Appendix IX-3

WLWB Objectives Workshop – February 25 & 26, 2009

Wek'èezhìi Land and Water Board

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(BHPB & Diavik)

March 12, 2009

DDMI and stakeholders,

Re: Draft Objectives for Diavik's Interim Closure and Reclamation Plan (ICRP)

The Wek'èezhìi Land and Water Board recently hosted a Closure Objectives Workshop as part of our Work Plan for the review of the DDMI Interim Closure and Reclamation Plan (ICRP). We wish to thank everyone for attending this workshop and for providing valuable input to the development of the ICRP. We greatly appreciate the constructive and respectful contributions made by everyone at the workshop.

As promised during the workshop, we are distributing draft ICRP objectives (attached) based on input received at the workshop for review. These draft objectives are based on what we heard and documented at the workshop, Diavik's proposed objectives, and input from our technical consultants. We also consulted the Comprehensive Study Report and the approved mine plan when we developed our suggested objectives. Our suggestions are draft and have not yet gone before the Board. We recognize that we may not have correctly captured all that was expressed at the workshop and welcome your recommendations for improving the objectives.

In addition to mine component objectives, our suggested objectives include global (or site wide) objectives. Although these were not explicitly discussed at the workshop, many of the suggestions made by workshop participants appeared to fall into this category. We have also included suggestions for key definitions (e.g., closure objectives, closure options, etc.) and welcome feedback on these.

Our original work plan for review of Diavik's ICRP did not include stakeholder review of the workshop results. This additional step was added after development of the Work Plan to allow enough time at the workshop for a more open discussion and to allow review by those who could not attend the workshop. As indicated in the attached updated Work Plan, your response to the attached draft material must be received by April 1, 2009.

If you have any furthe r questions, please feel free to contact Patty Ewaschuk at pewaschuk@wlwb.ca or Ryan Fequet at rfequet@wlwb.ca.

Sincerely,

Patty Ewaschuk
Technical Coordinator
cc Diavik Distribution List

Introduction

As explained in our cover letter (March 12, 2009), we are distributing draft ICRP objectives (attached) based on input received at the workshop. These draft objectives are based on what we heard and documented at the workshop, Diavik's proposed objectives, and input from our technical consultants. We also consulted the Comprehensive Study Report and the approved mine plan. Our suggestions are draft and have not yet gone before the Board. We recognize that we may not have correctly captured all that was expressed at the workshop and welcome your recommendations for improving the objectives. We have also provided draft closure definitions for your review.

For any proposed closure objectives or definitions that you would like to see changed, please fill in BOTH empty columns of the table (reviewer recommendation and rationale).

All comments will then be sent to Rio Tinto for a response and the objectives will be taken to the Board, who will then provide direction to Rio Tinto.

Draft Closure Definitions

To ensure a common understanding of important closure and reclamation terminology, Board staff have proposed the definitions below for review. Below each proposed definition we have provided some clarification. Where definitions are available in Indian and Northern Affairs Canada (INAC)'s *Mine Site Reclamation Guidelines for the NWT* (January 2007), we have proposed to adopt those as a starting point. This will allow consistency with the water licence, since the water licence requires Rio Tinto to prepare the plan in accordance with INAC's guidelines.

Term	Board Staff Proposal	Reviewer's Recommended Change	Reviewer's Rationale for Recommended Change
Closure Goal	*The closure goal is a broad statement (or set of statements) that provides the vision and purpose of reclamation. The goal is met when the company has satisfied all closure objectives.* Clarification: The closure goal is a broad high-level statement and by its nature cannot be directly measured. The goal may be complimented by "global" or site-wide objectives which support the goal and apply to all mine components. The global objectives, while providing greater detail than the goal, are also not measureable; however they provide guidance in the development of criteria and consideration of options to meet mine component specific objectives.		

Closure Objectives (specific to mine components)	*"Objectives describe what the reclamation activities are aiming to achieve."* (INAC) Clarification: The mine component closure objectives should support or be consistent with the closure goal and global objectives. Closure objectives should take into consideration the physical stability, chemical stability, and future use and aesthetics at the site. Closure objectives specific to a mine component (e.g., waste rock pile) must be measurable to determine whether the objectives and site goal have been met.		
Closure Options	*Closure options are the actions that are proposed to successfully achieve the closure objective.* Clarification: A set of options (or alternatives) should be evaluated for each mine component objective. This definition is consistent with what is contained in the water licence.		
Closure Criteria	*"Detail to set precise measures of when the objective has been satisfied." (INAC)* Although in principle we prefer to adopt the definitions in the INAC guidelines, a better definition might be "standards that measure the performance of closure activities in successfully meeting closure objectives." We welcome comments on your preferred definition.		

Closure Goal

The closure goal for the Diavik site was not explicitly discussed at the workshop; however, we are presenting it here for completeness. Diavik's stated goal for the site is: "To close the Diavik Mine responsibly and progressively, leaving a positive community and environmental legacy." The company should also be guided by the INAC Mine Site Reclamation Policy for the NWT, which states that "the required standard of reclamation should be based on the 1994 Whitehorse Mining Initiative definition: 'returning mines sites and effected areas to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities'." You may comment on Diavik`s goal; however, please consider that several site-wide issues are covered by the global objectives below.

Draft Closure Objectives

The following table is an extension of the tables distributed and presented on screen during the second day (February 26, 2009) of the Closure Objectives Workshop. Draft global objectives (as defined above) are presented first for review. These objectives were identified by participants and reasonably apply to all mine components. Draft mine component-specific objectives are then presented for each of the mine components discussed at the workshop.

Throughout the workshop, some participants recommended the use of traditional knowledge for the development of closure objectives or for closure options. We hope that these groups will provide traditional knowledge at this stage in the development of closure objectives, at the Closure Options and Criteria Workshop to be hosted by Rio Tinto in May this year and throughout the development of the current and future ICRPs.

Global Objectives

Diavik's Proposed Objective	Workshop Objective	Board Staff's Proposed Site-Wide Objective.	Reviewers Proposed Site- Wide Objective and Rationale
Land and Water that is safe for people, wildlife and aquatic life	Available for traditional harvesting for the future children. Returning as close to possible to natural topography. Aesthetic values as it relates to Aboriginal culture. Return site to as close as possible to the way it was – views, smells, interrelationships, spiritual, harvesting. Usability – is it safe, non- contaminating, same plants or different plants? Safe means no contamination and physical	1. The site condition is as close as possible to predevelopment conditions allowing for traditional use. 2. Land and water that is safe (physically and chemically) for aquatic life, wildlife and people. 3. The site is a neutral attractant for wildlife compared to surrounding environment. 4. The site is not a source of contamination. 5. Restore aesthetics of the site based on traditional knowledge.	

Global Objectives

Diavik's Proposed Objective	Workshop Objective	Board Staff's Proposed Site-Wide Objective.	Reviewers Proposed Site- Wide Objective and Rationale
	hazards. Caribou populations need to be same or better as today- site should not negatively affect caribou. Energy use of site by wildlife is neutral.		
Enhanced capacities for northerners and northern business	Need to involve Aboriginal people in the business aspect of reclamation.	6. Maximize northern business opportunities during closure. 7. Create enhanced capacity for northerners and northern businesses that remains after closure.	
Implementation of a closure design that does not require long term care and maintenance	Should be a "walk- away" situation.	8. Closure is final and does not require long term care.	
Agreement to remove financial security requirements.	INAC is solely responsible for this. Diavik's proposal is that parties other than INAC should agree to remove financial security requirements.	9. Obtain agreement from affected parties that financial security requirements should be removed by INAC.	

MINE INFRASTRUCTURE – BUILDINGS AND ROADS

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Maximize use of assets for regional benefits.	Promote salvage/reuse of infrastructure with local communities.	An asset is anything that has value to the communities. Demolition to maximize usability of assets. Improve definition of regional?	1. Maximize re-use of infrastructure by local communities. 2. Maximize usability of assets during demolition. *Staff comment: Definition of ``asset`` can be addressed when developing options and criteria.*		
No water retaining structures.			3. No constructed water retaining structures remain. *Staff comment: the word "constructed" is added to clarify that natural depressions and water retaining structures present before development can remain.*		

MINE INFRASTRUCTURE – BUILDINGS AND ROADS

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
A final landscape without buildings, with restored drainage patterns and with enhancements to encourage indigenous vegetation.	Re-establish natural channels etc by removal of culverts, bridges. Remove buildings.	Should include removal of pipes and other infrastructure (but not roads?) Include wording on natural topography. Stronger wording than "enhancements" and "encourage".	4. All imported infrastructure removed. 5. Natural drainage and indigenous vegetation restored.		
Inclusion of practical wildlife habitat features in final landscape.		Wording: "healthy", "safe", "productive". -Difficulty with word "practical". -Better wording of "wildlife habitat feature". -Use of TK to improve the objective. -Needs to be more specific.	6. Include practical wildlife features in final landscape. *Staff comment: The word `practical` can be defined by the closure criteria.* *We welcome any traditional knowledge that will improve the development of this objective.*		
	Safe passage for wildlife	Return to useful habitat. "Passage" may be too specific or may need to be defined better. Positive net energy for wildlife.	7. Safe passage for wildlife.		

MINE INFRASTRUCTURE – BUILDINGS AND ROADS

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
	Restore topography, aesthetics Do not leave site "unsightly"	- Better word than aesthetics to capture spiritual and other aspects of being on the land. - More TK input for this objective. - Better wording for ``unsightly``, e.g., "eyesore".	*See Global Objective #5*		
	Road areas restored to natural topography and growth	See above.	*Staff comment: This issue was not sufficiently explored at the workshop to allow staff to propose an objective. How feasible is road removal? Where would the removed material go? Would the remaining landscape be better than reclaimed roads (e.g., slope adjustments, scarification, revegetation, etc.)? What other considerations exist? Recommendations (with rationale) would be appreciated.*		

MINE INFRASTRUCTURE – BUILDINGS AND ROADS

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Maximize use of on-site disposal.		Disposal should not have an impact on usability of the area. Need more information about what will be disposed and where. Must be done safely, and meet usability objectives. Residual contaminated soil to be addressed/remediated – soil doesn't negatively affect wildlife. Remove sources of contamination. Contamination addressed during infrastructure removal.	8. Remove hazardous materials (e.g., from explosives, fuels, chemicals, etc.) 9. Remediate contamination.		
		Add objective regarding dust Add objective regarding disturbance of undisturbed areas.	10. Dust levels safe for people, vegetation and wildlife. 11. Areas in and around the site that are undisturbed during operation of the mine should remain in their natural state during and after closure.		

MINE INFRASTRUCTURE – BUILDINGS AND ROADS

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Financially practical.		Okay, but statement is subjective and open to interpretation. May contradict other objectives. May not be an appropriate objective.	*Staff comment: Not a closure objective. Finances can be considered during selection of options.*		

COUNTRY ROCK AND TILL STORAGE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Surface runoff and seepage water quality that is safe for human/wildlife and that will not cause significant adverse effects on water uses in Lac de Gras or the Coppermine River.	Seepage quality is good – no deleterious substances would come out of the rock pile.	More specifics on how to deal with waste, etc. that is deleterious? -Deleterious substances can come out of the rock pile, but concentrations and loadings should not impact the use of the site or lake water quality. -Should also think about concentration and loading, not just presence of deleterious substance. -Water entering LDG should be of similar quality to LDG. Is this realistic?	1. Surface runoff and seepage water quality that is safe for humans and wildlife. 2. Surface runoff and seepage water quality that will not cause significant adverse effects on water uses in Lac de Gras or the Coppermine River. *Staff comment: Diavik`s proposed objective was split into two since two separate criteria may be required. Use of the word deleterious implies the DFO definition of the word which addresses fish. This may be too narrow for WLWB purposes. Presence of contaminants, loading and concentration can be addressed through the criteria. The word `significant` is not problematic since it can be defined by closure criteria.*		

COUNTRY ROCK AND TILL STORAGE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Safe passage for caribou through and around the area.	Slopes shouldn't be too steep (should be rest areas), rocks shouldn't be too big or too sharp – for travel and aesthetics Positive net energy for caribou	"neutral" net energy may be more appropriate, or that net energy is the same as in a natural landscape. Steep slopes or shallow slopes may be beneficial to caribou passage. Slope direction can influence where seepage goes. TK used to determine best options. Do not want to make obstructions that trap caribou. Should be safe passage to the top since caribou will go there when stressed.	3. Safe passage for wildlife. *(Staff comment: Steepness and direction of slopes, obstructions, and passage to the top can be addressed by closure options and criteria. Slope stability and safety is addressed in objective #4 ; caribou net energy is addressed in Global Objective #3. TK to determine best options can be provided at Rio Tinto`s upcoming Closure Criteria and Options Workshop.)*		
Area not a significant attractant for caribou.	Build trails around piles for caribou to use? Positive net energy for caribou	"neutral" net energy may be more appropriate, or that net energy is the same as in a natural landscape. Access and safety, etc. for caribou same as before the mine.	*Staff comment: See site wide objective #3 and country rock and till storage area objectives # 3 and 4.*		

COUNTRY ROCK AND TILL STORAGE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Stable slopes safe for people and wildlife.	Slopes shouldn't be too steep (should be rest areas), rocks shouldn't be too big or too sharp – for travel and aesthetics	Should animal dens be on the slopes; would this jeopardize permafrost? May be better to talk about "practical habitat".	4. Stable and safe slopes for use by people and wildlife.		
Landform with more natural shapes versus sharp engineered angles.	Aesthetics – height, slopes, revegetation?		5. Pile features match aesthetics of surrounding area. 6. Till storage areas and rock piles re-vegetated where possible.		
	Any currently undisturbed areas left in their natural state.	Matches "smallest practical footprint". Competes with minimization of pile height, this can be worked out by balancing options.	7. Areas in and around the site that are undisturbed during operation of the mine should remain in their natural state during and after closure.		
	Erosion control in place, stable against wind scour and source of dust.	Geotechnically stable against wind AND water erosion.	8. Dust levels safe for people, vegetation and wildlife. 9. Erosion and sedimentation processes are minimized.		

COUNTRY ROCK AND TILL STORAGE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
	Should not support increased predation.	Should this be more neutral to allow for return of the site to state as it was before mine. Reclaimed sites will not improve predation success rate on caribou compared to site before mine.	10. No increased opportunities for predation compared to pre-development conditions.		
Smallest practical footprint.			*Staff comment: See above objective # 7.*		
No water retaining structures.		Addressed in infrastructure discussion.	11. No constructed water retaining structures remain. *Staff comment: the word "constructed" is added to clarify that natural depressions and water retaining structures present before development can remain.*		
Financially practical.		Addressed in infrastructure discussion.	*Staff comment: Not a closure objective. Finances can be considered during selection of options.*		

PROCESSED KIMBERLITE CONTAINMENT AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Surface runoff and seepage water quality that is safe for human/wildlife and that will not cause significant adverse effects on water uses in Lac de Gras or the Coppermine River.	No deleterious seepage from PKC. Promote drainage collection away from the PKC to prevent water contamination.	See discussion under waste rock regarding deleterious substances. Do not want to create erosion problems during runoff diversion. Should address wind erosion as well. "Significant" could be removed. Significance is measured differently by different groups. Regardless, criteria will define better.	1. Surface runoff and seepage water quality that is safe for humans and wildlife. 2. Surface runoff and seepage water quality that will not cause significant adverse effects on water uses in Lac de Gras or the Coppermine River. *Staff comment: Diavik`s proposed objective was split into two since two separate criteria may be required. Use of the word deleterious implies the DFO definition of the word which addresses fish. This may be too narrow for WLWB purposes. Presence of contaminants, loading and concentration can be addressed through the criteria. The word `significant` is not problematic since it can be defined by closure criteria. See objectives #8 and 9 regarding erosion.*		

PROCESSED KIMBERLITE CONTAINMENT AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Engineered containment of processed kimberlite material.		Note that this containment facility would remain permanently. Note that containment facility is meant to contain solids and not water. Objective is to keep solids permanently on-site. Use TK to design containment facility.	3. Processed kimberlite is permanently contained. 4. Processed kimberlite is not a source of contamination to Lac de Gras. *Staff comment: TK for the design of the containment facility can be provided at Rio Tinto`s upcoming Closure Options and Criteria Workshop.*		
Stable slopes safe for people and wildlife.		Similar to concerns for waste rock. Geotechnically stable as described under waste rock discussion.	5. Stable and safe slopes for use by people and wildlife.		
Financially practical.		See previous discussions.	*Staff comment: Not a closure objective. Finances can be considered during selection of options.*		

PROCESSED KIMBERLITE CONTAINMENT AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Area not a significant attractant for caribou. Safe passage for caribou through and around the area.	Safe for caribou health. Positive net energy for caribou	Interface between PK beaches and water is a concern - negative energy for caribou. No access to PK for caribou. Also see discussion under waste rock.	6. No access to processed kimberlite by caribou and other wildlife. 7. Safe passage for wildlife.		
	No erosion, not a source of sediment to Lac de Gras.		8. Erosion and sedimentation processes are minimized.		
	Surfaces must be stable enough to have no dust flying around.		9. Dust levels safe for people, vegetation and wildlife.		
			10. No water retaining structures remain. *Staff comment: This addresses collection ponds associated with the PKC.*		

OPEN PITS, UNDERGROUND, DIKE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Water quality in flooded pit areas that is sustainable for aquatic life.	1. should not be a source of contamination to Lac de Gras 2. ensuring water quality of the pit water is as similar as possible to Lac de Gras	Note - sustainable will be defined by criteria. Water quality in tunnels should be addressed as well.	1. Water quality in flooded pit areas is sustainable for aquatic life and is as similar as possible to Lac de Gras. 2. Not a source of contamination to Lac de Gras.		
Physical features in the flooded pit areas that enhance lake-wide fish habitat characteristics.		Habitat requirements are in the Fisheries Authorization. Should include wording to address effectiveness. (DFO success criteria may already be defined. DFO has requirements for monitoring plans with community input.)	3. Enhance lake-wide fish habitat.		
Maximize safe use of pit area for landfill.	preferential use of underground tunnels for safe disposal	Use of pit area for landfill includes tunnels in the right circumstances. Concern about what will be disposed in underground tunnels and pit area.	4. Disposal of material in pits and underground is safe.		
Financially practical.			*Staff comment: Not a closure objective. Finances can be considered during selection*		

OPEN PITS, UNDERGROUND, DIKE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
			of options.		
Safe small craft navigation through pit areas.	dike islands would be safe for navigation		5. Safe small craft navigation through pit areas.		
Safe use of area for people and wildlife	safe use of pit area by winter harvesters	Address ice safety in winter.	6. Safe for use by people and wildlife. 7. Dust levels are safe for people and wildlife.		
Surfaces to be geotechnically stable	1. physical stability of the pit walls after pit flooding 2.stable islands from dikes - no erosion from dike islands		8. Pit walls, islands and shorelines are stable.		
water levels in the Coppermine River not impacted by rate of pit flooding		This will also achieve protection of littoral zones.	9. No negative impacts on water levels in Lac de Gras and Coppermine River from flooding of open pits.		
	re-flooding of pits should not have a negative impact on fish habitat in Lac de Gras	Rate of flooding should not suspend sediments at the bottom of the pit. Littoral habitat is unaffected by pit flooding.	10. No negative impacts on fish habitat in Lac de Gras and Coppermine River from flooding of open pits.		
	ensure safety of wildlife during pit flooding (caribou falling into pits or raptor nests being destroyed)	Raptor nests may be destroyed - breeding should not be disrupted.	11. Wildlife safe during flooding of pits.		
	Aesthetics.	- Better word than	*Staff comment: See Global*		

OPEN PITS, UNDERGROUND, DIKE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
		aesthetics to capture spiritual and other aspects of being on the land. - More TK input for this objective. - Note that smoothing of islands for aesthetics may cause erosion problems.	*Objective #5 regarding aesthetics and TK.*		
		Progressive reclamation used for flooding pits to use learned information for subsequent flooding.	*Staff comment: This does not appear to be an objective. It can be considered when developing options and identifying research needs.*		
		Revegetate islands for erosion prevention and use by wildlife.	12. Revegetate islands for erosion prevention and use by wildlife.		
	Currents do not cause sediment release or pit wall instability.		*Staff comment: See objective #8.*		

NORTH INLET

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Water quality in the North Inlet that is safe for human/wildlife with no significant adverse effects on water uses in Lac de Gras.	1. The North Inlet should not be a source of contaminants to Lac de Gras 2.water quality is similar or equal to Lac de Gras water quality 3.If water quality in the North Inlet is harmful, then wildlife should be excluded	If water quality and sediment are harmful, then fish should be excluded from the North Inlet. See earlier comments about ``significant``.	1. Water quality in the North Inlet that is safe for humans and wildlife. 2. Water quality in the North Inlet that will not cause significant adverse effects on water uses in Lac de Gras or the Coppermine River. 3. Not a source of contaminants to Lac de Gras. *Staff comment: Diavik`s proposed objective was split into two since two separate criteria may be required. Use of the word deleterious implies the DFO definition of the word which addresses fish. This may be too narrow for WLWB purposes. Presence of contaminants, loading and concentration can be addressed through the criteria. The word `significant` is not problematic since it can be defined by closure criteria.*		

NORTH INLET

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Maintenance of water levels equal to Lac de Gras.			*Staff comment: This is unnecessary because of objective #4.*		
No water retaining structures.	reconnect the inlet to Lac de Gras		4. Reconnect with Lac de Gras.		
Evaluate opportunities to fully reconnect the North Inlet with Lac de Gras.	reconnect the inlet to Lac de Gras	Note that if water quality is sufficient, dike could remain to allow water movement, but not movement of fish.	*Staff comment: This is unnecessary because of objective #4.*		
	return North Inlet to productive capacity suitable for fish		5. Productive fish habitat present in North Inlet.		
		There was a comment from the workshop to include objectives for dust for all mine components.	6. Dust levels safe for people, vegetation and wildlife.		
			7. Stable channel banks and breach locations.		

List of Workshop Participants

Name	Organization
Nick Lawson	Jacques Whitford AXYS **now** Stantec (for WLWB)
Chandra Venables	Government Northwest Territories (GNWT)
Todd Slack	Yellowknives Dene First Nation (YKDFN) Land and Environment
Tim Byers	YKDFN consultant
John McCullum	Environmental Monitoring Advisory Board (EMAB)
Eddie Erasmus	EMAB
Floyd Adlem	EMAB
Doug Crossley	EMAB
Lindsey Cymbalisty	Indian and Northern Affairs Canada (INAC - E&C)
Lorraine Sawdon	Department Fisheries and Oceans (DFO)
Lionel Marcinkosky	INAC (E&C)
Lawrence Goulet	EMAB – YKDFN
Sheryl Grieve	North Slave Metis Alliance (NSMA)
Lena Adjun	Kitikmeot Inuit Association
Kevin Tweedle	Kitikmeot Inuit Association
Julian Kanigan	INAC
Marc Casas	INAC – Water Resources
Robert Jenkins	INAC – Water Resources
Florence Catholique	EMAB
Anne Wilson	Environment Canada (EC)
Jane Fitzgerald	EC
Gord MacDonald	Rio Tinto
Kathy Racher	WLWB
Ryan Fequet	WLWB
Patty Ewaschuk	WLWB
Stephen Bourn	Rio Tinto
Colleen English	Rio Tinto
Shannon Hayden	NSMA

Appendix IX-4

DDMI Options and Criteria Workshop – May 12-13, 2009

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memo

From	Gord Macdonald
To	Distribution (email)
Reference	Diavik ICRP Options and Criteria Workshop – May 12&13, 2009
Date	July 9, 2009 – Updated from June 15, 2009

Outcome from Diavik ICRP Workshop – Options & Criteria

Workshop Purpose

- To present and obtain comment on alternative closure options in order to assist DDMI in identifying a preferred option for each option(s) (Part L, Item 1a);
- Identify measurable closure criteria that describe each closure objective.

Workshop Outcome - Options

- Attached is a copy of the workshop options slides that were presented.
- A summary of the positive and negative aspects identified by workshop participants for each of the closure options presented at the workshop are attached.
- If we got something wrong in this summary – please let me know as soon as possible.
- This material will form an Appendix in the 2009 ICRP.

Workshop Outcome – Research Ideas/Opportunities

- As we worked through the closure options participants asked that we make a listing of research ideas/opportunities that came up during the discussions
- Attached is a copy of what was recorded.

Workshop Outcome – Criteria

- The workshop provided a good opportunity for general discussion on closure criteria but very little progress was made in establishing specific criteria.
- Attached is a copy of what was recorded from the session

On behalf of Rio Tinto I would like to thank all workshop participants for their continued time and effort.

Attachments: Workshop Presentation Material
Results from Closure Options Review (Tables 1-11)
Closure Criteria – Notes from Workshop (Tables 12-23)
Closure Research Ideas/Opportunities (Table 23)

Distribution

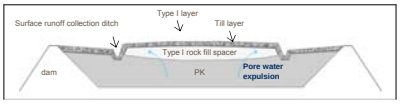
1	Lorraine Sawdon	DFO
2	Jennifer Potten	INAC
3	Shannon Hayden	EMAB – NSMA
4	Nathen Richea	INAC
5	Lindsey Cymbalisty	INAC
6	Velma Sterenberg	INAC
7	Steve Wilbur	WLWB (consultant)
8	Patty Ewaschuk	WLWB
9	Ryan Fequet	WLWB
10	Kathy Racher	WLWB
11	Anne Wilson	EC
12	Jane Fitzgerald	EC
13	Stanly Anablak	KIA
14	Kevin Tweedle	KIA
15	Florence Catholique	EMAB- LDFN
16	Lawrence Goulet	EMAB - YKDFN
17	Steve Bourn	DDMI
18	Lydnon Clark	DDMI
19	Calvin Yip	DDMI
20	Gord Macdonald	DDMI
21	Todd Slack	YKDFN
22	Tim Beyers	YKDFN
23	Zabey Nevitt	WLWB
24	Erika Nyyssonen	GNWT
25	John McCullum	EMAB

Diavik Closure Planning

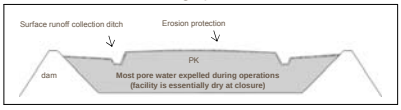
Interim Closure and Reclamation Plan – Options and Criteria Workshop
May 12-13, 2009

Option A – Processed kimberlite consolidation

A1- Consolidation post closure



A2 – Consolidation during operations



Option B – Surface of Processed Kimberlite Containment Area

B1 – Coarse Kimberlite

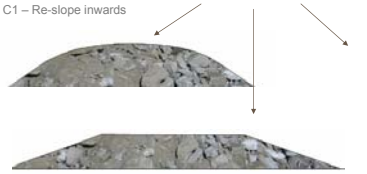
B2 – Kimberlite beach

B3 – Country rock

Rio Tinto

Option C – Height for roads, plantsite, laydown and airstrip

C1 – Re-slope inwards

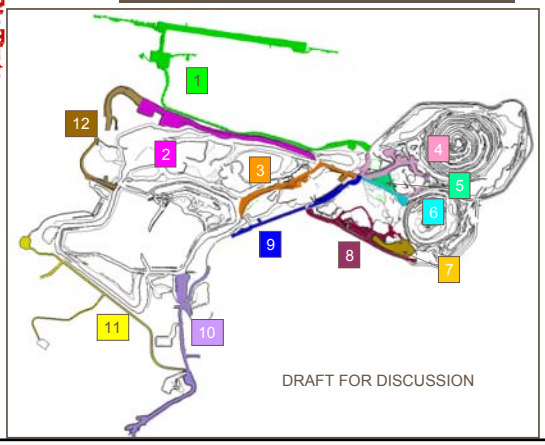


C2 – Re-slope outwards

C3 – Re-mine for material

Rio Tinto

Possible Other Type 1 Closure Material



DRAFT FOR DISCUSSION

Rio Tinto

Possible Other Type 1 Closure Material

		cubic metres	tonnes (x 2.04)
1	Runway/apron/airport road	906,330	1,848,910
2	Ring road	1,577,150	3,217,390
3	North haul road	1,771,090	3,613,020
4	Dump 7 area	646,200	1,318,250
5	N3 laydown	223,350	455,630
6	Pit access road	73,060	149,040
7	Pond 14	430,940	879,120
8	UG portal area	326,520	666,100
9	South haul road	213,360	435,250
10	A21 Causeway	1,229,220	2,507,610
11	AN storage/DWE road	185,180	377,770
12	Pond 2 dam	622,630	1,270,170

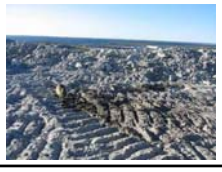
DRAFT FOR DISCUSSION

Rio Tinto

Option D – Surface for roads, plantsite, laydown and airstrip

D1 – Smooth surface

D2 – Scarified surface

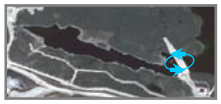


Option E – Inert landfill location

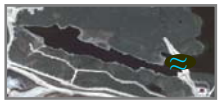
E1 – Country rock pile
E2 – PKC
E3 – Pit Bottom
E4 – Underground tunnels

Option F – North Inlet

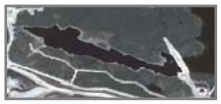
F1 – Hydrologic connection to Lac de Gras



F2 – Open connection to Lac de Gras



F3 – No connection to Lac de Gras



Option G – Side slope on country rock piles

G1 – Flat slopes

G2 – Steep slopes

Option H – Till cap on country rock piles

H1 – Till cap on top and sides

H2 – Till cap on top

H3 – No till cap

Rio Tinto

Option I – Alternative infrastructure use

I1 – On-site facility

I2 – Reuse in communities

Rio Tinto

Option J – Areas for revegetation

J1 – Roads, plantsite, laydown, airstrip
J2 – PKC
J3 – Country rock piles

Results from Closure Options Review

Table 1. Summary of workshop positives and negatives – Option A – Processed Kimberlite Consolidation

A1 – Consolidation Post Closure	A2 – Consolidation During Operations	A3 – Consolidation During Both*
- porewater mystery at closure - metals treatment at closure + no costs until closure - till cracking and porewater getting into the environment + thicker cap is isolation from wildlife and vegetation - slower freezing - active zone greater than 3-5 m	+ learn porewater chemistry and freezing rates - metals treatment during operations + no Lac de Gras raw water use - costs for piping and infrastructure + possibly reduce dam raises + seepage management + option to cover like A1 if necessary - operational dust – wind generated - impact on water quality from not having impermeable cover + faster freezing	+ don't have to make a decision with poor quality information + fully documents this option + includes positives from A2 - some negatives + till less likely to crack

* Option A3 was added during the workshop at the request of a participant. DDMI notes that most options evaluated are not either/or options. Options can be combined over time or even applied to different areas. They are not intended to be mutually exclusive.

