

# Technical Session Presentation August 14-17, 2012

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TSX & NYSE AMEX: AVL



# Safe Harbour Statement

### Forward looking information

Certain statements contained in or incorporated by reference into this presentation constitute forward-looking statements. Such statements reflect the current views of Avalon Rare Metals Inc. with respect to future events and are subject to certain risks, uncertainties and assumptions. Many factors could cause the actual results, performance or achievements of Avalon Rare Metals Inc. that may be expressed or implied by such forward-looking statements to vary from those described herein should one or more of these risks or uncertainties materialize. Avalon Rare Metals Inc. does not intend, and does not assume any obligation, to update these forward-looking statements.





# **Presentation Content**

- Corporate Overview & Rare Earths Markets
- Nechalacho Competitiveness, Benefits & Schedule
- Current Initiatives
- Project Review
- SSWQO's
- Fish & Fish Habitat
- Environmental Components
- Archaeology
- Closure & Reclamation

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# Capital Structure August 10, 2012

Canada - TSX: AVL	
United States - NYSE MKT: AVI	- Frankfurt- OU5
Shares Outstanding	103,611,986
Fully Diluted	111,362,236
Market Capitalization	US\$160 million (S/O @ \$1.55)
Recent Price Range	US\$1.75 - \$1.40
52 Week High / Low	US\$4.90 - \$1.36
Cash Reserves	C\$38 million (No debt)
Insider Share Position	2.8 million shares (2.7%)
Institutional Investors	Hancock, Global X, Sentry, Van Eck, Diamondback
(est. 30-40%)	AGF, Encompass, Chilton, Highbridge, Wellington
Office Locations	Toronto and Vancouver. 30 employees in total

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# **Board of Directors**

- Alan Ferry, CFA
  Non-Executive Chairman
- Donald S. Bubar, P.Geo. President & CEO
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- Hari Panday, C.A.
- David Connelly, CStJ, CD, MBA, B.Comm

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### **Management Team**

- Donald S. Bubar, P.Geo. President, CEO & Director
- Brian Chandler, P.Eng. Senior V.P. & COO
- Jim Andersen, CA, CPA V.P. Finance & CFO
- David Marsh, FAusIMM (CP) Senior V.P. Metallurgy
- Bill Mercer, Ph.D., P.Geo. V.P. Exploration
- Richard Pratt, B.Comm (Hons), LL.B. V.P. General Counsel and Corporate Secretary

- Pierre Neatby, BA Econ V.P. Sales and Marketing
- David Swisher, B.S. Min.Eng. V.P. Operations
- Mark Wiseman, B.Sc., MBA V.P. Sustainability
- Cindy Hu, CA, CPA, CGA *Controller*
- Kelly Cumming , B.A. Northern Relations Manager
- Ron Malashewski, P.Eng (AB) Manager, Investor Relations



### **Rare Metals: Vital to Many Clean Technologies and Electronics**



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### **Rare Metals Projects:** *Avalon is not just about rare earths*

**Properties Map** Avalon offers LILYPAD LAKE MIRAMIC Operations diversified SEPARATI ON RAPID EAST KEMPTVILLE exposure to a Corporate broad range of rare metals SPOR MOUNTAIN All projects 100% owned

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# What are Rare Earth Elements?



Light REE: La = Lanthanum Ce = Cerium Pr = Praseodymium Nd = Neodymium Sm = Samarium

Heavy REE: Eu = Europium Gd = Gadolinium Tb = Terbium Dy = Dysprosium Ho = Holmium Er = Erbium Tm = Thulium Yb = Ytterbium Lu = Lutetium Y = Yttrium

Neodymium, Dysprosium, Terbium and Europium in highest demand

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### **REE Balance is Key:** *The more heavies, the better!*

All deposits contain mostly cerium and lanthanum, which will soon be oversupplied once Molycorp and Lynas reach full production over the next 2 years





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# **The China Factor**

- China produces >95% of the world's rare earths
- China will soon consume 60-70% of the world's rare earths
- In the next 5-10 years, China may import <u>heavy</u> rare earths (HREE)
- China has been working to control its REE supply and improve environmental practice



- 2012 export quota allocations tied to environmental compliance
- Illegal mining and exports (mainly HREE) are being curbed

Experts believe that 2-3 HREE projects outside China will come into the market in the next 5-6 years and will grow with the market







# **Recent REE Market Events**

• Prices have fallen significantly from their 2011 highs with lights more affected than heavies by approx. 20%.

