

JOINT REVIEW PANEL PUBLIC HEARING

IN THE MATTER OF Application Nos. 1844520, 1902073,
001-00403427, 001-00403428, 001-00403429, 001-00403430,
001-00403431, MSL160757, MSL160758, and LOC160842
to the Alberta Energy Regulator

GRASSY MOUNTAIN COAL PROJECT - BENGA MINING LIMITED

VOLUME 16

VIA REMOTE VIDEO

November 16, 2020

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26

1 Proceedings Taken via Remote Video

2

3 November 16, 2020 Morning Session

4

5 A. Bolton The Chair

6 D. O'Gorman Hearing Commissioner

7 H. Matthews Hearing Commissioner

8

9 M. LaCasse AER Counsel

10 B. Kapel Holden AER Counsel

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12 K. Lambrecht, QC Joint Review Panel Secretariat
13 Counsel

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15 T. Utting IAAC Staff

16 E. Arruda AER Staff

17 D. Campbell AER Staff

18 T. Turner AER Staff

19 T. Wheaton AER Staff

20 A. Shukalkina AER Staff

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22 M. Ignasiak For Benga Mining Limited

23 C. Brinker

24

25 R. Warden For Ktunaxa Nation

26 T. Howard

1	K. Poitras	For Métis Nation of Alberta
2		Region 3
3		
4	Chief B. Cote	For Shuswap Indian Band
5		
6	B. Snow	For Stoney Nakoda Nations
7		
8	R. Drummond	For Government of Canada
9	S. McHugh	
10		
11	A. Gulamhusein	For Municipality of Crowsnest
12		Pass
13		
14	M. Niven, QC	For MD of Ranchland No. 66
15	R. Barata	
16	J. Nijjer (Student-at-Law)	
17		
18	B. McGillivray	For Town of Pincher Creek
19		
20	D. Yewchuk	For Canadian Parks and
21		Wilderness Society, Southern
22		Alberta Chapter
23		
24	R. Secord	For Coalition of Alberta
25	I. Okoye	Wilderness Association, Grassy
26		Mountain Group, Berdina Farms

1		Ltd., Donkersgoed Feeder
2		Limited, Sun Cured Alfalfa
3		Cubes Inc., and Vern Emard
4		
5	R. Cooke	For Crowsnest Conservation
6		Society
7		
8	G. Fitch, QC	For Livingstone Landowners
9	C. Agudelo	Group
10		
11	M. Sawyer	For Timberwolf Wilderness
12		Society and Mike Judd
13		
14	(No Counsel)	For Barbara Janusz
15		
16	(No Counsel)	For Jim Rennie
17		
18	S. Elmeligi	For Alberta Chapter of the
19	A. Morehouse	Wildlife Society and the
20	S. Milligan	Canadian Section of the
21	M. Boyce	Wilderness Society
22		
23	J. Gourlay-Vallance	For Eco-Elders for Climate
24		Action
25		
26	L. Peterson	For Trout Unlimited Canada

1 R. Campbell For Coal Association of Canada
2
3 (No Counsel) For Alistair Des Moulins
4
5 (No Counsel) For David McIntyre
6
7 (No Counsel) For Fred Bradley
8
9 (No Counsel) For Gail Des Moulins
10
11 (No Counsel) For Ken Allred
12 (Not Present)
13
14 (No Counsel) For Monica Field
15
16 S. Frank For Oldman Watershed Council
17 A. Hurly
18
19 C. Forster, CSR(A) Official Court Reporter
20 _____
21 (PROCEEDINGS COMMENCED AT 8:58 AM)
22 Discussion
23 THE CHAIR: Good morning, everyone. Just
24 a reminder that live audio and video streams and video
25 recordings of this proceeding are available to the
26 public through the AER's website and YouTube. Anyone

1 in the virtual hearing room with their camera or
2 microphone turned on will be captured, and images and
3 recordings of you and your surroundings will be
4 broadcast to a publicly available YouTube video. If
5 you have any concerns about this, please contact
6 counsel well in advance of the time you are scheduled
7 to participate to explain your concerns. We will make
8 best efforts to try and accommodate your concerns
9 considering the need for an open and transparent public
10 process.

11 So this morning we're going to finish up the
12 vegetation and reclamation session with some direct
13 evidence from the Livingstone Landowners Group, and
14 then once that's completed and the cross-examination is
15 completed, we'll move to the water session.

16 Are there any preliminary matters before we get
17 started?

18 Hearing none, Mr. Fitch, are you ready to proceed?

19 MR. FITCH: Yes. Thank you, Mr. Chairman.

20 Mr. -- Dr. McKenna, can you hear me?

21 DR. MCKENNA: Yes, I can.

22 MR. FITCH: Thank you.

23 Madam Court Reporter, can we please have the LLG's
24 next witness sworn or affirmed?

25 GORD MCKENNA, Affirmed

26 MR. FITCH: Thank you, Madam Court

1 Reporter.

2 Direct Evidence of Livingstone Landowners Group
3 (Vegetation, including species at risk, terrain and
4 soils, conservation and reclamation, closure, and
5 biodiversity)

6 Q MR. FITCH: Good morning, Dr. McKenna.
7 I'd like to begin by having you confirm that you were
8 retained by the Livingstone Landowners Group?

9 A Yes.

10 Q And you were retained to review Benga's application and
11 environmental impact assessment to look at, among other
12 things, the issues of reclamation and closure?

13 A Yes, that's true.

14 Q And, sir, you prepared a letter report that is dated
15 September 21st, 2012, that is titled "Engineering
16 Review of the EIA Design, Operation, and Reclamation
17 Plans for the Proposed Grassy Mountain Coal Project";
18 correct?

19 A That's correct.

20 Q And for the record, that is CIAR Document 552,
21 beginning at PDF 3.

22 Dr. McKenna, was that report prepared by you or
23 under your direction?

24 A Yes, it was.

25 Q Okay. And do you adopt it as your evidence in this
26 proceeding?

1 A Yes, I do.

2 Q And, sir, you acknowledge that you are an independent
3 expert witness and that you are under a duty to provide
4 opinion evidence that is fair, objective, and
5 non-partisan?

6 A I do.

7 Q Thank you.

8 MR. FITCH: Now, Zoom Host, we have --
9 Dr. McKenna prepared a PowerPoint presentation that we
10 provided to the secretariat on Friday. I confess I'm
11 not sure what the CIAR number is, but hopefully we can
12 locate that document and pull it up. Thank you.

13 Q MR. FITCH: So, Dr. McKenna, you have
14 prepared a PowerPoint presentation to act as an aid to
15 your evidence this morning; correct?

16 A That is correct.

17 Q All right. And I take it that there's -- that the --
18 what's in your PowerPoint presentation, effectively, is
19 a distillation or summary of what you put in your
20 letter report?

21 A Yes, it is. The -- there's two distillations. There's
22 this one and then one coming up in the later part as
23 well. Together they cover the letter.

24 Q Okay. Great.

25 Sir, can I ask you to proceed with your
26 presentation, then.

1 A Thank you, Mr. Fitch.

2 Good morning. I'm pleased to be here to highlight
3 aspects of my report as that relate to reclamation and
4 closure. My goal is neither to promote or oppose the
5 mine here but, instead, to provide the Panel my expert
6 opinion to aid in their decision and recommendations.
7 My main focus is on highlighting what I believe are
8 significant deficiencies in the current reclamation and
9 closure design.

10 Next slide.

11 Thank you.

12 I provided an outline of my presentation on this
13 slide. The information from the presentation is based
14 on my report dated September 21st as Mr. Fitch
15 mentioned, and it's filed under your system under
16 CIAR 552.

17 The presentation provides information on my
18 background, the process of landform design, and
19 highlights nine observations from my report that relate
20 to reclamation and closure. I'll cover most of the
21 other recommendations in the session on selenium and
22 water over the week. The last slide provides my
23 overall conclusions.

24 To give away the ending, I conclude that Benga
25 should be required to provide a more detailed closure
26 and reclamation design to address the outstanding

1 shortcomings listed in the letter before the
2 application can be fully considered.

3 THE COURT REPORTER: Excuse me. Can I see the
4 witness on the screen, please? I don't have him on the
5 screen.

6 MR. FITCH: I can see him.

7 THE COURT REPORTER: Okay. Okay. Thanks. I can
8 see --

9 A DR. MCKENNA: I'll continue.

10 THE COURT REPORTER: I can see you now.

11 A DR. MCKENNA: Okay. Good. Thank you.

12 Next slide, please.

13 I've included my background information here, and,
14 in brief, I'm a geotechnical engineer and a geologist
15 with 33 years of mining experience with a focus on mine
16 waste management. I have a PhD in geotechnical
17 engineering from the University of Alberta.

18 I worked as a geotechnical engineer at the
19 Synchrude oil sands mine for 17 years before becoming an
20 international geotechnical consultant based here in
21 Vancouver in 2004.

22 I've held several adjunct professor positions, and
23 I'm currently an adjunct professor of civil engineering
24 at the University of Alberta.

25 I sit on several geotechnical review boards. I've
26 sat on a number of panels related to mine waste

1 management. One of these panels was the strategic
2 advisory panel on selenium management for Rocky
3 Mountain coal mines in Alberta and BC, and that ran
4 back in 2010 through 2012.

5 Last year I founded the Landform Design Institute
6 to help support and grow that discipline.

7 Next slide.

8 Thank you.

9 Grassy Mountain application through a lens of
10 landform design. I would characterize the present
11 Grassy Mountain Coal Project mine and reclamation plans
12 as traditional reclamation planning. I was expecting
13 to see plans and designs that better reflect the
14 challenging nature of this property. Bedrock geology
15 model and the mine plans related to ore mining are
16 quite well developed as they usually are for most
17 mines, but I wonder if Benga fell into a trap of
18 thinking that the waste rock dump designs and
19 reclamation plans need only be conceptual in nature.
20 Time and again we find that conceptual plans usually
21 contain fatal flaws and don't provide a good basis for
22 decision-making by the mine, the regulator, or local
23 communities. Through -- though such designs are
24 expected to change over time, I found that to be
25 successful they still need to be done to a feasibility
26 level even before mining begins.

1 Many of my clients have adopted this landform
2 design approach for their mining projects. Designs
3 done by integrated multidisciplinary teams that work
4 with regulators and local communities has had clear
5 design and performance goals and create and implement
6 the designs to reliably meet the stated objectives.

7 I reviewed Benga's EIA through the lens of
8 landform design.

9 What do we mean "landforms"? Landforms are
10 defined as distinct topographic features formed by
11 natural or artificial processes. Taken together, they
12 make up the surface of the earth. Examples include
13 mountains, peninsulas, islands, sand dune and streams.

14 Landform design builds on this knowledge collected
15 over hundreds of years and -- this knowledge of natural
16 landforms by different disciplines, and it applies it
17 to the design and construction and reclamation of
18 mining landforms such as waste rock dumps, tailings
19 ponds, mined-out pits, et cetera. Together these
20 landforms form the mining landscape, which is designed,
21 constructed, and maintained to perform as intended over
22 the coming thousands of years, long after the coal is
23 consumed and to fit into the mining region and to be
24 able to leave a positive legacy for local communities
25 as has been promised in EIAs.

26 This chart shows how it's done. A

1 multidisciplinary team is formed usually with about a
2 dozen different specialists and generalists, the types
3 of people already working on the Benga application and,
4 I guess, the people reviewing it as well. Governance
5 is established. A design basis document is created
6 with agreed-upon vision, goals, design objectives,
7 design criteria. The landform is then designed by this
8 integrated team to meet these goals. Then a full
9 engineering risk assessment is done. And, crucially,
10 for areas where there's a risk of not meeting these
11 commitments, fold contingencies are developed and
12 implemented as needed.

13 This is different than the trial-and-error
14 approach that the proponent is offering under the name
15 of adaptive management. Instead, it follows a process
16 developed in the 1960s called the "geotechnical
17 observational method". The contingencies are developed
18 in enough detail that they can be quickly and
19 affordably implemented if performance does not meet
20 expectations.

21 Next.

22 As the mine advances, each of the landforms is
23 constructed, usually four or five at a time, and areas
24 of these landforms that are no longer needed for mining
25 are resloped with dozers, the surface water drainage
26 system established, a cover soil is applied, and the

1 area's revegetated. This is called "progressive
2 reclamation", as you know.

3 The monitoring program starts before mining begins
4 and ends decades after. Results from the monitoring
5 are used to assess whether the site is meeting the
6 intended performance and is set up so that the
7 contingencies can be put in place before environmental
8 damage occurs.

9 Sometimes the contingencies take a few years to
10 construct and to commission, get running well, so the
11 monitoring program and the design takes this into
12 account to make sure that we have timely data.

13 We use this observational method for tailings dams
14 and hydro dams around the world, and it's being applied
15 to mining landforms like waste rock dumps and pit
16 lakes. You might ask, Is this new? Is this just
17 state-of-the-art? Well, on one hand, this
18 observational method for geotechnical engineering --
19 used for the Apollo moon shots about when I was born.
20 So that's not new. The application to mining and mine
21 reclamation is less than 20 years old and has been
22 adopted internationally for tough sites like Grassy
23 Mountain. So it's somewhat new.

24 I argue that the traditional design methods used
25 by the proponents fall short in terms of protecting the
26 environment and meeting other goals. The current

1 design lacks many of the elements on the flow chart in
2 favours of big trial-and-error approach.

3 You might ask, How come all this detail? Why now?
4 Why can't it come later? You might ask rhetorically,
5 Isn't 17,000 pages enough? Well, it comes down to
6 designing with the end of mine, planning ahead, being
7 thorough from the beginning. Avoiding this level of
8 design almost always leads to a fatal flaw in the
9 design, the mine overcommitting on performance it can't
10 control, increased costs down the road, and a greater
11 risk of early abandonment and environmental performance
12 that's less than promised.

13 At this site, achieving the goals and protecting
14 the fish requires more design effort than is currently
15 being provided.

16 Next slide, please. Thank you.

17 The report I prepared for the Livingstone
18 Landowners Group provides 17 observations and my
19 suggestions for addressing each one. Let me focus
20 today on the nine shown here in yellow, the ones that
21 relate to closure and reclamation, and there's one
22 slide for observation.

23 Next slide, please.

24 This first slide says that the EIA presents
25 optimistic goals, many of which will be hard to
26 achieve. Just about all mines overpromise to get their

1 permit. In many cases, they are -- feel compelled by
2 miners' inherent optimism but also by the system to
3 make these commitments towards lofty, ill-defined, or
4 otherwise high-risk goals to get their permit.

5 This notion of equivalent capability, which is the
6 heart of -- of Alberta's regulatory system for this, is
7 one such promise which is both ill-defined and a high
8 risk. That the ecoscience will be restored to a future
9 regulator's satisfaction in a timely manner in this
10 harsh environment with limited cover soils is very
11 optimistic.

12 I'm certain the mined land can be well reclaimed
13 with good design, execution, monitoring, and oversight
14 by the regulator and members of the local community,
15 but most mines end up disappointing even when they
16 reclaim well.

17 Last week, a colleague of mine summed up today's
18 typical mine reclamation approach as: We do our best
19 and cross our fingers. But we can do better than that.
20 We need to do better than that here at this mine.

21 I think we should start by promising less and then
22 putting plans in place to reliably deliver on
23 reasonable goals and objectives. People talk about
24 smart objectives -- S-M-A-R-T, standing for specific,
25 measurable, achievable, relevant, and time-oriented.

26 The objectives for Grassy Mountain generally fail

1 most of these criteria.

2 Then there are the numerous and often onerous
3 commitments made in the EIA, SIRs, and hearings such as
4 this.

5 Another colleague you'll know, an ex-Alberta
6 environmental -- environment regulator, Mr. Chris
7 Powter, points out that the documents such as
8 applications and EIAs are typically given the lowest
9 weight in the regulatory process behind policy,
10 standards, decision reports, authorizations, acts,
11 regulations, and rules. Most mines end up focusing,
12 sometimes exclusively, on what is written in their
13 permit.

14 Local communities put great weight in the
15 commitments made in the EIA such as this and the
16 hearings, and it's important that such commitments be
17 gathered up and clearly written and included as part of
18 any permits. Sometimes a permit approval will say that
19 the proponent shall do all the things promised in their
20 EIA and the permitting process, but I see that
21 overarching statements like this are -- are usually
22 hard to enforce and -- and often just melt away.

23 This lack of clarity in goals manifests when a
24 mine manager is asked to sign cheques for expensive
25 reclamation without clear objectives, and then again it
26 appears when the mine applies for a reclamation

1 certificate for the first plot of reclaimed land.

2 Almost no one gets a certificate for their
3 reclaimed mine land anywhere in the world. Even fewer
4 get their financial assurance return. My count, it's a
5 fraction of 1 percent get their money back.

6 There is 1 square kilometre of reclaimed land in
7 oil sands that I led the effort to achieve such a
8 certificate. This landform was chosen in 1997 to trial
9 the process for oil sands, building on some of the
10 success of the prairie coal mines. A fairly boring
11 hill was selected, one made mostly with clay, with a
12 metre of soil, 10-metre high trees, and it still took
13 ten years of negotiation and rework to achieve the
14 certificate. And getting the certificate was in doubt
15 right to the end.

16 There are a couple of coal mines with some
17 certified land to celebrate, but around the world
18 people are hard-pressed to come up with examples of --
19 of successful sign-off.

20 There's lots of reasons -- and circling back to
21 this slide here, there's lots of reasons, but one of
22 the main ones is disagreement on what the commitments
23 actually are and whether they have been met. Often
24 these requirements prove impossible to meet. So I
25 would encourage a reset on the goals and objectives
26 at -- at Grassy Mountain.

1 On to Slide Number 2, please -- or the next slide.

2 This slide allows us to talk about the high risks
3 that full reclamation will not be achieved. Partly
4 because there's almost never sign-off and there's few
5 economic incentives, few mines ever get fully
6 reclaimed, most are less than half reclaimed. I'm not
7 aware of any fully reclaimed mine site even amongst the
8 hundred mines I've visited and worked at around the
9 world. My list of fully reclaimed sites is limited to
10 a few small quarries near cities. Clearly, if a
11 proponent were to offer to only reclaim half a mine
12 site, permitting would be difficult, but this is kind
13 of the ongoing reality on the ground.

14 Usual pattern is at the end of mining, the
15 partially reclaimed mine site goes into care and
16 maintenance with very little additional reclamation
17 done. If the mine goes into receivership or goes
18 bankrupt, the property reverts back to the original
19 landowner, typically the Crown, and the reclamation
20 activities were also minimal at that point, and the
21 land is simply put into care and maintenance; users are
22 continued to be denied access.

23 In this modern era -- oh, sorry. This means that
24 at every mine opening the local communities are
25 accepting risks that the land won't be reclaimed, and
26 they may never get back on the land again.

1 In this modern era, mines post financial assurance
2 to cover the risk of default. Some combination of
3 cash, bonds, lines of credit or corporate assurance are
4 common. But the amount of money held by the government
5 is typically a small percentage of the estimated cost
6 of reclamation and the cost of long-term care and water
7 treatment.

8 But, worse, the estimated cost of mine closure is
9 almost always underestimated by a factor of 4 to 10.
10 So let me give you some numbers that -- that highlight
11 this. These are from the Faro Mine in the Yukon some
12 I've been involved with for the last decade. This
13 large lead-zinc mine closed in 1998. The reclamation
14 bond was \$28 million. So far, Canadian taxpayers have
15 spent over \$500 million on care and maintenance of the
16 Faro site even though there's been almost no land
17 reclaimed over the last 20 years. The cost estimate of
18 reclamation and care and maintenance over the next
19 20 years is expected to be over \$1.5 billion. This is
20 all taxpayers' money. This is compared to the
21 \$28 million bond. This is, unfortunately, fairly
22 typical.

23 Furthermore, I'm not aware of any mine that has
24 paid for its own reclamation. It seems to always
25 require the mine owner to use revenues from other
26 mines, or the site is abandoned to the taxpayers.

1 And I've never heard of regulators say that they
2 were glad to get a mine -- mine land back and that they
3 had adequate funding for reclamation, and often
4 governments don't feel compelled to rush reclamation or
5 even to meet the original permit conditions for
6 reclamation opting for safe and stable, little else.
7 Users are usually excluded from the mine land
8 indefinitely.

9 So given this track record, I've recommended that
10 the project be asked to provide a more complete cost
11 estimate for closure and long-term care and that the
12 Province secure adequate financial assurance for all
13 phases of the project. A review of the security by a
14 third party would help reduce risk and uncertainty.

15 Next slide, please.

16 The proponent's updated conservation and
17 reclamation plan is still lacking in key items and
18 should be redone with greater detail before a decision
19 is made. A list of deficiencies is provided here on
20 the slide. The report provides more detail, and the
21 coming slides focus on specific deficiencies.

22 Next slide, please.

23 Observation 11, my point is that surprisingly
24 little effort has been expended on the end-pit lake
25 design. Yes, it's a long time until the end-pit lake
26 will be constructed, but the design of the lake and its

1 watershed should be developed now so people can be
2 assured the lake will be viable and meet the goals and
3 objectives set out. Right now, there is almost some
4 design provided, despite lots of available guidance.
5 And I've put screenshots of four textbooks on the
6 slide. It's unclear that the Grassy Mountain pit lake
7 will be safe and -- and sustainable.

8 I note there appears to be an error in two EIA
9 tables regarding the size of the watershed that feeds
10 the lake, which is listed as -- the watershed's listed
11 as 1,032 square kilometres. This must be an error.
12 It's much too large.

13 Given that the -- it is recognized that, for a
14 successful lake, the design of the reclaimed watershed
15 is at least as important as the design of the lake.
16 And this typo is perhaps indicative of lack of
17 attention to the lake design at this point.

18 Here's a detail that's telling. The table
19 indicates 10 percent of the lake will be designed as a
20 littoral zone. This littoral is a very shallow water
21 zone in the lake that allows for productivity that's
22 important to the lake ecology. 10 percent is often
23 regarded as the textbook minimum for a productive lake
24 if that's indeed what's promised. But there's no
25 details on the function of this littoral zone for this
26 lake or how it will be constructed or how deep the

1 water will be. Typically, the littoral zone is
2 difficult to plan and construct unless planned from the
3 very beginning. More detail is needed.

4 Furthermore, the water quality of the lake is
5 assumed to be good, and this hasn't been demonstrated.
6 The presence of even low levels of selenium in pit
7 lakes, which are quiet or lentic environments, can have
8 a profound impact on birds and fish. The watershed and
9 the lake need to be designed for sufficient water
10 quality and quantity and contingency plans put in place
11 and a monitoring plan to rectify any poor water quality
12 right away. This is a major design consideration for
13 pit lakes in the region.

14 What is especially odd is the plan for tunnels
15 through the mountain as an overflow outlet for the pit
16 lake. I've never seen anyone propose to drain an
17 end-pit lake through a tunnel through a mountain. How
18 would these tunnels be constructed and maintained? How
19 can they be self-sustaining? How would the mine or the
20 government do -- or what would the mine or the
21 government do if they were to collapse at some point?
22 How can the inlets be kept from blocking? How can kids
23 be kept out?

24 Every other pit lake I know has an armoured outlet
25 channel that is very robust, and these outlets can be
26 the weakest part of the -- of the lake design. The

1 outlet should be cut into the bedrock, even though this
2 is -- this expensive cut is large enough to affect the
3 mine plan; and such cuts often expose more ore,
4 complicating the mine plan. The waste rock from this
5 cut would need to go somewhere. None of this is
6 planned or costed. Better to plan for than have the
7 taxpayers get into the mining business, digging a hole
8 in the side of a mountain to replace the tunnels.

9 So the plan should be updated with more pit lake
10 design details. I think a pit lake with a tunnel
11 outlet or elevated selenium would be considered a fatal
12 flaw for this end-pit lake.

13 Next slide, please.

14 The point I'd like to discuss now is that almost
15 no effort is being devoted in the -- in the plan to the
16 design of the surface water drainage system for the
17 mine site for -- for closure. In my practice, water is
18 the main issue in mine reclamation, surface water,
19 groundwater, soil moisture. When I worked at Syncrude,
20 we would pay our consultants tens of thousands of
21 dollars to work up a surface water drainage design for
22 each closure plan. We needed this design to understand
23 how to design the mine, the individual landforms, how
24 to design with the end in mind. We have to keep the
25 water flowing safely downhill, so we note that water
26 only flows uphill, to money.

1 As part of hydraulic designs, mine declare the
2 return period for major design storms. We would design
3 the erosion -- design these channels to limit erosion
4 in, say, a 1-in-10-year event or 1-in-a-thousand-year
5 event or -- or, in critical cases, a 1-in-10,000-year
6 event. And same as we would do for the outlet of
7 critical dams.

8 The costs to meet these different criteria vary
9 greatly, so we need to declare these criteria up front.
10 We needed to make sure that there's enough gravel
11 and -- and Riprap to armour the channels. One rule of
12 thumb says that for mines in Alberta the drainage
13 density of about 1 kilometre of watercourses for each
14 1 square kilometre of disturbed land. The density does
15 vary with geography. I'm not -- I don't think it's
16 been determined what the right density is for the
17 Grassy Mountain.

18 But to give you a sense, if that density applies
19 here, it would amount to about 15 kilometres of
20 watercourses, which seem reasonable. And look at the
21 plan, and -- and on the slide here, all I see instead
22 of this design report and -- and all this work are
23 little blue arrows on the map called "drainage
24 direction" with no indication of what the design storm
25 would be, how the channels would carry the water, how
26 much they would cost, how the land would be protected

1 from uncontrolled erosion. Channels to safely carry
2 runoff water from waste rock dumps or a feature of
3 textbooks in the 1970s would have been forgotten by
4 the -- a lot of mines today, including Grassy.

5 Here's what I've seen happens when you don't have
6 a well-designed and well-constructed surface water
7 drainage system. Water ponds on the landscape sinking
8 into the waste rock and causing chemicals to leach from
9 the waste rock dumps. Where the ponded water slops
10 over a dump crest, floods down, the soil cover is
11 washed away, big gullies, and deposition is alluvial
12 fans at the toe of the slope, sometimes blocking a
13 watercourse down there too. Mine waste is often
14 inadvertently dumped where the channels are supposed to
15 be constructed, and who is going to move a dump to fit
16 a channel in later? When it comes time for the
17 reclamation certificate, the regulator may wonder where
18 all the channels are and why they weren't built. The
19 miner doesn't want to cut down the trees that have
20 grown and disturb the land to build channels. I know.
21 I've been there with the S4 dump certification at -- at
22 Syncrude. It's too late. There's increased cost,
23 increased risk, and decreased environmental performance
24 results.

25 The surface water drainage is serious business.
26 It's designed by professionals. It's constructed with

1 the greatest of care. It's repaired and maintained so
2 it acts as intended. The Grassy EIA provides
3 commitments regarding erosion but no designs to manage
4 it.

5 The diagram here in the upper right shows a modern
6 waste rock dump designed to control acid rock drainage
7 or selenium oxidation. I want to use the diagram to
8 focus on the kinds of surface water drainage that we're
9 talking about here. On the right, a run-on channel
10 above the waste rock dump kind of at the toe of the
11 mountain slope is used to keep clean water clean and
12 stop it from leaching materials from the waste rock
13 dump. Line channels on top of the waste rock dump
14 plateau are used to avoid ponding water. The watershed
15 berm at the edge of the dump crest is used to keep
16 water from gullying the crest. The Australians use
17 these widely; they call it a "bund". The toe creek is
18 used to collect the surface water and perhaps the
19 groundwater. These elements all need to be built into
20 the design from the start even -- it's important to
21 have these in the design even at this early stage as
22 now.

23 Down to my last four slides here. Next slide,
24 Number 13.

25 There's opportunities to improve the -- on the
26 commitment and mine plans for progressive reclamation.

1 The mine is promising progressive reclamation. Even
2 mines with good intentions generally fall short on
3 implementation of progressive reclamation. The permit
4 should reflect this commitment in a measurable way,
5 perhaps indicating that all areas of the mine that are
6 no longer required for operations shall be reclaimed
7 in, say, two years. This helps hold the proponent to
8 their commitment.

9 There's an opportunity to be the more aggressive
10 in the progressive reclamation plans making more land
11 available sooner for progressive reclamation, for
12 example, by adjusting the waste rock dump sequencing
13 such that a smaller area of active dumping is required
14 at any given time.

15 The mine is planning direct placement of
16 reclamation material, which is good. This is where the
17 reclamation material from active stripping is handled
18 once so it doesn't need to be stockpiled and is loaded,
19 hauled, dumped, and spread, typically within hours.
20 This approach not is only [sic] cheaper than
21 stockpiling and rehandling. As importantly, it
22 preserves the soil microbes, the seeds, and the
23 propagules in the soil that greatly speeds the recovery
24 of the vegetation community. The permit condition
25 should be written to maximize the direct placement
26 every year, not just as practicable or when possible

1 or -- or at the mine's discretion.

2 Benga should establish some large field trials
3 to -- for reclamation research, building covers and
4 revegetation plots planted or seeded at commercial
5 scale. It would have been good to start such plots
6 during the exploration period, but 2021 is also a good
7 year to start. These are to answer the question: What
8 covers and planting techniques are needed to establish
9 the promised ecosites in different areas of the
10 reclaimed landscape?

11 A simple example: There remains uncertainty
12 whether whitebark pine can be established and thrived
13 in mine reclamation at this kind of site. Fair enough.
14 Common practice to establish vegetation plots to answer
15 these kinds of questions and questions like: What
16 cover thickness does it need? What -- for whitepine?
17 What kind of substrate? Should it be contoured to
18 block the wind or -- or perhaps to trap snow? Should a
19 nurse crop be used? How should the seedlings be
20 planted? How can the mine demonstrate to regulators
21 and local communities the vegetation design for
22 whitebark park [sic] is likely to succeed?

23 Right now, the reclamation plan waits until
24 Year 15 to start planting these whitebark pine.
25 Instead, Benga should establish vegetation plots next
26 year and test the conditions needed to promote

1 whitebark pine. The needed knowledge will then be in
2 place prior to reclamation, and we can all be assured
3 then the plan is a good one. Or if we find it proves
4 impractical, Benga can ask for an exemption from the
5 whitebark pine commitments. Better to find this out
6 now in the next few years than to wait until 2040.

7 Next slide. Three more slides to go. I apologize
8 to the Panel; I'm taking a couple extra minutes here.

9 The proponent indicates a commitment to
10 establishing equivalent capability, which always begs
11 the question: Equivalent capability for exactly what?
12 If it's equivalent capability for re-establishing the
13 ecosites prior to mining, having the grasses, trees,
14 and shrubs grow at similar rates to pre-disturbance,
15 what really matters here is the cover soil, the depth,
16 the layers, the material properties, how it's placed.

17 I'm not a soil scientist, but I've worked for
18 25 years in multidisciplinary teams designing,
19 constructing, and testing reclamation material
20 prescriptions for cover soils in mines in Alberta and
21 internationally. Here's what I observed regarding
22 Grassy Mountain.

