

# **Regional Environmental Impacts of Mining the Duluth Complex and the Tamarack Intrusive Complex**

**Bruce Johnson December 2023**

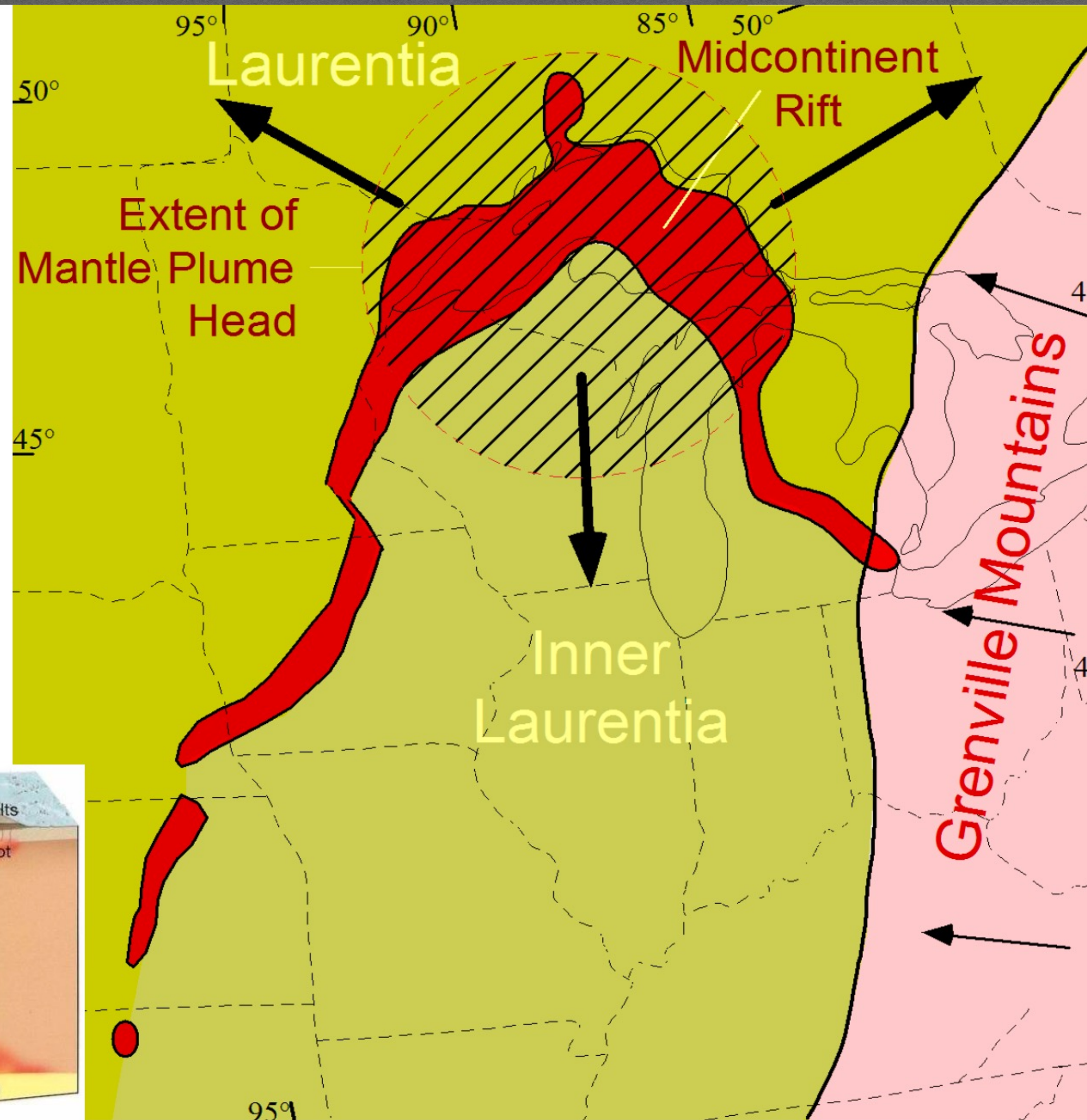
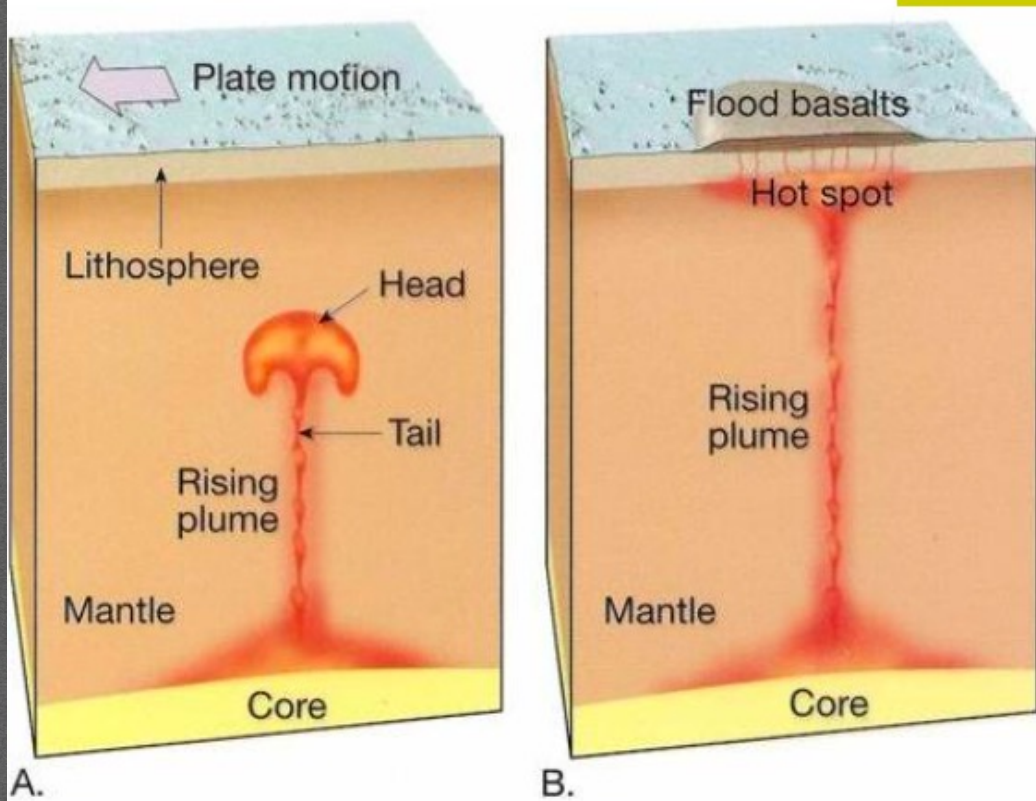
# **Geology & Mining Plans**