• <u>China</u>:

- 1. Closed 44 mines in the South
- 2. Initiated its new trading platform August 8 to try to further control prices
- 3. Is budgeting close to US\$ 1bn to stockpile mostly HREE
- Molycorp acquired Neo Materials for \$1.3bn
- Lynas wins court case and receives public apology from NGO seeking to block REE plant development in Malaysia.

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# **Rare Earth Element Prices**

Source: Metal-Pages.com, August 9, 2012 (US\$/kg) Prices are indicative and basis FOB China

Metal Oxide	Current Prices	Jul 2011 Prices	Oct 2009 Prices	CIBC 2015 Forecast
Light Rare Earths				
Lanthanum 99% min	18.00 - 20.00	147.00 - 149.00	4.40 - 4.90	17.49
Cerium 99% min	19.00 - 21.00	148.00 - 150.00	3.50 - 4.00	12.45
Praseodymium 99% min	100.00 - 110.00	237.00-240.00	14.20 - 14.70	75.20
Neodymium 99% min	100.00 - 105.00	315.00 - 320.00	14.70 - 15.20	76.78
Samarium 99% min	65.00 - 70.00	127.00 - 130.00	4.25 - 4.75	13.50
Heavy Rare Earths				
Europium 99% min	2,000.00 - 2,020.00	3,380.00 - 3,400.00	470.00 - 490.00	1,392.57
Terbium 99% min	1,800.00 - 2,000.00	2,900.00 - 2,920.00	340.00 - 360.00	1,055.70
Dysprosium 99% min	920.00 - 950.00	1,500.00 - 1,520.00	105.00 - 110.00	688.08
Gadolinium 99%min	90.00 - 95.00	200.00 - 205.00	5.00 - 5.50	54.99
Yttrium 99.999% min	83.00 - 88.00	167.00 - 172.00	10.00 - 10.50	67.25

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### Forecast for Global Demand and Supply in 2016 (+/- 20%) (tonnes REO)

### Demand



Data source: IMCOA, (Dudley Kingsnorth), April 2012

Supply Excess / Shortage

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# **Rare Earth Elements Supply Chain**

### Mining

From the ground to crushed ore

Milling Grinding and beneficiation of REE minerals

#### Hydrometallurgy

Cracking the REE minerals to produce mixed REE oxides concentrate

### Separation

Separating and purifying the individual REE oxides

### Refining

To meet specific downstream technology applications

#### **Products**

Permanent magnets, LED's, consumer electronics



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### NECHALACHO, THOR LAKE Competitiveness, Benefits & Schedule







# Canada & NWT Benefits (Assuming 18 year mine life)

- Life of Project Expenditures NWT:
  - Wages and Benefits
  - Goods and Services
  - Direct Employment
  - Territorial Government Revenues

- \$380 million\$1.2 billion3,590 person years\$774 million
- Life of Project Expenditures Canada as a whole:
  - Wages & Benefits
  - Goods & Services
  - Direct Employment
  - Government Tax Revenues

\$770 million\$3.4 billion7,000 person years\$1.5 billion

\* All values based on June 2010 prefeasibility study and supplied by independent economic analysis by GS Gislasson and Associates Inc.





# **Competitive Advantages with Other Emerging REE Producers**

- World Class Rare Earths Deposit
  - Very Large with exceptional enrichment in the "Heavies" (+25%)
- Relatively Advanced: at Feasibility Study Stage
  - Allows company to enter into off take discussions
- First Mover Advantage is Key
  - First to market will capture available market share
  - Only room for a handful of new producers "first come, first served"
- Metallurgical Flowsheet Determined
  - Very low Uranium and Thorium
  - Pilot plant test work and optimization underway





# **Future Project Milestones**

- Finalizing Remaining Aboriginal Participation Agreements
- Complete definitive agreements with strategic investor for financing and off-take(priority to maintain schedule)
- Arrange off-take agreements and project financing
- Complete EA process in Q1 2013
- Complete Definitive Feasibility Study by Q2 2013
- Receive Land Use Permits by April 2013 (Necessary for Financing)
- Begin early works construction June 2013