Table 2. Summary of workshop positives and negatives – Option B – Surface of Processed Kimberlite Containment Area

B1 – Coarse Kimberlite	B2 – Kimberlite Breach	B3 – Country Rock	B4 – Till
- susceptible to erosion - metal leaching potential - metal uptake in vegetation - salt attractant for wildlife - direct wildlife ingestion + less snow accumulation - probability of kimberlite getting out of containment area	- no erosion protection - metal leaching potential - metal uptake in vegetation - salt attractant for wildlife - direct ingestion by wildlife - wildlife getting physically stuck + can support vegetation if wanted + less snow - highest probability of kimberlite getting out of containment area - erodability of material	+ large rocks provide cover from predators + best dust control + keeps caribou out of kimberlite - increased snow load if rocks are too big	+ wildlife mobility + vegetation + thermal active zone - susceptible to erosion - material availability

Table 3. Summary of workshop positives and negatives – Option C – Height for roads, plantsite, laydown and airstrip

C1 – Re-slope Inwards	C2 – Re-slope Outwards	C3 – Re-mine for Materials
- Runoff water quality + maintain trafficability - wind erosion + safe travel for caribou - predation - safe travel for people + more natural feature - caribou less willing to cross	+ can keep trafficability - broadens footprint - wind erosion + safe travel for caribou - predation + safe travel for people	+ drainage crossings and drainage control + source of closure material + vegetation + can do it early - higher dust during active removal + most natural landscape + closest to the way it was + caribou most willing to cross - water erosion

Table 4. Summary of workshop positives and negatives – Option D – Surface for roads, plantsite, laydown and airstrip

D1 – Smooth Surface	D2 – Scarified Surface
+ trafficable for people, caribou, trucks - will not revegetate + no new disturbance – will not disturb established vegetation + smooth surface for caribou crossings + easy routes for caribou + use to encourage caribou routes - liability to third party traffic	+ micro habitat for vegetation + more natural + runoff erosion control - too rough is a hazard particularly on side slopes

Table 5. Summary of workshop positives and negatives – Added Option for E – Onsite versus Offsite Landfill

Onsite Landfill	Offsite Landfill
+ lower cost + fewer GHG from haulage offsite + progressive closure - larger footprint if surface located - final closure landfill waste volume versus rock volume Comment – if it is burnable then burn	+ increased salvage value by increasing disposal cost + meets global closure objective - Yellowknife landfill space limited + progressive reclamation – back haul + kick start NWT recycle - haul costs - increased and winter road use + everything removed from site

Table 6. Summary of workshop positives and negatives – Option E – Inert Landfill Location

E1 – Country Rock Pile	E2 – PKC	E3 – Pit Bottom	E4 – Underground Tunnels
- takes up rock storage space + already in use + all in one spot + more capacity than PKC + more transparent + reversible - might get bigger	- poor cover – as it freezes materials pushed to surface + in an engineered containment - capacity - increased waste volume	+ takes up space - preparation of materials - impact on water quality + technically a good place - spiritually unacceptable - lack of transparency - not reversible	+ takes up space - preparation of materials - impact on water quality - lack of transparency + progressive reclamation

Table 7. Summary of workshop positives and negatives – Option F – North Inlet

F1 – Hydrologic Connection to LDG	F2 – Open Connection to LDG	F3 – No Connection to LDG
- sediment disturbance from construction - water quality impacts on LDG + filter dam to remove particulates	- sediment disturbance during construction + additional fish habitat + fish in North Inlet can go to Lac de Gras - water quality impacts on Lac de Gras + meets a priority closure objective + no stability issues	+ reduced risk to downstream users - long-term water treatment to maintain water balance - geotechnical inspections long-term - does not meet priority closure objective

Table 8. Summary of workshop positives and negatives – Option G – Side slopes on Country Rock Piles

G1- Flat Slopes	G2- Steep Slopes
+ better stability + safe passage for caribou + could cover adjacent roads - greater water erosion - increased snow accumulation + greater opportunity for revegetation + caribou access to top of pile to get away from bugs	+ enhanced freezing + smaller footprint + prohibits caribou access - snow accumulation on benches + larger buffer from pile edge to Lac de Gras + more opportunities for natural drainage patterns - herd caribou against slopes - sharpness of angles

Table 9. Summary of workshop positives and negatives – Option H – Till Cap on Country Rock Piles

H1 – Till cap on top and sides	H2 – Till cap on top	H3 – No till cap
+ reduces oxygen into piles - reduces freezing + reduces infiltration - shortage of till material - difficulty in sorting useable till + good for revegetation	+ better freezing + good for vegetation - vegetation on surface holds snow increasing infiltration amounts Comment: target type III rock	+ enhanced freezing

Table 10. Summary of workshop positives and negatives – Option I – Alternative Infrastructure Use

I1 – On-site Facility	I2 – Reuse in Communities	I3 – Removal for Sale*
- legal liability/ownership + airstrip for emergencies - maintaining airstrip/facilities + creates long-term facility and use - not consistent with pre-development land use - still requires final closure - removal	+ community use + capacity for communities + viable business opportunity + removes from site - transport/deconstruction may not be net positive environmentally – life cycle basis - unfair to communities with no land	+ opportunities to increase community capacity - requires buyer with money + recycle/reuse + removes from site - cost of removal

* Option I3 was added during the workshop at the request of participants.

Table 11. Summary of workshop positives and negatives – Option J – Areas for Vegetation

J1 – Roads, plantsite, laydown, airstrip	J2 – PKC	J3 – Country Rock piles
+ surface stabilization – erosion protection + snow capture + return to useable + closest to pre-development land use - cost and additional monitoring - drainage from soil amendments - wildlife attractant that would increase predation in particular spots – easy targets	- attractant to wildlife - snow capture + dust control Comment: uncertain if we want vegetation	- attractant to wildlife - snow capture + dust control

Closure Criteria – notes from Workshop Discussion

Table 12. Closure Criteria – Objective #19,29,40,50,68 – Dust levels safe for people, vegetation, aquatic life, and wildlife.

Ideas - Options
• 60*u*g/L and 120*u*g/L • Background levels + ? • Return of caribou to area • Dependent on composition of dust • Level that meets requirements for fish habitat • Level that prevents smothering/degredation of vegetation
Suggestion
• What: develop (over 3 years) a risk based criteria for dust • When: criteria would apply post-closure • Where: criteria would apply to all mine site areas

Table 13. Closure Criteria – Objective #20,30,41,51,69 – Dust levels do not affect palatability of vegetation to wildlife.

Ideas - Options
• Observations of wildlife continuing to eat vegetation • Evidence that caribou are eating vegetation • Presence of scat • Wildlife observations in dust deposition • Wildlife use area but not more than in past
Suggestion
• What: criteria would be wildlife presence though direct observation, browse or scat • When: criteria would apply post-closure • Where: in areas where planned for specific wildlife use post-closure

Table 14. Closure Criteria – Objective #12 – A final landscape *(infrastructure)* guided by pre-development conditions.

Ideas - Options
• Add "infrastructure" to objective definition to differentiate from #14 – (topography and vegetation) • Criteria would be compliance with an approved plan that was based on a final landscape that was guided by pre-development conditions • No unwanted buildings left on site. • No foreign material left on site
Suggestion
• What: surface infrastructure removed or cut to post-closure surface • When: Post-closure • Where: all surface closure areas

Table 15. Closure Criteria – Objective #14 – Landscape features (topography and vegetation) that match aesthetics and natural conditions of surrounding natural areas, where appropriate.

Ideas - Options
• Match ecological land classification (ELC) – pre and post • Match percentage of pre-disturbance ELC • Maintain pre-disturbance ELC distribution of types • Criteria would be compliance with an approved plan that was based on a final landscape that was guided by pre-development conditions
Suggestion
• What: • When: • Where:

Table 16. Closure Criteria – Objective #11 – Opportunities for communities to re-use infrastructure, where appropriate, allowable under regulation and where liability is not a significant concern.

Ideas - Options
• Opportunities are clearly communicated to communities • Communities get something • Communities had opportunities • Process is auditable and fair • Contract are open tender • Adheres to conditions of Socio-economic Monitoring Agreement (SEMA) and Participation Agreements (PA) • Number of on-site and off-site opportunities created for communities • First offer to communities • Don't let economics dictate • On-island liabilities understood
Suggestion
• What: Confirmation via third-party audit that relevant conditions of SEMA/PA were met and PA communities were given priority. • When: • Where:

Table 17. Closure Criteria – Objective #26 – Physically stable slopes to limit risk of failure that would impact the safety of people or wildlife.

Ideas - Options
• No significant subsidence, erosion, slumping
Suggestion
• What: Design by and as-built inspected and signed off by a Professional Engineer • When: Post-closure • Where: Wasterock and Till Storage Area, PKC, Pit Walls, North Inlet, Dike Islands

Table 18. Closure Criteria – Objective #16,31,42 – Ground surface designed, where appropriate, to drain naturally and follow pre-development drainage patterns to protect water quality, limit erosion and enable safe use by wildlife and people.

Ideas - Options
•
Suggestion
• What: Design by and as-built inspected and signed off by a Professional Engineer • When: Post-closure • Where: Mine Infrastructure Area, Wasterock and Till Storage Area, PKC Area

Table 19. Closure Criteria – Objective #48 – Safe small craft navigation through pit area.

Ideas - Options
•
Suggestion
• What: Breaks in dike to be 6m wide X 3m deep as per Transport Canada approval • When: Post-closure • Where: A154 and A418 dikes

Table 20. Closure Criteria – Objective #32 – No increased opportunities for predation of caribou compared to pre-development.

Ideas - Options
• Insert word “natural” before “predation” in objective • Develop criteria with Traditional Knowledge and science • Traditional Knowledge and science sign-off on design • Build to design • DDMI to monitor predation
Suggestion
• What: • When: • Where:

Table 21. Closure Criteria – Objective #22 – Prevent infrastructure from contaminating land or water.

Ideas - Options
• Change option description to “Prevent materials from contaminating land or water”
Suggestion
• What: CCME Soil Quality Criteria or Risk-based Criteria or Site specific Criteria • When: Post-closure • Where: Hydrocarbon Land Farm, Process Plant, Ammonium Nitrate Storage, Water Treatment Plant, Waste Transfer Area, Tank Farms.

Table 22. Closure Criteria – Objective #24 – Surface runoff and seepage quality that will not cause adverse effects on aquatic life or water uses in Lac de Gras or the Coppermine River.

Ideas - Options
• CCME drinking water guidelines • CCME aquatic life guidelines • CCME equivalent guidelines • Traditional Knowledge guidelines • Baseline water quality • No deleterious substances • Water License Effluent Quality Criteria
Suggestion
• What: Aquatic Thresholds – Acute and Chronic • When: Post-closure • Where: Acute threshold applies before mixing with Lac de Gras – Chronic threshold applies some distance into Lac de Gras

Closure Research Ideas / Opportunities generated during Closure Options Review

Table 23. Listing of closure research ideas/opportunities identified during the review of closure options.

Closure Research Ideas - Opportunities
• Processed kimberlite pore water monitoring. • Processed kimberlite freeze monitoring. • Active thaw zone depth in rock pile. • Processed kimberlite consolidation rate. • Metals uptake in vegetation – is there a difference with processed kimberlite. • Will caribou walk safely on coarse processed kimberlite. • Seepage rates and quality from PKC. • Vegetation species mix – technical desirability and desirability for wildlife. • Traditional knowledge on wildlife and caribou travel on roads. • Review of wildlife mitigation used in design of road to Rae. • What is the limnology of the North Inlet. • Dust generation from slopes of rock pile. • Water quality impacts from steep versus flat slopes on rock pile. • Amount of till available for closure.

Appendix IX-5

DDMI Site Workshop – Post-Closure Caribou Movement

August 17-21, 2009

Appendix IX-5
Site Workshop on Caribou Movement

Caribou will occasionally use disturbed areas such as roads, airstrips and tailings ponds to rest (Gunn, 1998), returning to these areas after foraging on nearby tundra. This behaviour has been observed at other mines in the Bathurst range, such as Lupin and Ekati. It has been suggested that this is to take advantage of the view and to make it difficult for predators to conceal themselves, similar to their habit of bedding on frozen lakes in the winter. Further, these areas have fewer mosquitoes and blackflies (Gunn, 1998). Although it is not clear that these disturbed areas are used preferentially to undisturbed areas (Gunn, 1998), it is possible that the waste rock piles and Processed Kimberlite Containment (PKC) area may be used by caribou following closure.

Eventually, it is possible that the waste rock piles and PKC will revegetate, providing forage for caribou and other wildlife. During winter, caribou forage primarily on lichen, which is slow to recover. Studies of caribou behaviour in relation to forest fires indicate that caribou select areas which have remained un-burnt for at least 50 years (Dalerum et al. 2007; Joly et al. 2007). Shrubs and forbs may colonize the waste rock piles in a much shorter period, and these may be used by caribou during the late summer and fall months.

In many respects, the waste rock piles and PKC dams are similar to the boulder associations present in the Lac de Gras area and the larger central Canadian Arctic (described and mapped in Matthews et al. 2001). Both Traditional Knowledge and aerial surveys in the Lac de Gras area have indicated that caribou avoid these areas.

The objective of the 2009 program was to engage five affected Aboriginal communities in discussions regarding post-closure caribou movement with respect to the site.

The camp was held at the Diavik mine site between 17 and 21 August 2009, with 1.5 days allotted to a second program relating to fish palatability. Representatives from the five affected Aboriginal communities participated (Table 1). Camp activities were organized and implemented by Diavik and were supported by a Wildlife Biologist from Golder Associates Ltd. in Yellowknife.

Table 1. Members from the five affected Aboriginal parties that participated in the 2009 fish palatability and caribou movement study.

Aboriginal Party	Participants
Kitikmeot Inuit Association (KIA)	Sadie Hanak and Jimmy Hanak
Lutsel K'e Dene First Nation*	Florence Catholique (translator) and Ernest Boucher
North Slave Metis Alliance (NSMA)	Nora McSwaine and Ron Balsillie[§]
Tli Cho	Francis Williah and Michel Louis Rabesca
Yellowknives Dene First Nation*	Alfred Baillargeon and Mary Rose Sundberg (translator)

*One participant from Lutsel K'e Dene First Nation and one participant from Yellowknives Dene First Nation cancelled at the last-minute; [§] participant only present on 17-18 August.

The camp schedule is presented in Table 2.

Table 2. 2009 Community-based Monitoring Program camp schedule.

Monday 17 August	Tuesday 18 August	Wednesday 19 August	Thursday 20 August	Friday 21 August
• Arrival and orientation • Discussion of camp objectives and schedule • Bus tour of the camp, including PKC and waste rock pile	• Tour of East Island and Diavik mine by helicopter • Discussion on caribou movement post-closure (slides & maps)	• Fish activities	• Fish activities (a.m.) • Discussion on closure options relating to caribou • Break-out groups to discuss closure options	• Closing remarks by Diavik and camp participants • Flights home

Prior to discussing closure options, the Camp participants were provided with a bus tour of the Diavik mine, with particular emphasis on the waste rock pile and PKC, a helicopter tour of East Island and the Diavik mine, and graphics showing options for the waste rock pile closure (included in this report).

The bus tour included driving past the PKC, to show its structure and location relative to the waste rock pile. Following this, the Participants were brought to the waste rock pile, ending in a brief walk at the top of the waste rock pile to inspect the structure, edge and height of the pile. The tour also included a visit to the test pile, to illustrate what the waste rock pile may look like following closure.

The view overlooking Lac de Gras from the waste rock pile.

Camp participants overlooking Lac de Gras from the top of the waste rock pile.

The helicopter tour of the East Island and Diavik mine included a survey of caribou trails on the East Island and surrounding areas, and a second tour of the PKC and waste rock pile. The tour by helicopter was intended to provide a view of Diavik in the larger context of the East Island, and Lac de Gras.

Finally, Diavik presented computer-rendered graphics showing the likely final size and area of the PKC and waste rock pile, and possible locations for trails over these piles. Following the site tour, helicopter tour and presentation of graphics illustrating closure options, the participants were engaged in discussions regarding closure options for the Diavik mine in relation to caribou.

The mine site looking across from the CBM camp.

Participants spoke of the value of caribou to all, the long history of the Dene and Inuit of hunting and fishing in the Lac de Gras area, and their concerns about the effects of mining and other activities. Although the overriding concern seemed to be of effects to water quality in the Coppermine River, caribou-related issues were an area of great concern. With regards to caribou, some of the aspects of the mine discussed included:

- concerns regarding caribou crossing very high rock piles
- the possibility of restricting wildlife access on the pile so they don't eat any vegetation growing up there
- smoothing the sides of the pile so that wildlife can go over it if they want to
- the possibility of contouring the waste rock pile so that its similar to natural topography
- need for a fence around PKC
- concerns that caribou will sink down into the PKC area
- the concept of finding traditional paths and plan access/crossing areas around these
- the need to smooth crossing/access areas so caribou feet do not get hurt
- that the East island is now dead due to mine development, caribou may naturally avoid this area in the future for this reason
- ramps have been used along the Misery road to facilitate caribou crossing

Caribou discussions in the onsite meeting room.

During the course of the discussions, three options in particular were developed during the course of discussion by the Participants:

- Leave the rock piles and PKC as they are now. Participants stated that they view the East Island as dead because of the development so caribou will not return. Also, the current rock pile and PKC dams prevent access to most caribou due to the steep sides and large rocks.

- Cover the entire surface of the waste rock pile and PKC with fine, smooth gravel. This would allow access for caribou to pass freely over the waste rock piles and PKC. Further, the waste rock piles should be contoured to mimic the surrounding landscape.

- Design passages or corridors over or around the waste rock pile and PKC area. This would allow movement of caribou around, over and across the structures, but at specific areas. It was recommended that the general layout of these corridors should correspond to historic caribou trails on the island.

Observations of caribou in the Diavik study area and East Island do not support the assumption that the East Island is entirely dead. Although there has been disturbance to the East Island as a result of mine development and activities, caribou do still return to the island and are observed annually, predominantly in the late summer and fall.

With regards covering the waste rock pile and PKC with fine gravel and smoothing the surface, there are a number of feasibility issues which may not make this option viable. First, the waste rock pile contains acid-generating rock, which should be kept frozen to mitigate the potential for acid rock drainage. This permafrost development may (or would likely be) compromised if the waste rock piles were re-contoured to look like surrounding hills. Secondly, there are limited supplies of non-acid generating rock required to completely cover the waste rock pile and PKC area with fine gravel. Finally, the other environmental consequences to such an effort must be considered; in particular, the dust and emissions required to crush, move and contour such a large volume of rock.

The final option presented to Diavik, of creating pathways around and over the PKC and waste rock pile, appears to have several merits and would be feasible. There are currently various ramps and access points to the waste rock pile and PKC area, used by haul trucks to access the pile. The surface of these ramps is smooth and would not present a hazard to caribou. These could be expanded and added to, providing a series of access points over the waste rock piles and PKC area. Further discussion is required to decide if these should be straight passages, if there should be intersections between trails, how they should be bermed, and if they should be straight or tapered corridors or lead to some open areas.

Various Traditional Knowledge studies conducted during the Ekati and Diavik baseline studies will provide insight into the historic movements of caribou on the East Island. Aerial surveys could be conducted with community members to map caribou trails (or confirm trails identified in the Diavik EA). Air photos may also be helpful to identify pre-disturbance trails. In consultation with land users, these

trails could be used to guide the layout of caribou passages over the waste rock pile.

Recommendations - Wildlife Movement

- Further community consultations on closure options are required
- Ensure that good interpreters are available who know some technical terminology
- Keep participants for the camp consistent from year to year
- Diavik needs to communicate consistent participant requirements to the communities when requesting participants
- Each group needs to now relay information from this camp to their respective organizations
- Further discussion of the camp should take place during the meetings between Diavik representatives and community Chief & Council being planned for September 2009 in each community
- A summary PowerPoint presentation should be provided to community representatives so they can share with their communities

References

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Joly, K., Bente, P. and Dau, J. 2007. Response of overwintering caribou to burned habitat in Northwest Alaska. Arctic 60:401-410.

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Wildlife Movement Options

Closure Options for Wildlife Movement

Key Considerations

- How can wildlife safely move around or over the mine site once the site is no longer being used?
- Do participants prefer wildlife to avoid the area of the mine?
- Do we want to create habitat for wildlife in some areas within the mine footprint?
- What should the waste rock piles & PKC look like once they are no longer being used?
  - Left as is?
  - Smooth sides?
  - Smooth on top?
  - Corridors?

2

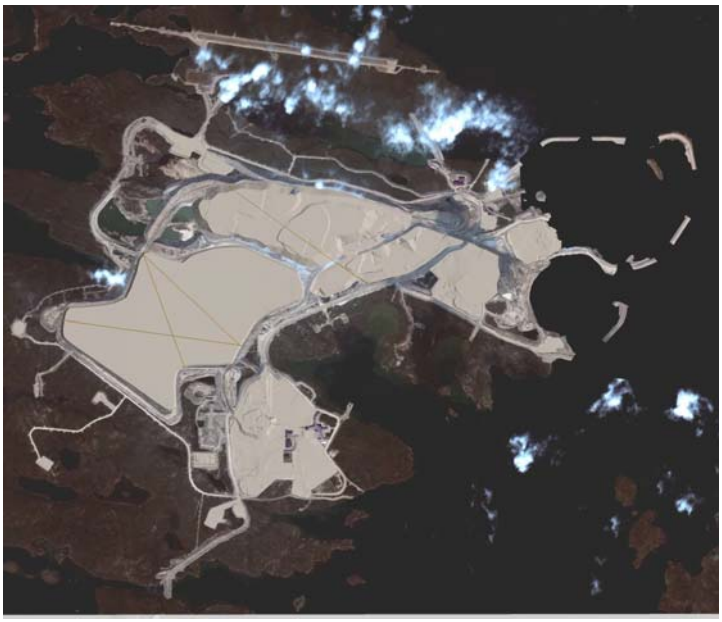
RioTinto

The Mine Site – Current (2008 image)

3

RioTinto

Drawings – Possible Closure Views



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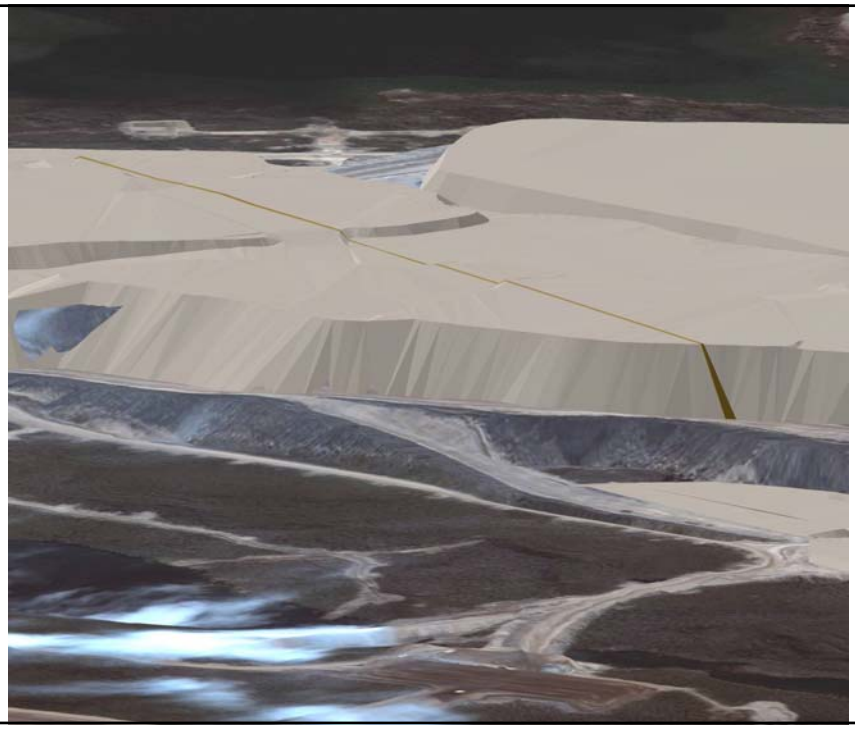

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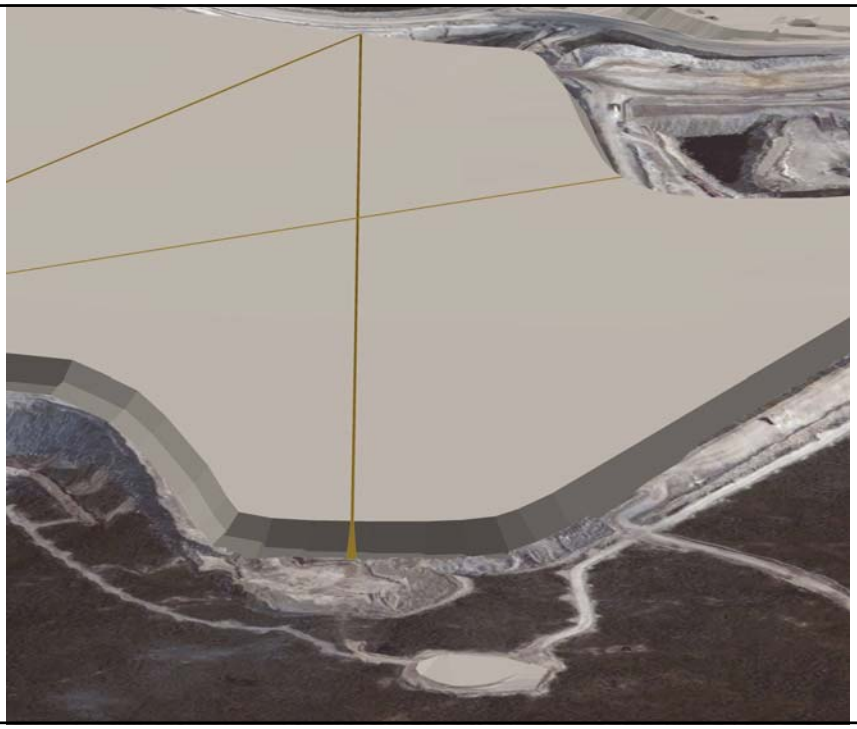

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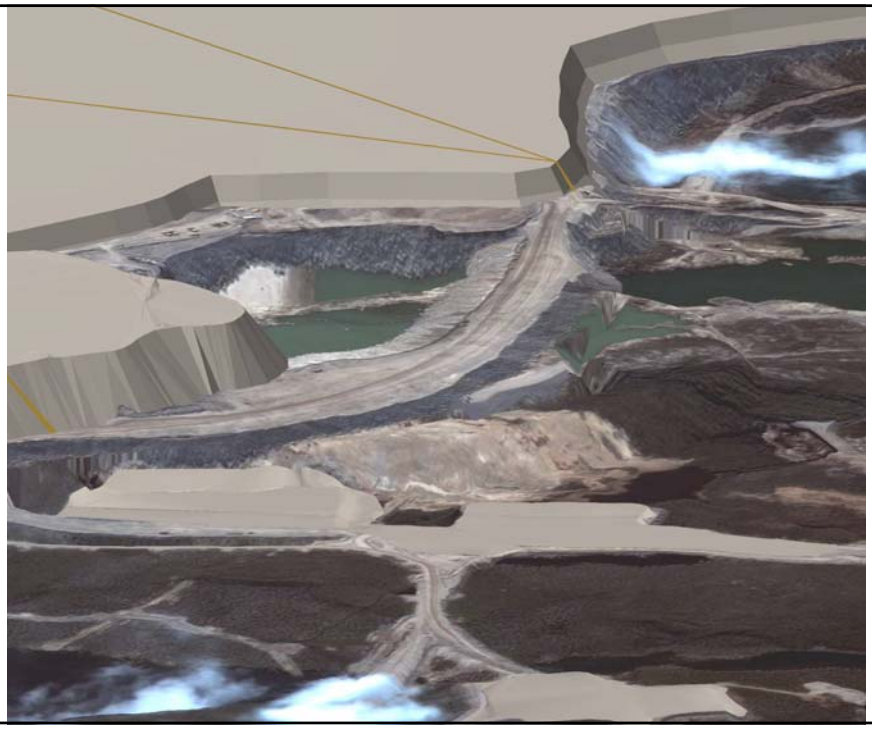

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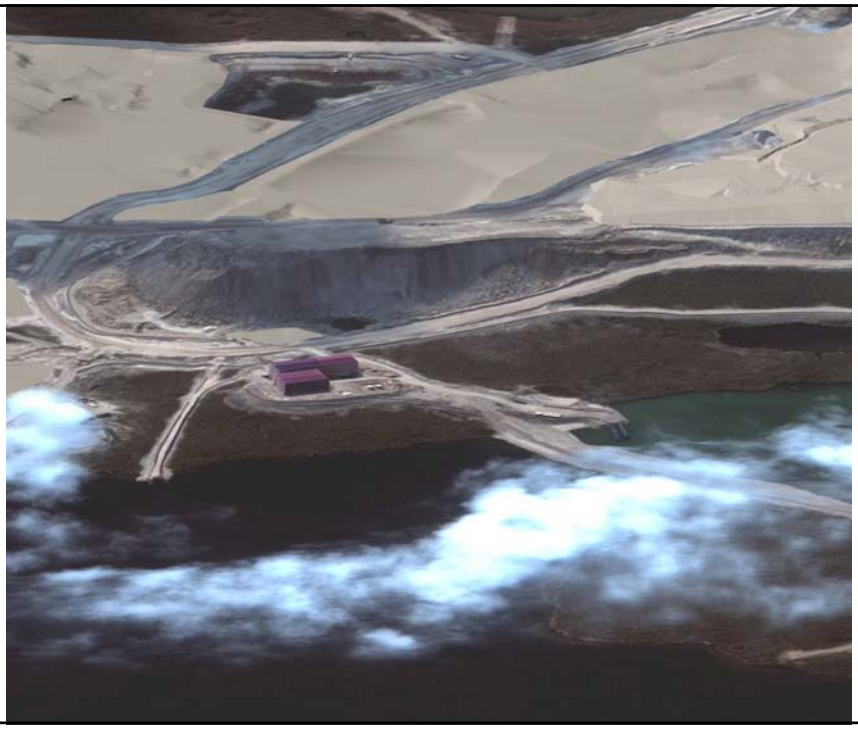

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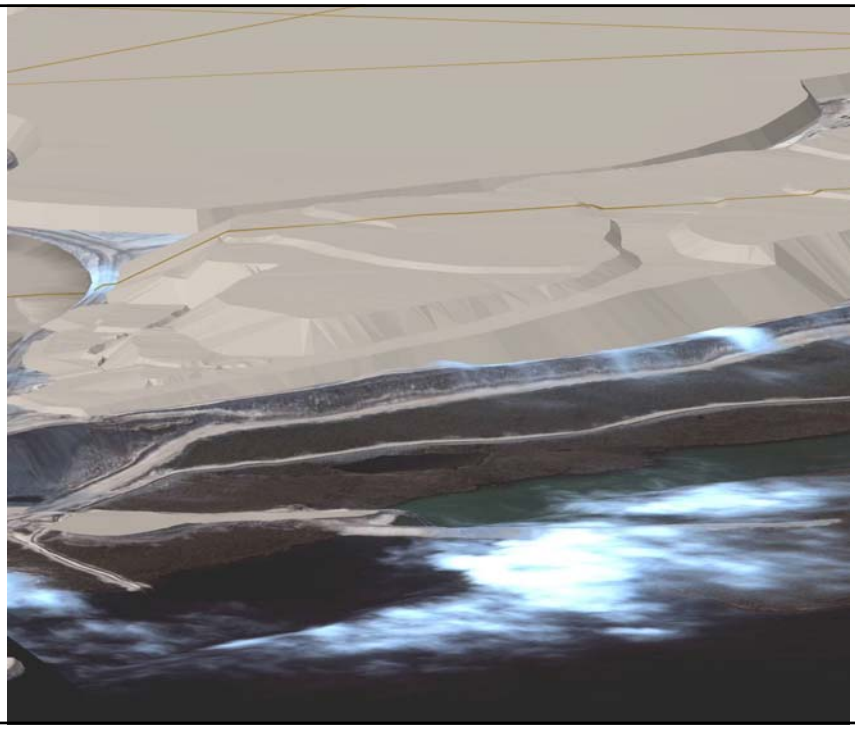

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Appendix IX-6

DDMI Presentation to Communities

September to December 2009

Diavik Diamond Mine

Interim Closure and Reclamation Plan

Communities Presentations
September - December 2009

Closure planning history

Closure alternatives – mine design phase

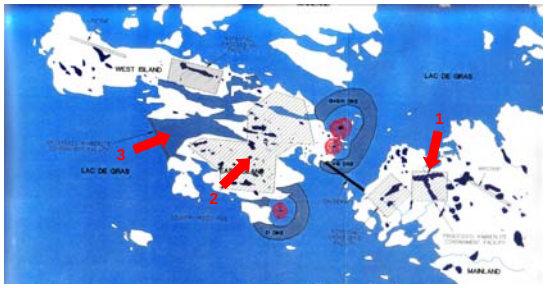
Human resources options

↳ Mining method options

↳ Siting options
- PKC
- Waste rock

↳ Design options
- Water management
- Water treatment
- Processed kimberlite containment

Location alternatives - PKC



- **#1: T-Lake on mainland** – causeway and larger footprint
  - Better closure option than #2 due to location.
- ✓ **#2: East Island valley** – closest to mine
  - Most technically challenging closure
- **#3: Lac de Gras** – preferred geochemical option – unacceptable from communities perspective.
  - Technically most secure closure option.

