEVE ELLIS: Yes, Steve Ellis,
18 with Treaty 8 Tribal Corporation. When I say, Treaty 8
19 Tribal Corporation, Akaitcho Dene means the same thing,
20 so sorry for confusing that. I confuse even myself
21 sometimes with that.

22 Just with regards to permafrost, I'm
23 just trying to find the reference in here. Just can --
24 can you go through the studies that were used to
25 characterize the permafrost regime around Kennady Lake?

1 There's some reference in here on one
2 (1) slide to a 2004 study, but I'm not sure if there's
3 more, or if that's it.

4

5 (BRIEF PAUSE)

6

7 MR. STEVE ELLIS: Yeah, Steve Ellis
8 here. I found the reference here. It's pa -- slide 22
9 where it speaks to the baseline studies at Kennady Lake
10 area. The only one (1) that says permafrost is the
11 2004 study.

12 I'm just wondering if any of the other
13 ones provided information that helped in the
14 characterization of the permafrost regime.

15 MS. VERONICA CHISHOLM: Veronica
16 Chisholm, from De Beers. Thanks, Stephen, that's a
17 good question. We would like to spend a bit of time
18 sort of getting a thorough answer for you, so we'd like
19 to either do that after lunch. Okay?

20 MR. STEVE ELLIS: Just the reason that
21 this is important for me anyways, is that on slide 24,
22 if we can go there, it says that...

23 Yeah, just when we're talking about the
24 shallow groundwater regime and -- and the active layer,
25 it says:

1 "Ephemeral system that is only
2 unfrozen during summer."

3 I had, I guess, the fortune last week to
4 sit through a series of presentations about the active
5 layer currently in the Northwest Territories from a
6 bunch of permafrost scientists with INAC actually.

7 And they've come to the conclusion that
8 in many areas throughout the Northwest Territories,
9 especially up and down the valley, and around the
10 Yellowknife area, that the active layer is not freezing
11 at all in many areas.

12 And those of us that live in and around
13 North -- Yellowknife remember what happened at Baker
14 Creek with the -- essentially the -- a big ice jam
15 filling up, and that was because the -- the water
16 through the active layer was flowing all -- all winter
17 long.

18 So that is clearly of concern. If -- if
19 climate change is imp -- is having impacts up here and
20 is resulting in a active layer that is not freezing
21 completely, or at all during the winter months, that,
22 from our perspective, would dra -- would drastically
23 change the -- the -- the shallow groundwater modelling
24 regime.

25 So I think that's why it's important to

1 understand where this information came from.

2 MS. VERONICA CHISHOLM: Veronica
3 Chisholm, from De Beers. So just to clarify your
4 question, Stephen, it's to provide some of the baseline
5 references and information around Kennady Lake?

6 MR. STEVE ELLIS: Yeah, Steve Ellis.
7 Yeah, that's exactly correct. Just understand what
8 studies, and if you could even provide the references
9 to those studies, just indicating how the permafrost
10 regime in and around Kennady Lake was characterized,
11 so.

12 That -- you know, you're basing a lot of
13 your re -- or your conclusions on -- on some
14 assumptions that the permafrost regime is frozen for
15 most of the year, so we'll look into that.

16 MS. VERONICA CHISHOLM: Veronica
17 Chisholm, from De Beers. We'll provide a response to
18 that question, a response after lunch. Thanks.

19 THE FACILITATOR HUBERT: Thanks very
20 much. Chuck Hubert, with the Review Board. Thanks
21 very much for those questions and responses. I'd like
22 -- okay. Go ahead.

23 MR. JULIAN KANIGAN: Thanks, Chuck.
24 It's just -- it's a follow up for Steve's question.
25 It's Julian Kanigan with AANDC. One (1) area that

1 we've -- we've kind of been looking at in the EIS and
2 wondering if maybe we're not finding it is climate
3 baseline data for the site.

4 So when I say climate I mean air
5 temperature and precipitation, those type of things
6 that you would capture with the MET Station. The
7 reason I ask and why it's pertinent to this question
8 is, in order to know what's going to happen in the
9 future with climate warming we need to know what the
10 conditions are currently at the site. And so I --
11 probably it's in the documents somewhere and maybe you
12 could just provide me with the reference.

13 MR. NATHAN SCHMIDT: Nathan Schmidt
14 from Golder. The climate baseline is -- is
15 incorporated in the hydrology section. So in Annex H,
16 Section H-4, there's a discussion of -- should be what
17 you're looking for.

18 MR. JULIAN KANIGAN: Thanks, Nathan.
19 It's Julian Kanigan again. Just to clarify, it's data
20 that's been collected at the site?

21 MR. NATHAN SCHMIDT: There's site
22 specific data collected on site as well as regional
23 data. Nathan Schmidt.

24 THE FACILITATOR HUBERT: Chuck Hubert,
25 Review Board. Another question from -- please approach

1 the microphone and state your name, please.

2 MS. VELMA STERENBERG: It's Velma
3 Stevenb -- sorry, Velma Sterenberg from AANDC minerals.
4 I have a comment and two (2) questions if we have time
5 for that.

6 First of all, I'd like to say how happy
7 I was to see that Golder put bore holes down the
8 primary and secondary structures. It's very gratifying
9 to see that those structures are being looked at.

10 My first question would be: What was
11 the density of the bore holes along the structures with
12 regard to the proximity to the pipes? And could you
13 perhaps provide that information later, if -- because
14 it's probably a little bit too involved a question to
15 answer immediately?

16 MS. VERONICA CHISHOLM: Veronica
17 Chisholm, from De Beers. Yeah, we'll -- we'll look for
18 that response and provide that. I -- I'm sorry, if --
19 can you just clarif -- can you just restate that
20 question?

21 MS. VELMA STERENBERG: Okay. What was
22 the density of bore hole studies relative -- along the
23 primary and secondary structures, based on proximity to
24 the pipes?

25 And the second question I have is based

1 on observations of various mines in the Shield and off
2 the Shield in the Northwest Territories and Nunavut.
3 And I was wondering if Golder had a chance to look at
4 some of the conjugate fractures -- fracture systems and
5 the movement of groundwater in some of those systems as
6 well as primary and secondary structures?

7 And did they have to -- I mean, that
8 would be a fairly intensive survey, but there should be
9 some kind of fracture set related to the local study
10 area and was that looked at?

11 MR. DON CHORLEY: Yes. Don Chorley
12 with Golder. We did look at some of the other ones.
13 There's some minor structures that have been identified
14 between the -- between the pipes.

15 And I was just going to say something
16 about your other question. It's too bad we didn't get
17 on to the assessment, because that might answer some of
18 your -- your -- because what we do in the assessment,
19 we actually assume that those structures are permeable.
20 Okay? Thank you.

21 MS. VELMA STERENBERG: Velma
22 Sterenberg, AANDC. Thanks very much for your
23 information. I look forward to the rest of the stuff.

24 THE FACILITATOR HUBERT: Chuck Hubert,
25 Review Board. Yes, thanks for that response and we'll

1 perhaps defer further questions until the -- your next
2 part of your presentation.

3 In the meantime, it's 10:30. Oh...

4 MR. PAUL GREEN: It's Paul Green with
5 Aboriginal Affairs water resources. This is just a
6 follow on to what Stephen was talking about. Just a
7 comment that one (1) of the implica -- like, there are
8 several implications that the permafrost isn't freezing
9 back. There's both the -- the actual volume of water
10 movement and timing, we well as some water quality
11 implications related to ions and nutr -- nutrients
12 movement through the active layer. So just comment,
13 just a comment that those are areas to consider.

14 THE FACILITATOR HUBERT: Chuck Hubert,
15 Review Board. Thanks. And with that, we'll take a
16 fifteen (15) minute break. It's 10:32 right now. So
17 see you in fifteen (15) minutes.

18

19 --- Upon recessing at 10:32 a.m.

20 --- Upon resuming at 10:51 a.m.

21

22 THE FACILITATOR HUBERT: Chuck Hubert
23 with the Review Board. Welcome back, everybody. I'd
24 like to give De Beers the opportunity to continue with
25 their presentation, Assessment Methods and Findings

1 from Hydrogeology.

2 Please proceed.

3

4 CONTINUED PRESENTATION BY DE BEERS CANADA RE

5 PERMAFROST, HYDROGEOLOGY, GROUNDWATER:

6 MR. DON CHORLEY: Thank you. This is
7 Don Chorley of Golder.

8 I'm on slide 31 now. Now the
9 groundwater quantity and quality model was developed
10 using MODFLOW and MT3D. This was used to evaluate the
11 effects to the surrounding lake levels, effects to
12 surface water quality.

13 The groundwater model was designed to
14 project the following: quantity of groundwater
15 reporting to the pits during operations and closure,
16 projected concentrations of total dissolved solids in
17 the groundwater inflow, and projected contribution from
18 the lake water, Kennady Lake.

19 I'm on slide 32. And this is actually
20 an animated slide. So unfortunately, the people that
21 are not here won't be able to see the animation. The
22 first -- the first part of this animation is what we
23 saw before which is the baseline conditions, the
24 groundwater conditions. And the second part of the
25 animation is what happens when the pit is -- open pit

1 is put into -- in the mine. It causes some reverse in
2 flow. I'll try to explain this to the people that
3 aren't here. It causes reversal in flow as the
4 groundwater is induced to flow into the pit.

5 I'm on slide 33 now. Now this just
6 shows a 3-dimensional projection of the numerical
7 hydrogeologic model. Now what the numerical model
8 does, it's -- it's built within the computer and it's -
9 - you put all of the information you've learned from
10 the baseline conditions into the model. For example,
11 the elevations of the lakes with those thru taliks, the
12 extent of the permafrost, the hydraulic --
13 hydrogeologic parameters that hydraulic conductivity
14 values, and all those different layers that I talked
15 about, the till, the exfoliated bedrock. It also puts
16 in the total dissolved solids with depth profile.

17 So we look at what the initial
18 conditions are and then we put the mine plan in and see
19 what the -- and simulate the mine plans to predict or
20 project what the inflows to the mine are, both quality
21 and quantity.

22 Okay. Now, I said in summary at the
23 front that we used a very conservative approach, that -
24 - and this -- this discusses it. Remember that
25 hydraulic conductivity is a measure of the ability of a

1 soil or rock to transmit water. So if you -- if you
2 assume a higher hydraulic conductivity, then it's going
3 to be higher inflow, and actually higher upwelling from
4 the higher TDS water.

5 What we've done at the site, as -- as I
6 said, a conservator -- conservative approach was used
7 in applying these hydraulic conductivity values.
8 First, we increased the geometric average of the
9 hydraulic conductivity of the -- all units, except the
10 potential permeability zones and the exfoliated rock
11 where the -- the increase was greater by a factor of
12 three (3). So most of the rocks we increased it by a
13 factor of three (3); three (3) times.

14 We assumed the bedrock structures even
15 though we did not measure that there was an enhanced
16 permeability zone within those structures. We assumed
17 that these structures were permeable, and that they
18 were 30 metres wide. That's based on experience with -
19 - with diamond mines in -- in the north.

20 We assigned arithmetic averages of
21 hydraulic conductivity. What arith -- arithmetic average
22 does is it -- it -- if you have a range of values it
23 tends to use the highest values. It tends to be
24 towards the highest values for those that you measured
25 in those units. And we used those for both the -- the

1 exfoliated rock and the enhanced permeability zones,
2 which are the structures -- related to those
3 structures. And we assume in the model that those
4 structures are continuous over long distances.

5 Also important for the -- for the TDS
6 upwelling from the deep -- deeper more higher TDS
7 water, we assumed that the hydraulic conductivity below
8 500 metres was basically the same as that -- it is at
9 500 metres depth. In reality, we expect the -- the
10 permeability to get less with depth. What this does is
11 it allows -- the simulation allows more of that TDS
12 water to -- to move up into the mine.

13 That's when I was talking about those
14 potential enhanced permeability zones, basically those
15 primary and secondary structures. We just assumed that
16 they were continuous and under -- under Kennady Lake.
17 That's where the -- it's most important because that's
18 where most of the flow is going to be, is from the water
19 management pond, and 30 metres wide.

20 I'm on slide 36, and this just shows our
21 finding. This is a table, and it's -- I just want to -
22 - this table just shows the detail in which the -- the
23 mine plan was simulated in the model. Basically the --
24 if you look at the first column where it's predicted
25 inflows, the 5034 pit is developed first. And the

1 inflow is -- increases until about year 5 when the
2 Hearne pit starts to get online, and then the Hearne
3 pit has taken some of the water that's -- would
4 normally flow to the -- to the five thirty-four (534).

5 Similarly, the Tuzo pit is developed
6 last, and it starts affecting the inflows in the other
7 two (2) pits. Also on this is the TDS that is
8 estimated for the -- each of those pits, and so they --
9 they vary from up to fifty-two hundred (5,200) parts
10 per million of TDS.

11 Also on here is a lake contribution.
12 Now, this might be a little bit clearer when -- when
13 Michael talks about the GoldSim model because what this
14 does is it provides a back loop for the GoldSim model.
15 For example, you'll be discharging this water into the
16 water management pond, and then some of that water will
17 be coming back into the -- into the pits, so it will be
18 picking up TDS. And so that provides that loop percent
19 contribution. Almost all of this water is coming from
20 the area, what is called Area 35, in the water
21 management plan.

22 The final columns are -- are just the
23 pit elevations that were simulated in the mine plan.
24 The ones that have the 'A' on it is the -- some of the
25 pits starts to -- water -- the water level starts

1 recovering in those pits, and that's just the water
2 level, because that's what's important for the -- for
3 the simulation of inflows.

4 As I said, these prediction of inflows,
5 TDS concentrations and percent lake water, are used as
6 input to the GoldSim model, which is kind of --
7 calculates the concentration in the surface water.

8 I'm on slide 38. We did some
9 sensitivities too to get a handle on what -- how they
10 could vary. Model sensitivity number 1, what we looked
11 at -- oops. Sorry -- sorry, slide 37. Okay, we un --
12 undertook two (2) sensitivities.

13 One (1) is we looked at -- to any
14 testing we did at that potential permeability zone
15 indicated that it was similar to the competent rock, so
16 we took that out. We realized that this would be kind
17 of the lower bound case of the inflow and -- and
18 effects.

19 Sensitivity 2, we also kept that
20 potential enhanced permeability zone out, so we ha --
21 made it the same as the hydraulic conductivity of the
22 competent rock, but we increased the -- that TDS
23 profile by twice as much. So we'll show you the
24 results of that.

25 Part of the -- the reason we didn't do -

1 - increase the TDS and leave the enhanced permeability
2 zone in there is because I said before that we were
3 very conservative on the hydraulic conductivities. And
4 if you start -- if you are conservative on the
5 hydraulic conductivities and conservative on TDS, then
6 you're going to end up with something that's overly
7 conservative because that upwelling really relies on
8 that hydraulic conductivity. And if you're
9 conservative -- you've got conservatively high
10 hydraulic conductivity in the deep zone, then it's
11 going to allow a lot more to -- to flow up into the --
12 the mine. So I -- we considered that to be overly
13 conservative.

14 What we found was that -- model
15 sensitivity 1, this is where we just removed the
16 enhanced permeability zones, make them the same as the
17 background. As expected, we get generally 40 percent
18 less inflow and the predicted groundwater quality is
19 somewhat better, but not -- a little bit lower
20 concentrations of TDS.

21 Sensitivity number 2, it protects TDS
22 concentration -- concentrations, not -- not
23 unsurprisingly, about one point five (1.5) to two (2)
24 times greater than the base case model. But the
25 overall TDS, because the inflow is less, inflow

1 quantity is less, is very similar to the base case.

2 Now, when you -- at closure what will
3 happen is that the -- the Tuzo pit will be slowly
4 filled with water over a nine (9) year period. What
5 happens is, as the pit is being development it induces
6 groundwater flow to go up into the -- up into the mine.

7 Once the water level in the -- in the
8 pit has reached, basically its current conditions, what
9 happens is that you have this heavier TDS water that
10 wants to sink by gravity because there's no other --
11 there's not a hydraulic gradient any -- anymore, so it
12 -- it wants to sink down back to where it was before.

13 How to analyze this, we had to use a
14 density dependent model. This is FEFLOW. So FEFLOW
15 looks at both groundwater flow due to hydraulic
16 gradients and then looks at -- at the TDS due to
17 density gradients, basically wanting to flow down.

18 The next slide, this is 40, it just goes
19 through the sequence of what you would see at the Tuzo
20 pit. First of all, this has got the current
21 conditions. You have higher TDS groundwater at depth.

22 The next slide, 41, shows when the pit
23 is completely developed. You have this higher TDS
24 water that moves upward due to hydraulic gradients.
25 Okay? So it's moving up. Those overwhelm the density

1 gradients. This is during mining.

2 42 is when we start closure. So there's
3 water going into there over that nine (9) year period.
4 As the water starts filling up the pit, the hydraulic
5 gradient becomes less and you start to get these
6 density gradients that wants to pull that TDS down.

7 This -- slide 43, is near the end of
8 closure, when the pit is completely flooded. There's
9 still a little bit of -- of flow due to the hydraulic
10 gradient, but it's starting to be dominated by the
11 density gradients that wants to sink that down.

12 And finally, the -- 44 is the post
13 closure. That the -- the TDS has -- has, after a
14 period of time, has gone pretty close to present
15 conditions -- gone back to present conditions.

16 And slide 45, this just shows the -- the
17 model grid that was used for assessing the -- that post
18 closure condition. It's got permafrost in it, section
19 through there -- density.

20 Slide 46 presents the results of this
21 density model, and it's groundwa -- in the first one
22 hundred (100) years, groundwater inflow rates to the
23 flooded pit -- this is due to density, it wants to go
24 into the flooded pit, varies from .5 metres cubed per
25 day to 3 metres cubed per day.

1 The higher end is -- is mostly within
2 the first year. The lower end is for most of the rest
3 of the hundred years. Just to give you some idea of --
4 of these values, the high end, 3 metres cubed per day.
5 An average home faucet when it is open full, is about
6 40 metres cubed per day. So that's more than ten (10)
7 times more than that -- that value right there. And
8 it's a hundred times more than the -- the low end of
9 that. About a hundred times more.

10 So -- and we also predicted what the TDS
11 flux into the pit -- flooded pit. It ranged from 300
12 grams per day to 4,500 grams per day. The higher value
13 occurring in the first year and then getting less and
14 getting to 300 grams per day.

15 What -- these values were then used in
16 the hydrodynamic model to estimate what the -- what the
17 stratification was in the -- in the pit -- in the Tuzo
18 pit. And that'll be discussed later.

19 Slide 48 is just an assessment summary.
20 The project will have a negli -- a negligible effect on
21 groundwater quantity. And there was no measurable
22 differences in lake water volumes outside of the
23 controlled area in our simulations.

24 Conservative assumptions is built into
25 the model to provide a high degree of confidence that

1 effects on groundwater, both the quantity and quality,
2 and surface water quality as a result of these changes
3 in groundwater, are not underestimated. And here's an
4 example. We used the upper bounds of the hydraulic
5 conductivities. We assumed that those enhanced
6 permeability zones were there.

7 Simulated groundwater inflow results and
8 concentrations will be validated during operational
9 monitoring, and this will give us an opportunity to
10 optimize the water management system.

11 That's the end of my presentation.

12 Thank you.

13

14 QUESTION PERIOD:

15 THE FACILITATOR HUBERT: Chuck Hubert,
16 Review Board. Thanks very much for that. I'd like to
17 open it up to the floor for a few minutes of questions,
18 at least. If anybody has a question, raise your hand
19 and state your name prior to the question, please.