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# **Nechalacho Project Schedule**



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### NECHALACHO, THOR LAKE Current Initiatives





# Thor Lake Area and Regional Infrastructure





# The Nechalacho Project Components

- Nechalacho Mine & Mill
  - 2,000 tpd Underground Mine
  - Mill and Concentrator (Flotation process)
  - Seasonal (Summer) Barging
  - 225 employees
- Pine Point Hydrometallurgical (Acid Bake) Plant
  - Seasonal (Summer) Barging
  - Hydrometallurgical (Acid Bake) Facility
  - Product Packaging and Shipping
  - Transport to Hay River Railhead
  - 65 employees
- Separation Plant and Refinery Southern US
  - 10,000 tpa separated and refined rare earth products
  - 200 employees



# **Project Development Activities**

- Completed updated prefeasibility study July 2011
- Definitive Feasibility Study (completion Q2 2013)
  - Engaged SNC-Lavalin to complete all phases including:
    - Nechalacho Mine & Flotation Plant
    - Pine Point Hydrometallurgical Plant
    - Southern US Separation Plant & Refinery
- EPCM bids for Nechalacho Mine & Flotation Plant
  - Procurement Execution starting in Feb 2013
- Building Owners Team:
  - 17 additions for 2013 and 12 additions for 2014
- Community Engagement and Product Marketing

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# Environmental Work and Permitting Progress

- April 2010 filed LUP & Water License applications with MVLWB
- June 2010 referred to Environmental Assessment by MVEIRB
  - Completed Scoping Sessions October 2010
  - Final Terms of Reference February 2011
  - Developers Assessment Report May 2011
  - Information Requests started November 2011
  - Remaining: Technical Sessions, Public Hearings, Decision
- New five year Land Use Permit issued in July, 2011
- Four years of Environmental Baseline data completed by EBA engineering and Stantec / Deton Cho
- Approved Land Use permit to extend airstrip during summer 2013

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# **Community Engagement &** CSR: First Nations

- Accommodation Agreement with Deninu K'ue First Nation in place
- Accom. Agts. with Yellowknives Dene and Lutsel K'e Dene in prep.
- Aboriginal Training
  - First Aid, Driller Helper
- Employment at site
  - 2010 40% Aboriginal
  - 2011 60% Aboriginal
- Business Contracts
  - Major contractors with Aboriginal ownership
  - Ice road haulage, airstrip Wind power evaluation
  - Helped start a new core box business with Deninu K'ue





### MATERIALS FOR CLEAN TECHNOLOGY

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# **Corporate Social Responsibility**

- 2010 PDAC Environmental & Social Responsibility Award
- Committed to the principles of PDAC *e3 Plus* program for responsible exploration
- A member of the Mining Association of Canada and committed to follow the principles of "Towards Sustainable Mining"
- Received positive report on sustainability performance from Jantzi-Sustainalytics
- Completed comprehensive Sustainability Report in 2012



# Journey to a Sustainable Future

- Sustainability or Sustainable Development?
  - Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Report, 1987)
- Published Corporate Social Responsibility Roadmap in January 2011
- Published first full Sustainability Report in April 2012 to GRI Version 3.1 and MAC TSM indicators



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# **Current Infrastructure -Airstrip**

### Airstrip

- Construction by Deton Cho Logistics
- Clearing supported by Akaitcho Dene members
- 30 x 300 metres
- Approval for airstrip extension

### Reclamation

- Reclaimed old waste rock piles for airstrip fill
- Repurposed old trailers for overflow camp facility



# **Current Facilities - Drilling Camp**



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### NECHALACHO, THOR LAKE Project Review





# Basal Zone Mineral Resources at Base Case \$260/tonne NMR Cut-Off

Category	Tonnes (millions)	TREO (%)	HREO (%)	HREO/TREO (%)	ZrO <sub>2</sub> (%)	Nb <sub>2</sub> O <sub>5</sub> (%)	Ta <sub>2</sub> O <sub>5</sub> (%)
Measured	8.90	1.64	0.36	21.7	3.11	0.40	0.038
Indicated	63.76	1.52	0.32	21.4	3.07	0.40	0.039
Measured and Indicated	72.66	1.53	0.33	21.5	3.07	0.40	0.039
Inferred	77.17	1.29	0.25	19.4	2.84	0.37	0.034