Location alternatives – waste rock

- ✓ **#1: Near open pits** – most practical
  - More difficult closure option
- **#2: Backfill completed pits** – mining sequence issue, geochemical problems, double handling
  - Better closure option if placed directly into flooded pits
- **#3: Lac de Gras** – widening of dikes – best geochemical control – fish habitat and communities concerns
  - Technically most secure closure option

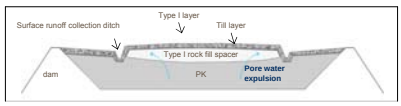
Initial closure and reclamation plan 1999

Interim closure and reclamation plan 2009 update

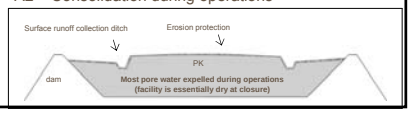
- Identification of options
- Selection of preferred options - landscape level
- Selection of more detailed options in the future
- Recommended closure criteria
- Working towards selection of all options and a Final Closure Design by 2015

A – Processed kimberlite consolidation

A1- Consolidation post closure



A2 – Consolidation during operations



B – Surface of processed kimberlite containment area

B1 – Coarse kimberlite

B2 – Kimberlite beach

B3 – Country rock

C – Height for roads, plant site, laydown and airstrip

C1 – Re-slope inwards

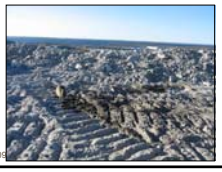
C3 – Re-mine for material

C2 – Re-slope outwards

D – Surface for roads, plant site, laydown and airstrip

D1 – Smooth surface

D2 – Scarified surface

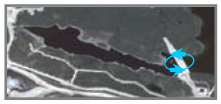


E – Inert landfill location

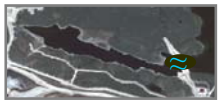
E1 – Country rock pile
E2 – PKC
E3 – Pit Bottom
E4 – Underground tunnels

F – North inlet

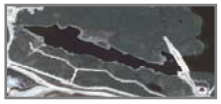
F1 – Hydrologic connection to Lac de Gras



F2 – Open connection to Lac de Gras



F3 – No connection to Lac de Gras



G – Side slope on country rock piles

G1 – Flat slopes

G2 – Steep slopes

H – Till cap on country rock piles

H1 – Till cap on top and sides

H2 – Till cap on top

H3 – No till cap

I – Alternative infrastructure use

I1 – On-site facility

I2 – Reuse in communities

J – Areas for re-vegetation

J1 – Roads, plant site, laydown, airstrip
J2 – PKC
J3 – Country rock piles

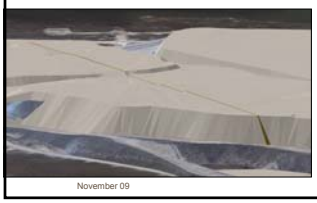
Wildlife movement – post-closure

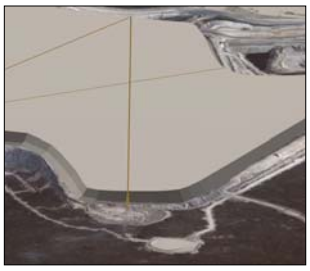
- Closure design for wildlife movement is current focus
- Communities workshop at site 17-21 August 2009
- Outcome was three main options:

1 Leave rock pile and dam as is – little to no access to PKC or rock piles

Wildlife movement – post-closure

2 Use traditional caribou trails to develop defined paths - controlled access to PKC and rock piles





Wildlife movement – post-closure

3 Contour the pile and dams - full access to PKC and rock piles

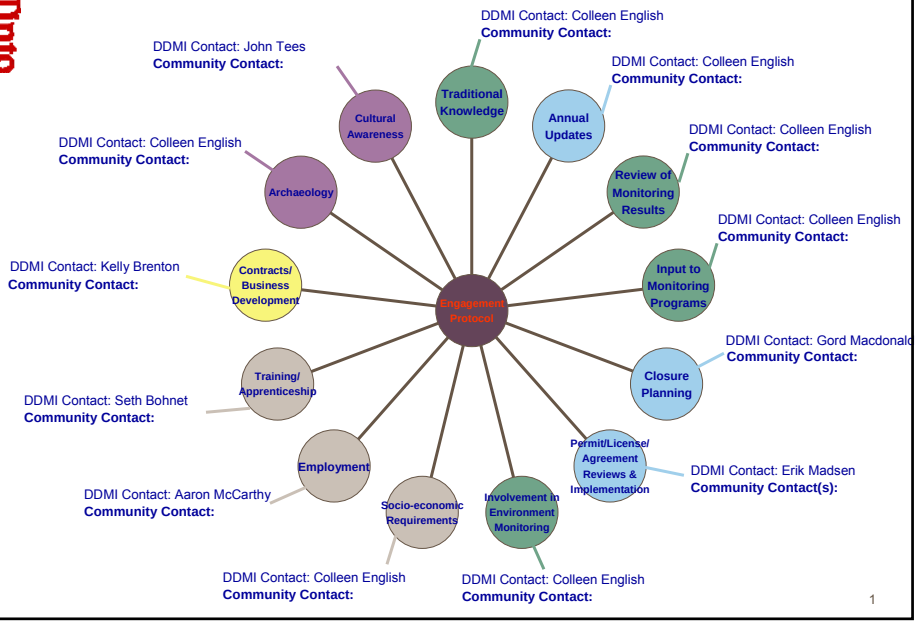
Next steps

- The Interim Closure and Reclamation Plan will be submitted to the WLWB by 2 November 2009
- The WLWB will be distributing the Plan for review on 9 November 2009
  - The Plan will discuss the options we have outlined here for you today
- Reviewer comments on the Plan will be due on 18 December 2009
- On-going process to define closure criteria, complete required research, conduct additional consultation and select closure options
  - Goal is final closure plan by 2015
- Continual community participation is beneficial – workshops, meetings, consultations, discussions, letters
- We want to know what is appropriate for how the site should look at closure, and how the animals should move through/around the site

Appendix IX-7

Community Engagement

Community Engagement Scope



1

- **Contracts & Business Development**
  - ***Purpose:*** notification of upcoming contracts, attending contractor meetings and discussing opportunities for business development
- **Traditional Knowledge**
  - ***Purpose:*** organize TK Holders to participate in Environment monitoring programs (workshops for input & conducting programs) & work to develop TK monitoring programs
  - How develop TK programs – with external assistance or "Aboriginal organization" in-house?
- **Annual Updates – all aspects of business**
  - ***Purpose:*** determine format and content to present
  - Need to organize date, time, location, meal, etc.
- **Review of Monitoring Results – Environment**
  - ***Purpose:*** determine format & content to present and who best to present to
  - Need to organize date, time, location, meal, etc.
- **Input to Environment Monitoring Programs**
  - ***Purpose:*** determine format to present & get feedback and who from the community to involve
  - Need to organize date, time, location, meal, etc.
- **Involvement in Environmental Monitoring**
  - ***Purpose:*** organize community assistants to participate in Environment monitoring programs
    - Includes assistance organizing security clearance documents, medicals, etc.
  - Does "Aboriginal organization" have a list of members with some experience or training who are willing to conduct ad-hoc or seasonal work who meet security requirements of the mine?
- **Heritage/Archaeological Sites**
  - ***Purpose:*** identify known sites for the "Aboriginal organization" in the Lac de Gras area, organize community assistants to participate in documenting sites and notification if we find an archaeological site that may be of interest to the "Aboriginal organization"

2

- **Closure Planning**
  - ***Purpose:*** determine format to present and get feedback, who from the community to involve
  - Need to organize date, time, location, meal, etc.
- **Agreement Reviews & Implementation** (Participation (PA) and Environmental (EA) Agreements)
  - ***Purpose:*** lead for PA review process for "Aboriginal organization", lead for PA implementation; lead for EA review process, lead for EA implementation
- **Permit/License Applications** – includes A21, land use permit applications, etc.
  - ***Purpose 1:*** notification of applications and how best notify
    - if multiple groups, please state hierarchy for notifications
  - ***Purpose 2:*** determine information required to present &/or distribute and who to present to & best format
  - If presentation(s) required, need to organize date, time, location, meal, etc.
- **Socio-economic Results & Reporting**
  - ***Purpose:*** communicate results (hierarchy?), provide copies of biannual reports (electronic vs hardcopy?), how to communicate results
- **Employment Opportunities/HR Issues**
  - ***Purpose:*** notification of upcoming employment opportunities, assistance to DDMI to organize recruitment drives in communities, posting of job advertisements
- **Training and Apprenticeships**
  - ***Purpose:*** notification of upcoming opportunities, how to distribute information on how to apply for apprenticeships, notifications for upcoming training programs
- **Cultural Awareness**
  - ***Purpose:*** input on content of a cultural awareness program for DDMI employees, opportunities for "Aboriginal organization" involvement in delivering the program
  - Does "Aboriginal organization" have existing video footage that can be incorporated in to the DDMI on-line training system?

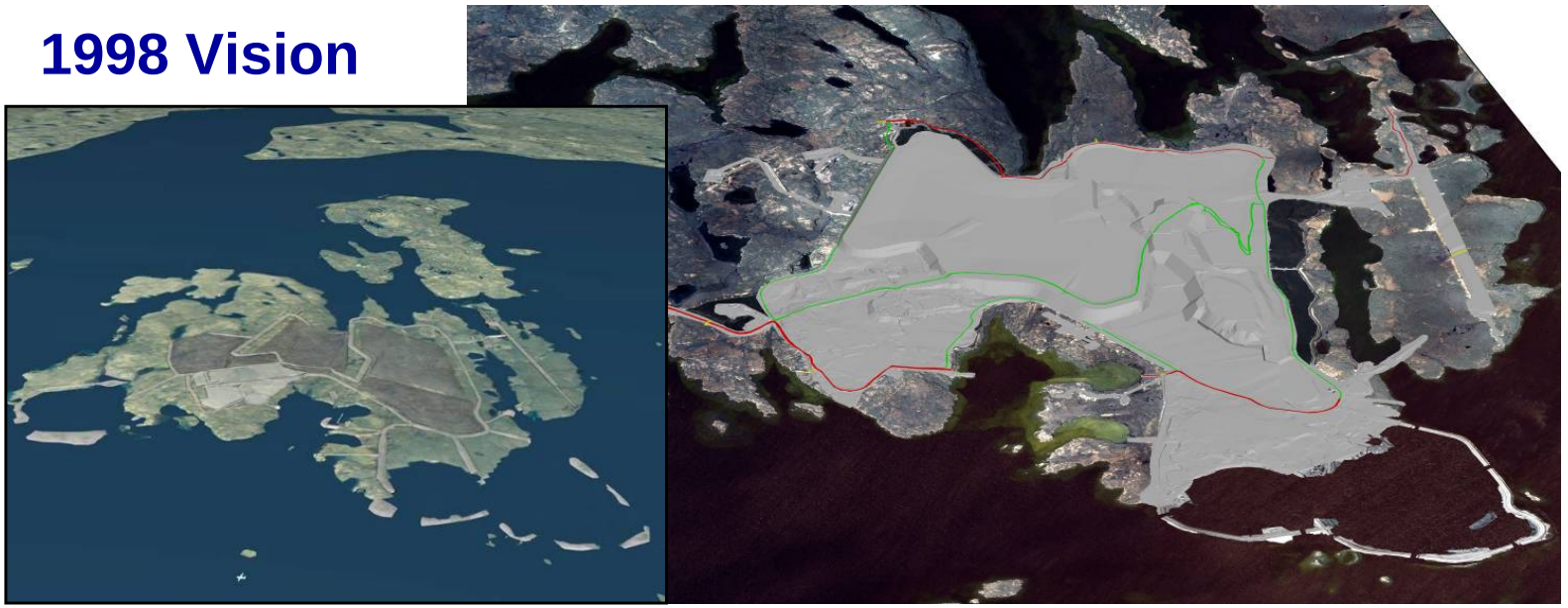
Appendix IX-8

Closure Planning

Closure planning

Current Concepts

1998 Vision



- Interim Closure and Reclamation Plan update to WLWB December 2010
- Describes current concepts and future research plans
- We are working with community leadership to determine best approach to engaging communities and incorporating Tradition Knowledge in closure planning.

APPENDIX X

CLOSURE REPORTS

X-1 Fish Habitat Design for the Pit Shelf Areas at Diavik Diamond Mine

X-2 Fish Habitat Design for the A418 Pit Shelf Areas at Diavik Diamond Mine

X-3 Preliminary Pit Lake Mixing Study

X-4 Initial Screening Assessment of Options for Disposal of Inert Building Materials at Closure – Diavik Mine Site

X-5 Disposal Alternatives for North Inlet Water Treatment Plant Sludge

X-6 Diavik Waste-Rock Research Program – 2009 Progress Report

X-7 Reclamation Materials Inventory and Mapping – 1996 Environmental Baseline Program

X-8 Climate Change Adaption Project

X-9 Diavik Underground Backfill

X-10 North Inlet Sediment Investigation

Appendix X-1

Fish Habitat Design for the Pit Shelf Areas at the Diavik Diamond Mine

REPORT ON

FISH HABITAT DESIGN FOR THE PIT SHELF AREAS AT THE DIAVIK DIAMOND MINE

Submitted to:

Diavik Diamond Mines Inc.
1420 6A Street N.W.
Calgary, Alberta T2M 3G7
Attention: Mr. Gord MacDonald

DISTRIBUTION:

1	Copy -	Diavik Diamond Mines Inc., Calgary (Attention Gord MacDonald)
1	PDF -	Diavik Diamond Mines Inc., Calgary (Attention Gord MacDonald)
2	Copies -	Diavik Diamond Mines Inc., Yellowknife
1	Copy -	Diavik Diamond Mines Inc., Yellowknife (UNBOUND)
1	CD -	Diamond Mines Inc., Yellowknife
3	Copies -	Diavik Diamond Mines Inc., Lac de Gras (Attention Jeff Reinson)
1	Copy -	Golder Associates Ltd., Saskatoon
1	Copy -	Golder Associates Ltd., Calgary
1	Copy -	Golder Associates Ltd., Yellowknife

March 2003
012-2331

EXECUTIVE SUMMARY

This report presents the detailed design for the creation of fish habitat on the interior of the water retention dikes (dikes) for the Diavik Diamond Mines Inc. diamond mine located on Lac de Gras in the Northwest Territories, Canada. This design was prepared in accordance with the "No Net Loss" plan prepared by Diavik Diamond Mines Inc.

This design is applicable to the A154, A418, and A21 pits; however, since only the A154 dike has been constructed, the majority of the information is based on A154. This design has been prepared by developing criteria for the end result, thus providing flexibility on the part of Diavik Diamond Mines Inc. as to how the end result is achieved.

The fish habitat creation on the interior of the dikes consists of placing material excavated from the open pits in the area between the pit crest and the toe of the dikes, to create an area generally varying from 3 m to 5 m below the mean normal water level for Lac de Gras. During mining operations, the toe of the fill will be set back from the edge of the pit crest for safety. At the completion of mining, the fill will be extended to the pit crest.

Detailed design drawings have been prepared for A154, and construction guidelines have been presented that can be applied to A418 and A21, once the dike location and pit geometry are determined.

TABLE OF CONTENTS

LIST OF TABLES

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

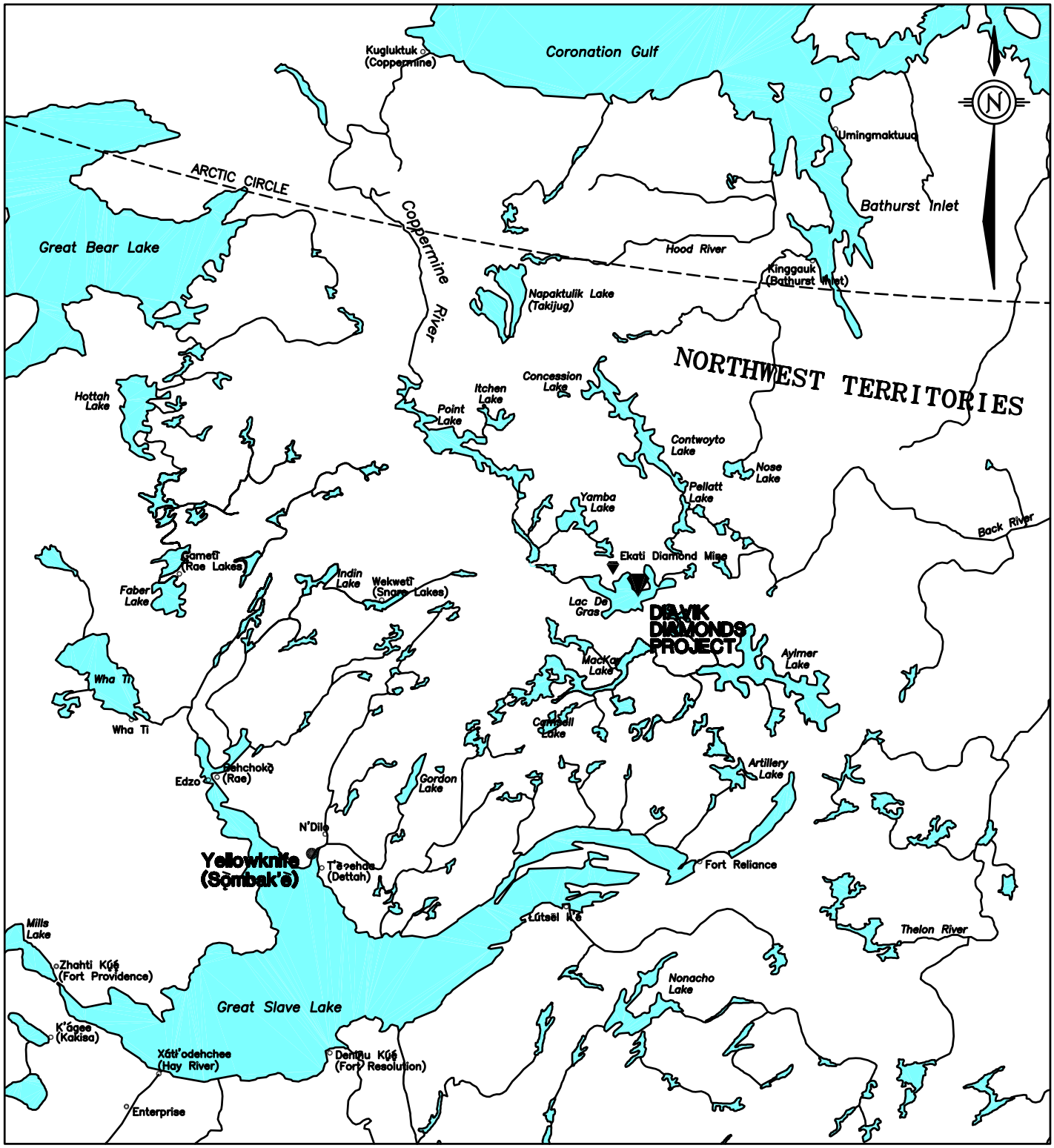
LIST OF APPENDICES

1.0 INTRODUCTION

This report presents the detailed design for the fish habitat compensation plan for the interior of the water retention dikes (*i.e.*, the pit shelf) at the Diavik Diamond Mines Inc. (DDMI) diamond mine in the Northwest Territories. The location of the mine is shown in Figure 1. This detailed design is based on the "No Net Loss" (NNL) Plan (Diavik 1998), and the conceptual fish habitat plan prepared by Golder Associates Ltd. (Golder). The conceptual fish habitat compensation plan for the pit shelf is to construct habitat on the shelf, by filling in the lower elevation (deeper water) areas. The general plan is to fill in the areas on the shelf that are deeper than 5 m of water depth with materials excavated during development of the pits.

As stated, this document provides the detailed design for the fish habitat compensation for the pit shelf; however, it does not provide specifications for construction. Rather, this document provides details for achieving the desired end result, while providing flexibility in how the end result is achieved. The requirement for this flexibility is due to some of the unknowns with respect to material parameters, mine operations (*i.e.*, blasting details, availability of various materials), and construction timing. The habitat design parameters were developed considering fish habitat, surface water runoff, and geotechnical issues. Design details with respect to surface water handling, material selection, construction, and other issues would be addressed by DDMI, to achieve the desired habitat compensation prior to reflooding of the diked areas.

This design applies to the A154, A418, and A21 pits; however, only A154 has been constructed to date. A418 is scheduled for construction in approximately 2007, with A21 currently scheduled for about 2013. Since the water retention dike (dike) locations and pit layouts for A418 and A21 have not been finalized, some of the design details may be modified for these two pits. It is intended that the design details (particularly setback distances and slope angles) be reviewed prior to construction of fish habitat compensation measures for A418 and A21, to incorporate knowledge gained from the construction and performance of A154. Also, it was understood that the pits will be developed in a series of expansion cuts, thus permitting the opportunity to monitor slope stability and pore-pressures in the in-situ materials in each pit well in advance of the excavation of the final pit slopes, and construction of the fish habitat fills.



LEGEND

- ○ COMMUNITY
- ▼ DIAMOND MINE/EXPLORATION

REFERENCE

SELECTED MINERAL DEPOSITS OF THE NORTHWEST TERRITORIES, DEPARTMENT OF ENERGY, MINES AND RESOURCES, MINERAL INITIATIVES 1991 TO 1996 REVISED OCTOBER, 1996

PROJECT

DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE

PROJECT LOCATION

Golder Associates
Saskatoon, Saskatchewan

PROJECT	012-2331.5310		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	RML	02/17/03		
CHECK				
REVIEW				

FIGURE: 1

N:\Active\2000\012-2331 Diavik Habitat Compensation\cad\LDD\ Drawing file: KeyplanA.dwg Mar 27, 2003 - 5:37pm

2.0 BACKGROUND

The objective of the fish habitat compensation measures on the interior of the water retention dikes is to provide nursery and rearing habitat similar to the pre-mine habitat in the north inlet. The conceptual design for the fish habitat compensation, as outlined in Golder's report entitled "Conceptual Design and Compensation Workplan for the Fish Habitat Compensation Program, Diavik Diamond Mines Inc., Lac de Gras", dated August 2001 consisted of:

- Re-contouring the pit shelf (area between the interior toe of the water retention dike and the crest of the pit slope) to provide habitat with a water depth of approximately 5 m after the dike is breached. New habitat will only be constructed where the water depth exceeded 5 m, the shallower areas of the shelf will not be excavated, as these areas already provide shallow water habitat. If fill is placed in this area during mine operations, setbacks will be required between the pit crest and the toe of the slope, as well as between the interior toe of the dike and the toe of the fill slope. These areas could be filled near the end of mining, or after completion of mining, if required.

- Constructing long, narrow, rocky reefs extending from the interior slope of the dike to the crest of the open pit. The reefs would be built in areas where the water depth is 5 m and would be approximately 2 m to 3 m high. Areas of granular and soft substrates between the reefs would be based on the conditions that existed in the north inlet.

- Modification of disturbed shoreline areas to establish conditions similar to pre-development. This may include placement of boulders in water depths up to about 5 m.

- Flooding the area after completion of habitat construction.

- Breaching the dikes to create shallow (minimum 2-m depth from low water) entrances, to deter the movement of larger fish into the nursery and feeding habitat, similar to the rearing habitat in the north inlet.

3.0 DESIGN PARAMETERS

3.1 Geotechnical Parameters

The information that was available to carry out the design consisted of bathymetric contours, till thickness isopachs, sediment thickness isopachs, till and sediment grain size and strength parameters, and earthquake seismic parameters. Production blasts have only recently begun, and thus some assumptions were made, and will be used in conjunction with the observational method to account for the potential of blast-induced instability. The majority of the information provided was specifically for the A154 dike and pit. However, the material parameters and construction guidelines for the fish habitat compensation on the pit shelves are similar for all three proposed open pits.

The till and sediment shear strength parameters used for slope stability analyses were obtained from the final A154 dike design report prepared by Nishi-Kohn/SNC-Lavalin (NKSL). The till and sediment were also observed and sampled to check that the material appeared consistent with the shear strength parameters used for the dike design. The till was also sampled to determine if the grain size of the material sampled was similar to that presented in the dike design report.

The till was sampled at the till dumps, as the active excavation areas were inaccessible at the time of sampling. Inactive excavation areas could not be sampled, as the till was frozen. The till that was sampled at the till dumps is considered representative of the till that was being excavated on October 14 and 15, 2002. It is not considered representative of the till throughout the A154 pit shelf area, as this is a very large area and the till is likely to vary across the shelf, as reflected in the range of grain sizes presented in the dike design report. The results of the grain size analyses are shown in Table 1. The grain size of the till that was sampled generally fall within the range of samples reported in the design report, but on average the samples obtained on October 14 and 15 contain more silt and less sand than the typical samples from the design report. The grain size information from the design report and the October 2002 samples are compared in Table 2.

Table 1
Grain Size Analysis Results

Location	Moisture Content (%)	Gravel Content (%)	Sand Content (%)	Silt/Clay Content (%)	Clay Content (%)
South Dump	6.2	52	23	25	nm
South Dump	9.5	23	34	43	nm
Upper Quarry	11.0	18	39	43	5
Upper Quarry	19.2	27	37	36	4
Batch Plant	7.6	33	35	32	nm
Batch Plant	31.2	7	46	47	nm
Average	14.1	26.7	35.7	37.7	NA

Notes: nm = not measured.
NA = not applicable, insufficient values measured.

Table 2
Summary of Grain Size Analyses

Material	Gravel Content (%)	Sand Content (%)	Silt/Clay Content (%)	Clay Content (%)
From Dike Design Report				
Till (range)	0 to 45	40 to 90	3 to 50	0 to 6
Till (average)	26	51	23	NA
Sediments (range)	0 to 15	0 to 75	10 to 100	0 to 33
Sediments (average)	2	29	63	6
From samples obtained in October 2002				
Till (range)	7 to 52	23 to 46	25 to 47	4 to 5
Till (average)	27	36	38	NA

Note: values from dike design report are approximate.
NA = not applicable, insufficient values measured.

The shear strength results reported in the design report are listed in Table 3. The samples were tested in a disturbed state and thus are considered appropriate for the placed material and are conservative for the in-situ material. The design parameters are considered reasonable for the till and sediments, considering the variability of the grain size of these materials.

Table 3
Shear Strength Parameters (from Final Dike Design Report)

Material	Measured Friction Angle (°)	Measured Cohesion (kPa)	Design Friction Angle (°)	Design Cohesion (kPa)
Sediments	32 to 38.7 (average = 34)	0	26	0 to 10 (0 used in this study)
Till	36 to 41.5 (average = 39)	0	35	0

Note: Strength parameters are based on effective stresses.
kPa = kilopascal.

The bathymetric measurements carried out by DDMI prior to dewatering A154 indicate that the maximum water depth was 22 m. The deepest water around the pit crest appears to be approximately 17 m, and the deepest water near the toe of the dike is also approximately 17 m. Consequently, the highest expected long-term face of placed fill for A154 is expected to be 12 m to 14 m, depending on surface water drainage requirements.

Based on available information from exploration boreholes, the lakebed sediments range from 0 m to 7 m thick and are typically less than 2 m thick, except for a few localized pockets. The in-situ till, beneath the sediment, ranges up to 13 m thick and is typically 5-m to 10-m thick. The till is significantly thicker above the pit than on the pit shelf area. The till thickness information is relatively scant on the east side of the A154 pit and thus the till thicknesses could vary from the interpreted values.

3.2 Fish Habitat Parameters

3.2.1 Overview of No Net Loss Requirements related to Insides of Dike Areas

The Fisheries Authorization identified the requirements for achieving NNL of habitat for all aspects of the DDMI Diamond Project. Specific requirements for the inside of all three dike areas included:

- the development of shallow rearing habitat and shoreline habitat; and,
- ensuring that the habitat features within the dikes areas are modeled after those features found in other productive areas of Lac de Gras, including depth, substrate type, size, and configuration.

Four key zones of habitat were identified in the NNL Plan (Diavik 1998) for the area found inside the constructed dikes during the post closure phase. These included:

1. Inside edge of the dike. The area of water depths from 0 m to 2 m along constructed sections of the dike representing new shoreline habitat.

2. Reclaimed shorelines. Areas of pre-existing shorelines.
3. The pit shelf. The area between the inside edge of the dike, the shorelines, and the pit crest.
4. Deep water. The pit itself as it will have a depth of approximately 250 m.

The NNL Plan provided habitat unit calculations based on the available design information for the dikes and pits at the time. Some modifications to the design dike and pit dimensions were made subsequent to the submission of the NNL plan, and as-built information is now available for the A154 dike. The habitat units calculated as part of the NNL Plan Addendum (DDMI April 1999), along with re-calculated values based on this updated information are presented in Appendix I.

The following sections outline the general principles and criteria to be used in developing the final layout for all three dike areas. As discussed in the NNL, the primary focus for habitat creation inside of all dikes is based on maximizing rearing habitat value. Target species include lake trout (*Salvelinus namaycush*), arctic grayling (*Thymallus arcticus*), burbot (*Lota Lota*), longnose sucker (*Catostomus catostomus*), round whitefish (*Prosopium cylindraceum*), cisco (*Coregonus artedi*), lake whitefish (*Coregonus clupeaformis*), and slimy sculpin (*Cottus cognatus*).

3.2.2 Overall Criteria

Several overall governing criteria can be applied to the habitat creation activities inside the dikes. First of all, areas inside the dike on the pit shelf that are already at a depth of 4 m or less should not be disturbed if possible. This will allow the maintenance of habitat features not easily re-created. In areas where final depth is between 4 m and 5 m, it would be desirable to maintain existing habitat depending upon grading requirements for drainage, or other construction considerations. Existing shoreline features should also be maintained to the extent feasible. Construction crews should avoid driving on, dumping on, scraping, or otherwise impacting these areas. Leaving these areas intact will decrease the amount of work required to restore the shoreline at closure and will speed the recovery process of the altered areas inside the dike as a variety of organic properties, including the possibility that dormant life stages of some plants or animals will be present in the substrate.

The storage and handling of materials, particularly hydrocarbons or other types of contaminants, should be closely monitored on the shorelines, pit shelf, and inside edges of the dike. Heavy equipment in the area should be maintained and fuelled in a manner that avoids the possibility of spills occurring in areas to be reclaimed as fish habitat.

3.2.3 Inside Edges of Dike

The inside edge of the dike is intended to provide new shoreline features for foraging and rearing habitat for most species as well as other values, including spawning, for slimy sculpin. The dike itself will resemble existing shoreline and reef habitat and is expected to provide a rocky (boulder/cobble), moderate slope area with low to moderate wind and wave action. The NNL plan habitat evaluation completed for the inside edge the dikes treated this area as shoreline habitat.

Suitable materials for this habitat feature are a mix of primarily large boulder with some smaller cobble. Slopes should also ensure a stable profile and range from gentle to moderate. The range of slopes for existing shorelines should be used as a guideline. The area of habitat predicted in the NNL plan for this habitat type, for all three dikes is provided in Table 4. For A154, based on constructed dike configuration and the design criteria presented in this report, 3.41 ha of new shoreline habitat are expected to be created.

Table 4
Inside Edge of the Dike Shoreline Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area [1] (ha)
A154	1.37	3.41
A418	0.48	n/a
A21	1.07	n/a

[1] Note: Based on final constructed configuration of dikes, where available.
ha = hectare.

3.2.4 Reclaimed Shorelines

The objectives for the pre-existing shoreline along the edge of the diked area, and around any islands within diked areas, are to:

- minimize change to existing substrates or other features; and,
- re-configure disturbed portions to pre-development conditions as much as possible.