20 MR. MARK CASAS: Yeah, thank you. Hi,
21 my name is -- sorry -- Mark Casas. I'm with the
22 Mackenzie Valley Land and Water Board and I just -- I
23 just have one (1) quick question about -- it sort of
24 relates more towards the closure of the -- I'm trying
25 to find the page that had it -- where you're talking

1 about after -- as the pit is filling that it's going to
2 be based mo -- mostly the -- on the density -- it'll be
3 separated by density.

4 And I was wondering in terms of the pit
5 filling, what -- like, I guess a lot of that density is
6 based -- it's assuming that the water that's going into
7 the pit is -- is relatively low in TDS.

8 Is that right? In order to make that,
9 that gradient, like, strong enough to keep the -- the
10 TDS water in the bottom, and then the water going in
11 would have to be of a low TDS.

12 So I'm wondering how you determine the
13 TDS of the water going in, like, that's going to fill
14 the pit?

15 MR. DON CHORLEY: Okay. Well, first --
16 sorry, Don Chorley of Golder.

17 That -- that simulation is continuous.
18 We used the MODFLOW model to predict where the various
19 TDS is so that -- that'll -- and then we used that as
20 initial conditions in the FEFLOW model so that that
21 density is covered there, right.

22 So what you'd look at is that it knows -
23 - the model knows that what the density is at various
24 points along the pit and that's actually what's
25 simulated in the hydrodynamic model.

1 I don't know if I answered your...

2 MR. MARK TASIS: Yeah. Mark Tasis.

3 Yeah, I -- I'm not sure either. I think -- I think so.

4 I guess -- yeah, what I'm saying is I'm not sure how it

5 -- how it can predict the -- the densities of that

6 water if its not sure what the -- like, we don't really

7 know what the TDS is going to be like when that water

8 fills us, right. There's also going to be -- it's

9 probably going to be of a higher TDS than -- than it is

10 right now because I'm assuming it's going to be filled

11 with water that -- that's been let back into the --

12 into the area that's been de-watered, right.

13 So I guess that's where I'm getting at

14 is that it's not -- it's not fresh, really low TDS

15 water. It could actually have a reasonably high TDS,

16 in which case there won't be as strong a gradient to

17 keep --

18 MR. DON CHORLEY: I understand.

19 MR. MARK TASIS: Okay. Thanks.

20 MR. JOHN FAITHFUL: Thanks, Mark. John

21 Faithful. So you -- you're correct. The -- the pit

22 inflows are going to be dominated by the surface water

23 which are going to have a low TDS. And that that

24 gradient will be generated and the hydrodynamic model

25 will develop that -- that gradient differential in

1 terms of its modelling.

2 MR. MARK TASIS: Yeah, Mark Tasis here.
3 I guess, I don't -- how do -- how do we calculate or
4 how did you guys calculate the low -- low TDS for the -
5 - for the water to go in the pit?

6 I guess that's -- that's just my -- I
7 mean, I don't think we necessarily have to answer this
8 right now. It's just sort of something to -- to keep
9 in mind in terms of -- of when determining whether all
10 the TDS is going to stay in the bottom of the pit, it -
11 - it certainly will depend on -- on the TDS or -- or
12 density of -- of the water that's -- that's being put
13 in there. So that's just -- that's just a -- a concern
14 I wanted to raise, that's all.

15 Thank you.

16 MR. JOHN FAITHFUL: Thanks, Mark. The
17 -- the TDS concentrations in the -- in the surface
18 water inflows were modelled in the water quality model
19 that, Mark (sic) Herrell will speak to in a little
20 while and that will be for during both operations and
21 in early stages of the closure when the pit is actually
22 being refilled.

23 John Faithful, Golder Associates.

24 THE FACILITATOR HUBERT: Chuck Hubert,
25 Review Board. We look forward to that presentation or

1 discussion to come.

2 Any further questions?

3 MR. PAUL GREEN: It's Paul Green with
4 Water Resources. Just a quick one (1).

5 The -- the slides appear to assume it
6 was going to be a pit, sort of empty at the end of --
7 of -- when the -- when the groundwater began to refill.
8 But I understand some of the pits will actually have
9 some fine processed kimberlite, perhaps some waste rock
10 in the bottom.

11 Will -- how -- will that change or what
12 will that -- how will that effect the assumptions
13 you've made on -- on the refilling or what -- I guess,
14 what -- how will that be different than a pit with
15 nothing in it when it comes to the -- to the TDS and
16 the groundwater coming back in, if at all?

17

18 (BRIEF PAUSE)

19

20 MR. JOHN FAITHFUL: John Faithful,
21 Golder Associates. Thanks, Paul. Can you -- can you
22 restate your question, and just clarify the -- whether
23 you're talking about im -- impediments to inflows from
24 the groundwater in terms of what Don presented?

25 MR. PAUL GREEN: I'm not sure that I'm

1 referring to impediments. I'm just -- I'm just under -
2 - my understanding was that many of the pits will have,
3 you know, fine process kimberlite in them.

4 And I was just wondering if your slides
5 would look any different, or if your -- your
6 description would have been any different if, you know,
7 assuming fine kimber -- fine process kimberlite in the
8 bottom of the pit, or if that won't really affect the -
9 - the infilling at all, or your assumptions on the
10 whole.

11 That's -- that's just kind of what I was
12 curious.

13 MR. DON CHORLEY: Don Chorley. It
14 won't affect the infilling. In fact, if you have some
15 sediment there, then -- then the lake dynamics get a
16 little bit different because, you know, you have a
17 smaller amount of actual lake in there, open water, if
18 you like, water column, but it won't affect the -- the
19 inflow estimates or anything like that.

20 I showed on that one (1) really complex
21 table that we actually accounted for the water levels
22 coming up in -- in the other pits in the Hearne, and
23 5034, and in Tuzo, the water level recovering.

24 Yes, this -- this one (1) here, the
25 water level recovering over time, that's what those --

1 the superscript 'A' means, that -- it means that's not
2 the bottom of the pit, it's -- it's the pit starting to
3 recover.

4 MR. PAUL GREEN: Okay, thank you.

5 THE FACILITATOR HUBERT: Chuck Hubert,
6 Review Board. I'll end the questions there in the
7 interests of time, and -- and ask De Beers to continue
8 with presentation, I believe hydrology.

9

10 PRESENTATION BY DE BEERS CANADA RE HYDROLOGY:

11 MR. NATHAN SCHMIDT: Nathan Schmidt
12 with Golder Associates, and I'll be addressing the --
13 the hydrology component of the project.

14 So starting on slide 50, I just want to
15 give a bit of an outline of the presentation. I'll be
16 starting with a bit of an introduction, talking about
17 the terms of reference, sections of the EIS, and a bit
18 of an overview, then moving into environmental setting,
19 talking about the study areas. There's a bit of
20 overlap with what John Faithful presented this morning,
21 so I'll try to be brief on that.

22 And from there, getting into the meat of
23 it with the assessment approach and results. We'll be
24 talking, you know, first about the approach, and then
25 by project phase we'll be talking about activities of

1 the project, including the mitigation measures that
2 we're implementing to protect the environment, and then
3 the corresponding effects on -- residual effects on
4 water level and flow, and also effects on channel and
5 bank stability. At the end we'll have a bit of a
6 summary of the results.

7 So moving onto slide 51, based on the
8 terms of reference, you know, we're really interested
9 in looking at from a hydrological perspective how this
10 affects water quality and fish in Kennady Lake, and
11 also downstream water effects beyond Kennady Lake.

12 So some of the excerpts from the terms
13 of reference that, you know, guided our assessment are,
14 you know, describing the water balance of Kennady Lake,
15 and provided water balance calculations for present
16 conditions and over time as the project proceeds, and
17 comparing those to baseline conditions.

18 That allows us to evaluate the changes,
19 and to pass that information down to the water quality
20 team, and to the fisheries team as input into their
21 evaluations.

22 One (1) of the things that -- that was
23 key here was for the fisheries assessment, you can see
24 in that third sub bullet:

25 "Include a detailed assessment of

1 impacts on aquatic life that
2 considers timing and levels of
3 increased flows."

4 So we had to approach this at a fairly
5 fine time scale, and I'll get into how we did that when
6 I get into the approach section.

7 So on to slide 52, a bit of a summary of
8 what we presented in the EIS. We identified residual
9 effects on flows, water levels, channel and bank
10 stability for water bodies in the Kennady Lake
11 watershed and downstream watersheds. Those effects
12 were used as an asse -- as inputs to the assessment of
13 impacts on water quality in fish, and also on
14 downstream watersheds. And essentially what we found
15 was we don't expect any significant adverse impacts
16 because of the mitigation measures that are applied
17 during the project.

18 So moving into the environmental
19 setting, you've seen slide 54 there already in John's
20 presentation this morning, but I do want to restress
21 that the area there where the Gahcho Kue project is
22 located is a very small part of the overall Lockhart
23 River basin. They number, it -- it's just over .1
24 percent. The Kennady Lake watershed is about .1
25 percent of the total drainage area of the Lockhart

1 River where it enters Great Slave Lake.

2 Our local study area -- and for those of
3 you that are there remotely, I'm just kind of circling
4 the -- the tan coloured lobe on the western portion of
5 the -- the watershed map. Our local study area is only
6 about 3 percent. So once we get to the end of our
7 local study area our effects on hydrology are quite
8 small, and a quite small affect on 3 percent of the
9 watershed translates into a much smaller effect on the
10 entire watershed.

11 Now zooming in a little bit to that
12 local study area on slide 55 -- okay, I apologize.
13 We're missing a slide here, but it is actually a repeat
14 of the -- the local study area that was shown -- was
15 shown in John's presentation this morning, so it can be
16 referenced as the local study area map. And it just
17 provides a little more detail.

18 The real key point that I wanted to make
19 on that local study area map was that downstream of the
20 site within the local study area we have the -- the
21 flow from the Kennady Lake watershed goes through the
22 'K', 'L' and 'M' watersheds. The 'N' watershed flows
23 in parallel to that and they meet at Lake 410.

24 Okay, so some of our water transfers
25 that we're talking about here during de-watering and

1 during refilling of the lake are actually internal to
2 our LSA and, you know, quite a ways upstream of the
3 boundary of our LSA at the Kirk Lake outlet. Okay.
4 And just to be clear, that's slide 17 in the -- the
5 proceeding presentation that describes the local study
6 area.

7 Now moving on, slide 55, talking a
8 little bit about the environmental setting, we do have
9 quite a bit of site specific local baseline data that
10 have been collected over the years starting in 1996 and
11 going right through to -- to this year. These include
12 climate data, hydrometric data, including flows and
13 water levels, lake bathymetry data. We have stream and
14 lake shoreline geomorphology data. And we also have
15 some ice and winter flow information. So we've tried
16 to get a good understanding of what's happening locally
17 there by collecting data at the site and filling gaps
18 as they're identified.

19 In addition to this and what you'll see
20 in our baseline report is we've taken the short-term,
21 the relatively short-term data from 1996 to present and
22 combined that with the long-term data from regional
23 Environment Canada and water survey of Canada stations
24 to get a good handle on what we expect our long-term
25 conditions at the site to be from a hydrological

1 perspective.

2 So a little bit of what we know, ice
3 thicknesses over the course of the winter typically
4 grow to, you know, in the range of 1.8 metres, so we're
5 dealing with fairly thick ice covers and some cases on
6 relatively shallow lakes.

7 Most of the small lake outlets we've
8 observed to be frozen, so with no outflow during the
9 wintertime in the late season, and though some of the
10 larger ones, such as Lake N -- N11 and Kirk Lake, we
11 have observed flows in the early spring, which leads us
12 to believe that they will flow over the wintertime.

13 Many of the lake shorelines in the study
14 area are comprised of boulders and exposed bedrock,
15 okay, some of the typical shorelines that we see there.
16 And this is really key to, you know, how we've
17 developed our mitigation measures and what we
18 anticipate the effects to be, in that we're dealing
19 with fairly shallow deposits of material on top of
20 bedrock that are -- are pretty bony. Like there's a
21 lot of heavy boulder and cobble material in there.

22 The smaller fractions, there's a lot of
23 sand, but not so much in terms of clay and silt that --
24 that we would expect to be more erodible, or have
25 greater effects on -- on fish if it was mobilized.

1 In some of the other areas that aren't
2 as rocky, they tend to be the -- the shallower gradient
3 areas where we have the peats and the organic materials
4 that have built up.

5 When we look at the outlet channels of
6 these lakes that we're dealing with -- and I should --
7 I should also stress that we're not dealing with long
8 creeks or long rivers or anything in this watershed.
9 Like John said this morning, we've got 35 percent of
10 the landscape that's composed of water. So we've got
11 many, many lakes that are generally connected by fairly
12 short connecting channels.

13 And you'll see some of the typical
14 channels up on screen right now, on slide 58. For
15 small lakes, where we don't have a lot of flow, what
16 you typically see is a very narrow sort of channel
17 through an organic area.

18 For -- as the -- the watershed areas
19 increase, what we tend to see is something like you see
20 on the lower right of that slide where you can see
21 quite a rocky bed with fringes of organic material on
22 the banks.

23 In terms of lake levels and discharges,
24 there's a fairly predictable cycle here that's pretty
25 typical for northern water bodies. We see a -- a rise

1 in lake elevation during spring runoff and tapering off
2 to something that's a little more steady in the late --
3 late season.

4 By -- we -- we said this morning that
5 half of the precipitation at the site is due to
6 snowfall. Half of it's due to rainfall. What happens
7 in the -- in the springtime is, your snow melts and you
8 get a large flood peak.

9 During the late season, we have lake
10 evaporation effects. Those are -- those are
11 significant up here. And some of the rainfall runs
12 off, but some of it goes to evaporation --
13 evapotranspiration, a gradual release into -- into the
14 subsurface.

15 So in terms of the baseline reporting in
16 the -- the studies that we've done, we have current
17 work that is still underway. We're doing supplementary
18 surveys. We've completed some supplementary surveys
19 this year on bank and lake shores, and also some
20 additional hydrometry to basically support and to
21 validate the work that we've done to date.

22 So, you know, we consider that to be
23 good practice, continuing to collect data after the
24 submission of the EIS. And just to be clear, you know,
25 any significant changes that are noted, that need to be

1 -- in addition to that an operational monitoring
2 program would be expected if the -- if the project
3 proceeds.

4 So I want to move into the assessment
5 approach here. So we are on slide 62. What we did to,
6 you know, develop our baseline and to pro -- to provide
7 a basis for our impact assessment was to develop a
8 water balance model for, not just Kennady Lake, but the
9 adjacent lakes and downstream to -- to the Kirk Lake
10 outlet. So essentially, we've got the entire LSA
11 covered here.

12 The model was developed using GoldSim
13 software. That's a -- a publicly available program.
14 It was calibrated and validated using flow and climate
15 data, site specific data from 2004, 2005, and 2007.
16 And what we've done is we've simulated these flows on a
17 daily time step for a period 1959 to 2005.

18 Why 1959 to 2005? Well, our data set
19 for the climate is based on the available record from
20 the Lupin and Contwoyto stations that are located to
21 the north of the site. They have been adjusted to
22 reflect local site conditions and that adjustment was
23 based on measurements at the site, but what that does,
24 is it provides us -- it provides that linkage between
25 the long-term regional data and the short-term local

1 data that we've collected. So this is a pretty
2 standard approach.

3 Like I said, the Kennady Lake downstream
4 and adjacent watersheds we've divided those into sub-
5 watersheds. Our model is essentially a -- a cascade of
6 flows from lake to lake to lake. And so another key
7 component of our model is the stage discharge rating
8 curves at the outlet.

9 So we've incorporated, you know, site
10 specific stage discharge rating curves at the outlet,
11 we've incorporated melting effects of the ice in the
12 springtime and along with, you know, rain and snow
13 runoff, inflow from upstream watersheds, lake
14 evaporation. Okay, so we've -- we've covered off the
15 components of the hydrological cycle here.

16 What it doesn't include is any
17 significant groundwater inflows or outflows, and we've
18 discussed that with the -- the hydrogeologists and
19 consider that to small relative to the surface water
20 flows that we're -- we're dealing with here.

21 So once our baseline model was set up,
22 what we did was we superimposed the affects of the
23 project on that baseline model to evaluate
24 hydrologically what our affects would be. So things
25 like, as I say on slide 63 here, diversions of flow,

1 landscape modifications, consumptive water use, we've
2 got all these incorporated into our model. And what
3 that gives us is, for each outlet or water body that
4 we're looking at, it gives us that time series of flow,
5 forty-seven (47) years of data, and it gives us the
6 versatility to extract statistics to -- from that flow
7 record as indicators of what's going on and for
8 comparison purposes.

9 So I want to get a little bit here into
10 the phases, the project phases that we're looking at,
11 the activities associated with the project, and what
12 our -- what our affects -- a bit of a summary of
13 affects.

14 We've got a lot of detailed results in
15 the EIS for people to look at, so this is a -- a bit of
16 a look through the keyhole, but we're going to
17 highlight some of the -- some of the ones of interest.
18 Some of this may be a bit of an overlap from the
19 project description presentation, but the format for
20 this, I'm going to show a figure, and then there's some
21 text on the subsequent slides for each of the phases
22 that really describe the same thing, so I may gloss
23 over the text portion of it.

24 But during construction the major things
25 that we have going on here are de-watering of Kennady

1 Lake, okay. So we've got water being pumped north to
2 Lake N11. We've got water being pumped east to Area 8.
3 We've got a dike at Area 8 to make sure that we don't
4 have water flowing back. And at this point some of the
5 other features that you'll see there are dams that will
6 be constructed. At some of the tributary lakes we want
7 to reduce the inflow, the runoff into these lakes as
8 we're de -- as we're de-watering Kennady Lake. And so
9 you can see at E-1 here, downstream of Lake D-2 on the
10 west of Kennady Lake at the outlet of B-1 in the north
11 there.

12 One (1) thing I will mention in the
13 northeast, Lake 3 in the EIS is also designated as a
14 lake that will be, you know, diverted north to the 'N'
15 watershed. There's a -- a design variant that's being
16 looked at right now where we're considering not doing
17 that, okay. Flow would come down from A3 to A2 to A1
18 and then be pumped over to Lake J1.

19 And we see that as a -- as a positive
20 effect because we would no longer be diverting water
21 into the 'N' watershed at that point, we would no
22 longer be raising the lake elevation of Lake A3, and we
23 would actually also be supplementing the flows into
24 Area 8, which from a fisheries perspective would be
25 viewed as positive. So I'm not going to, you know,

1 reiterate that in the subsequent phases, but it would
2 be present in those subsequent phases, as well.

3 So again, we -- as it says on slide 65
4 there, we did model that. The results are in the --
5 the EIS and compared to baseline conditions. One (1)
6 of the key sort of results, residual effects that I
7 want to discuss here is shown on slide 66.

8 And what you can see there is a typical
9 annual hydrograph. This is at the Lake N11 outlet, so
10 this is the receiving lake from the de-watering water
11 of Kennady Lake.

12 What you can see at the 500,000 cubic
13 metres per day level on the -- the Y-axis there,
14 there's a green line that goes across, and we have the
15 natural hydrograph in -- in red that shows a spring
16 runoff peak, okay, that comes right about to that line.