# Midcontinent Rift

## THE MIDCONTINENT RIFT

An attempt at continental separation 1.1 billion years ago





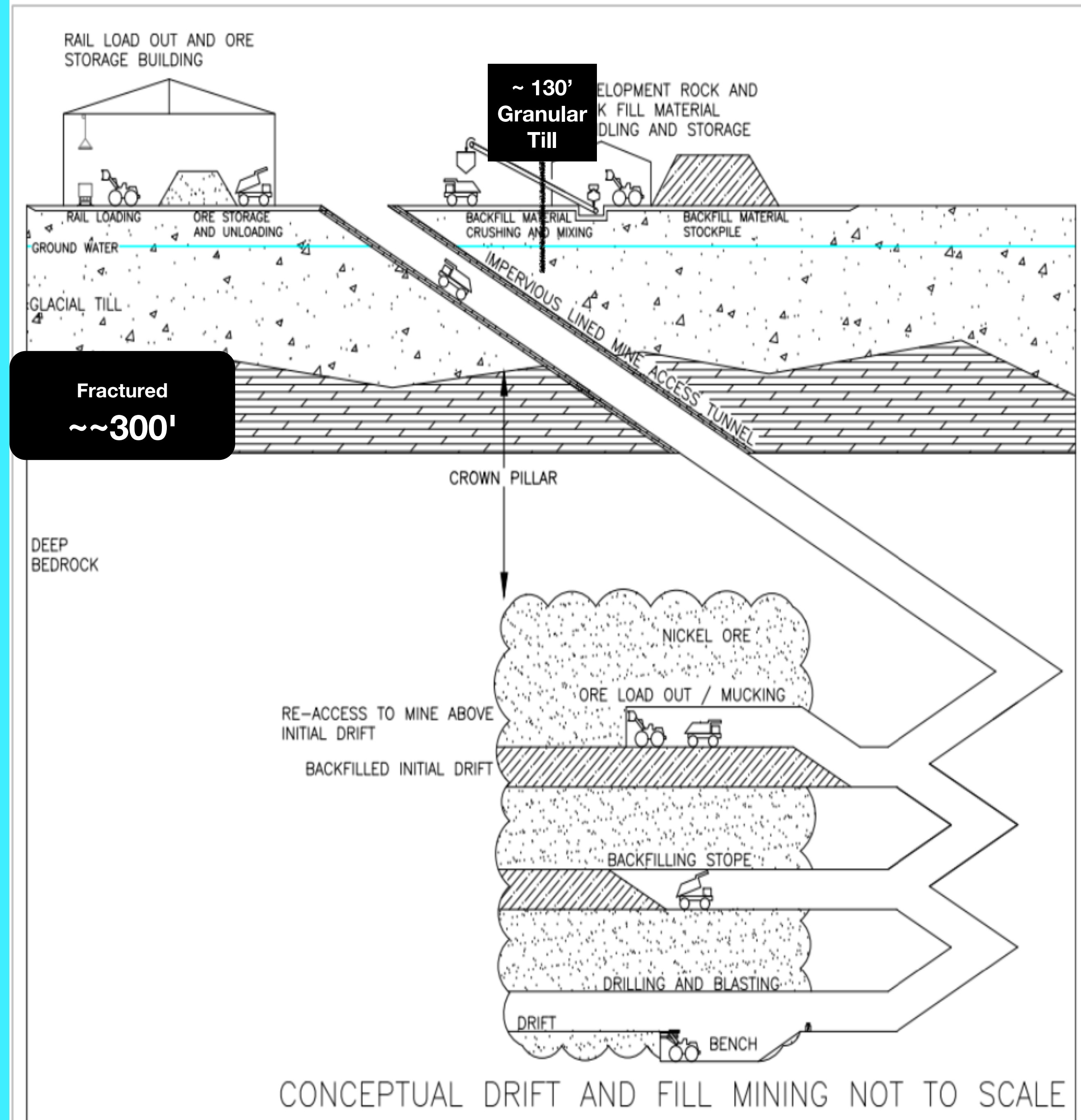
Rift contains **disseminated** mineralization = metal minerals scattered as specks and veinlets throughout the rock