This will allow the shoreline areas to be restored to pre-existing conditions once the dikes are breached. Any areas of disturbed shoreline are to be re-configured to provide fish habitat resembling that which was temporarily lost during the project. This may include placement of boulders in water up to 5 m deep to provide a sloping shoreline. The area of habitat predicted in the NNL plan for this habitat type, for all three dikes, is provided in Table 5. For A154, based on constructed dike configuration and the design criteria

presented in this report, 2.36 ha of shoreline habitat are expected to be reclaimed and includes shoreline areas around one island on the pit shelf.

Table 5
Reclaimed Shoreline Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area [1] (ha)
A154	0.52	2.36
A418	0.61	n/a
A21	0.82	n/a

[1] Note: Based on final constructed configuration of dikes, where available.
ha = hectare.

3.2.5 Pit Shelf

The pit shelf area extends from the lower inside edges of the dike to the edges of the pit. The reclaimed pit shelf area is intended to provide shallow foraging and rearing habitat for most species of fish present in Lac de Gras. Material excavated from the pit will be used to fill in deeper portions of the pit shelf area. The area of the pit shelf will be covered by water that ranges from 3 m to 5 m deep. As per the *Navigable Waters Protection Act* Permit for the project, no dike breach or constructed shoal features will be less than 2 m from the expected low water level in Lac de Gras.

As indicated in the NNL plan and the Fisheries Authorization, the objectives for the selection of substrate type are based on reflecting physical characteristics of other areas of good foraging and rearing in Lac de Gras. The pit shelf configuration is also to be based on reflecting the physical characteristics of foraging and rearing habitats within Lac de Gras. In order to address these objectives, substrate information from baseline data collections was used and a basic configuration evaluation of the North Arm and two other nearby inlets identified as rearing areas within Lac de Gras was completed. The configuration evaluation was completed through air photo interpretation. Key features identified by assessing other rearing areas included:

- Rocky Shoal Shape – rocky shoals should be somewhat irregular in size and shape and relatively long and narrow. Some may also be constructed like a series of submerged rocky humps like links in a chain. Longer and narrower reefs have more "edge" habitat. Edges are important to fish that feed in one habitat type and rest or seek refuge in another.

- Isolated Pond-like Areas - In some cases it is beneficial to small fish to have the reefs forming a disjointed "ring" to provide pond-like conditions where circulation is limited.

- Hard to Soft Substrate Ratio - The hard substrate (shoals areas) to soft substrate (depositional areas) ratio in other nearby rearing areas ranged from 25% to 40% hard with the remainder as soft substrate.

- Access to Refuge Habitat – Rocky reefs provide refuge or cover for small fish. It is important for fish to have connectivity between rocky areas and reefs to avoid exposing themselves for extended distances or periods of time to predators. Keeping the distance between rocky reef areas less than 30 m to 40 m will allow fish reasonable access refuge, or hiding places.

Shape Configuration

With regard to water circulation within the diked area, several features should be incorporated to reduce circulation. The shallow nature of the breaches, shallow nature of the pit shelf, and the creation of shoals on the pit shelf will reduce circulation and wind and wave action. The shallow water is expected to warm up quickly in the spring, relative to open areas of the lake, because of the limited water circulation within the enclosed area. As with other rearing habitats in Lac de Gras, warmer water should therefore assist in increasing biological productivity inside the dike by providing a warmer, refuge, and foraging area.

Determining the locations of the reefs should take several factors into consideration. Reefs should have some connectivity to the dikes and other reefs to allow fish to travel throughout the area without being fully exposed to predators for long distances. If the reefs are long, winding, and finger-like, a large amount of "edge" habitat will be created to allow fish to feed in the fine substrate while maintaining close proximity to the cover provided by the rocky reefs. Ideally the reefs will be placed in areas where the final water depth will be 3-m to 5-m deep and the tops of the reefs will remain under at least 2 m of water at all times. This will allow the reef habitat to remain functional even in winter with ice thickness of up to 2 m. Widths of the reefs should vary between 5 m and 30 m, averaging from 10 m to 20 m in width. Distance between the reefs could range from 10 m to 40 m, averaging from 20 m to 30 m apart. Habitat diversity is important and varying the size and shape of the reefs throughout the pit shelf area is expected to improve its value as fish habitat.

Substrate Material

Based on the substrate materials within the North Arm, substrates on the pit shelf should be mostly fine material, primarily sand and silt interspersed with rocky reefs for habitat diversity. The till (existing lake substrate) is primarily sand and silt with some gravel (Tables 1 and 2). The till material will therefore be an appropriate substrate for the

expected biological zone of the sediments (*i.e.*, approximately top 10-cm layer represents the biological zone). The fine substrate areas will support a variety of benthic organisms that will provide forage for small fish.

If till is placed over angular rock to provide the soft substrate zone, it should be a layer deep enough to maintain at least 0.5 m depth of soft substrate after settling, accounting for some migration of fines into the voids in the rock fill.

Reefs should be constructed of granular material of a range of sizes. The primary material should be large boulder size rock with some smaller cobble material. The objective is to create refuge habitat, or hiding areas, among the rocks. Angular, unconsolidated material would provide this benefit. Run of mine blast rock is expected to be acceptable for this purpose.

The area of habitat predicted in the NNL plan for this habitat type, for all three dikes, is provided in Table 6. For A154, based on constructed dike configuration and the design criteria presented in this report, 61.35 ha of shallow rearing and foraging habitat are expected to be created.

Table 6
Pit Shelf Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area [1] (ha)
A154	59.89	61.35
A418	8.68	n/a
A21	54.13	n/a

[1] Note: Based on final constructed configuration of dikes, where available.
ha = hectare.

3.2.6 Deep Water (Pit Area)

The deep water habitat created by the project will be located in each of the mine pits near the center of the diked area. The deep water will provide a cooler environment for fishes and was considered a pelagic zone in the NNL plan. This area will likely be used by pelagic feeding fish such as cisco and may provide other benefits. The maximum depth of the pit areas is anticipated to be 250 m. The area of habitat predicted in the NNL plan for this habitat type, for all three dikes is provided in Table 7. For A154, based on constructed dike configuration and the design criteria presented in this report 52.3 ha are actually expected to be created.

Table 7
Deep Water Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area [1] (ha)
A154	55.21	52.3
A418	41.94	n/a
A21	29.29	n/a

[1] Note: Based on final constructed configuration of dikes, where available.
ha = hectare.

3.3 Construction Considerations

There are a number of construction considerations that arise due to the variabilities in the material parameters, pore-pressure conditions, blasting effects and construction timing. The following construction considerations were evaluated with respect to the detailed design of the fish habitat compensation measures for the pit shelf areas:

- It was understood that flowing artesian conditions were present the southeast portion of the A154 pit shelf. Artesian conditions may cause build-up of porewater pressures within the fill on the pit shelf, depending on drainage conditions and the development of frozen layers.

- The fine-grained lake-bottom sediments are expected to provide poor trafficability, particularly where artesian conditions exist, and when the materials are thawing.

- A berm will be required between the pit crest and the toe of the fish habitat fill to provide safety with respect to equipment travelling too close to the pit crest and to reduce the potential for fill materials spilling into the pit during placement. The berm could also be used as a construction access road prior to pit development adjacent to the berm.

- The majority of the fill volume may consist of either till or rock fill, depending on construction timing and material availability. The final surface of the fill will consist of till, or lake-bottom sediments, to support aquatic life. The thickness of the final till/sediment layer will depend on whether a filter is used between the rock and till. DDMI will be responsible for picking the construction methods, and materials handling such that adequate quantities of till are available for the final fill surface.

- Based on gradation information for the till, summarized in Section 3.1, and predicted blast rock gradations from the feasibility study, it is anticipated that at least two, and possibly three graded aggregate filters would be required. The gradations of the till and blast rock, along with tentative filter gradations are shown in Appendix II.

Production of filter material would be relatively expensive, since it would involve crushing, screening, stockpiling, and double handling of the materials. It has been assumed that use of a filter between the rockfill and the till would not be utilized, due to logistical and economic considerations. As an alternative to using a filter, the thickness of the till cover on a rock fill can be varied as a function of the total fill thickness. The premise for this approach is that a certain portion of the till will migrate into the void spaces in the rock fill, so the thickness of the till cover must be such that a minimum of 0.5 m of till remains on top of the rock. For design purposes, it has been assumed that the porosity of the rock fill would be approximately 30 percent, and that with time, till would migrate into the rock such that 50 percent of the available voids would be filled. Thus, the thickness of till required over the rock is equal to 15 percent of the rock fill thickness, plus 0.5 m. Theoretically, where rocky reefs are to be constructed, till would not be required between the rock fill and reef material.

- Rock fill has the advantages of higher shear strength and better potential for drainage/dissipation of pore-water pressures. Rock fill may require a smaller thickness than till to provide a stable trafficking surface for the initial lifts.

- Rock fill would permit faster infiltration than till, which may provide a more stable trafficking surface after precipitation events and during spring thaw.

- Till will be available earlier in the mining cycle for each pit, since it overlies the bedrock. Materials may be transported between pits, if required.

4.0 STABILITY ANALYSES

4.1 Overall Pit Stability

The overall pit stability was assessed in Golder's report entitled "Revised A154 Ultimate Pits Stability Review", dated August 16, 2002. The summary of the ultimate pit stability review, and recommendations were as follows:

The pit slope configurations incorporated into the revised A154 ultimate pit plan are consistent with recommendations previously made by Golder in December 1999, November 2000, and February 2002.

Based on the overall slope stability and deformation analyses of the revised A154 pit design, the pit slopes are anticipated to be stable.

The haulage ramp crosses the northeast wall at the 190 m elevation, and coincides with the contact between the granitic waste rocks and the A154 north kimberlite pipe. The slope above the ramp on the northeast wall is single benched and consist of kimberlite rocks. The kimberlite is highly fractured, with a low rock mass strength, and ravelling of benches excavated within kimberlite is expected to occur. The bench configuration within the kimberlite should provide adequate catchment for ravelled material. However, the kimberlite exposures must be closely monitored for signs of excessive ravelling on to the haulage ramp.

The stability and deformation review of the revised A154 ultimate pit slopes, highlight the following geotechnical considerations:

- *If localized areas of bench scale toppling are encountered, additional operational considerations such as scaling and installation of ground support in problem areas may be necessary.*

- *The orientation and nature of the structures exposed along the exposed pit slopes should be detailed as excavation of these slopes begins. This can be achieved by continuous geotechnical mapping of new exposures, and comparison of these data with those previously collected through drillcore.*

- *The sensitivity of the northwest wall deformation analyses highlights the need for slope and dike movement monitoring program as outlined in Golder's February 2002 report.*

Analyses indicated that the overall pit stability is not significantly impacted by the presence of the fish habitat fills on the pit shelf.

4.2 Stability of Fish Habitat Fills

Slope stability analyses were carried out to determine the stability of the face of the fish habitat fills, and the required setback from the pit crest. The impact of the placed material on the stability of the pit was also checked.

Stability analyses were carried out using the computer programs, XSTABL and SLOPE/W. Factors of safety were calculated on the principle of limit equilibrium against potential sliding along a failure surface for each of the selected cross-sections. Factors of safety were computed using both Spencer's method and the Morgenstern-Price method, which satisfy both force and moment equilibrium. Based on the type of soil and the configuration of the habitat, both circular and wedge failure mechanisms were assessed.

DDMI indicated that flowing artesian conditions have been measured in the southeast portion of the A154 pit shelf. It is expected that these conditions would be affected by the development of the pit, but it is not possible/feasible to quantify these conditions until pit development commences. Thus, the factor of safety was assessed for various phreatic levels within the fill. Surface grading towards the sumps along the toe of the dike will help to drain surface water, reducing infiltration of the water into the fill, particularly if the surface of the fill consists of till or lake-bottom sediments.

The effects of blasting in the pit on the stability of the fill were assessed parametrically by using a pseudo-static limit equilibrium analysis with varying levels of pseudo-static loading. As production blasting data is accumulated, the impact of blasting may be reassessed and the design refined.

The results of the stability analyses are summarized in Appendix III. The stability analyses indicate that the critical slip surface impacting both the fish habitat fill and the in-situ till slope in the pit only impacts a small portion of the fish habitat fill. The factor of safety is sensitive to both the phreatic surface and the pseudo-static loading; therefore, a conservative approach with respect to setback distances and slope angles is proposed, combined with monitoring to assess modifications to the proposed design as mining proceeds. The recommended setback from the pit crest (*i.e.*, top of the in-situ till slope to the toe of the fish habitat fill) is 4 times the height of the fill (taken as the difference between the ultimate top of the fill and the elevation of the pit crest), with a minimum of 15 m. The slope of the faces of the fish habitat fill facing the pit and the interior of the dikes should be 3H:1V or flatter. As mining progresses, it may be possible to modify the setback and slope angle parameters.

5.0 CONSTRUCTION GUIDELINES

The recommended configuration of the fish habitat on the pit shelves is based on the following guidelines:

- Construct fills with face slopes of 3H:1V during mining, and final slopes at the angle of repose adjacent to the pit crest at the completion of mining.

- Setback from the pit crest to the toe of the fill equal to 4 times the elevation difference between the top of fill and the pit crest, with a minimum of 15 m.

- To the extent feasible, areas of existing shallow habitat (*i.e.,* water depth less than 5 m below mean normal water level) should remain untouched.

- Construction of a berm between the toe of the till slope and the crest of the pit. This berm will help retain material that erodes from the slope away from the pit, and will reduce the potential for any material rolling down the slope and into the pit. A minimum setback of 5 m from the crest of the pit to the toe of the berm has been used. As a minimum, the berm would be approximately 2 m high, with a 2-m crest width and 2H:1V sideslopes. The geometry of this berm may be modified on the basis of construction techniques.

- A setback from the interior toe of the water retention dike, to the upstream toe of the fill may also be required. This setback distance should be determined by DDMI, based on operational requirements and surface water handling requirements.

- Construction in one lift is acceptable.

- The materials used to construct the fill may consist of till, rock fill, or a combination of materials. If rock fill is used to construct the lower portion of the fill, the thickness of till to create the final surface should be equal to 0.15 times the height of rock fill, plus 0.5 m. Alternatively, filter zones could be provided between the rock fill and the till. Details of the filter zones would have to be developed further, once construction techniques and material gradations are determined. Processing of the blast rock will be required to produce filter materials, and is likely to be expensive. If the filter zone approach is taken, it is likely that at least two, and possibly, three filters would be required.

- Grading of the surface of the fill at a nominal grade of 1% is recommended, to direct surface water towards the water collection system at the toe of the dike.

- Final contouring of the surface will be required to establish some relief to provide fish habitat (*i.e.*, some hummocks and hollows, rather than an evenly graded surface).

- Rock ridges or reefs are also required for fish habitat. These reefs should be constructed of non-acid generating country rock, and conform to the parameters discussed in Section 3.2.5.

6.0 DETAILED DESIGN DRAWINGS

A set of detailed design drawings is included in Appendix IV for the A154 pit. Detailed design drawings for the A418 and A21 pits have not been prepared, since the dikes have not been constructed, and the pit layout may change prior to construction. The detailed design guidelines presented in this document are considered sufficient to develop drawings for the A418 and A21 pits once the dike and pit details have been finalized.

7.0 MONITORING RECOMMENDATIONS

Monitoring of various parameters is recommended to confirm the design assumptions, and to provide information for refining the design of the fish habitat on the pit shelves. It is recommended that monitoring consist of:

- Monitoring pore-water pressures in the lake-bottom sediments and till that will form the foundation for the fish habitat fills to assess drainage due to pit development, as well as pore-pressures due to fill placement and blasting.

- Monitor pore-pressures within the fish habitat fills, so that the slope stability analyses can be confirmed.

- Monitor production blasting to assess accelerations and peak particle velocities (PPV) for the fish habitat fills.

- Monitor movements of the fish habitat fills using a series of monitoring prisms, and potentially slope inclinometers. Visual inspections should also be conducted to check for signs of instability, such as bulging, slumping or the development of tension cracks.

Monitoring programs have previously been recommended for the water retention dikes and for monitoring the overall pit stability. It is recommended that the monitoring for the fish habitat fills on the interior of the dikes be integrated into the overall monitoring program, to provide consistency, and improve the efficiency of the monitoring efforts.

8.0 CLOSURE

We trust this report presents the information that you require. Please feel free to call at anytime if you have any questions or concerns.

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9.0 REFERENCES

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APPENDIX I

HABITAT UNITS

Appendix I, Table 1. No Net Loss Habitat Summary "Accounting" Showing Habitat Units Only in the Proposed Areas of Disturbance, from No Net Loss Addendum, 1999

Life Stage	Species	North Inlet (2001 - 2023)		A418 (2009 2023)		A154 (2001-2023)		A21 (2012 2018)		**Available (pre-1988)	**Available (post-2024)	Net Change
		loss	gain	loss	gain	loss	gain	loss	gain			
Spawning	LKTR	0.32	0.00	0.10	0.07	0.68	0.15	0.79	0.14	1.88	0.37	-1.51
	ARGR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CISC	0.31	0.00	0.11	0.06	0.95	0.12	0.80	0.11	2.16	0.29	-1.87
	RNWH	0.05	0.00	0.02	0.05	0.18	0.29	0.14	0.26	0.39	0.60	0.21
	LKWH	0.12	0.00	0.04	0.02	0.24	0.04	0.30	0.04	0.70	0.11	-0.59
	LNSC	0.07	0.00	0.02	0.01	0.06	0.02	0.17	0.02	0.33	0.04	-0.29
	BURB	0.04	0.00	0.02	0.00	0.16	0.01	0.12	0.01	0.33	0.02	-0.31
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SLSC	0.11	0.00	0.03	0.21	0.23	0.78	0.27	0.66	0.65	1.65	1.01
Rearing	LKTR	1.60	0.00	1.00	3.60	5.65	10.53	3.46	8.31	11.71	22.44	10.73
	ARGR	0.17	0.00	0.17	0.26	1.03	0.76	0.44	0.60	1.81	1.62	-0.19
	CISC	1.06	0.00	1.53	3.47	6.37	10.17	3.83	8.02	12.78	21.66	8.87
	RNWH	0.40	0.00	0.26	0.61	1.21	2.06	0.72	1.69	3.90	4.35	0.46
	LKWH	0.52	0.00	0.28	0.62	1.27	2.31	1.00	1.93	3.07	4.85	1.79
	LNSC	0.34	0.00	0.30	0.48	1.40	1.63	0.80	1.34	2.85	3.45	0.60
	BURB	0.27	0.00	0.19	0.27	0.99	0.90	0.65	0.74	2.09	1.91	-0.18
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SLSC	0.36	0.00	0.26	0.43	1.36	1.57	0.87	1.32	2.86	3.32	0.47
Foraging	LKTR	0.70	0.00	0.90	0.96	4.03	2.76	2.44	2.19	8.08	5.91	-2.17
	ARGR	0.11	0.00	0.10	0.13	0.54	0.39	0.27	0.31	1.01	0.83	-0.18
	CISC	0.77	0.00	0.88	1.65	3.90	4.31	2.37	3.31	7.92	9.27	1.35
	RNWH	0.23	0.00	0.17	0.28	0.88	0.80	0.51	0.63	2.37	1.71	-0.66
	LKWH	0.21	0.00	0.15	0.28	0.73	0.94	0.44	0.77	1.54	1.99	0.46
	LNSC	0.18	0.00	0.21	0.24	0.88	0.81	0.55	0.67	1.82	1.72	-0.10
	BURB	0.10	0.00	0.11	0.12	0.51	0.34	0.31	0.27	1.04	0.73	-0.31
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SLSC	0.07	0.00	0.14	0.21	0.61	0.77	0.40	0.64	1.23	1.62	0.39
Nursery	LKTR	0.32	0.00	0.10	0.06	0.68	0.12	0.79	0.12	1.88	0.30	-1.58
	ARGR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CISC	0.31	0.00	0.11	0.06	0.95	0.12	0.80	0.11	2.16	0.29	-1.87
	RNWH	0.05	0.00	0.02	0.05	0.18	0.29	0.14	0.26	0.39	0.60	0.21
	LKWH	0.12	0.00	0.04	0.02	0.24	0.04	0.30	0.04	0.70	0.11	-0.59
	LNSC	0.07	0.00	0.02	0.01	0.06	0.02	0.17	0.02	0.33	0.04	-0.29
	BURB	0.04	0.00	0.02	0.00	0.16	0.01	0.12	0.01	0.33	0.02	-0.31
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SLSC	0.11	0.00	0.03	0.21	0.23	0.78	0.27	0.66	0.65	1.65	1.01
Total		9.10	0.00	7.33	14.45	36.38	43.84	24.27	35.19	78.95	93.49	14.54
Total by life stage	Spawning	1.01	0.00	0.34	0.43	2.50	1.41	2.59	1.24	6.44	3.09	-3.35
	Rearing	4.71	0.00	4.00	9.73	19.29	29.93	11.78	23.94	41.07	63.61	22.54
	Foraging	2.37	0.00	2.66	3.86	12.09	11.11	7.30	8.80	25.00	23.77	-1.22
	Nursery	1.01	0.00	0.34	0.42	2.50	1.38	2.59	1.22	6.44	3.02	-3.42
Total by species	LKTR	2.93	0.00	2.11	4.69	11.04	13.56	7.48	10.76	23.55	29.02	5.47
	ARGR	0.27	0.00	0.27	0.40	1.57	1.15	0.71	0.91	2.83	2.45	-0.37
	CISC	2.44	0.00	2.62	5.23	12.18	14.72	7.80	11.55	25.03	31.51	6.48
	RNWH	0.72	0.00	0.47	0.99	2.46	3.44	1.52	2.84	7.05	7.26	0.22
	LKWH	0.97	0.00	0.51	0.94	2.48	3.34	2.05	2.79	6.00	7.06	1.06
	LNSC	0.67	0.00	0.55	0.74	2.40	2.48	1.69	2.03	5.31	5.25	-0.07
	BURB	0.45	0.00	0.34	0.40	1.81	1.26	1.21	1.03	3.80	2.68	-1.12
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SLSC	0.65	0.00	0.47	1.06	2.45	3.91	1.82	3.28	5.38	8.25	2.87

Note:
Minor variation in numbers, when compared with 1999 documentation, due to rounding

** - habitat units available the pre-1998 and post-2024 represent the number of habitat units present on shoals, shorelines, and 'in deep/shallow water areas within the proposed boundaries of the three dikes (A154, A418, A21) and the north inlet.

LKTR = lake trout; ARGR = Arctic grayling; CISC = cisco; RNWH = round whitefish; LKWH = lake whitefish; LNSC = longnose sucker; BURB = burbot; NRPK = northern pike; SLSC = slimy sculpin.

Appendix I, Table 2 No Net Loss Habitat Summary "Accounting" Showing Habitat Units Only in the Proposed Areas of Disturbance, Recalculated with 2002 Dike A154 Constructed Dimensions

Life Stage	Species	North Inlet (2001 - 2023)		A418 (2009 2023)		A154 (2001 2023)		A21 (2012 2018)		**Available (pre-1988)	**Available (post-2024)	Net Change
		loss	gain	loss	gain	loss	gain	loss	gain			
Spawning	LKTR	0.32	0.00	0.10	0.07	0.68	0.24	0.79	0.14	1.88	0.45	-1.43
	ARGR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	CISC	0.31	0.00	0.11	0.03	0.95	0.27	0.80	0.16	2.16	0.37	-1.79
	RNWH	0.05	0.00	0.02	0.05	0.18	0.31	0.14	0.26	0.39	0.63	0.24
	LKWH	0.12	0.00	0.04	0.02	0.24	0.09	0.30	0.04	0.70	0.15	-0.55
	LNSC	0.07	0.00	0.02	0.01	0.06	0.02	0.17	0.02	0.33	0.05	-0.28
	BURB	0.04	0.00	0.02	0.00	0.16	0.02	0.12	0.01	0.33	0.03	-0.30
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	SLSC	0.11	0.00	0.03	0.21	0.23	0.83	0.27	0.66	0.65	1.70	1.05
Rearing	LKTR	1.60	0.00	1.00	3.60	5.65	10.82	3.46	8.31	11.71	22.73	11.01
	ARGR	0.17	0.00	0.17	0.26	1.03	0.79	0.44	0.60	1.81	1.65	-0.16
	CISC	1.06	0.00	1.53	2.48	6.37	3.42	3.83	1.86	12.78	21.89	9.10
	RNWH	0.40	0.00	0.26	0.61	1.21	2.14	0.72	0.31	3.90	3.06	-0.84
	LKWH	0.52	0.00	0.28	0.62	1.27	2.42	1.00	1.93	3.07	4.97	1.90
	LNSC	0.34	0.00	0.30	0.48	1.40	1.69	0.80	1.34	2.85	3.51	0.67
	BURB	0.27	0.00	0.19	0.27	0.99	0.95	0.65	0.74	2.09	1.95	-0.14
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	SLSC	0.36	0.00	0.26	0.43	1.36	1.66	0.87	1.32	2.86	3.41	0.56
Foraging	LKTR	0.70	0.00	0.90	0.96	4.03	2.87	2.44	2.19	8.08	6.03	-2.05
	ARGR	0.11	0.00	0.10	0.13	0.54	0.40	0.27	0.31	1.01	0.85	-0.17
	CISC	0.77	0.00	0.88	1.59	3.90	4.27	2.37	3.20	7.92	9.36	1.43
	RNWH	0.23	0.00	0.17	0.28	0.88	0.83	0.51	0.63	2.37	1.74	-0.62
	LKWH	0.21	0.00	0.15	0.28	0.73	0.98	0.44	0.77	1.54	2.03	0.49
	LNSC	0.18	0.00	0.21	0.24	0.88	0.84	0.55	0.67	1.82	1.74	-0.08
	BURB	0.10	0.00	0.11	0.12	0.51	0.36	0.31	0.27	1.04	0.75	-0.29
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	SLSC	0.07	0.00	0.14	0.21	0.61	0.81	0.40	0.64	1.23	1.65	0.42
Nursery	LKTR	0.32	0.00	0.10	0.06	0.68	0.21	0.79	0.12	1.88	0.39	-1.49
	ARGR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	CISC	0.31	0.00	0.11	0.05	0.95	0.55	0.80	0.11	2.16	0.37	-1.79
	RNWH	0.05	0.00	0.02	0.05	0.18	0.31	0.14	0.26	0.39	0.62	0.23
	LKWH	0.12	0.00	0.04	0.02	0.24	0.09	0.30	0.04	0.70	0.15	-0.55
	LNSC	0.07	0.00	0.02	0.01	0.06	0.02	0.17	0.02	0.33	0.05	-0.28
	BURB	0.04	0.00	0.02	0.00	0.16	0.02	0.12	0.01	0.33	0.03	-0.30
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	SLSC	0.11	0.00	0.03	0.21	0.23	0.83	0.27	0.66	0.65	1.70	1.05
Total		9.10	0.00	7.33	13.38	36.38	39.04	24.27	27.59	78.95	94.01	15.06
Total by life stage	Spawning	1.01	0.00	0.34	0.41	2.50	1.78	2.59	1.28	6.44	3.39	-3.05
	Rearing	4.71	0.00	4.00	8.75	19.29	23.88	11.78	16.41	41.07	63.16	22.10
	Foraging	2.37	0.00	2.66	3.81	12.09	11.35	7.30	8.69	25.00	24.14	-0.86
	Nursery	1.01	0.00	0.34	0.41	2.50	2.03	2.59	1.21	6.44	3.31	-3.12
Total by species	LKTR	2.93	0.00	2.11	4.69	11.04	14.13	7.48	10.76	23.55	29.59	6.04
	ARGR	0.27	0.00	0.27	0.40	1.57	1.19	0.71	0.91	2.83	2.49	-0.33
	CISC	2.44	0.00	2.62	4.16	12.18	8.50	7.80	5.32	25.03	31.99	6.96
	RNWH	0.72	0.00	0.47	0.99	2.46	3.60	1.52	1.47	7.05	6.05	-0.99
	LKWH	0.97	0.00	0.51	0.94	2.48	3.57	2.05	2.79	6.00	7.30	1.29
	LNSC	0.67	0.00	0.55	0.74	2.40	2.58	1.69	2.03	5.31	5.35	0.03
	BURB	0.45	0.00	0.34	0.40	1.81	1.34	1.21	1.03	3.80	2.76	-1.04
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SLSC	0.65	0.00	0.47	1.06	2.45	4.13	1.82	3.28	5.38	8.47	3.09

Note:
Minor variation in numbers, when compared with 1999 documentation, due to rounding

** - habitat units available the pre-1998 and post-2024 represent the number of habitat units present on shoals, shorelines, and 'in deep/shallow water areas within the proposed boundaries of the three dikes (A154, A418, A21) and the north inlet.
LKTR = lake trout; ARGR = Arctic grayling; CISC = cisco; RNWH = round whitefish; LKWH = lake whitefish; LNSC = longnose sucker; BURB = burbot; NRPK = northern pike; SLSC = slimy sculpin.