17 How that line was established is it's
18 the --the two (2) year natural discharge. So the
19 median discharge from the N11 outlet, and as is typical
20 of these lakes, we get a high flood peak. We have the
21 -- the flows and water levels dropping off rapidly over
22 the course of the open water season. And the effect of
23 the de-watering flows would be to increase the
24 discharge from that outlet, but we never want to go
25 above the two (2) year line. That's the -- the

1 criteria that's been, you know, developed here. We see
2 that as being very protective, and I'll show you some -
3 - for the N11 outlet I'll show you some photographs of
4 it later on, so very protective in terms of erosion of
5 that outlet.

6 And what you can see there is, we're --
7 in this case, you know, we're not even approaching that
8 two (2) year level. We're more limited by, you know,
9 the ability to pump water at a high enough rate than we
10 are by that -- that self-imposed limit there that we
11 believe is protective.

12 Okay. That was slide number 66, and
13 we'll move onto slide number 67 here. The findings for
14 the construction phase. You know, we're expecting that
15 -- at the Kennady Lake watershed, flows are going to
16 increase in Area 8, and that's because of the de-
17 watering activities. But again, we've got that same
18 two (2) year -- natural two (2) year discharge limit
19 that we're imposing there, so we don't anticipate that
20 there will be any -- any adverse effects.

21 In the downstream watersheds, again in
22 the N11 and moving downstream, we will be increasing
23 the flows after the -- the flood peak there and making
24 sure that we don't exceed the two (2) year discharge.

25

1 (BRIEF PAUSE)

2

3 MR. NATHAN SCHMIDT: No, that is
4 actually correct, I -- I had a question here on
5 whether...

6

7 (BRIEF PAUSE)

8

9 MR. NATHAN SCHMIDT: Yeah, no that --
10 that's correct. Just to clarify, the question there
11 was in that first column on the -- the table on page 60
12 -- or slide 67, the use of increase and decrease.

13 What we'll see is that the -- the mean
14 monthly flows and low flows will increase because of
15 the de-watering activities, but the hundred (100) year
16 discharge at the Kennady Lake outlet will actually
17 decrease because it's close circuited, and we won't
18 have a natural peak runoff coming off. If we do get an
19 extreme event in there during that period, it will just
20 be captured, you know, in the lake and pumped at our
21 pumping rates. So that is -- that is correct.

22 Okay. In terms of channel and bank
23 stability, because we have that -- that protective
24 criteria that's imposed there for the -- the discharge
25 rates, we don't expect downstream erosion to be a

1 problem. We may have sediment resuspension along the
2 exposed shoreline within what is now the water
3 management pond, but that is in the controlled area of
4 the mining project.

5 I told you I'd show you some -- some
6 photographs for channel and bank stability here. What
7 you see in the photographs on the bottom of slide 69
8 are some photos of the Lake N11 outlet, and what you
9 can see is large boulder deposits. I mean, this is --
10 this is very well armoured, and in many cases, many
11 areas we actually have bedrock outcrops across the
12 channel in the -- the left photo, and on the shoreline
13 on the left photo as well.

14 And so we've done quite a detailed, you
15 know, survey of this area. And, you know, really it --
16 there's an evaluation in the EIS as well. And erosion
17 at the rates that we're proposing is -- is just not an
18 issue here.

19 Downstream watersheds, also, you know,
20 quite robust. The -- the other thing I should note is
21 the effects as we move downstream become less reduced
22 because we have natural flows coming in and melding,
23 mixing with these modified flows. And so as we move
24 downstream it becomes less and less of a concern.

25 Moving on to the operations phase on

1 slide 70, and this is one (1) snapshot of the
2 operations phase. We will be maintaining that closed
3 circuiting as we move into operations. These lakes on
4 the west side of Kennady Lake where we've put these
5 dams in to divert flows away will begin to fill and
6 spill into the 'N' watershed over there from -- you
7 know, the -- the combination of lakes, D2, D3 and E1
8 will go into the 'N' watershed. B1 will actually also
9 go into the 'N' watershed and we'll have closed
10 circuiting at the outlet of Kennady Lake.

11 At that point, we're not going to have
12 any pumping into Area 8, so we'll expect flows to be
13 reduced in that area. And there may be pumping during
14 some years still from the water management pond into
15 Lake N11, subject to water quality restrictions.

16 So slide 71 kind of merely reiterates
17 what I just said but in text just for your reference.
18 And again, we did model these as a snapshot to -- to
19 reflect those conditions and compare them to baseline
20 conditions.

21 So a summary of those findings is on
22 page -- or slide 73. And so what you'll see in the
23 Kennady Lake watershed is, you know, outflows to Area 8
24 will be reduced. We have that diversion of the -- the
25 western lakes into the 'N' watershed.

1 The actual water yield from those lakes
2 will be reduced a little bit from what baseline is
3 simply because we've got more surface area and more
4 potential for lake evaporation. The D2, D3 lakes, in
5 particular, will take a few years to fill up, so we
6 won't see this in the early years of operations. But
7 at a certain point they will spill in the downstream
8 watersheds, you know, similar but -- but reduced from
9 what we would see during de-watering over on the -- the
10 'N' watershed side because we won't be pumping it as at
11 large rates. And in years when there is no pumping
12 it'll be pretty similar to baseline conditions except
13 for what's being received from those western diversion
14 lakes.

15 Channel and bank stability, I did want
16 to talk a little bit about the diversion flows going
17 from those western lakes into the 'N' watershed. These
18 -- these lakes are expected -- some of them will be
19 just ephemeral. We'll have -- and this is what we see
20 in the -- in the natural situation, is we get flow
21 during springtime. But if the watersheds are small
22 enough in the late season they cease to discharge just
23 because it's so evaporation dominated and we don't have
24 enough rainfall to -- to compensate for the amount of
25 evaporative loss.

1 You can see a typical hydrograph there
2 which looks a little bit like the one we saw from Lake
3 N11 except for the fact that in the late season, yeah,
4 we do go down to a zero discharge. In concert with --
5 on the -- the upper part of that graph you can see the
6 precipitation that's occurring during those periods,
7 and so you can see small spikes in the -- in the
8 hydrograph due to local precipitation.

9 And looking at some of the -- the
10 existing outlet channels, I mean, these give us an
11 indication of what the diversion channels, you know,
12 could look like for the -- the corresponding drainage
13 areas, so, you know, through the organics, very small
14 channels, low erosion potential. For some of the
15 larger ones we do have again kind of the rocky beds
16 that would be exposed during the late season, so.

17 That was slide 76 that we just discussed
18 there.

19 And another, you know, typical of a -- a
20 larger channel in the area. Really, this is -- this is
21 a consequence of the surficial geology in the area. In
22 those areas that are vegetated, if you stripped off
23 that vegetation and got rid of the fines this is what's
24 lying underneath. It's in most areas. It's quite
25 rocky. And so that's another factor to consider when

1 we talk about the shoreline erosion that's coming up.

2 Moving to slide number 78 now. Just to
3 elaborate a little bit on the baseline study that has
4 been ongoing. In 2010, we started a program to look at
5 lake shorelines, to deal with potential effects of
6 raising these lakes in the -- the western diversion
7 area, in particular. And we also did look at the A3
8 lake.

9 So we collected information such as, you
10 know, slope gradients, what types of materials are
11 present along those shorelines. There's also some work
12 going on in terms of ways exp -- wave exposure. And
13 I've brought in one (1) of my colleagues on this, who
14 is actually a coastal geomorphologist that, you know,
15 gives me a lot of comfort in the results that are
16 presented in the EIS.

17 So what you'll see in the EIS is that
18 it's a -- it's a qualitative assessment, but there is
19 more quantitative work that's being done right now
20 based on this data that we've collected in 2010 and
21 2011.

22 Channel -- or slide 79. You know --
23 again, some typical shorelines in the area. And what
24 you can see, even in the overbank areas along the
25 shore, we've got exposed boulders, that sort of thing.

1 You know -- we see, you know, heavy materials in here.
2 Also thin -- relatively thin layers of surficial soils.
3 And so that gives us a lot of comfort in the
4 assessment.

5 So, in summary, during the operations
6 phase, slide number 80, here. I -- looking at the
7 Kennady Lake watershed, you know, we do expect that the
8 raised lakes will have new shorelines forming over time
9 as -- as things stabilize. But what we also expect is
10 that the quantity of fines in those existing mat -- in
11 those exiting shor -- or the -- the future shoreline
12 areas is small. It's very bony material. It will
13 armour up quite rapidly. And the fines that are in
14 there aren't things like clays that refuse to settle
15 out. They're things like sands that settle out very
16 rapidly and would expect to settle out quite locally to
17 those new shorelines.

18 Downstream watershed 9 -- I mean, things
19 are quite stable here during operations, so we don't
20 expect any -- any significant effects on channel or
21 bank stability in the 'N' watershed or indeed
22 downstream.

23 Moving on to the closure phase. And
24 closure to me means refilling. Okay, this is when
25 Kennady Lake gets its water back. And what you can see

1 on the -- the photo. Or the plan, on -- on slide 81,
2 is where that water's going to come from.

3 We'll still have close circuiting at the
4 upstream of area 8, but we will have those reconnection
5 of the diversion lakes. So we'll have the -- the
6 existing watershed of Kennady Lake contributing. We'll
7 reconnect the areas that were diverted away. And we're
8 also looking to refill the lake sooner. What we want
9 to do is pump water from Lake N11.

10 So, as with every snapshot here, what
11 we've done is modelled that according to the -- the
12 activities that are present in the project description.
13 So that's summarized on slide 80 -- 82.

14 And, just an illustration of what we're
15 dealing with here on slide 83. This is another
16 representation of, you know, what's going on with the
17 hydrology of Lake N11 during closure. And -- so you
18 can see another green line. That's our self-imposed
19 protective criteria for how much water we can take out
20 of that lake in any given year.

21 And what we're seeing is -- we want to
22 make sure that the flows at -- at the Lake N11 outlet
23 don't go -- go below the one (1) in five (5) year dry
24 condition. So we're not going to, you know, pump so
25 much water out of the lake that the outlet dries up and

1 -- and there are downstream effects. We're going to go
2 with something that's well within the range of natural
3 variability. And the excess water is what will be
4 siphoned off, pumped off to use to -- to refill the
5 lake.

6 So on slide 84, again, we have kind of a
7 text summary of that -- that modelling -- the modelling
8 results. And what you can see for the Kennady Lake
9 watershed, the effect of diverting that water, pumping
10 that water in from Lake N11 would be to reduce the
11 refilling time from around seventeen (17) years down to
12 about eight (8) or nine (9). So it's going to bring
13 the -- the system back more rapidly, restoration of the
14 'B', 'D', and 'E' watersheds, those operational
15 diversions.

16 And what we will still have is a -- a
17 reduction in flow at Area 8 because we still have that
18 close circuiting upstream of Area 8, so it's not
19 receiving the -- the Kennady Lake flows during closure
20 period. In the downstream watershed, you know, the --
21 the primary area of effects is at Lake N11 and
22 downstream. And like we've said we're -- we're
23 attempting to be very protective of the environment
24 with our -- our approach there.

25 On to slide 85. And what we want to do

1 is restore the existing flow and water level regimes in
2 those diversion lakes. So that's our -- our primary
3 focus during closure in the Kennady Lake watershed.
4 And in slide 86, again we have a text summary of that
5 for people to reference.

6 Now moving on in slide 87 to the post-
7 closure phase. And post closure, you know, represents
8 our -- our long-term, kind of, walk-away period. And
9 what we see there -- and this is for the case that's --
10 that's presented in the EIS, is the primary effect that
11 we see is the -- a change in land to lake ratios. And
12 so, I talked before about how important the evaporation
13 during the summer, how important those effects are on
14 the flow regimes.

15 And so what actually happens here is we
16 have less lake and more land. What that does is it
17 increases the -- the runoff to the lake and it reduces
18 the evaporative potential. So we actually would see
19 flows increasing a little bit. The -- the flow regime
20 increasing a little bit in the post-closure scenario.
21 So a little more water, not a lot, okay.

22 The other change there is we'll be
23 changing, because of that encroachment in the lake,
24 changing the area elevation/volume relationships of
25 Kennady Lake and so there will be a little less

1 attenuation during floods. And so the floods would
2 come up a little bit, but you know, we're talking less
3 than 10 percent, it's not a significant change.

4 Again, in -- in slide 88, you know, we -
5 - we talk about what I've just -- just discussed in the
6 context of the -- the figure.

7 And on slide on 89, you know, a few -- a
8 few numbers in the summary. We're looking at a 8.9
9 percent increase in Kennady Lake mean annual water
10 yield. You know, that would change somewhat based on
11 some design variance, but not significantly. And I
12 think it -- it would -- if we -- if we keep that 'A'
13 lake -- 'A' watershed intact with that design variant
14 it actually reduces the -- the overall effect here.

15 So modest permanent changes to the flow
16 regime at the Kennady Lake outlet. A continual theme
17 here is that any changes at the outlet get reduced as
18 we move downstream. We've got more natural water
19 coming in and mixing with our water that we've changed
20 the -- the flow regimes on.

21 So as you move downstream to the outlet
22 of the LSA changes will become small. Once again,
23 that's only 3 percent of the -- the area at the mouth
24 of the Lockhart River. And so there will be no, you
25 know, measurable effect there during any of these

1 phases at the -- at the Lockhart.

2 So just to bring it to and end here,
3 I've got a couple of slides with a summary of the
4 assessment findings. Short-term effects, and by short
5 term we're talking construction, operations, closure
6 period. Water management activities, you know, are
7 intended to allow the mine development while being
8 protective of the environment. I've discussed, you
9 know, a number of mitigation measures, limits, that we
10 are imposing here just to make sure we don't have any
11 adverse effects related to hydrology.

12 Dewatering and refilling. You know,
13 certainly those are the -- the biggest water transfers
14 that we're going to see during this project, and those
15 will affect the magnitude and the variability of -- of
16 flows and water levels downstream, but like I said,
17 we've -- we think those are fully mitigated.

18 And I think the other major thing that
19 we're concerned about is the shoreline erosion, but we
20 have collected a lot of, you know, site-specific data.
21 Everything that we've seen from the site-specific data
22 we've collected this year is -- is consistent and
23 supports the conclusions that are in the EIS.

24 The EIS was -- was mainly a desktop
25 qualitative assessment, but what we've seen so far from

1 the quantitative data collection supports what we said,
2 and we're going to take that a step further and, you
3 know, do a more detailed analysis on it once all those
4 -- the field data are available.

5 Okay. And I've -- I've just been passed
6 a note here that I -- I can say that we expect the new
7 information to be delivered in the first quarter of
8 2012, so you know, that analysis is already under way,
9 and it's -- we don't see any roadblocks to, you know,
10 putting it in front of the Board.

11 In terms of long-term effects, you know,
12 we expect them to be smaller in general than the short-
13 term effects. We're reconnecting our systems. The
14 biggest effect is, like I said, the changes in the
15 balance to -- of lake and land area within the Kennady
16 Lake watershed. Effects less than 10 percent are what
17 we're expecting there.

18 And those -- on that scale, those aren't
19 expected to have any long-term geomorph --
20 geomorphological changes downstream, especially with
21 the kind of channels that we -- we see in this area,
22 and the kind of shorelines that we see in this area.

23 And that pretty much brings me to the
24 end of my presentation, so thank you for your
25 attention. Appreciate it.

1 THE FACILITATOR HUBERT: Chuck Hubert
2 with the Review Board. Thanks very much for that
3 presentation. And we find ourselves close to lunch
4 here, so I -- even though I know there are likely
5 questions from participants, I think we'll let you all
6 ponder the information presented and ask these
7 questions after lunch.

8 So with that, I think we can dismiss
9 ourselves until returning at 1:15. See you then.

10 MS. VERONICA CHISHOLM: Chuck, I --
11 Veronica Chisholm from De Beers. I just have a quick
12 question to Velma Sterenberg, I hope I pronounced that
13 correctly, to see whether we -- we did answer your
14 questions through the presentation. I'm wondering if -
15 - if we -- if we've managed to cover that off.

16 MS. VELMA STERENBERG: Velma
17 Sterenberg, AANDC. Yes, you've -- you've raised
18 another question, but I think it would be better if I
19 just talked to John directly about that, because it's
20 quite detailed and I don't think -- I think it falls
21 outside the scope of -- of the -- what's going on here
22 at the hearing.

23 And your colleague there had suggested
24 he might provide me with one of SRK's reports that'll
25 have the information -- the rest of the information I'm

1 looking for. Thank you.

2 MS. VERONICA CHISHOLM: Thank you.

3 THE FACILITATOR HUBERT: Okay, once
4 again, 1:15. See you then.

5

6 --- Upon recessing at 11:58 a.m.

7 --- Upon resuming at 1:18 p.m.

8

9 THE FACILITATOR HUBERT: Good afternoon
10 and welcome back, everybody, to the Gahcho Kue GAP
11 (phonetic) analysis session. It's not a GAP analysis
12 session, actually. Dur -- this morning we had a few
13 follow-up items that De Beers was going to provide some
14 information on. Are you ready to respond to those?

15 MS. VERONICA CHISHOLM: Veronica
16 Chisholm, from De Beers. Yes, we're ready to respond.
17 There's just actually one (1) because Velma indicated
18 that our presentation addressed her questions. So we
19 just have the one (1) question from Steve Ellis. And
20 John Faithful will respond to that.

21 MR. ALAN EHRLICH: Looking around the
22 room, I don't actually see Steve. It's Alan Ehrlich.
23 I don't see Steve Ellis here right now. If you're
24 going to respond to him it's probably better -- but was
25 the question Todd Slack's or...? Sorry, I'm just

1 getting a little bit of confusion from our team over
2 here.

3 If it's a question for Steve I'd rather
4 wait a few minutes until he's here to that De Beers
5 doesn't need to repeat itself to -- you know, to settle
6 the discussion. Is there another subject that came up
7 that you have information on?

8 MS. VERONICA CHISHOLM: I think we have
9 addressed all of the questions from the morning
10 session. But I do have -- earlier I had asked for
11 clarification from Todd Slack, from the Yellowknives
12 Dene First Nations, on a question regarding the
13 persistent organic pollutants and the dioxin/furans.

14 MR. ALAN EHRLICH: Todd, are you ready
15 to give that clarification now?

16 MR. TODD SLACK: Todd Slack,
17 Yellowknives Dene First Nation. I'm ready to give it a
18 try anyhow. The -- excuse me. The intent behind the -
19 - the question was twofold. One (1), to establish that
20 there was going to be some type of emissions
21 guidelines, which the -- the Company has indicated that
22 there would be, but number 2, to also ensure that
23 there's some sort of baseline collection to allow
24 parties at a later date if the emissions plan has
25 exceedances, as we've seen at all of the mines thus

1 far, to allow us to go back and evaluate effects from
2 the mine. If we don't understand where the starting
3 point is we won't be able to understand what the
4 contribution of the mine will be.

5 Does that clarify the intent?

6 MS. VERONICA CHISHOLM: Veronica
7 Chisholm, form De Beers. Just one (1) more
8 clarification question. Thank you, Todd. Were you
9 looking for -- in terms of baseline sampling you're --
10 are you looking for air or soil samples or do you have
11 a particular parameter you would like us to measure?

12 MR. TODD SLACK: Todd Slack,
13 Yellowknives Dene. Well, I -- I'm not looking to
14 dictate the -- the nature of this. The -- the key is
15 the receiving environment. So, to my mind, this would
16 be sediments. This is consistent, as far as I know,
17 with the -- the work that Anne Gunn and EC did up at
18 the other mi -- mine sites.

19 And so there is precedent for this. We
20 -- this is not asking for something new. Over the
21 years we've seen a -- troubles with all the
22 incinerators, but we have no starting point to try and
23 evaluate what the impacts were.

