

# **10<sup>th</sup> Annual BC ML/ARD Conference**

**Elliot Lake – Status Report on Water Cover  
Performance**

**Simon Fraser University, Vancouver, Dec 2-3,  
2003**

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**bhpbilliton**

# Former Mine Site Locations

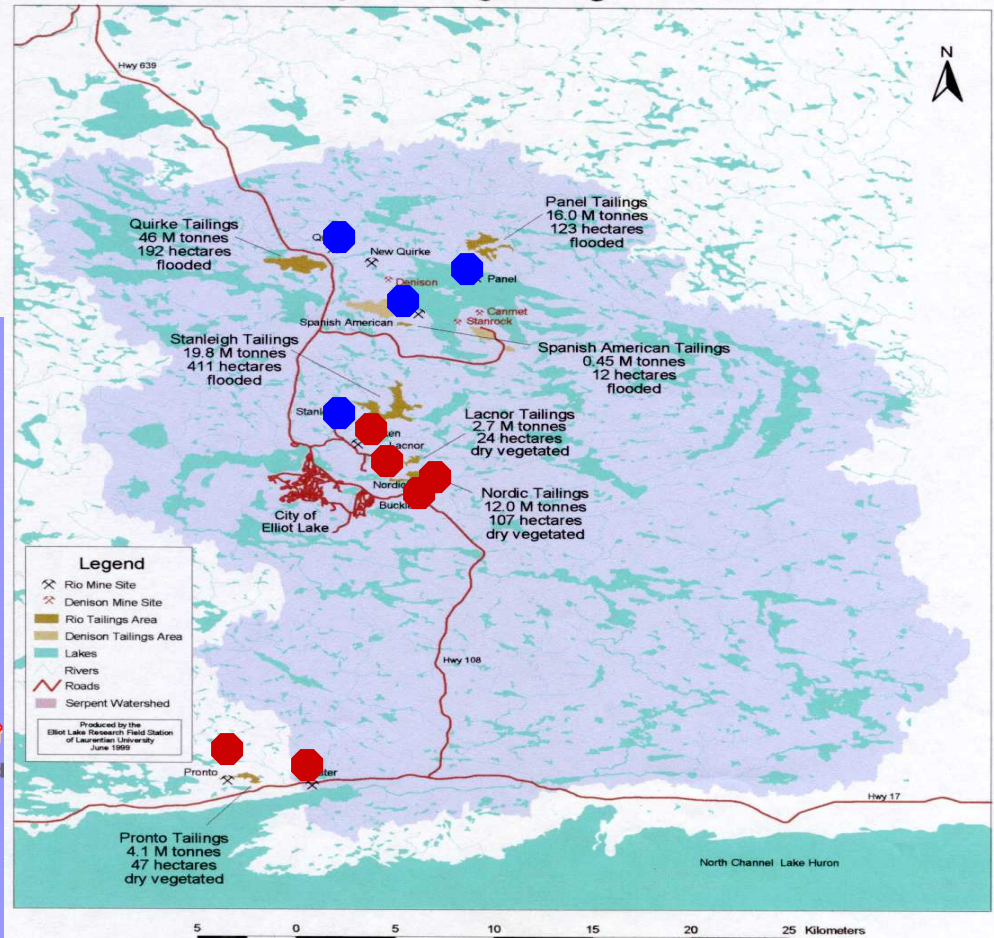
**Watershed Area – 571 sq. miles**



**Elliot Lake**

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**Elliot Lake and the Serpent River Watershed  
Former Uranium Mine Site Locations  
and  
Rio Algom Tailings Management Areas**