Notes:

- 1. CIM definitions were followed for Mineral Resources.
- 2. The Qualified Person for this Mineral Resource estimate is Tudorel Ciuculescu, M.Sc., P.Geo., RPA Senior Geologist.
- 3. HREO (Heavy Rare Earth Oxides) is the total concentration of: Y<sub>2</sub>O<sub>3</sub>, Eu<sub>2</sub>O<sub>3</sub>, Gd<sub>2</sub>O<sub>3</sub>, Tb<sub>2</sub>O<sub>3</sub>, Dy<sub>2</sub>O<sub>3</sub>, Ho<sub>2</sub>O<sub>3</sub>, Er<sub>2</sub>O<sub>3</sub>, Tm<sub>2</sub>O<sub>3</sub>, Yb<sub>2</sub>O<sub>3</sub> and Lu<sub>2</sub>O<sub>3</sub>.
- 4. TREO (Total Rare Earth Oxides) is HREO plus: La<sub>2</sub>O<sub>3</sub>, Ce<sub>2</sub>O<sub>3</sub>, Pr<sub>2</sub>O<sub>3</sub>, Nd<sub>2</sub>O<sub>3</sub> and Sm<sub>2</sub>O<sub>3</sub>.
- 5. Rare earths were valued at an average net price of US\$41/kg, ZrO<sub>2</sub> at US\$3.77/kg, Nb<sub>2</sub>O<sub>5</sub> at US\$56/kg, and Ta<sub>2</sub>O<sub>5</sub> at US\$256/kg. Average REO price is net of metallurgical recovery and payable assumptions for a mixed rare earth concentrate, and will vary according to the proportions of individual rare earth elements present. This average price is based on the price set used in the Updated Pre-Feasibility Study, applied to the Measured & Indicated Basal Zone resources.
- 6. An exchange rate of US\$1.00 = C\$1.05 was used.
- 7. A cut-off NMR value of C\$260 per tonne was used. NMR is defined as "Net Metal Return" or the in situ value of all payable metals, net of estimated metallurgical recoveries and off-site processing costs.
- 8.  $ZrO_2$  refers to Zirconium Oxide, Nb<sub>2</sub>O<sub>5</sub> refers to Niobium Oxide, Ta<sub>2</sub>O<sub>5</sub> refers to Tantalum Oxide.

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### **Proposed Access Ramp**



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# Nechalacho REE Deposit Conceptual Mine Plan



- Underground Mining with 58% room & pillar and 42% long-hole stoping
- Mining rate @ 2,000 tpd
- Development drifts 5x5 m with mined stopes at 5x15 m

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# **Nechalacho Flotation Plant**



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# **Proposed and Existing Roads**



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![](_page_37_Picture_0.jpeg)

# **Tailings Management Facility**

- Ring & Buck Lake
  - Natural Topo less fill
  - Accommodate mine life
  - Non-fish bearing
  - Drainage design ideal
  - Discharge to Drizzle Lake
    non-sustainable fish
  - Natural drainage to Murky then Thor Lake
  - Tailings inert
  - Closed loop design
  - Room for Expansion
  - Reduced 149 ha 121 ha
  - Embankment reduced 4m
- Fresh water supply TL
- Alternatives

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- Required more fill
- Limited life
- Could not close loop

![](_page_37_Figure_19.jpeg)

![](_page_38_Picture_0.jpeg)

# **Nechalacho Mill & Concentrator**

- New Orientation reduces footprint & minimizes construction
- Mining @ 2,000 tpd
  - 1,600 tpd waste
    - 600 tpd tailings
    - 1000 tpd paste fill
  - 400 tpd concentrate
- Concentrates loaded into 35-40 t sealed containers
- Stored at intermediate site for summer barging

![](_page_38_Figure_10.jpeg)

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![](_page_38_Picture_11.jpeg)

![](_page_39_Picture_0.jpeg)