23 The current mine plan reclamation plan uses a very
24 simplistic design. The proponent has determined
25 there's about 3.3 million cubic metres of available
26 reclamation material needed to cover or to put on 15

1 million square metres of reclaimed land. That's 1,500
2 hectares. Long division provides the design in this
3 case: 20 centimetres cover soil depth. This is the
4 amount placed on all substrates at all elevations, on
5 windy polygons and calm ones, on old roads, on waste
6 rock dumps alike. This is the kind of mining
7 engineering and design promoted in my 1973 version of
8 the mining engineering handbook. This thinking is long
9 out of date and insufficient to meet the lofty goals
10 like equivalent capability, especially given the site
11 conditions, not to mention the need to control the
12 ingress of water and oxygen into waste rock dumps which
13 impacts selenium generation. It's unusual to propose
14 this one-size-fits-all blanket approach.

15 Normally for vegetated covers, the goals are set,
16 the landscape is divided into polygons, soil scientists
17 figure out the soil moisture regime and the soil
18 nutrient regime and plot these on an adaptive grid as
19 shown above.

20 They use this to figure out what ecosites will
21 flourish in various -- with various soil prescriptions.
22 In particular, the water-holding capacity of the soil
23 often governs vegetation performance. Will there be
24 enough water during a drought to sustain the plants?
25 The model results are tested in long-term vegetation
26 plots that we talked about in the last slide. The soil

1 prescriptions, the depth, the layering, the material
2 properties are adjusted and designed to support the
3 desired ecosites and land uses and net percolation
4 requirements.

5 If the designs don't meet the requirements, the
6 designs are adjusted. This is a practice of Teck coal
7 mines elsewhere in the Rockies under Alberta
8 regulations. It's embedded in oil sands mine design
9 reclamation. This -- I expected to see this in the
10 report, but I didn't.

11 Yes, all this does have to fit into a reclamation
12 material balance. There's only so much soil to
13 salvage, and especially in a mountain mine. And this
14 is why it's so critical to get this right ahead of
15 mining. If the requirements need more material than is
16 available to be salvaged, then more overburden needs to
17 be stripped, taking a deeper cut down in the glacial
18 tills before mining.

19 If you don't do this during initial mine
20 development, the material is lost during excavation of
21 the mine pits or buried in waste rock -- under waste
22 rock dumps. The designs can't wait. The point is soil
23 prescriptions and mine waste covers are so much more
24 than dividing two numbers together. And even if this
25 were a good idea, the reclamation plan fails to show
26 how this rudimentary prescription will meet the goals

1 for equivalent capability in each part of the reclaimed
2 landscape. And the lack of analysis in design and
3 planning means that certain doors will be closed even
4 before mining starts. There needs to be a proper
5 design before mining begins, before permitting, and
6 with a plan and eventually field trials to show that
7 it's all going to work.

8 Next slide.

9 This one overlaps with Slide Number 14 before.
10 There's been little effort to design the covers, to
11 control net percolation for the waste rock systems.
12 Much of this discussion's covered in the previous slide
13 on soil covers, except the design methods are more
14 involved when needing to limit net percolation.

15 There's several international guides to show the
16 design of cover systems, two of which I've contributed
17 to. Most of these covers are designed as some
18 combination of growth media, erosion protection, and
19 control of percolation into dumps with adverse
20 geochemistry. It's a multidisciplinary undertaking
21 involving modelling, design, field trials, and close
22 controls and construction.

23 My presentation later in the week on water
24 management, selenium control will get into the covers
25 in more detail. They need design. I believe the --
26 the source control for selenium is a precondition to

1 success at this site. Lack of selenium-source control
2 is likely a fatal flaw to the design. Having adequate
3 covers can change a lot of things to do with the mine
4 design and especially the reclamation closure plan and
5 needs to be done up front.

6 Next slide.

7 The proponent has promised to develop a
8 reclamation monitoring program, but this seems to be
9 more of a bolt-on than part of the design. The
10 monitoring program is fundamental to engineering
11 design. As engineers, we wouldn't think of issuing a
12 design, say, for a roller coaster without a full
13 inspection and maintenance plan. It's integral to the
14 design. Monitoring is also integral to the landform
15 design process and the observational method. The plan
16 can't wait till a future date. The Panel ought to
17 require the integrated monitoring plan in fair detail
18 in support of the design to -- to -- that is being set
19 out. You need the monitoring program to tell you when
20 to tweak your designs and practices, when to implement
21 the contingency measures, and start to gather the data
22 needed to manage and operate the site and some day
23 make -- serve as the basis for the application for a
24 reclamation certificate.

25 It's not a nice-to-have thing. A monitoring plan
26 is an integral element of the design operation, not

1 something to leave behind. My report provides some
2 detail and references on -- on how to accomplish this
3 at this stage of mining.

4 Last slide, please. Thank you.

5 So as noted at the beginning, I'm neither for or
6 against the Grassy Mountain Coal Mine, while I am
7 advising that the current level of design falls short
8 of the standard practice for this kind of sensitive
9 mine site, even during this early permitting period.

10 One might ask if landform design is too new or
11 state of the art than the state of practice? Is it --
12 the new formation of the Landform Design Institute
13 proof of that? Yes, perhaps. But regardless of what
14 it's called, this kind of approach is especially needed
15 for mines operating in tough conditions where there's
16 doubt that the lofty goals will be achieved, where
17 people struggle with high-altitude reclamation in less
18 windy conditions, where there are creeks and fish
19 populations sensitive to even minute changes in water
20 quality coming from the waste rock dumps, but landform
21 design has packaged these activities into a framework
22 to help ensure success.

23 One might say that the EIA terms of reference only
24 require conceptual plans, blue lines on a map, as it
25 were, instead of an engineering design. But only
26 having conceptual plans usually masks unknown fatal

1 flaws. Mines and regulators are learning -- and I
2 think what local communities have surmised all along --
3 that plans that lack detail are the root cause of mines
4 failing to meet the reclamation commitments. The devil
5 is in the details. Conceptual plans don't have enough
6 detail in this respect to protect the environment.

7 More details need to see the light of day during
8 permitting. Waiting a few years or decades to work the
9 details means lost opportunities, increased cost,
10 decreased performance, and more risk to the regulator,
11 local communities, and the environment. Mines need to
12 be ahead of the curve. If only we had known what we
13 know now. The cost -- well, a well-run mine with a
14 good plan and good operations typically spends a few
15 percent of its life-of-mine budget on the sum of all
16 environmental and reclamation activities, a lot of
17 money but a small percentage. A mine that finds itself
18 behind the eight ball always ends up playing catch-up
19 and can find itself spending 10 to 20 percent of its
20 budget on such activities and may find the mine life
21 shortened or may find that it has to keep mining to
22 avoid confronting newly discovered environmental
23 liabilities. It's in everyone's best interest to do
24 this front-end-loaded engineering, keep cost down, keep
25 opportunities open. Overall engineering design costs
26 are usually just about 1 percent of the mining budget.

1 It's a lot of money during this permitting stage, as --
2 as we all know, but important nonetheless.

3 These planning shortcomings may not only impact
4 the mine economics and the long-term performance of the
5 reclaimed landscape, but may have important
6 implications for selenium management, as I'll discuss
7 in my upcoming presentation.

8 I believe the current level of detail for the site
9 is insufficient to judge the merits of the project or
10 to be able to rule out a potential fatal flaw of the
11 designs or to provide a reasonable cost estimate for
12 reclamation.

13 I believe that prior to full consideration of the
14 application, closure and reclamation plans should be
15 significantly upgraded. In particular, the design of
16 the soil covers, the revegetation plans, adding a
17 surface water drainage system, designing of the end-pit
18 lake and its watershed, and design and implementation
19 of landscape performance monitoring are all still
20 required. My report provides details, including
21 potential solutions, for each of these observations.

22 Thank you, Mr. Chair and Panel Members, for the
23 opportunity to highlight these concerns today.

24 Q MR. FITCH: Thank you, Dr. McKenna.

25 MR. FITCH: Mr. Chair, Dr. McKenna is
26 available for questioning.

1 THE CHAIR: Thank you, Mr. Fitch.

2 Mr. Ignasiak or Mr. Brinker, does Benga have
3 questions for Mr. -- Dr. McKenna?

4 MR. IGNASIAK: Thank you, Mr. Chair. Yeah,
5 just a couple.

6 Mr. Ignasiak Cross-examines Livingstone Landowners
7 Group

8 Q MR. IGNASIAK: Good morning, Dr. McKenna.

9 A Good morning.

10 Q My name is Martin Ignasiak. I'm counsel to Benga in
11 this proceeding. Thanks for your presentation.

12 I was looking at your CV. You've obviously got a
13 lot of experience in this area, and I understand you
14 chair -- and I think you founded if I have it right --
15 the Landform Design Institute?

16 A That's correct.

17 Q And I think you describe that on the website as:

18 (as read)

19 Landform design as an emerging process to
20 reconstruct mine landscapes with confidence
21 and pride.

22 Is that right?

23 A That's true.

24 Q And the mission of the institute is to make landform
25 design routine in the mining industry worldwide by
26 2030; is that right?

1 A That is correct.

2 Q Okay. Now, looking at your CV, I was looking at PDF --
3 it's PDF 39 of the -- of the submission by LLG, which
4 is Document 552. But looking at it, you list on that
5 page 22 -- there's 22 bullets listing projects, and I
6 see you've got experience not just in the oil sands,
7 but also with process timber lights of diamonds, gold,
8 and coal; is that right?

9 A Yes, that's true, and other metals as well.

10 Q Okay. And it states there that you've led the design
11 and construction of 23 large mining landform projects
12 totalling 44 square kilometres, including 37 wetlands
13 and 101 kilometres of watercourses; right?

14 A That's true.

15 Q So you would have led -- so what would your involvement
16 be with those projects? You would have kind of led
17 these teams responsible for the overall design or --

18 A Yes. And usually there's a -- a lead designer that I
19 mentor and -- and help with, and I take overall project
20 management and guide -- help him or her guide the team
21 through -- through these processes through design and
22 all through -- also through construction and -- and
23 monitoring.

24 Q Okay. And so one of the projects I understand you've
25 had considerable success with -- and I know you've
26 written some cases studies about it -- is what's

1 referred to as "Suncor Pond 1" or the "Wapisiw
2 Lookout"; is that right?

3 A That's right.

4 Q Okay. And that -- so -- and I understand you were
5 working on that from 2008 to 2010?

6 A Yes, and a little bit beyond that.

7 Q Okay. And as I understand it, that's the first
8 tailings pond that was ever built in the oil sands
9 industry; right? It was created by something called
10 "Tar Island Dyke" in 1967?

11 A That's correct.

12 Q And it's about 2.2 square kilometres in size?

13 A Right.

14 Q And I understand from the case studies you've written
15 that it reached a maximum height of about 92 metres in
16 1985 and then continued operating thereafter; is that
17 right?

18 A That seems right.

19 Q And Suncor decided in 2007 that they would stabilize
20 and reclaim that landscape by the end of 2010; is that
21 right?

22 A That's right.

23 Q And I understand with your -- when you got involved in
24 2008 work, and that you managed to successfully reach
25 that objective; right?

26 A Yes.

1 Q Okay. Great.

2 So just switching gears, then, one other topic I
3 had was at PDF 11 -- it's in your report; I think you
4 probably remember -- you talked a bit about the north
5 dump and the south dump and -- and the fact that the
6 south dump was separated by a power line; right?

7 A Yes.

8 Q So -- now, one of the things you've recommended is
9 looking at relocating that power line as if it wasn't
10 there, I guess. But one of the things -- like, you
11 wouldn't have any -- you haven't done any assessment of
12 how much of that power line would have to be moved and
13 what the utility would price the movement of that power
14 line at; right? Like, you haven't done any type of
15 assessment like that?

16 A Actually, I read where the -- in the EIA documents
17 where the mine had done that assessment and made the
18 decision to leave the line there.

19 Q Okay. And do you know what -- what the cost of moving
20 that power line would have been?

21 A I don't know if that -- I can't remember if it was
22 included or not.

23 Q Okay.

24 A It would be high. It would be a lot of money.

25 Q Okay. All right. Thank you, Dr. McKenna. Thank you
26 very much.

1 MR. IGNASIAK: No further questions,
2 Mr. Chair.

3 THE CHAIR: Thank you.

4 Ms. LaCasse or Ms. Kapel Holden, any questions?

5 MS. LACASSE: We don't have any questions,
6 Mr. Chair.

7 THE CHAIR: Thank you.

8 Mr. Lambrecht?

9 MR. LAMBRECHT: Mr. Chair, federal staff do
10 not have any questions, and I thank this witness for
11 his evidence and participation in the Joint Review
12 Panel process.

13 DR. MCKENNA: You're welcome.

14 THE CHAIR: Thank you.

15 Mr. Matthews, any questions?

16 Alberta Energy Regulator Panel Questions Livingstone
17 Landowners Group

18 Q MR. MATTHEWS: Thank you, Dr. McKenna. I
19 just have a couple of questions.

20 You mentioned about care and maintenance. Is it a
21 normal practice for an operator to -- when they go into
22 care and maintenance, do they -- are they bound by
23 environmental commitments? Like, are they bound by
24 monitoring and ongoing environmental work?

25 A Yeah. Typically, the -- the care and maintenance --
26 its Number 1 duty is protect the mine site -- or

1 protect the environment away from the mine site, any
2 receiving streams or -- or other areas. It -- often
3 also to protect people from coming onto the mine site
4 and falling down old shafts and things like that. But
5 there isn't much work or commitment that's -- that's
6 required for reclaiming the areas on-site. And so
7 those -- the minimum is typically done.

8 Q Okay. And another -- my last question here is
9 regarding -- you mentioned that, on dumps, they often
10 have covers as part of their closure and reclamation
11 plan. Are you aware of any coal mines where they have
12 complete liners, like, underneath the -- the dump?

13 A Yeah. That's an emerging trend. I'm not aware of any
14 old dumps that have that. There's questions about
15 the -- the longevity of -- of such a liner, especially
16 if it's geosynthetic, or even just cracking if it's a
17 cliff-compacted clay liner. So it's -- and it also has
18 some -- it -- it can form a weak layer geotechnically
19 under the -- under the dump. And so it is used in some
20 tailings ponds in -- in some jurisdictions, even over
21 large areas. It's of course used in landfills and
22 that, but it -- I'm not aware of any -- personally
23 aware of any coal mines that are -- that are using it
24 for under -- for lining a waste rock dump. The covers
25 are -- are becoming more common, the stuff that's on
26 the top, but the liners aren't.

1 Q Okay. Great. Well -- great. Well, thanks a lot.

2 Thanks, Dr. McKenna. That's all I have to say -- ask.

3 THE CHAIR: Mr. O'Gorman, any questions?

4 MR. O'GORMAN: Thank you, Mr. Chair, and I do
5 have just a couple of quick questions for Dr. McKenna.

6 Q MR. O'GORMAN: Thanks very much for that
7 presentation. It's quite -- it's quite informative. I
8 just wanted to clarify a couple of things, please.

9 You spoke in your -- in your presentation about a
10 successful end-pit lake. You talked about the littoral
11 zone, for example, that would be associated with that.
12 I wonder if you could just give us a bit more
13 explanation of, in your view, what are some key
14 elements that would make an end-pit lake successful,
15 which was the word you used?

16 A Very good. Well, I -- I'll tap into two sources. One
17 is -- is I was one of the lead authors on the end-pit
18 lake design guide for the oil sands that came out in
19 2012, and we had quite a bit of information on what
20 constitutes success. And I also worked with a couple
21 end-pit lake experts who have written the textbooks
22 that I featured on there and can tap from that.

23 The main -- the main item for success is actually
24 meeting the goals that you set out that you are going
25 to meet, so having very clear goals and clear
26 objectives and then showing that you've met them.

1 That's -- from a procedural point of view, I think
2 that's critical.

3 From a purely environmental view, you need to keep
4 the water quality good, which means having enough
5 watershed of -- of relatively clean water that can
6 flush the -- any contaminants in the lake; or if the
7 lake doesn't have enough water, it tends to evaporate
8 and accumulate salts and that. So having lots of clean
9 water coming from the watershed. Having a lake
10 geometry that keeps the water clean. There's all sorts
11 of -- it's outside my expertise, but where you -- you
12 can get stratification within the lake and -- and
13 overturning, which is hard on the -- hard on the lake
14 ecology. And having a -- a -- if you're offering a
15 productive lake -- not all the mountain lakes --
16 natural or -- or end-pit lakes are -- are productive --
17 (UNREPORTABLE SOUND) -- but the -- sorry about that.
18 But having a -- a good littoral zone that's very
19 shallow -- it tends to be less than a couple of metres
20 deep -- and stays shallow so that you don't, you know,
21 build your littoral zone and -- and have it even flood
22 out or -- or drop -- settle and -- and become too deep.
23 That's common -- both of those are common in pit lakes
24 for -- for that to happen. So having a -- a suitable
25 littoral zone that's good for the fish to -- to rear
26 and -- and feed and stuff like that. Those are all

1 critical elements of it.

2 Having a safe and stable shoreline and having a
3 safe and stable outlet are also really critical,
4 especially the outlet.

5 Q Okay. Thanks, Dr. McKenna. And, actually, you take me
6 to the -- the thing that I wanted to go next on this
7 vein, which was the outlet.

8 So you -- you talked in your presentation about
9 the idea of outlet and outflow via a tunnel. You also
10 talked about your preference for outflow -- no, "your
11 preference" might not be fair to say. You talked about
12 outflow via an armoured channel. And, of course,
13 another option might be outflow strictly via
14 evaporation.

15 In a -- in a hypothetical end-pit lake in which
16 there were no outflow channels but relied strictly on
17 evaporation, would that be a kind of design that would
18 be more or less likely to produce a successful end-pit
19 lake?

20 A I think it would be quite a lot less successful or --
21 or were that. They -- textbooks refer to what you
22 describe as a "terminal end-pit lake" and -- and was
23 common in some desert metal mines and that. It
24 tends -- they tend to go -- they evapo-concentrate
25 anything that's in the water there, and the water in
26 those metal mines, often pH 2 -- and -- and the

1 Berkeley Pit comes to mind as the poster child of -- of
2 perhaps the worst end-pit lake around, or one of them.

3 And so these terminal end-pit lakes with -- with
4 no physical outlet and -- and just allowing the water
5 to -- you know, would sit low and -- and find its own
6 level for -- between evaporation and water losses or
7 gains to groundwater seepage. I wouldn't think that
8 that would have much chance of -- of providing an
9 end-pit lake that would be acceptable to people in
10 Alberta.

11 Q Okay. Thanks.

12 I have one final question. You -- you include
13 quite a few recommendations with your report. I guess
14 I'm curious to know what you think of the idea of this
15 Panel, in potential approval conditions, including
16 those as recommended conditions in an EPEA approval,
17 for example. Do you think those would make sense,
18 particularly around -- and I'm particularly thinking
19 now about the end-pit lake design and the requirements
20 for more details on that. Just curious your views
21 on -- on those as potential conditions.

22 A Yes. As I -- as I wrote the letter for Livingstone
23 Landowner [sic] Group, I thought, well, the -- the mine
24 will -- will either be -- the permit will either be
25 denied or it will be approved with conditions, and so I
26 tried to think of -- of you and the Alberta Regulator

1 and the local communities and the mine as I was putting
2 together the recommendations.

3 I -- I was hoping that you would sift through them
4 and -- and find the ones that -- that you found most
5 important to success and either include them or reword
6 them in -- in support of your work, yes.

7 Q Okay. Thank you very much, Dr. McKenna. I don't have
8 any further questions, and thanks for appearing and --
9 before us and submitting your report.

10 A You're welcome.

11 THE CHAIR: Thank you, Mr. O'Gorman.

12 Dr. McKenna, I don't have any further questions
13 for you, but I just want to echo my colleagues' views.
14 Thank you very much for your written submission and
15 your presentation today. Very helpful for the Panel.

16 A You're welcome. Glad to oblige.

17 THE CHAIR: Mr. Fitch, any re-direct?

18 MR. FITCH: No, sir.

19 THE CHAIR: Okay. Thank you.

20 (WITNESS STANDS DOWN)

21 THE CHAIR: So that brings us to the end
22 of the vegetation and reclamation topic area. Next
23 we're going to move to the water session, and so that
24 will include surface and groundwater management,
25 quantity and quality; selenium management; and aquatic
26 resources, including fish, fish habitat, and fish

1 species at risk.

2 I'll maybe suggest we take a 15-minute break, our
3 morning break, to let the panel get ready, and then
4 we'll hear direct evidence from Benga. So it's 10:00.
5 We'll come back at 10:15.

6 (ADJOURNMENT)

7 Discussion

8 THE CHAIR: Okay. Go ahead, Mr. Ignasiak,
9 whenever you are ready.

10 MR. DRUMMOND: Just before that, Mr. Chair.

11 THE CHAIR: Sure.

12 MR. DRUMMOND: It's -- it's Robert Drummond
13 from Justice Canada. I did want to raise something to
14 the Court's [sic] attention. This morning the Canadian
15 Science Advisory Secretariat issued a science response
16 in respect of an assessment of the ecological impact of
17 this project on the westslope cutthroat trout. I have
18 sent it off to the Panel manager, Panel counsel, and to
19 counsel for Benga. DFO does not consider this to be
20 new evidence; however, it is a new report synthesizing
21 previously available information, and I wanted to bring
22 it to the Panel's attention. I think we'd seek to
23 enter it as an exhibit because I think it might be
24 useful for the Panel, and I -- I also did not want to
25 cause any unfairness to Benga in respect of this
26 report. And I leave it to the Panel, but I'm -- I

1 would not object if -- if, say, Benga wished to review
2 this and give further direct evidence as it sees
3 necessary at some subsequent point. But I leave that
4 in the -- in the Panel's hands.

5 THE CHAIR: Okay. Thank you.

6 Mr. Ignasiak, have you had a chance to look at
7 this yet, or do you need some time?

8 MR. IGNASIAK: I just opened it up, sir, and
9 it's a -- it's dense document; it's 23 pages. So if we
10 could just -- and, of course, our experts in this area
11 are currently busy appearing before a panel, so if we
12 could have the day maybe to look at this and get back
13 to you, that would be great.

14 THE CHAIR: Yeah. That would be fine.

15 MR. DRUMMOND: Absolutely, sir.

16 THE CHAIR: Yeah. Report back when you've
17 had a chance to look at it.

18 Okay. Thank you, Mr. Drummond.

19 So, Mr. Ignasiak?

20 MR. IGNASIAK: Yeah. Thank you, Mr. Chair.

21 So this witness panel for this topic block has
22 some of the usual suspects, so maybe I'll ask them to
23 first just confirm that they still consider themselves
24 under oath or affirmed as the case may be.

25 So, Mr. Houston, can you confirm that you're still
26 under oath?

1 GARY HOUSTON, DANE MCCOY, MIKE YOUL, MIKE BARTLETT,
2 Previously Affirmed

3 A MR. HOUSTON: I do.

4 MR. IGNASIAK: Mr. Youl?

5 A MR. YOUL: I do.

6 MR. IGNASIAK: Mr. McCoy?

7 A MR. MCCOY: Sorry. I was on mute. Yes, I
8 do.

9 MR. IGNASIAK: Mr. Bartlett?

10 MR. BARTLETT: I do.

11 MR. IGNASIAK: Okay. Thank you.

12 And so, Mr. Chair, then the -- the other witnesses
13 who still -- who haven't yet appeared before the Panel
14 as indicated in our letter of October 28 are
15 Mr. Cory Bettles, aquatic resources, with Hatfield
16 Consultants; Mr. David DeForest with aquatic resources,
17 Winward Environmental; Mr. Stephen Day on geochemistry,
18 with SRK Consulting; Ms. Nancy Grainger, hydrogeology,
19 with Millennium EMS Solutions; Dr. Dan Bewley,
20 hydrology, with Hatfield Consultants; Mr. Soren Jensen,
21 hydrology with SRK Consulting; Mr. Martin Davies,
22 surface water quality, with Hatfield Consultants; and
23 Dr. Leif Burge with -- fluvial geomorphologist with
24 Stantec.

25 So if we could get those individuals sworn or
26 affirmed by the court reporter, Mr. Houston will then

1 be ready to deliver the opening statement.
2 CORY BETTLES, DAVID DEFOREST, SOREN JENSEN,
3 MARTIN DAVIES, LEIF BURGE, Affirmed
4 STEPHEN DAY, NANCY GRAINGER, Sworn
5 Direct Evidence of Benga Mining Limited (Water,
6 including surface and groundwater management, quantity
7 and quality, selenium management and aquatic resources,
8 including fish and fish habitat and fish species at
9 risk)

10 A MR. HOUSTON: So, Mr. Chair, I'm not sure if
11 Dr. Bewley, who was previously before this Panel,
12 reconfirmed that he is still under oath.

13 MR. IGNASIAK: Yeah. Sorry, Mr. Chair. I
14 failed to recall he's already been in front of the
15 Panel.

16 DAN BEWLEY, Previously Affirmed

17 MR. IGNASIAK: So, Dr. Bewley, can you just
18 confirm you're still under -- you consider yourself to
19 be bound by your oath?

20 A DR. BEWLEY: Yes, I do.

21 MR. IGNASIAK: All right. So I think that's
22 everyone, Mr. Chair, unless -- unless someone advises
23 otherwise.

24 Mr. Houston, I think you're free to go.

25 A MR. HOUSTON: Good morning, Mr. Chair and
26 members of the Joint Review Panel. Water and aquatic

1 environment are of paramount importance to the
2 successful implementation of any resource project and
3 especially so for the Grassy Mountain Coal Mine.

4 There are many aspects that I'm sure will be
5 discussed over the coming days, but we would like to
6 focus this morning on two broad topics that seem to
7 define this project. The first is protection and
8 recovery of the westslope cutthroat trout, in
9 particular the Gold Creek stock; and the second is the
10 management and mitigation of selenium.

11 The westslope cutthroat trout is a species of
12 concern and the fish species of focus for the
13 environmental assessment because of their provincial
14 and federal status in the local study area. Westslope
15 cutthroat trout inhabiting upper Blairmore Creek
16 watershed are defined as a conservation population per
17 the Alberta recovery plan due to hybridization levels
18 with non-native rainbow trout exceeding the 99 percent
19 genetic threshold. Westslope cutthroat trout in Gold
20 Creek are genetically pure and have maintained this
21 status in part because of a man-made barrier that
22 prevents the invasion of rainbow trout. The Gold Creek
23 stock of westslope cutthroat trout is listed in
24 Schedule 1, Part 3 of the federal Species At Risk Act
25 as a threatened species.

26 Unfortunately, the same barrier that protects the

1 westslope cutthroat trout in Gold Creek confines the
2 local population to an area of suboptimal habitat.
3 Because of the project and research conducted by Benga,
4 more is known now about this community of westslope
5 cutthroat trout and the limitations of Gold Creek than
6 ever before.

7 While Gold Creek has been classified as critical
8 habitat per the recovery strategy, it is not good
9 habitat due to multiple existing stressors that are a
10 direct threat to the sustainability and persistence of
11 the local westslope cutthroat trout stock.

12 Mr. Chair, I would like the Zoom host to pull up
13 Registry Document 89, which is Addendum 8 to the EIA,
14 and to go to PDF page 907.

15 This is an aerial photo of a section of Gold Creek
16 adjacent to the proposed mine. The yellow line is the
17 original location of Gold Creek prior to flooding
18 events in recent years. The flooding caused the creek
19 to change its path near the historical townsite of
20 Lille.

21 Now, if the Zoom host could focus in on Photo C,
22 which is the lower photo on the right side of the page.

23 So the quality's not great in this photo because
24 of the scale, but what it shows at this location on
25 September 14th, 2016, is that there is no water in the
26 creek. The surface water is absent and goes subsurface

1 and then comes back up to the surface further
2 downstream in the vicinity of the Morin Creek
3 confluence.

4 Benga has identified two additional areas in Gold
5 Creek where fragmentation like this area has occurred
6 and Gold Creek becomes completely disconnected at key
7 times of the year. At these three known points, the
8 main stem of Gold Creek is braided, runs through treed
9 areas where habitat is extremely poor, and, in fact,
10 westslope cutthroat trout have been observed stranded
11 in disconnected isolated pools that are rapidly running
12 dry.

13 Mr. Chair, as part of its fisheries offset plan,
14 Benga is proposing to re-establish connectivity for the
15 westslope cutthroat trout so that they can move freely
16 along the entire length of Gold Creek in search of
17 suitable habitat.

18 I would now like the Zoom host to bring up
19 PDF page 864 in this same document and focus on the
20 graph, please. Yes.

21 Mr. Chair, this is a graph showing the area
22 weighted suitability of Gold Creek for various life
23 stages of westslope cutthroat trout. Of note on this
24 graph is the dramatically smaller area available for
25 overwintering. Typically, high-quality overwintering
26 habitat for westslope cutthroat trout is comprised of

1 deep pools that are unlikely to freeze either due to
2 depth or maintenance of suitable conditions through
3 influence of groundwater influx.

4 And now if the Zoom host could turn to page
5 PDF 867 in the same document.

6 This is a map of Gold Creek showing the location
7 of potential overwintering habitat along the length of
8 Gold Creek.

9 If the Zoom host could zoom in on Photo A at the
10 top, we can see another location similar to the one I
11 mentioned on the previous map where the creek is dry
12 during parts of the year. Again, there is no way for
13 trout to cross this barrier to seek appropriate
14 habitat.

15 Finally, I would ask, Mr. Chair, for the Zoom host
16 to focus in on Photo C on this page and the bottom left
17 corner. This is the man-made weir that was built to
18 supply water to the old town of Frank. This is the
19 lower barrier on Gold Creek that blocks non-native
20 species from swimming upstream, and it is also the
21 barrier that prevents the westslope cutthroat trout
22 from moving downstream to the Crowsnest River.

23 Zoom Host, you can take these down now.

24 Mr. Chair, Benga will not directly touch the main
25 stem aquatic habitat of Gold Creek with the proposed
26 mine. In fact, we will maintain a hundred-metre

1 setback from the creek. As we have discussed in other
2 documents, there will be about a 10 percent decrease in
3 surface flows which results in a modest reduction in
4 aquatic habitat. We have also discussed that the mine
5 footprint will interact with tributaries to Gold Creek
6 and, therefore, will affect riparian habitat.

7 Benga has proposed to restore Gold Creek habitat
8 in documented areas we have seen and to improve habitat
9 connectivity and overwintering habitat to
10 counterbalance the predicted effects of the project.

11 As part of the draft fisheries offset plan, an
12 initial estimate of the benefit from this work could
13 offset loss by a factor of approximately nine times.
14 Since then, additional fragmented segments in the Gold
15 Creek have been documented, thus there are other
16 opportunities to provide additional offsetting benefits
17 to westslope cutthroat trout in Gold Creek.