24 However you want to develop your
25 sampling and, you know, and part of your aquatic

1 effects monitoring program at a later date to evaluate
2 this is fine by us as long as there's a commitment to
3 do this type of work before the mine is in place,
4 because once it's there we're never going to know.

5

6 (BRIEF PAUSE)

7

8 MR. STEPHEN LINES: Todd, well,
9 Veronica discusses -- Stephen Lines, from De Beers. I
10 just wanted to clarify the work you mentioned. Was it
11 Anne Wilson of Environment Canada that did the work, or
12 -- you mentioned Anne Gunn.

13 MR. TODD SLACK: Oh. Todd Slack,
14 Yellowknives Dene. Yeah, pardon my misspeak there, my
15 error. You're quite correct.

16 MR. STEPHEN LINES: Thank you.

17 MS. VERONICA CHISHOLM: Veronica
18 Chisholm, from De Beers. Yes, Todd, we are developing
19 aquatics monitoring framework and a monitoring program,
20 and we will evaluate the parameters that we will
21 measure, and that will be done in advance of
22 construction.

23 MR. TODD SLACK: Todd Slack,
24 Yellowknives Dene. Can I ask one (1) point of
25 clarification there, and is the intent to have

1 persistent organic pollutants as part of this
2 monitoring program? Th -- that's the commitment that
3 I'm looking for.

4

5 (BRIEF PAUSE)

6

7 MR. STEPHEN LINES: Hi, Todd, it's
8 Stephen Lines, for De Beers. I think at the last
9 meeting De Beers had back at the end of October we had
10 mentioned to all the communities that one (1) of the
11 things that De Beers is going to be undertaking early
12 next year is getting out to the communities and talking
13 to them.

14 One (1) of the specific purposes of
15 those engagement activities is to discuss what the
16 communities would like to see in the -- the monitoring
17 plan. So I think Veronica has mentioned that De Beers
18 would be doing monitoring of some kind in relation to
19 this. But the specifics, I think, it might be helpful
20 if we had a specific discussion over what should be
21 included in those with the communities. So maybe this
22 is something that we can follow up on, specifically
23 with the Yellowknives Dene at that time. I don't know
24 if that's helpful to you. Thank you.

25 MR. TODD SLACK: Todd Slack,

1 Yellowknives Dene. We're -- you know, we're at an
2 information gap session. Here's an information gap,
3 the other mines, we can't do this, because they're
4 already built, the impacts are there.

5 Your mine is to come and it's not going
6 to do us any good to not evaluate this in a baseline.
7 I'm telling you that here you have this gap, you guys
8 can take that away, but we're going to, you know, it --
9 you don't even have to come to the community for this
10 one. We're telling you right now. Yeah, I'm -- I'm --
11 I'm just -- I'm a little unclear as to sort of what
12 we're trying to achieve here then.

13 THE FACILITATOR HUBERT: Chuck Hubert,
14 Review Board. We're trying to achieve, Todd, exactly
15 what you're expressing, and that is if parties have
16 gaps perceived they -- those should be expressed dur --
17 to De Beers. The Review Board notes them and if a
18 commitment cannot be made then the recourse for a party
19 such as yourself is an Information Request.

20 MR. STEPHEN LINES: Thanks, Chuck.
21 Thanks, Todd, for the comment. I guess just to follow
22 up, I would, you know, note that the development of the
23 monitoring plan, this is an ongoing process as De Beers
24 learns feedback from communities and all parties
25 throughout the -- the process. And Veronica had

1 mentioned that this is something that we're going to be
2 looking at, and it's just the details of, I guess, what
3 to monitor, when that needs to be worked out. So as I
4 said, we'll look to get more input on that in the very
5 near future from the communities.

6

7 QUESTION PERIOD:

8 THE FACILITATOR HUBERT: Chuck Hubert
9 with the Review Board. Thanks very much for that
10 response.

11 I'd like to continue now. We ended this
12 -- this morning with a presentation on hydrology, and I
13 -- I would like to take about ten (10) minutes to -- to
14 address a few questions on that -- on that topic. And
15 I'd like to start out with two (2) questions from the
16 Review Board's technical advisor, Doug Ramsey, of
17 Tetrathec. So his question is as follows:

18 "For lakes and streams that will
19 experience higher water levels than
20 at baseline, what is the increase in
21 area for each water body, both in
22 total area and as a percentage of the
23 existing water surface area, and how
24 long will these increases persist?"

25

1 (BRIEF PAUSE)

2

3 THE FACILITATOR HUBERT: Chuck Hubert
4 with the Review Board. Just a note to parties remote,
5 De Beers is caucusing at the moment, and will respond
6 when -- in due course. Thanks.

7

8 (BRIEF PAUSE)

9

10 MR. NATHAN SCHMIDT: Nathan Schmidt
11 with Golder. And the question, as I understand it, has
12 to do with the -- in -- in the areas where we have
13 stream diversions and pumped diversions, what are the
14 changes to the -- the total watershed areas and the
15 balances of -- of lake areas and land areas.

16 There are two (2) different cases that
17 we're looking at here. One (1) is where we're
18 diverting a watershed in the -- and that's the case of
19 the, in the current EIS, the 'A' watershed, as well as
20 the -- the 'B', 'D', and 'E' watersheds.

21 So it's -- it's possible to extract
22 those numbers out of the EIS. If you need us to follow
23 up on that, we can -- we can do that. The -- the
24 watershed areas and the lake areas are all in -- in the
25 EIS. They haven't been added up, to answer your

1 question, but if you need us to do that, we can do
2 that. For the case of the pumped diversions, it --
3 it's not a case of an addition to a watershed area,
4 it's a -- an addition of a quantity of flow at a
5 certain rate.

6 And so we can't really answer that
7 question in that instance, but, like I said this
8 morning, we have some very protective criteria for
9 limiting those discharge rates that we have a -- quite
10 a high degree of confidence in.

11 I'll -- I'll leave it at that, and...

12 THE FACILITATOR HUBERT: Chuck Hubert
13 with the Review Board. Thanks for that response. I
14 believe that, as you've stated, if the hectarage, or
15 acreage, of -- of expanded lakes is in fact in the EIS,
16 then -- then we can locate that. How about streams,
17 however? As opposed to -- to lakes?

18 MR. NATHAN SCHMIDT: Can you clarify
19 the question again, please?

20 THE FACILITATOR HUBERT: Yeah, the --
21 the question -- to reiterate, it -- it was for lakes
22 and streams that will experience higher water levels
23 than -- than at baseline.

24 What is the increase in the -- in the
25 water body size? So, not -- not simply lakes, but

1 interconnecting streams as well? In total area?

2 MR. NATHAN SCHMIDT: Okay. Typically
3 what we would provide is the -- the increase in size at
4 the lake outlet. And because we're in a situation
5 where the -- the connecting streams are so short, any
6 additional watershed area contributing directly to the
7 stream, rather than to the upstream watershed, would be
8 negligible. So the -- the answer is essentially the
9 same. Like, for the N17 outlet, and the N17 channel,
10 the numbers would be identical.

11 THE FACILITATOR HUBERT: Thank you very
12 much. Chuck Hubert, Review Board. Thanks for that
13 response. And the latter part of the question was, how
14 long will the increases in -- in extended lake or -- or
15 water body boundaries persist?

16

17 (BRIEF PAUSE)

18

19 MR. NATHAN SCHMIDT: Nathan Schmidt
20 with Golder. Now again, we have the -- the two (2)
21 different types of activities. We've got the -- the
22 diversion of a watershed and then we've got the pumped
23 diversion during de-watering. So I'll address it on a
24 -- a kind of a water body by water body basis here.

25 During construction, the de-watering

1 activities -- we will have the elevated flows at the
2 Area 8 outlet for one (1) year. And at the N11 outlet
3 for two (2) years. At the N11 outlet for three (3) or
4 four (4) years of operations, we expect some elevated
5 discharges as well, though at a lower rate or a lower
6 volume than during de-watering. So that covers off the
7 -- the de-watering activities in the pumped diversions.

8 On the other side of it we have the
9 watershed diversions, where we're raising those -- the
10 'D' and 'E' lakes, and we're diverting the 'B' lake.
11 As I mentioned this morning, there will be some filling
12 times for the 'D' lakes. 'B' lake is expected to -- the
13 diversion take place immediately, as soon as we, you
14 know, construct that dam and the diversion. So there'd
15 be a duration there of approximately eleven (11) years
16 during the mine life.

17 The 'E' lake, it has to rise up a little
18 bit, but we do expect that to happen in the first year.
19 And so again, for the 'E' lake there would be an eleven
20 (11) year duration. And for the 'D2', 'D3' lakes it
21 does take a little bit longer for that to fill -- about
22 three (3) years to fill. And so we'd be looking at
23 eight (8) years duration for the -- for the diversion.

24

25

(BRIEF PAUSE)

1 THE FACILITATOR HUBERT: Chuck Hubert,
2 with the Review Board. Thanks very much for that --
3 what I think was a comprehensive answer. But I'll -- I
4 -- I believe it's a comprehensive answer on behalf of
5 Doug Ramsey, who -- who will respond either way. So
6 thanks.

7 One (1) -- one (1) further question from
8 Doug Ramsey that relates to climate change. And this
9 is verbatim from -- from Doug.

10 "How have the potential expected
11 effects of climate change have been
12 incorporated into the hydrologic
13 model both for the hundred-year
14 predictions as well as the fifteen
15 thousand (15,000) year predictions?"

16 MR. ALAN EHRLICH: If it -- if it's any
17 help at all, when I saw the question about fifteen
18 thousand (15,000) years I went, What? And wrote back
19 and said, Fifteen thousand (15,000)? And Doug Ramsey
20 pointed out that the -- one (1) of your slides you do
21 extrapolate to the fifteen thousand (15,000) year
22 point. And I wasn't here for the morning, so I don't
23 know which slide it is, but it sounds like that's where
24 that number came from.

25

1 (BRIEF PAUSE)

2

3 MR. NATHAN SCHMIDT: Nathan Schmidt

4 with Golder. First of all, I think we know the source

5 of the fifteen thousand (15,000) year -- and that's

6 from the hydrodynamic model that's part of the water

7 quality assessment. So if we could potentially defer

8 that question to the questions for the water quality.

9 It -- it was not -- that sort of time frame wasn't

10 factored into the -- the hydrology component at all.

11 The short answer for the climate change

12 is we did not consider it in the hydrology section,

13 it's dealt with in "subject of note" on climate change

14 which is Section 11.13 in Volume 6B. It's discarded

15 there as a secondary pathway because we don't see

16 significant effects over the time frame of the project.

17 Basically the projections of changes to

18 precipitation, in which there's a great deal of

19 inherent uncertainty, really only indicate

20 precipitation increases on the order of 10 percent.

21 When you translate precipitation into runoff, other

22 things that you need to factor in are things like lake

23 evaporation. I spoke about that this morning, and what

24 it says in the subject of note there, and which I agree

25 with, is they don't know what's going to happen

1 necessarily with lake evaporation in terms of increase
2 or decrease.

3 The lakes themselves are attenuators of
4 flow, so it decreases the sensitivity, the fact that we
5 have this whole chain of lakes. So the endpoint of all
6 this is, you know, will climate change change flows and
7 water levels and from thereon bank stability --
8 shoreline stability? And we think we're in a very
9 robust -- like, we've got confidence that we're in a --
10 a fairly robust system with the amount of rock there,
11 with the lake attenuation, that -- and the short time
12 frame of the project and the minimal changes at closure
13 that we don't think it's a concern. We -- we believe
14 that.

15 THE FACILITATOR HUBERT: Chuck Hubert,
16 with the Review Board. Thanks very much for that
17 response. I'd like to now open it up to other
18 participants who were here for the hydrology
19 presentation this morning. A question or two (2) would
20 -- from anybody, now is the time.

21 MR. JULIAN KANIGAN: Thanks. It's
22 Julian Kanigan from Aboriginal Affairs. So, as John
23 mentioned this morning, AANDC and -- and De Beers have
24 had a bit of a back and forth with our consultant
25 giving some comments, and then Golder giving some

1 responses back. And so this is in regards to one (1)
2 of those responses and just getting some clarification.

3 And so one (1) of the things that we
4 heard -- heard Nathan mention today is that in terms of
5 sediments, the -- it's mostly cobbles and coarser
6 sediments at the margins of the lakes, particularly
7 Kennady Lake. And one (1) of the things that our
8 consultant noted was that over half of the lake area of
9 -- the Kennady Lake area, according to the EIS,
10 actually consists of finer sediments, so he calls them
11 fine flocculated sediments, at deeper -- at levels
12 deeper than 4 metres.

13 And so I -- I guess I'm looking for some
14 clarification now as to whether you think tho -- those
15 are significant or not. And the reason that I'm asking
16 for -- for those that are maybe not so familiar with
17 the water quality issue -- when de-watering occurs, if
18 those finer sediments were stirred up they could cause
19 consequences to fish, could have consequences for fish
20 habitat. And I think they could also impact nitrogen
21 and phosphorus levels, so potentially leading to algal
22 bloom. So that -- that's the reason we're asking.

23

24 (BRIEF PAUSE)

25

1 MR. ALAN EHRLICH: While De Beers is
2 caucusing and considering its response to Mr. Kanigan's
3 questions, we've just received an email saying that the
4 webcast appears to be temporarily down. I'm just going
5 to remind everyone we said we're going to continue on
6 briefly with the session despite any technological
7 hiccups we might have.

8 But if you can -- some of the quiet
9 times you have are going to be because people are
10 considering their answers or considering their
11 questions, so don't despair. That last pause was De
12 Beers trying to figure out how to best reply to the
13 question.

14 Anyway, if -- we are having technical
15 problems with our international webcast we will
16 certainly -- we've got someone looking into this right
17 now and we hope to get things working soon.

18

19 (BRIEF PAUSE)

20

21 MR. ALAN EHRLICH: What I'm told by our
22 sound technician is that sometimes if it cuts out it's
23 going to be an issue regarding the person who's
24 receiving its computer, and it sounds like our system
25 is still working. I'm going to ask any of the Board's

1 technical advisors to send an email to Chuck to
2 indicate if you can hear me right now, but just because
3 we want to know if people in other places are still
4 able to participate.

5 Meanwhile, De Beers continues its caucus
6 on the subject.

7

8 (BRIEF PAUSE)

9

10 MR. ALAN EHRLICH: While we're waiting
11 for a response from De Beers, I'm going to ask everyone
12 who's here, if you have not signed the sign-in sheet,
13 please sign the sign-in sheet. It's at the table by
14 the door. Thank you. Wendy Warnock our
15 transcriptionst emphasizes you should not just sign it,
16 you should sign it in a clear and intelligible manner,
17 it's legible, because she needs to be able to read it
18 for the purposes of the transcript. Thank you.

19

20 (BRIEF PAUSE)

21

22 MR. JOHN FAITHFUL: John Faithful,
23 Golder Associates. Thanks, Julian. The objective of
24 the water management plan in the construction period is
25 to de-water the -- the lake, Kennady Lake to the -- to

1 the maximum extent possible. It will -- that will
2 accompany the diversions of the upper watersheds and
3 the diking of areas -- area -- between Area 7 and Area
4 8 to control -- to develop the control area to -- to
5 isolate the Areas 2 to 7.

6 The de-watering of Kennady Lake to
7 either Area 8 in the first year, or to Lake N11 for the
8 subsequent two (2) years is going to result in draw-
9 down. At some point the draw-down will get to a point
10 where there is likely to be some exposure of the final
11 -- at the deeper lake bed sediments that will result in
12 turbidity. In order for the -- for discharge to
13 continue there will -- there will most likely be some
14 water quality discharge criteria that will be more
15 likely set with -- with total suspended solid
16 concentrations, and possibly even other parameters such
17 as -- as nutrients, nitrogen, and phosphorus.

18 Prior to and during the de-watering
19 process there will be a fish salvage and the -- as a
20 result of the de-watering, the Areas 3 and 5 will be
21 deemed habitat unsuitable for fish. Water that doesn't
22 meet discharge criteria will not be pumped to Lake N11
23 and to Area 8.

24 Does that provide your answer?

25

1 (BRIEF PAUSE)

2

3 THE FACILITATOR HUBERT: Chuck Hubert,
4 Review Board. Thanks very much for that response.

5 Further questions? We'll take one (1)
6 more, because we do have to move onto geochemistry.

7 MS. CORRINE GIBSON: Corrine Gibson
8 with DFO. Two (2) questions, one is quick. The first
9 one relates to groundwater contributions in the streams
10 draining Area 8. And you mentioned that you haven't
11 quantified how much groundwater is contributing to the
12 water balance.

13 Do you have an indication as to whether
14 or not those streams are gaining, losing, or in
15 potential locations of groundwater upwelling? Corrine
16 Gibson, DFO.

17

18 (BRIEF PAUSE)

19

20 MR. DON CHORLEY: Yes, this is Don
21 Chorley. There's a -- there's no taliks underneath
22 those rivers and creeks, so the contribution to base
23 flow from that would only be from the active layer.

24 And right now we think the active layer
25 is only in the summer, so I don't know if -- it would

1 not be that much compared to the -- the flow from
2 surface water just from precipitation and runoff.
3 Thank you.

4 MS. CORRINE GIBSON: The other question
5 would then relate to the pumping rates, as well as to
6 the potential supplementary inputs that you'll be
7 putting into the downstreams, both in the stream down
8 of Area 8 as well as through the N11 watershed.

9 And you mentioned that you've picked
10 levels that are protective for erosion, and I'm
11 wondering what considerations you've given to be
12 protective towards fish and preventing -- and
13 minimizing impacts to fishes spawning, rearing, and
14 their various life stages.

15

16 (BRIEF PAUSE)

17

18 MR. ALAN EHRLICH: Our apologies to our
19 remote participants. We lost the webcast for somewhere
20 between five (5) and ten (10) minutes, but our
21 understanding is it's back on, and our -- our sound
22 technician has solved and -- and fixed the problem.

23 You'll have to have a look at the
24 transcript to see what happened in the last five (5) or
25 ten (10) minutes. De Beers is now preparing a

1 response to the Department of Fisheries and Oceans.

2

3 (BRIEF PAUSE)

4

5 MS. VERONICA CHISHOLM: Veronica
6 Chisholm from De Beers. Thanks, Corrine. Appreciate
7 the question. We will respond to the pumping rate one,
8 and with respect to the fish we do have the fish
9 presentation coming up, and we would like to respond to
10 that as part of that presen -- fish habitat
11 presentation, if that's okay. So, Nathan...?

12 MR. NATHAN SCHMIDT: Okay. Nathan
13 Schmidt from Golder. With regards to the discharge of
14 pumped water into Area 8, a couple other features that
15 we're incorporating including not exceeding that --
16 that median freshet discharge. So we're not going to
17 be, you know, piling extra water on top of flood flows,
18 that sort of thing. So that helps with not just
19 erosion but with, you know, fish passage, that sort of
20 thing.

21 The other part of it is there's an
22 element of ramping up and ramping down, so fish will
23 have time to respond to changing conditions rather than
24 having just a rapid step change in inflows and water
25 levels to prevent any stranding sort of incidents.

1 MS. CORRINE GIBSON: Corrine Gibson,
2 DFO, to follow up. My concern comes to -- for the most
3 part with respect to grayling spawning, and they spawn
4 with peak freshet. And that's an indicator cue as to
5 when they go to spawn, as well as, as water levels drop
6 off it's an indicator cue for changing temperatures, as
7 well, for fish to migrate downstream. And you don't
8 have to give an answer now, but just -- it would be
9 nice if you could present some sort of thought that
10 you've given and how you're going to be con -- taking
11 these into consideration in ensuring that you're not
12 disrupting the natural hydrograph, seasonal hydrograph,
13 daily hydrograph rates. So that you aren't disrupting
14 the fish cues.