### Nechalacho Seasonal Barge Dock

- Utilize existing road
- Marshaling yard reduced to 2 ha
- 1 Barge holds 38 containers for 1,710 tonnes
  - 78 barge trips required
  - 2-3 barges/tug
  - 2 tugs operating
  - 2 day cycle time

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 ~60 days to complete all shipments

![](_page_39_Figure_10.jpeg)

![](_page_40_Picture_0.jpeg)

# **Nechalacho Dock Facility**

![](_page_40_Picture_2.jpeg)

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![](_page_41_Picture_0.jpeg)

### Nechalacho and Hydromet Project Location

![](_page_41_Figure_2.jpeg)

![](_page_41_Picture_3.jpeg)

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![](_page_42_Picture_0.jpeg)

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## **Pine Point Seasonal Barge Dock**

- Utilize existing road
- ~2 ha Marshaling yard
- 3 docking barges
- Offloading and storage
- 12 km haulage to Hydrometallurgical Plant

![](_page_42_Picture_7.jpeg)

43

![](_page_43_Picture_0.jpeg)

### Proposed Pine Point Barge Dock and Hydrometallurgical Plant

![](_page_43_Picture_2.jpeg)

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![](_page_44_Picture_0.jpeg)

# **Proposed Hydrometallurgical Plant Facility – Pine Point**

![](_page_44_Picture_2.jpeg)

![](_page_44_Picture_3.jpeg)

![](_page_45_Picture_0.jpeg)

# Proposed Hydrometallurgical Plant Facility – Pine Point

- Located on GNWT (MACA) lands
- Reduced power line infrastructure ~3.5 km
- Reduction in ~4 km of tailings piping
- Close proximity to L-37 tailings pit
- Close proximity to fresh water makeup at J-44
- Decant water discharge to N-42

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![](_page_45_Figure_8.jpeg)

![](_page_46_Picture_0.jpeg)

# HydroMet Rare Metal Product Transport

- 85 km transport to Hay River Railhead
- Two products (LREO & Acid Bake Residue) will be shipped by bulk truck and containers
- Daily shipping @ 417 tpd
- CN transload facility to transfer products to Southern US location

![](_page_46_Picture_6.jpeg)

![](_page_47_Picture_0.jpeg)

### Day 1 & 2 (Aug 14 & 15) NECHALACHO, THOR LAKE SSWQO's

![](_page_47_Picture_3.jpeg)

![](_page_48_Picture_0.jpeg)

### **Metal Concentrations**

	Day 5 Decant		Drizzle Lake		hor Lake		
Parameter	Metal Concentration (µg/L)	Background Mean (µg/L)	Modelled Maximum 20-yr Value (µg/L)	Background Mean (µg/L)	Modelled Maximum 20-yr Value (µg/L)	Proposed SSWQO [For Drizzle Lake] (µg/L)	CCME Guideline (µg/L)
Aluminum (Al)	620	8.30	148	3.3	60.1	100	100
Arsenic (As)	2.2	0.92	1.21	0.77	0.90	5	5.0
Cadmium (Cd)	0.067	0.01	0.02	0.02	0.02	Background	0.052
Chromium (Cr)	1.1	<0.5	0.44	<0.5	0.36	8.9	8.9
Copper (Cu)	2.3	0.25	0.72	0.36	0.54	3	2-4
Iron (Fe)	570	1091	972	69.5	116	Background (seasonal)	300
Lead (Pb)	0.60	0.028	0.16	0.05	0.10	4	1-7
Mercury (Hg)	<0.10	<0.01	<0.027	<0.01	<0.018	0.026	0.026
Molybdenum (Mo)	47.1	1.27	11.7	2.1	6.24	73	73
Nickel (Ni)	7.0	<0.5	1.79	<0.5	0.87	110	25-150
Selenium (Se)	<1.0	<1.0	<0.60	<0.1	<0.50	1	1
Silver (Ag)	0.03	<0.01	0.02	<0.01	0.01	0.1	0.1
Thallium (TI)	<0.2	<0.1	<0.08	<0.1	<0.06	0.8	0.8
Uranium (U)	10.0	0.08	2.1	0.36	1.1	15	15
Vanadium (V)	0.58	<1.0	0.5	<1.0	0.5	6	6*
Zinc (Zn)	7.0	0.90	2.30	1.43	1.90	Background	30