- Low grade
- Inconsistent higher grade areas
- Very large waste volumes 95 -99%
- Overall large total volume of metals
- Waste also can contain environmentally problematic minerals *e.g.* arsenic, mercury, manganese, chromium, chlorides, asbestiform particles.

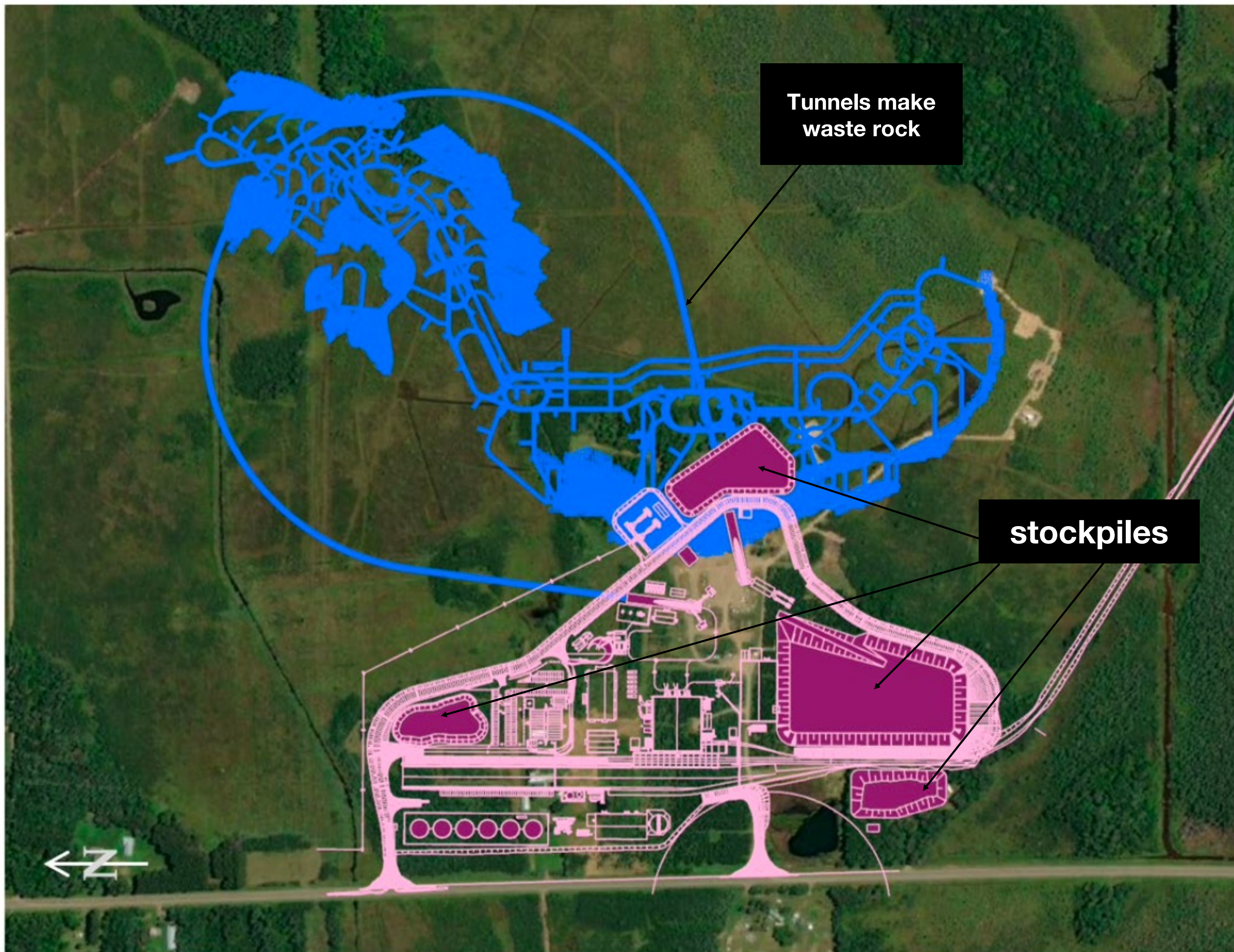
# Mining Plans

*Totally dependent on  
Known mineral  
locations*

- \* Mining is incremental  
not static
- \* Shallow minerals  
economics require open  
pits







(see Figure 2 for project boundary areas)

**Graphic 1: Co-located Surface Facilities and Underground Facilities**



# **Duluth Complex Vs Tamarack Intrusion Ecology and Chemistry**







# **Duluth Complex/Tamarack Intrusion Chemical Comparison**

*(Tamarack Mineralogy Non-Public)*

- Tamarack higher Nickel than Copper (averaging 4%)
- Tamarack higher Cobalt -
- Lead - Likely present
- Mercury - Likely present & added sulfate and dewatering will increase wetland release
- Zinc - Present
- Sulfates will be similar if not higher
- Chloride
- Sodium
- Nitrogen from underground blast likely higher than open pit
- Asbestos-like particles from dust from mine ventilation likely will be released
- Beneficiation Chemicals & Degradates - currently will be in North Dakota ??



## ***Multiples of Known Parameters Exceeding Standards in the Duluth Complex***

<b>Parameter</b>	<b>Waste rock **</b>	<b>Tailings ***</b>
	<b>Leachate</b>	<b>Leachate</b>
<b>Cobalt</b>	<b>7.4x</b>	<b>7x</b>
<b>Copper</b>	<b>2.9x</b>	<b>9x</b>
<b>Nickel</b>	<b>4.8x</b>	<b>2x</b>
<b>Zinc</b>	<b>1.7x</b>	<b>9x</b>
<b>Chloride</b>	<b>NR</b>	<b>1.8x</b>
<b>Sulfate</b>	<b>73 x or 3.2 x</b>	<b>175x or 7.5x</b>
<b>Specific Conductivity *</b>	<b>9.7x</b>	<b>14x</b>

\* Specific Conductance standard eliminated by MPCA recently.

Used Fond du Lac standard 300, and Copper Nickel data

\*\* Data from MPCA 2009

\*\*\* Data from MNDNR 2004



**Total Impaired waters listing MPCA 2024 draft: 6,345 impairments of lakes and stream segments for various pollutants.**