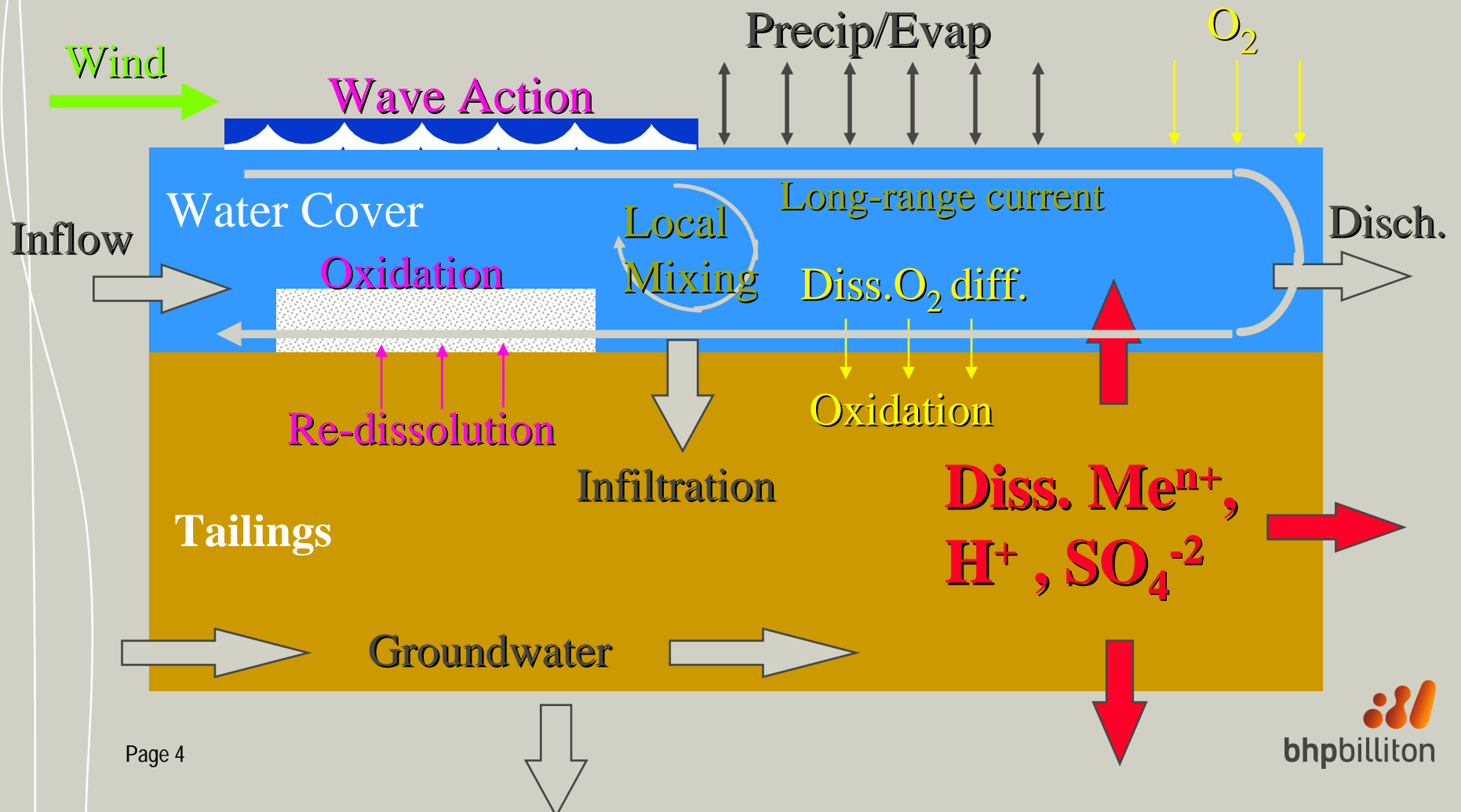


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# Conclusions of Elliot Lake Water Covers

- Water covers are not a universal solution
  - Physical characteristics of the site will determine suitability
- Existing oxidation products will enter the water cover and will require treatment
- Long term care and maintenance of man-made impoundment structures are needed to minimize risk
- Provides effective control of acid generation
- Internal seepage at the Quirke TMA contributing to radium dissolution into the water cover.

# Factors and Processes Affecting Water Cover Quality



# Elliot Lake Wet Covers



- Stanleigh - designed for closure with water cover
- Spanish American - used a former lake to provide a water cover
- Panel - raising dams to flood tailings
- Quirke – to resolve topography multiple cells created a water cover