18 Benga has further proposed to offset the loss of
19 riparian habitat by focus on -- focusing on enhancing
20 previously disturbed riparian areas. Enhancing these
21 currently compromised riparian habitats will benefit
22 westslope cutthroat trout by increasing the capacity of
23 these areas to trap sediment and filter nutrients and
24 contaminants contained in the surface runoff, provide
25 shade that maintains cool water temperatures, and
26 provide improved habitat for terrestrial insects which

1 serve as food for juvenile westslope cutthroat trout.

2 Proposed areas for this work are included in the
3 draft fisheries offset plan, but other candidate areas
4 are available if the size of offsetting needs to be
5 expanded. Buffers of undisturbed riparian habitat will
6 be made -- maintained on creek main stems and
7 tributaries in accordance with the most updated
8 recovery strategies.

9 In summary, Mr. Chair, the westslope cutthroat
10 trout in Gold Creek are surviving, but they are not
11 thriving. Fish surveys were conducted in 2016 as a
12 basis for the EIA, and follow-up annual surveys have
13 been conducted since that time, producing several years
14 of fish population and habitat data.

15 We provided annual survey information to CPAWS in
16 response to an information request, and that
17 information was included in the CPAWS submission to the
18 Panel in Registry Document 555. This information has
19 recently been updated with 2020 survey results and has
20 also been filed with the Panel. They were submitted
21 yesterday and are now posted as Registry Document 843.

22 To summarize the findings for multi-year surveys,
23 observations of westslope cutthroat trout in Gold Creek
24 have decreased dramatically since 2016 and now seem to
25 have a population density that is only 10 to 20 percent
26 as compared to five years ago.

1 Benga has proposed a fisheries offsetting plan
2 that is intended to replace or counterbalance changes
3 in fish habitat caused by the project and to improve
4 habitat functionality and suitability with focus on
5 improving those limiting factors that have been
6 documented over several years of study.

7 The proposed habitat registration initiatives are
8 not novel and will help stabilize and sustain the local
9 stock of westslope cutthroat trout. Although certainly
10 not a finalized offset plan, the draft does aim to
11 align with the criteria and conditions set out in the
12 westslope cutthroat trout strategy and Fisheries Act
13 offsetting guidance, and we are confident that the
14 outcome will result in a more resilient stock.

15 Benga -- Benga fully understands that prior to
16 approval by regulators, including DFO and AER, there
17 needs to be further study and engineering design work
18 completed to develop the current offsetting approach to
19 meet Species At Risk Act and Fishery Act [sic]
20 requirements, and Benga commits to embark on that work
21 immediately following this regulatory review to allow
22 for early implementing of the offsetting proposals.

23 Turning now to selenium management. We will be
24 focusing on three main issues: capture of contact
25 water, treatment of contact water, and appropriate --
26 and -- and appropriate site-specific water quality

1 objective for selenium in Blairmore Creek.

2 Before I get into these three subjects, Mr. Chair,
3 I will reiterate that contact water, which means water
4 that potentially contains elevated selenium, will be
5 treated and returned to Blairmore Creek. Gold Creek
6 will not be affected.

7 Now, in terms of capture of contact water, I would
8 like to turn to Registry Document 42, Section A,
9 PDF page 161, if you will, Zoom Host.

10 This is a topographic map that we discussed with
11 Mr. Fitch a week ago relative to the location of the
12 ex-pit rock dumps.

13 Could I ask the Zoom host to focus on the top
14 portion of the map and specifically the area labelled
15 "The North Rock Disposal Area". That should be good.

16 As we discussed with Mr. Fitch, this is an area
17 that is isolated from any cross flow of water and is
18 characterized by steep slopes. We discussed that there
19 is an elevation difference of some 200 metres across
20 this part of the footprint.

21 Mr. Chair, it is pretty clear that water does not
22 pool in this area today. If a raindrop falls here, it
23 flows down slope and into the small rivulet which runs
24 along the base of this elevated valley and then towards
25 the outlet.

26 Benga will be utilizing this natural topography to

1 facilitate capture of the contact water that percolates
2 through the rock dump. We will remove any organic
3 materials, do additional grading to further improve
4 drainage, and construct under-drains in the lower
5 elevations. We will capture the natural drainage from
6 this waste rock in the northwest surge pond, which will
7 be in the same place where water naturally exits the --
8 the area today. As the dumps are created, the waste
9 rock will be compacted in layers to further encourage
10 water exodus from the waste rock dump.

11 Our water quality modelling is based on humidity
12 cell tests and regional experience to determine the
13 propensity for selenium leaching from expected mass of
14 waste rock. The model makes the simplifying assumption
15 that 5 percent of the contact water may seep into the
16 groundwater and immediately enter the creeks. The
17 model further assumes that there's no attenuation of
18 seepage or leaching rates with time. All of these
19 assumptions are conservative. Given that, Benga has
20 committed to maximize in-pit storage of waste rock and
21 expects the quantities of ex-pit waste rock storage can
22 be reduced from the quantities assumed for the
23 application. Also, any seepage that does occur will
24 move relatively slowly at the rate of 1 to 2 metres per
25 month, taking a number of decades to reach the creeks.

26 During the lengthy journey through the groundwater

1 system, it is possible that selenium content will be
2 attenuated naturally following a biochemical process
3 similar to that which Benga will be managing in the
4 saturated backfill zone, or "SBZ". And, finally,
5 observation of selenium levels at some reclaimed mines
6 has demonstrated a potential for decreasing and
7 leaching of selenium over time. So all of those
8 factors tell us that our assumptions for the EIA in
9 terms of modelling are -- are conservative.

10 Benga has committed to monitor groundwater down
11 gradient from the dumps to detect if there is
12 significant seepage through the ground -- groundwater.
13 Monitoring will be immediately adjacent to the ex-pit
14 dumps and also adjacent to the receiving environment at
15 Blairmore and Gold Creeks.

16 Zoom Host, you can take this map down now.

17 If there are indications that seepage of contact
18 water is greater than predicted by the models, Benga
19 will be alerted by this -- to this early through the
20 monitoring wells adjacent to the ex-pit dumps. If this
21 should occur, Benga will have a number of tools to
22 return to acceptable seepage rates, including
23 installation of seepage capture wells, down gradient
24 from ex-pit dumps -- these are described conceptually
25 in Addendum 5, Appendix A3 -- reducing the quantity of
26 water that infiltrates and percolates through the waste

1 rock to encourage runoff by implementing more
2 aggressive final slopes and revegetation of the ex-pit
3 dumps; and by promoting selenium reduction within the
4 ex-pit dumps using processes similar to those used
5 within the SBZ.

6 In summary, Mr. Chair, Benga has proposed a
7 layer -- layered approach to the capture of contact
8 water that will ensure the desired results are
9 achieved.

10 Now I'm going to turn to contact water treatment.

11 Mr. Chair, Benga has proposed to treat contact
12 water using a saturated backfill zone, or "SBZ". The
13 process used to remove selenium, anaerobic biological
14 reduction, is not new technology, and we have provided
15 numerous examples of its application in our filings.
16 We have referred several times to the application of
17 this technology by Teck and Elk Valley, which is the
18 closest comparator, including in terms of specific size
19 and operating methodology.

20 We note that Teck has recently announced on its
21 website that it will be doubling the size of its
22 existing installation, which has been in service since
23 2017, and that it will be building several more such
24 installations over the coming years. Teck indicates
25 that they prefer the SBZ over other methods for
26 treating selenium and nitrate because they are less

1 complex to operate, they have lower capital and
2 operating costs, they treat larger volumes of water,
3 use less energy, and they require smaller surface
4 footprints. Benga agrees with this assessment.

5 Mr. Chair, based on similar technology installed
6 at Teck and other industrial examples, Benga's
7 confident that it will achieve treated water
8 concentrations lower than the 15 micrograms per litre
9 that were used for the project water balance models.
10 Again, we have listed these examples in our various
11 filings on this subject.

12 We heard the concerns expressed by Ktunaxa on
13 Monday regarding the need to do site-specific field
14 scale tests to properly evaluate the SBZ design and
15 operating parameters for this project. Benga has
16 committed to doing just that and will be implementing a
17 field-scale pilot during the construction phase of the
18 project to develop the necessary engineering parameters
19 required for the final SBZ design.

20 Mr. Chair, the SBZ is not the only possible
21 solution for treatment of selenium, and Benga has
22 elaborated on the alternative or additional measures of
23 both a treatment plant and a gravel-bleed [sic] reactor
24 solution in its IR -- IR responses in Addendum 11.
25 Benga has committed to implementing one or both of
26 these additional technologies in the unlikely event

1 that the SBZ does not meet expectations.

2 To be clear, there is room on the site for all of
3 these technologies if necessary.

4 Again, Mr. Chair, we heard the views of Ktunaxa on
5 Monday that implementation of a selenium water
6 treatment plant could take longer than expected. Benga
7 considers that such an installation would be very
8 similar to the West Line Creek plant that Teck has
9 installed and which appears to be functioning well
10 today. By following the Teck lead on this technology,
11 Benga considers that installation times could be
12 considerably shorter for Grassy Mountain.

13 Mr. Chair, Benga has proposed a site-specific
14 water quality objective for selenium in Blairmore
15 Creek. In its review of this approach in its filings,
16 ECCC concluded that a sulphate-adjusted guideline for
17 selenate is based on sound science. However, ECCC is
18 concerned that if selenate is not the only selenium
19 species, environmental effects may be greater than
20 predicted.

21 Benga agrees with ECCC that the proposed
22 site-specific water quality objective is valid and
23 based on sound science -- science, provided that the vast
24 majority of the residual selenium is in the form of
25 selenate. Based on the latest information and results
26 shared by operators of other similar selenium treatment

1 systems, Benga believes this will be the case.

2 However, Benga is not merely assuming that the
3 residual selenium will be selenate. Benga has
4 committed to ensure that this will be the case. As
5 stated in response to Information Request 6.20:
6 (as read)

7 Benga will implement advanced oxidation
8 processes with powerful oxidant, like
9 hydrogen peroxide injection, or ozone
10 addition, if necessary, to further the
11 conversion of selenite to selenate.

12 A recent presentation by Teck on this issue has
13 indicated that a similar process has been successfully
14 implemented at its West Line Creek selenium treatment
15 plant. Therefore, the science behind the site-specific
16 conclusion of no significant effects of predicted
17 selenium levels of up to 9.5 micrograms per litre on
18 aquatic biota in Blairmore Creek is supported.

19 Additional checks for this range of selenium
20 concentrations being protective in Blairmore Creek have
21 been made, including development of a risk-based
22 selenium bioaccumulation model for Blairmore Creek
23 presented in Registry Document 89. We also compared
24 our findings against a range of existing site-specific
25 in-stream objectives for selenium accepted by
26 regulators for other settings in Western Canada. These

1 comparator sites, which are summarized in Benga's
2 October 5th filing, Registry Document 571, show
3 permitted selenium objectives downstream of coal or
4 metal mines in British Columbia that are in the 10 to
5 20 microgram per litre range for smaller streams
6 similar to Blairmore Creek and 3 to 5 micrograms per
7 litre in larger streams similar to Crowsnest River.

8 Site-specific objectives in rivers draining Elk
9 Valley mines are considerably higher, but these
10 objectives are generally targets for remediation of
11 previously affected streams and, therefore, not
12 directly applicable to our case.

13 In conclusion, Mr. Chairman, there are many other
14 points for discussion under the heading of "Water and
15 Aquatic Environment". We have addressed all of these
16 in our filings on the registry to date; however, we
17 felt that it would be helpful to have this discussion
18 of westslope cutthroat trout and selenium management in
19 order to set the table for the coming days.

20 Mr. Chairman, Benga's panel is now available for
21 questions.

22 THE CHAIR: Thank you, Mr. Houston.

23 So first up for questions is CPAWS. Mr. Yewchuk.
24 Mr. Yewchuk Cross-examines Benga Mining Limited

25 Q MR. YEWCHUK: Hello. Thank you for that
26 opening statement, Mr. Houston. That was a little more

1 thorough than I thought, so my questions are going to
2 be very fast, but I have some.

3 I'm counsel for the Canadian Parks and Wilderness
4 Society. I have met some of you before.

5 I will start. Does Benga accept that the
6 extirpation of the westslope cutthroat trout in Gold
7 Creek would jeopardize the recovery of the species?

8 A MR. HOUSTON: It would be a setback for
9 sure, Mr. Yewchuk.

10 Q Maybe a slightly clearer answer? Would it jeopardize
11 the recovery of the species?

12 A We have -- in Gold Creek, we have an opportunity to --
13 to develop a -- a population of westslope cutthroat
14 trout that is sustainable, and so I -- I think not
15 taking advantage of that opportunity would be a
16 setback.

17 Q Thank you.

18 Mr. Youl, where are you there? There you are.
19 Good to see you again.

20 On November 6, you mentioned that you won't be
21 storing coal for long periods of time because the coal
22 oxidizes and loses its quality. Do you remember that?

23 A MR. YOUL: I do.

24 Q Perfect.

25 Does the coal heat up as it oxidizes?

26 A Not normally. It -- in some deposits it can, but from

1 the observations we've made for our project, it hasn't
2 shown any instances of -- of heating.

3 Q No heat from the oxidation reduction -- reaction?

4 A Well, we -- we've -- we've not seen that in our
5 explorations or our test work.

6 Q Did Benga take a conservative approach for selenium
7 management, or did Benga take a more risk-accepting
8 approach?

9 A MR. HOUSTON: Mr. Yewchuk, Mr. Chair,
10 there -- there are many elements of our evaluation of
11 selenium that are -- are conservative.

12 Q Are there some of them that aren't conservative?

13 A I would say that we've taken a precautionary approach
14 to selenium management.

15 Q Have all aspects of the approach been precautionary or
16 conservative?

17 A Well, for example, the development of a site-specific
18 guideline for selenium in Blairmore Creek has been
19 based on a -- a detailed scientific investigation, so
20 that's an area where we saw that we need to go -- we
21 needed to go deeper and have a more precise evaluation
22 of the conditions and -- and so we've done that. So
23 that might be a -- an area where you would say that the
24 very conservative approach was -- was not helpful
25 and -- and that we had to dig deeper.

26 Q Was not helpful for what?

1 A Well, it didn't -- I -- I -- I guess in the specific
2 case of selenium guidelines for creeks, the typical
3 guidelines that are -- are prepared for any water body,
4 whether it be a lake or a marsh or whatever, are -- are
5 developed to be conservative in all of those
6 circumstances.

7 When we took a look at Blairmore Creek, we
8 realized two things. One, that those very conservative
9 across-the-board measures wouldn't be achievable with
10 our project, but we also recognize that there are many
11 factors -- site-specific factors in Blairmore Creek
12 that indicated that a higher level of selenium could be
13 tolerated in that environment due to a number of
14 factors, and so we invested in the science to look at
15 that because, in the end, we want to be protective, but
16 at the same time, an investment in science allows us to
17 be confident that we can be protective and also
18 function at the higher levels of selenium that we're --
19 we're proposing for this project.

20 Q Did Benga hire a particular expert because that expert
21 takes a less precautionary approach?

22 A No. I would say Benga hired experts that we felt
23 were -- were leading the field in this area.

24 Q Leading the field in taking a precautionary approach or
25 leading the field in taking a risk-tolerant approach?

26 A Leading the field in terms of having developed a

1 systematic and scientific basis for evaluating in
2 detail the -- the -- the environment and the capacity
3 of that environment to tolerate selenium levels.

4 Q When considering other projects for inclusions in the
5 cumulative effects assessment, did Benga consider
6 projects that were officially announced or only
7 announced?

8 A Could you repeat that question, Mr. Yewchuk? I think
9 the wording is important here.

10 Q Yes. When considering other projects for inclusion in
11 the cumulative effects assessment, did Benga consider
12 projects that had been officially announced or only
13 announced?

14 A And -- and are we speaking strictly of water,
15 Mr. Yewchuk, when you're talking about the cumulative
16 effects assessment?

17 Q I'm focused on water, but, I mean, you can answer in
18 other regards as well.

19 A So we -- we looked at projects that were reasonably
20 certain to appear, and -- and generally that requires
21 that the project has some definition around it in terms
22 of -- and -- and that generally appears in a formal
23 application to a regulator.

24 Q So if there was no formal application to a regulator, a
25 project was not considered?

26 A In general, that's the -- that's the trigger. And --

1 and, again, it -- it's going to come back to whether a
2 project is sufficiently defined to be included in
3 the -- in the cumulative effects assessment, Number 1;
4 and, Number 2, that there is a reasonable expectation
5 that the -- the developer, if you will, is determined
6 to move to the next step.

7 MR. YEWCHUK: Can I get Document Number 42?
8 It's Addendum 8, and I want PDF page 375, please.

9 Q MR. YEWCHUK: And the words "officially
10 announced" appear on the table when it comes up. I
11 just want to know if Benga has any distinction between
12 things that are officially announced and things that
13 are -- are just announced. If you could explain how
14 you draw that distinction.

15 A So what was the PDF page number?

16 Q PDF 375. It should be marked "Table 2-1", if I have
17 the right page. It's the first box under "Temporal
18 Boundaries".

19 A Yeah. So there -- there we talk about projects that
20 have been defined and officially announced.

21 Q Yeah. And do you draw a distinction between
22 "announced" and "officially announced"?

23 A It's easy for anybody to say, Hey, I want to build a
24 coal mine, but putting forth -- putting in the effort
25 to do the work, prepare an application, and submit that
26 to the regulator is -- is really a -- a kind of test in

1 terms of determination to see the project through.

2 Q At what date would you say Benga was -- Benga
3 officially announced Grassy Mountain?

4 A It was in 2015.

5 Q When they -- when you -- Benga submitted the EIA
6 document?

7 A We -- we submitted a -- a first version in 2015, yes.

8 Q Okay. That's when you would have considered your
9 project to be officially announced?

10 A If we were looking at another project at that step,
11 that -- that's what we would look for. And -- and
12 it -- it's not just the announcing the project, but
13 putting some boundaries around it, talking about the --
14 the area to be affected, the location, the -- the
15 technologies that are expected to be used. There --
16 there are many things that help to include a project
17 in -- in a cumulative effects assessment that just
18 aren't available if -- if all you know is that I would
19 like to build a coal mine.

20 Q Is it enough if you know a coal mine has started
21 gathering their baseline information to prepare for the
22 regulatory application?

23 A No. No.

24 Q Perfect. Then let's move on.

25 Does Benga use the terms "saturated backfill zone"
26 and "suboxic saturated fill zone" to refer to the same

1 structure?

2 A The saturated backfill zone, I think, would be the more
3 common title that you would see throughout the
4 documentation. The suboxic zone is a more technical
5 description of what we're trying to achieve within the
6 saturated backfill zone.

7 Q But it -- it would be two terms for the same thing?

8 A Yes.

9 Q Okay. Perfect.

10 What about the term "suboxic saturated treatment
11 zone", is that the same thing again?

12 A I -- again, yes. And I would take it that you would
13 see those words in a -- in a more technical description
14 of what we're trying to achieve.

15 Q Okay. What about "saturated rock zone"?

16 A Again, same thing.

17 Q Yeah. "Fluidized bed reactor"?

18 A That would be a different animal. That would be a -- a
19 plant, let's call it -- a plant that you would have in
20 a building with vessels and pipes and pumps, and it --
21 it would be more like the West Line Creek installation
22 that Teck has implemented for treatment of selenium.

23 Q What about "gravel bed reactor"?

24 A Again another technology. Gravel bed reactor is again
25 an engineered structure. Typically you have
26 geomembranes to isolate the water within a rock --

1 isolate water, and you would have graded rock fill that
2 you would put into that as a medium, and then you would
3 create the suboxic zone inside that engineered
4 structure to remove selenium.

5 Q So the gravel bed reactor is not the saturated backfill
6 zone?

7 A A gravel bed reactor is -- uses the same biochemical
8 process, but it would be an engineered structure closer
9 to the surface and separated from the environment by
10 geomembranes, for example.

11 Q So it's the same approach to some new removal but
12 includes geomembranes?

13 A Yes. And -- and it's -- yeah, it's -- it's -- it's an
14 engineered structure that, you know, has very -- has
15 standards for size of rock substrate, for example,
16 within the -- within the process, and -- and I think
17 what it does is, with a very much smaller volume, it
18 allows you to treat a similar amount of water as the
19 saturated backfill zone, for example.

20 Q Does the saturated backfill zone have a particular size
21 of rock substrate used?

22 A No. No. It's -- it is literally the mine pit that has
23 been backfilled with -- with the waste rock.

24 Q So just still checking that I know what this thing is.
25 Is the basic idea of a saturated backfill zone to
26 produce a zone of low acidity and neutral oxidation

1 potential with microbial life that causes the selenium
2 to precipitate out as selenate and remain in the SBZ?

3 A I'm -- I'm going to ask my -- my colleague,
4 Mr. Jensen -- you are using a lot of long words that I
5 think we need Mr. Jensen to comment on.

6 A MR. JENSEN: Yeah. I'm happy to comment.
7 Can you hear me okay?

8 Q Yeah.

9 A Okay, I'm happy to comment on that. I will ask you if
10 you could please repeat the question.

11 Q All right. And you can correct my -- my understanding
12 here if I'm off, but is the idea of a saturated
13 backfill zone to produce a zone of low acidity and
14 neutral oxidation potential with microbial life that
15 causes the selenium to precipitate out as selenate and
16 remain in the SBZ?

17 A No. So there -- there's a number of -- it's a bit of a
18 long definition, but generally that's -- that's not
19 accurate. The -- aside from -- from the end --
20 selenate is not the end product of the process that
21 occurs within the saturated backfill zone. Selenate is
22 reduced to (INDISCERNIBLE) become selenite that can
23 absorb on to minerals or --

24 THE COURT REPORTER: I'm sorry. Can I get you to
25 speak up?

26 A MR. JENSEN: Oh, I apologize.

1 THE COURT REPORTER: Just repeat that -- repeat the
2 last part, please.

3 A MR. JENSEN: Yeah. So the process that
4 occurs within a saturated zone is that typically
5 selenate, which is a -- is a dissolved selenium
6 species, becomes reduced to either selenite, which can
7 absorb onto the minerals within the -- the saturated
8 zone, or to elemental selenium, which is a solid, that
9 likewise become trapped within the rock matrix of the
10 saturated rock fill.

11 The -- whether it's -- I mean, it -- it does occur
12 under neutral conditions. There's no explicit
13 considerations around neutrality. In -- in typical
14 systems like this, there's plenty of -- of buffering
15 capacity that -- that really the acidic or non-acidic
16 considerations are in some ways not terribly important.

17 It is important that it's -- it's circumneutral,
18 water within the facility, but it's not a specific
19 design primary, typically. I hope that answered your
20 question.

21 Q Yes. That was wonderful.

22 Is the SBZ a contingency plan, or is it Benga's
23 initial plan?

24 A MR. HOUSTON: So, Mr. Yewchuk, the SBZ is
25 our -- our plan. That's what we've proposed in our
26 application.

1 Q Does Benga have a Plan B if the SBZ does not work out?

2 A We've -- Mr. Chair, we've explicitly stated a number of
3 times -- I -- I believe I stated in my statement this
4 morning that Benga has committed, if the SBZ doesn't
5 work out, to implement another technology; and we've
6 put a significant amount of detail in our response to
7 IR questions around what -- what a fluidized bed
8 reactor plant, for example, might look like and also
9 what a -- a -- a gravel bed reactor treatment process
10 might look like. And I think I also mentioned that all
11 three of those technologies can fit on the project
12 footprint.

13 Q Has Benga selected between the gravel bed reactor or
14 the fluidized bed reactor at this point?

15 A Mr. Chairman, no, we have not. That's -- we've looked
16 at both technologies in some detail. In fact, I
17 believe in one IR we submitted a preliminary design for
18 a gravel bed reactor that -- that would be suitable for
19 this project, but we -- we haven't selected between the
20 two processes, and -- and I think it's premature to do
21 so. We would be talking about an additive process or a
22 parallel process to the proposed saturated backfill
23 zone, and implementation of one or the other
24 contingency plan would -- would kind of be informed by
25 what we were seeing through the treatment results that
26 we were getting from the saturated backfill zone.

1 Q That -- there was a no, actually; right? You haven't
2 selected between the two of them?

3 A That's correct.

4 Q Yeah. That's fine. Perfect.

5 Okay. So I'm going to use "SBZ" or try to go
6 forward because it's got a lot of names, but now we've
7 established what it is.

8 A Okay.

9 Q Is the SBZ, in Benga's view, experimental technology?

10 A Mr. Chair, what we've stated is that the -- the
11 process -- the underlying process is well-known and
12 well-documented. I think the specific application
13 in -- in terms of flow rates and establishment of
14 operating parameters is relatively new, but it's been
15 in operation at Teck since 2017. So, in one sense, the
16 technology is fairly old and well-understood, but the
17 specific application is -- is relatively new.

18 Q When would you say the general technology, as you
19 described it, was -- was discovered or first used?

20 A Again, I'm going to ask Mr. Jensen to -- to take that
21 question.

22 A MR. JENSEN: Okay. Thank you.

23 So I'm touching -- the -- the first instance that
24 I'm aware of where this process was used for treatment
25 of selenium dates back to the -- the early 2000s. The
26 application I'm most familiar with of -- of an earlier

1 implementation is the work that was done in North
2 Carolina by Duke Energy.

3 THE COURT REPORTER: I'm sorry. You are going to
4 have to speak up.

5 A MR. JENSEN: Okay. Yeah. I'm not sure
6 what -- maybe I'll -- using my microphone's quite good.
7 Give me a second. I'll just see if I can -- hello?

8 MS. ARRUDA: Mr. Jensen, it's Elaine Arruda
9 here.

10 A MR. JENSEN: Okay.

11 MS. ARRUDA: If you just click the "up"
12 arrow beside your mute and unmute.

13 A MR. JENSEN: With your permission, maybe
14 I'll just switch headsets real quick here.

15 MS. ARRUDA: Sure.

16 A Are you able to hear me better now?

17 THE COURT REPORTER: Yes. Thank you.

18 A MR. JENSEN: Okay. Let me just get -- so
19 now I can't hear you. I -- I do apologize for this. I
20 just can't hear the --

21 Q I will shift ahead to another topic for a moment if
22 Mr. Jensen's headset is in trouble.

23 Did Benga find all historical mine tunnels on the
24 Grassy Mountain site?

25 A MR. HOUSTON: Mr. -- Mr. Youl, maybe --
26 maybe you could talk to that.

1 A MR. JENSEN: I don't ...

2 A MR. YOUL: Whether we found all remains
3 to be seen. What we do have are historical maps dating
4 back from the 1950s through the 1960s which show the
5 extraction from the two -- the seams that were mined in
6 those times. We have drilled holes through the area.
7 A few of those holes intersected voids.

8 But a -- I guess a technique that I was very
9 interested in a few years ago was ground-penetrating
10 radar, and we've used that over part of the initial pit
11 area with considerable success, which has shown the
12 areas that have actually been partially mined. And
13 typically the miners in those days would extract the
14 lower part of the seam with a coal roof because the
15 thickness of the seams was such -- and given the ditch,
16 that -- I think they didn't have the technology or the
17 equipment to extract the full seam. So they mined out
18 a portion of the seam, get to the end of the tunnel or
19 a crosscut, and then retreat and try and remove the
20 remaining sort of coal before the conditions sort of
21 became unsafe.

22 So we've used that ground-penetrating radar,
23 "GPR", as we call it, to identify areas of primary
24 extraction and also areas where we've seen secondary
25 recovery where sections of the seam have collapsed. So
26 we'll look at increasing the density of that technique

1 as we move into the detailed short-term planning. But
2 it's showing a lot of promise.

3 And the final check, if you like, before we start
4 excavating into the old areas is blast-hole drilling
5 that will -- very short space -- closely spaced drill
6 holes, typically 9 metres square approximately, which
7 will give us the last piece of information we need to
8 ensure that we can conduct those operations safely.

9 Q That was a longer answer than I expected, but that's --
10 that's fine.

11 Are there -- does Benga expect there are
12 historical mine tunnels on-site that they haven't found
13 yet?

14 A We don't expect so. The maps that we have are very
15 detailed and, based on what I've just said, appear to
16 accurately represent, you know, what was recovered.
17 But using the -- the techniques I've described in
18 greater density will help fill in any gaps that remain.

19 A MR. HOUSTON: Mr. Yewchuk, I believe
20 Mr. Jensen's headset is working now, if -- so I'll
21 leave it to you to go back there when you want to.

22 Q Perfect. I'm wrapped on that topic, so we go back to
23 you, Mr. Jensen.

24 Do you remember the question?

25 A MR. JENSEN: Yes, I do.

26 And just a sound check. We're good?

1 THE COURT REPORTER: Yes.

2 A Perfect. Thank you. I apologize for that.

3 Yes. As I was describing, the -- the technology
4 or the process specifically -- I mean, it -- in many
5 ways, it -- it's not new. It's a natural process
6 that's been occurring in -- in nature for -- probably
7 since microbes were around, but in the -- in the
8 engineering sense, the anaerobic bioreactor for
9 removing selenium specifically -- the development of
10 that process began in -- in the early 2000s. And as I
11 was stating, the -- the application I'm most familiar
12 with, the early application, is Duke Energy in North
13 Carolina at their Roxboro plant implemented a -- a
14 GE -- a system engineered by GE called "ABMet". That
15 was one of the -- and that was in 2007, I believe.
16 They implemented that after a number of piloting was
17 done. I've been to visit that plant, and it's been
18 operating since. And -- and since then I know Duke
19 Energy has installed a number of these plants, and
20 they're becoming more and more common worldwide.

21 Now, GE is not the only supplier of these plants.
22 Envirogen is another company that -- that supplies
23 these. And, in fact, now Veolia and most major
24 treatment companies will now offer some version of this
25 precise same process. So it's -- it's becoming more
26 and more well-established, and -- yeah. And I guess

1 that's my summary of -- of my understanding of -- of
2 the history of -- of the process.

3 Q When would you say they were first shown to be
4 effective for selenium attenuation?

5 A Well, I would say -- like I said, I can't give you an
6 exact date, but early -- sort of early -- in the early
7 2000s, I believe, the -- they became -- like, they were
8 implemented commercially.

9 Q So did you say the -- the one built by Duke Energy
10 started 2007?

11 A Yeah, that's correct. Well, that -- that's -- that's
12 just the one I'm most familiar with in the -- in terms
13 of a detailed implementation of it. I've been there.
14 I've visited it. I understand, you know, the process,
15 the -- I've -- I've studied that plant in some detail,
16 so I'm referring to that because that's the one I'm
17 most familiar with.

18 Q Okay. But there were active ones in the early 2000s
19 that were working properly?

20 A I believe so.

21 Q The Duke Energy one that you were describing, did that
22 one work properly?

23 A Yes.

24 Q Is Teck a more experienced metallurgical coal mining
25 company than Benga?

26 A MR. HOUSTON: So, Mr. Chair, I -- I would

1 say that Teck, particularly in Canada, has a long track
2 record in -- in coal mining; and -- and, as we've
3 discussed, Benga's fairly new on the scene.

4 Q Has Teck taken what Benga considers to be an adaptive
5 management approach to their selenium problem in the
6 Elk Valley?