15 MR. NATHAN SCHMIDT: Thank you for the
16 -- the comment and we'll make sure that that's
17 addressed during the fisheries presentation. Nathan
18 Schmidt, Golder.

19 THE FACILITATOR HUBERT: Chuck Hubert,
20 Review Board. Thanks very much and we look forward to
21 -- to the fisheries portion of the aquatics
22 presentation later on. And there may be some questions
23 about -- about the whole ramping issue as well. So,
24 just to -- to let you know that that may -- may occur
25 as well.

1 But I'd like to now continue with the De
2 Beers presentation. Thanks I'd like to continue with
3 the De Beers presentation on geochemistry now, and so
4 if we can proceed with that, that would be great.
5 Thanks.

6

7 PRESENTATION BY DE BEERS RE GEOCHEMISTRY:

8 MR. KEN DE VOS: My name is Ken De Vos.
9 I'm a geochemist with Golder Associates. I have about
10 twenty (20) years of experience evaluating geochemistry
11 for mine sites around the world. And I've spent a
12 significant portion of the last twelve (12) years of my
13 life evaluating geochemistry for mine sites in the
14 Northwest Territories.

15 I'm going to talk to you today about
16 geochemistry. In particular, the geochemistry of the
17 Gahcho Kue project. I believe we're starting out the
18 geochemistry presentation on slide number 93. I'm
19 going to flip down immediately to slide number 94. And
20 slide 94 gives an overview of what I'll be talking
21 about.

22 I'm going to provide a brief discussion
23 on the objectives of a typical geochemistry program.
24 And I'm going to follow this with a discussion of the
25 methods that we're going -- that we've used, the

1 program completed for the Gahcho Kue project, the
2 results, and the supplemental evaluations completed.

3 The results to date for the Gahcho Kue
4 project, geochemistry, show that most of the mine rock
5 and all of the PK, or processed kimberlite, is non-acid
6 generating, with low potential for metal leaching. The
7 leach test results are used in the water quality
8 assessment and sub -- some supplemental data was
9 collected, in particularly -- or sorry, in particular,
10 as related to phosphorous.

11 I'd like to note here that there's a
12 very large body of detailed information available
13 regarding the geochemistry for this project and I
14 encourage everyone who's interested to read Appendix
15 8.2 of the environmental impact statement, where all of
16 that data is presented.

17 Moving to slide 95. There are a couple
18 of primary objectives related to a geochemical test
19 program and analysis program. One (1) of these
20 objectives is understanding the influencing factors
21 that control the water quality. These factors include
22 rock-water interactions. Rock-water interactions are
23 simply what happens to the chemistry of the water as
24 the -- the water -- when it encounters rock from the
25 site. And particularly, blasted rock or rock that's

1 moved around the site.

2 We also want to understand the
3 interactions with the atmosphere, which are the changes
4 that could take place when this rock is exposed to
5 weathering. There are also then chemical reactions
6 that could alter the water chemistry as it moves
7 through the different rocks and water pathways. So we
8 want to understand that as well.

9 The other main objective of developing
10 this geochemical understanding is so that we can
11 develop appropriate design and mitigation measures for
12 the mine rock and the processed kimberlite. And that's
13 going to help us to protect the environment.

14 Aspects of the geochemistry program that
15 help us in the design decisions include understanding
16 what inputs are appropriate for the water quality
17 estimates and understanding what different mitigation
18 option -- options can do to help change the chemistry
19 of the water coming from the site.

20 Slide 96. When we assess the
21 geochemistry for a project such as Gahcho Kue we use a
22 number of publicly available documents for guidance.
23 These documents are fairly widely accepted -- they are
24 widely accepted and they're listed on the slide. They
25 include a guideline for acid rock prediction in the

1 north as published by DIAND in 1992, there's BC
2 guidelines for prediction of metal leaching and acid
3 rock drainage published in 1997, and there's more
4 recent guidelines published by MEND in 2009, and
5 there's also the Global Acid Rock Drainage guide --
6 guideline published in 2009. And the GARD Guide, or
7 the Global Acid Rock Drainage Guideline is available on
8 the website as shown on the -- on the slide. And
9 again, I encourage anyone interested in understanding
10 the test methods and rationale for the geochemistry to
11 refer to those documents. I enjoy reading them and I'm
12 sure you will too.

13 Slide 97. I'm going to speak briefly
14 now about the test program considerations for the
15 testing completed on the Gahcho Kue site. The first
16 consideration in the design of a geochemistry program
17 is selection of appropriate and representative samples.
18 To select these samples we consider the geological
19 distribution of the materials, we consider the mine
20 plan, the tonnage of rock to be excavated, the rock
21 types or lithology of the rocks to be excavated as
22 well.

23 We look at ore processing, the types of
24 processing that are going to take place, and the types
25 of waste materials such as processed kimberlite that

1 are produced. And then based on all of this
2 information we select a set of samples that we consider
3 to reasonably represent the rock to be excavated and
4 processed.

5 Following the sample selection we
6 complete a laboratory testing program on the samples
7 which consists of what we call static testing and
8 kinetic testing. Static tests are typically one (1)
9 time tests or -- or are completed over a short period
10 of time, and they provide the information --
11 information about a specific sample.

12 Types of tests include acid base
13 accounting or ABA elemental analysis, mineralogy, and
14 short-term leach testing. Acid base accounting
15 provides a measure of the balance between the acid-
16 forming minerals such as sulphate and the buffering
17 minerals such as carbonate or aluminum silicates. An
18 example of a sulphide mineral that could produce
19 acidity would be pyrite.

20 We -- they also do chemical or elemental
21 analysis. And this analysis provides an indication of
22 the overall elemental makeup of the rock or the
23 chemistry of the rock.

24 Mineralogy is completed and that
25 provides an indication of how those elements or

1 chemicals are put together in the rock, or the types of
2 minerals in the rock. And that gives us a good
3 indication of how those -- those -- those rocks are
4 going to react understanding what the mineralogy is.

5 In short-term leach testing, which is
6 also a static test, we typically take a rock sample and
7 we'll grind it or pulverize it, mix it with distilled
8 water typically, and then the water is analyzed --
9 filtered and analyzed to look for chemical changes that
10 occur when you in -- the rock interacts with the water.

11 Kinetic tests are often carried out on a
12 smaller subset of samples. And these are simply
13 repetitive leach tests where you take the same sample,
14 and we add water on a regular cycle, typically a weekly
15 cycle, and the water that interacts with the rock on
16 that weekly cycle is then analyzed for the chemistry.
17 And that helps us determine whether the chemistry is
18 going to change over time with interaction with those
19 rock samples.

20 There are several different types of
21 humidity cell tests -- or sorry, kinetic tests,
22 including humidity cell tests, columns, submerged
23 columns. And I'm going to describe some of those in
24 the next few slides.

25 Also I'd like to note that a typical

1 test program uses a staged approach. In a staged
2 approach we look at the results of the initial set of
3 analyses, use that information to help us focus on what
4 other parameters or analysis we might have to look at
5 in more detail to get a better understanding of their
6 behaviour.

7 And an example of this staged approach
8 for this particular project is the development of our
9 test program in our understanding of phosphorus, which
10 I am also going to talk about a little bit later.

11 Slide 98. This slide shows a photograph
12 -- this slide shows a photograph of a typical humidity
13 cell. Material in the humidity cell is subject to wet
14 and dry cycles. Water is added to the top once per
15 week. The water is allowed to drain through the
16 sample. Then it's collected and analysed at the base
17 of the sample for a comprehensive suite of chemical
18 analysis.

19 And the duration of these -- these tests
20 or the number of cycles is typically about twenty (20)
21 weeks, but oftentimes that's extended longer in order
22 for us to get a better understanding of longer term
23 behaviour of these materials and the types of changes
24 that the rock may encounter as it weathers.

25 We're on to slide 99. This is a

1 different type of kinetic test. This is a typical
2 saturated column test. So in the previous slide we
3 showed what would happen if -- on a series of wet and
4 dry cycles, and these particular tests, they're similar
5 to humidity cells in that water is added and analysed
6 once per week. However, the cells remain saturated for
7 the entire week, and this gives us a better indication
8 of what might happen in a submerged environment.

9 Again -- well, the other thing that we
10 do with these tests is we collect water from both the
11 top and the bottom of the cell so we understand what
12 might happen on either side, either above the materials
13 or as water filters through these -- these solids.

14 Again, the test duration is typically
15 about twenty (20) weeks, but, you know, we also extend
16 some of these tests longer to predict long-ter --
17 longer term behaviours.

18 Slide 100. So I spoke briefly about the
19 types of tests that we conduct. This table is provided
20 to give an indication of the number of tests performed
21 for the Gahcho Kue project. For static testing on
22 solids I'm going to round some numbers here.

23 We can -- tested over six hundred and
24 fifty (650) samples of kimberlite and process
25 kimberlite. We tested over twelve hundred (1,200)

1 samples of mine rock. And this is far above the
2 suggested minimum number of samples to be re --
3 required by most of the guideline -- well, by all of
4 the guideline documents referenced earlier.

5 Now from these main static tests of
6 solids, these are primarily ABA tests, we also
7 submitted a subset of samples for short-term leach
8 tests and kinetic testing. There's a significant
9 number of kinetic tests that were performed on these --
10 these samples, including forty-eight (48) samples of
11 kimberlite and process kimberlite and twenty-four (24)
12 samples of mine rock.

13 Slide 101 provides an example of the
14 type of data that we would obtain from a kinetic test
15 cell. These graphs in particular show chloride data
16 for the ongoing test work that we started in 2010 and
17 2011. There's additional humidity cell test and column
18 test data that's available in Appendix 8.2, including
19 all of the different parameters and all of the
20 different test cells.

21 In this particular -- in these graphs
22 the 'X' axis represents time in weeks from the start of
23 the test progra -- or from the start of the test and
24 the 'Y' axis provides concentration. And again, this
25 is for chloride as an example.

1 However, it's important to note on here
2 that each of these data points actually represents an -
3 - an analysis of about fifty (50) other parameters. So
4 each data point is a weekly sample that's collected and
5 analysed for approximately fifty (50) parameters.

6 Now even though there's a lot of
7 information on this slide, and I don't expect you to --
8 to comprehend and grasp that immediately upon looking
9 at it, I'd like to point out a few key things here, and
10 that's the data that we would typically use to develop
11 a water quality estimate for a program.

12 So we would typically use the first five
13 (5) weeks of data as a early time data, which would
14 represent a first flush of the material, or the initial
15 water that could -- would -- would encounter this
16 material right after it's -- it's deposited on the
17 site.

18 And then we look at the later time data,
19 either -- well, the last five (5) weeks of -- of
20 testing typically, we would average that out for a
21 curve like this, because most of the parameters
22 typically start out with higher concentrations and
23 decrease over time unless the pH changes, in which case
24 you can get some -- some other changes in -- in the
25 graph, but we would analyse those on a parameter by

1 parameter basis.

2 But typically we use the first five (5)
3 weeks and the last five (5) weeks of data to develop
4 our short-term leach or our -- our -- our first flush
5 in our steady state concentrations. And these are the
6 two (2) parts of the curve that we would take forward
7 into the water quality modelling aspects of the job.

8 We're onto slide 102 now. And now that
9 we've discussed some of the types of testing and the
10 number of samples collected, I'd like to give you some
11 indication of what we found with all this test work.

12 I'm going to talk about the mine rock
13 first. The mine rock is the rock that's going to be
14 removed to access the ore and it's primarily composed
15 of granite or variations on granite, somewhat possibly
16 altered, a little bit of diorite in there, as well.

17 The re -- results of this testing of
18 this material, or these greater than twelve hundred
19 (1,200) samples, show that there's very little sulfide
20 minerals in -- in this rock, in this granite. And
21 there's also small amounts of buffering capacity.

22 Overall the materials are generally non-acid
23 generating, or they don't have sufficient sulfide
24 minerals to generate significant acidity.

25 So -- and these non-acid generating

1 samples account for about 98 percent -- well, they
2 account for more than 98 percent of the rock samples
3 tested. Humidity cell testing conducted on these
4 samples confirm that low sulfide minerals -- or low sul
5 -- low sulfide materials aren't likely to generate
6 acidity, with only one (1) of the twenty-three (23)
7 mine rock humidity cell tests generating any acidity.
8 And the cell that did generate the acidity had about
9 0.1 percent sulfide and a very low neutralizing
10 potential for that particular sample.

11 Elemental analysis on the data set
12 showed that the primary solid phase rock components are
13 aluminum and silicate as you would expect with the
14 granite. And there was some elevated concentrations in
15 molybdenum and zinc that were above a typical crustal
16 abundance.

17 Short-term leach tests and kinetic tests
18 show a potential for metal leaching -- sorry, a low
19 potential for metal leaching. And leachate results
20 from the kinetic tests were used in the overall water
21 quality analysis, which is the subject of the next
22 presentation.

23 So we take all of this data and we use
24 the leach test results from the kinetic tests typically
25 to represent the water quality, and we do that for all

1 of the different parameters.

2 We're onto slide 103, with respect to
3 processed kimberlite. Now it's anticipated that the
4 kimberlite excavated, of course, is going to be
5 processed, is going to produce a processed kimberlite.
6 So the process of -- you know, in that process,
7 materials are ground and -- and pretty well mixed
8 together. The results for the testing of processed
9 kimberlite, which I may also refer to as PK if I slip,
10 they show that all of the samples are characterized as
11 non-acid generating. So all of the processed
12 kimberlite samples are non-acid generating following
13 the criteria in the guidance documents. And they have
14 significant excess buffering capacity. What this means
15 is that these materials can neutralize much more
16 acidity than they can produce. Humidity cell tests
17 confirm that these materials are non-acid generating
18 with excess buffering capacity, as well.

19 If we look at the elemental analysis it
20 shows that the fine processed kimberlite and the course
21 processed kimberlite are similar in composition. Fine
22 PK or processed kimberlite has slightly elevated metal
23 values compared to the coarser PK. And this is likely
24 a function -- could be a function of one (1) of two (2)
25 things. It could be -- just be the test method in

1 terms of the acid digest of the sample, or it could be
2 a function of the crushing process whereby some of the
3 softer mineral -- minerals would preferentially be
4 crushed to the finer grain size and -- and show some
5 slight differences in the concentrations.

6 And for the PK, or processed kimberlite,
7 parameters, nickel, cobalt, chromium, magnesium,
8 selenium, and strontium in the solid phase were
9 slightly elevated relative to typical crustal
10 abundance.

11 It's important to point out that a solid
12 phase concentration of a particular element does not
13 necessarily mean that element will end up in the water.

14
15 It just means that we want to look at
16 that element as we do our leach testing to determine in
17 -- in particular we want to look at those elements to
18 get a better understanding of -- of their leach
19 characteristics.

20 Slide 104, we're going to continue
21 talking a little bit about processed kimberlite with
22 respect to the leach tests.

23 The short term leach tests and kinetic
24 tests also -- or all show neutral to slightly alkaline
25 pH values with a low potential for metal leaching, with

1 the fine PK, again reaching slightly more metals and
2 other elements than the coarse PK, and this is likely a
3 function of the grain size of the material.

4 And we also analysed water from the
5 process test work. So as the process testing was
6 completed to understand the -- the extraction, we took
7 samples of the water from that process test work.

8 And what we found is that the process
9 test water -- or sorry, the process water test results
10 were very similar to the short-term leach test results.

11 And these wat -- these waters -- or the
12 understanding of the water quality from the process
13 waters, the short-term leach tests, and the kinetic
14 tests are all carried forward in the water quality
15 analysis, which again is subject of the presentation
16 next.

17 Of note is that as a result of the
18 initial water quality analysis, phosphorus was
19 identified as a parameter, which we considered required
20 some follow-up work.

21 And I'm just going to talk about that
22 briefly on slide 105 here. So before I go on to
23 summarize, I -- I want to speak about how we go about
24 determining what parameters we need to look at more
25 closely, and how we proceed with supplemental test

1 programs, so how do we decide that we need to -- a
2 supplemental test program for a parameter, and then how
3 do we go about doing that.

4 And I think it's very important to
5 realize that the scientific process is an iterative
6 one. That's to say, as we find out more information we
7 can better focus on what's important. An example of
8 how this process works is -- can be found in our
9 evaluation of phosphorus.

10 With respect to phosphorus, we decided
11 to look at this particular parameter in more detail
12 because of the results from one (1) of the submerged
13 column tests that we ran, this, coupled with our
14 preliminary water quality model that appeared to be
15 providing unrealistic estimates of phosphorus
16 concentrations. This led us to the conclusion that we
17 needed to better understand phosphorus as a source term
18 and particularly at low detection limits. So we
19 initiated a supplemental test program to evaluate
20 phosphorus.

21 The supplemental test program consisted
22 of procuring and producing additional samples of
23 processed kimberlite. We completed approximately 21
24 analyses of these samples, along with initiation of ten
25 (10) kinetic test cells. The kinetic test cells

1 included subaerial, or -- or standard humidity cell
2 tests plus submerged tests.

3 And with respect to analysis of these
4 samples, we conducted the analysis of these samples at
5 a very low detection limit so that we'd have a better
6 understanding of what real phosphorus values were
7 moving forward.

8 And as -- what this has done is it's
9 allowed us to better understand the rates of release of
10 phosphorus over time from the solid phase material to
11 the liquid phase, and that's what we're going to be
12 carrying forward into additional work on the water
13 quality modelling.

14 Now I'm going to summarize in slide 106.
15 So in summary, we completed a comprehensive
16 geochemistry program on representative samples of the
17 materials, of the solid materials found to be expected
18 on site.

19 Based on the samples testing -- tested,
20 acidic drainage is not expected at this site. However,
21 there will be a monitoring program, and as at all mines
22 there will be a rock management plan.

23 There is a small amount of rock with
24 some potential to generate acidity -- or to -- for acid
25 generation. However, it's important to note that there

1 are several mitigation options and available if
2 necessary to deal with these materials during
3 operations.

4 From the leach testing and kinetic
5 testing, concentrations of metals, major irons, and
6 nutrien -- nutrients were evaluated, and were carried
7 forward into the water quality model. Supplemental
8 data was also collected, particularly with respect to
9 developing a better understanding of phosphorous.

10 And in conclusion, we consider that the
11 geochemical program completed for the Gahcho Kue
12 project is robust, and we are confident that our
13 understanding of the possible geochemical conditions on
14 site will lead to sound decision making that will help
15 protect the environment. Thank you.

16

17 QUESTION PERIOD:

18 THE FACILITATOR HUBERT: Chuck Hubert,
19 with the Review Board. Thanks very much for that
20 presentation. I'd like to -- well, I'll give parties
21 the opportunity to ask a question or two (2) if there
22 are any, on that.

23

24 (BRIEF PAUSE)

25

1 THE FACILITATOR HUBERT: Okay, thanks.

2 Then...

3 MR. PAUL GREEN: It's Paul Green, with
4 Aboriginal Affairs. Just a couple of quick ones. From
5 your first slide I -- I read that there was 98 percent
6 of samples are non-acid generating, which would be
7 about 2 percent that are potentially acid generating.
8 My previous understanding had been that it was more on
9 the order of 6 percent. I guess there may have been
10 some additional data collected.

11 Is that the case?

12 MR. KEN DE VOS: Ken De Vos with Golder
13 Associates. There are actually a couple of different
14 ways to evaluate acid generation potential. And the 6
15 percent comes from using a ratio of neutralization
16 potential to acid potential, not considering the amount
17 of sulfide mineral in -- in the sample.