APPENDIX II

TENTATIVE FILTER GRADATIONS

012-2331: DDMI Fish Habitat Compensation - Interior of Dikes
Tentative Filter Gradations

Specification Bands	SHT Type 31		SHT Type 33	
Sieve Size	Percent Passing		Percent Passing	
mm	Coarse Ra	Fine Range	Coarse Ra	Fine Range
31.5	100%			
25				
18	75%	90%	100%	
12.5	65%	83%	75%	100%
5	40%	69%	50%	75%
2	26%	47%	32%	52%
0.9	17%	32%	20%	35%
0.4	12%	22%	15%	25%
0.16	7%	14%	8%	15%
0.071	6%	11%	6%	11%

Manitoba Highways Class A		
Sieve Size	Percent Passing	
mm	Coarse Ra	Fine Range
19	100%	
16	80%	100%
4.75	40%	71%
2	25%	55%
0.425	15%	30%
0.075	8%	15%

Mean Till Gradation

Diam	% Passing	
80	100.0%	
50	100.0%	
40	100.0%	
20	97.4%	
10	89.3%	D_{85}
5	80.5%	7.0
2.5	74.0%	
1.25	68.0%	
0.63	62.3%	
0.315	55.9%	
0.16	48.9%	D_{15}
0.08	39.1%	0.08

Filter 1 - Concrete Sand

Sieve Size	Coarse % Passing	Fine % Passing	
10	100%	100%	
5	95%	100%	D_{85}
2.5	80%	100%	1.9
1.25	50%	90%	
0.63	25%	65%	D_{15}
0.315	10%	35%	0.4
0.16	2%	10%	

Filter 2

Diam Fine	Diam Coarse	Fine % Passing	
		100%	
12.5	40	95%	
8	25	85%	D_{85}
3	12.5	60%	21
1.2	5	15%	
0.9	4	10%	D_{15}
			3.3

Filter 3

Diam Fine	Diam Coarse	Fine % Passing
		100%
75	200	95%
50	150	85%
25	75	60%
10	25	15%
9	22	10%

Blast Rock

Diam	% Passing
490	80%
280	50%
130	20%

REPORT NUMBER: _____

Golder Associates

Grain Size Analysis

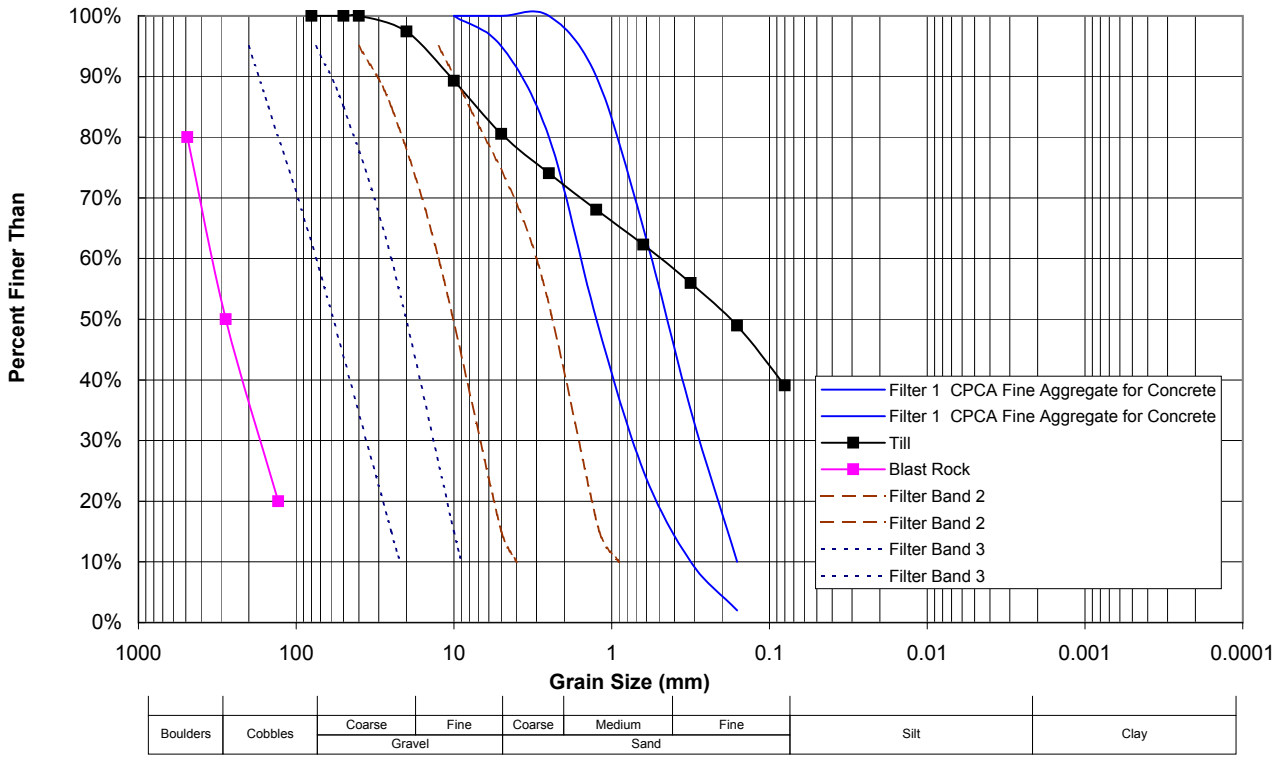
PROJECT No.	012-2331
PROJECT:	Diavik - Fish Habitat Compensation - Dikes
LOCATION:	Lac de Gras, NWT
SITE:	
TESTED BY:	N/A
DATE:	March 2003

		SIEVE No.	Size of Opening		WEIGHT RETAINED (grams)		Total Weight Finer Than (grams)	Percent Finer Than (%)	% Finer Than Original Sample
			Inches	mm	per sieve	cumulative			
Tare Weight (grams) =	0						0		
Moist Weight + Tare (grams) =	0						0		
Dry Weight + Tare (grams) =	0						0		
Washed, Dry Wt. + Tare (grams) =	0				0	0	0		
					0	0	0		
Moisture Content (%) =	#DIV/0!				0	0	0		
Total Dry Weight of Sample (grams) =	0				0	0	0		
Passing Total Weight					0	0	0		
					0	0	0		
					0	0	0		
					0	0	0		
					0	0	0		
					0	0	0		
					0	0	0		
					0	0	0		

Total Retained on Sieves (grams) = 0

LABORATORY SAMPLE IDENTIFICATION NUMBER:
DESCRIPTION OF SAMPLE:

REMARKS:
This spreadsheet is being used to illustrate tentative grain-size distributions for filters between rock fill and till for the fish habitat compensation plans on the pit shelf.



UNIFIED SOIL CLASSIFICATION SYSTEM

Checked By:_____ Reviewed By:_____

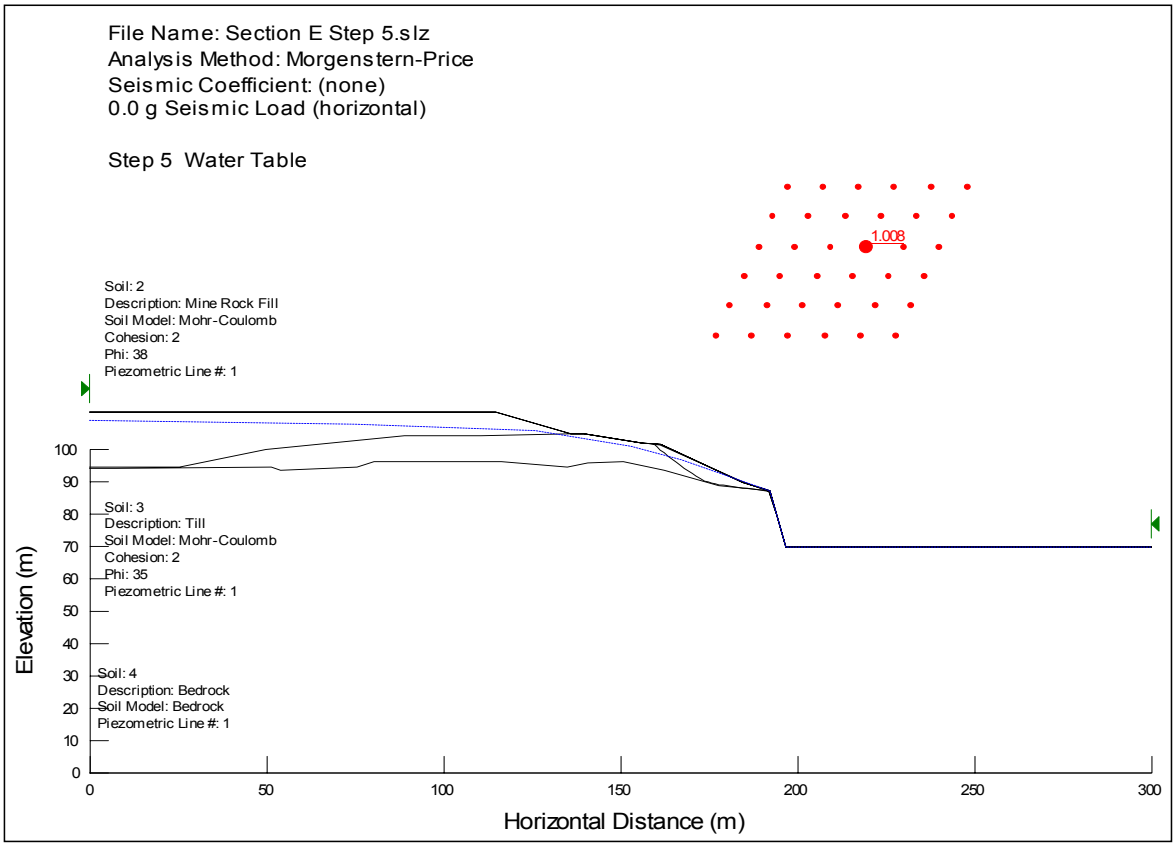
APPENDIX III

SUMMARY OF SLOPE STABILITY ANALYSES

Section E With 25 m Setback		With 35 ϕ Till & 38 Fill		With 35 ϕ Fill & 35 Till	
Water Table Elevation	Seismic Coefficient (horizontal)	F of S (through Till)	F of S (global)	F of S (through Till)	F of S (global)
Base Case	0	1.50	2.66		
Base Case	0.05	1.33	2.24		
Base Case	0.1	1.19	1.94		
Base Case	0.15	1.07	1.71		
Step 1 Water Table	0	1.34	2.43		
Step 1 Water Table	0.05				
Step 1 Water Table	0.1				
Step 1 Water Table	0.15				
Step 2 Water Table	0	1.19	2.22		
Step 2 Water Table	0.05				
Step 2 Water Table	0.1				
Step 2 Water Table	0.15				
Step 3 Water Table	0	1.18	2.05	1.18	2.04
Step 3 Water Table	0.05	1.04	1.76	1.04	1.74
Step 3 Water Table	0.1	0.92	1.53	0.92	1.52
Step 3 Water Table	0.15	0.82	1.35	0.82	1.34
Step 4 Water Table	0	1.01	1.82	1.01	1.81
Step 4 Water Table	0.05				
Step 4 Water Table	0.1				
Step 4 Water Table	0.15				
Step 5 Water Table	0	1.01	1.67	1.01	1.66
Step 5 Water Table	0.05	0.88	1.43	0.88	1.42
Step 5 Water Table	0.1	0.78	1.25	0.78	1.24
Step 5 Water Table	0.15	0.69	1.11	0.69	1.10
Step 5 Water Table					
Step 5 Water Table					

Project Number: 012-2331
Project: DDMI - Diavik
Fish Habitat Comp.

SUMMARY OF SLOPE STABILITY ANALYSIS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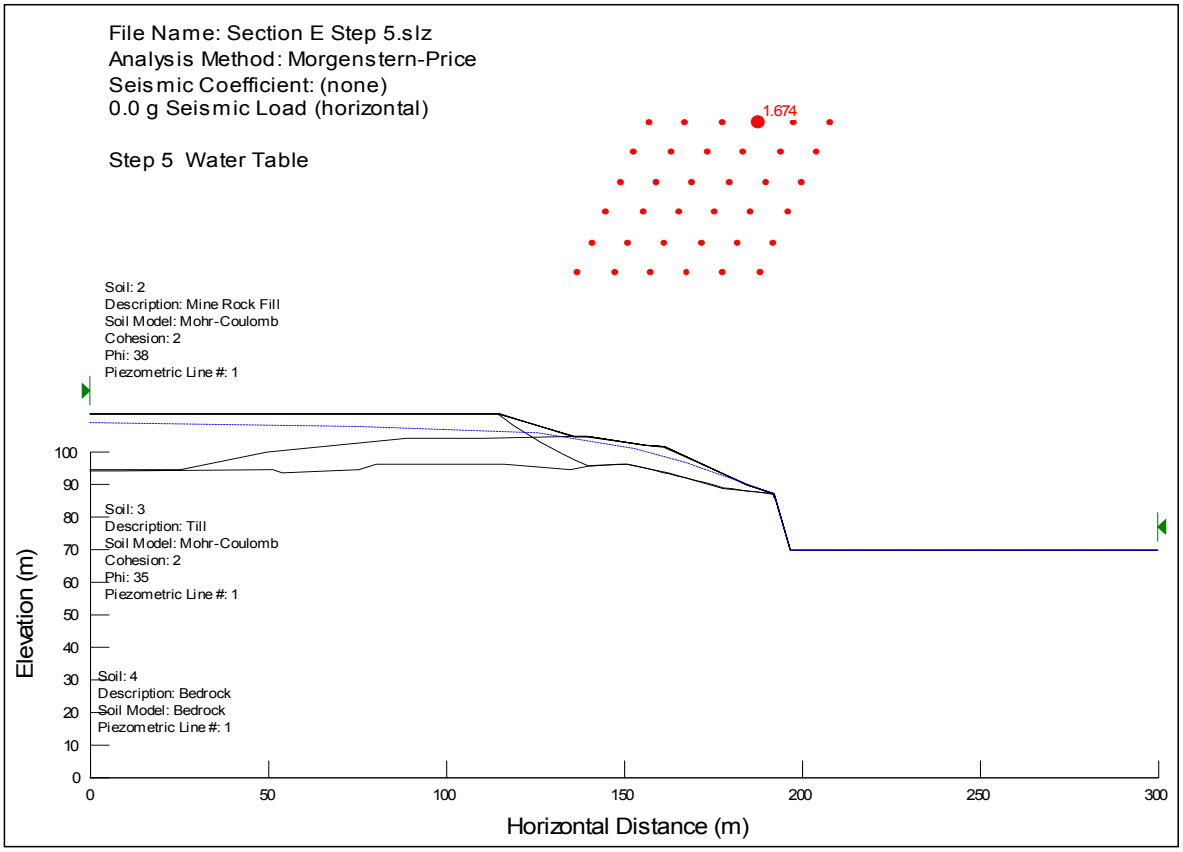
Analysis Method: Morgenstern-Price
Seismic Coefficient: (none)
0.0 g Seismic Load (horizontal)
Step 5 Water Table
1.008
Soil: 2
Description: Mine Rock Fill
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 38
Piezometric Line #: 1
Soil: 3
Description: Till
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 35
Piezometric Line #: 1
Soil: 4
Description: Bedrock
Soil Model: Bedrock
Piezometric Line #: 1
Elevation (m)
Horizontal Distance (m)
0
10
20
30
40
50
60
70
80
90
100
0
50
100
150
200
250
300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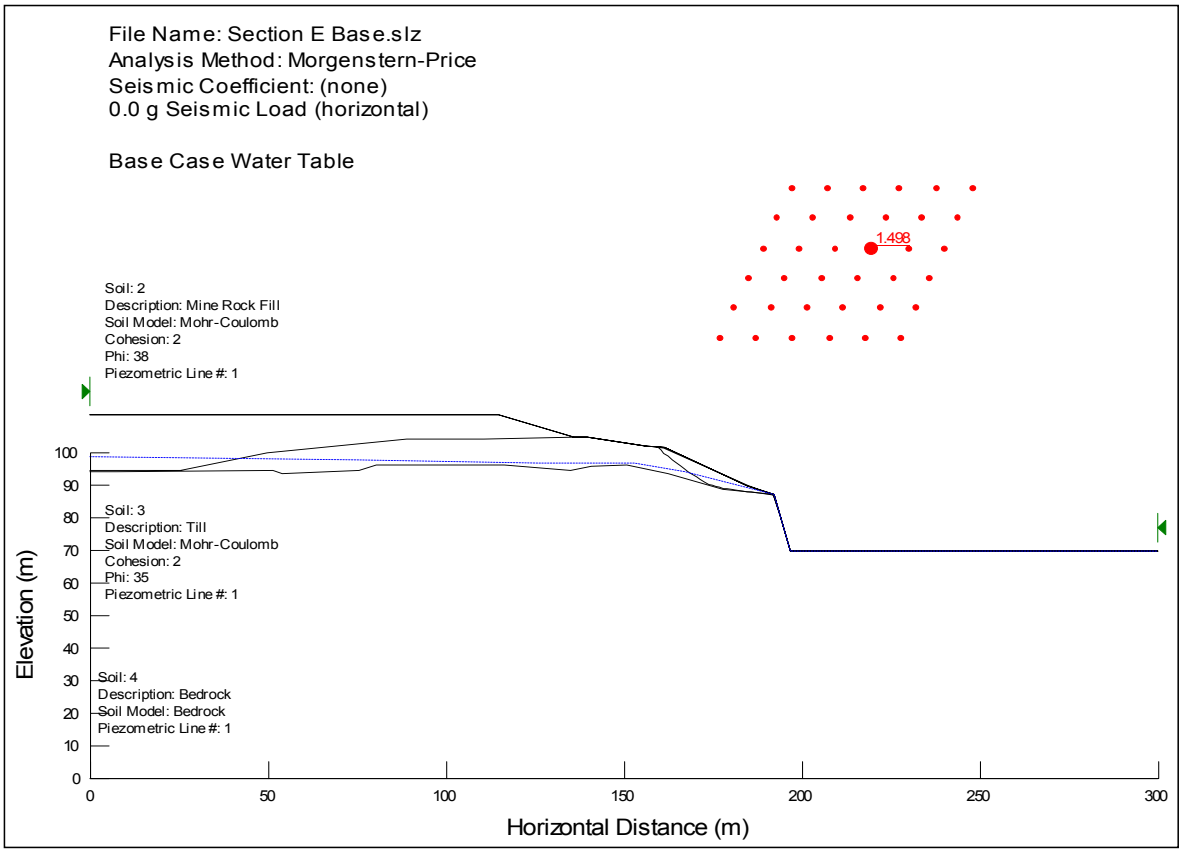
0.0 g Seismic Load (horizontal)
Step 5 Water Table
1.674
Soil: 2
Description: Mine Rock Fill
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 38
Piezometric Line #: 1
Soil: 3
Description: Till
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 35
Piezometric Line #: 1
Soil: 4
Description: Bedrock
Soil Model: Bedrock
Piezometric Line #: 1
Elevation (m)
Horizontal Distance (m)
0
10
20
30
40
50
60
70
80
90
100
0
50
100
150
200
250
300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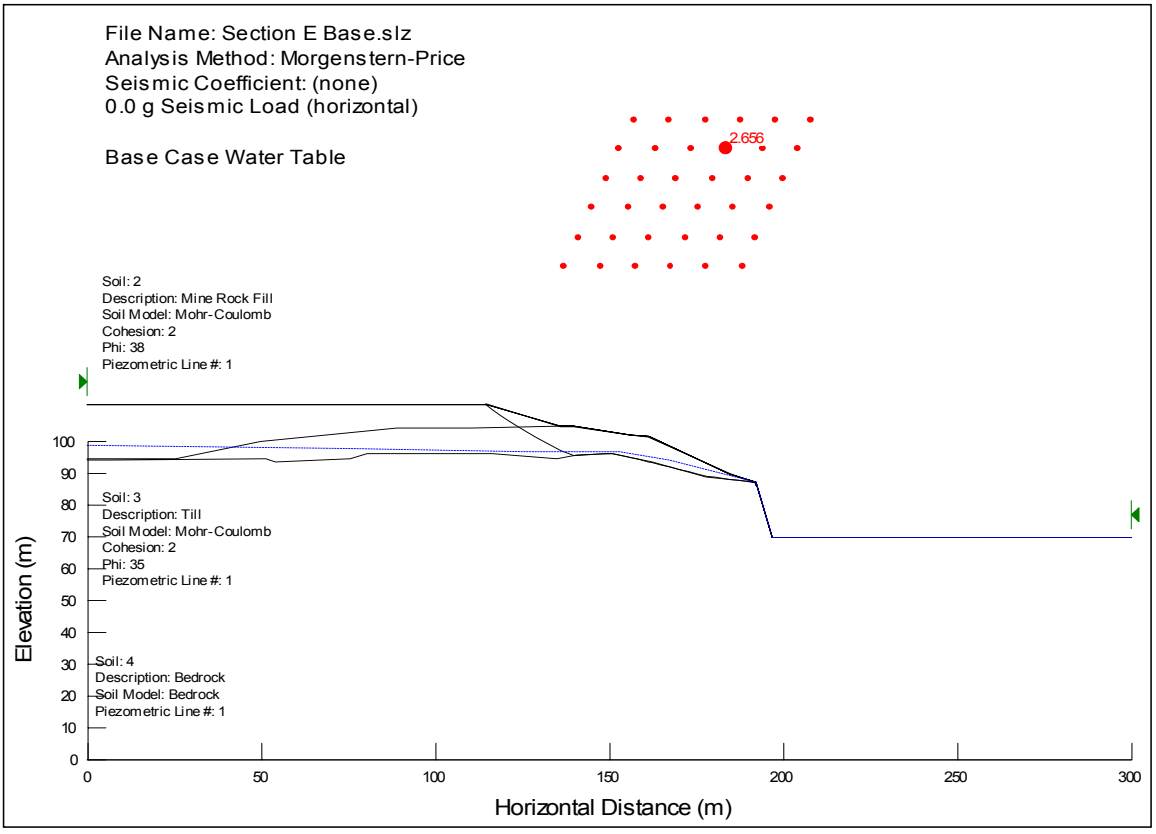
0.0 g Seismic Load (horizontal)
Base Case Water Table
1.498
Soil: 2
Description: Mine Rock Fill
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 38
Piezometric Line #: 1
Soil: 3
Description: Till
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 35
Piezometric Line #: 1
Soil: 4
Description: Bedrock
Soil Model: Bedrock
Piezometric Line #: 1
Elevation (m)
Horizontal Distance (m)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0.0 g Seismic Load (horizontal)
Base Case Water Table
2.656
Soil: 2
Description: Mine Rock Fill
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 38
Piezometric Line #: 1
Soil: 3
Description: Till
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 35
Piezometric Line #: 1
Soil: 4
Description: Bedrock
Soil Model: Bedrock
Piezometric Line #: 1
Elevation (m)
Horizontal Distance (m)

APPENDIX IV

DETAILED DESIGN DRAWINGS

w3

e1

e2

A154

e3

e7

e6

e8

e11

LAC DE GRAS

e10

A418

EAST ISLAND

e14

e16

e20

e17

e21

A21

LAC DE GRAS

MAINLAND

300 0 300
SCALE METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORHTWEST TERRITORIES

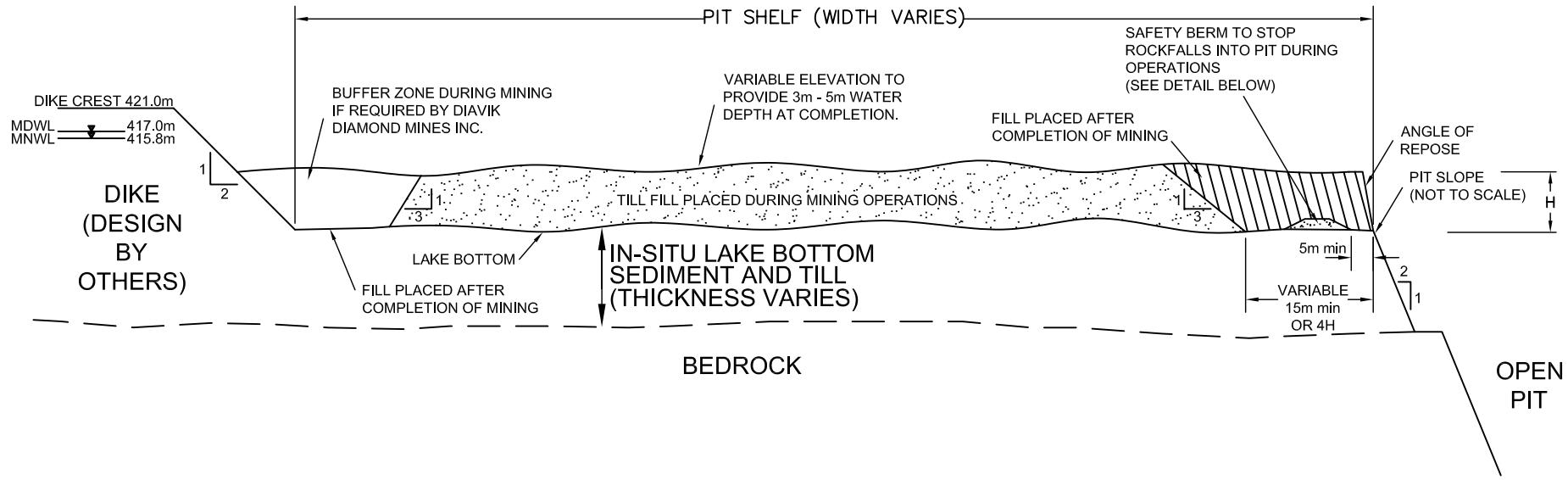
TITLE
PROJECT LAYOUT

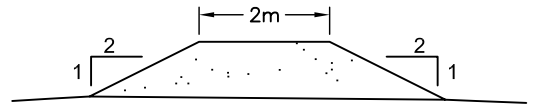
Golder Associates
Saskatoon, Saskatchewan

PROJECT No. 012-2331.5310			FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	RML	02/17/03	DRAWING: 1
CHECK			
REVIEW			

N:\Active\2000\012-2331 Diavik Habitat Compensation\cad\LI001 Drawing file: Keyplan.dwg Mar 27, 2003 - 5:41pm

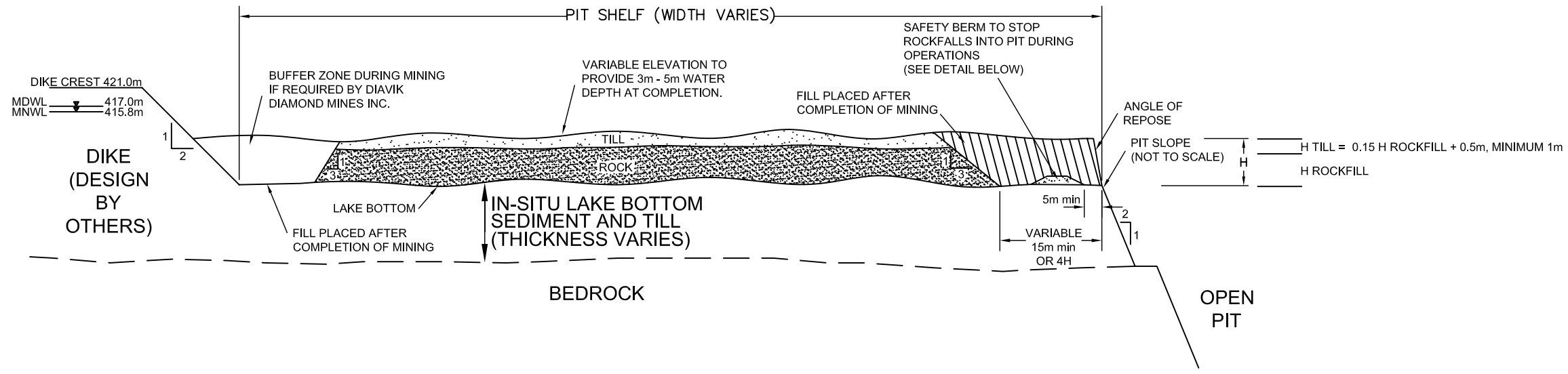
TILL FILL OPTION



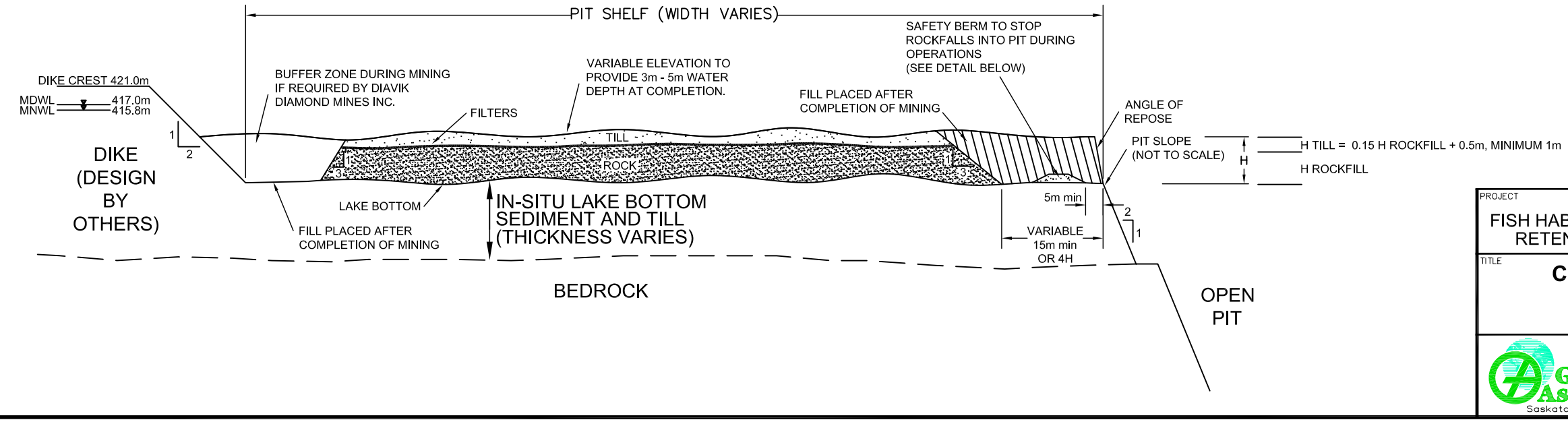


SAFETY BERM DETAIL
(MINIMUM DIMENSIONS)

ROCK/TILL OPTION (NO FILTERS)



ROCK/TILL OPTION (WITH FILTERS)



PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
CROSS-SECTION OPTIONS FOR FISH HABITAT CREATED INSIDE DIKES

Golder Associates
Saskatoon, Saskatchewan

PROJECT	012-2331.5310		FILE No.	
DESIGN			SCALE NTS	REV. 0
CADD	RML	02/17/03		
CHECK				
REVIEW				

DRAWING: 2

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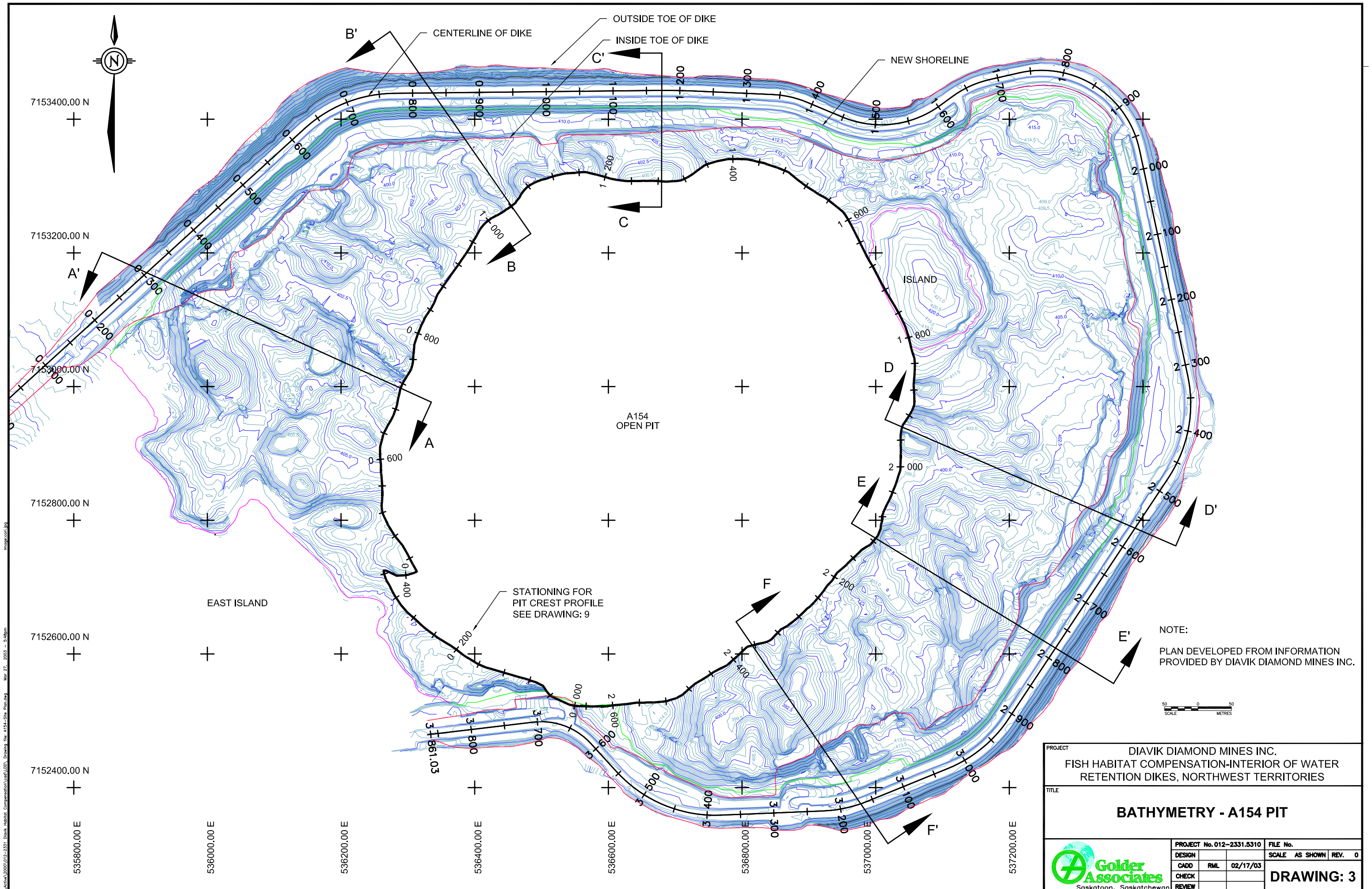

NOTE:

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

SCALE 50 0 50 METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
BATHYMETRY - A154 PIT