7 A Mr. Chair, I -- I think that Teck is dealing with a --
8 a selenium issue that originates decades ago at a time
9 when there maybe wasn't a focus on selenium, and -- and
10 they've, as a consequence, been pushed into an area
11 where they have invested a lot of money in research and
12 development of -- of technologies and methodologies for
13 dealing with selenium. But -- but I would say the --
14 the issue that they're dealing with -- the difficulties
15 they're dealing with are related to projects that were
16 started three and four decades ago.

17 Q Okay. I didn't see that one actually connect to my
18 question very much, but has -- have they taken an
19 adaptive management approach, in your view?

20 A I -- I think they are adapting to a situation, and --
21 and they're doing a lot of good work to look for
22 solutions to an issue, yes.

23 Q Is there a difference between adaptive management and
24 just adapting?

25 A You know, I -- I think when we're talking about best
26 practices, Mr. Chair, in an ideal world -- and this is

1 the case with -- with the Grassy Mountain Mine. You're
2 aware of what the issues might be in advance. You
3 develop a primary conceptual design that is based on
4 conservative assumptions and implementation of -- of
5 known technologies. But you also do a risk assessment
6 to -- to try to understand where there could be issues,
7 and you develop contingency plans.

8 So I think that's the -- the best description of
9 adaptive management, is to understand the issues, do a
10 proper design, and then also do a risk assessment and
11 develop contingency plans in the -- if -- if things
12 don't work out the way you have planned.

13 Q Is Teck in the Elk Valley using an SBZ or a fluidized
14 bed reactor?

15 A They're using both. They have a fluidized bed reactor,
16 the plant installed at West Line Creek, and that is in
17 operation and appears to be functioning well.

18 They also have what they call -- and this is going
19 to drive you crazy, Mr. Yewchuk, but they call it a
20 "saturated rock fill", and that's what we've called a
21 "saturated backfill zone", which they've been operating
22 since 2017. So they have both technologies installed.

23 And what's more, they have extensive long-term
24 selenium management plans that look at deploying both
25 of those technologies at additional sites going
26 forward.

1 Q Do you know why Teck is using both?

2 A They are planning to use both. As I mentioned in my
3 opening remarks, I think their tendency is to prefer
4 the saturated backfill zones for many of the reasons
5 that I mentioned in my opening remarks.

6 Q So Teck's saturated rock fill is directly comparable to
7 Benga's proposed SBZ?

8 A Yes.

9 Q And their fluidized bed reactor would be comparable to
10 your potential fluidized bed reactor if you went that
11 route because you had problems with the SBZ?

12 A That's correct.

13 Q Perfect. I wish these things didn't have so many
14 names.

15 So the saturated rock fill -- Teck's saturated
16 rock fill, how long has that thing been operating?

17 A Since 2017.

18 Q And one of Teck's systems caused a fish kill; right, in
19 about 2018 or so?

20 A What -- I'm -- I'm not sure what you're referring to
21 there.

22 MR. YEWCHUK: So can I get Addendum 10,
23 Package 5, PDF 498, I believe. And I think this will
24 clarify where I'm going.

25 A Addendum 10.

26 MR. YEWCHUK: 498, I believe.

1 A 498. This is the biblio -- the reference section?

2 Q MR. YEWCHUK: I've given you the wrong page.
3 I will come back to that later.

4 So who here was working with Teck on their
5 saturated rock fill -- has been working with Teck on
6 the saturated rock fill? You're sure some experts;
7 right?

8 A That's correct. Mr. Steve Day has been working with
9 Teck extensively, as well as Mr. Jensen.

10 Q And Teck now expects their saturated rock fill system
11 to consistently allow them to meet all water quality
12 targets?

13 A So what I understand, Mr. Chair, is that Teck is
14 satisfied with the results of the water treatment
15 through the saturated rock fill zone, and -- and
16 that -- for that reason, they're proposing to build
17 more of the -- more of the same and larger sizes.

18 I -- I think in terms of meeting in-stream
19 selenium levels, that -- that's a broader issue. So --
20 so this particular technology is treating water and
21 delivering the results they're expecting, but whether
22 that in and of itself will be sufficient to meet water
23 quality guidelines, I don't -- I don't think we can say
24 here.

25 Q Do you know what level of selenium attenuation Teck's
26 system is achieving?

1 A I think maybe I'll ask Mr. Day to -- to comment on
2 this.

3 A MR. DAY: Yeah. I'd be happy to do
4 that.

5 Mr. Yewchuk -- Mr. Yewchuk, you can -- I think the
6 best way to do that is to look at the presentation
7 that -- that Teck gave about this time last year at a
8 conference. And I believe it's in -- I'm going to need
9 some help on the -- the reference.

10 Can somebody else remind me of what that is? I
11 think it's 5 -- 571, maybe.

12 But there's a presentation there that Teck gave
13 summarizing the performance of the saturated rock fill
14 that they're operating, and that -- that showed that
15 concentrate -- they can achieve selenium concentrations
16 around about 15 parts per million, and lower at times.

17 Q Did they have it as a -- a percentage attenuation;
18 right?

19 A You know, I couldn't -- I couldn't tell you that,
20 actually. I'd have to -- somebody would have to --
21 somebody else would have to get you -- get that for
22 you. But you could probably -- actually, if you look
23 at that figure -- and I don't know -- maybe it's
24 worth -- Zoom Coordinator, if you could maybe pull up
25 the -- I had a note of this.

26 UNIDENTIFIED SPEAKER: I think that's --

1 A MR. BARTLETT: Steve, it's -- Zoom Host,
2 it's -- I believe he's looking for CIAR 503.

3 A MR. DAY: Yeah. 503, PDF page 42.

4 Yeah. So here you can see a chart from the -- the
5 presentation that some people at Teck gave. And,
6 Mr. Yewchuk, I don't -- I can't tell you what the
7 attenuation is there, but you can see -- you can see
8 that they have influent concentrations of between a --
9 I mean up to -- you see up to 200 parts per million.
10 Variable -- and -- and then the effluent concentration
11 you can see down there in the -- the green line at
12 the -- the bottom. So that gives you a sense of
13 the degree of the attenuation.

14 Q But you -- you can't -- you can't sort out the average
15 attenuation rate from this?

16 A I -- well, I could. I mean, I -- I just -- I don't
17 have the number for you at this point.

18 Q You -- you haven't previously calculated or are not
19 aware of what the attenuation rate for this system is?

20 A I'm not involved in that -- that aspect of the
21 performance monitoring of the -- of the SRF that Teck
22 operate.

23 Q Does anyone else on the panel happen to know that?
24 Doesn't seem.

25 So this document you brought up and we are looking
26 at now, is this a peer-reviewed paper?

1 A This is a presentation at conference proceedings. It
2 is a -- if -- there's a great deal of peer review that
3 goes on to support the -- the operation of the
4 facility.

5 A MR. HOUSTON: So, Mr. Chair, Mr. Yewchuk, I
6 just wanted to jump in a little bit here. You're
7 mentioning attenuation rate, Mr. Yewchuk. But do I
8 understand you're looking for a percentage removal or
9 something like that?

10 Q Yes. That was the -- the kind of figure I was seeing
11 in some of the documents that I was hoping to work
12 with.

13 A Okay. So I'll ask for one of my colleagues to talk to
14 this. But I think what's more appropriate to look at
15 is a -- an effluent concentration of selenium. Because
16 of the process, the natural process tends to reduce the
17 selenium down to a concentration. So talking about a
18 percentage removal, that would be something that's more
19 suitable if we were, you know, installing a filter or
20 something like that.

21 What's more appropriate would be to talk about the
22 concentration achieved in the effluent. And I think
23 Mr. Jensen can maybe add to that.

24 A MR. JENSEN: Yeah. That's correct,
25 Mr. Yewchuk and Mr. Chair. It's -- when we look at
26 these systems, it's -- it's -- we have to look at

1 the -- the process to (INDISCERNIBLE) behind what's
2 going on with -- with the selenate, the reduction.
3 It's not -- it comes down to -- once the conditions are
4 present such that you can achieve reduction of these
5 species and you can have them either absorb a selenite,
6 or a metal selenium, or some other selenium -- reactive
7 selenium species that will absorb into the matrix.

8 Those conditions persist same way if you have a
9 200 -- 200-degree hard -- a 200-degree Celsius part.
10 You simply wouldn't have any -- over time you wouldn't
11 have any liquid water left in there 'cause the
12 conditions are such that now it will all evaporate.

13 When it comes to the very low limit of -- of
14 concentrations -- when we're talking 15 parts per
15 billion or less, there's some other mechanisms that
16 come into play, and it's -- you know, I think I will go
17 into a -- into too much of a rabbit hole if I go into
18 it here.

19 But simply thinking of it as a simple percent
20 removal is -- is not a sufficient description of a
21 system like this.

22 Q So based on the table we are looking at now, what
23 amount of selenium in micrograms per litre comes out of
24 Teck's system?

25 A MR. HOUSTON: Mr. Chair, it's in the order
26 of 10.

1 Q Do you know if Teck -- sorry, I'll take a word that we
2 agreed on. Their saturated rock fill system has
3 biofouling problems since it started operating?

4 THE COURT REPORTER: Sorry, could you repeat that
5 word, please?

6 Q MR. YEWCHUK: Has Teck's saturated rock fill
7 system had biofouling problems since it started
8 operating?

9 A MR. JENSEN: I would say, Mr. Yewchuk, not
10 to my knowledge.

11 Q So you just don't know?

12 A That's correct. I mean, not to my knowledge.

13 MR. YEWCHUK: Trying to get a document up
14 here. Can I get Number 313? This is Addendum 11 at
15 PDF page 220.

16 Q MR. YEWCHUK: While we're waiting for that,
17 does Benga have a --

18 A Excuse me. I'm sorry, Mr. Yewchuk, to interrupt. I'm
19 being informed by my colleague they indeed have had
20 some -- some biofouling incidents. I'm not aware of
21 those, though, so ...

22 My statement stands "not to my knowledge", but it
23 doesn't mean it didn't happen.

24 Q So which of your colleagues knew about that?

25 A MR. DAY: It's me, Mr. Yewchuk,
26 Stephen Day. They -- I wouldn't say it's been a

1 problem. They have had to manage biofouling.

2 Q Okay. So did Benga have a plan to deal with
3 biofouling?

4 A MR. HOUSTON: Yeah. No, Mr. Chair, we've
5 proposed to do a pilot test, you know, once we get an
6 approval and get on to the site, so that we can clear
7 an area and commence a pilot test. And the intent of
8 that pilot test would be to evaluate things such as
9 rates and carbon demand and the propensity for -- for
10 things like biofouling.

11 Again, some of these issues have been encountered
12 by other companies working with this technology, and --
13 and issues have been managed.

14 Q So what does the system need to deal with potential
15 biofouling? Mr. Day, do you have any idea since you're
16 aware of this?

17 A I think Mr. Jensen has -- has some ideas to share with
18 us, Mr. Yewchuk.

19 A MR. JENSEN: Yeah. So biofouling, it's a
20 well-known phenomenon when it comes to these types of
21 systems, and it -- biofouling really -- what it refers
22 to is the build-up of biomass. So as these material
23 microorganisms, as they multiply, they form what we
24 refer to as a "biomass", which is nothing more than a
25 collection of -- of cells that it's -- the system is --
26 requires that these cells thrive and grow; and as they

1 do, they tend to fill out void spaces. So it's being
2 dealt with in -- in different ways for different
3 systems.

4 In the -- in the active water treatment systems
5 and fluidized bed you have constant purging of these --
6 of this biofouling. In gravel bed reactors that
7 Mr. Houston described earlier, you -- you employ
8 different strategies for -- for managing biofouling.
9 One is to inject your feed water at different locations
10 and cycle through different locations so you allow
11 biomass to flourish, and then die back.

12 You can -- you can pace your -- the addition of
13 your carbon source at different rates. So instead of
14 having a constant drip of methanol, say, into a
15 specific intake, you send in a slug of methanol. And
16 what that does in the immediate vicinity of your
17 injection point it might kill off, for lack of a better
18 word, because of high concentration some of the
19 biomass, so you prevent -- and then once you have
20 attained more dilution downstream, you now have the
21 appropriate conditions for the microbe to thrive.

22 So there's many -- it's a well-known problem.
23 It's an engineering -- it's an engineering problem from
24 a process engineering point of view, and it's --
25 there's many different approaches to managing it. So
26 it's -- it's -- I would say it's well-understood.

1 Q Does Benga know what approach they will take to deal
2 with biofouling?

3 A MR. HOUSTON: Not at this point, Mr. Chair.

4 Q Does Benga have an estimate of how much work -- how
5 much it will cost to deal with biofouling in the SBZ
6 per year?

7 A Mr. Chair, I think you've just heard Mr. Jensen talk
8 about some of the various processes or methods to deal
9 with biofouling. None of those are really things that
10 would generate a cost that is not within, you know, a
11 margin of error.

12 Q Mr. Jensen, is that correct, this work is within a
13 margin of error, cheap?

14 A MR. JENSEN: Yeah. That's absolutely
15 correct. It's an integral part of the design, so it's
16 not -- it's already anticipated, and it will be built
17 into a design from Day 1. It's -- it's not an
18 addition.

19 Q And how long does the biofouling treatment need to go
20 on for the saturated backfill zone?

21 A MR. HOUSTON: Mr. Chair, this is something
22 that will be an ongoing part of the process. Again,
23 we'll develop parameters in the full-scale field test
24 to inform the engineering design of the SBZ, and that
25 design will incorporate procedures and design aspects
26 that are intended to deal with biofouling. But it's --

1 it's an aspect of the process that will be dealt with
2 on an ongoing basis.

3 Q I think I may have asked this one, but just checking:
4 Will the rock for the SBZ be crushed to uniform size
5 before being placed into the SBZ?

6 A No, Mr. Chair, it will be the regular backfill that we
7 use to backfill the mine pit.

8 Q Is there any risk the saturated backfill zone will
9 convert the selenium into more dangerous selenium
10 species?

11 A So my understanding, Mr. Chair, is that other operators
12 haven't seen that. I think it's important to
13 understand the difference between the fluidized bed
14 reactor, for example, and the saturated rock --
15 saturated backfill zone.

16 The fluidized bed reactor is designed to treat as
17 much water as possible in the smallest space in time as
18 possible, and that, by its very nature, can -- can lead
19 to not -- not a full reduction of the selenium to the
20 -- the base state.

21 When we're talking about a saturated backfill
22 zone, we're talking about a very slow process that
23 operates over months instead of hours, and for that
24 reason there is time for the selenium species to
25 fully -- reduce to species or elemental selenium that
26 will be deposited and filtered through the rock

1 substrate.

2 Q What does Benga expect to inject into the saturated
3 backfill zone to keep it functioning?

4 A In terms of a carbon donor; is that what you are
5 talking about, Mr. Yewchuk?

6 Q What does it need?

7 A A carbon donor. So typically you would use something
8 like methanol, or molasses, or another simple
9 hydrocarbon as to -- as a carbon donor. And that
10 drives the low oxygen levels that we're looking for,
11 Mr. Yewchuk.

12 Q Thank you.

13 Does it need anything else in order to operate?

14 A So possibly. Possibly. Especially to -- to get the
15 initial biological mass to -- to generate. We may --
16 may consider injecting other things like perhaps
17 nitrates to -- to encourage that -- that mass to
18 develop quickly.

19 Q Does the saturated backfill zone need any acid?

20 A MR. JENSEN: No. No acid is required,
21 Mr. Yewchuk.

22 Q Does the saturated backfill zone produce waste
23 residuals?

24 A MR. HOUSTON: Can you tell us what you mean
25 by "waste residuals"?

26 Q Does it produce a sludge?

1 A Mr. Chair, the saturated backfill zone is ultimately
2 when -- at full build-out is a huge space, and -- and
3 the space between the rocks, if you will, is -- has an
4 enormous capacity to absorb and filter any -- anything
5 like sludge that -- that may be generated by the
6 biological activity, so we wouldn't be removing any
7 sludge.

8 MR. YEWCHUK: Could I get what I believe is
9 Number 251, this is Addendum 10. I want Package 5, at
10 the bottom of PDF page 50. And can I just scroll to
11 the bottom of this page, please.

12 Q MR. YEWCHUK: So based on those last two
13 paragraphs, I was expecting you to say you needed
14 glycolic acid and phosphate. Has that changed?

15 A So this -- -- this. Maybe I'll ask my colleague
16 Mr. Day to speak to this.

17 A MR. DAY: Sorry, could you repeat the
18 question, please?

19 Q So I had asked you what you need to inject in the
20 saturated backfill zone to keep this thing working.
21 Are you going to need to add glycolic acid and
22 phosphate?

23 A I am not aware of the need for glycolic acid, and I --
24 and I -- okay, let's -- let's just think about the
25 process you need to get for -- so a full-scale
26 operation of this facility.

1 There's going to be a bunch of lab testing.
2 There's going to be pilot-scale testing and not -- and
3 a whole bunch of -- kind of studies that go on to
4 support getting this thing going. And so it's -- and
5 it's possible you may need to add some things to help
6 the bacteria to do their -- to do their work, but I
7 don't think that's been determined yet for this -- this
8 facility.

9 Does that help?

10 Q Kind of.

11 So in that last paragraph it mentions Teck
12 indicated that phosphate was a required additive at the
13 Line Creek operation. You see that; right?

14 A Yes, I do. Yeah.

15 Q Is the Line Creek operation the saturated rock fill or
16 is that the fluidized bed reactor?

17 A That's the fluidized bed reactor.

18 Q So -- and the sentence before that refers to the
19 saturated backfill zone?

20 A MR. HOUSTON: So maybe I can help here,
21 Mr. Yewchuk. We refer to the chemicals injected at the
22 Line Creek operation as a possible requirement to
23 inject into the saturated backfill zone. But as
24 Mr. Day mentioned, we have to go through a lot of
25 testing in the -- to inform the design.

26 And this is just an example of what has been

1 required at the fluid -- in the fluidized bed reactor
2 process, which -- which, as I mentioned, is -- is the
3 same biochemical process but operating on a different
4 scale in terms of size and speed.

5 Q So the -- Teck's initial plan is to saturate the
6 backfill zone, and then their two secondary plans would
7 be the gravel bed reactor and then the fluidized bed
8 reactor?

9 A Mr. Yewchuk, you mentioned "Teck". I think you meant
10 Benga. And, yes, that's correct.

11 Q Yes. Thank you.

12 Those all use basically the same process?

13 A That's correct.

14 Q Okay. What if that process doesn't turn out to work,
15 do you have another plan?

16 A Mr. Yewchuk, as Mr. Jensen mentioned, the process is
17 well-understood. The chemistry and biology is
18 well-understood, and there are dozens, if not -- well,
19 there are dozens of plants and applications of the
20 process in operation at other mines.

21 So, you know, I don't think it helps us to have a
22 hypothetical question: What if -- what if it doesn't
23 work?

24 Q Okay. So the first one of these that was working was
25 in 2007?

26 A That's -- that's the one that Mr. Jensen was familiar

1 with.

2 Q It's slightly later than that; early 2000s?

3 A Yes.

4 Q Right. And Teck didn't build one until 2017?

5 A A fluidized bed reactor?

6 Q The saturated backfill zones?

7 A Okay. So, again, we're -- we're mix -- we're mixing up
8 applications of the technology and the technology
9 itself but ...

10 So I believe Teck first started working on a --
11 their fluidized bed reactor in 2015, perhaps, with the
12 design. But the saturated backfill zone, again -- I
13 know they started working on this, and Mr. Day could
14 probably help with the exact time, but they -- they
15 worked on a number of preliminary pilot tests,
16 laboratory tests. So they would have been working on
17 that -- the development of the concept two or three
18 years in advance of 2017, before they first got their
19 saturated rock fill up and running.

20 Q So how was the Duke Energy plan that Mr. Jensen is
21 familiar with different from what Teck built in 2017?

22 A MR. JENSEN: Just a couple of --
23 Mr. Yewchuk, a couple of, I would say, minor
24 differences. The process is essentially the same.
25 Duke, as I -- as I said, they -- they use an ABMet
26 process, which is a packed bed. It's a -- it's a bed

1 of -- it's a packed bed made of granular-activated
2 carbon that is very high surface area.

3 The fluidized bed reactor is fundamentally
4 different in that it fluidizes. It's a different mass
5 transfer-type reactor. So -- but, you know,
6 ultimately, the process is -- is much the same.

7 And if I may add, I mean, the -- this is more
8 related to your previous question, which is: When was
9 this first realized as an engineered solution? It
10 really went hand in hand with the recognition of
11 selenium as a problem. That had -- that wasn't
12 terribly well-understood until -- I don't want to put
13 an exact date on it, but it was -- it was an awareness
14 that grew, I'd say, from the '90s into the 2000s; and
15 once it was understood what the potential was, that's
16 when technologies were developed to address it.

17 I will say that it's the exact same process that's
18 been used for decades to -- to address nitrate
19 contamination. You know, that -- and that -- at least
20 that dates back to the '70s and '80s when you would
21 inject in situ carbon sources into the subsurface to
22 achieve the exact same thing. At the time it was -- it
23 was to remove nitrate. But functionally, there's no
24 difference in -- in the -- in what sort of process was
25 used.

26 So, in part, it comes down to understanding what

1 the problem is before you go and develop a solution.

2 Q So the risks of selenium weren't known until the early
3 '90s?

4 A MR. DAVIES: May -- Mr. Yewchuk, it's
5 Martin Davies here. I can take this question.

6 My understanding of it is that the -- the
7 awareness of selenium as -- as an issue in the
8 environment, you know, it built through probably the
9 1970s, but its awareness -- a broader awareness of it
10 in the mining industry as a -- as a potential concern,
11 to my awareness anyway in Canada, really started in the
12 1990s.

13 Q So the selenium problem was discovered in the '70s and
14 the mining industry didn't worry about it until the
15 1990s?

16 A MR. HOUSTON: So, Mr. Chair, I don't think
17 we should put the mining industry into the -- into the
18 corner here.

19 I think, you know, as -- as society, regulators,
20 environmentalists, mining companies, and other
21 industries as well, were all -- were all learning about
22 the stuff at about the same time.

23 Q It sounded like I was just told that environmentalists
24 knew in the 1970s and then the mining industry didn't
25 do anything until the 1990s. I mean, that could -- not
26 like the same time, Mr. Houston. That sounds like

1 20 years.

2 A So I -- I'm trying not to put people in categories or
3 groups in categories, Mr. Chair. I think that
4 recognizing the problem, understanding the problem,
5 developing solutions for -- for the problem, those
6 things all happen along a time frame, and we're all
7 playing our parts in that development.

8 Q Does anyone know when a guy named Dennis Lemley
9 discovered selenium was a problem?

10 A MR. DAVIES: Yeah. Mr. Yewchuk, this is --
11 his were some of the most -- some of the original
12 papers looking at this, and this is in the 1970s.

13 Q Okay. So back to the SBZ. When can the SBZ be removed
14 from the project footprint, or when does Benga plan to
15 have it removed?

16 A MR. HOUSTON: Mr. Chair, the SBZ is
17 fundamentally the pit shell that has been backfilled
18 with rock. The surface will be reclaimed, as we
19 discussed last week. And the -- the pit will always be
20 full of water because the natural groundwater table
21 will -- will rise after -- after mining is -- and
22 dewatering are -- are stopped. So the pit will always
23 be full of water. It will always be full of rock that
24 has been broken, and it's now submerged with water.

25 When -- when will the SBZ cease to be actively
26 managed? That will depend on when monitoring

1 demonstrates that the -- effluent from the SBZ because
2 the -- the water will forever decant through the mine
3 pit. It will -- it will come into the mine pit due to
4 precipitation, and it will decant from the lower levels
5 of the mine pit out into the environment.

6 So when monitoring shows that process, that flow
7 through the mine pit is delivering water that is --
8 meets -- meets downstream requirements, then we can
9 stop actively managing and monitoring the SBZ.

10 Q This was probably stated before, but do you have a
11 guess as to when that would be? When that
12 modelling ... (INDISCERNIBLE).

13 A Mr. Chair, that's one of the issues that we don't have
14 a good handle on. And, again, it's due to perhaps not
15 having enough years of case studies that -- that will
16 tell us how this is going to turn out or how long it's
17 going to take for -- for us to achieve that. And so
18 it's something that we can't be definite on.

19 Q So the longest anybody's ever run one of these things
20 is three years?

21 A In terms of the SBZ, yes.

22 Q Where does the selenium end up when it's removed from
23 the water in the SBZ?

24 A Mr. Chair, the selenium will revert primarily to
25 selenite, which has an affinity -- and will get caught
26 up in the rock matrix. Or elemental selenium, which

1 again will deposit in the rock matrix.

2 And as I mentioned before, one of the benefits of
3 this approach is that the backfilled rock in the -- in
4 the SBZ or in the mined-out pit acts as a huge filter
5 for these less soluble forms of selenium.

6 Q So where is the selenium as --

7 A The selenium -- the selenium -- Mr. Chair, the selenium
8 originates in the rock. It leaches out of the rock
9 primarily in the ex-pit rock dumps, and it goes back
10 into the rock. It -- it attaches to the broken rock in
11 the mined-out pit or gets caught up in the biological
12 network that develops there. So it -- it stays in the
13 mined-out pit.

14 Q Is the mined-out pit -- that's not the mine pit, that's
15 the saturated backfill zone?

16 A In the end, Mr. Chair, obviously, the entire mined-out
17 pit becomes part of the saturated backfill zone.

18 Q Sorry, the -- not the mine pit; right?

19 A The mine pit.

20 Q The mine pit --

21 A That's correct.

22 Q -- becomes a giant saturated backfill zone?

23 A Yes. It's a -- it's a huge -- it's a huge treatment
24 facility, yes.

25 Q Isn't the end-pit lake on the mine pit?

26 A So I -- yes, you're right, and that's not part of the

1 saturated backfill zone.

2 But the end-pit lake ultimately will decant into
3 the -- the rest of the mined-out pit and flow
4 downstream through what is planned to be a saturated
5 backfill zone.

6 Q I don't think I fully realized that.

7 So the saturated backfill zone stops being
8 actively managed, but it's there forever?

9 A Yes.

10 Q Okay. And is the selenium in the rock in the saturated
11 backfill zone?

12 A It's -- it's in a submerged part of the mine pit.

13 So, Mr. Chair, I think we all appreciate that
14 while we're mining, we're actively pumping out of the
15 mine pit to lower the groundwater table, and that's so
16 that, obviously, we don't get our feet wet.

17 Once we stop mining, we stop pumping, and the
18 level in the entire mine pit, the groundwater level,
19 rises to a natural level, and so the majority of the
20 rock in the mined-out pit will be below water. And,
21 yes, you can consider that all part of the ultimate
22 saturated backfill zone.

23 Q If there's some kind of landslide or earthquake
24 disturbance in, say, 400 years, would the selenium
25 release out of the saturated backfill zone?

26 A I can't picture that.

1 Q As in it won't happen, or you just can't imagine that
2 far ahead? I don't understand the --

3 A Well, I can't imagine the earth rising up, the rock
4 being spewed out onto the landscape, and the water
5 disappearing. I mean, it -- this is not a highly
6 seismic zone. And I guess, yeah, you can -- you can
7 look at the landscape and know that that kind of event
8 hasn't happened in millennia.

9 Q So it -- I'll think of something else here.

10 So if anything happens to disturb the saturated
11 backfill zone at any point in the future, would the
12 selenium come back out?

13 A Mr. Chair, the -- the only thing that -- we've tossed
14 this around. The only thing that we can imagine that
15 would do that would be if somebody came in and decided
16 they wanted to re-mine the pit. Obviously, they
17 wouldn't be looking for coal at that point because the
18 coal would be gone, but they -- if they wanted to
19 re-mine the pit for some other reason. And I would
20 suggest if somebody were to do that, they -- they would
21 have to determine how they're going to deal with the --
22 the selenium at that point in time.

23 I -- I can't imagine another scenario where, you
24 know, the -- the groundwater table was -- would
25 magically disappear. I can't imagine it.

26 Q So Benga expects the mine site to be seismically stable

1 forever?

2 A It is seismically stable. It has been for millennia.

3 I -- I think that's a reasonable projection.

4 Q So yes?

5 A Yes.

6 Q Perfect.

7 THE CHAIR: Mr. Yewchuk, just let you know
8 it's about noon, so whenever is a good time for you, we
9 could take our lunch break.

10 MR. YEWCHUK: Now works just fine. Thank
11 you, Mr. Chair.

12 THE CHAIR: Okay. It's just a little
13 after 12:00, so let's resume at 1:00. Thank you.

14

15 PROCEEDINGS ADJOURNED UNTIL 1:00 PM

16

17

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1 Proceedings Taken via Remote Video

2

3 November 16, 2020 Afternoon Session

4

5 A. Bolton The Chair

6 D. O'Gorman Hearing Commissioner

7 H. Matthews Hearing Commissioner

8

9 M. LaCasse AER Counsel

10 B. Kapel Holden AER Counsel

11

12 K. Lambrecht, QC Joint Review Panel Secretariat
13 Counsel

14

15 T. Utting IAAC Staff

16 E. Arruda AER Staff

17 D. Campbell AER Staff

18 T. Turner AER Staff

19 T. Wheaton AER Staff

20 A. Shukalkina AER Staff

21

22 M. Ignasiak For Benga Mining Limited

23 C. Brinker

24

25 R. Warden For Ktunaxa Nation

26 T. Howard

1	K. Poitras	For Métis Nation of Alberta
2		Region 3
3		
4	Chief B. Cote	For Shuswap Indian Band
5		
6	B. Snow	For Stoney Nakoda Nations
7		
8	R. Drummond	For Government of Canada
9	S. McHugh	
10		
11	A. Gulamhusein	For Municipality of Crowsnest
12		Pass
13		
14	M. Niven, QC	For MD of Ranchland No. 66
15	R. Barata	
16	J. Nijjer (Student-at-Law)	
17		
18	B. McGillivray	For Town of Pincher Creek
19		
20	D. Yewchuk	For Canadian Parks and
21		Wilderness Society, Southern
22		Alberta Chapter
23		
24	R. Secord	For Coalition of Alberta
25	I. Okoye	Wilderness Association, Grassy
26		Mountain Group, Berdina Farms

1		Ltd., Donkersgoed Feeder
2		Limited, Sun Cured Alfalfa
3		Cubes Inc., and Vern Emard
4		
5	R. Cooke	For Crowsnest Conservation
6		Society
7		
8	G. Fitch, QC	For Livingstone Landowners
9	C. Agudelo	Group
10		
11	M. Sawyer	For Timberwolf Wilderness
12		Society and Mike Judd
13		
14	(No Counsel)	For Barbara Janusz
15		
16	(No Counsel)	For Jim Rennie
17		
18	S. Elmeligi	For Alberta Chapter of the
19	A. Morehouse	Wildlife Society and the
20	S. Milligan	Canadian Section of the
21	M. Boyce	Wilderness Society
22		
23	J. Gourlay-Vallance	For Eco-Elders for Climate
24		Action
25		
26	L. Peterson	For Trout Unlimited Canada

1 R. Campbell For Coal Association of Canada
2
3 (No Counsel) For Alistair Des Moulins
4
5 (No Counsel) For David McIntyre
6
7 (No Counsel) For Fred Bradley
8
9 (No Counsel) For Gail Des Moulins
10
11 (No Counsel) For Ken Allred
12 (Not Present)
13
14 (No Counsel) For Monica Field
15
16 S. Frank For Oldman Watershed Council
17 A. Hurly
18
19 C. Forster, CSR(A) Official Court Reporter
20 _____
21 (PROCEEDINGS COMMENCED AT 1:01 PM)
22 GARY HOUSTON, DANE MCCOY, MIKE YOUL, MIKE BARTLETT,
23 CORY BETTLES, DAVID DEFOREST, SOREN JENSEN,
24 MARTIN DAVIES, LEIF BURGE, DAN BEWLEY, Previously
25 Affirmed
26 STEPHEN DAY, NANCY GRAINGER, Previously Sworn

1 THE CHAIR: Okay. Welcome come back,
2 everyone.

3 Mr. Yewchuk, you can continue.

4 Mr. Yewchuk Cross-examines Benga Mining Limited

5 MR. YEWCHUK: Perfect. So can I start with
6 Addendum 10, Package 5 again on the screen?

7 Q MR. YEWCHUK: And while that comes up, I
8 wanted to double-check something about the addition of
9 acid to saturated backfill zone. Will that not be
10 happening -- will be happening, or are you yet not
11 sure?