18 When we combine both the ratio of NP to
19 AP, or neutralization potential to acid potential, and
20 we consider the amount of sulfide minerals, so the
21 amount of acidity that can actually be generated by a
22 sample, we find that -- that for many of those samples
23 that contributed to the 6 percent, there was less than
24 .01 percent sulfide mineral in those actual samples.

25 So there's not an appreciable amount of

1 acid generating materials in those, to actually
2 generate acidity. So our classification of the 98
3 percent excludes those samples that -- that don't have
4 appreciable amounts of sulfide minerals in them.

5 Ken De Vos of Golder. I'd -- I'd just
6 like to -- to point out that there's an error in the
7 slide. And that is slide 94, slide 94 up on the
8 screen. It says the majority should read -- and 98
9 percent of the mine rock is considered non-acid
10 generating, not what it currently reads on the screen.

11 MR. ALAN EHRLICH: It's Alan Ehrlich.
12 I -- I'm confident that most listeners read it -- read
13 it that way.

14 I have a question. I was wondering if
15 you could talk a little bit more about the -- the 2
16 percent that is pote -- or roughly 2 percent that is
17 potentially acid generating.

18 How homogenous is your rock? Is this 2
19 percent that's distributed throughout the rock we're
20 dealing with? Is there a particular patch where you're
21 expecting to have to deal with potential acid
22 generation? If it is dis -- if it is not homogenous,
23 do you have a way of recognizing when you've hit that
24 period so that you understand when you should be able
25 to mitigate it? Can you talk a little about the -- the

1 distribution of that? Thanks.

2 MR. KEN DE VOS: Ken De Vos with
3 Golder. Yeah, I can talk a little bit about that. The
4 sulfide minerals -- if -- if we look at that 2 percent
5 of -- of material, sulfide is associated with --
6 primarily with secondary fracture infilling, and it's
7 disseminated.

8 So there are fractures throughout --
9 throughout the site, small fractures. The nu -- a
10 number of the samples, there's -- there's slightly more
11 samples associated with the 5034 pipe, in the rock
12 around the 5034 pipe, than there are with the other
13 pipes.

14 However, that's about seventeen (17) of
15 the two thousand eight hundred (2,800) or, sorry, two
16 thousand six hundred (2,600) samples or, sorry, twelve
17 hundred (1200). Seventeen (17) of the twelve hundred
18 (1200) samples, approximately, have some potential for
19 acid generation.

20 And, you know, I'd like to point out
21 that that doesn't mean that those particular samples
22 are going to generate acidity. And when taken in bulk
23 with the large amount of samples that have some minor
24 excess neutralization potential, it's unlikely that
25 acid generation will occur at this site; that said, as

1 mentioned earlier, there will be a monitoring program
2 for the site rock as part of operations.

3 I hope that answers your question.

4 MR. ALAN EHRLICH: No, I think it does
5 if the monitoring program is what you will be relying
6 on to decide when to use the mitigations that you've
7 identified you have.

8

9 (BRIEF PAUSE)

10

11 MS. VERONICA CHISHOLM: Veronica
12 Chisholm from De Beers. Yes, we will be monitoring.
13 And based on the results or outcomes of the monitoring
14 we will put in additional mitigations as necessary.

15 Does that answer your question?

16 MR. ALAN EHRLICH: It sure does. It
17 sounds fortunate that you've got an abundance of
18 alkaline material there to work with if you need to
19 mitigate this stuff. I'm sure that many diamond mine
20 developers look forward to finding this little
21 potentially acid generating rock when they're doing
22 their initial scout out. So it's nice to know that, at
23 least from what we've heard here, this may not be a
24 major issue. I'm going to hand the chairing back to
25 Chuck.

1 MR. TODD SLACK: Todd Slack,
2 Yellowknives Dene. I guess I have to start this
3 question with a bit of a preamble.

4 At the Snap Lake mine, for instance,
5 we've seen water flows let's say -- I don't have the
6 numbers handy, let's say 30 percent higher than normal,
7 we've seen TDS predictions proved -- they've turned out
8 to be 40 or 30 percent higher than the original
9 prediction. Nitrates, other -- and now directly
10 related to the geochemistry or the elements in this
11 case.

12 With that kind of perspective in mind
13 and understanding how those predictions went awry, what
14 contingency planning is in place for both the flows and
15 the geo-chemistry and nutrients for this site if it
16 turns out that the predictions are again a little bit
17 off?

18 For instance, has there been a test run
19 -- and, you know, I realize this isn't TDS, but has
20 there been a test run to examine plus/minus 25 percent
21 TDS? And I -- I'm just using this as an example
22 because of how important the concentrations are for
23 your closure and just your operations plan.

24 Or plus/minus 25 percent flow -- and we
25 -- you know, these are -- this is a solid rationale,

1 we've seen this. So if the company can speak to what
2 contingency planning is available, I'd appreciate that.

3

4 (BRIEF PAUSE)

5

6 MR. KEN DE VOS: Ken De Vos, with
7 Golder Associates. Before we respond to the question I
8 would first like to point out that your -- the comments
9 with respect to Snap Lake, there are a couple of -- I
10 also work on Snap Lake and we have tracked inflows
11 relative to predictions and we have tracked TDS
12 concentrations relative to the predictions.

13 And for the discharge from the mine
14 site, both of those are actually tracking right on the
15 predicted values from the 2001/2002 environmental
16 assessment. Now it's true that there is an undated
17 prediction, but that's a subject of another -- another
18 hearing and I don't think it's relevant to necessarily
19 bring those into this particular hearing.

20 But I did want to respond to the -- the
21 first comment, that -- that those predictions from the
22 environmental assessment are tracking very well with
23 the flows and the TDS from the mine.

24 With respect to contingency, the --
25 there is ample room and ample mitigation available if

1 we encounter more acid generating materials onsite in
2 terms of mitigation plans for those materials. And I
3 believe there's another part.

4 MS. VERONICA CHISHOLM: Veronica
5 Chisholm, from De Beers. Yes, I'm just awaiting some
6 additional information from the engineers to answer the
7 second part of your question, Todd, in terms of the --
8 the te -- 25 percent test runs. I think that was what
9 you were specifying.

10 So if you could just allow us after the
11 break to maybe come back with that respo -- are you
12 ready?

13 MR. WAYNE CORSO: Sure.

14 MS. VERONICA CHISHOLM: Oh, sorry.
15 Wayne Corso will respond to that part of the question.
16 They sneak up from behind me.

17 MR. WAYNE CORSO: Yeah, Wayne Corso,
18 JDS. Just dealing not with the chemistry part, but
19 with the -- the volume in the water management plan,
20 and one (1) of the things that the strengths of the --
21 of the plan itself is when we create this isolated
22 basin and pump down the lake it gives us the capacity
23 to handle some of these upset conditions.

24 And we looked at a couple of -- a couple
25 of specific upset conditions. One (1) is wet years.

1 So that would sort of address your concern about
2 volumes of water much more than we'd anticipated. We
3 looked at one in hundred year storms. And if those
4 storms occur during years when we're -- we're pumping
5 annually, which is the first four (4) years of the --
6 of the base case project, then we're fine. We -- we
7 pump more water out because the -- the quality is --
8 allows us to do that. So no problem there as far as
9 quality.

10 The -- the other upset conditions we
11 looked at were, say, the quality does not allow us to
12 discharge, and then we've got to store the water. And,
13 in that case, we've got, with no di -- discharge at
14 all, two (2) years in order to, you know, take our
15 mitigative measures, get the quality where we need to
16 do, divert other in -- flows coming into the -- into
17 the controlled area so that we can -- we can handle
18 that kind of water.

19 So those are the types of things that we
20 have looked at. We can get you, you know, the -- the
21 actual numbers for those upset cases if -- if that
22 would be helpful for you. But -- but just to let you
23 know that the -- the actual design of the -- of the
24 system such that we isolate and -- and drain the basin
25 gives us that kind of flexibility to work with those

1 upset conditions. Thank you.

2 MR. TODD SLACK: Thanks. Sorry. Todd
3 Slack, Yellowknives Dene. And I didn't catch your
4 name. But if you could provide, excuse me, tho --
5 those kind of contingencies as -- as the mine
6 development goes I would be very interested to see
7 that.

8 Now just one (1) point of clarification.
9 Ken, could you say that first part over again just to
10 make sure I understood what, sorry, you were saying.

11

12 (BRIEF PAUSE)

13

14 MR. KEN DE VOS: Todd, it's Ken De Vos
15 here. Which -- sorry, which part were you referring
16 to, Todd, the -- of the first part? Which part of the
17 first part were you referring to?

18 MR. TODD SLACK: Ken, you're here
19 tomorrow?

20 MR. KEN DE VOS: No.

21 MR. TODD SLACK: Oh, I was going to go
22 back and look at the transcript, but...

23 I'll -- I'll think about it. I'll come
24 back to it.

25 THE FACILITATOR HUBERT: Chuck Hubert,

1 Review Board. It's possible that the following
2 presentation on water quality might jog your memory,
3 possibly.

4 MS. VERONICA CHISHOLM: And Veronica
5 Chisholm, from De Beers. And we'd be happy to go over
6 and look at the transcript with you at the break, Todd,
7 so that we can understand what the question is.
8 Thanks.

9 THE FACILITATOR HUBERT: Chuck Hubert,
10 with -- with the Review Board. With that, if we can
11 continue with the water quality presentation. Can you
12 give me an estimate roughly of how long your
13 presentation --

14 MR. MICHAEL HERRELL: It's Mike
15 Herrell, from Golder. It's about thirty (30) minutes
16 to forty (40) minutes.

17 THE FACILITATOR HUBERT: Well,
18 according to our agenda we are five (5) minutes from
19 our scheduled -- scheduled break. So how about we take
20 a break now and -- and you can relax and have all the
21 time you need for your presentation afterwards.

22 So a ten (10) minute break. See you in
23 ten (10) minutes.

24 MS. VERONICA CHISHOLM: Veronica
25 Chisholm, from De Beers. I think that I noticed that

1 Steve Ellis is here, so we could perhaps read the
2 response to the question before we had our lunch break,
3 so I'm going to have John Faithful respond to that now.

4 MR. JOHN FAITHFUL: John Faithful,
5 Golder Associates. This is a -- a response to a
6 question from Steve Ellis, Treaty 8 Tribal Corporation.
7 And let me paraphrase the question and get confirmation
8 that it's -- it's still correct, Steve.

9 And that was to confirm that the 2004
10 study that was referenced in the permafrost baseline
11 was the -- the only document that was used to
12 characterize the permafrost conditions. He's nodding.

13 Yeah, so in answer to that -- to that
14 question, yes, the AMEC 2004 draft report titled,
15 "Gahcho Kue Pre-feasability Study Geotechnical and
16 Geophysical Site Investigations," which was prepared
17 for De Beers, was the only document that was utilized
18 to characterize the permafrost conditions on site.

19 With respect to -- to your -- to follow
20 up on the active layer, currently there's no evidence
21 of the active layer on site not freezing through the
22 winter. However, even if it did it would not change
23 the conclusions of the EIS, as the results of the
24 assessment are not depend -- not dependent on the
25 development of all continued existence of permafrost in

1 the area.

2

3 (BRIEF PAUSE)

4

5 THE FACILITATOR HUBERT: Chuck Hubert.

6 Thanks very much for that response.

7 Todd, were you waving your hand?

8 MR. TODD SLACK: Thanks, I -- I was. I

9 think I got to the bottom of what I was getting at,

10 what the first part of the first part was. Todd Slack,

11 Yellowknives Dene.

12 Now, Ken, you said that TDS and flows

13 from Snap Lake -- because I understand that this --

14 this is part of a different process, but the nature of

15 models and the nature of these predictions matters,

16 because that's what we're going on here. So if it

17 turns out they were 40 percent wrong on that one (1),

18 you know, why couldn't they be 40 percent wrong on this

19 one (1)?

20 Now I want to understand that you said

21 that they are tracking exactly as predicted. I think

22 that's what I heard.

23 MR. KEN DE VOS: Ken De Vos, with

24 Golder. Yeah, I -- I want to be clear, and -- and I --

25 you know, Snap Lake is a different process, so I don't

1 want to go into huge amounts of detail. And -- and I
2 think I may understand the discrepancy between your
3 percent difference in my tracking.

4 I have the tracking records and the
5 tracking records for Snap Lake are provided in each
6 annual report in terms of loading at the discharge
7 that's in the ARD Report. And those loading and
8 cumulative loading trends from the discharge pipe to
9 Snap Lake are -- are what is tracking very well within
10 Environmental Assessment predictions.

11 Now I think -- and -- and you can check
12 the Snap Lake ARD, annual ARD Reports to confirm that
13 if you wish.

14 MR. TODD SLACK: Todd Slack,
15 Yellowknives Dene. Yeah, we'll pursue that through an
16 Information Request.

17 THE FACILITATOR HUBERT: Chuck Hubert,
18 Review Board. Thanks very much. I think we're ready
19 for about a ten (10) to fifteen (15) minute maximum
20 break. Thanks. See you then.

21

22 --- Upon recessing at 2:42 p.m.

23 --- Upon resuming at 3:00 p.m.

24

25 THE FACILITATOR HUBERT: Chuck Hubert

1 with the Review Board. Welcome back everybody from the
2 break. If -- we have some interesting topics up next,
3 water quality, and I'd like to turn the mic over to De
4 Beers to discuss it. Thanks.

5

6 PRESENTATION BY DE BEERS CANADA RE WATER QUALITY:

7 MR. MICHAEL HERRELL: Good afternoon.

8 My name is Mike Herrell from Golder Associates. I'm
9 going to talk about the -- the effects to surface water
10 quality.

11 I'm actually very excited to give this
12 presentation now because there were several questions
13 this morning that I think will be covered off at the
14 end of this presen -- presentation.

15 Mark had a few questions about the --
16 the Tuzo pit stability. This water quality model
17 brings together a lot of the assessments that were
18 discussed this morning by Ken and Nathan and Don, so a
19 lot of the -- the questions that were asked were -- are
20 more appropriately answered as a part of -- as this
21 presentation.

22 So -- so on slide 108 is an outline of
23 my presentation. To begin, I'll discuss the -- the key
24 lines of inquiry in the terms of reference that guided
25 the assessment, and present the key sections in the EIS

1 where information can be found, including the methods
2 and the results.

3 I will then discuss the baseline studies
4 that have been completed to date to -- that were used
5 to characterize the baseline condition for the project
6 LSA, and the RSA.

7 I will then provide an overview of the
8 assessment approach, which included incorporating the
9 results of hydrology, hydrogeology, and geochemical
10 assessments that I previously mentioned, and how
11 they're incorporated into a single model that projects
12 the -- the surface water quality for Kennady Lake, and
13 the -- the downstream watershed.

14 More specifically for the surface water
15 quality evaluation, I'll discuss also how the project
16 air emissions, the surface water quality model, and the
17 Tuzo pit hydrodynamic model are accounted for in the
18 simulations.

19 And finally I'll present the -- the
20 winter oxygen depletion rate modelling that was
21 completed to further assess the outputs of the -- the
22 surface water quality model.

23 And finally to -- to finish off, I'll --
24 I'll provide a discussion of the approach, and how
25 these -- the -- the results from the -- the surface

1 water quality model, and how that was carried forward
2 into the -- the aquatic risk assessment, how that
3 assessment was completed, and the results of that
4 assessment.

5 I've moved to slide 1 -- 109. So as
6 John Faithful mentioned this morning in the -- the
7 aquatics introduction, based on the terms of reference
8 for the Gahcho Kue project, effects on water quality
9 were captured primarily in two (2) key lines of
10 inquiry.

11 These were water quality and fish in
12 Kennady Lake, which is covered off in the EIS in
13 Section 8, and downstream water quality effects, which
14 are covered off in Section 9 of the EIS.

15 And to provide a couple of excerpts from
16 the terms of reference that guided the assessment,
17 verbatim:

18 "The EIS must provide a detailed
19 analysis of all impacts, including a
20 comprehensive analysis of potential
21 impacts on water quality of Kennady
22 Lake as a result of possible
23 contamination. Also, the EIS must
24 provide an evaluation of the
25 potential downstream effects, and the

1 extent of the impact."

2 The results of the -- the water quality
3 assessment also serve as an input to the -- the fish
4 assessment, which will be discussed tomorrow.

5 I'll now discuss the -- the existing
6 environment for the -- the Gahcho Kue project with
7 respect to surface water quality.

8 It's important to have a -- a good
9 understanding of -- of the existing conditions, because
10 that forms the -- the basis for evaluating the effects
11 to surface water quality from a project.

12 At the Gahcho Kue project, there is a
13 very good understanding of the existing condition, and
14 it's been developed through several studies that span
15 several years. So the existing environment data for
16 water quality and sediment data was collated from
17 historic data sa -- historic data sources within
18 Kennady Lake watershed, the LSA and the RSA -- and for
19 those on the webcast, I'm now on slide 111 -- and then
20 more recent field surveys that were conducted as part
21 of the -- the EIS within the Kennedy Lake watershed and
22 within the -- the local study area.

23 Moving on to slide number 112, field
24 programs that have been completed within the L -- LSA
25 include twenty-three (23) water quality sampling

1 programs between 1995 and 2005, and also between 2010
2 and 2011.

3 These surveys had an emphasis on the
4 Kennady Lake watershed and monitoring included open
5 water and under ice condition surveys, sampling for
6 water chemistry data and water column profile data.

7 Sampling programs to characterize the
8 sediment properties and chemistry were also conducted.
9 These included surveys in Kennady Lake in 2004 and
10 2005, and then also in 2010 and 2011.

11 So the existing data set for sediment
12 and water quality for the Gahcho Kue project is quite
13 abundant.

14 To provide -- slide 112 presents a
15 summary of the existing environment water quality
16 studies that were mentioned in the -- the previous
17 slide. Some key observations that can be drawn from
18 the water quality assessment include the water quality
19 is similar throughout Kennady Lake and other lakes in
20 the LSA, and that seasonal variability is low.

21 Lakes exhibit season -- seasonal
22 physical chemical characteristics, and most lakes have
23 low concentrations of total dissolved solids,
24 alkalinity and hardness, and also total suspended
25 solids.

1 The lakes can be characterized as
2 oligotrophic and phosphorous limited. The lakes have
3 total -- have low total organic carbon and dissolved
4 organic carbon, but do possess some colour, and metal
5 concentrations are generally low. But some metals, for
6 example, aluminum, cadmium, copper, iron and zinc, have
7 been reported above the -- the aquatic life guidelines,
8 the CCME guidelines for the protection of aquatic life.

9 I'm on slide 113 now. This slide
10 presents some of the key observations of the existing
11 sediment characteristics based on samples collected in
12 the -- the sampling programs mentioned on slide 111.

13 Sediments can be characterized as being
14 mainly composed of sand with approximately 70 percent
15 of it being sand, with low -- with a low silt content
16 of approximately 25 percent and very low clay contents,
17 with approximately 2 percent.

18 There is low to moderate organic carbon
19 content found within the sediments, and concentrations
20 of most metals in Kennady Lake bed sediments are below
21 sediment quality guidelines. But arsenic, cadmium,
22 chromium, copper and zinc have been measured above
23 guideline concentrations in samples collected from the
24 studies that were presented on slide 111.

25 On slide 114, there are some additional

1 studies that are ongoing, and future studies. The
2 purpose of these is to add to the existing
3 environmental database, to collect additional water and
4 sediment quality data in target locations.