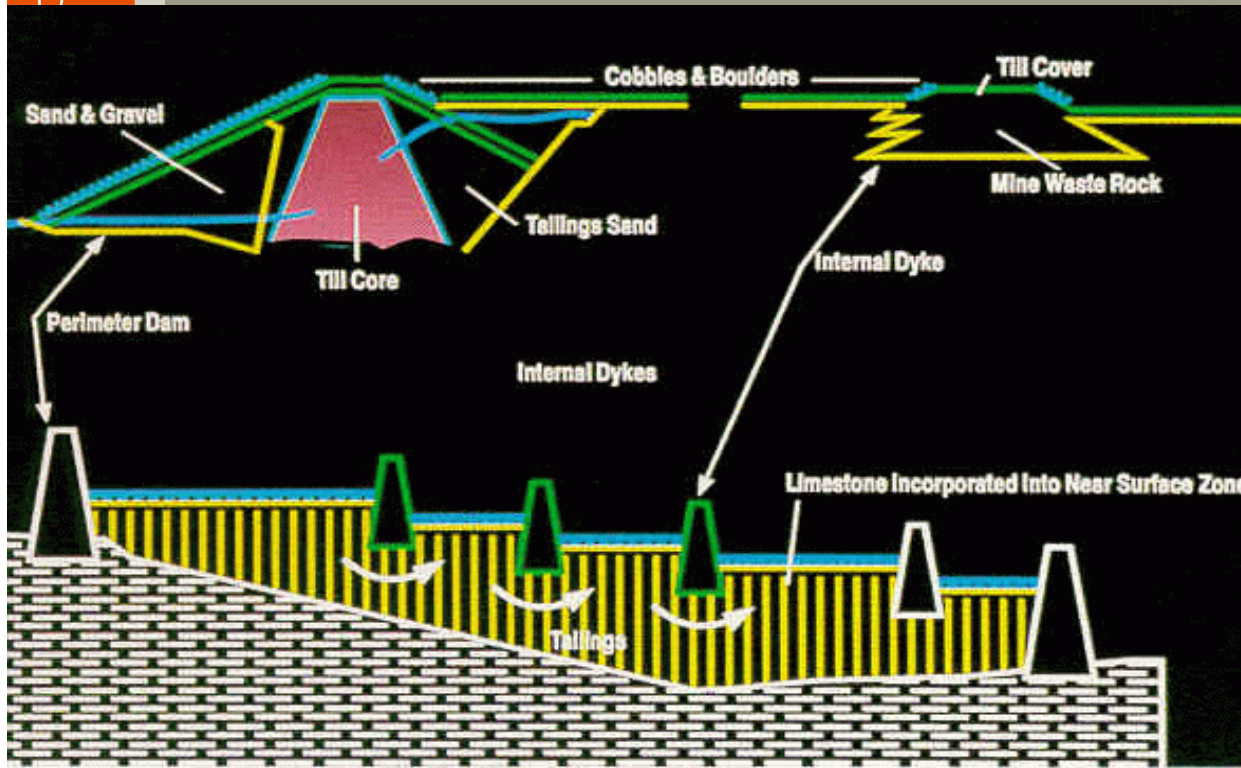


# QUIRKE – History and Characteristics

- Flooding completed in 1995
- Dykes have spillways designed to pass peak flows
- Eight low permeable dam structures along perimeter of facility are designed to contain tailings and reduce seepage
- Gravel Pit Lake supplies water to basin to maintain water cover



# QUIRKE – History and Characteristics

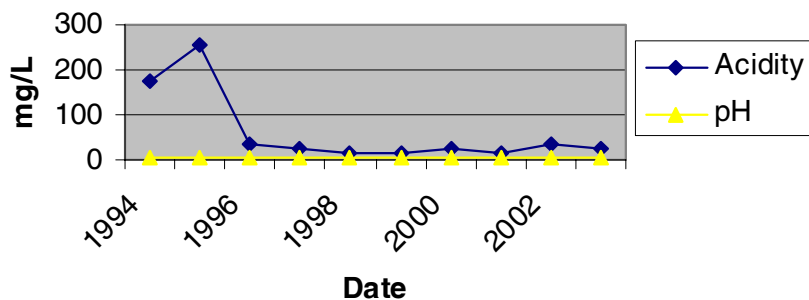


- Operated 1956 – 1961, 1968 to 1990
- tailings basin capacity is 192 ha
- 42 m tonnes acid generating tailings containing < 5% S
- 5 tiered cells with 3 meter elevation between cells separated by waste rock dykes
- Leakage between cells approximately 3 times design; contributor to the observed radium levels in water cover
- 2003 program to seal seepage pathways and install radium diffusion barrier

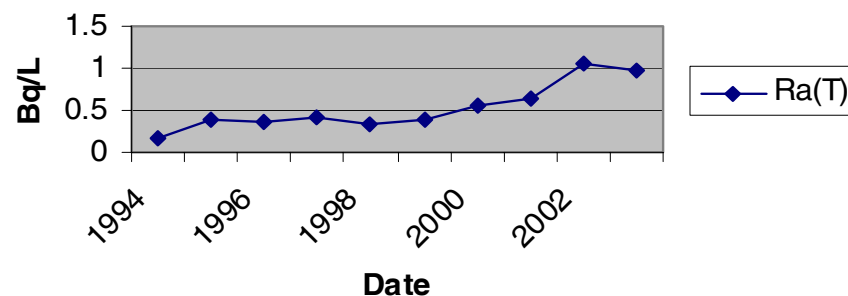
• Gravel Pit Lake supplies water to cell 14, thus flowing cell to cell, discharging from cell 18; observed radium concentrations approaches background (20 ppm) in Cell 14