12 A MR. HOUSTON: We don't believe it'll be
13 necessary, Mr. Yewchuk.

14 Q Okay. What method will you be using to deal with
15 biofouling if it occurs?

16 A I -- I think Mr. Jensen mentioned a couple of other
17 methods. One -- one was to introduce a slug of
18 methanol instead of a -- a -- a measured amount. What
19 that would do was kill the biological material around
20 the input.

21 The other method -- I think that was the -- the
22 primary method he mentioned. The other method was to
23 have multiple inlets, wells so that you could cycle
24 between them, and -- and that's been shown to help
25 reduce the problem of biofouling.

26 MR. YEWCHUK: And can I get PDF page 36 on

1 the bottom of the page? Oh, sorry. 35. Bottom. So
2 just up a little bit. My PDF counter is working
3 slightly -- there you go. So this one.

4 Q MR. YEWCHUK: Can Benga confirm that they
5 were asked to provide examples of saturated backfill
6 zones with this question?

7 A MR. HOUSTON: So we were asked to provide --
8 to -- to be complete -- a -- a detailed summary of case
9 studies that have been completed and that investigate
10 selenium attenuation in saturated backfill zones in
11 British Columbia and elsewhere.

12 Q Great. Okay.

13 MR. YEWCHUK: And can we go down to PDF
14 page 39, I think, the bottom of the page. It is -- no,
15 it's 38, bottom of the page. I'm having the same
16 problem I was earlier. So just up a little bit.

17 Q MR. YEWCHUK: And is Example E of the
18 saturated backfill zone a fluidized bed reactor?

19 A MR. HOUSTON: So it's a -- it's an example
20 of using the same biochemical technology in a fluidized
21 bed reactor. But, to be clear, what was asked was to
22 show any case studies, including laboratory tests or --
23 or scale pilot tests, that pertain to the saturated
24 backfill zone technology.

25 Q Well, you just read it, and I think you -- I don't
26 think it had the word "pertained" there, but ...

1 A Yeah. I -- I didn't read the first sentence of the
2 question, which -- which talks about case studies and
3 laboratory analysis.

4 Q Do you want to go back up and read it, or do you -- do
5 you --

6 A If it's helpful.

7 Q Okay. So let's -- let's go back up to that page. I
8 believe it was bottom of 35.

9 A So you see the brackets where it says: (as read)
10 ... including small-scale laboratory tests or
11 other large-scale pilot projects.

12 Q Yeah. And if you read: (as read)
13 ... that have been completed and that
14 investigate selenium attenuation in saturated
15 backfill zones in British Columbia and
16 elsewhere.

17 A So -- so the -- the Case Study E does pertain to the
18 same biochemical process that we're using in the
19 saturated backfill zone.

20 Q Okay. So you consider the -- the FBR to be close
21 enough that it's useful for this purpose?

22 A I -- I think it inform -- it -- you know, it's
23 informative. It's helpful.

24 Q All right.

25 MR. YEWCHUK: And can I get PDF page 37?

26 I'm looking for Example B.

1 Q MR. YEWCHUK: Now, the -- the last sentence
2 in paragraph, for example, (b), can you just read that
3 to me?

4 A MR. HOUSTON: Example B, there's three
5 paragraphs. The first paragraphs [sic]?

6 Q Yes.

7 A (as read)

8 The columns were filled with fine coal
9 rejects from the mine with an average
10 particle size of approximately 1 millimetre.

11 Q Okay. Is an average particle size a gravel bed
12 reactor, or is that a saturated backfill zone?

13 A This is a laboratory test. When it talks about six
14 column bioreactors, that -- that's a laboratory setup
15 to investigate aspects of the -- again, the same
16 biochemical process that we're talking about.

17 Q Is this column test for a gravel bed reactor or for a
18 saturated backfill zone?

19 A It could be for either. Again, we're -- you're testing
20 rates of reaction, effects of -- I'm not exactly sure
21 what they're testing for here, but you could test for
22 rates of reaction, resistance to cold weather. I mean,
23 you could test many parameters that help to inform
24 further field-scale pilot tests or -- or a full-scale
25 installation.

26 Q Are the saturated backfill zone, the fluidized bed

1 reactor, and the gravel bed reactor very similar
2 technologies?

3 A The -- the basic biochemical reactions are -- are the
4 same. The differences lie in the rate of water
5 treatment and -- and -- well, a -- a number of other
6 factors. But, basically, as you go from the water
7 plant -- water treatment plant, which is in a building
8 with vessels, you're -- you're talking about moving
9 water through a lot more quickly, and -- and for that
10 you need to have higher state of engineering.

11 For the gravel bed reactor, it's a -- a little bit
12 less quick, but still, compared to the saturated
13 backfill zone, a fast process. And so engineering is
14 required to achieve that.

15 And then the saturated backfill zone, as we've
16 talked about, is quite a slow process in terms of
17 taking months as opposed to hours or days.

18 Q So Teck's three plans -- first, second, and third plans
19 to control selenium are -- are just variances of the
20 same thing?

21 A It's the same basic biochemical reaction, yes.

22 Q Do FBRs have a problem where they produce sludge? The
23 "FBR" being the fluidized backfill zone [sic]. I'm
24 switching to "FBR".

25 A Yeah. And that's because the reaction's taking place
26 in -- in a vessel. And because of the volume of water

1 that's going through a small place, you -- you need to
2 have time in the process to remove the build-up of
3 sludge and -- and dispose of it.

4 Q Do saturated backfill zones produce sludge?

5 A So they'll produce the same biological mass. The
6 difference is the enormous space that's in the
7 saturated backfill zone. And so that enormous space
8 allows for the development of sludge, and it's --
9 it's -- actually becomes part of the treatment, if you
10 will. But it remains in situ.

11 Q Is the saturated backfill zone just going to take
12 longer to fill up with sludge because it's bigger?

13 A I think the dimension of the -- you know, the -- the
14 scale is -- is orders of magnitude bigger, and I
15 think -- I think that what you'll find is that the --
16 the sludge, which is primarily biological material, has
17 a finite volume.

18 Q Why?

19 A Because it's based on how much selenium you feed in.
20 The selenium is the food, if you will, for the -- for
21 the biological material. Selenium and nitrates, both
22 of them.

23 So that's the food for the biological material.
24 And when you run out of food, the -- the growth slows.
25 And so as you move further and further away from the
26 inlet on the -- at -- in the saturated backfill,

1 your -- your degree of biological material is going to
2 be less.

3 If you will, let me just consult with my
4 colleagues here. I think we may want to add something
5 here.

6 So Mr. Jensen's going to add a bit of colour to
7 what I just said.

8 A MR. JENSEN: Yeah. So, I mean, it's
9 biological the -- they go through a life cycle, the --
10 the microorganisms that develop within a -- within a
11 saturated backfill or really anywhere, and part of
12 that -- part of that cycle is you have initial growth;
13 then you have a period, generally speaking, where it's
14 sustained. And then it dies off.

15 So you keep going -- in -- in effect, the biomass
16 will cycle itself within the -- within the biomass. So
17 that's one of the things we are hoping to -- not hoping
18 to -- we do achieve by switching feed wells, is that if
19 you inject your feed and interwell for a certain amount
20 of time, we expect it to foul up with biomass. What we
21 then achieve by switching to a new well and operating
22 that for a while is that the biomass no longer gets
23 sustained by incoming nutrients. So it'll die back
24 and, in fact, contribute to electron donors or carbon
25 in and of itself. It'll help to keep that -- the
26 reducing conditions reducing. The -- much the same way

1 we don't want phosphates and other things going into
2 lakes 'cause then you get a lot of algae bloom. That
3 algae bloom sinks to the bottom, and it starts to
4 decay. I'm sure that process is familiar to some.

5 That decay -- so lakes don't just fill up with
6 biomass. And, you know, in the end of -- and all of a
7 sudden they're not lakes anymore. Wetlands might. But
8 most lakes don't, and that's because it gets recycled.
9 So it's much the same process.

10 Q But some lakes do?

11 A Yeah, some lakes do.

12 Q That would be the algae bloom-type example you just
13 gave; right?

14 A No. No. I mean, when they do, it's -- it's
15 hydraulically controlled. It's -- that -- that's when
16 it turns into a wetland. And even wetlands don't grow
17 into the sky. Like, they -- they have their own
18 recirculation of -- of organic material that -- you
19 know, cycles of growth and decomposition that they,
20 too, attain a steady state. I hope that makes sense.

21 Q Does Benga expect the SBZ to have a 99 percent
22 attenuation rate?

23 A MR. HOUSTON: So what we talked about
24 earlier this morning was that we expect the SBZ to
25 produce an effluent that has less than 15 micrograms
26 per litre of selenium.

1 Q So that was 15?

2 A 15 micrograms per litre. That's -- that's a -- a
3 conservative estimate of what the performance will be.

4 Q Okay. As a percentage attenuation rate, what is that?

5 A Yeah. It -- we talked about this this morning as well.
6 Mr. Chair, percentage attenuation rate is -- is more
7 appropriate for a filtration system. And -- and I know
8 at one point in our -- our documents we -- we talked
9 about that. But the more -- more appropriate use --
10 the more appropriate definition of "performance" is to
11 talk about what the expected effluent concentration of
12 selenium will be at a maximum, and that's 15 micrograms
13 per litre.

14 Q Can you just look at the page we already have up and
15 the second paragraph under selenium attenuation
16 Example B, the last sentence of the second --

17 A M-hm.

18 Q -- paragraph there, an average removal rate of
19 97 percent?

20 A Yes.

21 Q Okay. So if I -- if I try to take you through your
22 documents to show you all the places you refer to
23 attenuation rates and removal rates, would that take us
24 the rest of the day?

25 A I -- I know it -- it -- it is a way we use to talk
26 about it, and that's sometimes a function of the way

1 the laboratory tests are -- are set up.

2 What -- what we've understood is that the -- if --
3 the attenuation rate or the percentage reduction has
4 very little to do with how we should be measuring the
5 success of this process. It's -- it's very much
6 related to the -- the concentration of the effluent.

7 And -- and that goes back to the -- the idea
8 that -- our understanding that this is -- the SBZ is --
9 is a huge reactor compared to, say, this column test
10 that you're looking at here. So it's a huge reactor.
11 There's months of time. And so achieving that -- that
12 lower level of performance or that -- that level of
13 performance that we're expecting is -- is -- is really
14 dependent on the end limits of the process as opposed
15 to the -- the space and time that's available.

16 Q Does Benga think it's going to be easier to run the
17 enormous outdoor SBZ than it is to run these column
18 tests?

19 A Well, the column tests -- so when we're talking about a
20 "column", these -- these columns might be -- I don't
21 have the specifics here, but they might be, say,
22 8 inches or 10 inches in diameter and 2 or 3 feet tall.
23 So they're -- at least the column tests I'm familiar
24 with are -- are of that size. So it -- it's quite a
25 different thing when you're talking about running them.

26 MR. YEWCHUK: So -- here. Can I get

1 Document Number 555, PDF page 48 -- 84, please.
2 Page 84, sorry. And I think this will just illustrate
3 what we're talking about.

4 A MR. HOUSTON: 555?

5 MR. YEWCHUK: PDF page 84. Maybe go down
6 one. This is not exactly page I want.

7 A MR. HOUSTON: Are you looking for the
8 picture?

9 Q MR. HOUSTON: Yeah. That's the one.

10 A Yeah.

11 Q There it is. 87.

12 A 87. Okay.

13 Q So this is what a column test looks like; right?

14 A Yeah. That's right. It's a laboratory experiment.

15 Q How large is the planned saturated backfill zone?

16 A Well, as we've talked about, it gets built up in
17 phases. But at the ultimate extent, it's virtually the
18 entire mine pit.

19 Q Did the column test that we are looking at right now
20 meet the selenium attenuation expectations that Benga
21 had?

22 A So, Mr. Chair, we're -- we're using these column tests
23 to test the -- the behaviour of the biochemical
24 reaction (a) with the specific materials from the --
25 the site, and -- and (b) as they react to changing
26 levels of selenium input, nitrates, temperature. So

1 we're -- we're not intending to achieve the
2 15 micrograms per litre in -- in these column tests.
3 We're -- we're really looking to see how the process
4 varies with variation in input parameters.

5 Q So the point of these tests is not to show that the SBZ
6 or -- or GRB technology or whatever actually works?
7 That's not the point?

8 A It's -- it's to -- we -- we know the technology works,
9 and -- and so what we're trying to do is understand,
10 from an engineering design parameter point of view, how
11 the process varies with -- with changes in input
12 parameters.

13 Q Now, in the column test that we are looking at now, was
14 the selenium precipitated out as expected, or did it
15 remain suspended in the water?

16 A Again, this is a very short column test. The -- the
17 selenium's moving through at a fairly -- or the --
18 the -- the water with the selenium is moving through
19 fairly rapidly, and so what we're looking for are rates
20 of -- of reduction under varying input conditions.
21 And -- and it's those rates of reduction that we're --
22 we're looking at to see how does the biochemical
23 reaction accelerate or -- or slow down or react to
24 changes in the amount of methanol, for example, that's
25 put in, or the temperature -- ambient temperature of --
26 of the process.

1 Q Okay. So for this test -- and I'd like an answer
2 from Soren Jensen. You actually ran this test; right?

3 A No. No, Soren didn't run this test.

4 Q Who did?

5 A It was Geosyntec, another consultant.

6 Q Okay.

7 MR. YEWCHUK: Can I get Document Number 571,
8 PDF page 21? This is Benga's response, I hope. I'm
9 having a rough time with these today.

10 A MR. HOUSTON: What is the PDF page, please?

11 Q MR. YEWCHUK: 21.

12 A 21.

13 Q Bottom of 21. I think that should be it.

14 A Yeah.

15 Q These are the selenium limit comparisons you -- you
16 provided; right?

17 A Yeah. Yes.

18 Q Okay. Do you know what years those first four mines in
19 this table were permitted?

20 A One moment, Mr. Chair.

21 So we're trying to get the collective wisdom of
22 the panel to bear here. We -- we think that the Red
23 Chris Mine may -- may have received its selenium
24 objective 2015 or 2016.

25 The -- which was the other -- the Brule Mine?

26 Yeah. The Brule Mine -- the Kemess Mine. I'm sorry.

1 That -- that selenium objective might have been set in
2 2018 or 2019. We -- we can't speak to all of the rest.

3 Q All right. That's good enough.

4 Mr. Day, did you work on the permitting for the
5 Red Chris Mine?

6 A MR. DAY: Yes, I've worked on that,
7 yeah.

8 Q Perfect.

9 Do you continue to do work relating to the Red
10 Chris Mine?

11 A I do, yeah.

12 Q Did that mine get a noncompliance advisory letter from
13 the BC Ministry of Environment in 2017?

14 A I don't know.

15 Q Not sure about that.

16 Do you know if there was no surface runoff control
17 works installed at parts of the mine where the Red
18 Chris Mine permit required them to have those?

19 A That wasn't the area that I was working on, so I'm not
20 familiar with those, Mr. Yewchuk.

21 Q What were you doing?

22 A I -- I work on the geochemical characterization of the
23 rock and tailings.

24 Q Do you do any work relating to selenium at Red Chris?

25 A I do, but it's on the source aspects.

26 Q Okay. Did selenium levels in fish start to rise in the

1 lake beside the Red Chris Mine in 2016?

2 A Yeah. I'm not familiar with that.

3 MR. YEWCHUK: Can I get Aid to Cross 3?

4 Q MR. YEWCHUK: And, Mr. Day, did you see this
5 Aid to Cross 3 before -- did anyone bring it to your
6 attention?

7 A MR. DAY: Mr. Yewchuk, I don't work on
8 the fish tissue aspects, so this wouldn't be something
9 I'd be involved in.

10 Q Right. So you do work for Red Chris, but you've just
11 never heard of this at all?

12 A Well, I hear it peripherally, but I don't -- I'm not --
13 this is not my expertise, so I don't get involved in
14 this aspect.

15 A MR. HOUSTON: Mr. Chair, I think Mr. Day
16 made it clear that he works on the source terms for
17 selenium on this project, and without -- without
18 getting into exactly what he's doing, working on the
19 source terms means that you're looking at the rock and
20 the rate of leaching out of the rock and -- and what
21 that might produce. So the -- the other end of the
22 chain, the fish, Mr. Day wouldn't be involved in that
23 at all.

24 Q Mr. Day, have you ever visited the Mount Polley mine
25 site?

26 A MR. DAY: Yes, I have.

- 1 Q Did you visit it prior to the dam failure?
- 2 A Yes, I did.
- 3 Q Okay. What was the most recently you visited it before
- 4 the dam failure?
- 5 A Before the dam failure, I couldn't -- I couldn't tell
- 6 you. I -- I was in and out of there a few times over
- 7 the years.
- 8 Q You worked for Teck on their selenium problem in the
- 9 Elk Valley?
- 10 A I worked for Teck on -- again, on the source
- 11 geochemistry aspects, yeah.
- 12 MR. YEWCHUK: Can I get Aid to Cross
- 13 Number 6?
- 14 Q MR. YEWCHUK: And if I set this upright,
- 15 this should be an article on selenium in the Elk Valley
- 16 that you coauthored. We will know once it comes up.
- 17 Am I right this is an article you coauthored?
- 18 A MR. DAY: Yes, that's right.
- 19 Q Okay. And it is on selenium and selenium pollution?
- 20 A It is specifically on where does the selenium reside in
- 21 the rock.
- 22 Q Does this article cite DeForest?
- 23 A I -- I couldn't tell you. I don't know, no.
- 24 Q Okay.
- 25 A You have to look in -- look in the reference list.
- 26 Q Okay. Well, let's go to the last page of this, I

1 believe PDF page 7. No. I guessed. Up one should be
2 there.

3 So you can check and get back to me -- you can
4 check if it -- if it has Mr. DeForest. Do you know if
5 you cite Dennis Lemly?

6 A I don't know. I -- yeah.

7 Q Can you check Footnotes 4 and 12? Is that too small
8 for you to read or --

9 A Oh, I'm sorry. Oh, I see. Okay. Yeah. I see, yeah,
10 Lemly is, yeah, Reference 4 and -- yeah. Okay. I see
11 him there, yeah.

12 Q Okay. Thank you.

13 And now on to someone else. Can I get Aid to
14 Cross Number 4, and, Mr. Davies, is this a study you
15 coauthored?

16 A MR. DAVIES: Yes.

17 Q Right.

18 A Well, when it comes up, I think it is.

19 Q Who provided the funding for this study?

20 A This was the Kemess Mine.

21 Q Okay.

22 A It was done at the requirement of the provincial
23 government.

24 Q What was the connection between Northgate Minerals'
25 Kemess Mine and the Dolly Varden char?

26 A The creeks in the area are generally dominated by

1 either the Dolly Varden char or bull trout. And so
2 it -- you know, this is what they -- what they need to
3 manage.

4 Q Okay. Was Kemess Mine dumping waste rock into the
5 habitat of the Dolly Varden char?

6 A I wouldn't characterize it that way. They -- the --
7 the upper portion of this -- of this creek was a
8 permitted discharge area -- or not discharge area.
9 Sorry. It was a permanent waste rock storage area, and
10 it was, you know, managed through a -- a fisheries
11 compensation program.

12 Q So can you just read me this two sentences underneath
13 "Materials and Methods" on that first page? We'll have
14 to scroll down a little.

15 A The first two sentences there?

16 Q Yeah.

17 A (as read)

18 The Kemess Mine is an open-pit gold and
19 copper mine and mill complex located
20 430 kilometres northwest of Prince George,
21 British Columbia, Canada.

22 Since 1997, non-acid-generating waste
23 rock has been placed in the upper portions of
24 Waste Rock Creek, a 3-kilometre second-order
25 creek that contains Dolly Varden spawning and
26 rearing areas.

1 Q Okay. Was Kemess placing waste rock in Dolly Varden
2 char habitat since 1997?

3 A By that time, it had been -- it had been compensated
4 for, and it was no longer considered fish habitat.

5 Q Okay. Was the conclusion of this study that the Dolly
6 Varden char was more tolerant of selenium exposure than
7 any other fish species tested up to that day?

8 A Not exactly. I think if you see the -- if you read the
9 conclusions there, it looks that way to start. It was
10 a bit of a surprise to us, honestly. But -- oh, sorry,
11 I got a -- can you still see me? I've lost my video
12 here.

13 Q I'm not too worried about it.

14 A Okay. Yeah. I'm -- I'm still here. Believe me.
15 The -- you'll see in the -- the conclusions of the
16 study that there is another study that was done with
17 brook trout, which is a very closely related species.
18 Like, Dolly Varden, bull trout, Arctic char, and --
19 and -- and brook trout are all -- almost the same
20 species, honestly. Where if you dive down into the
21 brook trout study, the results were actually quite
22 comparable.

23 Q So --

24 A I -- I can find that in the -- in the paper, if you
25 like.

26 Q Is the overall conclusion here that the Dolly Varden

1 char is very tolerant of selenium?

2 A I would say the Dolly Varden char are more tolerant
3 than -- than trout.

4 Q What about the bull trout?

5 A We didn't do direct studies of bull trout in this.
6 Like, they're very -- they're so -- so closely related
7 in this area that they hybridize, and so, you know, you
8 might think that it's similar, but we haven't done any
9 direct studies of it to see.

10 Q Is the implication of this study that the Kerness --
11 the Kemess Mine doesn't need to worry as much about
12 their selenium releases?

13 A No, not at all, actually. One of the advantages -- one
14 of the things that allowed us to do this study the way
15 we did -- 'cause we were taking samples of -- of eggs
16 that had been -- from Dolly Varden char that had been
17 raised -- or not -- sorry, not raised -- that had grown
18 in the creek -- in these creeks that had very high
19 exposure to waterborne selenium. And so it gave us an
20 opportunity to actually look at a real-life setting
21 where there were high concentrations of selenium and
22 fish eggs. And what we found is that the
23 concentration -- this EC10 concentration that we put
24 forward as a -- a potential tissue threshold -- there's
25 probably about -- depending on the year of monitoring,
26 about maybe a -- a -- a third or half of the fish, in

1 some years more, that are above that threshold. So
2 certainly there -- there were effects in this
3 environment. And I think that this -- this study
4 helped to confirm that.

5 Q Okay. Thank you.

6 Mr. Jensen, have you visited the Mount Polley mine
7 site?

8 A MR. JENSEN: No, I have not.

9 Q Did you do any work related to the Mount Polley mine
10 site?

11 A Yes, I have.

12 Q Okay. But you never did a site visit?

13 A That's correct. I did not.

14 Q Mr. DeForest, are you responsible for the work on the
15 site-specific selenium threshold sought by this
16 project?

17 A MR. DEFOREST: Yes, I am.

18 Q Do you believe Alberta's selenium release limits are
19 overconservative?

20 A By Alberta release limits, is that the guideline of
21 2 micrograms per litre, or is that different? I --

22 Q I think that's the one.

23 A It's -- I believe it's conservative for certain water
24 minings. It's designed to be a conservative value
25 that's protective of waters with the highest --

26 THE COURT REPORTER: I'm sorry. Can I get you to

1 speak up?

2 A MR. DEFOREST: Yeah. Sorry.

3 What I was saying was I believe the guideline is
4 conservative for certain water bodies, and it was
5 designed to be a conservative guideline that would be
6 protective of water bodies throughout the province that
7 have high bioaccumulation potential.

8 For a -- a flowing or loaded receiving water
9 like -- as is the case here, we do expect that selenium
10 bioaccumulation potential would be lower than those
11 high bioaccumulation sites that are really the basis
12 for a lower water selenium guideline.

13 So -- so I guess to answer your question, I do
14 believe that the 2-microgram-per-litre guideline is
15 conservative for this receiving water for this project.

16 Q Okay. Mr. DeForest, is there an unsettled controversy
17 regarding appropriate selenium thresholds for the
18 protection of fish populations?

19 A Are you referring to thresholds in water or fish tissue
20 or other?

21 Q Both.

22 A I -- I suppose that there's probably still
23 disagreement, for sure. Like, there are -- like there
24 is in almost anything, I suppose.

25 There are, I guess, different interpretations of
26 what the level of protection should be and how to

1 interpret the available effects-based data for
2 selenium. So I know in the literature that there --
3 there are still differences of opinion in that regard.

4 Q Could it be fairly characterized as a dispute between a
5 group of researchers who think the appropriate
6 regulatory thresholds can be set higher and a group who
7 believe they need to be set low?

8 A No. I -- I think the difference is just differences in
9 interpretation of the available data independent of
10 sort of, quote/unquote, one thinks it should be lower
11 or one thinks it should be higher.

12 I think a lot of the more conservative guidelines
13 are developed from studies that came out mostly in the
14 '80s and early '90s following the events at Belews
15 Lake. And starting in the late 1990s and past 2000, a
16 substantial amount of research on the effects of
17 selenium has been undertaken, and I think we know a lot
18 more now than we did in the '80s; and I think,
19 depending on how you choose to interpret the new
20 information, probably influences different folks'
21 opinions on -- on what a protected guideline should be.

22 Q Are you familiar with Dennis Lemly?

23 A I am.

24 Q Are you familiar with Joseph Skorupa?

25 A Yes.

26 Q Have Lemly and Skorupa favoured tighter limits on

1 selenium releases for environmental protection?

2 A Yes. I -- or can I have you repeat that?

3 Q Have Lemly and Skorupa favoured limits on selenium
4 releases for environmental protection reasons?

5 A Yes, they generally have.

6 Q Have you favoured laxer selenium release limits?

7 A I have not favoured laxer limits, but the -- the limits
8 or guidelines that I've recommended and work I've done
9 in the past are higher than the ones that they've
10 recommended and I think based on evaluation of the data
11 available. And -- and I can just say too, you know,
12 I'm not -- I'm not alone in that thinking. The US
13 EPA's fish tissue-based criteria are actually very
14 consistent with recommendations that colleagues and I
15 made back in 1999, before even a lot more information
16 became available, and I think it's just a -- a
17 difference in interpretation of the data. I think it
18 would be inaccurate to say that they're more lax.
19 They're still conservative and protective values, in
20 our opinion.

21 Q Do mining companies generally prefer your
22 interpretation of the data to Lemly's?

23 A MR. HOUSTON: So, Mr. Yewchuk, I -- I -- I
24 don't know if it's Mr. DeForest's place to talk about
25 what mining companies generally think. That -- you
26 know, that's asking him to put himself in somebody

1 else's position.

2 Q Mr. DeForest, do you agree that you are unable to
3 answer that question?

4 A MR. DEFOREST: I'd agree. I can't say for
5 sure what the different companies might be thinking.

6 Q Okay. In 1999, you cowrote a paper, the critical --
7 called "Critical Review of Tissue-Based Selenium
8 Toxicity Thresholds for Fish"?

9 A Yes.

10 Q Did that paper conclude that the United States Fish and
11 Wildlife Service thresholds were lower than they needed
12 to be?

13 A That's -- yes, that's -- that's what we concluded.

14 Q Can I get Aid to Cross Number 14, PDF page 40? I
15 believe it's on the bottom of the page. And if I
16 called up the correct page, this will show a table of
17 your proposed selenium limits compared to Lemly's and
18 Skorupa's; right?

19 A Yes, that's correct.

20 Q Who funded this study?

21 A This was funded by Kennecott, a mining --

22 THE COURT REPORTER: I'm sorry?

23 A MR. DEFOREST: -- company in Utah.

24 Q MR. YEWCHUK: In 2013, you coauthored
25 "Comment on Wildlife and the Coal Waste Policy Debate:
26 Proposed Rules for Coal Waste Disposal Ignore Lessons

1 From 45 Years of Wildlife Poisoning"?

2 A Yes.

3 Q And that was responding to an article by Lemly and
4 Skorupa?

5 A It was.

6 Q Was your position in that article that Lemly and
7 Skorupa's suggestions for controlling selenium
8 pollution were too strict and that lower standards for
9 environmental protection would be safe?

10 A The -- the focus, I think, of that paper was more
11 around acknowledging again how much the science on the
12 fate and effects of selenium in aquatic systems has
13 evolved. The particular paper that this was a rebuttal
14 to was -- in part, look back at various case studies
15 early on when there were cases of population level
16 effects in receiving waters such as Belews Lake and
17 Hyco reservoir that received fine-ash discharges from
18 coal-fired power plants and -- and more just that this
19 state of the science both, as I said, on creative
20 effects, and effects have evolved and -- and also for
21 managing selenium.

22 And that was really kind of the focus of the
23 paper, was we can -- we can -- we can look back at
24 those cases, but we can't extrapolate those to the
25 future because we know a lot more now than we do --
26 than we did then.

1 And -- and just basically a -- a -- you know, a
2 recommendation that -- given that knowledge that we
3 have, that they have improved methods for evaluating
4 those cases going -- going forward.

5 Q Who funded that study?

6 A That was the Utility Solid Waste Advisory Group, or
7 "USWAG".

8 Q Solid Waste Activities Group?

9 A Thank you.

10 Q Is that a lobbying group for a consortium of electric
11 utilities and affiliates that have a vested economic
12 interest in keeping selenium release limits higher?

13 A I can't honestly say that for sure. I have to say that
14 I have not worked with that group before, nor have I
15 since. But my coauthor on that, Robin Reash, who I
16 knew from a North American Metal Council selenium
17 working group that we both participate in, he had
18 reached out to me to work on this paper with him, and
19 then the USWAG did provide the funding to support that
20 effort. But I honestly don't know a lot about that
21 group.