Golder Associates
Saskatoon, Saskatchewan

PROJECT No. 012-2331.5310			FILE No.		
DESIGN			SCALE AS SHOWN	REV.	0
CADD	RML	02/17/03	DRAWING: 3		
CHECK					
REVIEW					

N:\Active\2000\012-2331 Diavik Habitat Compensation\cad\LIDO\ Drawing File: A154-Site Plan.dwg Mar 27, 2003 - 5:45pm Imagecoord.jpg

CENTERLINE OF DIKE

OUTSIDE TOE OF DIKE

INSIDE TOE OF DIKE

NEW SHORELINE

LEGEND:

MAINTAIN EXISTING HABITAT "NO DISTURBANCE AREA"

NO DISTURBANCE AREAS

ISLAND

A154
OPEN PIT

EXTENT OF FILL DURING MINING

EAST ISLAND

NO DISTURBANCE AREAS

EXTENT OF FILL DURING MINING

7153400.00 N

7153200.00 N

7153000.00 N

7152800.00 N

7152600.00 N

7152400.00 N

535800.00 E

536000.00 E

536200.00 E

536400.00 E

536600.00 E

536800.00 E

537000.00 E

537200.00 E

NOTE:

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

50 0 50
SCALE METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A154 - TOTAL FILL ISOPACH (TOP OF FILL ELEVATION = 411.8m)

Golder Associates
Saskatoon, Saskatchewan

PROJECT No. 012-2331.5310			FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
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CHECK				
REVIEW				

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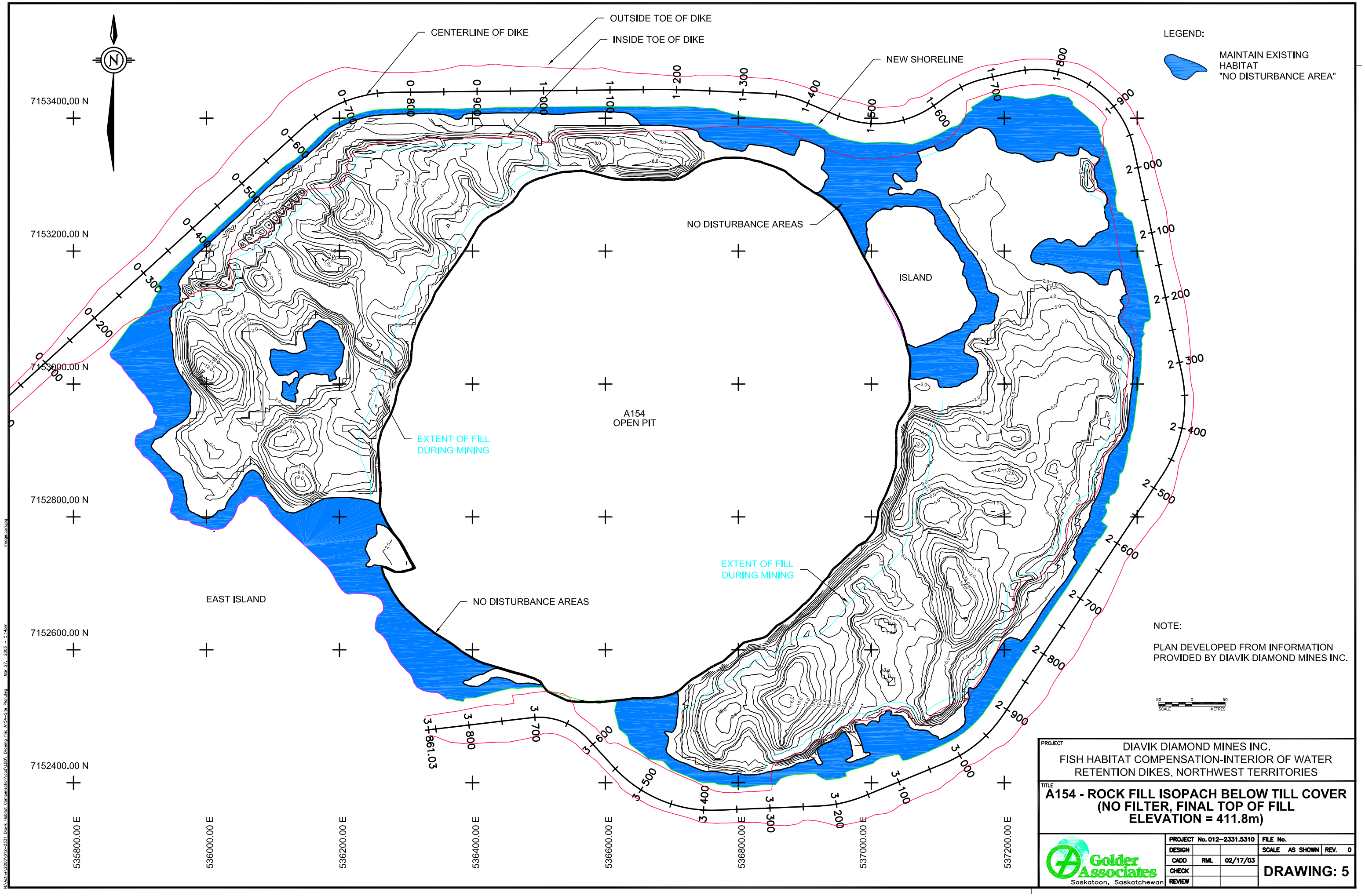

NOTE:

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

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SCALE METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A154 - ROCK FILL ISOPACH BELOW TILL COVER (NO FILTER, FINAL TOP OF FILL ELEVATION = 411.8m)

Golder Associates
Saskatoon, Saskatchewan

PROJECT No. 012-2331.5310			FILE No.
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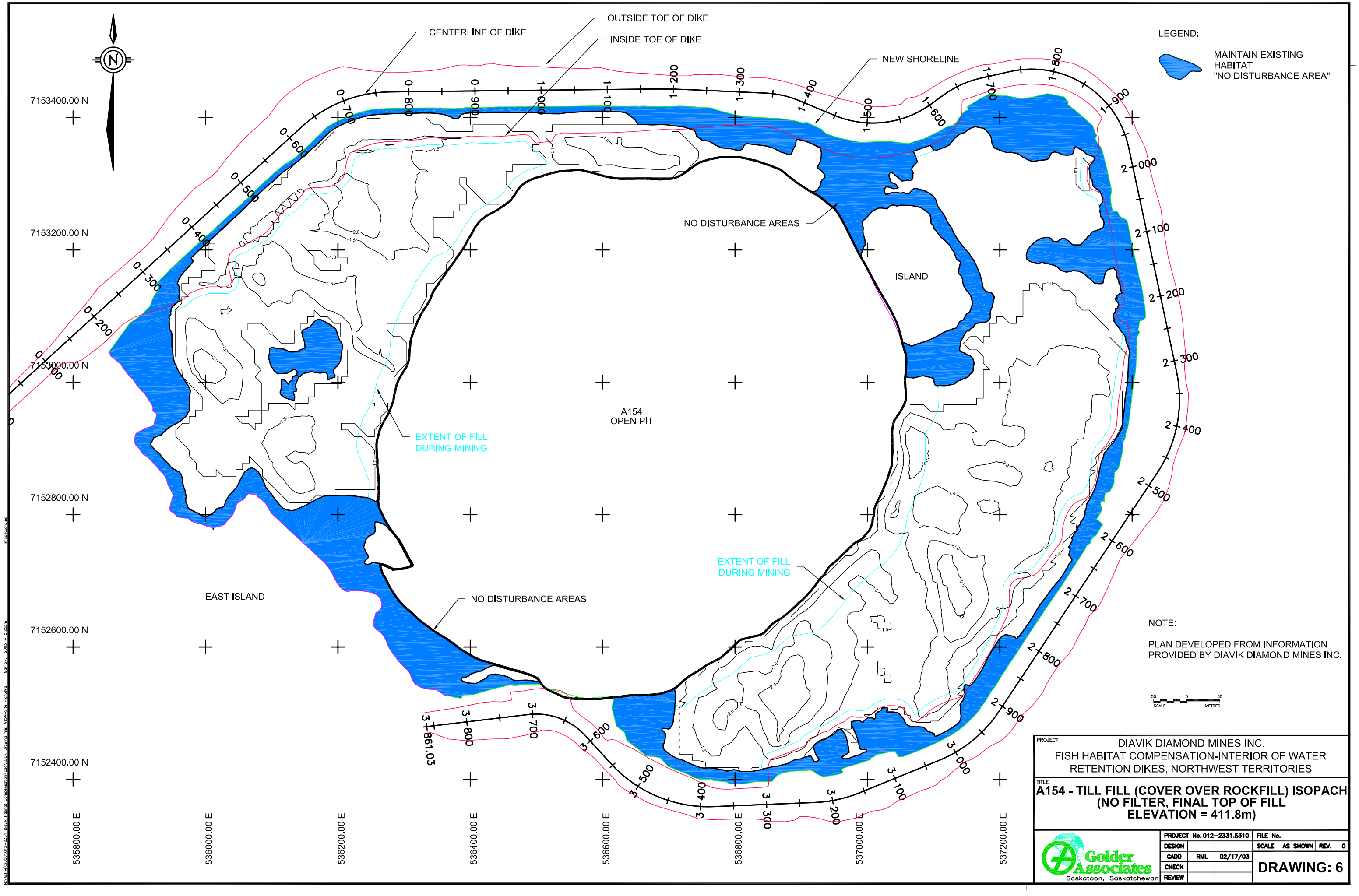

NOTE:

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A154 - TILL FILL (COVER OVER ROCKFILL) ISOPACH (NO FILTER, FINAL TOP OF FILL ELEVATION = 411.8m)

Golder Associates
Saskatoon, Saskatchewan

PROJECT No. 012-2331.5310			FILE No.	
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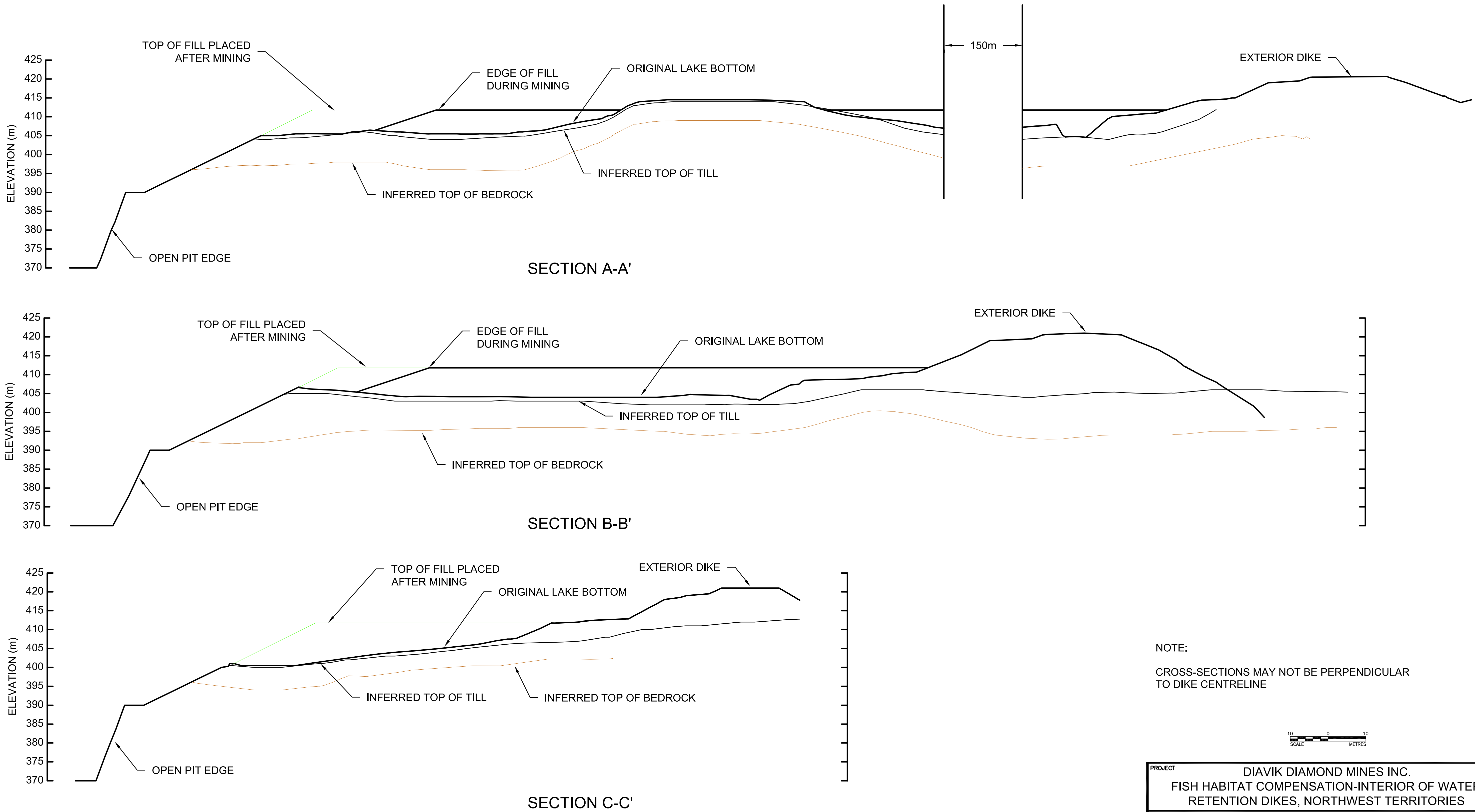

NOTE:

CROSS-SECTIONS MAY NOT BE PERPENDICULAR TO DIKE CENTRELINE

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A154 PIT - CROSS SECTIONS OF FISH HABITAT FILL ON EXTERIOR DIKES

Golder Associates
Saskatoon, Saskatchewan

PROJECT	No. 012-2331.5310		FILE No.	
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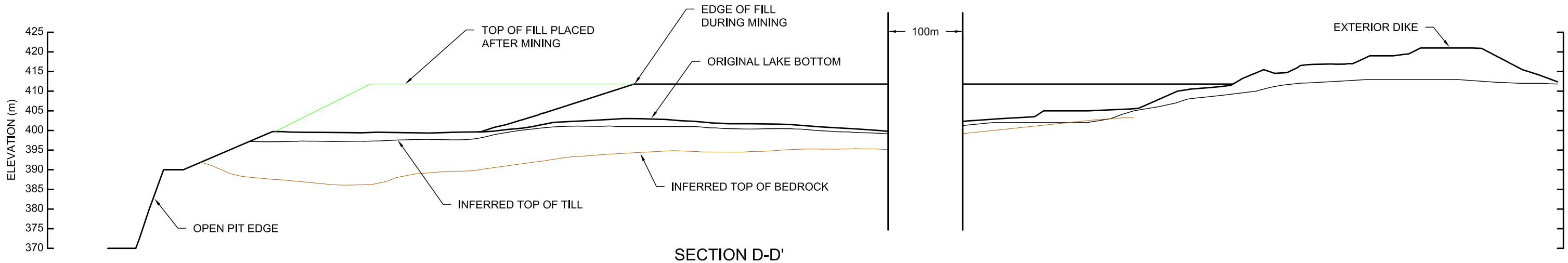

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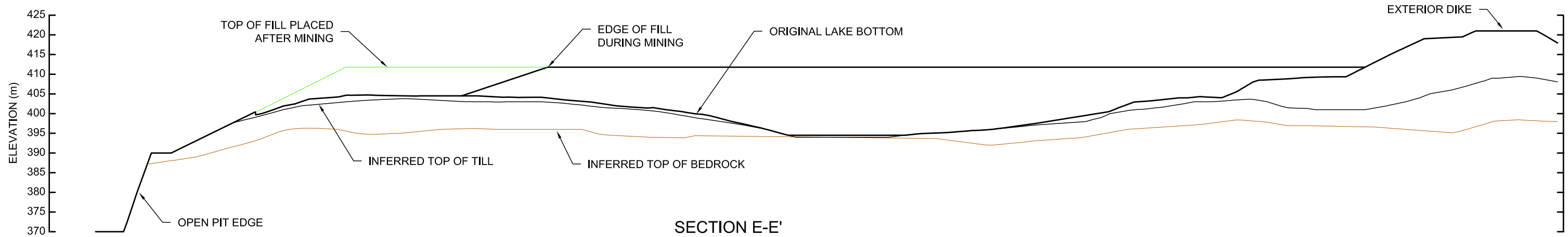

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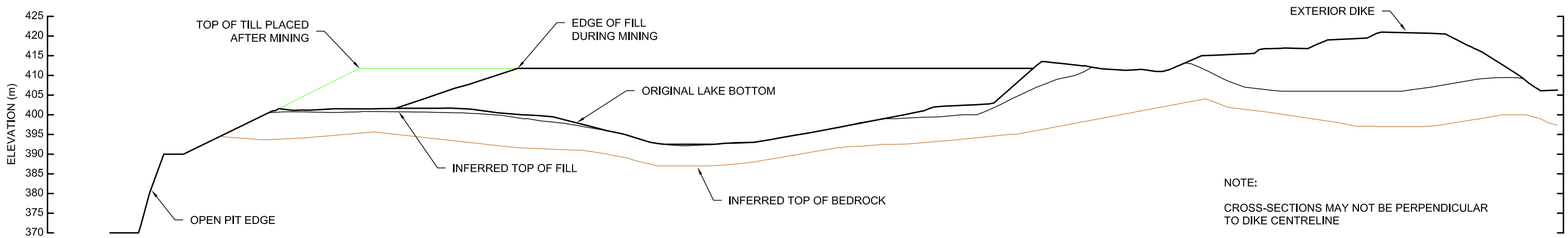

SECTION F-F'

NOTE:

CROSS-SECTIONS MAY NOT BE PERPENDICULAR TO DIKE CENTRELINE

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SCALE METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A154 PIT - CROSS SECTIONS OF FISH HABITAT FILL ON EXTERIOR DIKES

Golder Associates
Saskatoon, Saskatchewan

PROJECT No. 012-2331.5310			FILE No.	
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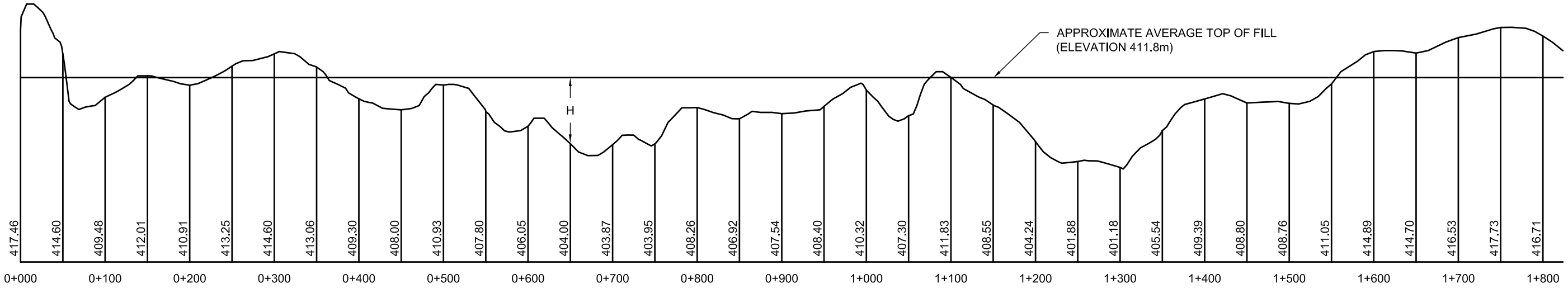

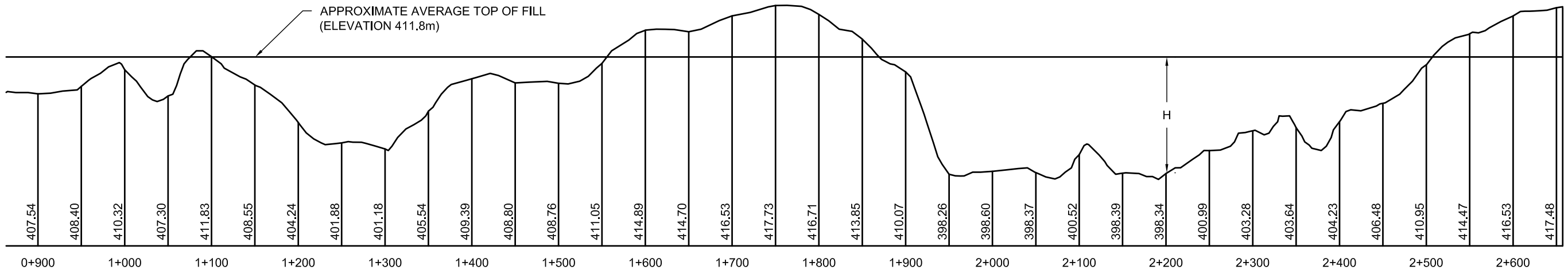

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SCALE METRES

10x VERTICAL EXAGGERATION

NOTES:

1. SEE DRAWING : 3 FOR STATIONING

2. SETBACK FROM PIT CREST TO TOE OF FISH HABITAT FILL (DURING MINING) EQUAL TO 4H WITH A MINIMUM OF 15m.

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A154 PIT - PIT CREST PROFILE

Golder Associates
Saskatoon, Saskatchewan

PROJECT No. 012-2331.5310			FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	RML	02/17/03	DRAWING: 9	
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REVIEW				

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Image:cad\jpg

CENTERLINE OF DIKE

OUTSIDE TOE OF DIKE

INSIDE TOE OF DIKE

DIKE BREACH

NEW SHORELINE

DIKE BREACH

DIKE BREACH

ISLAND

A154
OPEN PIT

REEFS

EAST ISLAND

DIKE BREACH

7153400.00 N

7153200.00 N

7153000.00 N

7152800.00 N

7152600.00 N

7152400.00 N

535800.00 E

536000.00 E

536200.00 E

536400.00 E

536600.00 E

536800.00 E

537000.00 E

537200.00 E

LOW WATER SURFACE

LARGE ANGULAR BOULDERS WITH SOME COBBLES

2m MIN

5m

FINE SUBSTRATE ADJACENT

5 to 20m (AVG. 10m)

TYPICAL CROSS-SECTION OF REEF
NOT TO SCALE

NOTE:

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

SCALE 50 0 50 METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A154 PIT - SCHEMATIC REEF CONFIGURATION

Golder Associates
Saskatoon, Saskatchewan

PROJECT No. 012-2331.5310			FILE No.		
DESIGN			SCALE AS SHOWN	REV.	0
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Appendix X-2

Fish Habitat Design for the A418Pit Shelf Area at the Diavik Diamond Mine

REPORT ON

FISH HABITAT DESIGN FOR THE A418 PIT SHELF AREA AT THE DIAVIK DIAMOND MINE

Submitted to:

Diavik Diamond Mines Inc.
P.O. Box 2498
5007 – 50th Avenue
Yellowknife, Northwest Territories
1XA 2P8

Attention: Mr. Gord MacDonald

DISTRIBUTION:
1 Copy - Diavik Diamond Mines Inc., Yellowknife (+1 CD)
1 Copy - Golder Associates Ltd., Saskatoon
1 Copy - Golder Associates Ltd., Vancouver

December 2008
07-1328-0001 Doc No. RPT-788 Ver.0 Rev.1

EXECUTIVE SUMMARY

This report presents the detailed design for the creation of fish habitat on the interior of the A418 water retention dike for the Diavik Diamond Mines Inc. diamond mine located on Lac de Gras in the Northwest Territories, Canada. This design was prepared in accordance with the "No Net Loss" plan prepared by Diavik Diamond Mines Inc.

This design is applicable to the A418 pit and has been prepared by developing criteria for the end result. This approach provides flexibility on the part of Diavik Diamond Mines Inc. as to how the end result is achieved.

The fish habitat creation on the interior of the dikes consists of placing material excavated from the open pits in the area between the pit crest and the toe of the dikes, to create an area generally varying from 3 to 5 m below the mean normal water level for Lac de Gras. During mining operations, the toe of the fill will be set back from the edge of the pit crest for safety. At the completion of mining, the fill will be extended to the pit crest.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENTS (Continued)

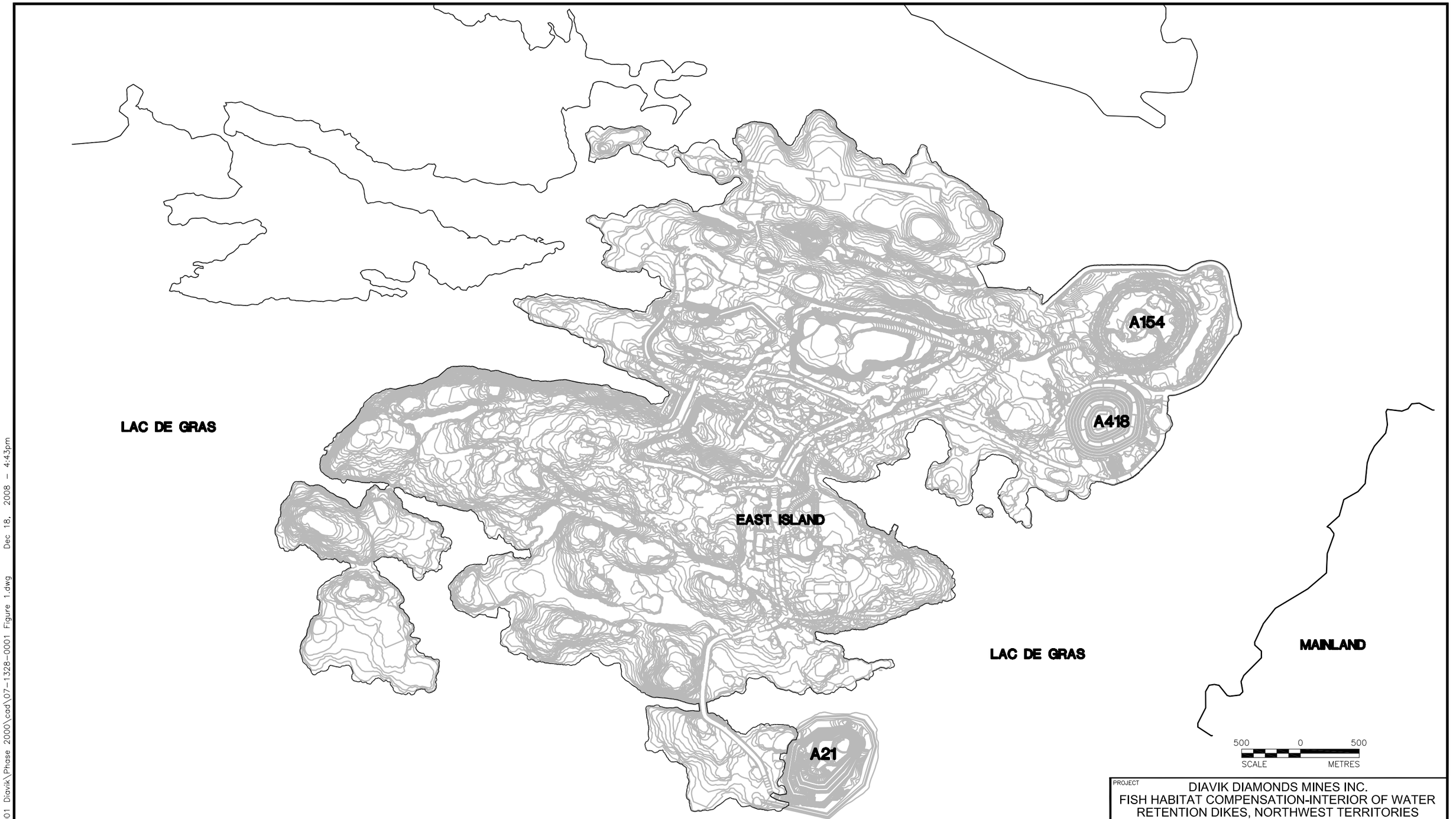
LIST OF APPENDICES

1.0 INTRODUCTION

This report presents the detailed design for the fish habitat compensation plan for the interior of the water retention dikes (i.e., the pit shelf) at the Diavik Diamond Mines Inc. (DDMI) diamond mine in the Northwest Territories. The location of the mine is shown in Figure 1. This detailed design is based on the "No Net Loss" (NNL) Plan (Diavik 1998), and the conceptual fish habitat plan prepared by Golder Associates Ltd. (Golder 2001). The conceptual fish habitat compensation plan for the pit shelf is to construct habitat on the shelf, by filling in the lower elevation (deeper water) areas. The general plan is to fill in the areas on the shelf that are deeper than 5 metres (m) of water depth with materials excavated during development of the pits.

As stated, this document provides the detailed design for the fish habitat compensation for the pit shelf; however, it does not provide specifications for construction. Rather, this document provides details for achieving the desired end result, while providing flexibility in how the end result is achieved. The requirement for this flexibility is due to some of the unknowns with respect to material parameters, mine operations (i.e., blasting details, availability of various materials), and construction timing. The habitat design parameters were developed considering fish habitat, surface water runoff, and geotechnical issues. Design details with respect to surface water handling, material selection, construction, and other issues would be addressed by DDMI, to achieve the desired habitat compensation prior to reflooding of the diked areas.

This design applies specifically to the A418 pit; however, it is similar in concept to plans developed for the A154 and A21 pits. Both A154 and A418 have been constructed with the A418 construction completed in 2006. A21 is currently under financial review and has no scheduled construction timeline. The water retention dike (dike) locations and pit layouts for A418 were modified slightly during construction, and have resulted in minor changes in habitat areas when compared with the original NNL Plan predictions. It is intended that the design details (particularly setback distances and slope angles) be reviewed prior to construction of fish habitat compensation measures to incorporate knowledge gained from the construction and performance of A154, as well as any additional studies, investigations and analyses conducted after the preparation of this report. It will also be important to consider mine operations, seepage control measures for the dikes, overall pit stability and instrumentation/monitoring requirements. It was understood that the pits will be developed in a series of expansion cuts, thus permitting the opportunity to monitor slope stability and pore-pressures in the in situ materials in each pit well in advance of the excavation of the final pit slopes, and construction of the fish habitat fills.



PROJECT
DIAVIK DIAMONDS MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
PROJECT LAYOUT

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.	
DESIGN			SCALE 1:4000	REV. 0
CADD	RML	03/12/07		
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REVIEW	PGB	18/12/08		

FIGURE: 1

G:\2007\1328\07-1328-0001 Diavik\Phase 2000\cad\07-1328-0001 Figure 1.dwg Dec 18, 2008 - 4:43pm

2.0 BACKGROUND

The objective of the fish habitat compensation measures on the interior of the water retention dikes is to provide spawning, nursery, rearing and foraging habitat for lake trout (*Salvelinus namaycush*), cisco (*Coregonus artedi*), round whitefish (*Prosopium cylindraceum*), lake whitefish (*Coregonus clupeaformis*), longnose sucker (*Catostomus catostomus*), burbot (*Lota lota*), northern pike (*Esox lucius*), and slimy sculpin (*Cottus cognatus*), in addition to rearing and foraging habitat for Arctic grayling (*Thymallus arcticus*). The primary gains in habitat are expected to relate to rearing habitat for lake trout, cisco, and slimy sculpin. The habitat on the insides of the dikes was to be designed to be similar to the pre-mine habitat in the north inlet which was considered a shallow, productive area of the lake. The objectives and conceptual design for the fish habitat compensation, were outlined in Golder's report entitled "*Conceptual Design and Compensation Workplan for the Fish Habitat Compensation Program, Diavik Diamond Mines Inc., Lac de Gras*", dated August 2001. The conceptual design consisted of:

- Re-contouring the pit shelf (area between the interior toe of the water retention dike and the crest of the pit slope) to provide habitat with a water depth of approximately 5 m after the dike is breached. New habitat will only be constructed where the pre-mining water depth exceeded 5 m; the shallower areas of the shelf will not be excavated, as these areas already provide shallow water habitat. If fill is placed in this area during mine operations, setbacks will be required between the pit crest and the toe of the slope, as well as between the interior toe of the dike and the toe of the fill slope. These areas could be filled near the end of mining, or after completion of mining, if required.
- Constructing long, narrow, rocky reefs extending from the interior slope of the dike to the crest of the open pit. The reefs would be built in areas where the water depth is 5 m and would be approximately 2 to 3 m high. Areas of granular and soft substrates between the reefs would be based on the conditions that existed in the north inlet.
- Modification of disturbed shoreline areas to establish conditions similar to pre-development. This may include placement of boulders in water depths up to about 5 m.
- Flooding the area after completion of habitat construction.
- Breaching the dikes to create shallow (minimum 2 m depth from low water) entrances, to deter the movement of larger fish into the nursery and feeding habitat, similar to the rearing habitat in the north inlet.