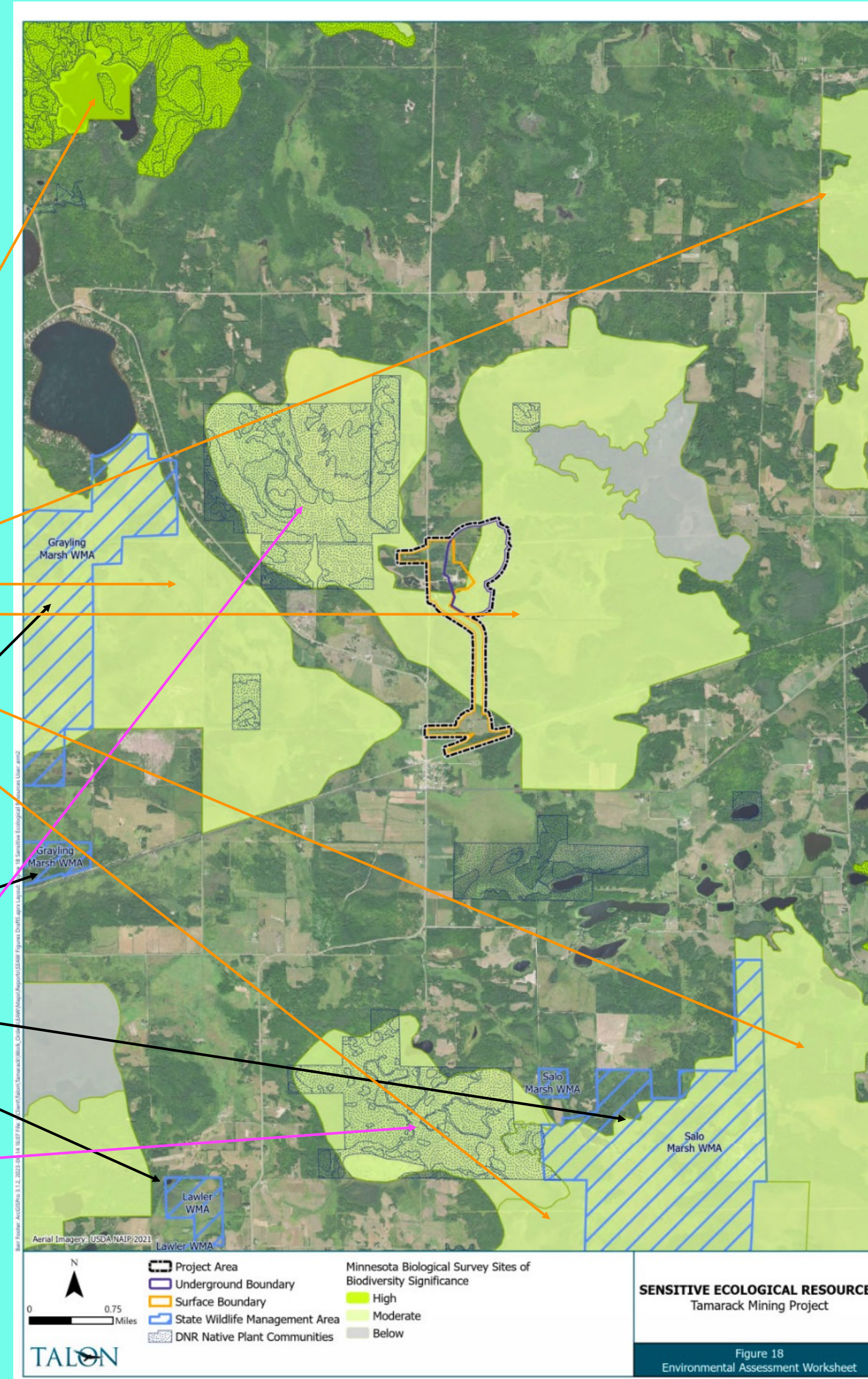
**Sensitive Ecology – this is just a few of the local impairments**

- Big Sandy Lake (nutrients, Mercury (fish))
- Sandy River (aquatic life, aquatic insects)
- Kettle River (numerous runs for mercury) (upper Kettle, fish)

**DNR Biodiversity significant**

**Named Wetland Complexes**

**native plant communities**





# ***Technical Issues***



# Backfilling with Crushed Waste Rock & Cement



- Underwater (low oxygen)
- Cement (lime) gets coated (deactivates buffering)
- Ineffective with chlorides & sulfates
- Subsidence?



## Water Quality Treatment - Reverse Osmosis?

- Talon has not described treatment of mine contact water before discharge. Reverse osmosis described below.
- Fine filter, high pressure/high energy requirement
- Before RO pretreatment is necessary
- Back flush water is a disposal problem
  - Up to 50% concentrated brines (metals, salts)



## Duluth Complex Regional Copper- Nickel Study 1976 -1978

EQB determined that conventional site-specific environmental impact statements and the corresponding regulatory process are **inadequate** to deal with the broader issues involving large areas of unexploited resources in mining districts.

Developed baseline conditions area that included:

- Surface water chemistry, ground water conditions
- Air quality
- Noise
- Ecology



# Tamarack Intrusive Complex

Again, today conventional site-specific environmental impact statements and the corresponding regulatory process remain **inadequate** to deal with the broader issues involving the Tamarack Intrusive Complex unexploited resource.



**“...Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web he does to himself...”**

*Chief Seathl, 1857, Suquamish and Duwamish Tribes*



Only known photograph of Seattle, 1864