# Quirke TMA In-Basin Water Quality

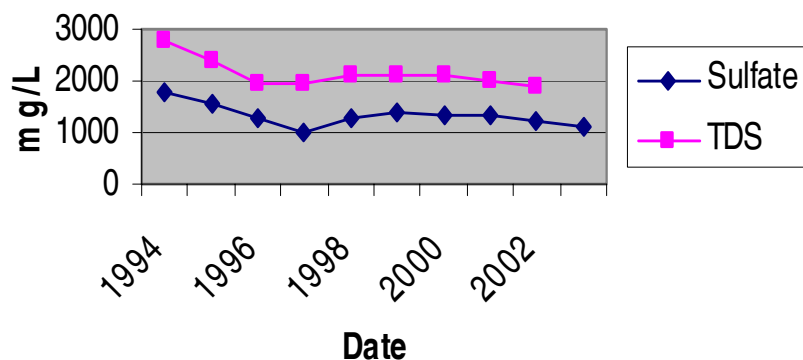
Quirke Q-05



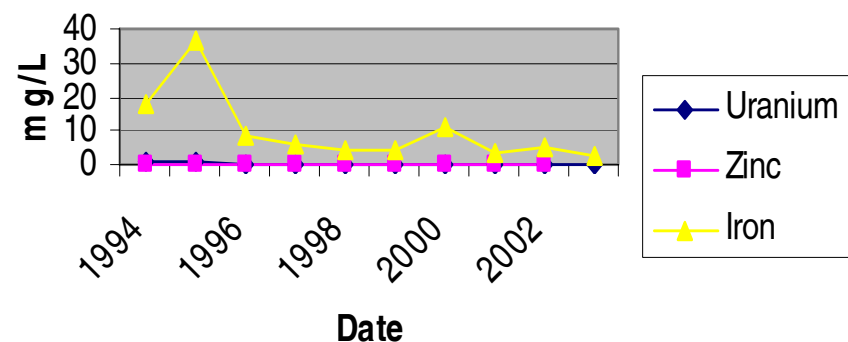
Quirke Q-05



Quirke Q-05



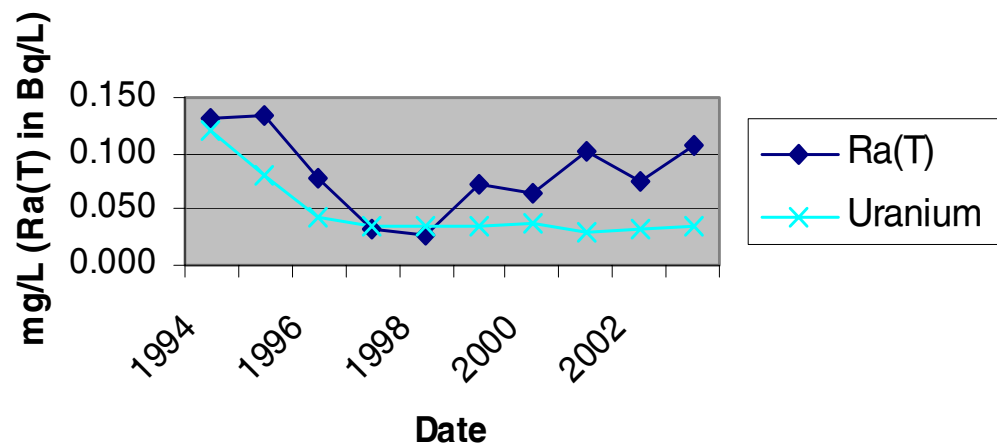
Quirke Q-05



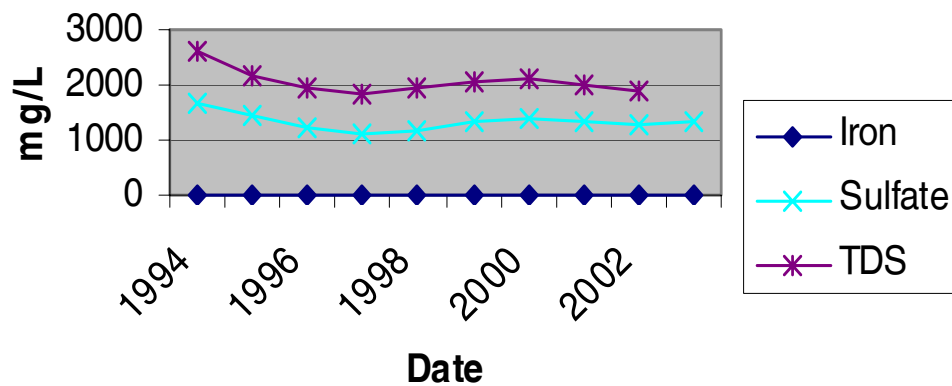


# Quirke TMA Discharge

## Quirke Q-28



## Quirke Q-28



# PANEL – History and Characteristics

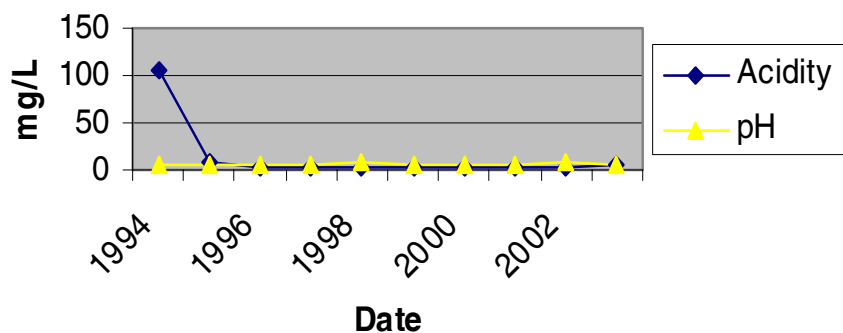


- 14 million tonnes of tailings in 123 ha. basin
- Situated natural rock with low permeability dams at perimeter low points