3.0 DESIGN PARAMETERS

3.1 Geotechnical Parameters

Geotechnical parameters used were similar to those used in the fish habitat design for pit A154, as the material composition and construction guidelines for the fish habitat compensation on the pit shelves are similar. Bathymetric contours, till thickness isopachs, and sediment thickness isopachs for the A418 pit area were updated in the analysis, as were till strength properties and seismic parameters. During the final design and construction stage, these input parameters can be re-evaluated as necessary if new information becomes available.

Till and sediment samples were characterized as part of the fish habitat design for A154, as described in the Golder report number 012-2331, "*Fish Habitat Design for the Pit Shelf Areas at the Diavik Diamond Mine"*, dated March 2003 (Golder 2003). Since then, additional testing has been conducted on the till; therefore, updated material properties for the till material on site were incorporated into the fish habitat design for the A418 pit. Due to the thickness of the lake sediments and its similarity to the till material, the sediments were modelled as till in the analysis. Material properties used in the stability analysis are summarized in Table 1.

Table 1
Material Strength Properties Used for Stability Analysis

Material	Unit Weight (kN/m^3)	Effective Angle of Internal Friction (°)	Effective Cohesion (kPa)
Till	22	34	0
Sediment	22	34	0

Notes: kN/m^3 = kiloNewtons per cubic metre; ° = degrees; kPa = kilopascal.

The bathymetric information in the A418 area indicated that the maximum water depth was about 22 m. The deepest water around the pit crest appears to be approximately 17 m, and the deepest water near the toe of the dike is also approximately 17 m. The highest expected face of placed aquatic habitat fill over the long-term for A418 is expected to be approximately 11 m.

Based on available information from exploration boreholes, the lakebed sediments range from about 0 to 5 m thick and are typically less than 2 m thick, except for a few localized pockets. The in situ till, beneath the sediment, ranges up to approximately 10 m thick and is typically 5 to 9 m thick.

3.2 Fish Habitat Parameters

3.2.1 Overview of No Net Loss Requirements related to Insides of Dike Areas

The Fisheries Authorization identified the requirements for achieving NNL of habitat for all aspects of the DDMI Diamond Project. Specific requirements for the inside of the A418 dike include:

- the development of shallow rearing habitat, spawning shoals, and shoreline habitat within the dikes areas around the open pits in Lac de Gras upon completion of mining in each open pit; and
- ensuring that the habitat features within the dikes areas are modelled after those features found in other productive areas of Lac de Gras, including depth, substrate type, size, and configuration.

Four key zones of habitat were identified in the NNL Plan (Diavik 1998) for the area found inside the constructed dike during the post closure phase. These included:

1. Inside edge of the dike. The area of water depths from 0 to 2 m along constructed sections of the dike representing new shoreline habitat.
2. Reclaimed shorelines. Areas of pre-existing shorelines.
3. The pit shelf. The area between the inside edge of the dike, the shorelines, and the pit crest.
4. Deep water. The pit itself as it will have a depth of approximately 210 m.

The NNL Plan provided Habitat Unit (HU) calculations based on the available design information for the dikes and pits at the time. Some modifications to the dike design and pit dimensions were made subsequent to the submission of the NNL plan, and the new HU calculations reflect these changes. The HUs calculated as part of the NNL Plan Addendum (DDMI April 1999), along with re-calculated values based on this updated information are presented in Appendix I.

The following sections outline the general principles and criteria to be used in developing the final layout for the A418 dike area. As discussed in the NNL, the primary focus for habitat creation inside of all dikes is based on providing spawning, nursery, rearing and foraging habitat. Target species include lake trout, arctic grayling, burbot, longnose sucker, round whitefish, cisco, lake whitefish, northern pike, and slimy sculpin.

3.2.2 Overall Criteria

Several overall governing criteria can be applied to the habitat creation activities inside the dike. First of all, areas inside the dike on the pit shelf that are already at a depth of 4 m or less should not be disturbed if possible. This will allow the maintenance of habitat features not easily re-created. In areas where final depth is between 4 and 5 m, it would be desirable to maintain existing habitat depending upon grading requirements for drainage, or other construction/operational considerations. Existing shoreline features should also be maintained to the extent feasible. Construction crews should avoid driving on, dumping on, scraping, or otherwise impacting these areas. Leaving these areas intact will decrease the amount of work required to restore the shoreline at closure and will speed the recovery process of the altered areas inside the dike as a variety of organic properties, including the possibility that dormant life stages of some plants or animals will be present in the substrate.

The storage and handling of materials, particularly hydrocarbons or other types of contaminants should be closely monitored on the shorelines, pit shelf, and inside edges of the dike. Heavy equipment in the area should be maintained and fuelled in a manner that avoids the possibility of spills occurring in areas to be reclaimed as fish habitat.

3.2.3 Inside Edges of Dike

The inside edge of the dike is intended to provide new shoreline features for foraging and rearing habitat for most species as well as other values, including spawning, for slimy sculpin. The dike itself will resemble existing shoreline and reef habitat and is expected to provide a rocky (boulder/cobble), moderate slope area with low to moderate wind and wave action. The NNL plan habitat evaluation completed for the inside edge the dike treated this area as shoreline habitat.

Suitable materials for this habitat feature are a mix of primarily large boulder with some smaller cobble. Slopes should also ensure a stable profile and range from gentle to moderate. The range of slopes for existing shorelines should be used as a guideline. The area of habitat gain predicted in the NNL plan as well as the area based on the constructed dike alignment for this habitat type is provided in Table 2. For A418, based on constructed dike configuration and the design criteria presented in this report, 0.34 hectares (ha) of new shoreline habitat are expected to be created.

Table 2
Inside Edge of the Dike Shoreline Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area[(a)] (ha)
A418	0.48	0.34

Notes: ha = hectare.
(a) = Based on final constructed configuration of the A418 dike.

3.2.4 Reclaimed Shorelines

The objectives for the pre-existing shoreline along the edge of the diked area, and around any islands within diked areas, are to:

- minimize change to existing substrates or other features; and
- re-configure disturbed portions to pre-development conditions as much as possible.

This will allow the shoreline areas to be restored to pre-existing conditions once the dike is breached. Any areas of disturbed shoreline are to be re-configured to provide fish habitat resembling that which was temporarily lost during the project. This may include placement of boulders in water up to 5 m deep to provide a sloping shoreline. The area of habitat predicted in the NNL plan for this habitat type is provided in Table 3. For A418, based on the dike configuration and design criteria presented in this report, 1.2 ha of shoreline habitat are expected to be reclaimed and includes shoreline areas around one island on the pit shelf.

Table 3
Reclaimed Shoreline Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area[(a)] (ha)
A418	0.61	1.2

Notes: ha = hectare.
(a) = Based on final constructed configuration of the A418 dike.

3.2.5 Pit Shelf

The pit shelf area extends from the lower inside edges of the dike to the edges of the pit. The reclaimed pit shelf area is intended to provide shallow foraging and rearing habitat for most species of fish present in Lac de Gras. Material excavated from the pit will be used to fill in deeper portions of the pit shelf area. The area of the pit shelf will be covered by water that ranges from 3 to 5 m deep. As per the *Navigable Waters*

Protection Act Permit for the project, no dike breach or constructed shoal features will be less than 2 m below the expected low water level in Lac de Gras.

As indicated in the NNL plan and the Fisheries Authorization, the objectives for the selection of substrate type are based on reflecting physical characteristics of other areas of good foraging and rearing in Lac de Gras. The pit shelf configuration is also to be based on reflecting the physical characteristics of other productive habitats within Lac de Gras. In order to address these objectives, substrate information from baseline data collections was used and a basic configuration evaluation of the North Arm and two other nearby inlets identified as rearing areas within Lac de Gras was completed. The configuration evaluation was completed through air photo interpretation. Key features identified by assessing other rearing areas included:

- Rocky Shoal Shape – Rocky shoals should be somewhat irregular in size and shape and relatively long and narrow. Some may also be constructed like a series of submerged rocky humps like links in a chain. Longer and narrower reefs have more "edge" habitat. Edges are important to fish that feed in one habitat type and rest or seek refuge in another.
- Isolated Pond-like Areas - In some cases it is beneficial to small fish to have the reefs forming a disjointed "ring" to provide pond-like conditions where circulation is limited.
- Hard to Soft Substrate Ratio - The hard substrate (shoals areas) to soft substrate (depositional areas) ratio in other nearby rearing areas ranged from 25 to 40% hard with the remainder as soft substrate.
- Access to Refuge Habitat – Rocky reefs provide refuge or cover for small fish. It is important for fish to have connectivity between rocky areas and reefs to avoid exposing themselves for extended distances or periods of time to predators. Keeping the distance between rocky reef areas less than 30 to 40 m will allow fish reasonable access refuge, or hiding places.

Shape Configuration

With regard to water circulation within the diked area, several features should be incorporated to reduce circulation. The shallow nature of the breaches, shallow nature of the pit shelf, and the creation of shoals on the pit shelf will reduce circulation and wind and wave action. The shallow water is expected to warm up quickly in the spring, relative to open areas of the lake, because of the limited water circulation within the enclosed area. As with other rearing habitats in Lac de Gras, warmer water should, therefore, assist in increasing biological productivity inside the dike by providing a warmer refuge, and foraging area.

Determining the locations of the reefs should take several factors into consideration. Reefs should have some connectivity to the dikes and other reefs to allow fish to travel throughout the area without being fully exposed to predators for long distances. If the reefs are long, winding, and finger-like, a large amount of "edge" habitat will be created to allow fish to feed in the fine substrate while maintaining close proximity to the cover provided by the rocky reefs. Ideally, the reefs will be placed in areas where the final water depth will be 3 to 5 m deep and the tops of the reefs will remain under at least 2 m of water at all times. This will allow the reef habitat to remain functional even in winter with ice thickness of up to 2 m. Widths of the reefs should vary between 5 and 30 m, averaging from 10 to 20 m in width. The distance between the reefs could range from 10 to 40 m, averaging from 20 to 30 m apart. Habitat diversity is important and varying the size and shape of the reefs throughout the pit shelf area is expected to improve its value as fish habitat.

Substrate Material

Based on the substrate materials within the North inlet substrates on the pit shelf should be mostly fine material, primarily sand and silt interspersed with rocky reefs for habitat diversity. The till (existing lake substrate) is primarily sand and silt with some gravel. The till material will therefore be an appropriate substrate for the expected biological zone of the sediments (i.e., approximately top 10 centimetre (cm) layer represents the biological zone). The fine substrate areas are expected to support a variety of benthic organisms that will provide forage for small fish.

If till is placed over angular rock to provide the soft substrate zone, it should be a layer deep enough to maintain at least 0.5 m depth of soft substrate after settling, accounting for some migration of fines into the voids in the rock fill.

Reefs should be constructed of granular material of a range of sizes. The primary material should be large boulder size rock with some smaller cobble material. The objective is to create refuge habitat, or hiding areas, among the rocks. Angular, unconsolidated material would provide this benefit. Run of mine blast rock is expected to be acceptable for this purpose.

The area of habitat predicted in the NNL plan for this habitat type is provided in Table 4. For A418, based on constructed dike configuration and the design criteria presented in this report, 9.4 ha of shallow rearing and foraging habitat are expected to be created.

Table 4
Pit Shelf Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area[(a)] (ha)
A418	8.68	9.4

Notes: ha = hectare.
(a) = Based on final constructed configuration of the A418 dike.

3.2.6 Deep Water (Pit Area)

The deep water habitat created by the project will be located in the mine pit, near the center of the diked area. The deep water will provide a cooler environment for fish and was considered a pelagic zone in the NNL plan. This area will likely be used by pelagic feeding fish such as cisco and may provide other benefits (e.g., over wintering habitat). The maximum depth of the pit areas is anticipated to be 210 m. The area of habitat predicted in the NNL plan for this habitat type is provided in Table 5. For A418, based on constructed dike configuration and the design criteria presented in this report, 34.13 ha are actually expected to be created.

Table 5
Deep Water Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area[(a)] (ha)
A418	41.94	34.13

Notes: ha = hectare.
(a) = Based on final constructed configuration of the A418 dike.

3.3 Construction Considerations

There are a number of construction considerations that arise due to the variability in the material parameters, pore-pressure conditions, blasting effects, and construction timing. The following construction considerations were evaluated with respect to the detailed design of the fish habitat compensation measures for the pit shelf areas:

- It was understood that flowing artesian conditions were present in the southeast portion of the A154 pit shelf. Artesian conditions may cause build-up of porewater pressures within the fill on the pit shelf, depending on drainage conditions and the development of frozen layers. It is unknown if similar conditions exist on the A418 pit shelf.

- The fine-grained lake-bottom sediments are expected to provide poor trafficability, particularly where artesian conditions exist, and when the materials are thawing. Portions of the A418 dike are expected to encounter permafrost, which would also present poor trafficability conditions if it thaws.
- A berm will be required between the pit crest and the toe of the fish habitat fill to provide safety with respect to equipment travelling too close to the pit crest and to reduce the potential for fill materials spilling into the pit during placement. The berm could also be used as a construction access road prior to pit development adjacent to the berm.
- The majority of the fill volume may consist of either till or rock fill, depending on construction timing and material availability. The final surface of the fill will consist of till, or lake-bottom sediments, to support aquatic life. The thickness of the final till/sediment layer will depend on whether a filter is used between the rock and till. DDMI will be responsible for picking the construction methods, and materials handling such that adequate quantities of till are available for the final fill surface.
- Based on gradation information for the till from the A154 pit shelf, it is anticipated that at least two, and possibly three graded aggregate filters would be required to prevent the till from migrating into the voids within the rock fill. Production of filter material would likely be relatively expensive, since it would involve crushing, screening, stockpiling, and double handling of the materials. It has been assumed that a filter between the rockfill and the till would not be utilized, due to logistical and economic considerations. As an alternative to using a filter, the thickness of the till cover on a rock fill can be varied as a function of the total fill thickness. The premise for this approach is that a certain portion of the till will migrate into the void spaces in the rock fill, so the thickness of the till cover must be such that a minimum of 0.5 m of till remains on top of the rock. For design purposes, it has been assumed that the porosity of the rock fill would be approximately 30 percent, and that with time, till would migrate into the rock such that 50 percent of the available voids would be filled. Thus, using this approach, the minimum thickness of till required over the rock is equal to 15 percent of the rock fill thickness, plus 0.5 m. If this approach is adopted, some overbuilding of the till layer should be considered to maintain the desired water depths after the till migrates into the rock fill, especially where the till thicknesses are greater. Theoretically, where rocky reefs are to be constructed, till would not be required between the rock fill and reef material.
- Rock fill has the advantages of higher shear strength and better potential for drainage/dissipation of pore-water pressures. Rock fill may require a smaller thickness than till to provide a stable trafficking surface for the initial lifts.
- Rock fill would permit faster infiltration than till, which may provide a more stable trafficking surface after precipitation events and during spring thaw.

- Till will be available earlier in the mining cycle for each pit, since it overlies the bedrock. Materials may be transported between pits, if required.

4.0 STABILITY ANALYSES

4.1 Overall Pit Stability

Golder prepared various reports regarding the stability of the A154 pit (Golder 1999, 2000, 2002, 2002a). The overall pit stability for A418 was assessed in Golder's report entitled, "*A418 Feasibility Pit Slope Design*" (Document No. Rpt-138, dated January 11, 2007). Pertinent items from this report related to the fish habitat compensation fills are as follows:

- Fractured rock zones similar to Dewey's Fault in the vicinity of the A154N/S pipes have not been encountered in the A418 area; however, a bathymetric low, trending a north-south direction, occurs in the south through southeast area of the planned pit. This feature is not fully understood, although while it has been speculated that it could potentially be a zone of high hydraulic conductivity, there is currently no evidence to support this.
- Modelling showed that depressurization will be necessary for Section 130 in order to achieve the required safety factor for the overall slope. Recommendations were provided for piezometer installations to monitor the depressurization of the pit wall.

Construction of the fish habitat compensation fill will require a setback from the crest of the pit to the toe of the fill, such that the overall pit stability is not significantly impacted by the presence of the fish habitat fills on the pit shelf during operations.

4.2 Stability of Fish Habitat Fills

Slope stability analyses were carried out to determine the stability of the fish habitat fills, and the required setback from the pit crest. The impact of the placed material on the stability of the pit was also checked.

Stability analyses were carried out using the computer program, SLOPE/W. Factors of safety were calculated using the principle of limit equilibrium, for potential sliding along assumed failure surfaces for each of the selected cross-sections. Factors of safety were computed using both Spencer's method and the Morgenstern-Price method, which satisfy both force and moment equilibrium. Based on the type of soil and the configuration of the habitat, both circular and wedge failure mechanisms were assessed. The factor of safety was assessed for a phreatic level which was situated at the top of the till/lake sediment surface, simulating saturated conditions in the pit shelf. This is considered conservative due to cut-off measures to be implemented during the dyke construction.

The effects of blasting in the pit on the stability of the fill were assessed by using a pseudo-static limit equilibrium analysis using a 1:2500 year return earthquake value of 0.06 g in the horizontal direction. As production blasting data is accumulated, the impact of blasting may be reassessed and the design refined.

The results of the stability analyses are summarized in Appendix II. The stability analyses indicate that computed factors of safety for the fills are in excess of 1.4 for the conditions during mining. A conservative approach with respect to setback distances and slope angles is proposed, combined with monitoring to assess modifications to the proposed design as mining proceeds, due to the critical importance of maintaining stability during operations. The recommended setback from the pit crest (i.e., top of the in-situ till slope to the toe of the fish habitat fill) is four times the height of the fill (taken as the difference between the ultimate top of the fill and the elevation of the pit crest), with a minimum of 15 m. The slope of the faces of the fish habitat fill facing the pit and the interior of the dikes should be 3H:1V or flatter. As mining progresses, it may be possible to modify the setback and slope angle parameters.

5.0 CONSTRUCTION GUIDELINES

The recommended configuration of the fish habitat on the A418 pit shelf is based on the following guidelines:

- Construct fills with face slopes of 3H:1V during mining, and final slopes at the angle of repose adjacent to the pit crest at the completion of mining.
- Setback from the pit crest to the toe of the fill equal to four times the elevation difference between the top of fill and the pit crest, with a minimum distance of 15 m.
- To the extent feasible, areas of existing shallow habitat (i.e., water depth less than 5 m below mean normal water level) should remain untouched.
- A berm should be constructed between the toe of the till slope and the crest of the pit. This berm will help retain material that erodes from the slope of the fish habitat fill and keep it away from the pit, and will also reduce the potential for any material rolling down the slope and into the pit during fill placement. A minimum setback of 5 m from the crest of the pit to the toe of the berm has been used. As a minimum, the berm would be approximately 2 m high, with a 2 m crest width and 2H:1V sideslopes. The geometry of this berm may be modified on the basis of construction techniques.
- A setback from the interior toe of the water retention dike, to the upstream toe of the fill may also be required. This setback distance should be determined by DDMI, based on operational requirements and surface water handling requirements. Construction must also accommodate instrumentation for monitoring seepage through the dike, and overall pit slope stability.
- Construction in one lift is acceptable.
- The materials used to construct the fill may consist of till, rock fill, or a combination of materials. If rock fill is used to construct the lower portion of the fill, the thickness of till to create the final surface should be a minimum of 0.15 times the height of rock fill, plus 0.5 m. Alternatively, filter zones could be provided between the rock fill and the till. Details of the filter zones would have to be developed further, once construction techniques and material gradations are determined. Processing of the blast rock will be required to produce filter materials, and is likely to be expensive. If the filter zone approach is taken, it is likely that at least two, and possibly, three filters would be required.
- Grading of the surface of the fill at a nominal grade of 1% is recommended, to direct surface water towards the water collection system at the toe of the dike.
- Final contouring of the surface will be required to establish some relief to provide fish habitat (i.e., some hummocks and hollows, rather than an evenly graded surface).
- Rock ridges or reefs are also required for fish habitat. These reefs should be constructed of non-acid generating country rock.

6.0 DETAILED DESIGN DRAWINGS

A set of detailed design drawings is included in Appendix III for the A418 pit. The design drawings indicate the desired end results, and provide DDMI with flexibility in regards to construction materials, methods, and timing. Operational considerations and the results of monitoring programs to assess seepage through/below the dike, and overall pit slope stability should be taken into account when planning the construction of the fish habitat fills. At the end of mining, construction of angle of repose slopes adjacent to the pit crest will be required. The exact extent of the fill, placement procedures, and safety protocols should be developed prior to construction.

7.0 MONITORING RECOMMENDATIONS

Monitoring of various parameters is recommended to confirm the design assumptions, and to provide information for refining the design of the fish habitat on the pit shelves. It is recommended that monitoring consist of:

- Monitoring pore-water pressures in the lake-bottom sediments and till that will form the foundation for the fish habitat fills to assess drainage due to pit development, as well as pore-pressures due to fill placement and blasting.
- Monitor pore-pressures within the fish habitat fills, so that the slope stability analyses can be confirmed.
- Monitor movements of the fish habitat fills using a series of monitoring prisms, slope inclinometers or other technologies, consistent with monitoring of the overall pit slopes. Visual inspections should also be conducted to check for signs of instability, such as bulging, slumping, or the development of tension cracks.

Monitoring programs have previously been recommended for the water retention dikes and for monitoring the overall pit stability. It is recommended that the monitoring for the fish habitat fills on the interior of the dikes be integrated into the overall monitoring program, to provide consistency, and improve the efficiency of the monitoring efforts.

8.0 CLOSURE

We trust this report presents the information that you require. Please feel free to call at anytime if you have any questions or concerns.

GOLDER ASSOCIATES LTD.

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ALL/PGB/LCB/JDH/msd

9.0 REFERENCES

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APPENDIX I

SUMMARY OF HABITAT UNIT ACCOUNTING FOR A418

Table I-1
No Net Loss Habitat Summary "Accounting" Showing Habitat Units for A418, from No Net Loss Addendum, 1999

Life Stage	Species	A418 (2009-2023)		Net Change
		loss	gain	
Spawning	LKTR	0.10	0.07	-0.03
	ARGR	0.00	0.00	0.00
	CISC	0.11	0.06	-0.05
	RNWH	0.02	0.05	0.03
	LKWH	0.04	0.02	-0.02
	LNSC	0.02	0.01	-0.01
	BURB	0.02	0.00	-0.01
	NRPK	0.00	0.00	0.00
	SLSC	0.03	0.21	0.18
Rearing	LKTR	1.00	3.60	2.60
	ARGR	0.17	0.26	0.09
	CISC	1.53	3.47	1.94
	RNWH	0.26	0.61	0.34
	LKWH	0.28	0.62	0.34
	LNSC	0.30	0.48	0.19
	BURB	0.19	0.27	0.08
	NRPK	0.00	0.00	0.00
	SLSC	0.26	0.43	0.17
Foraging	LKTR	0.90	0.96	0.06
	ARGR	0.10	0.13	0.04
	CISC	0.88	1.65	0.77
	RNWH	0.17	0.28	0.11
	LKWH	0.15	0.28	0.13
	LNSC	0.21	0.24	0.03
	BURB	0.11	0.12	0.00
	NRPK	0.00	0.00	0.00
	SLSC	0.14	0.21	0.06
Nursery	LKTR	0.10	0.06	-0.04
	ARGR	0.00	0.00	0.00
	CISC	0.11	0.06	-0.05
	RNWH	0.02	0.05	0.03
	LKWH	0.04	0.02	-0.02
	LNSC	0.02	0.01	-0.01
	BURB	0.02	0.00	-0.01
	NRPK	0.00	0.00	0.00
	SLSC	0.03	0.21	0.18
Total		7.33	14.45	7.12

Table I-1
No Net Loss Habitat Summary "Accounting" Showing Habitat Units for A418, from No Net Loss Addendum, 1999 (continued)

Life Stage	Species	A418 (2009-2023)		Net Change
		loss	gain	
Total by life stage	Spawning	0.34	0.43	0.10
	Rearing	4.00	9.73	5.74
	Foraging	2.66	3.86	1.20
	Nursery	0.34	0.42	0.08
Total by species	LKTR	2.11	4.69	2.59
	ARGR	0.27	0.40	0.13
	CISC	2.62	5.23	2.61
	RNWH	0.47	0.99	0.51
	LKWH	0.51	0.94	0.43
	LNSC	0.55	0.74	0.19
	BURB	0.34	0.40	0.06
	NRPK	0.00	0.00	0.00
	SLSC	0.47	1.06	0.60

Notes: LKTR = lake trout; ARGR = Arctic grayling; CISC = cisco; RNWH = round whitefish; LKWH = lake whitefish; LNSC = longnose sucker; BURB = burbot; NRPK = northern pike; SLSC = slimy sculpin.

Table I-2
No Net Loss Habitat Summary "Accounting" Showing Habitat Units for A418, Recalculated with Constructed Dimensions for A418 Dike

Life Stage	Species	A418 (2009-2023)		Net Change
		loss	gain	
Spawning	LKTR	0.10	0.09	-0.01
	ARGR	0.00	0.00	0.00
	CISC	0.11	0.07	-0.03
	RNWH	0.02	0.06	0.04
	LKWH	0.04	0.03	-0.01
	LNSC	0.02	0.01	-0.02
	BURB	0.02	0.01	-0.01
	NRPK	0.00	0.00	0.00
	SLSC	0.03	0.21	0.17
Rearing	LKTR	1.00	3.25	2.24
	ARGR	0.17	0.24	0.06
	CISC	1.53	3.11	1.58
	RNWH	0.26	0.56	0.30
	LKWH	0.28	0.59	0.31
	LNSC	0.30	0.45	0.15

Table I-2
No Net Loss Habitat Summary "Accounting" Showing Habitat Units for A418, Recalculated with Constructed Dimensions for A418 Dike (continued)

Life Stage	Species	A418 (2009-2023)		Net Change
		loss	gain	
Rearing (continued)	BURB	0.19	0.25	0.06
	NRPK	0.00	0.00	0.00
	SLSC	0.26	0.41	0.16
Foraging	LKTR	0.90	0.88	-0.03
	ARGR	0.10	0.12	0.03
	CISC	0.88	1.47	0.59
	RNWH	0.17	0.25	0.09
	LKWH	0.15	0.26	0.11
	LNSC	0.21	0.22	0.02
	BURB	0.11	0.11	-0.01
	NRPK	0.00	0.00	0.00
	SLSC	0.14	0.19	0.05
Nursery	LKTR	0.10	0.08	-0.02
	ARGR	0.00	0.00	0.00
	CISC	0.11	0.07	-0.03
	RNWH	0.02	0.06	0.04
	LKWH	0.04	0.03	-0.01
	LNSC	0.02	0.01	-0.02
	BURB	0.02	0.01	-0.01
	NRPK	0.00	0.00	0.00
	SLSC	0.03	0.21	0.18
Total		**7.33**	**13.28**	**5.95**
Total by life stage	Spawning	0.34	0.46	0.13
	Rearing	4.00	8.85	4.86
	Foraging	2.66	3.51	0.85
	Nursery	0.34	0.45	0.12
Total by species	LKTR	2.11	4.29	2.18
	ARGR	0.27	0.36	0.09
	CISC	2.62	4.72	2.10
	RNWH	0.47	0.93	0.45
	LKWH	0.51	0.90	0.40
	LNSC	0.55	0.69	0.14
	BURB	0.34	0.38	0.04
	NRPK	0.00	0.00	0.00
	SLSC	0.47	1.02	0.56

Notes: LKTR = lake trout; ARGR = Arctic grayling; CISC = cisco; RNWH = round whitefish; LKWH = lake whitefish; LNSC = longnose sucker; BURB = burbot; NRPK = northern pike; SLSC = slimy sculpin.