\* Ontario Water Quality guideline value; no CCME guideline published

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![](_page_49_Picture_0.jpeg)

# **REE Water Quality Objectives**

- Environment Canada sponsored a literature by Wilfred Laurier University to review eco-toxicity of the 15 lanthanide rare earth elements
- 577 peer reviewed published articles and 52 other articles were reviewed
- Chronic and acute toxicities from these papers were tabularized (effect levels)
- Water quality objectives were determined by using the Environment Canada methodology of taking the lowest effect level identified and dividing it by 10
- Water quality objectives do not consider mitigation factors such as alkalinity or dissolved organic carbon into consideration which makes them conservative. Potential exists to modify these in the future to take this into consideration

![](_page_49_Picture_7.jpeg)

![](_page_50_Picture_0.jpeg)

### **Rare Earth Element Concentrations**

		Drizzle Lake		Thor Lake		
Parameter	Day 5 Decant Metal Concentration (μg/L)	Background Mean (μg/L)	Modelled Maximum 20-yr Value (µg/L)	Background Mean (µg/L)	Modelled Maximum 20-yr Value (μg/L)	Proposed SSWQO* [Drizzle L.] (μg/L)
Cerium (Ce)	139	<0.05	31.8	<0.05	12.8	3.2
Dysprosium (Dy)	2.52	<0.05	0.61	<0.05	0.28	16.2
Erbium (Er)	0.581	<0.05	0.171	<0.05	0.099	19.1
Europium (Eu)	1.09	<0.05	0.29	<0.05	0.15	11.2
Gadolinium (Gd)	9.37	<0.05	2.18	<0.05	0.91	15
Hafnium (Hf)	0.267	<0.1	0.138	<0.1	0.115	4.4
Holmium (Ho)	0.312	<0.05	0.110	<0.05	0.074	0.7
Lanthanum (La)	68.8	<0.05	1.6	<0.05	6.4	1.8
Lutetium (Lu)	0.033	<0.05	0.46	<0.05	0.048	2.9
Niobium (Nb)	2.57	<0.1	0.66	<0.1	0.33	2.6
Neodymium (Nd)	61.6	<0.05	14.1	<0.05	5.72	14.3
Praseodymium (Pr)	17.3	<0.05	3.99	<0.05	1.64	3.5
Samarium (Sm)	11.0	<0.05	2.55	<0.05	1.06	7.4
Scandium (Sc)	3.39	0.9	1.47	0.5	1.13	2.9
Tantalum (Ta)	0.230	<0.1	0.130	<0.1	0.112	0.2
Terbium (Tb)	0.819	<0.05	0.226	<0.05	0.121	8.4
Thulium (Tm)	0.046	<0.05	0.049	<0.05	0.050	6.9
Ytterbium (Yb)	0.324	<0.05	0.113	<0.05	0.075	6.9
Zirconium (Zr)	3.29	<0.1	0.83	<0.1	0.39	11.2
* Based on 10% of Lowest Observed Adverse Effect Level						

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![](_page_51_Picture_0.jpeg)

### Effects of Hardness on Rare Earth Element Toxicity

Parameter (µg/L)	Organism	Hardness (mg CaCO <sub>3</sub> /L)	7-day LC 50 (µg/L)
Cerium	Hyallela azteca	18	32
		124	651
Erbium	H. azteca	18	191
		124	929
Europium	H. azteca	18	112
		124	717

![](_page_51_Picture_3.jpeg)

![](_page_52_Picture_0.jpeg)

### **Nutrients and Ions**

	Drizzle Lake		Thor Lake		Proposed	CCME
Parameter	Background Mean (mg/L)	Modelled Maximum 20-yr Value (mg/L)	Background Mean (mg/L)	Modelled Maximum 20-yr Value (mg/L)	SSWQO (mg/L)	Guideline (mg/L)
Ammonia-as N	0.71	<0.571	0.01	<0.018	Background	Range based on pH and temperature*
Chloride	3.6	12.8	4.3	8	120	120
Nitrate-as N	0.01	<0.02	0.05	<0.05	29	29
Nitrite-as N	<0.001	not modelled	<0.001	not modelled	0.06	0.06
Total phosphate	0.015	not modelled	0.008	not modelled	Background	0.01*
Sulphate	<0.5	23.2	<0.5	9.7	100	100