- Acid generation essentially arrested following flooding to depth of 0.6 m
- Water treatment conducted seasonal in spring and fall.
- In- basin liming during cover formation completed in 2000.

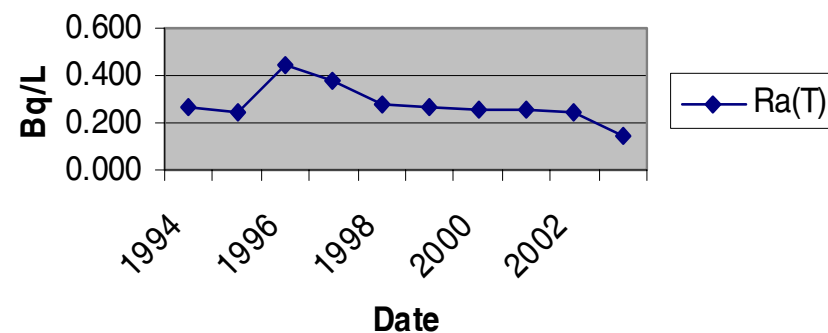
Operated from 1958 to 1961, then 1979 to 1990

# Panel TMA In-Basin Water Quality

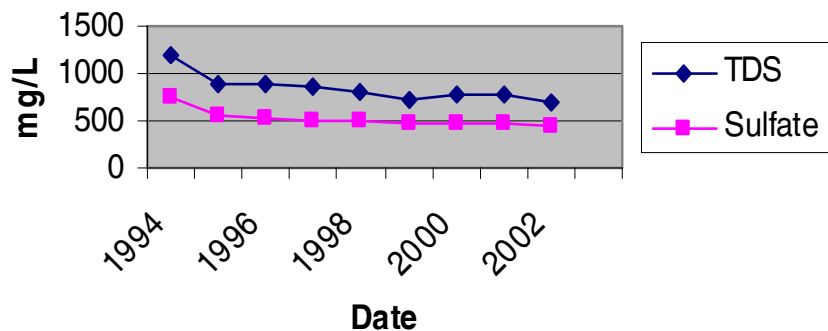
P-21



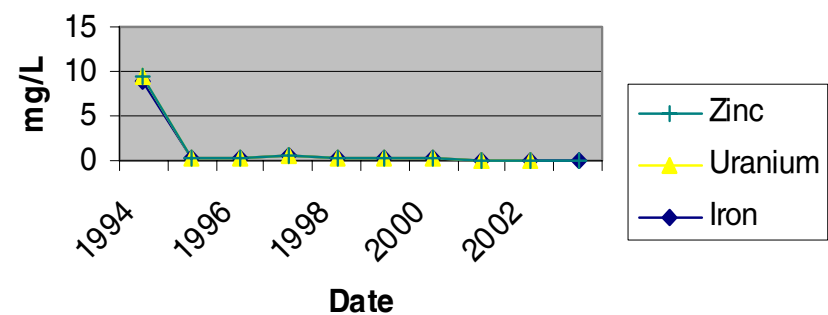
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P-21