5 These programs included under ice and
6 open water conditions and targeted freshet monitoring.
7 And these studies incor -- included in situ monitoring
8 of physicochemical parameters and turbidity.

9 And some of the key purposes of these
10 studies is to transition the baseline data set to the
11 collection of AEMP data and also apply updated
12 analytical techniques to measurement of ultra-low
13 metals and nutrients, specifically phosphorous, as a --
14 as appropriate. And also to include chlorophyll A
15 sampling in association with -- with nutrients. And,
16 finally, to improve the -- the sediment nutrient data.

17 I'm now on the -- the next slide, which
18 provides the assessment approach. The -- the existing
19 environment discussed in the previous slides form the
20 basis of evaluating water quality effects of the
21 project. This information formed an input to a
22 comprehensive water quality assessment that considered
23 the results of the assessments presented by Don,
24 Nathan, and Ken as inputs in the model also.

25 The Service Water Quality Assessment was

1 completed as four (4) individual assessments that are
2 all interlinked. And I -- I mentioned these
3 previously, but to repeat, these include the effects to
4 water quality from project air emissions; effects to
5 service water quality in Kennady Lake and in the
6 downstream watersheds; and the Tuzo pit lake refilling
7 and the stability of the pit following repill --
8 refilling -- just as a clarification, the stability of
9 the pit lake following refilling -- and also a winter
10 oxygen depletion rate modelling within Kennady Lake.

11 So, I'll present the -- the approach for
12 each of these modelling efforts individually and
13 discuss how the results are carried forward into the --
14 the Aquatic Health Risk Assessment.

15 So the first assessment I'll talk about
16 is on slide 117 which discusses the -- the project air
17 emissions.

18 So, project air emissions. Effects from
19 project air emissions were evaluated using an air
20 quality dispersion model which Dennis Chang presented
21 in detail on Wednesday. This model produced the
22 following outputs that were used to assess the effects
23 of project air emissions on surface water quality.
24 These were mass loadings to Kennady Lake and in the
25 downstream watersheds, and also the potential for lake

1 acidification as a result of deposition -- deposition
2 of acidifying air emissions.

3 Moving on to the surface water quality
4 model on slide 118. The effects to surface water
5 quality were evaluated using a conservative mass
6 balance model developed in the GoldSim modelling
7 package. For those who are not familiar with Gold --
8 the GoldSim modelling software, to provide an excerpt
9 from the water quality modelling appendix in the EIS,
10 Appendix 8.1:

11 "GoldSim is a graphical object
12 oriented mathematical model where all
13 input parameters and functions are
14 defined by the user and built as
15 individual objects or elements linked
16 together by mathematical expressions.
17 The object based nature of the model
18 is designed to facilitate the
19 understanding of the various factors
20 which control an engineered or
21 natural system and predict the future
22 performance of the system."

23 I'll present an -- an overview of the
24 GoldSim software package in the upcoming slides. So in
25 -- to provide a clarification on how the -- the

1 software tool is used to calculate the water quality --
2 to project the -- to project the water quality for
3 Kennady Lake and the downstream watersheds.

4 So, as I previously indicated, water
5 qualities were projected for both Kennady Lake and the
6 downstream watershed. And this was done in GoldSim by
7 itemizing all inflow volumes to water bodies and
8 assigning them a water chemistry selected from either
9 the baseline information or geo-chemical testing to
10 account from loadings from natural areas, disturbed
11 areas, mine rock runoff, and fine and coarse PK runoff,
12 and the groundwater inflows to the -- the open pits.

13 Moving on to slide 119, to bro -- before
14 I -- I get into a detailed discussion of how the model
15 calculates water quality, I'd like to provide a -- an
16 example of how the source terms were selected. And Ken
17 brushed on this in his presentation also.

18 So, in this slide is a typical water
19 quality trend that is observed in humidity cells. The
20 trend is characterized by initial high concentrations
21 that are follow -- in the first five (5) weeks of
22 testing; that is seen on the left of the figure.
23 Followed by a steep decline of concentrations until a
24 steady state is generally reached later in the humidity
25 cell test.

1 As Ken indicated in his presentation,
2 the -- the concentrations in the first five (5) weeks
3 are used to represent the water quality during first
4 flush and the last five (5) weeks is used to --
5 generally used to represent steady state
6 concentrations.

7 The way the -- the humidity cell
8 information was incorporated into the -- the GoldSim
9 water quality model for the -- the Gahchoe Kue project
10 was quite conservative in that each humidity cell there
11 were several humidity cell tests for various materials.
12 So to provide an example of fine PK, the -- all of the
13 humidity cells that were run for the fine PK materials,
14 the maximum concentration from each of those three (3)
15 tests was assigned to the first flush water quality
16 from a particular facility.

17 Similarly, the maximum concentration
18 observed in the last five (5) weeks of the humidity
19 cell testing was assigned to the -- the steady state
20 flows following freshet. So within the modelling
21 environment the -- the maximum concentrations are
22 applied during freshet.

23 Now, freshet accounts for 56 percent of
24 the annual flow to the -- the lakes, so the maximum
25 concentrations observed in the first five (5) weeks are

1 assigned to the -- to more than half of the flow to
2 calculate loadings into Kennady Lake.

3 So moving on to slide 120. These slides
4 are animated for those who are on the web cast, so I'll
5 do my best to try and explain how things are flying
6 around the screen as I -- as I move through these --
7 these slides.

8 So I just would like to give an overview
9 of how the water quality is calculated in GoldSim so
10 it's clear to everybody how our numbers are generated.
11 So GoldSim -- I gave a very technical description from
12 the EIS of how GoldSim works but, to simplify, it has
13 elements designed to facilitate water quality
14 modelling.

15 So some of these elements are
16 reservoirs. And the purpose of a reservoir is to track
17 a volume within the modelling environment. So, it has
18 an inflow assigned to it and an outflow assigned to it
19 and the purpose of the reservoir is to calculate the
20 volume of water in a water body.

21 Now, I'd like to clarify that the -- the
22 picture here, the simulated volumes here, are not
23 related to the Gahchoe Kue project and are only
24 presented for -- for illustrative purposes only.

25 In the handout, I am now on slide 120.

1 So reservoir elements are connected to what are called
2 mixing cells. The purpose of a mixing cell is to track
3 chemical mass in a model. So the volu -- the inflow to
4 each mixing cell is assigned a concentration which
5 equates to a mass that flows into that mixing cell and
6 the outflow is assigned the concentration within the
7 mixing cell to remove the appropriate amount of mass to
8 transfer it to wherever -- wherever that flow may --
9 may report to.

10 So cell pathways are used to track the -
11 - the mass inflow and the outflow rates to simulate the
12 -- the water quality of -- of a water body, since -- if
13 we know the mass that remains within a water body and
14 we know the volume, the quotient of the two (2) results
15 in a concentration.

16 And in the -- the presentation, for
17 those on the web cast, I'm now on slide 122 which shows
18 a typical output from -- from a mixing cell. And
19 again, these mixing cells -- sorry. The results from
20 this mixing cell are only presented for illustrative
21 purposes and are not related to the project.

22 So the -- the previous slides presented
23 a conceptual high level overview of how the surface
24 water quality is calculated in the GoldSim interface.
25 Now I'll go through how we use this software to develop

1 a water quality model for the -- the Gahchoe Kue
2 project.

3 So the first step is to develop a
4 conceptual flow model for the site. And the water
5 quality model was built as a cell network in which each
6 of the key areas within Kennady Lake or in the
7 downstream watershed were divided into various areas
8 shown here on slide 123.

9 So at each stage of the -- the mining
10 cycle each flow is itemized and assigned a water
11 quality and a proportional mass exchange was evaluated
12 monthly to calculate water quality for each area.

13 So on slide 124, you can see flows
14 during the mine de-watering, the initial mine de-
15 watering, where water will be pumped from the areas 3,
16 5 to Lake N11 and then also to Area 7 to Area 8.

17 One (1) of the -- the advantages of the
18 -- the GoldSim modelling software is that it is robust
19 enough to incorporate changes to flow pathways on a
20 continuous basis. And this is useful for -- to
21 facilitate tracking of water quality.

22 The Water Management Plan that was
23 presented, I believe on Monday, was built into the
24 GoldSim water quality model to provide a continuous
25 record of the flows as they change.

1 So I'm not going to go in detail of all
2 the -- the various changes from one (1) stage of mining
3 to the next, but I just want to point out that the
4 GoldSim water quality model -- I'm now on slide 125 --
5 accounts for all of the changes in the flow throughout
6 the -- the construction period and the -- the
7 operations period, and moving into the closure period,
8 where I'm now on slide 129, when Kennady Lake is
9 refilled, and then also in the post-closure period once
10 Kennady Lake is refilled and then reconnected back to
11 the -- its downstream watersheds.

12 I am now moving on to slide 131. So one
13 (1) of the -- the components of the Water Management
14 Plan is the refilling of Kennady Lake and the refilling
15 of Tuzo Pit at closure. The proposed Water Management
16 Plan indicates that water -- at closure water will be
17 directed to the Tuzo Pit from Kennady Lake, areas 3, 5,
18 and Area 7.

19 So the water level will be drawn down to
20 417 metres and then the -- the surplus water above that
21 elevation will be moved into the -- the Tuzo Pit to
22 expedite the -- the refilling of the pit and also to
23 try to isolate a higher TDS water that may be stored in
24 the water management pond in the bottom of the Tuzo
25 Pit.

1 So to isolate the -- the high TDS water
2 in the bottom of the pit, meromixis will have to form.
3 And to evaluate whether meromixis would form within the
4 Tuzo Pit, a hydrodynamic model was completed and also
5 incorporated into the -- the site water quality model.

6 So two (2) -- two (2) water quality
7 models were completed to -- to assess the -- the
8 meromixis in the Kennady Lake -- in -- sorry, in Tuzo
9 Pit. And for the benefit of those on -- on the
10 webcast, this slide is also animated, so you may not be
11 able to see the -- the figure related to the CE-QUAL
12 model on the presentation. It's -- it's likely hidden
13 behind the -- the mass balance model results which run
14 for fifteen thousand (15,000) years into post-closure.

15 But all of the results of the
16 hydrodynamic model and the figures that are presented
17 in this slide can be found in Section 8.8.4.2.1 of the
18 EIS. Just to repeat, 8.8.4.2.1.

19 And the -- the assessment approach is
20 also presented in Section 8.I.4 in Appendix 8.I of the
21 -- of the -- the EIS. I -- I can direct anyone during
22 the break to where that is located in the EIS. I have
23 it here with me.

24 Sorry, I -- I went through this fairly
25 quickly and I -- I brushed over not defining what

1 meromixis and pycnocline development is.

2 Meromixis is the development of two (2)
3 distinct water quality signatures within a -- a pit
4 lake. So where you have high TDS water located at the
5 bottom of the pit, and a -- a TDS -- or water with a
6 different TDS signature overlying that. The pycnocline
7 is the boundary between these two (2) types of water.

8 So to discuss the results of the -- the
9 hydrodynamic modelling, first I'll -- I'll present the
10 -- the CE-QUAL model results which are presented in the
11 first figure here on slide 131.

12 So the initial conditions above 100
13 metres and below 100 metres were identified based on
14 the output from the -- the GoldSim water quality model.

15 The -- the CE-QUAL model was then
16 allowed to run, and what it indicated was above
17 approximately 125 metres the concentrations of TDS
18 decreased through time. So the individual lines on
19 this figure represent different snapshots in time, and
20 the years are indicated at the -- the top of the
21 figure.

22 Below this depth, TDS concentrations
23 generally remain the same, indicating that meromixis is
24 forming within the pit, and that two (2) distinct
25 signatures of water quality will exist in the Tuzo pit

1 at closure.

2 Another key observation from this slide
3 is that the pycnocline development does move downward,
4 because the -- as you see in the figure the
5 concentrations at different times below 400 metres move
6 to a deeper -- deeper depth, and above that depth the
7 concentrations are -- are somewhat diluted.

8 In addition, to look at the -- the long-
9 term effects in the Tuzo pit, a spreadsheet model was
10 developed where the Tuzo pit was divided into several
11 segments, and groundwater inflows were introduced at
12 the varying depths at different concentrations to
13 evaluate how the concentrations would change over a
14 long period of time, up to fifteen thousand (15,000)
15 years in this figure.

16 So the key observations from this figure
17 indicate that the initial boundary conditions that are
18 -- are built into the model above 100 metres and also
19 below 100 metres, the TDS -- the different TDS
20 signatures, don't change -- they -- they do change, but
21 not for -- it requires a significant amount of time
22 before the TDS concentrations change at varying de --
23 at varying depths within the -- the Tuzo pit.

24 As you can see, it requires at least a
25 thousand years before the concentrations below 250

1 metres deviate from the -- the initial boundary
2 condition after the Tuzo pit is -- is flooded.

3 And it requires more than fifteen
4 thousand (15,000) years for concentrations to increase
5 significantly at depths, and below 150 metres, but
6 above this -- this elevation the concentrations do not
7 really change with time.

8 So to -- to visualize this, on the -- on
9 the next slide I -- I've put in a few other animations
10 to -- to show how the -- the pycnocline will develop
11 through time.

12 So the Tuzo -- I'm on slide 132 for --
13 for those on the call, and I believe on the -- the
14 handout the -- the animations are broken into a series
15 of slides of 'A' through 'B', et cetera.

16 So initially at closure there'll be no
17 water in the Tuzo pit after mining is complete, and the
18 Tuzo pit is approximately 300 metres deep, ranging from
19 121 metres above sea level to 409 metres above sea
20 level approximately. The total capacity of the pit is
21 approximately 41 million metres cubed.

22 So as I presented initially, the water
23 level in Kennady Lake will be lowered to direct water
24 into the -- into the Tuzo pit. The signature of this
25 water has a higher TDS concentration.

1 Following -- and this -- this water --
2 the change in the water elevation results in about 16
3 million metres cubed of water being directed towards
4 the Tuzo pit.

5 So I am on slide 132, I think it's 'B' -
6 - 'B'. The water above the 16 million, the -- the pit
7 will then naturally refill from surface runoff,
8 groundwater inflows, and also water pumped in from --
9 from N11 that is pumped to expedite the -- the
10 refilling of Kennady Lake.

11 And this accounts for about 25 million
12 metres cubed of the remaining water that will be -- to
13 fill up the capacity of the Tuzo pit.

14 As I indicated on the previous slides,
15 pycnocline will develop between these two (2) -- two
16 (2) water qualities. However, through time the
17 pycnocline will migrate downwards, and it becomes
18 roughly stable when there's approximately 9 million
19 metres cubed of water in the Tuzo pit. And as the
20 pycnocline moves down, the higher TDS water is released
21 into the -- the lower TDS water and mixed with the --
22 the lower TDS water in the -- in the water quality
23 model.

24 I think it's important to point out that
25 the concentrations that were simulated in the water

1 quality model -- up until this point I've been talking
2 about high and low TDS. Just to create some
3 clarification around that, the low TDS is about 100
4 milligrams per litre. And the -- the high TDS that was
5 simulated was about 500 milligrams per litre in -- in
6 the bottom of the -- the Tuzo pit.

7 So what drives the pycnocline moving
8 down is -- is mainly wind, initially. And I'm on slide
9 133. So the wind energy at the surface is strong and a
10 lot of mixing will occur at the surface. But as you
11 get deeper down into the Tuzo pit, the -- the wind
12 energy will gradually decrease until the point where
13 the pycnocline is no longer affected by -- by the wind
14 movement.

15 And it's at -- at this point -- I'm
16 pointing to the boundary, the dark blue boundary
17 between -- the boundary between the dark blue water in
18 the Tuzo pit and the -- the lighter blue water above
19 the darker blue water on the slide.

20 That is the boundary where the
21 pycnocline is expected to stabilize. And this is
22 accounted for in the -- the surface water quality
23 model. So all of the water that remains below in this
24 deeper, high TDS water is considered to be isolated
25 from -- from the system in the surface water quality

1 simulations.

2 So the Tuzo pit stability was
3 incorporated into the -- the GoldSim model as a cell
4 pathway, as I presented in the -- the discussion of the
5 -- the GoldSim interface.

6 And as the py -- pycnocline moves down,
7 deeper with time, the additional water stored in the
8 Tuzo pit will mix with Kennady Lake. So we -- the
9 initial water that's put into Kennady Lake with the
10 high TDS, the 16 million, as the pycnocline moves down,
11 a -- a mass load is introduced into Kennady Lake to
12 account for the higher TDS water migrating up into
13 Kennady Lake.

14 And that's -- that sums up that third
15 bullet there. The change in the capacity result --
16 resulting from the pycnocline migration in the Tuzo pit
17 is included in the GoldSim model.

18 Moving on to slide 135. A winter oxygen
19 depletion rate model was also completed based on the --
20 the outputs of the -- the surface water quality model.
21 This was developed to estimate the DO depletion under
22 ice conditions as a result of the projected total
23 phosphorous concentrations that were predicted in
24 Kennady Lake.

25 Three (3) different approaches were used

1 to -- to estimate the -- the winter oxygen depletion
2 rate, and these are listed here. The first one (1), by
3 Voll -- Vollenweider, in 1979, is based on the annual
4 rate of carbon productivity. And Marthias and Barica,
5 1980, looks at the -- the sediment surface area to the
6 -- the lake volume. And then Babin and Prepas, it's
7 the summer total phosphorous concentration in the --
8 the trophic zone. And these -- these three (3)
9 approaches are based on North American lakes.

10 And this model is ongoing and it's --
11 it's used to -- to validate the -- the projections the
12 total phosphorous projections that were -- were
13 provided in the -- the EIS.

14 I'm now going to go through the -- the
15 assessment findings for each of the -- the modelling
16 topics that I -- I've just discussed the -- the
17 approaches to.

18 The first one on slide 137 is the
19 changes to water quality from project area emissions.
20 The air quality modelling indicated that there's
21 limited spatial and temporal extents of air emissions.
22 They're expected to result in minor changes to the
23 water chemistry within the -- the Kennady Lake
24 watershed.

25 And projected net PAI values

1 representing peak emissions were below the critical
2 loads for nineteen (19) lakes studied, indicating that
3 lake acidification is not expected within the Kennady
4 Lake watershed.

5 With respect to the projections for
6 surface water quality, several parameters are projected
7 to increase in Kennady Lake in the downstream watershed
8 lakes after closure. These include TDS, major ions,
9 nutrients, and metals. And as expected projected
10 concentrations decreased downstream in the watershed
11 relative to Kennady Lake as more additional dilution,
12 natural background dilution is reported to these lakes.

13 Metals were projected to be higher than
14 the -- the CCME guidelines for the -- the protection of
15 aquatic life. Within Kennady Lake, cadmium, chromium,
16 copper and iron were above the guideline value, n Area
17 8, cadmium and chromium, and then also in Lake N11.
18 And within Lake 410, cadmium was also elevated or
19 projected to be above the guideline.

20 Now it's important to put this in
21 context because the cadmium and chromium
22 concentrations, if you remember back in my -- the
23 existing -- the existing environment summary, cadmium
24 and chromium were also measured to be greater than the
25 -- the CCME guidelines for aquatic life under existing

1 conditions.

2 So impacts to water quality are expected
3 to be negligible at the outlet to Lake 410. And these
4 -- the simulated concentrations as a part of this
5 assessment were then carried forward into the -- the
6 aquatic health assessment.

7 On slide 139, the changes to winter
8 oxygen depletion rate I presented, so the additional --
9 additional depletion of oxygen under ice after closure
10 is expected in Kennady Lake as a result of the -- based
11 on the -- the projected concentrations of total
12 phosphorous during the post-closure period.