\* See Notes

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![](_page_52_Picture_4.jpeg)

![](_page_53_Picture_0.jpeg)

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### Notes

- Avalon commits to meet CCME guidelines at the discharge of Drizzle Lake.
- CCME guidelines are exceeded in naturally occurring background concentrations, including TSS, ammonia, phosphorous, zinc, cadmium, flourine and iron. Background will be the target for these elements.
- Values preceded by '<' indicate concentrations below detection limit</li>
- Background mean values for Thor Lake are the mean of mean values for four sampling locations
- Rare Earth Element data obtained from Det'on Cho Stantec (2012)
- Proposed SSWQO values for metals based on CCME Freshwater Aquatic Life guidelines unless otherwise noted; SSWQO values for Rare Earth Elements are based on 10% of the lowest observed effect level using published toxicity data
- SSWQO values for copper, lead and nickel are based on water hardness in the range of 120-180 mg/L
- There are no CCME Guidelines for the Rare Earth Elements
- CCME and SSWQO concentrations for phosphorous are based on measurements of total phosphorous, rather than total phosphate.
- The CCME range for ammonia is as follows:

Temperature (°C)	Total Ammonia-N (mg/L)				
	pH 7.5	pH 8.0	pH 8.5		
0	6.02	1.92	0.62		
5	3.98	1.27	0.41		
10	2.68	0.86	0.28		
15	1.82	0.59	0.2		
20	1.26	0.41	0.14		

![](_page_54_Picture_0.jpeg)

# Water Quality

![](_page_54_Picture_2.jpeg)

![](_page_54_Picture_3.jpeg)

AVALON

![](_page_55_Picture_0.jpeg)

# Water Quality

Project Component	Potential Impact	Mitigation
Site Preparation and Construction	Localized sedimentation	Silt barriers and runoff retention basins as necessary during construction activities
Underground Mining	Discharged mine water	Mine water used in process plant or directed to engineered tailings containment facility
Processed Waste Storage	Suspended solids or metal concentrations	Tailings retention/polishing at both project sites. Compliance with MVLWB and MMER criteria
Sewage	Nutrients and bacteria to groundwater	Treatment using packaged RBC plants at both project sites
Water Consumption	Process water sourced from Thor Lake for mine and groundwater for hydromet plant	Excess water directed to engineered tailings containment facilities at both project sites
Hazardous Materials	Impacts on water quality	Management Plan(s) covering the transportation, use, disposal, and emergency response
		MATERIALS FOR CLEAN TECHNOLOGY

![](_page_56_Picture_0.jpeg)

### NECHALACHO, THOR LAKE Fish and Fish Habitat

![](_page_56_Picture_2.jpeg)

![](_page_57_Picture_0.jpeg)

# **Fish and Aquatic Resources**

![](_page_57_Picture_2.jpeg)

![](_page_57_Picture_3.jpeg)

![](_page_58_Picture_0.jpeg)

# **Fish and Aquatic Resources**

![](_page_58_Picture_2.jpeg)

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![](_page_59_Picture_0.jpeg)

# **Fish and Aquatic Resources**

Project Component	Potential Impact	Mitigation
Site Preparation and Construction	Localized sedimentation	Silt barriers and runoff retention basins as necessary during construction activities
Underground Mining	Discharged mine water	Mine water used in process plant or directed to engineered tailings containment facility
Processed Waste Storage	Suspended solids or metal concentrations	Use of non fish bearing water bodies for tailings containment Tailings retention/polishing at both project sites. Compliance with MVLWB and MMER criteria
Sewage	Nutrients and bacteria to groundwater	Treatment using packaged RBC plants at both project sites.
Water Consumption	Process water sourced from Thor Lake for mine and groundwater for hydromet plant	Excess water directed to engineered tailings containment facilities at both project sites
Hazardous Materials	Impacts on water quality	Management Plan(s) covering the transportation, use, disposal, and emergency response
VALON		MATERIALS FOR CLEAN TECHNOL

![](_page_60_Picture_0.jpeg)

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