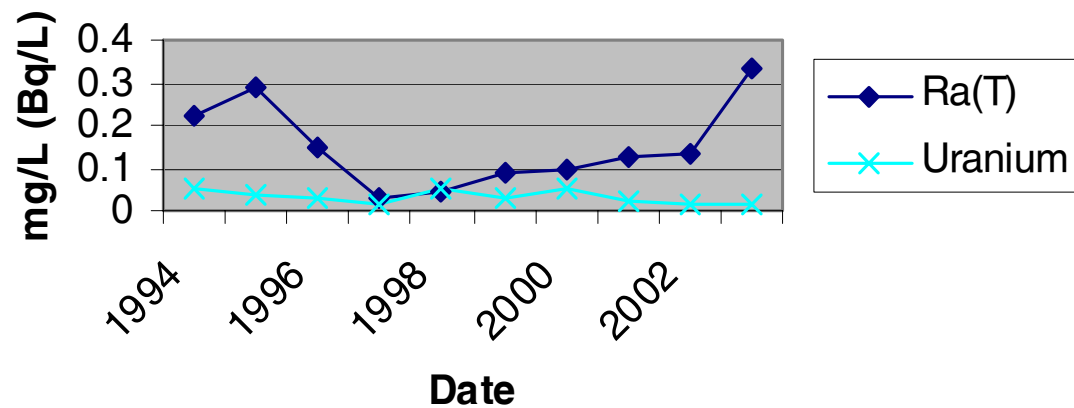


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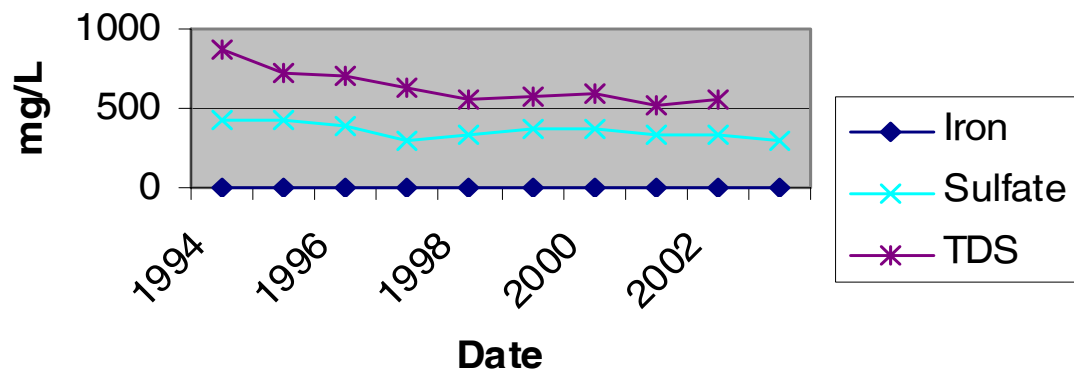