13 However the -- the increased oxygen
14 demands are likely to affect only 22 percent of the
15 water volume, which is located mainly below a six (6)
16 metre depth. And the surface zone, or the remaining 78
17 percent of the volume, is expected to maintain
18 sufficient oxygen concentrations to support cold --
19 cold water aquatic life or have values that are greater
20 than the CCME guideline of 6.5 milligrams per litre.

21 I -- I want to -- on slide 140, I want
22 to talk a little bit about the confidence we have in
23 our -- in our water quality modelling predictions.

24 Water quality projections are based on
25 several inputs and all of these inputs have inherent

1 variability and uncertainty. However, to address this
2 uncertainty we built confidence into the model by
3 applying conservative assumptions. Conservatism was
4 applied in the groundwater inflows, the geo-chemical
5 source terms. And in addition, no consideration of
6 mass retention as a result of permafrost was developed
7 or no attenuation of mass was accounted for due to
8 geochemical or biological rea -- reactions. So the
9 projected concentrations are expected to be greater
10 than those that will be observed when the mine is
11 operating and during the closure and post-closure
12 periods.

13 And to further provide additional
14 confidence into the model projections, on -- ongoing
15 work is continuing to refine -- refine these
16 projections as additional information becomes available
17 from other assessments such as the -- the DO modelling.

18 So the results of the surface water
19 quality were carried forward into the -- the aquatic
20 health assessment and these are presented on -- the
21 assessment approach for aquatic health is presented on
22 slide number 142.

23 So the predicted changes to water
24 quality on aquatic health were evaluated through two
25 (2) exposure pathways: One, direct exposure, where a

1 predicted water concentrations were compared with
2 chronic effects benchmarks or CEBs to evaluate the
3 potential for aquatic health effects due to direct
4 water born exposure; and also through indirect effects
5 where predicted tissue concentrations are compared with
6 toxicological benchmarks to evaluate the potential for
7 the -- the aquatic healths related to tissue
8 concentrations.

9 The results of this assessment are
10 presented on slide 143. And the key message from the
11 assessment is the prose -- the proposed water
12 management plan is designed to be protective of the
13 environment and the project is expected to have
14 negligible effects on aquatic life in Kennady Lake and
15 within the downstream watersheds.

16 And to support this the -- the
17 assessment indicated that the potential for adverse
18 effects from dust and metals deposition during
19 operations is really low within the Kennady Lake
20 watershed and it's not expected to have effects to
21 aquatic life. And changes to concentrations of all
22 substances considered in the assessment predict -- are
23 predicted to result in negligible effects to aquatic
24 health within Kennady Lake.

25 Carrying the assessment downstream into

1 the -- the downstream watersheds, the changes to
2 concentrations of all substances considered in the
3 assessment were also predicted to result in negligible
4 effects to aquatic health in water bodies downstream of
5 the -- the Kennady Lake.

6 That is the -- the end of my
7 presentation. And I invite questions. Thank you.

8

9 QUESTION PERIOD:

10 THE FACILITATOR HUBERT: Chuck Hubert,
11 Review Board. Thanks very much for the presentation.
12 And, yes, questions, please. Yeah, please speak into
13 the microphone and announce your name. This is Chuck
14 Hubert with the Review Board. Thanks.

15 MR. MARC CASAS: Hi. Yeah, I'm Marc
16 Casas, with Mackenzie Valley Land and Water Board.
17 Thanks. Yeah, thanks for the presentation. It did
18 answer a lot of my questions from earlier, I believe.
19 So I just have two (2) quick ones.

20 One (1) was about the question referring
21 to the modelling of the -- of the Tuzo pit. In terms
22 of the -- the formation of the pycnocline, or I forget,
23 whatever it's called, that -- that line, is that -- was
24 TDS the -- the only -- TDS and wind, were those the
25 only factors used in assessing that?

1 MS. VERONICA CHISHOLM: Veronica --
2 Veronica Chisholm, from De Beers. First of all, I'd
3 like to say thanks, Marc. It's nice to see someone
4 from the Mackenzie Valley Land and Water Board
5 participating in the Mackenzie Valley Review Board
6 process, so we appreciate your -- you being here today,
7 before I have Mike answer that question.

8 MR. MICHAEL HERRELL: It's Mike
9 Herrell, from Golder Associates. The -- the boundary
10 you're referring to is the pycnocline. Within the --
11 the hydrodynamic model the -- the modelling software
12 accounts for temperature also in those predictions. So
13 it'll simple -- it'll simulate TDS concentrations and
14 it'll incorporate wind and also temperature.

15 MR. MARC CASAS: Okay. Thanks for
16 that. And... Oh, my next question I guess refers to
17 the -- the last -- the last comment or the last slide,
18 which I think was 143. And -- and maybe it has been
19 defined, but is -- is negli -- "negligible effects,"
20 has it been defined or how -- how was that determined?

21 MR. JOHN FAITHFUL: John Faithful,
22 Golder Associates. Thanks for your question, Marc.
23 With respect to the definition of "negligible," it's --
24 it's outlined in the assessment approach, which is in
25 Section 5. And it's also outlined in Section 8.5 of

1 the downstream key lines of inquiry. And in terms of
2 negligible effects, it refers to a -- it refers to a
3 concentration that's equivalent to a threshold or
4 equivalent to -- to baseline conditions or similar to
5 baseline conditions. Thank you.

6 John Faithful, Golder Associates. Just
7 a clarification. The assessment approach is in Section
8 6.

9 THE FACILITATOR HUBERT: Chuck Hubert,
10 Review Board. Thanks for that response and
11 clarification. Other questions with respect to water?

12 MR. PAUL GREEN: It's Paul Green with
13 Water Resources. Just a couple of questions. I just
14 want to clarify that I understand kind of the process
15 that happens as the -- as the pycnocline is -- is
16 pushed down in the pit.

17 If you like looking at 142 -- 132B,
18 anyway, you've got about 16 million cubic metres of
19 high TDS water in -- in the -- in the pit about halfway
20 down.

21 Okay, so the one (1) before that.
22 You've got about 16 million metre -- cubic metres at
23 the bottom, and then in this slide you come down --
24 yeah, so you start there, and then you come down to 9
25 million cubic metres in the next slide. The -- the 7

1 million metre cubic difference, I understand that that
2 is -- is sort of over time, and -- and it's with sort
3 of -- sort of mixed into the bulk of the Kennady Lake
4 water, is that where that 7 million cubic metres goes?

5 MR. MICHAEL HERRELL: It's Mike Herrell
6 from Golder Associates. That's correct. The results
7 of the -- the hydrodynamic model indicate that the --
8 the pycnocline will require approximately a hundred
9 (100) years to stabilize. So as the pycnocline moves
10 down, the total volume of water -- the difference of
11 the volume of water, approximately 7 million metres
12 cubed, is then mixed with the overlying Kennady Lake at
13 a linear rate over that hundred (100) year period.

14 MR. PAUL GREEN: Okay, thanks. And now
15 one (1) -- one (1) final question. In the reading I've
16 done to date, the tables with sort of the water quality
17 summary data, I've seen mins -- minimum values, maximum
18 values, and medians.

19 And I was wondering if a 95th
20 percentile, or some sort of baseline number has been
21 calculated anywhere? It -- it -- maybe it's in a -- in
22 an appendix I haven't come across yet, but if it is, if
23 you could point me towards that.

24 MR. MICHAEL HERRELL: It's Mike Herrell
25 from Golder Associates. Can you clarify where you --

1 which tables you're referring to when you talk about
2 those statistics?

3 MR. PAUL GREEN: It would be the
4 Section 8 tables, and the -- basically just the -- the
5 overall -- your surface water quality summary tables.

6 There's a discussion about how you
7 treated the data based upon non-detects, and so -- so
8 basically the three (3) numbers that I can get out of
9 those are the mins, the medians, and the maxes. And
10 I'm just wondering if somewhere in the -- in the
11 baseline or appendices there's a -- you know, a 95th
12 percentile type number. And if there is if you could -
13 - you don't have to -- like if it's something you could
14 follow, like it's -- yeah.

15 MR. MICHAEL HERRELL: It's Mike Herrell
16 from Golder. If we can follow up on that, we -- we'd
17 like to do that. Thanks.

18 THE FACILITATOR HUBERT: Thank -- Chuck
19 Hubert, Review Board. Can -- can you clarify exactly
20 again what that follow-up is? Thanks.

21 MR. PAUL GREEN: I guess what I was
22 looking for was a 95th percentile water quality data
23 number, surface water quality, if it exists in the --
24 in the appendices or in -- in the addenda.

25 THE FACILITATOR HUBERT: Chuck Hubert.

1 And as far as timing goes, when would De Beers be able
2 to produce that?

3

4 (BRIEF PAUSE)

5

6 MS. VERONICA CHISHOLM: Veronica
7 Chisholm from Be Dee -- De Beers. Yes, we'll provide
8 that probably tomorrow, if not later on. Oh, they have
9 more updates.

10

11 (BRIEF PAUSE)

12

13 MS. VERONICA CHISHOLM: Results from
14 the update. Veronica Chisholm from De Beers. Yeah,
15 we'll provide that information tomorrow, if that's
16 okay. An update tomorrow. Thanks.

17

18 THE FACILITATOR HUBERT: Chuck Hubert,
19 Review Board. Thanks very much. We have time, I
20 think, for another question or two (2) on the preceding
21 presentation.

22 If anybody has a question, please ask it
23 now.

24

25 MS. VELMA STERENBERG: Velma
Sterenberg, AANDC Minerals. I'm a little embarrassed
about asking this question, but it has to do with the -

1 - the currently existing cadmium and chromium levels,
2 and how they relate to the current fish health of the
3 population. I -- I'm not able to be here tomorrow, but
4 I was just quickly going through the fish habitat
5 presentation that I assume will be given tomorrow, and
6 I didn't see any mention of that.

7 And my question would be: Are the fish
8 currently ex -- well, they're currently existing in
9 those lakes at higher than CCME approved levels. Are
10 they healthy? And you state that it -- those -- at
11 least cadmium and chromium are projected to be higher.
12 I'm assuming that the -- quantities -- higher
13 quantities are in one (1) of the appendices that is in
14 your report and I just haven't seen it?

15 And is my -- is my question clear
16 enough? I'm more -- I'm more curious -- and I'm
17 curious because of the geochemistry. I'm not a fish
18 person, but if -- if the fish are healthy at higher
19 than acceptable lever -- levels, excuse me, is there
20 going to be a tipping point when the levels get a
21 little bit higher and then the fish start to suffer
22 from that? Thank -- oh, excuse me.

23 MR. JOHN FAITHFUL: John Faithful,
24 Golder Associates. Thanks, Velma. At the initial --
25 to first answer the questions, the -- the projected

1 concentrations that Mike -- that Mike alluded to in his
2 presentation are only marginally above the guidelines.
3 And I can provide you an indication to -- to the source
4 of that.

5 The second part of this response is that
6 the -- the aquatic health assessment provides a
7 screening assessment of all of the -- the -- the
8 maximum concentrations that Mike has predicted from the
9 -- the long-term projections, and then through that
10 process applies comparisons to chronic effects
11 benchmarks and -- and -- and other comparison tools.
12 And through that was -- was able to screen out cadmium
13 and chromium as being a potential issue.

14 So the -- the fish will remain healthy.

15 MS. VELMA STERENBERG: Velma
16 Sterenberg, AANDC. Thanks.

17 THE FACILITATOR HUBERT: Chuck Hubert,
18 Review Board. Any further questions on the topic of
19 water quality from participants here in the room?

20 MR. MICHAEL HERRELL: It's Mike
21 Herrell, from Golder. I'd like to make a clarification
22 on my response to Paul Green's question.

23 The -- the -- the -- I indicated that
24 the -- the pycnocline becomes stable after a hundred
25 years. The pycnocline is actually stable initially,

1 after the refilling period. After the -- the 16
2 million metres cubed of water is introduced into the
3 pit, and then it is refilled to surface. A pycnocline
4 has already been established, that is stable. It moves
5 down through time, through changes in the density of
6 the TDS, and then also from the -- the wind action.

7 MR. JOHN FAITHFUL: John Faithful.
8 Chuck, I'd like to just add another comment to -- to my
9 response that I provided to Velma. And that's to -- to
10 indicate that the -- the CCME guidelines are typically
11 conservative and very protective. And to say that
12 they're guidelines, they're not -- not particularly
13 limits, and that -- and they don't -- and it doesn't
14 mean an exceedance to them represent risks.

15 MS. VELMA STERENBERG: I'm sorry, I'm
16 not used to these microphones. I'm Velma Sterenberg,
17 AANDC.

18 Yeah, a couple of things with CCME.
19 They're very conservative and also people are finding
20 that they don't necessarily apply to northern lakes.
21 And so, I take your points and, like I say, it was more
22 of a curiosity than -- than -- like I said, I'm not a
23 fish person. Okay.

24 MR. JOHN FAITHFUL: John Faithful,
25 Golder Associates. Thank you very much, Velma.

1 THE FACILITATOR HUBERT: Chuck Hubert,
2 Review Board. Further questions on water quality? And
3 if not, I'll ask De Beers whether they'd like to
4 proceed with beginning the fish topic or save it for
5 tomorrow.

6 MR. JOHN FAITHFUL: John Faithful,
7 Golder Associates. Chuck, what sort of time frame are
8 you looking at?

9 THE FACILITATOR HUBERT: Can we have a
10 minute, please? Thanks.

11

12 (BRIEF PAUSE)

13

14 THE FACILITATOR HUBERT: Good
15 afternoon, again. Chuck Hubert, Re -- Review Board.

16 We've had a -- a bit of a discussion and
17 what we'd like to do is complete the water quality in
18 its entirety today and if there's any follow-up
19 questions from what's gone on at -- in the preceding
20 time today we can deal with those. And then we'll start
21 tomorrow with fish and -- the fish and aquatic -- or
22 fish and fish habitat topic and do that in its entirety
23 tomorrow. We won't start the fish or fish habitat
24 portion of the agenda today.

25 So -- and by the way the -- we should be

1 done possibly by -- by noon tomorrow. It should be an
2 -- an early morning. And if we go later than -- than
3 noon that's fine too. But we're -- we're anticipating,
4 let's say, three (3) hours of fish and fish habitat.

5 So with that understanding, let -- if
6 there's any further questions on -- on water quality,
7 or hydrology, or geolog -- or geo -- or geochemistry,
8 all of the topics today, we can deal with those right
9 now. Thanks.

10

11 (BRIEF PAUSE)

12

13 MR. JULIAN KANIGAN: It's Julian
14 Kanigan, with Aboriginal Affairs. In looking at the
15 agenda for today we had looked forward to a
16 presentation on and a discussion on permafrost. And I
17 know we've touched on it in some of the presentations.

18 And I'm just wondering if we can expect
19 a presentation from De Beers on permafrost or whether
20 that's now not on the agenda today or tomorrow?

21 MS. VERONICA CHISHOLM: Veronica
22 Chisholm, from De Beers. No, there's no further
23 presentations on permafrost. We tried to integrate it
24 into some of the aquatic themes. We're -- we had some
25 uncertainty about the length of time it would take us

1 to get through some of this material, and so I guess we
2 -- we pull -- pulled together what we could given the
3 time that we had.

4 Veronica Chisholm, from De Beers. And -
5 - but we would be happy to follow up on any specific
6 questions you might have on permafrost and go through
7 any of the sections with you on permafrost. Thank you.

8 THE FACILITATOR HUBERT: Chuck Hubert,
9 Review Board. Thanks for that answer. Do you have any
10 followup to that? Okay, I'll take that as a "no".
11 Thanks.

12 And anybody else have questions on what
13 we've discussed today for De Beers?

14 MS. MADELAINE CHOCOLATE: This is
15 Madalaine Chocolate, Tlicho Government. Having sat
16 here for the last couple of days I must say I've
17 learned a lot. And I just want to thank the panel for
18 all the details and the information that we share --
19 they've shared with me the last couple of days.

20 It seems like there's going to be a lot
21 of study done onsite. One (1) thing that I will say is
22 that we will be monitoring the -- the pit, the -- the
23 work, the operation of the pit real closely and that
24 all the information details that we've been given we're
25 going to see that it's in -- it's in line with what's

1 been -- what's been said here today and yesterday and
2 the day before. Mahsi.

3 THE FACILITATOR HUBERT: Chuck Hubert,
4 Review Board. Thanks very much for those comments.
5 I'll give one (1) more opportunity to parties before --
6 my colleague, Alan, has one (1).

7 THE FACILITATOR EHRLICH: Thanks,
8 Chuck. I have a question that is interdisciplinary,
9 but it touches on hydrology and one (1) of the
10 questions that DFO asked earlier today. I'm just going
11 to extend it to a different species.

12 DFO asked how your predicted ramping
13 would be affecting grayling spawning, and I think there
14 was an element of timing in the question, although I
15 can't quite remember.

16 My question has to do with water birds
17 and how the timing of any ramping, you know, I'm
18 bringing this out, the hydrology today because the
19 ramping's a hydrological thing is why I didn't bring it
20 up on the birds time, but how the timing of ramping
21 relates to vulnerable periods regarding nesting of
22 water birds considering among other things that the
23 horned grebe is one (1) of the species you've
24 identified on your list of species at risk here.

25 Would you care to comment on that? Have

1 you considered timing of ramping relative to sensitive
2 periods in the nesting of vulnerable water birds?

3 Thank you.

4

5 (BRIEF PAUSE)

6

7 MS. VERONICA CHISHOLM: Veronica
8 Chisholm, from De Beers. We'd like to defer that
9 question until tomorrow. We'll provide you with a
10 follow-up tomorrow, Alan. Thanks.

11 THE FACILITATOR HUBERT: Chuck Hubert.
12 Thanks very much. We'll -- we'll anticipate that for
13 tomorrow, and we'll deal with it first thing.

14

15 (BRIEF PAUSE)

16

17 THE FACILITATOR HUBERT: Chuck Hubert.
18 Final opportunity for -- for questions from -- from
19 today, and if not we'll bid everyone an early adieu.

20

21 (BRIEF PAUSE)

22

23 THE FACILITATOR HUBERT: And expanding
24 beyond just what was discussed today, just since we
25 have the time, if there are questions that participants

1 felt they would have liked to ask on previous days,
2 Monday through Wednesday, but either did not have the
3 opportunity, or weren't thinking about it at the time,
4 now would be the time to ask any real question on what
5 happened previously. So, if you do, ask it now.

6

7 (BRIEF PAUSE)

8

9 THE FACILITATOR HUBERT: Excellent.
10 I'll -- I'll take that as people are content for the
11 moment. And so with that, I'd like to close the day.
12 And I -- just one (1) thing I'd like to -- to mention,
13 that there was one (1) under -- undertaking for the
14 caribou question from -- from Anne Gunn. I understand
15 that you -- you may resolve that, or may not resolve
16 that tomorrow, but in any case that undertaking is
17 currently noted by -- in the transcription as
18 Undertaking number 2.

19 I would like to very much thank people.
20 Alan, thank you. I -- thanks everybody for attending
21 today, and it's great to have you participate, all --
22 all parties, and De Beers and their consultants, and --
23 and Wendy and the sound people. It takes everybody
24 here to make this a successful event, so thanks very
25 much.

1 And nine o'clock tomorrow, we will see
2 you all again. So, bye for now.

3

4 --- Upon adjourning at 4:06 p.m.

5

6 Certified correct,

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10 _____

11 Wendy Warnock, Ms.

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