APPENDIX II

SUMMARY OF SLOPE STABILITY ANALYSES

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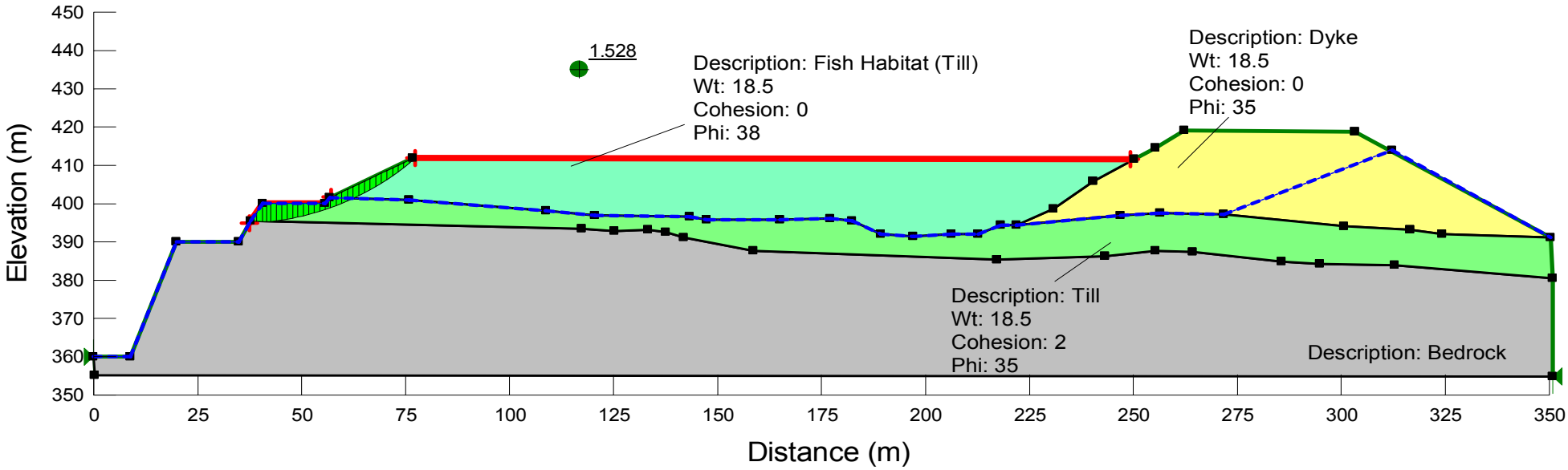
Comments: Final Configuration



PROJECT
DIAVIK DIAMONDS MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A418 STABILITY ANALYSIS RESULTS

Golder Associates
Saskatoon, Saskatchewan

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REVIEW	PGB	18/12/08		

APPENDIX III

DETAILED DESIGN DRAWINGS

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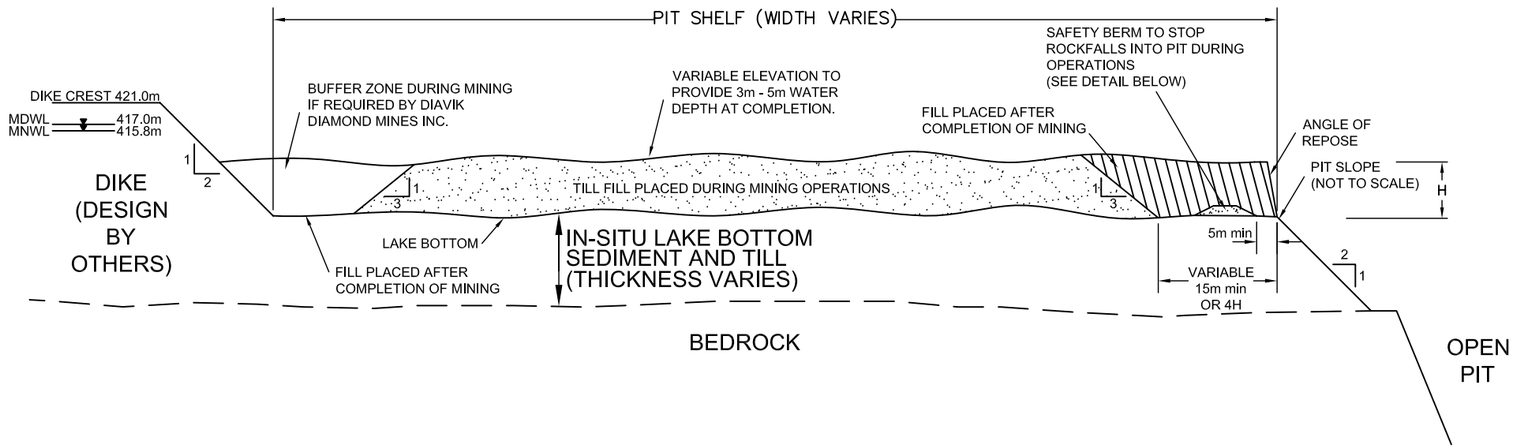

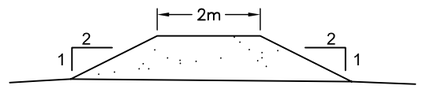

SAFETY BERM DETAIL
(MINIMUM DIMENSIONS)

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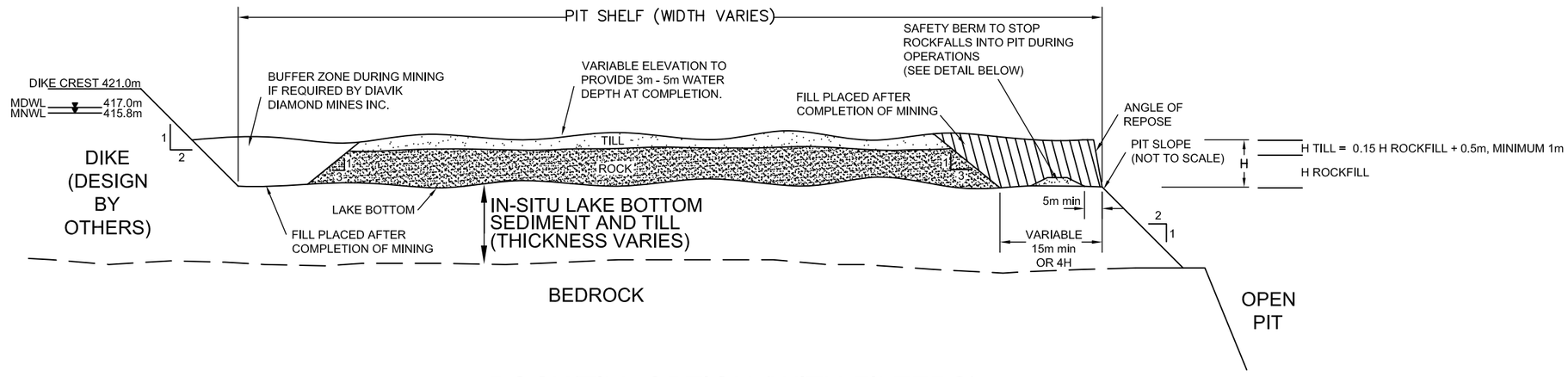
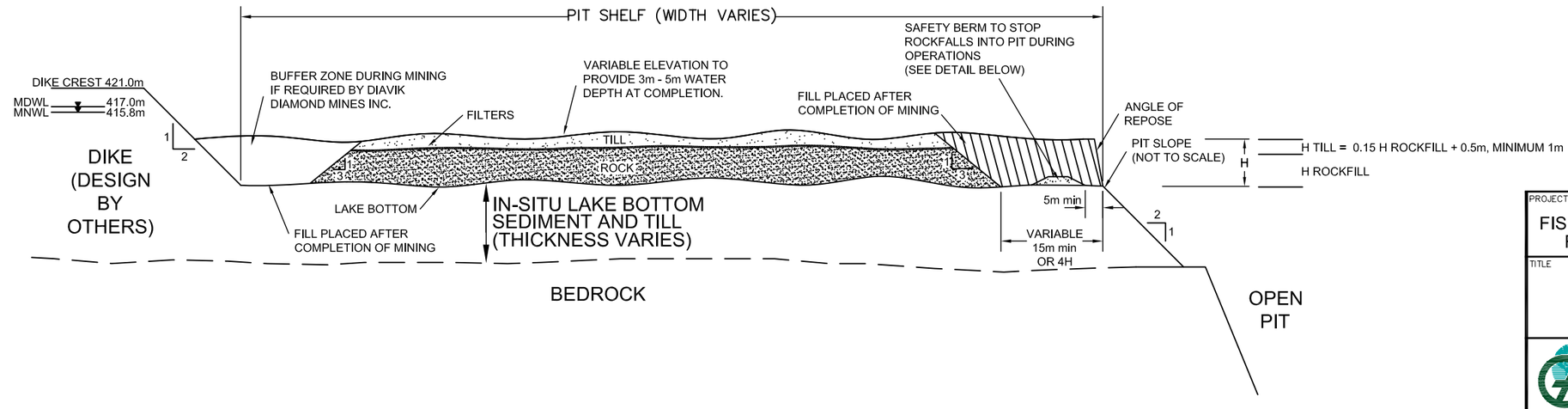


ROCK/TILL OPTION (WITH FILTERS)



PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
CROSS-SECTION OPTIONS FOR FISH HABITAT CREATED INSIDE DIKES

Golder Associates
Saskatoon, Saskatchewan

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CHECK	AL	18/12/08		
REVIEW	PGB	18/12/08		

FIGURE: III-1

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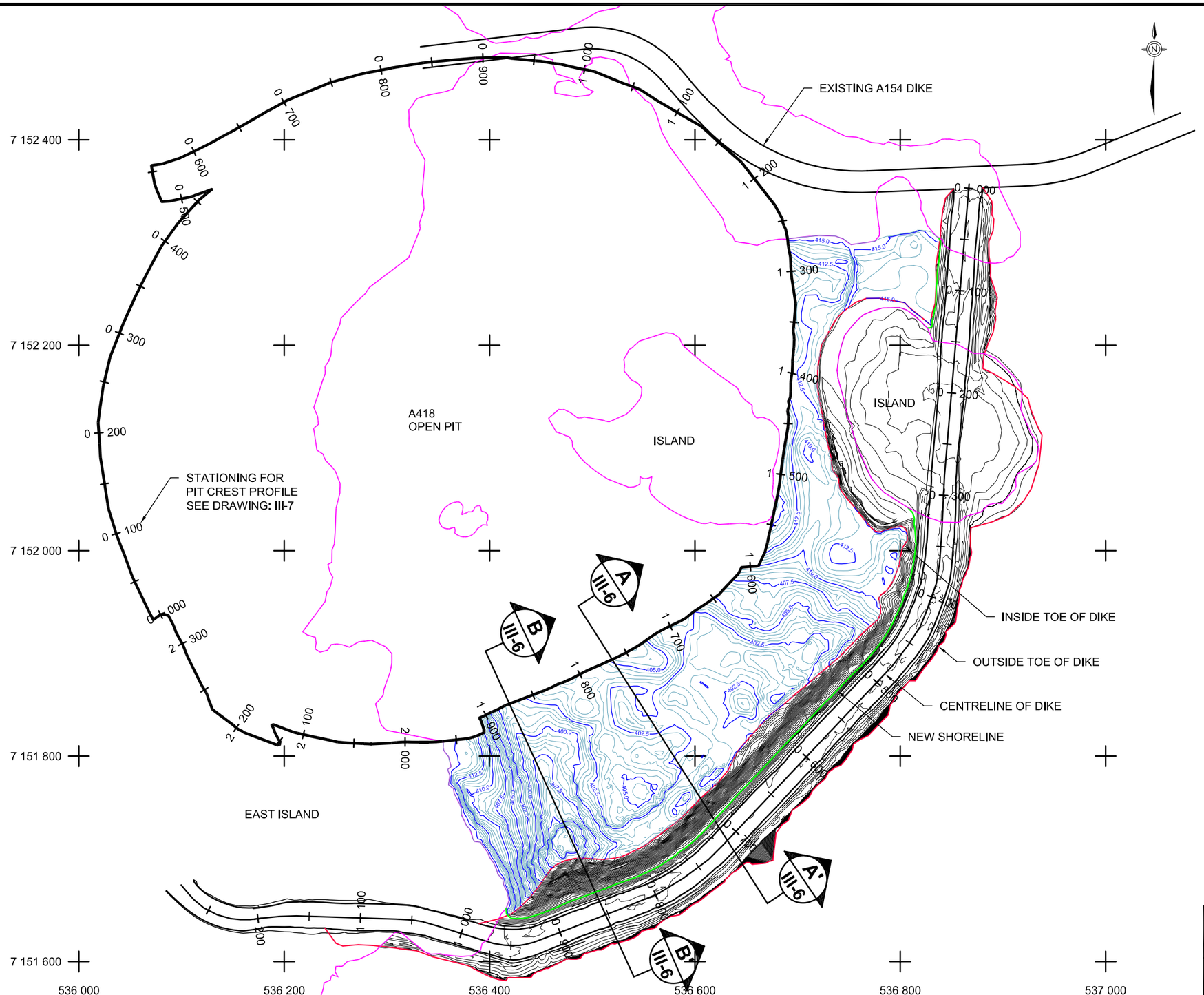

REFERENCE

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SCALE METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
BATHYMETRY - A418 PIT

Golder Associates
Calgary, Alberta

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CHECK	AL	18/12/08		
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FIGURE: III-2

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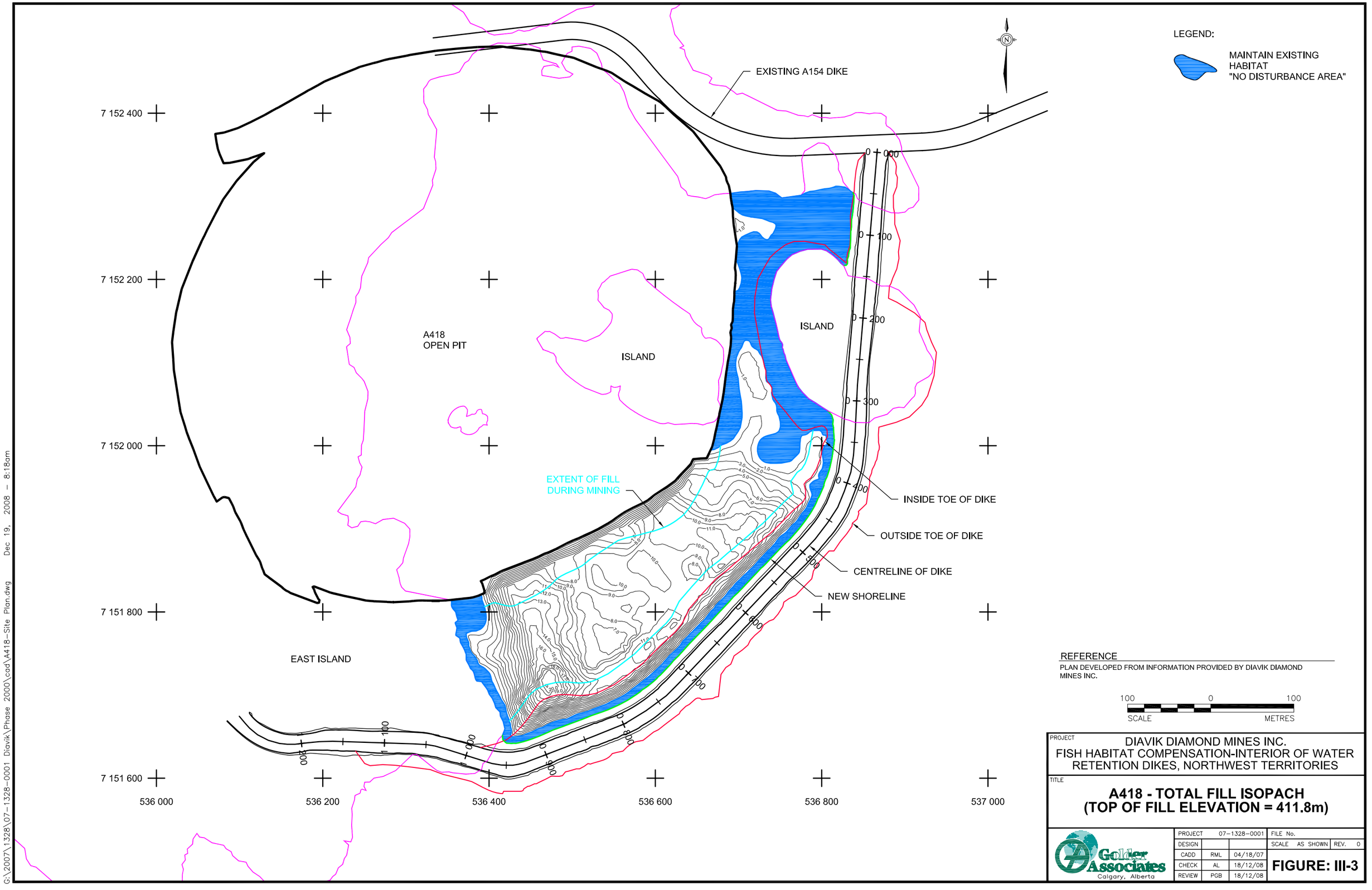

REFERENCE

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

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SCALE METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A418 - TOTAL FILL ISOPACH (TOP OF FILL ELEVATION = 411.8m)

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
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CHECK	AL	18/12/08	**FIGURE: III-3**	
REVIEW	PGB	18/12/08		

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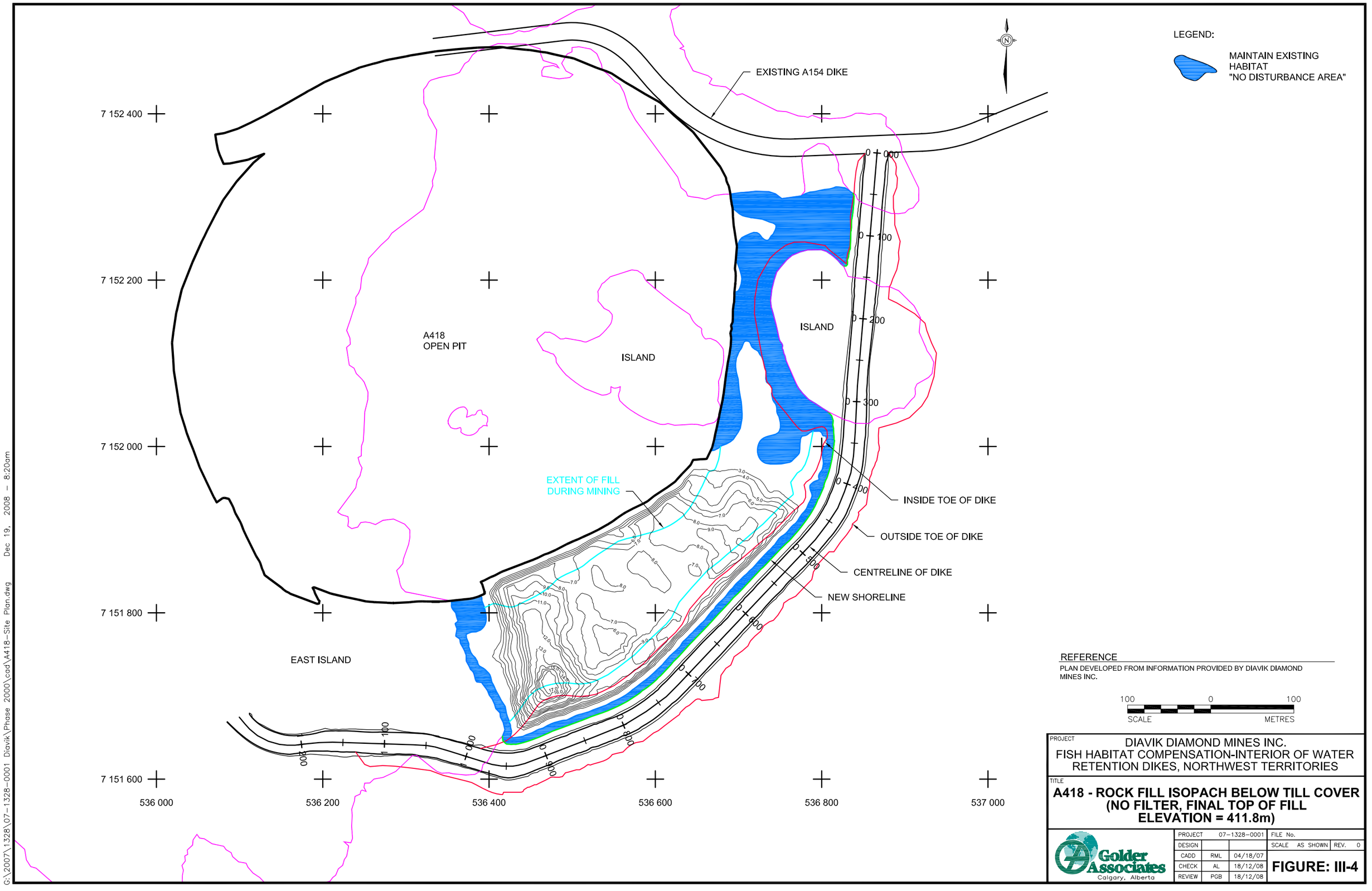

REFERENCE

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

100 0 100
SCALE METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A418 - ROCK FILL ISOPACH BELOW TILL COVER (NO FILTER, FINAL TOP OF FILL ELEVATION = 411.8m)

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.
DESIGN			SCALE AS SHOWN REV. 0
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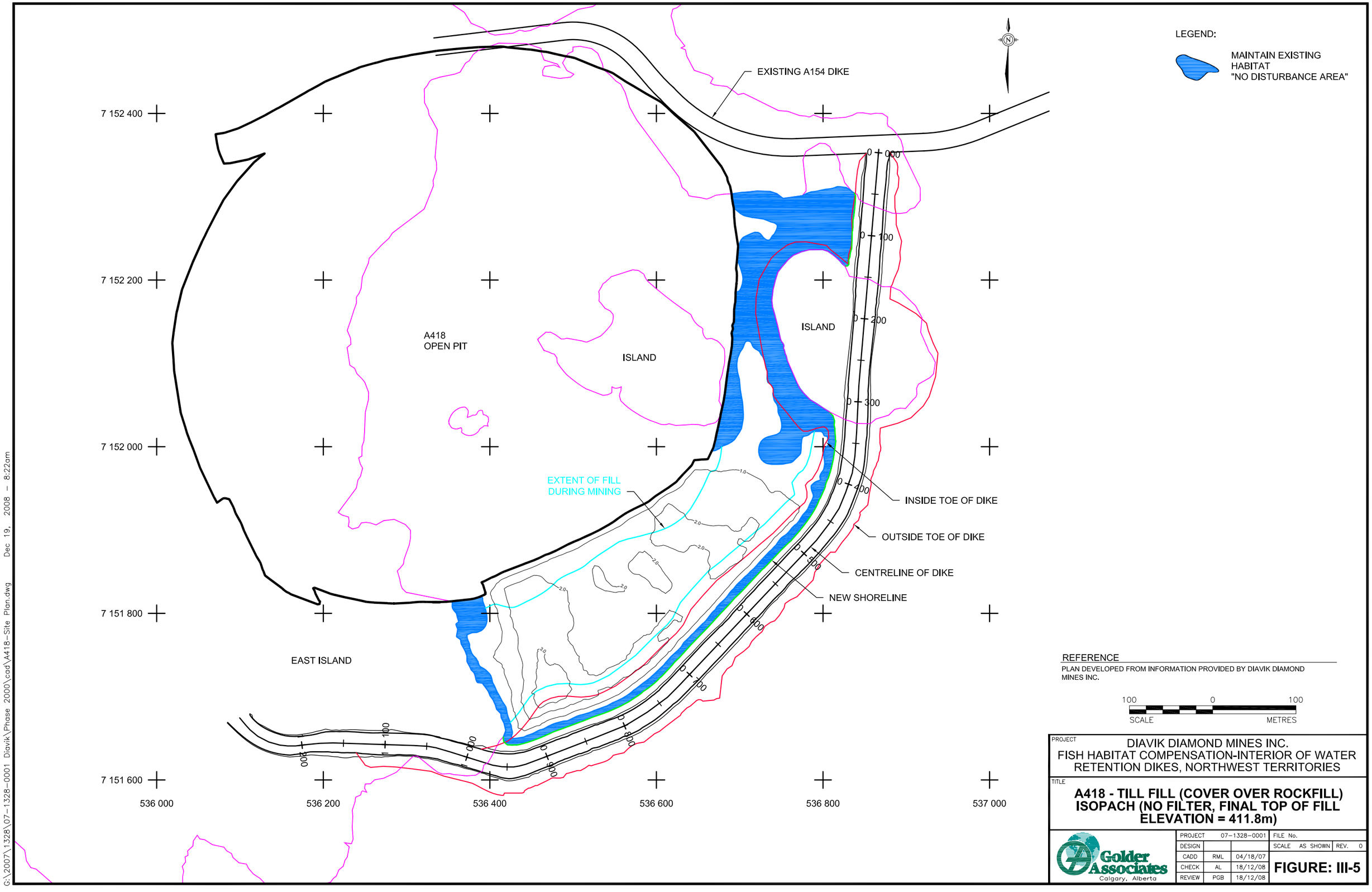

REFERENCE

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

100 0 100
SCALE METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A418 - TILL FILL (COVER OVER ROCKFILL) ISOPACH (NO FILTER, FINAL TOP OF FILL ELEVATION = 411.8m)

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.	
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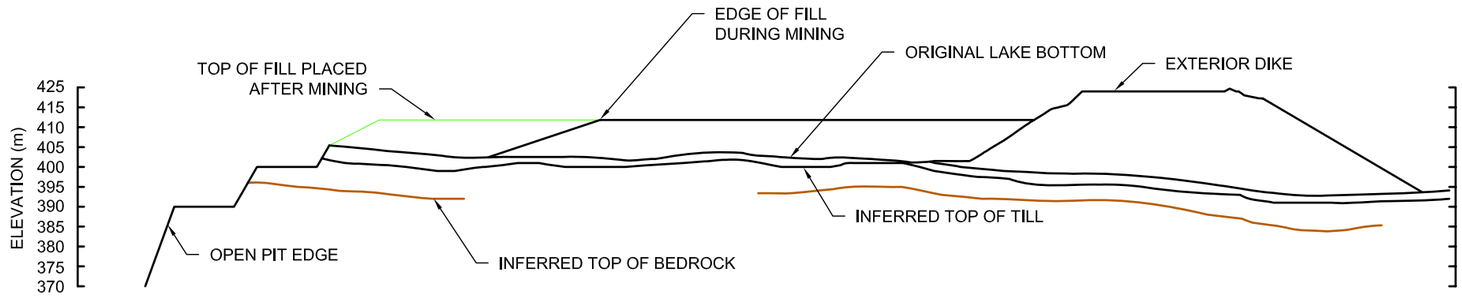
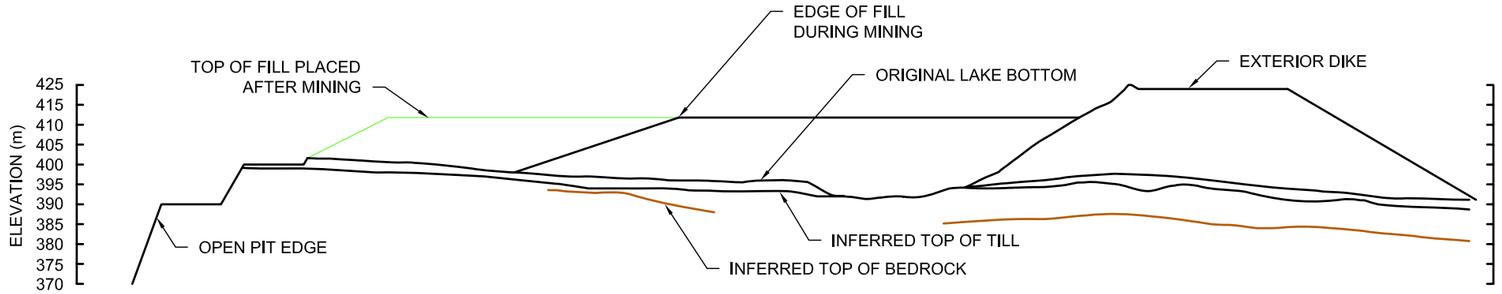


A
III-2

CROSS SECTION A-A'



B
III-2

CROSS SECTION B-B'

NOTE:

CROSS-SECTIONS MAY NOT BE PERPENDICULAR TO DIKE CENTRELINE.

30 0 30
SCALE METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A418 - CROSS SECTIONS OF FISH HABITAT FILL ON EXTERIOR DIKES

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	RML	04/18/07	
CHECK	AL	18/12/08	
REVIEW	PGB	18/12/08	

FIGURE: III-6

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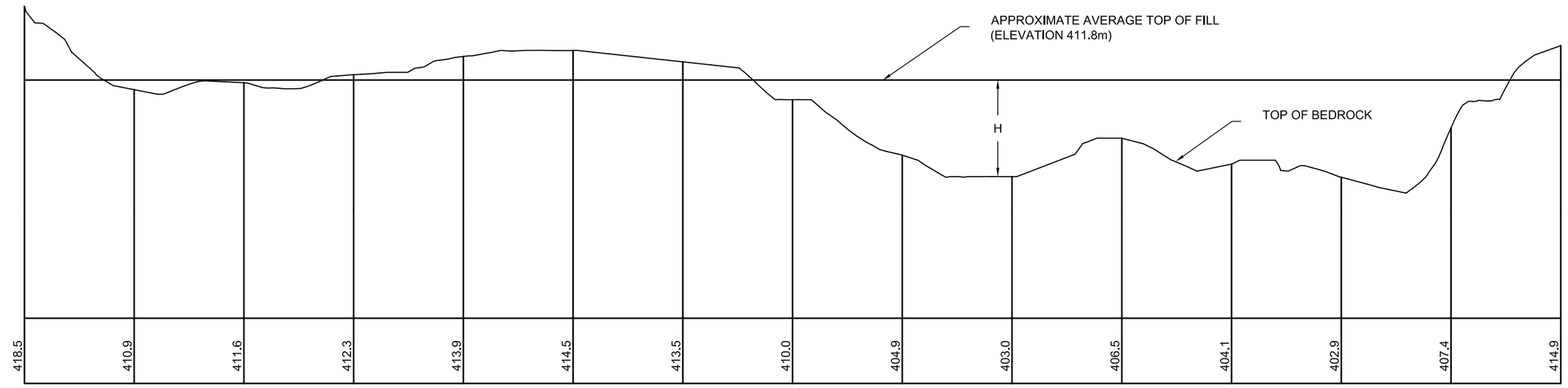


PIT CREST PROFILE

40 0 40
SCALE METRES

5x VERTICAL EXAGGERATION

NOTES:

1. SEE FIGURE : III-2 FOR STATIONING

2. SETBACK FROM PIT CREST TO TOE OF FISH HABITAT FILL (DURING MINING) EQUAL TO 4H WITH A MINIMUM OF 15m.

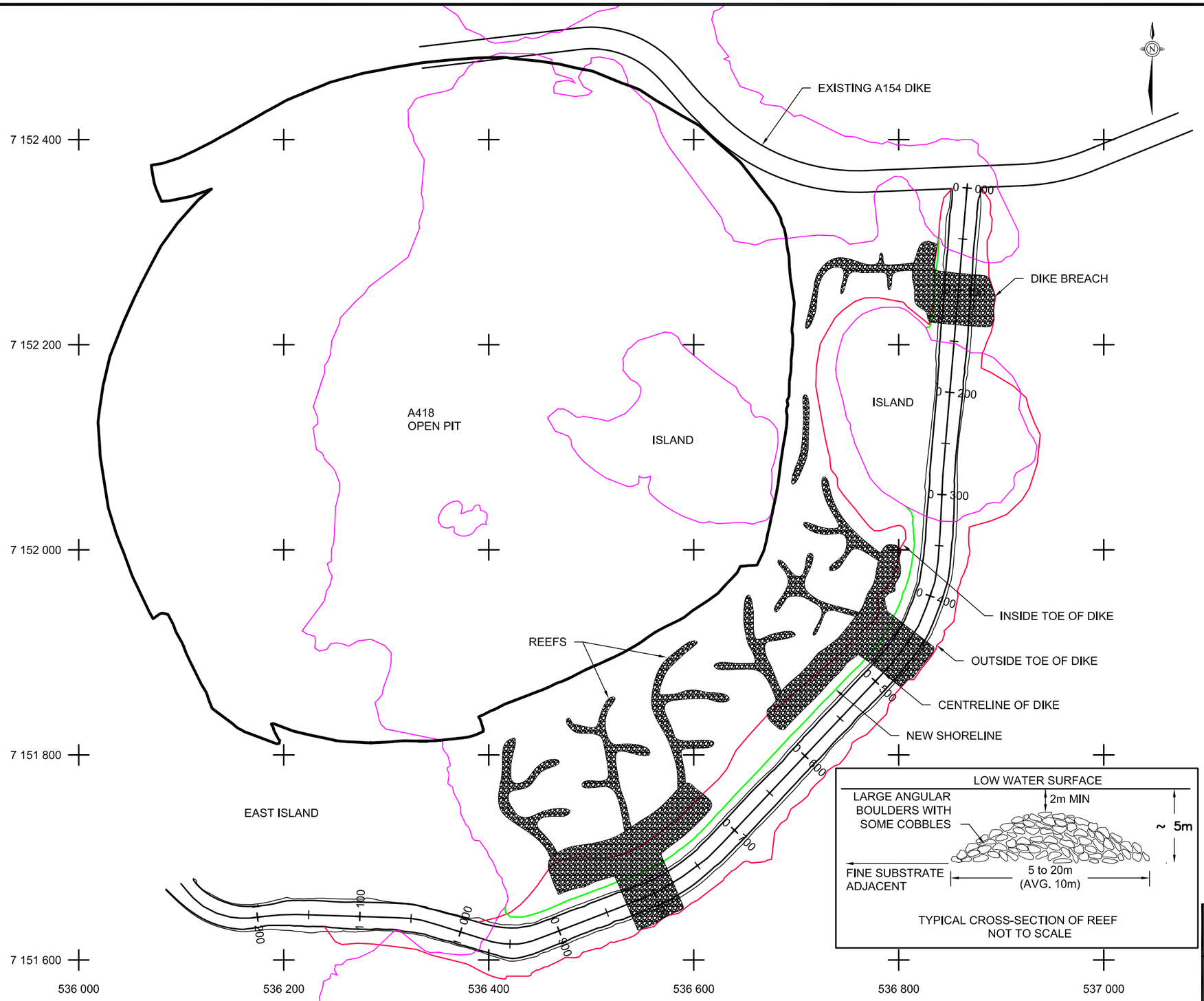
PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A418 - PIT CREST PROFILE

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	RML	04/18/07	**FIGURE: III-7**	
CHECK	AL	18/12/08		
REVIEW	PGB	18/12/08		

G:\2007\1328\07-1328-0001 Diavik\Phase 2000\cad\A418-Site Plan.dwg Dec 19, 2008 - 8:26am



TYPICAL CROSS-SECTION OF REEF
NOT TO SCALE

REFERENCE

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

100 0 100
SCALE METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A418 PIT - SCHEMATIC REEF CONFIGURATION

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	RML	04/18/07		
CHECK	AL	18/12/08		
REVIEW	PGB	18/12/08		

FIGURE: III-8

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