# Panel TMA Discharge

## Panel P-14



## Panel P-14



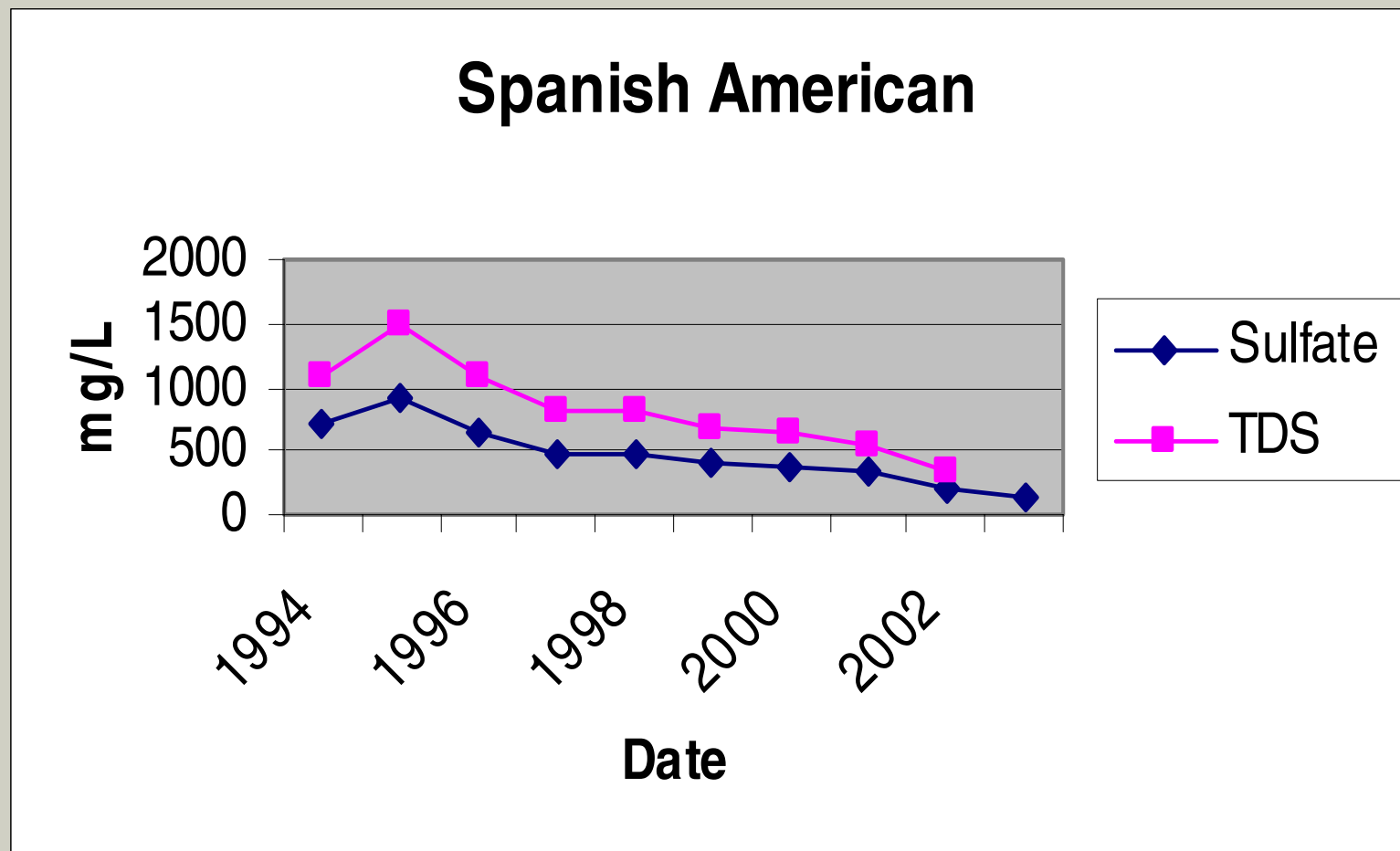


# SPANISH AMERICAN- History and Characteristics



- Operated less than one year in the late 1950's; <0.5 m tonnes of tailings in Olive Lake
- Permanent berm and spillway constructed to control water levels
- Drainage through a series of beaver ponds to Denison Tailings Management Area
- In- basin liming during cover formation.
- Minimum water cover of a 1.5m
- Radium levels at 0.6 Bq/L

# Spanish American TMA Water Quality



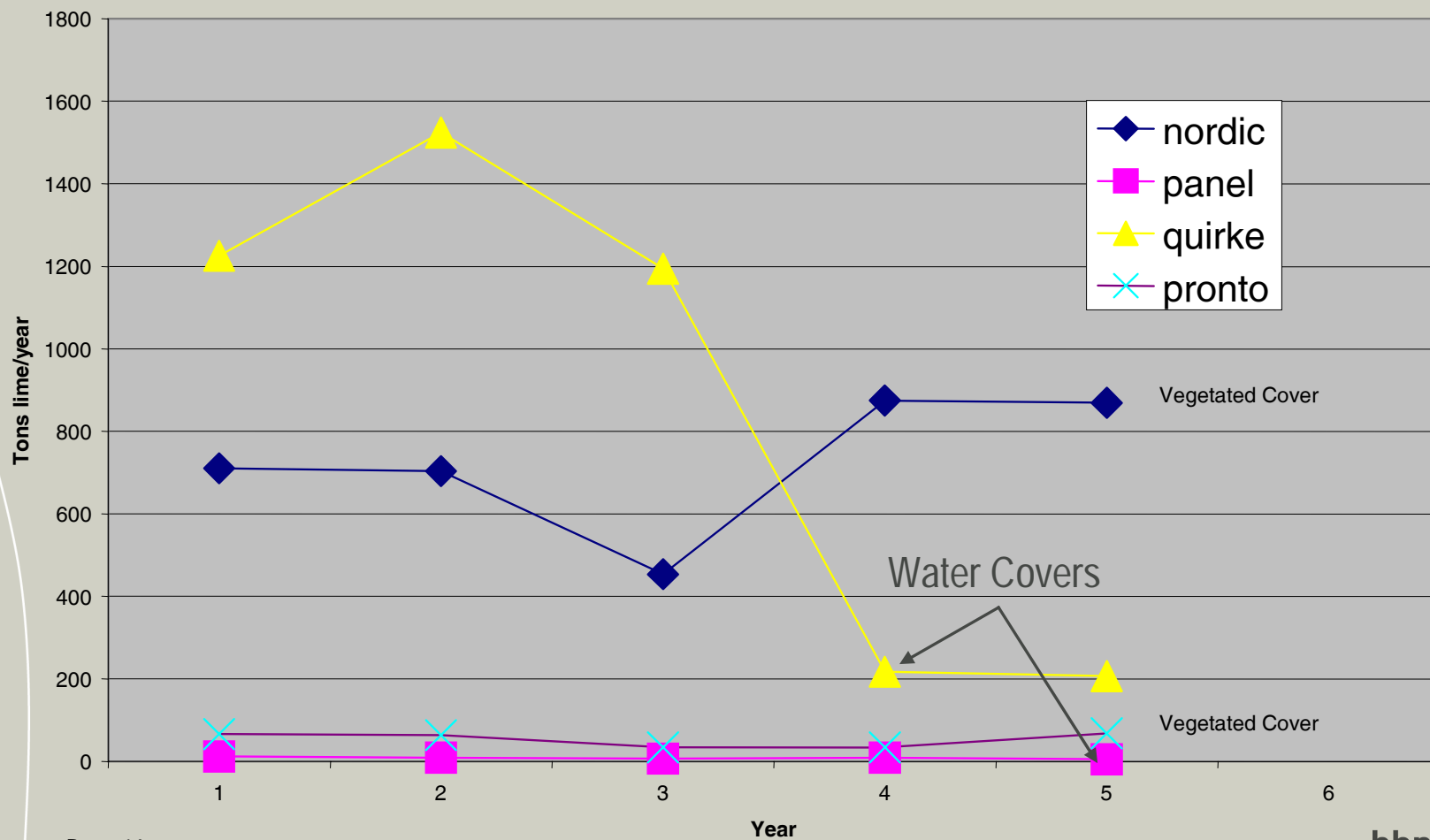
# STANLEIGH – History and Characteristics