22 MR. YEWCHUK: Can I get Aid to Cross 1,
23 which I believe is the article we've just been
24 discussing.

25 Q MR. YEWCHUK: How many pages is this
26 article?

1 A Just -- just one or two. A little over one.

2 Q So did you -- did you do new research for this comment?

3 A No. No. By -- by its very nature, it's intended just
4 to be a -- as it's stated there at the top, a
5 correspondence/rebuttal paper.

6 Q Okay. So how much funding did you need from the USWAG
7 to write a little more than a page and do no research?

8 A It wasn't very much, but this was long ago. I -- I
9 can't remember. But it wouldn't have been very much.

10 Q When you say "not very much", what -- what kind of
11 range are you talking?

12 A MR. HOUSTON: So --

13 Q \$5?

14 A So, Mr. -- Mr. Chair, I don't know if it's fair for
15 Mr. Yewchuk to ask Mr. DeForest how much he got paid
16 for a piece of work that seems to be out of bounds to
17 me.

18 MR. IGNASIAK: Yeah, Mr. Chair, I obviously
19 agree with that.

20 MR. YEWCHUK: I'm not sure I agree, but I'm
21 not going to debate the point, so I'll move on.

22 Q MR. YEWCHUK: Mr. DeForest, in 2015, you
23 coauthored "Biokinetic Food Chain Modelling Waterborne
24 Selenium Pulses in the Aquatic Food Chains:
25 Implications for Water Quality Criteria"?

26 A MR. DEFOREST: Yes.

1 Q Was one of the conclusions of that paper that the
2 Environmental Protection Agency's draft intermittent
3 selenium criteria may be overly protective for selenate
4 pulses but potentially underprotective for selenite
5 pulses?

6 A I think that's correct.

7 Q Okay. Who funded that research?

8 A Oh, boy. I'm not recalling off the top of my head.

9 Q All right. That's all right.

10 A It was --

11 Q Aid to Cross 12, PDF page 16.

12 A Thank you.

13 Q You've had a long career. I don't expect you to
14 remember all these offhand, so ...

15 There you go. Acknowledgement. Who funded that
16 study?

17 A Let's see. It's cut off a little bit on my screen. I
18 know North American Metals Council, Evalley Coal
19 [phonetic], Rio Tinto, and -- let me see. I've got to
20 scroll over again. I'm sorry. I can't -- I can't read
21 that. Oh, let's see. Oh, and Wharf Resources.

22 Q 2017 you cowrote the paper "Updated Species Sensitivity
23 Distribution Evaluations for Acute and Chronic Lead
24 Toxicity to Saltwater Aquatic Life"?

25 A I did.

26 Q Did that paper conclude that the United States

1 Environmental Protection Agency's ambient water quality
2 criteria for lead was lower than necessary and that it
3 could be safely increased?

4 A The conclusion of that paper was that it was to
5 incorporate bioavailability-based considerations, and
6 this has been an ongoing effort for metals in general
7 beyond lead and -- and beyond work that I've been
8 doing.

9 The USEPA and 'E' triple three -- or 'E' --
10 Environment and Climate Change Canada have also been
11 exploring these same approaches for developing
12 bioavailability approach -- based approaches for -- for
13 guidelines or water quality criteria in the US.

14 And the objective of that is to derive criteria or
15 guidelines that reflect the conditions that influence
16 site-specific bioavailability.

17 In the case of lead, under many water chemistry
18 conditions, the EPA criteria -- existing EPA criteria
19 for lead might be, quote/unquote, overprotective. But
20 it's also important to note that there are higher
21 bioavailability conditions where these
22 bioavailability-based criteria can be lower than
23 existing criteria. The -- the -- the objective is not
24 just to try to find out if a number should be lower or
25 higher; it's trying to come up with criteria that are
26 accurate to the defined level of protection, and

1 bioavailability that varies highly from conditions that
2 are highly -- from site to site is -- is a key
3 component of that.

4 Q Who provided the funding for that study?

5 A That was the International Lead Zinc Research
6 Organization.

7 Oh, and I -- actually, I -- I should note -- I
8 didn't have a paper -- did -- was that the saltwater
9 paper -- did you cite, or was it freshwater?

10 Q This -- Aid to Cross 13. Let's pull it up so we're on
11 the same one.

12 A Okay. Yeah. I apologize. I just want to make sure
13 I'm responding correctly.

14 Okay. This is the saltwater paper. So I -- we
15 had two papers come out in 2017 on lead. One was
16 freshwater, and one was saltwater. And my previous
17 response was relative to -- to freshwater. I sign up
18 by availability.

19 For saltwater, the -- the data aren't available
20 yet to develop a robust bioavailability base criteria.
21 But this just represents updated information.

22 The -- the previous saltwater life criteria were
23 developed in the mid-'80s, so this is just looking at
24 all the additional saltwater toxicity data that had
25 been compiled in the last 35 years and following EPA
26 protocols for developing criteria. This is just the

1 result of what the updated saltwater criteria would be.

2 Q I'm going to re-ask my question now 'cause I may have
3 asked -- you may have answered in regards to the wrong
4 paper. Does this --

5 A Okay.

6 Q -- paper conclude that the United States Environmental
7 Protection Agency's ambient water quality criteria for
8 lead is lower than necessary and that it could be
9 safely increased?

10 A It -- it -- it might. To be honest, I'm trying to
11 remember the specific numbers here. And I thought the
12 chronic criteria were actually fairly similar with the
13 update, but they might be a little bit higher than --
14 that the -- again, EPA's criteria. That's 35 years old
15 at the time that we did this.

16 Q Okay. Tell me if I'm reading this right. The
17 8.1 microgram per litre in the second line was your
18 suggested level, and the old USEPA one was the
19 10 microgram per litre?

20 A The existing one is 8.1, and the value that we derived
21 following US EPA methods was 10.

22 Q Okay.

23 A So it -- it went up from 8.1 to 10 micrograms per
24 litre, so not -- not a substantial change.

25 Q And the acute one goes down 110 micrograms per litre?

26 A Yeah. The acute actually went lower with our update.

1 Q And who funded this study?

2 A The International Lead Zinc Research Organization.

3 Q And at PDF page 6. And acknowledgements there. You're
4 just using the old name for them; right? They
5 are now --

6 A Oh, this is --

7 Q -- (INDISCERNIBLE - OVERLAPPING SPEAKERS) Association?

8 A Yeah. This was about the time they changed, yeah.
9 They're -- they're currently the International Lead
10 Association.

11 Q Okay. Thank you, Mr. DeForest. I think that's all for
12 you for a bit.

13 A Thank you.

14 Q So, Mr. Houston, does Benga believe this project will
15 ultimately benefit the westslope cutthroat trout?

16 A MR. HOUSTON: So you ask a good question.
17 What we believe is that there are environmental
18 stressors in Gold Creek today that could be repaired
19 and that if -- if that were to happen, that the
20 westslope cutthroat trout in -- population in Gold
21 Creek would -- would be more sustainable and -- and
22 would -- well, be more sustainable.

23 So we -- we do believe that the offsetting
24 mechanisms that we've proposed will -- will approve the
25 situation for westslope gold -- cutthroat trout in Gold
26 Creek.

1 Q Do the westslope cutthroat trout use a lot of coal or
2 steel?

3 A Yeah. No. You're -- you're right. Not big steel
4 users, and -- and so that wouldn't be something they'd
5 be interested in.

6 Q Any plans to repair and improve westslope cutthroat
7 trout habitat to offset the damage caused by the mine?

8 A First of all, "the damage caused by the mine" is -- is
9 not a phrase I would use. As I mentioned in my opening
10 remarks, we're -- we're staying a hundred metres back
11 from Gold Creek itself. Benga's project will be
12 intercepting tributaries, and so we will be -- we will
13 be removing some riparian habitat.

14 I might add that that's a temporary feature, but
15 you'll -- you'll tell me that many decades of removal
16 is -- is a long time. So I -- I would agree with that.

17 But we are removing some riparian habitat and
18 repairing other riparian habitat that is currently
19 maybe degraded because of the previous coal mining in
20 the region, and we're proposing to offset that with,
21 you know, upgrading other areas of riparian habitat.

22 Q You said "Gold Creek itself". Were you --

23 A Yes.

24 Q -- differentiating Gold Creek from the tributaries to
25 Gold Creek?

26 A I was.

1 Q Okay. Are the tributaries to Gold Creek critical
2 habitat?

3 A Yes, they are.

4 Q Yeah. But you don't agree with the characterization
5 that the mine will damage the critical habitat of the
6 westslope cutthroat trout?

7 A No. You said the mine will damage Gold Creek, and I --
8 I wanted to be sure that everybody was clear that we're
9 staying a hundred metres back from Gold Creek.

10 Q Right. So you'll -- you're damaging tributaries to
11 Gold Creek?

12 A That's right.

13 Q Okay. How much does Benga expect to spend on that
14 remediation work?

15 A I don't think we've got a full cost estimate for it
16 yet, Mr. Yewchuk.

17 Q Do you have any kind of cost estimate or totally
18 unresolved?

19 A It's totally unresolved. We've -- we've looked at the
20 work that may be involved and -- but we haven't -- we
21 haven't explicitly estimated the cost.

22 Q Could Benga have physically built the mine without
23 doing that remediation work?

24 A Could -- could we have built the mine without doing the
25 remediation work?

26 Q Yeah.

- 1 A We're --
- 2 Q Just (INDISCERNIBLE - OVERLAPPING SPEAKERS) --
- 3 A -- talking about --
- 4 Q -- right? Not -- not regulatory possible, but --
- 5 A Of course. And -- and we're -- when we talk about
- 6 "remediation work", we're talking about the -- the
- 7 re-establishment of the channel so that the -- the fish
- 8 aren't isolated in the fall and -- and the -- the
- 9 development of overwintering habitat, that -- that kind
- 10 of stuff; right?
- 11 Q Yeah.
- 12 A So absolutely we could have built the mine without
- 13 doing that.
- 14 Q Is it possible for Benga to have completed the
- 15 remediation work in advance of constructing the mine?
- 16 A We would need an approval from the Department of
- 17 Fisheries and Oceans to -- to go in the creek and do
- 18 that work.
- 19 Q Okay. Is it physically possible to remediate the
- 20 westslope cutthroat trout habitat and then not
- 21 construct the mine?
- 22 A Yes. That would also be possible.
- 23 Q So the remediation work and the mine are two separate
- 24 activities?
- 25 A That's right. I -- I -- I should add that a -- a lot
- 26 of the remediation work is only possible because of the

1 research that we've done and the amount of time we
2 spent studying Gold Creek. So in -- in a certain
3 sense, yes, we've -- we've come to a point where one
4 could proceed without the other, but to get here,
5 there -- there had to be a -- a mine proposal.

6 Q Would the westslope cutthroat trout be better off if
7 the habitat restoration was done and the mine was not
8 built?

9 A I'm not sure. I -- I think one of the other benefits
10 of -- of having the mine proceed is that you've got
11 somebody who has got deep pockets and who is the
12 caretaker of that creek for the next 30 or 40 years.
13 So I think having that kind of a party act as a
14 caretaker, monitoring, and if necessary, you know,
15 tweaking the -- the habitat recovery and -- and
16 monitoring the -- the health of the fish, I think
17 there's a benefit to having somebody in the area that's
18 hands on doing that work.

19 Q Does the federal government have deep pockets?

20 A Not today, if I -- if I understand the discussion
21 around deficits and -- and borrowing. But they
22 certainly have access to money.

23 Q Would the westslope cutthroat trout be better off if
24 the mine were built and no habitat restoration done?

25 A I would not say so, no.

26 MR. YEWCHUK: So I propose to take a little

1 break, Mr. Chairman, to reorganize my papers, and then
2 I'll finish my cross, if that's okay.

3 THE CHAIR: Sure. That's fine. Would you
4 like 15 minutes?

5 MR. YEWCHUK: Perfect.

6 THE CHAIR: Okay. We'll resume at 2:15.

7 MR. YEWCHUK: Thank you.

8 (ADJOURNMENT)

9 THE CHAIR: Okay. Let's carry on,
10 Mr. Yewchuk.

11 Q MR. YEWCHUK: When did Benga start
12 consultation with DFO about the permitting for this
13 project?

14 A MR. HOUSTON: 2051. Yeah, 2015, more or
15 less.

16 Q All right. Does Benga believe it is likely the
17 responsible federal minister will determine this
18 project will cause significant adverse environmental
19 effects?

20 A That's -- that's not up to us to say, Mr. Chairman.
21 We've put forward the best case we can for the project
22 based on the -- the science and -- and the evidence
23 we've been able to collect. It's -- it's not for us to
24 say what the government will determine.

25 MR. YEWCHUK: Can I get Document Number 555,
26 PDF 261? And this should be a little PowerPoint slide

1 prepared by Riversdale. If I scroll -- you scroll down
2 a little for me.

3 Q MR. YEWCHUK: The last box in the step
4 there -- or the last two boxes, what do those arrows
5 marked "likely" and "not likely" mean?

6 A MR. HOUSTON: I -- I guess that's just
7 identifying the -- the pathways that are possible
8 that -- for -- for this project and identifying that
9 it's likely that the final decision will go through to
10 the Governor in Council.

11 Q Does the final decision go to the Governor in Council
12 because the federal minister determines if significant
13 adverse environmental effects are likely?

14 A No. I don't think that's what this graph is saying.
15 It's identifying there are two pathways after the
16 federal minister determ -- makes his determination.
17 And two pathways, one that can go to the Governor in
18 Council, or it can go -- the federal minister can
19 directly issue a -- a decision statement. It depends,
20 I guess, on -- on the findings that the -- the federal
21 minister makes in that penultimate box.

22 Q I apologize. I took you into the legal means on that
23 one. That wasn't a good question.

24 A It's my -- it's my chart, so I need to be able to
25 explain it.

26 Q So Mr. Bettles, when did you start the collection of

1 fisheries data for Benga?

2 A MR. BETTLES: I started collecting data in
3 2016.

4 Q Was Benga collecting fisheries data before that?

5 A Yes, they did.

6 Q When did Benga start collecting their baseline data?

7 A I believe it was, oh, 2014, 2015. Around that time.

8 Q Who was doing the work in 2014?

9 A I can't say. I can't say that.

10 Q Mr. --

11 A Actually -- actually, there's somebody else who could
12 maybe speak to that.

13 Q Sure.

14 A Martin Davies can speak to that.

15 A MR. DAVIES: Sure. I can just add,
16 Mr. Yewchuk, that we started to do baseline work in
17 2014, I believe, on -- on fisheries, but there were a
18 lot of the work -- oh, sorry, am I -- my -- my -- am I
19 back? Okay. Sorry about that.

20 But the -- the -- the fisheries work -- the
21 baseline work in 2014 and 2015 was somewhat limited
22 because there were -- it was difficult to get research
23 licences to do work in these creeks, and that was
24 resolved through 2015, 2016. And that's where, you
25 know, the -- the work really stepped up at that point,
26 in 2016.

1 Q Okay. And what was the purpose of all that work?

2 A MR. BETTLES: Which work are you referring
3 to, Mr. Yewchuk? The 2014, 2015, or the 2016?

4 Q The fisheries baseline work through 2014 through 2016.

5 A Well, I think it was -- it was meant to collect
6 existing condition information in both Blairmore and
7 Gold Creek watersheds to help inform the environmental
8 assessment.

9 Q Was it in order to prepare Benga to submit their
10 environmental assessment and application?

11 A Yes, it was.

12 Q And is starting that early an ordinary part of the
13 process for obtaining project approvals?

14 A Generally it's important to collect data early on in
15 the -- in the process before submitting an application.

16 Q Okay. Is it ordinary for a party to hold meetings with
17 the Department of Fisheries and Oceans about licence
18 conditions before making an initial application?

19 A MR. HOUSTON: I would say that getting early
20 relationship and -- and understanding the challenges
21 and the points that need to be addressed in an eventual
22 application, I think that would be normal.

23 Q Mr. Bettles, have you done other aquatic resource
24 modelling relating to the westslope cutthroat trout?

25 A MR. BETTLES: Yes, I have.

26 Q For which projects?

1 A I've worked on some projects recently with Atrum.

2 Q Was that Elan South?

3 A Yes.

4 Q Okay. How early did you contact DFO about regulatory
5 requirements for Elan South, or how early do you know
6 anyone at Atrum did?

7 A MR. HOUSTON: Mr. Chair --

8 MR. IGNASIAK: Mr. Chair --

9 A MR. HOUSTON: Yeah. Go ahead, Martin.

10 MR. IGNASIAK: Yeah. Again, Mr. Chair, I
11 think we're going beyond the scope of relevance for
12 this proceeding.

13 MR. YEWCHUK: I think the answers to these
14 questions determine the scope of relevance.

15 MR. IGNASIAK: No, I don't think so,
16 Mr. Chair. Atrum -- the Atrum project's not subject to
17 this proceeding.

18 THE CHAIR: How do you think they're
19 relevant, Mr. Yewchuk?

20 MR. YEWCHUK: Whether or not at the Elan
21 South project was subject to this depends on how far
22 along they were in preparing their materials.

23 MR. IGNASIAK: Well, again, Mr. Chair, the
24 Panel's already ruled on the cumulative effects
25 assessment. We're not here to determine what should or
26 shouldn't be included in that assessment. We're here

1 to determine, you know, the public-interest decision
2 with respect to the Grassy Mountain Project.

3 MR. YEWCHUK: I don't think I have a further
4 submission, Mr. Chairman. Would you like me to wrap up
5 on this point?

6 THE CHAIR: Yes, please.

7 Q MR. YEWCHUK: Okay. Mr. Bettles, is
8 baseline data necessary for the application of adaptive
9 management?

10 A MR. BETTLES: I would say yes.

11 Q Okay. Did Benga collect genetic samples of the
12 westslope cutthroat trout who were used in testing
13 their genetic purity?

14 A There was genetic testing done in 2015 in Blairmore
15 Creek, which -- those samples were submitted to
16 Alberta Energy and Parks.

17 Q Alberta --

18 A Environment and Parks, yes.

19 Q So Benga collected the samples in 2015 and sent them to
20 AEP. Benga didn't conduct any of the testing itself?

21 A No. That was a condition of the fisheries research
22 licence with Alberta and -- Environment and Parks to
23 submit them the samples.

24 Q Okay. Did Benga collect genetic samples in any other
25 year, or was it just 2015?

26 A Just 2015.

1 Q Okay. Are you familiar with how hybridization
2 threatens the westslope cutthroat trout?

3 A Yes.

4 Q Okay. Why are barriers that are impassable to fish
5 important to the conservation of westslope cutthroat
6 trout?

7 A Well, the barriers are important because it -- it helps
8 to prevent other non-native species that do hybridize
9 with them to -- to move up and occupy habitats that --
10 that the pure westslope are occupying.

11 MR. YEWCHUK: Can I get part of the enormous
12 Document Number 42? I'm looking for Consultant
13 Report 6 on hydrology. And as I'm sure one of Benga's
14 representatives will correct me, this -- this document
15 was partially replaced with an updated version, but it
16 has a map that I need. PDF page 32.

17 A MR. HOUSTON: Yeah.

18 Q MR. YEWCHUK: I'm not sure. The consultant
19 reports don't have any other number assigned to them
20 that's faster to bring them up, do they?

21 A I -- I go to the file that holds the Document 42 and --
22 and go to the consultant report tab and then go to
23 Consultant Report 6. We're in Document 555 here.

24 THE CHAIR: We need to be in CIAR 42. I
25 think that's what you said.

26 MR. YEWCHUK: Yeah. It's the -- the general

1 environmental impact assessment, Consultant Report 6 on
2 hydrology. It should be a map of the -- the barriers
3 to fish passage on-site.

4 Q MR. YEWCHUK: So if you scroll down to see
5 the legend, the -- the black 'X's are barriers to fish
6 passage. Are these the barriers to fish passage that
7 will be built during the project, or are these the ones
8 that already exist?

9 A MR. BETTLES: Mr. Chair, they -- they
10 already exist.

11 Q So just above Blairmore Creek Tributary 03, is there an
12 impassable barrier to fish moving up Blairmore Creek?

13 A Can you -- can you scroll up on the map? I'm having a
14 hard time. Maybe -- yes, I can see that now.

15 Can you repeat the question, Mr. Yewchuk?

16 Q Just above Blairmore Creek Tributary 3, is there a
17 barrier to fish passage on Blairmore Creek?

18 A Based on our assessment, yes.

19 Q Is your assessment correct?

20 A In our opinion, we feel it's a full barrier.

21 Q Okay. Okay. How genetically pure are the westslope
22 cutthroat trout above that barrier?

23 A Well, they're -- they're less than the 99 percent that
24 some -- requires them to be deemed critical -- species
25 at risk, so they're less than a hundred percent.

26 Q Do you know what percent they are?

1 A I -- that's a -- that's a difficult question. It
2 varies based on the individual fish, but -- and based
3 on the genetics of that individual fish. So I can't
4 say for certain what percentage they are, but it's --
5 it's variable, and there's probably individuals that
6 have obviously less than the 99 percent threshold.

7 Q So does the Department of Fisheries and Oceans assign
8 critical habitat status based on the individual fish or
9 on the general population?

10 A It's my understanding that is based on the population.

11 Q Yeah. So you don't know how genetically pure the
12 population above that barrier is?

13 A Well, I mean, the information that was provided to us
14 by Alberta Environment and Parks based on our 2015
15 samples do indicate that there are individuals that are
16 comprised of hybrids between rainbow and -- and
17 westslope.

18 Q Has there been any genetic purity testing since the
19 2015 stuff that was done with Benga's help?

20 A To my knowledge, no.

21 Q When did DFO determine Gold Creek is critical habitat
22 for the westslope cutthroat trout and Blairmore Creek
23 is not?

24 A To my knowledge, the 2014 recovery strategy for the
25 species was the -- the timing around when Gold Creek
26 was deemed to be a species at risk in critical habitat.

1 Q And there's -- there's a new recovery strategy and
2 action plan, 2019; right?

3 A That's correct.

4 Q Yeah. So why, in your understanding, did DFO make Gold
5 Creek critical habitat and Blairmore Creek no longer
6 has any?

7 A I can't speak for DFO, but through some recent
8 documents I've read from DFO is that DFO defines
9 species of westslope cutthroat -- populations of
10 westslope cutthroat trout as -- pure as being greater
11 than -- or higher than -- or equal or greater than
12 99 percent genetic purity.

13 Q That's my understanding too. I don't -- I don't expect
14 you to have knowledge of what goes on behind the scenes
15 there.

16 So there was critical habitat in Blairmore Creek
17 under the 2014 plan; right?

18 A In the Blairmore --

19 Q Right. In the tributary to Blairmore Creek; right? It
20 was --

21 A Correct.

22 Q -- Blairmore Creek Tributary 04; right?

23 A Correct.

24 Q It's no longer critical habitat?

25 A Based on the 2019 recovery strategy from DFO, that
26 would be correct.

1 Q And that change was because of the genetic information
2 that Benga passed to Alberta Environment and Parks?

3 A Mr. -- Mr. Chair, I'm unaware of how they've come to
4 that conclusion. Not sure exactly where that's come
5 from, but DFO's determined it's not included.

6 Q So the only genetic testing done in between 2014 and
7 2019 was the genetic testing that Benga dealt with?

8 A I can't speak to that, Mr. Chair.

9 Q I thought you just answered that a minute ago. Sorry.
10 I might be misunderstanding you.

11 A MR. HOUSTON: So, Mr. Yewchuk, what I
12 heard -- what I heard him say was that he wasn't aware
13 of any.

14 Q Oh. Yeah. You're right.

15 So -- and as part of your baseline data here, you
16 didn't -- you didn't check? You didn't find any -- did
17 you take any steps to find if other genetic testing had
18 been done in Blairmore Creek?

19 A MR. BETTLES: No, we did not.

20 Q Okay. So, to your knowledge, the westslope cutthroat
21 trout in Blairmore Creek are less than 99 percent pure,
22 but you -- really, between 0 and 99, you -- you don't
23 know?

24 A Well, I mean, based on the 2015 data that was provided
25 to us by Alberta Environment and Parks, there's a broad
26 range of -- of fish that have varying levels of

1 hybridization.

2 Q Is there evidence of new introgression of fish in the
3 Blairmore Creek?

4 A To my knowledge, I don't know.

5 Q So can I get documents -- sorry. Let me -- yeah. This
6 is Number 42. This is the first addendum, Appendix A1,
7 or you can get to this through Number 44, Appendix 1 --
8 Appendix A1. Either one will get you the same
9 document; is that right? And PDF page 63 is what I
10 expect you want.

11 So how many trout -- how many fish were caught in
12 the Blairmore Creek tributaries during the August
13 '14 -- 2014 surveys?

14 A Sorry. I was on mute there.

15 I'm assuming you are referring to Table 4.3.

16 Q I'm referring to the whole page, but yeah.

17 A Oh.

18 Q How many fish did you catch in the tributaries to
19 Blairmore Creek?

20 A Table 4.3 states 107.

21 Q Okay. What does the line beneath that say?

22 A Genetic samples, around 170 of those were collected
23 from captured fish and provided to AEP in support of
24 their -- their mapping program. Do you want me to keep
25 going, or is that --

26 Q Well, now I'd like you to answer again. How many fish

1 did you catch in the tributaries to Blairmore Creek?

2 A Well, there's 107.

3 Q Okay. Now can you read the second sentence underneath
4 that table?

5 A (as read)

6 The majority of the sampled -- the majority
7 of the sampled fish, which is 132, were
8 identified as pure strain.

9 Q And the remaining 38 fish were identified as backcross
10 hybrids?

11 A M-hm.

12 Q Okay. So did you catch 107, or did you catch 170 fish?

13 A Mr. Chair, the -- those -- those fish of genetic
14 samples also included fish probably -- well, we know
15 it's coming from the main stem of Blairmore Creek as
16 well.

17 Q So that 170 number is fish from the main stem of
18 Blairmore Creek and fish from the tributary of
19 Blairmore Creek?

20 A To my knowledge, yes.

21 Q Okay. Now, can I get back to the document we were just
22 in, Consultant Report 6, PDF page 34 at the bottom of
23 the page? Sorry I'm asking you to jump from document
24 to document so much.

25 Now, how many fish did Benga capture in
26 August 2014 in the main stem of Blairmore Creek?

1 A We have a total of 132 based on Table 3.6.

2 Q And in the sentence below that, what does it say?

3 A (as read)

4 Genetic samples collected in August 2014 from
5 170 trout were collected from two sites in
6 Blairmore Creek, which were provided to
7 Alberta Environment and Parks to support
8 their westslope cutthroat mapping program.

9 Q Okay. Now, is that paragraph that we're looking at the
10 exact same paragraph we were looking at in the other
11 document? You can --

12 A Yeah. Yeah. No, it's -- it's fairly accurate.

13 Q Sir, it's fairly accurate. And what is it actually
14 telling me about?

15 A Mr. Chair, I think it's important to -- to point out
16 that not all fish captured wherever we did sampling
17 were -- were samples sent in for genetic analysis.

18 Q So did you send even the fish from the Blairmore Creek
19 tributaries for genetic analysis?

20 A Mr. Chair, given the -- the Blairmore Creek tributary
21 in question, BCT04, is away from the mine. To my
22 knowledge, that -- that tributary was not sampled
23 specifically for hybridization.

24 Q Can we jump back to the other document we were just
25 looking at? So do you see Blairmore Creek Tributary 4
26 on there? Actually, 4A and 4B?

1 A I do.

2 Q Right. So were those fish taken for genetic samples?

3 A The hundred -- I -- I think it's important to point
4 out, Mr. Chair, that the genetic samples is a separate
5 issue -- or separate component to the actual sampling
6 that we did. I wouldn't -- I wouldn't say that that
7 statement below Table 4.3 is associated with the
8 table -- the text below that.

9 I think the -- the previous document that,
10 Mr. Yewchuk, you've referred to identifies that there
11 were two sites collected in Blairmore Creek that did --
12 that samples were collected for genetic analysis.

13 Q So you -- how many total samples did Benga send
14 Alberta Environment and Parks for genetic testing for
15 Blairmore Creek?

16 A I think it's clear in the -- the document, Mr. Chair,
17 that we submitted 170 samples in 2014, and those were
18 identified as -- 132 then identified as pure strain and
19 38 were not.

20 Q So you didn't send any of the trout from Blairmore
21 Creek tributaries for genetic sampling?

22 A To my knowledge, we sampled from two locations in 2014,
23 and those two locations were, I believe, on Blairmore
24 Creek main stem. That was before my time. But my
25 understanding is from two locations.

26 Q Can I get the other document we were on a moment ago?

1 A I just correct myself. It was actually, I believe,
2 five sites, not two sites.

3 Q So the five sites would be the five tributaries?

4 A I would not say that that's the case.

5 Q There's two sites listed for the main stem and five
6 sites for the tributaries.

7 A You're -- you're -- I think you're getting confused,
8 Mr. Yewchuk. As I said before, we did fish sampling on
9 tributaries and the main stem, but that doesn't -- that
10 doesn't mean that we sent all samples from every site
11 that we sampled for genetic analysis.

12 Q Benga did not -- so did Benga send the Blairmore Creek
13 main stem samples or the Blairmore Creek tributary
14 samples or both?

15 A Mr. Chair, I think it's important to point out that the
16 whole purpose of the genetic sampling is to understand
17 its -- its purity and -- and whether or not
18 hybridization is there and if it's -- at what -- at
19 what level. I don't think it -- it matters whether
20 it's a tributary or the main stem. I think the point
21 is is that there's hybridization above this known
22 obstruction, and, you know, fish freely move, what have
23 you, and -- and -- and that's -- what we have is we
24 have a hybrid population above -- above the barrier.

25 Q Based on an amount of genetic sampling that you're not
26 sure about from locations you're not sure about?

1 A Well, that's -- that's not true. We collected from
2 multiple sites where we did work in Blairmore Creek,
3 and those sites were sent -- those samples were sent in
4 for genetic analysis based on the fisheries research
5 licence that was issued to -- to -- to Benga.

6 Q Which sites?

7 A MR. HOUSTON: Mr. Chair, I think Mr. Bettles
8 has been fairly clear on this. And, first of all, this
9 sampling -- the genetic sampling was done by somebody
10 other than Mr. Bettles. It was done from multiple
11 sites. 170 fish -- or tissue samples were sent to
12 Alberta Environment and Parks. I think that's the
13 relevant information here.

14 Q So the -- the paragraph below these two tables, this
15 one in this document -- table and the other one, would
16 Benga agree that you -- you just copy/pasted that
17 paragraph that was initially about the main stem
18 under -- in the main stem in the first document under a
19 table that was above the tributaries in the second
20 document?

21 A I -- Mr. Chairman, I -- I -- I think Mr. Yewchuk has
22 captured the issue here. This -- this part of the
23 report is -- is about 2014 fish surveys. This section
24 contains a table that talks about westslope cutthroat
25 trout captured in tributaries, and it contains a
26 paragraph about genetic sampling. The two aren't --

1 they're -- they're juxtapose -- they're -- they're
2 adjacent to each other in the text, but -- we're not
3 trying to imply that the 170 samples were taken from
4 the tributaries. They're two separate parts of that
5 section of the document.

6 Q What is Benga's most recent estimate for the number of
7 westslope cutthroat trout in Gold Creek and Blairmore
8 Creek?

9 A MR. BETTLES: Just give me a second,
10 Mr. Chair. I'm just going to pull up a document.

11 A MR. HOUSTON: Careful. We're not estimating
12 the total number of fish.

13 Q You may have been supposed to be on mute.

14 A It happens from time to time, Mr. Yewchuk.

15 Q Yeah. I'm actually surprised it hasn't happened more,
16 given how much we've got to click on and off in this
17 thing. Actually, that answers a lot of questions.
18 That saves time.

19 A MR. BETTLES: I'm still trying to find the
20 document here that he's trying to ...

21 So, Mr. Yewchuk, you're looking for most recent
22 2020 information?

23 Q As recent as possible.

24 A So can you just repeat the question one more time for
25 me just so I make sure I give you the -- the accurate
26 estimate.

1 Q What is Benga's most recent estimate for the number of
2 westslope cutthroat trout in Gold Creek and Blairmore
3 Creek?

4 A Based on our most recent information in -- collected in
5 2020, for Blairmore Creek, we've -- based on snorkel
6 surveys, we've estimated around 285 in visuals at index
7 sites. And then obviously at Gold Creek, 2020 was --
8 is 55 index sites. But when you add up the non-index
9 sites for Gold Creek with the index sites, your numbers
10 are much higher. So Gold Creek you're looking at
11 approximately a density of around 14.3 fish per
12 kilometre, which works out to about -- about an
13 estimate of around 215.

14 Q Was Benga careful not to estimate the total number of
15 trout in west Gold Creek and Blairmore Creek?

16 A Sorry. Can you repeat that part of your -- I didn't
17 understand part of your question.

18 Q Did Benga estimate the total number of trout in
19 Blairmore Creek and Gold Creek?

20 A Mr. Chair, we -- we've been doing ongoing monitoring
21 over the last number of years to -- to track and --
22 and -- and monitor the -- the populations of -- of --
23 of the westslope in both systems.

24 Q But you didn't generate estimates of total population?

25 A We did in 2016.

26 Q So how many were there in 2016, then?

1 A If you -- if you go back to our -- our technical
2 baseline report from 2016, the mark-recapture estimate
3 was around 1,600 in -- in Gold Creek.

4 Q 16 -- 1,625 and 3,210 in Blairmore; is that correct?

5 A That -- from 2016.

6 Q Yeah. And there's no comparable estimate for 2020?

7 A Mr. Chair, I think it's important to -- to recognize
8 that -- that the mark-recapture we did in 2016 was --
9 was -- was an individual estimate that we made and that
10 through the work that we've collect -- done over the
11 last number of years and seeing some -- some
12 differences in -- in numbers from year to year that
13 we've -- we've expanded our surveys to a broader area
14 within both systems to -- to get a better sense of
15 where these fish are. So I would argue that our -- our
16 estimates through the snorkel surveys we've done since
17 2016 are -- are a reasonable estimate of -- of the --
18 of the numbers of fish in those systems, and I would
19 argue that they're -- they're -- they're conservative.

20 A MR. HOUSTON: Mr. Chair, if I could just add
21 a little bit to that. And I've -- I've been learning
22 in this area as -- as well as you've been, going
23 through this -- fish surveys.

24 So my understanding of the process is that the --
25 the surveyors identify index sites. So they don't
26 survey the entire creek; they survey specific reaches

1 of the creek snorkeling. And the idea is to compare
2 year over year in those pre-identified spots how the
3 population is -- is changing.

4 What we've noticed, and especially after the
5 dramatic reduction in counts from 2016, we've
6 determined that perhaps we need to look further afield.
7 And so we've, over the years, been surveying longer and
8 longer sections of the creek, but we -- we still do not
9 do an exhaustive survey of the creek when we go out to
10 do these snorkel surveys.

11 Q Did you do an exhaustive survey in 2016?

12 A MR. BETTLES: Mr. Chair, we -- we assessed
13 based on what we felt was appropriate at the time. And
14 I think the numbers of fish that we saw reflect that.
15 And it's a standard protocol methodology that we
16 applied for -- for monitoring westslope in these
17 systems, particularly species at risk.

18 Q And whatever you did in 2016, it allowed you to produce
19 an estimate of the total number of trout?

20 A MR. HOUSTON: One minute, Mr. Chair.

21 A MR. BETTLES: So, Mr. Chair, in 2016 we --
22 we did execute a mark-recapture program that we -- we
23 felt was -- was appropriate. It's been -- we wanted to
24 make sure that the stress of the fish were -- was
25 minimized. The approach that was put forward was --
26 was discussed and approved with regulators at the time.

1 We -- we that executed program. And since then --
2 since that, we've been continuing on with -- with our
3 snorkel program to -- to minimize stress on the fish
4 and the systems using -- using acceptable standard
5 protocol for snorkeling. When we started seeing the --
6 the numbers of fish decline in subsequent years, we
7 expanded our surveys beyond the index sites in -- in
8 the systems to -- to cover more length of habitat
9 throughout both Gold Creek and -- and Blairmore Creek.

10 Q Why didn't Benga do more mark-recaptures?

11 A I think, Mr. Chair, part of the reason for that is --
12 is, again, as I had mentioned earlier, was just to
13 minimize the stress on the fish. There's -- there's a
14 lot of stress in terms of actively handling and
15 capturing these fish to -- to mark and capture them and
16 recapture them and what have you; and given the
17 sensitivities of the Gold Creek population and given
18 the -- the dialogue we had with regulators at the time,
19 it was deemed that we wanted to be responsible and do
20 the right thing and use snorkeling as our -- our -- our
21 means of primarily monitoring and -- and tracking the
22 fish. And that's --

23 Q You --

24 A Go ahead. Sorry.

25 Q Sorry. I cut off the end of your -- your response
26 there. If you --

1 A I'm done. Thank you.

2 Q All right. Did DFO tell you you couldn't do mark and
3 recapture anymore?

4 A No.

5 Q Did you apply for licences to do mark and recapture
6 again?

7 A MR. HOUSTON: So -- so, Mr. Chair, I think
8 what -- what I've heard Mr. Bettles say is that in
9 2016, we did an extensive program, mark and recapture,
10 and we did snorkel surveys, identifying and -- these --
11 these index sites. And every year since then we've
12 been back to do snorkel surveys as a means of gauging
13 how the population was changing year over year.

14 I -- we -- we wouldn't want to do mark and
15 recapture surveys every year because it does create a
16 stress for the fish and -- and, quite frankly, the --
17 the -- the need is not there. We did it once, we
18 learned what we learned, and we're using the snorkel
19 surveys as -- as a year-over-year gauge of how the
20 population is varying with time.

21 Q Mr. Houston, did you get caught on a hot mic a moment
22 ago saying something along the lines of, Careful that
23 we are not estimating the total number of trout?

24 A Exactly. What we're doing is we're doing snorkel
25 surveys at index sites and using -- so -- so I wanted
26 to be clear that we're not counting every fish in the

1 stream, that we're comparing index sites year over
2 year. What we learned from that -- and when we saw the
3 dramatic fall in the population from 2016 to subsequent
4 years, what we learned from that is that maybe the fish
5 are just moving from the index sites. And so we -- we
6 extended our -- our surveys to cover more of the
7 streams. But we're still not covering the entire
8 streams. So even though in -- in the areas we're --
9 we're looking, the population seems to be 10 percent or
10 20 percent of what it was in 2016, and -- and we
11 measure that on a fish-per-kilometre basis to get a
12 comparable number year from year.

13 I -- I think it's wrong to take that
14 fish-per-kilometre number and multiply it by the number
15 of kilometres of stream length. So I -- I think that's
16 the point that we are getting an indication of the
17 change in population from year to year but not -- not
18 an absolute count.

19 MR. YEWCHUK: Can I get Document Number 42,
20 the first addendum, Appendix A1? I think we were in
21 this one a moment ago. So -- yeah, the addendum -- the
22 aquatic ecology effects assessment. Looking for
23 Table 4.12. 73. Sorry. Seven three. Okay. And
24 scroll down a little bit. 4.12.

25 Q MR. YEWCHUK: Now, this was your 1,625 and
26 3,210 estimates for Gold and Blairmore in August 2016;

1 right?

2 A MR. HOUSTON: That's right.

3 Q Okay. Why do some reaches appear in this table more
4 than once?

5 A Well, we're sometimes doing angling, sometimes doing
6 electrofishing.

7 Q So were you trying to count every fish in Reach 7?

8 A MR. BETTLES: Mr. Chair, we're trying to --
9 to get a -- we're trying to get a -- an estimate of --
10 of -- based on habitat type. And in some habitats you
11 have to angle, and some habitats you have to
12 electrofish to -- to gather different -- class --
13 different size of fish use different habitats. And
14 some habitats you just can't electrofish them, and
15 other parts you just can't angle.

16 Q So for Reach 7 did you angle or electrofish?

17 A We did both.

18 Q You did both. Which one did you use to get your total
19 population estimate?

20 A Give me a second, Mr. Chair.

21 Mr. Chair, these are the -- the -- the estimate of
22 fish density per reach based on -- on sampling method.
23 That's all that this -- this table is -- is showing us
24 right now.

25 Q Okay. What does that total -- fish total 1,625 mean?

26 A Mr. Chair, that is an estimate using the mark-recapture

1 process that we applied here that -- that is an
2 estimator which give -- gives us the output of the
3 1,620 fish.

4 Q So the first row is how many fish were estimated to be
5 in Reach 7 based on angling; right?

6 A That is correct.

7 Q And the second row is how many fish were estimated
8 being in Reach 7 based on electrofishing?

9 A That's correct.

10 Q Okay. So what is your estimate of how many fish were
11 in Reach 7?

12 A Mr. Chair, when we -- we did the mark-recapture, the
13 estimate that we gave was an estimate for all of Gold
14 Creek. So the numbers you see here for Reach 7, based
15 on an angling and electrofishing, are -- are -- are
16 presented in the table.

17 Q Okay. Did you accidentally sum the quantity of fish
18 estimated for Reach 7 based on angling with the
19 quantity of fish based on electrofishing to give you a
20 total number that doesn't represent anything?

21 A MR. HOUSTON: Mr. Chair, the whole point of
22 the -- the tag-and-release process is that if you catch
23 a fish twice, you don't count it twice. So we used
24 angling, as Mr. Bettles mentioned, in places where you
25 can't use electrofishing. We used electrofishing in
26 other places in the creek.

1 We didn't double count fish because we had
2 previously tagged them, and that -- and that helps us,
3 you know, if -- if a fish swam from one area to the
4 other, we -- we would say, Oh, we've already caught
5 this fish. So we -- we didn't double count.

6 And so the -- the total fish here are the total
7 fish that we caught in Reach 7, 8, and 9. And then the
8 density of fish is -- is a calculation of density based
9 on the length of those reaches.

10 Q Mr. Bettles, is that correct? Did you catch 1,625 fish
11 and pulled them up out of Gold Creek in 2016?

12 A MR. BETTLES: Based on the electrofishing
13 that we did in Reach 9 -- well, throughout Reaches 7,
14 8, and 9, Mr. Chair, that's the numbers that we
15 collected.

16 Q And --

17 A That's -- yeah, that's correct. Sorry.

18 Q Okay. So I had assumed that you picked a site,
19 measured out the size of it, and then just
20 electrofished it to get an average for that section of
21 the reach and then used that number to calculate a fish
22 density and get a guess at total fish. That's not how
23 this worked at all.

24 A This density was determined by dividing the total
25 number of fish observed through the snorkel surveys or
26 captured through angling or electrofishing by the

1 survey length, and that's what the density estimates
2 have given you. It's based on the total number of
3 fish.

4 Q So if you scroll up on this page -- now, that's --

5 MR. YEWCHUK: Mr. Chairman, can I get about
6 five minutes to look at this? I'm -- I'm a little
7 stumped, and I'd appreciate a moment before I have
8 to -- have to figure out if this is worth asking more
9 about -- asking more about this.

10 THE CHAIR: Sorry. I was muted.

11 Yeah, let's take a five-minute break.

12 MR. YEWCHUK: Okay. Thank you,
13 Mr. Chairman.

14 (ADJOURNMENT)

15 THE CHAIR: Okay. Go ahead, Mr. Yewchuk.

16 A MR. HOUSTON: Mr. Chair --

17 THE CHAIR: Yeah.

18 A MR. HOUSTON: -- we've been discussing
19 the -- the last few answers about this
20 mark-and-recapture program, and -- and I think it's
21 worthwhile to review that and -- and discuss what --
22 what that mark-and-recapture program is, the process,
23 so that everybody can understand the numbers in these
24 tables.

25 So Mr. Bettles is going to just say a few words
26 about that.

1 A MR. BETTLES: Thank you, Mr. Houston.

2 So just to -- just to clarify, a mark-recapture --
3 we broke out our population estimates into two
4 different approaches, relative abundance and then
5 mark-capture, which focused on the subadult/adult-size
6 class, and we used a combination of angling and
7 electrofishing techniques to capture the fish and
8 snorkeling as the recapture method. And this was an
9 approach that was -- it was scoped, and it was put
10 together and -- and run through with -- with the --
11 with the agencies at the time, and that's what we
12 applied in this.

13 And then we -- so we would -- we'd capture the
14 fish, we would -- we would mark them, and then we would
15 release them, and then we would try to recapture them.
16 Then we would then, based on the -- the marking number
17 of fish and the recaptured number of fish, we would use
18 a calculation that would estimate the population.

19 So a couple of numbers that -- that came up in a
20 table earlier that -- that Mr. Yewchuk had raised were
21 actually not the total number of fish that we actually
22 captured, but estimates.

23 Q MR. YEWCHUK so on that Table 4.12 -- we
24 can pull it up again if you'd like to look -- did you
25 double count Reach 7 in Gold Creek and Reaches 3 and 4
26 in Blairmore Creek?

1 A And pull up the table again, please.

2 Q Because the way I'm seeing this, you did an estimate of
3 how many fish were in Reach 7 based on your angling
4 results; then you did an estimate of how many fish were
5 in Reach 7 on your electrofishing --

6 A M-hm.

7 Q -- results --

8 A Yes.

9 Q -- and you --

10 A So as a --

11 Q -- summed them?

12 A So, Mr. Chair, just to -- just to clarify, when we're
13 electrofishing and angling, we're -- we're sampling
14 different habitats. So, yes, the fish moved. These
15 are not closed systems. But generally, given the
16 habitat types and the size of fish you would generally
17 be encountering, there's not a -- there may be some
18 double counting but very little, I would -- I would
19 say, is -- is being double counted because of the
20 different habitat types that you're -- you're targeting
21 with the -- the method of sampling.

22 Q So how large was the portion of Reach 7 that you
23 estimated using angling, and how large was the portion
24 you estimated using electrofishing?

25 A Well, that's the reach length that was sampled.

26 Typically with the electrofishing, we're -- we're

1 sampling around 300-metre lengths per Alberta --
2 Alberta standards. And then the angling is based on
3 areas that are opportunistic for angling. So it's not
4 entirely reflected that the whole 2,874 metres was
5 actually sampled for angling. That's the reach length.
6 And that -- based on the number of fish we caught
7 through angling, the density estimate was calculated
8 based on the length -- overall length of the reach.

9 Q Okay. So how do you get to the total fish number on
10 the end? Since you didn't actually catch all those
11 fish, that was generating an estimate; right?

12 A MR. HOUSTON: So, Mr. Chair -- and maybe
13 this helps to have this from a non -- non-specialist in
14 the area because I -- I've -- I've been trying to
15 understand it as well.

16 So my understanding is you -- you go out and you
17 angle or you electrofish, and you capture a certain
18 number of fish, you mark them, and then you go back out
19 and do that again. And you capture another quantity of
20 fish, and you note that a percentage of those have been
21 marked. You use that percentage to estimate what the
22 total population of that reach is.

23 There's a broad assumption in these numbers that
24 the fish that are in the angling areas don't generally
25 migrate to the fish that are -- to the areas that
26 are -- are suitable for electrofishing. And -- and

1 that's based on the -- the desire of certain fish at
2 certain stages to be in pools instead of swimming along
3 a 300-metre reach of the -- the stream.

4 So the -- the -- the system's not perfect; there
5 may be some double counting, but it's -- it's the --
6 the way it's done.

7 Q Can I get Document Number 843? And this should be
8 Benga's recent westslope cutthroat trout population
9 data, if it is the correct document.

10 And I think this one you'll agree too because
11 we've discussed this already. The westslope cutthroat
12 trout in Blairmore Creek dropped by about 60 percent
13 from 2016 to 2017?

14 A I've not done the math, but in that order of magnitude.

15 Q Okay. And --

16 A And, again -- again, that's based on snorkel surveys at
17 index sites.

18 Q Yeah. And the westslope cutthroat trout in Blairmore
19 Creek dropped by about 90 percent from 2016 to 2017?

20 This is PDF 2. Thank you.

21 A So I think you've got those backwards, Mr. Yewchuk. In
22 Gold Creek, the population at the index sites dropped
23 90 percent; and in Blairmore Creek, it dropped
24 60 percent.

25 Q Right you are. That is backwards.

26 And can we go to PDF page 5? And, Mr. Bettles,

1 why did you add the additional sites to the index
2 sites?

3 A MR. BETTLES: Mr. Chair, we've -- since
4 2016, we started to -- as I mentioned earlier, we've
5 expanded our -- our survey within those systems, in
6 particular Gold Creek, to -- to survey more of -- of --
7 of the system through snorkeling. Because of the --
8 the index sites monitoring that we commenced in 2016,
9 the numbers weren't there. And so we wanted to get a
10 better handle of what was actually in the system, which
11 required us to -- to be more exhaustive in -- in
12 checking out the entire -- most of the other areas.

13 So the -- the Table 2 combines the index sites
14 plus the additional area we've -- we've covered over
15 the last few years.

16 Q Does the addition of the index sites give the
17 impression that there are more westslope cutthroat
18 trout in those years?

19 A MR. HOUSTON: So -- so, Mr. Chair, I --
20 Mr. Chair, again, when we saw the drop in the numbers
21 from 2016 to 2017 at the index sites, having only a few
22 years of data and seeing that magnitude of drop, I
23 think it was reasonable for us to extend our -- our
24 sites and to look at a greater length of the -- of the
25 creeks.

26 Nonetheless -- and -- and when you do that, you

1 can't compare absolute numbers of fish because
2 you're -- you're looking now at a -- at a longer length
3 of the stream.

4 So we -- we tried to compare based on the fish per
5 kilometre as -- as a broad number that will help us to
6 look at the -- the -- to compare year over year.

7 And so if you look at the westslope cutthroat
8 trout per kilometre number, Year 2016 -- and I'm
9 looking at the very right-hand column of that table --
10 you see, again, a -- a very significant change of --
11 from 2016 to 2017. So even with the broader surveys,
12 we -- we saw quite a substantial change.

13 And the -- the comparison between the index sites
14 and -- and the extended surveys varies year over year.
15 But I -- I -- I think what's important here is the
16 dramatic drop from 2016 to the other years.

17 Q When do you think the westslope cutthroat trout
18 population started dropping?

19 A Well, according to the information we've been able to
20 gather, it happened after Year 2016. We -- we can't
21 say what the population was in Year 2014 or '15 because
22 we don't have the data.

23 Q So you don't know if the population was stable up until
24 2016?

25 A No.

26 Q You don't know if it was falling for decades before

1 2016? You just --

2 A No.

3 Q -- don't have any idea about that?

4 A Nobody really knows, Mr. Chair. And this is the first
5 real data collected on -- on these -- on this stream.

6 Q So what do you think causes the population drop from
7 2016 to 2017?

8 A Again, Mr. Chair, we can't be certain about that.
9 Again, not having a -- a comprehensive database, we --
10 we can say that the numbers dropped. 2016 was a
11 particularly dry year, and -- and so one could
12 speculate that that drought had -- had an effect.

13 Q So you think that a drought year might put a 90 percent
14 dent in Gold Creek of westslope cutthroat trout
15 populations?

16 A Mr. Chair, we -- we -- in my opening statement this
17 morning, we talked about some of these sections of the
18 creek that absolutely dry up during a drought year.
19 The fish between those impassable spots will -- and
20 especially to the extent that there's very little water
21 in the creek, will have trouble finding adequate
22 habitat, and especially for overwintering.

23 So -- but, again, Mr. Yewchuk, Mr. Chair,
24 that's -- you know, we're -- we're presuming something
25 without sufficient data to -- to demonstrate it. If we
26 collect data and see the population recover back up

1 at -- to these levels and -- and then see the range of
2 natural variability in the fish population -- but
3 that's going to take a few more years of data
4 collection.

5 Q Was Benga doing much work on the Grassy Mountain site
6 in 2016?

7 A No. Very little environmental surveys primarily.
8 Possibly a little bit of drilling.

9 Q Bit of drilling.

10 Benga electrofished in Gold Creek and Blairmore
11 Creek in 2016?

12 A That's correct.

13 Q They marked the fish that they caught?

14 A Yes, that's right. Yes.

15 Q How do you mark them?

16 A Mr. Bettles, how do we mark them?

17 A MR. BETTLES: We used a method of -- it's
18 called a "VIE", which was approved by the regulators,
19 which is basically putting a little bit of dye around
20 the eye of a fish that you would then use a light to
21 detect, or you would do adipose fin clipping of fish.
22 Because at the time, the -- it was -- it was hard to --
23 to detect the VIE in the fish, so the -- the regulators
24 gave us approval to use fin clipping.

25 Q How many fish did you take a fin clip from?

26 A Give me one second, Mr. Chair.

1 So, Mr. Chair -- you want to tell him? Go ahead.

2 A MR. HOUSTON: Mr. Chair, we don't have the
3 specific number here, but I could tell you it wasn't
4 90 percent of the population.

5 Q What stream does the end-pit lake ultimately drain
6 into?

7 A Mr. Chair, the end-pit lake is currently designed to
8 decant into the saturated backfill zone, and eventually
9 that water will end up in Blairmore Creek.

10 Q Okay. Did the plan for the end-pit lake change since
11 the project was first proposed?

12 A We had proposed an option in the original application
13 to have some of the end-pit lake water decant into Gold
14 Creek. We heard about that this morning. That option
15 was basically set aside after we did the detailed
16 instream flow needs assessment of Gold Creek in -- in
17 2016, which was filed in 2017.

18 Q Is the end-pit lake -- sorry. Is Benga planning to
19 stock any fish into the end-pit lake?

20 A No.

21 Q Why not?

22 A Mr. Chair, we're not -- there's no need to stock fish
23 in the end-pit lake.

24 Q Were westslope cutthroat trout short on habitat?

25 A Yeah. Mr. Chair, I'm not sure stocking a few fish in
26 an end-pit lake is going to change the situation for

1 the westslope cutthroat trout.

2 Q Patching up a couple streams will?

3 A Mr. Chair, we've talked about Gold Creek. There is a
4 population of westslope cutthroat trout in Gold Creek.
5 If we want that population to persist and thrive,
6 something needs to be done there.

7 Q What would happen if you tried to stock westslope
8 cutthroat trout in the end-pit lake?

9 A I have no idea, Mr. Yewchuk.

10 Q What about the rest of the panel? Some of you are
11 experts on water quality and --

12 A Mr. Chair, we're -- we're not planning on stocking
13 westslope cutthroat trout in the end-pit lake.

14 Q I understand that. What would happen if you tried it?

15 A It -- okay. It's a hypothetical question, Mr. Yewchuk.

16 Q The whole project's hypothetical. You haven't built it
17 yet.

18 A Yeah. And -- and -- and even if we do, we're not
19 planning on stocking westslope cutthroat trout in the
20 end-pit lake, so I ...

21 Q If somebody grabs a westslope cutthroat trout in a
22 bucket and dumps it into the end-pit lake, would it
23 live, or would it die of selenium poisoning?

24 MR. IGNASIAK: Mr. Chair, I think

25 Mr. Houston's answered this, and the fact is Benga

26 hasn't assessed this. So I don't think it's fair to

1 ask the witnesses to now, on the stand, on the spot, to
2 make assessments of that nature.

3 Q MR. YEWCHUK: Has Benga assessed how much
4 selenium is going to be in the end-pit lake?

5 A So, Mr. -- Mr. Chair, we've assessed in great detail
6 the effects of selenium on westslope cutthroat trout or
7 other aquatic biota in Blairmore Creek and -- and in
8 Gold Creek based on science, based on what we know
9 about the water quality that will exist in those creeks
10 once the project starts. We have not assessed the
11 effects of -- of -- or the viability of westslope
12 cutthroat trout in the end-pit lake simply because it's
13 not something we are intending to do.

14 Q Would it be safe for waterbirds to nest and live on the
15 side of the end-pit lake? Would the birds be able to
16 lay eggs that produce new birds?

17 A Mr. Chair, that's -- that's a question that might best
18 be pushed over to the session on wildlife and human
19 health.

20 Q Okay. Sounds good to me.

21 That wraps up my questions. I have hopefully come
22 in a little faster than expected. I agreed to leave a
23 couple issues for Mr. Secord. If it goes a touch over
24 time, that's my fault. Thank you for your time, panel.

25 MR. YEWCHUK: Thank you, Mr. Chairman.

26 THE CHAIR: Thank you, Mr. Yewchuk.

1 It's 3:30. I didn't want to go too late today,
2 but a question for Mr. Secord if he's here.

3 MR. SECORD: I'm here.

4 THE CHAIR: Or Ms. Okoye.

5 Mr. Secord, would you be interested in starting
6 your cross and going for, you know, maybe 45 minutes or
7 so and taking a break, or would you prefer to start in
8 the morning?

9 MR. SECORD: I think it would be good to
10 start now. And I notice Mr. Yewchuk only used up four
11 of his five hours. There were some climate change
12 questions that were not answered, so I might ask, sir,
13 if we could start now, and I might borrow some of
14 Mr. Yewchuk's unused time. Because I do think I'm
15 going to need it all. If -- I mean, obviously if I get
16 done sooner, great, but that -- I would say let's use
17 the time now, and what we would then -- what, stop at
18 4:15? Is that what you are suggesting?

19 THE CHAIR: Yeah, sometime, you know, a
20 little after 4. It doesn't have to be exactly 4 or
21 4:15, but I don't want to go too late, so certainly
22 before 4:30.

23 MR. SECORD: Okay. But I'm -- yeah, I'm
24 happy to start -- happy to start now if that's
25 agreeable, unless you -- unless the court reporter
26 needs a break.

1 THE CHAIR: Would you like to take a short
2 break? Yes, I'm getting a nod. So let's take ten
3 minutes, and then -- and then we'll start.

4 MR. SECORD: Thank you.

5 (ADJOURNMENT)

6 THE CHAIR: Okay. You can go ahead,
7 Mr. Secord. And, yeah, if you can kind of look for a
8 spot to break, you know, 4:15 to 4:30-ish, that would
9 be great.

10 MR. SECORD: Thank you very much.

11 Mr. Secord Cross-examines Benga Mining Limited

12 Q MR. SECORD: Good afternoon, panel. My
13 name is Richard Secord. I am counsel for the Coalition
14 of the Alberta Wilderness Association and the
15 Grassy Mountain Group.

16 Now, I take it you can confirm that SRK Consulting
17 (Canada) Inc. did a groundwater numerical model in 2016
18 attached as Appendix C to CR Number 3 in CIAR
19 Number 42?

20 A MR. HOUSTON: That's correct.

21 Q And is it agreeable if we refer to SRK Consulting
22 (Canada) Inc. as "SRK" in this cross-examination?

23 A I -- I think they'd be okay with that.

24 Q Now, Mr. Soren Jensen, did I hear it correctly that you
25 were introduced as covering the area of hydrology?

26 A MR. JENSEN: Yes. I will speak to the

1 aspects of hydrology but not hydrogeology.

2 Q But you're not a hydrologist?

3 A I'm an -- I'm an environmental engineer.

4 Q Right. I noticed you had a -- you got a BSc in zoology
5 in 1977 from the University of Manitoba; correct?

6 A Mr. Secord, no, that's not correct. I was three years
7 old at the time.

8 Q Okay. If we could turn up your CV, which I believe is
9 in Exhibit 571.

10 THE CHAIR: Did you have a PDF page
11 number, Mr. Secord?

12 MR. SECORD: I'm just getting -- I believe
13 it's 209.

14 Q MR. SECORD: So I have you as having a --
15 sorry. I have you as having a BA -- bachelor of
16 science, is it, from the UBC?

17 A No, it's bachelor of applied science.

18 Q Bachelor of applied science? And then you got a --

19 A Which is in engineering.

20 Q And then you got an MA from McGill; correct?

21 A That's correct, yes.

22 Q And I noted in your CV that one of your specializations
23 is water quality and contaminant transport modelling;
24 correct?

25 A That's correct.

26 Q Okay. And have you been involved in -- in previous

1 Joint Review Panel hearings as an expert witness?

2 A No, I have not. This is my first appearance before a
3 Joint Review Panel.

4 Q Okay. Mr. Stephen Day, I understand you were -- you
5 were introduced as covering the area of geochemistry
6 earlier today; is that correct?

7 A MR. DAY: Yes, sir, that's correct.

8 Q And I notice also in your CV that you have expertise in
9 the modelling of leachate chemistry?

10 A That's correct, yeah.

11 Q And you have been -- it looks like you've got a -- you
12 have an MSc in geochemistry from UBC and also a BSc in
13 geology from UBC; correct?

14 A Yeah. That's right.

15 Q Right. And are you located in British Columbia as we
16 speak?

17 A I am, yes.

18 Q And how about you, Mr. Jensen, where are you located as
19 we sit here today?

20 A MR. JENSEN: You mean --

21 Q Physically.

22 A Mr. Secord, you mean physically today? I'm --

23 Q Yeah.

24 A I'm in Calgary.

25 Q Okay. All right.

26 MR. SECORD: If we could please turn up

1 Consultant's Report Number 3 in CIAR 42 at PDF page 12.
2 This is the Millennium hydrogeology report. That's
3 PDF 12. Okay. Section 3 point -- Section 3.2. That's
4 great.

5 Q MR. SECORD: So it states here under the
6 "MEMS Field Investigation": (as read)

7 The hydrogeological data collection program
8 consisted of [at first bullet] drilling and
9 installing 19 monitoring wells targeting
10 either one of three coal seams across the
11 project or the upper water table at the CHPP
12 and near a future rock disposal area/water
13 management pond in Blairmore Creek.

14 Do you agree that the impacts associated with the mine
15 development on the groundwater are predicated on the
16 SRK numerical model developed using site data?

17 A MR. HOUSTON: So, Mr. Secord, I guess I'm
18 not really clear on what you're asking there. Are
19 you -- you asking if the groundwater information we
20 collected through these field investigation programs
21 are predicated on our estimate of future rainfall or
22 future hydrological climate? I'm not quite sure what
23 you're asking.

24 Q Do you agree that the impacts associated with the mine
25 development on the groundwater are predicated on the
26 SRK numerical model developed using site data?

1 A Okay. I -- I --

2 Q That might be better for the SRK witnesses.

3 A Well, this report was done -- you've taken us to this
4 report. It was done by Millennium.

5 Q Yeah.

6 A And -- and this particular part talks about drilling
7 and -- and water sample collections. I was just trying
8 to -- having trouble making the connection.

9 Q Well, maybe if you looked at the entire report,
10 Mr. Houston, you would see that Appendix C attaches the
11 SRK modelling results. So although it's a Millennium
12 report, it attaches the SRK numerical modelling
13 results; correct, as Appendix C?

14 A So that's correct, but I -- I guess I was confused by
15 going to this 3.2 and -- which is talking about
16 collecting data.

17 Q Right. So -- so do you agree that the impacts
18 associated with the mine development on the groundwater
19 are predicated on the SRK numerical model developed
20 using site data? And put more -- and put more
21 explicitly, this is derived from only 19 monitoring
22 wells, some of them dry?

23 A So I'm going to ask Ms. Grainger to respond to your
24 question.

25 A MS. GRAINGER: Mr. Secord, the groundwater
26 assessment was based on site data in part; but as is

1 listed immediately above Section 3.2 and Section 3.1,
2 there's a lengthy list of information that was used to
3 inform and undertake the groundwater assessment.

4 Q Sure. But in terms of the SRK modelling, I take it the
5 dataset that it had consisted of 19 monitoring wells,
6 some of them dry. That's the dataset that was given to
7 SRK for the model.

8 A That's a portion of the dataset, but that's not the
9 complete dataset.

10 Q But in terms of the dataset that consists of monitoring
11 wells, the entire dataset consisted of only
12 19 monitoring wells, some of them dry. Do I have that
13 right?

14 A Monitoring wells, that would be correct. There's other
15 information, but just monitoring wells, there were only
16 19, correct.

17 Q So given the size of the project area, over 1,500
18 hectares or 3,706 acres, and given the complexity of
19 the hydrogeology, can you tell me how this can possibly
20 capture the variability to produce adequate model
21 projections? And maybe that's a question for SRK.

22 A Mr. Secord, I will speak to the groundwater numerical
23 modelling portion as it's attached to the Millennium
24 groundwater assessment.

25 Sorry. Your question was whether a -- 19
26 monitoring wells alone would be enough to

1 characterize -- sorry. Can you repeat your question,
2 then?

3 Q Given the size of the project area and the complexity
4 of the hydrogeology, how can this possibly capture the
5 variability to produce adequate model projections?

6 A Well, I believe when you take the entirety of the data
7 that was utilized to prepare the groundwater numerical
8 model, then it does provide us with an understanding of
9 the hydrogeology at the site and that we have suitably
10 tested uncertainties associated with that model in the
11 numerical model report.

12 Q So you're saying you can -- you could capture the
13 variability to produce adequate model projections with
14 only 19 monitoring wells, some of them dry? That's
15 what you're saying under oath?

16 A MR. HOUSTON: Mr. Chair, I believe what the
17 witness, Ms. Grainger, said, was that the 19 monitoring
18 wells are part of the dataset. There are other data
19 points that are used to -- to create the model.

20 Q Okay.

21 MR. SECORD: If we could turn up CR Number
22 3 and CIAR 42 at page -- PDF page 233. And I'm looking
23 for -- yeah, significance of the results.

24 Q MR. SECORD: So it states here: (as read)
25 The British Columbia groundwater monitoring
26 guidelines define three levels of modelling

1 complexity, based on the potential impacts,
2 modelling objectives, hydrogeological
3 framework, and data availability. The model
4 developed to undertake this assessment may be
5 classified as of moderate complexity defined
6 as follows.

7 "These are conceptual or numerical
8 models based on a reasonable, though limited,
9 dataset and having limited calibration.
10 These models may be used to determine the
11 potential range of change or to bracket
12 potential effects that may occur due to a
13 given stress."

14 Hence, while specific results are
15 calculated during the modelling process,
16 there always remains a degree of uncertainty
17 associated with these estimates.

18 Quantification of the uncertainty may be a
19 laborious and expensive process. SRK has
20 attempted to quantify the uncertainty by
21 providing a range of estimates; however,
22 these ranges should not be viewed as
23 definitive.

24 Now, this statement is made by SRK that the groundwater
25 transport model developed for the project is based on
26 reasonable, although limited, dataset and calibration.

1 Please explain what you mean by "reasonable" given the
2 limited nature of the dataset supporting this model.
3 And I'm assuming that would be a question for
4 Mr. Jensen or Mr. Day.

5 A MR. HOUSTON: Although -- Mr. Secord,
6 although Mr. Jensen and Mr. Day both work for SRK, this
7 question you're asking relates to hydrogeology, and so
8 we'll have Ms. Grainger respond.

9 Q So, Ms. Grainger, do you work for SRK?

10 A MS. GRAINGER: I do not. I work for
11 Millennium.

12 Q Okay. And did you write this section of SRK's report?

13 A I did not.

14 Q Okay. But you're going to speak to it?

15 A Correct. It was --

16 Q Okay.

17 A -- completed to support the -- the groundwater
18 assessment, and therefore I can speak to it to a
19 degree, yes.

20 Q Okay. Okay. So the question, then, was: This
21 statement is made by SRK that the groundwater transport
22 model developed for the project is based on a
23 reasonable, although limited, dataset and calibration.
24 Can you please explain what you mean by "reasonable"
25 given the limited nature of the dataset supporting the
26 model?

1 A My understanding of that would be that, yes, although
2 the dataset is limited, as you pointed out, for a large
3 area, it does -- it's internally consistent. It does
4 provide us an overall understanding of the hydrogeology
5 of the site. It's consistent with our observations.
6 And on that basis, we can use it to predict the
7 potential effects of the project on the hydrogeology at
8 the site.

9 And I note that in the first paragraph that you
10 quoted, it states that the assessment is classified as
11 moderate complexity, not simplistic. But it is of an
12 intermediate complexity, so it's not -- anyway. Deemed
13 sufficient for the purpose of -- that was utilized for
14 this assessment.

15 Q And who made the assessment that the British Columbia
16 groundwater modelling -- modelling guidelines Level 2
17 classification applied in this case? Was that you?

18 A That would have been completed by the authors of this
19 report.

20 Q Okay.

21 MR. SECORD: So please turn up PDF page 226
22 of CR Number 3, Figures 3-12. So just six pages back.
23 If you can ... 226. There we go. Thank you.

24 Q MR. SECORD: So if we look at Figure 3-12,
25 which is entitled "Transient Calibration, Monthly
26 Hydraulic Heads, Linear Calibration", you can see that

1 the blue line is what was measured between 2014 and
2 2017; correct? I'm assuming you're going to speak to
3 this, Ms. Grainger?

4 A Yes, that's correct. I'm just confirming the legend.

5 Q Do you want to scroll down a little bit so we can see
6 the legend at the bottom?

7 A I guess perhaps it would help if I just confirm that
8 one line represents the modelled output or the head for
9 that period, whereas the other line represents the
10 observed measurements.

11 Q Sure. And if you see -- if you looked at this before,
12 you'll see underneath that the -- the photograph or the
13 print -- the picture of the mine area, you'll see the
14 blue line showing observed response, and then the --
15 the red dot is the modelled response; correct?

16 A Correct.

17 Q Okay. So the blue line is what was measured between
18 2014 and 2017 and represents the steady state or
19 observed response; correct?

20 A That's correct.

21 Q And the red dotted line is what the SRK model simulated
22 over that period of time?

23 A Yes --

24 Q Is that --

25 A -- that's also correct.

26 Q And do you agree that the calibration of the

1 groundwater level fluctuations for the transient
2 calibration are not very good in some parts of the
3 model domain, specifically the northeast quadrant,
4 RGSC-0009C and MW14-06-105, containing Gold Creek?

5 A I think the model report identifies that there are
6 specific locations that are -- are not well-captured by
7 the model. However, on the whole, the calibration did
8 meet the requirements.

9 Q Okay. Yeah. But, of course, that wasn't what I asked
10 you.

11 Let's just take a look at RGSC-0009C in the top
12 right-hand corner. You'll notice the observed response
13 is essentially a fairly flat blue line, whereas the
14 model doesn't come close to duplicating the observed
15 response between 2014 and 2017; correct?

16 A Correct. The model's overpredicting.

17 Q And then -- over or under; correct? Why do you say
18 "over", when you have the red line going underneath the
19 observed response? Why did you go to -- why did you go
20 to "over", Ms. Grainger?

21 A MR. HOUSTON: So -- so I think what --

22 Q I'm asking -- I'm not -- I'm not -- I'm not asking you
23 questions, Mr. Houston.

24 A Yeah, I just feel the need to explain. That -- that's
25 all.

26 Q I don't -- I don't have the need for you to explain.

1 Are you a hydrologist, Mr. --

2 A No. I -- I --

3 Q Are you a hydrogeologist?

4 MR. IGNASIAK: Mr. Chair, the witness can
5 answer. To the extent it's -- he doesn't think the
6 answer is good, he can make that point in argument.

7 MR. SECORD: Yeah. Well, I haven't got an
8 argument yet.

9 A MR. HOUSTON: So --

10 Q MR. SECORD: How can you answer for
11 Ms. Grainger?

12 A So what -- what "over" means is -- is that the model is
13 exaggerating the response both in the positive and
14 negative direction to what is actually experienced on
15 the graph.

16 Q Okay. So you wouldn't accept Ms. Grainger's evidence
17 that it was overpredicting?

18 A No, I -- I was just confirming her evidence, that it's
19 overpredicting both the positive and negative
20 directions that are -- are --

21 Q Okay. All right. Ms. Grainger, if we look at the
22 second graph, MW14-06-105, you would agree that the
23 model there comes nowhere close to predicting -- or
24 matching the observed response; correct?

25 A MS. GRAINGER: Correct. There's also a
26 significant -- well, a notable difference between the

1 model prediction and the observed measurements at that
2 location.

3 Q That's in Gold Creek?

4 A This is in a monitoring well.

5 Q Right. That monitoring well, MW14 -- I guess,
6 MW14-06-105, that would be sort of in the centre of the
7 mine projection area?

8 A Yes. It --

9 Q (INDISCERNIBLE - OVERLAPPING SPEAKERS)

10 A That's consistent with the figure.

11 Q Yes. Essentially that black line going to that -- so
12 the red dot area, that -- that would be where that
13 monitoring well is located?

14 A Correct.

15 Q Okay. And then we have RGSC. That would be in one of
16 the reaches of Gold Creek?

17 A That's also in a -- in a vibrating wire piezometer.

18 Q Okay.

19 A So a different -- one is a monitoring well, and one's a
20 vibrating wire piezometer.

21 Q So do you agree, Ms. Grainger, that the red dotted line
22 is way more variable than the blue line, which means
23 that SRK have not constrained the model; or put another
24 way, SRK haven't matched it very well to the observed
25 conditions around Gold Creek?

26 A These are not -- these are in -- at depth in

1 groundwater, so this is not in Gold Creek --

2 Q This is an area --

3 A -- to be clear.

4 Q Just to be clear, this is in an area around and near to
5 Gold Creek, RGSC-0009C?

6 A MR. HOUSTON: Mr. Chair, that point is on
7 the west side of the project footprint. I -- I don't
8 think we can say that it's in Gold Creek. And the
9 other point --

10 Q I see.

11 A The other point is certainly in the centre of the mine
12 and probably closer to Blairmore Creek.

13 Q I think you can -- I think you can say, Mr. Houston,
14 that RGSC-0009C is near to Gold Creek.

15 A It's on the west side of the project, that's right.

16 Q Right.

17 A Or east side of the project. I'm sorry.

18 Q Okay. Do you agree that -- Ms. Grainger, that this
19 casts doubt on the accuracy of the model to address
20 predicted changes in certain parts of the domain
21 assessed?

22 A MS. GRAINGER: As I said earlier, it's
23 acknowledged that in specific locations we may not have
24 accurate predictions; however, the intent of the model
25 is provide overall understanding and a good
26 understanding of the system. So there may be specific

1 locations where there are inconsistencies. That's been
2 acknowledged, yes.

3 Q How can the Joint Review Panel and my clients, like
4 Fran Gilmar, have faith that the model is giving us
5 results that are anything close to what will actually
6 happen during and after mine development?

7 A Well, we -- Mr. Secord, there's a significant component
8 of the model which includes the sensitivity test, a
9 series of them, in which we look at and test various
10 scenarios to understand how the model predictions would
11 be different from the ones that were used in the
12 assessment based on those changes. So some of those
13 include variations and recharge, changes in our
14 understanding of the conceptual site model. So we've
15 tested those through the -- the sensitivity analysis to
16 give us confidence in our predictions.

17 Q Yeah. We're going to look at some of those sensitivity
18 analysis tomorrow.

19 But, Ms. Grainger, you would agree one of the
20 assumptions in the groundwater model is that the
21 geological strata are homogenous and anisotropic with
22 greater k-values in a north-south versus west-east
23 direction; correct?

24 A It's a layered system, so the -- each layer is
25 homogenous and anisotropic, so different k-values in
26 each orientation. But each layer has a set different

1 of properties, so it's not just one mass with the same
2 three properties.

3 Q How will this affect the model output regarding spatial
4 extent of the drawdown?

5 A Well, we can start reviewing the sensitivity analysis
6 now if you'd like to look at some of those specific
7 assumptions. But, for example, the anisotropy without
8 the X-Y plan, so parallel to bedding, was tested in the
9 sensitivity analysis, and it was found to make no
10 significant difference in the predictions, whether they
11 were the same or whether they were using the values
12 that were reported in the calibrated version of the
13 model.

14 Q On this -- on this Figure 3-12, why did you decide to
15 put these monitoring wells where you did?

16 A Monitoring wells, oftentimes we were combining them
17 with the core-hole program, so we were utilizing
18 locations that were already being drilled as part of
19 the core-hole program. We tried to spatially
20 distribute them across the site and obtain information
21 from different zones.

22 So that's essentially the driver for why they're
23 located where they are.

24 Q Okay. I take it you would agree, Ms. Grainger, that
25 sensitivity tests on a bad model are still bad?

26 A MR. HOUSTON: So, Mr. Secord, we haven't

1 said that we have a bad model. We've said that our
2 model correlates well with the observations that we --
3 that we have. So I'm not sure that -- I'm not sure the
4 nature of your question.

5 Sensitivity analysis around uncertainties in a
6 model are a normal and prudent practice to understand
7 the possible variability.

8 Q Ms. Houston [sic], did you conduct any investigations
9 to substantiate the more limited hydraulic conductivity
10 in the west-east direction like pumping tests to
11 determine connectivity between discrete monitoring well
12 locations or impacts at springs?

13 A MS. GRAINGER: So if I understand you,
14 Mr. Secord, you're asking how we specifically identify
15 that anisotropy within the -- the units? Is that what
16 you're asking?

17 Q Yes.

18 A So that was an assumption. The physical tests test the
19 conductivity in the planer direction, so in the
20 horizontal direction. So there's no way to tell from
21 the results whether that's reflective of the 'X'
22 direction or the 'Y' direction, whether it's
23 north-south or east-west. It just reflects generally
24 the more permeable direction.

25 Because of our understanding of the geology and
26 the understanding that there are thrust faults that are

1 mapped with displacement that's been determined on
2 those features and that they're orientated in a
3 north-south direction, combined with the folding, there
4 was an interpretation that there was a -- a lower
5 conductivity in the east-west direction. And so that's
6 why that was incorporated into the model to account for
7 that feature in the geology.

8 Q Did Millennium conduct any pumping tests to determine
9 connectivity between discrete monitoring well locations
10 or impacts at springs?

11 A So I think there was two questions there. There -- the
12 first was, yes, there was one pumping test that was
13 completed in a flowing core-hole which gave us some
14 limited information, but there's no observation wells
15 that were included in that pumping test. So it gives
16 us some data, but it's limited in its value because of
17 the lack of observation wells.

18 I'm sorry. The second part of your question --
19 can you remind me?

20 Q Were there any pumping tests to determine conductivity
21 [sic] between discrete monitoring well locations or
22 impacts at springs?

23 You probably heard, for instance, that my clients
24 have a number of springs that provide water to their
25 properties, both inside the mine permit boundary and
26 outside, just outside.

1 A So with regards to springs, we did complete a review of
2 all the information of recorded springs in the area.
3 We also completed a field survey which included
4 collecting information from those springs. And, in
5 fact, some of the old mine portals were monitored on a
6 very frequent basis. I'm not sure if that answers your
7 question.

8 Q Did that include looking at the springs on Ms. Gilmar's
9 property?

10 A I don't believe it does.

11 Q Okay.

12 A Because it was private property, we didn't access that.

13 Q Please turn up Bullet Point 3 on this -- CR 3, so
14 basically PDF 202 of this same document. So PDF 207
15 under the heading "Model Assumptions". So this is --
16 so Bullet Number 3. So we're now dealing with the SRK
17 model and its assumptions, and the third bullet reads:
18 (as read)

19 On the scale of the assessment, groundwater
20 system flow, which is expected to occur
21 dominantly via fracture flow, can be
22 approximated by an equivalent porous media
23 (EPM) model.

24 What is "EPM"?

25 A The numerical models use equations which essentially
26 are valid for porous media. So they don't model

1 specifically the fractures or faults or features like
2 that. So the approach is to take -- essentially to
3 correlate, to say that because we're doing a large
4 model that we can use values on a larger scale that
5 allow us to use equations applicable to equivalent
6 porous media that are essentially representative and
7 reflect the groundwater flow even though there -- there
8 is the influence of fractures or -- or jointing.

9 Q You would agree with me that EPM is like a sand and --

10 A Or a sandstone.

11 Q And everything is flowing equally in the model;
12 correct?

13 A I -- I think "equally" implies it's isotropic, which
14 isn't necessarily the case.

15 Q But that's -- that's what happens with an EPM model,
16 isn't it?

17 A EPM model would mean that it's -- its flow within the
18 porous spaces of the rock, so around grains and that
19 kind of flow, as opposed to a fracture flow, which is
20 through a -- a planar surface.

21 Q Do you agree that Grassy Mountain is a
22 fracture-dominated groundwater system flow so that
23 groundwater could go left or right?

24 A I agree. Our interpret -- in the sense that our
25 interpretation is that it is likely a
26 fracture-dominated flow system. But we believe that it

1 can be represented in order that we can -- by an
2 equivalent porous media approach, and then -- in order
3 that we can use a numerical model to estimate effects.

4 Q So: (as read)

5 On the scale of the assessment, groundwater
6 system flow, which is expected to occur
7 dominantly by a fracture flow, can be
8 approximated by an equivalent porous media
9 model.

10 In which essentially everything is flowing equally,
11 whereas you've just said the Grassy Mountain is a
12 fracture-dominated groundwater system.

13 So it is nothing like -- it is nothing like an
14 EPM; correct?

15 A No. This is a -- a common approach that is used for
16 numerical modelling and -- and has been shown to be
17 useful and provide accurate predictions for a fractured
18 system.

19 Q Please explain how the groundwater system can act as an
20 EPM when conditions are dominated by flow in discrete
21 fracture networks in Grassy Mountain.

22 A So the equivalent porous media framework assumes that
23 the behaviour of the fractured rock system can be
24 represented by a porous media with properties that
25 approximate the larger scale of conductivity of the
26 fracture network. So flow within the discrete

1 fractures is not directly accounted for, but
2 represented by the equivalent porous media.

3 Q If we could look at Bullet Point Number 4 on PDF
4 page 207, so the same page, it says: (as read)

5 K is largely anisotropic, with the highest K
6 parallel to bedding planes/coal seams, and to
7 the thrust fault strike with lowest K
8 perpendicular to bedding.

9 What is "anisotropic"?

10 A "Anisotropic" basically means that the conductivity,
11 which is the ability of a -- of a -- a unit or a
12 material to transmit water, is different in different
13 directions.

14 Q So basically anisotropic has a direction to it;
15 correct?

16 A Correct.

17 Q And "isotropic" means in all directions?

18 A "Isotropic" means that it's the same in all directions.

19 Q And let's look at Bullet Point Number 5 next:
20 (as read)

21 Apart from preferential flow parallel to
22 fault strike, there is no major fault acting
23 as a significant conduit and no major
24 regional deep flow influences.

25 Could we please turn up Bullet Number 2 on PDF page 209
26 of this same document. And this is under the heading

1 "Model Properties", and the second bullet is as
2 follows -- it -- it reads in part: (as read)

3 The north-south thrust fault systems are
4 modelled to impede flows in the east-west
5 direction.

6 Do you see that?

7 A Yes.

8 Q Do you agree that this configuration will have a
9 profound effect on how much drawdown will propagate
10 outward to the west and east of the proposed Benga mine
11 pit?

12 A I -- I don't agree. And the reason is because the
13 sensitivity tests -- the sensitivity analysis
14 specifically looked at this condition and tested a
15 scenario where we made the conductivity K1 equal to K2,
16 and there was no significant change in the output of
17 the model with respect to hydraulic heads and baseflow
18 predictions.

19 Q Please explain why the model has been configured this
20 way when we know that there is evidence of active
21 west-east faults based on the trellis-style drainage
22 pattern.

23 A Well, I -- I would disagree, Mr. Chair, that there is
24 no evidence for east-west faults.

25 A MR. HOUSTON: Mr. Secord, if -- if you could
26 give us a reference where you found that information,

1 that would be helpful, perhaps.

2 Q Are you saying, Ms. Grainger, that there is no evidence
3 of active east-west faults in the project area?

4 A MS. GRAINGER: That's correct. The model --
5 or the site was investigated by -- in Section B, it
6 reports over 400 boreholes, and subsequently there's
7 been more than another hundred, so more than 500
8 boreholes advanced on the site. The geology has been
9 mapped in detail. As I indicated, there's thrust
10 faults that have been mapped with displacements of, I
11 believe, 10 to 200 metres. All of -- any east-west
12 structure would impact -- if there was displacement on
13 it, would impact the distribution of coal on the
14 project and, therefore, would have been mapped. And
15 these features are not described in the geology section
16 in Section B.

17 Q So do you agree that the trellis-style drainage
18 system -- or the trellis-style drainage pattern is a
19 fault drainage system and that it is typical in the
20 mountains?

21 A I -- my understanding of a trellis-style drainage
22 system is that it can occur when there's a -- a ridge
23 and drainage is perpendicular away from that ridge.
24 And that is what we see at the site, but that doesn't
25 necessitate the existence of east-west faults in order
26 to create that drainage pattern.

1 Q If we could go back to PDF page 207, Bullet Point 6, it
2 states as follows: (as read)

3 Recharge follows the same spatial trend with
4 elevation as precipitation. The
5 precipitation, evaporation, and
6 evapotranspiration mechanisms are not
7 explicitly modelled but assumed to be
8 integrated as net recharge. It is assumed
9 that this is approach will not unduly bias
10 the model.

11 How can this assumption be substantiated in the absence
12 of any documented or field-based evidence?

13 A Well, the information that we have is recharge at
14 different elevations at the project, which clearly show
15 increasing elevation -- or increasing recharge with
16 elevation. So there is a positive correlation between
17 the two.

18 Q If too much recharge is added to certain parts of the
19 model domain, how will that affect the extent of
20 drawdown in those portions of the model domain?

21 A So if I understand you, yes, applying too much recharge
22 would -- it has multiple effects, and -- and that's
23 part of understanding a numerical model, is all of
24 these features are interlinked. So if we apply too
25 much recharge, we also get water levels that are too
26 high in the groundwater system. So there would be

1 multiple changes that we would see. I think it's
2 important to understand that recharge was calibrated in
3 the process of building the model.

4 Q So let's -- let's look --

5 A So, in other words, it's -- yeah.

6 Q Sorry.

7 A No. Go ahead.

8 Q So let's look, just to finish off this afternoon, at
9 PDF 183 in the same document, CR Number 3. And at the
10 bottom -- at the bottom of the page -- bottom of this
11 page, it states that the MAP -- so the maximum annual
12 precipitation for the entire Blairmore catchment is
13 estimated at 719 millimetres and Gold Creek as
14 777 millimetres.

15 Correct?

16 A Correct, that's what it states there. But it's mean
17 annual precipitation, sorry --

18 Q Mean annual.

19 A -- not maximum. Yes.

20 Q Mean annual.

21 And SRK used the average number of 28 percent for
22 recharge in its model; correct?

23 A It's not that simplistic. They actually used two
24 calculations of -- of a proportion of mean annual
25 precipitation based on elevation. So there's what's
26 referred to in the model as a linear recharge scenario

1 and then an exponential recharge scenario. So there
2 are two different functions that were applied to apply
3 recharge across the model.

4 Q Okay. My understanding is, though, that Benga used the
5 average of 28 percent recharge in its groundwater
6 numerical model, and in some cases -- in some areas of
7 the model, it is as high as 50 percent?

8 A So it was increased in some specific areas, such as
9 a -- a clear-cut area, where it was interpreted that
10 groundwater recharge would be higher because of reduced
11 evapotranspiration.

12 Q So is the model then saying that 28 percent of the Gold
13 Creek MAP will end up as recharge? So that would -- by
14 my math, that would be -- 217 millimetres would go as
15 recharge, and 550 -- 559 millimetres would run off.
16 That's what the model would be doing using the
17 28 percent figure; correct?

18 A Sorry. To be clear, the -- the model's only adding
19 recharge onto the top layer. Runoff is -- is not
20 included in the model.

21 Q No. I'm just doing the math, Ms. Grainger. So if the
22 model is saying that 28 percent of the Gold Creek MAP
23 will end up as recharge, that would be 217 millimetres
24 annually; correct?

25 A MR. JENSEN: Mr. Secord, perhaps I can step
26 in here. We are moving into the -- into the realm of

1 water balance. No, that's -- that's not correct.

2 Q Okay.

3 A The -- you're leaving out the evaporation proportion of
4 it. So we estimate that the mean annual runoff is
5 equivalent to 323 millimetres.

6 Q Okay.

7 A So -- sorry, not runoff. Yield. We think of it as
8 yield when it comes to a water balance.

9 Q Yes.

10 A So that means the difference would evaporate.

11 Q Yes.

12 A So you're -- you're -- you're not accounting for the
13 evaporation in your math.

14 Q Sure. Well, the number I'm really mostly interested
15 in, Mr. Jensen, was the recharge number. That would be
16 217 millimetres would end up in -- as recharge?

17 A MS. GRAINGER: Sorry. Can you repeat the
18 question?

19 Q I thought it was just simple math. 28 percent of
20 777 millimetres is 217 millimetres.

21 A Sorry. You're asking if that is the correct value? I
22 guess what I was trying to be clear is that's not
23 necessarily the amount of recharge that's applied
24 across the model. So if that's what -- if you're just
25 asking what's 28 percent of 777, I would have to check
26 the -- you know, but that sounds about right.

1 Q Sure. And my understanding, that was the average
2 number, and in -- and in some cases the model uses --
3 the model has a recharge as high as 50 percent. So
4 that would be -- basically half of the 777 millimetres
5 would be allocated as recharge in some area -- in some
6 parts of the mine site? Do I have that right?

7 A I guess as I tried to explain, it's -- it's -- there is
8 a function that's applied, so I would have to confirm.
9 But --

10 Q You want to -- you want to confirm that and then come
11 back in the morning, and we can pick up on this thread?
12 Because I think the chair would like me to finish at
13 about 4:30, and we're there.

14 A MR. HOUSTON: So, Mr. Chair, I think it
15 would be a good time for us to come back to this in the
16 morning, and -- and we'll have a clear answer then.

17 MR. SECORD: Thank you, panel. We'll see
18 you all at 9 AM.

19 THE CHAIR: All right, Mr. Secord. We
20 will start tomorrow morning at 9 AM, and you will
21 continue with your cross.

22 MR. SECORD: Thank you.

23 THE CHAIR: Is there any business we need
24 to take care of before we say goodbye for the evening?

25 Discussion

26 MR. IGNASIAK: Mr. Chair, it's

1 Martin Ignasiak. We did have an opportunity to look at
2 the -- the DFO document that Mr. Drummond provided
3 earlier.

4 THE CHAIR: Yeah.

5 MR. IGNASIAK: Look, so that document is
6 essentially another submission by -- by DFO in this
7 proceeding. It's about 23 pages or so. I might be off
8 a few. But it's -- it's basically a -- you know, a
9 number of additional DFO people I understand
10 contributed to it and -- and they're submitting it, and
11 it -- it essentially bootstraps DFO's previous
12 submissions.

13 So, one, it's -- it's an additional submission in
14 the middle of a proceeding long after the deadlines.
15 Two, it bootstraps previous evidence, which is
16 inappropriate to say the least. But that said,
17 provided it -- you know, it's clear to everyone we're
18 not -- we're not setting a precedent here where this
19 will be allowed going forward, we -- we don't object to
20 it being entered as an exhibit, you know, taking into
21 account the nature of these proceedings in a somewhat
22 more, you know, more -- more -- more lax rules, I would
23 say, about filing of exhibits and accepting evidence on
24 the record so -- so would allow it, but -- but we
25 wanted to make those comments and -- and will address
26 it to the extent we need to further in argument or

1 during cross-examination of DFO's panel.

2 THE CHAIR: Okay. Thank you,
3 Mr. Ignasiak.

4 So I guess on that basis we'll accept it as an
5 exhibit. I guess the Panel's open to -- if there's a
6 feeling that there's a need for any additional process
7 in relationship to this late submission, we would
8 entertain that, and people can make that case if they
9 would like to.

10 MR. IGNASIAK: Thank you, sir.

11 THE CHAIR: So do we have a CIAR
12 number for that?

13 MS. ARRUDA: Elaine Arruda here. It would
14 be CA -- CIAR 847.

15 THE CHAIR: Okay. Thank you.

16 EXHIBIT CIAR 847 - FROM THE GOVERNMENT OF
17 CANADA (FISHERIES AND OCEANS CANADA) TO THE
18 JOINT REVIEW PANEL RE: ASSESSMENT OF THE
19 ECOLOGICAL IMPACT OF THE GRASSY MOUNTAIN COAL
20 PROJECT ON WESTSLOPE CUTTHROAT TROUT IN THE
21 BLAIRMORE AND GOLD GREEK WATERSHEDS, ALBERTA

22 THE CHAIR: Any other business? Okay.
23 Good evening, everyone. We'll resume tomorrow morning
24 at 9 AM.

25 _____
26 PROCEEDINGS ADJOURNED UNTIL 9:00 AM, NOVEMBER 17, 2020

1 CERTIFICATE OF TRANSCRIPT:

2

3 I, Claire Forster, certify that the foregoing
4 pages are a complete and accurate transcript of the
5 proceedings, taken down by me in shorthand and
6 transcribed from my shorthand notes to the best of my
7 skill and ability.

8 Dated at the City of Calgary, Province of Alberta,
9 this 16th day of November 2020.

10

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<Original signed by>

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14 Claire Forster, CSR(A)

15 Official Court Reporter

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