- Operated in 50's, then 1983-1996
- Moved 50,000 tonnes of tailings below water elevation, completed 1.5 m thick water cover in 2002
- Dams and control spillway constructed
- In- basin liming during cover formation.
- Treatment systems re-conditioned in late 2002
- Radium levels 0.6 Bq/L, pH is 6.8

# Elliot Lake - Water Treatment Trends

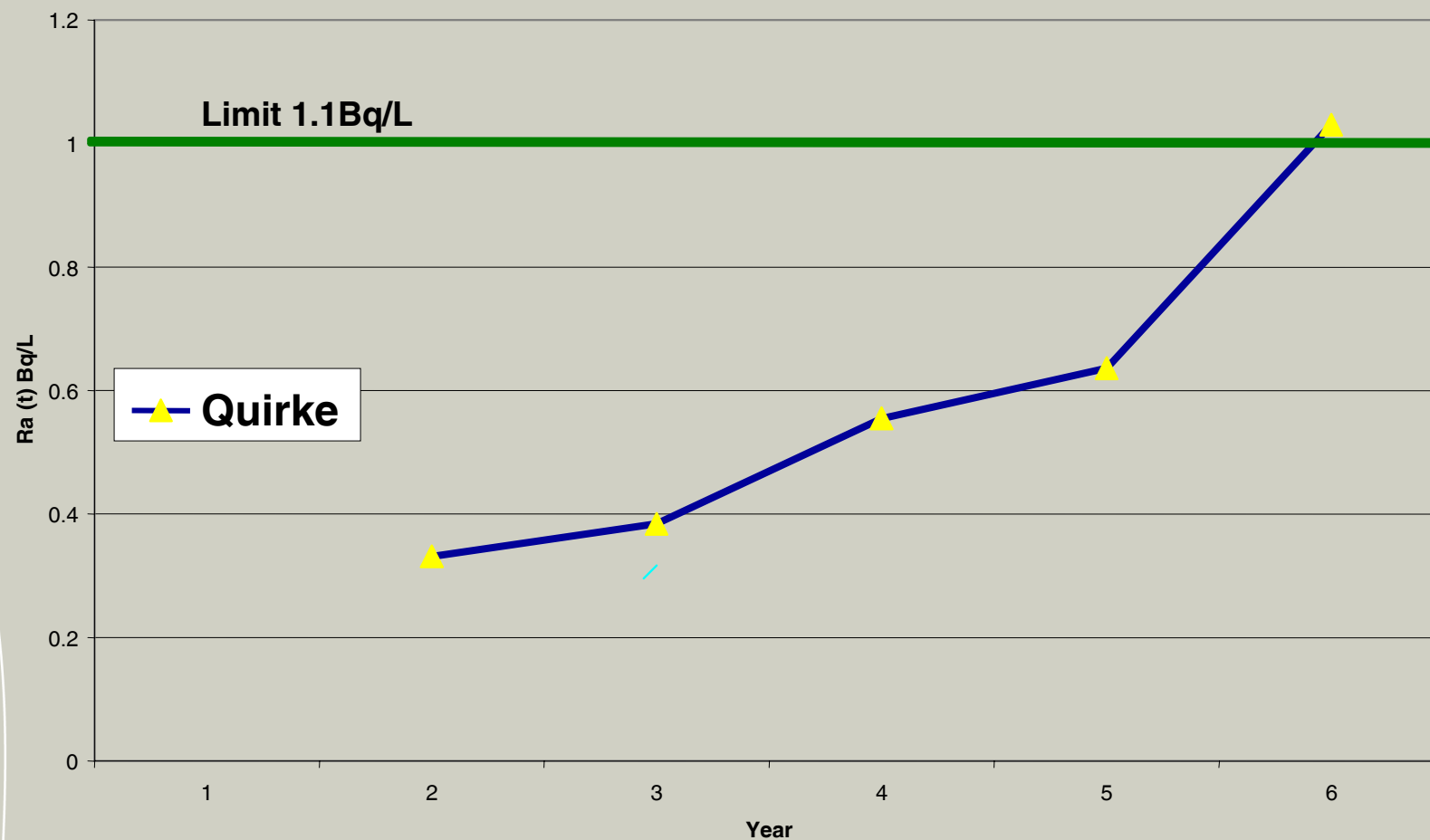
## ET Plant Lime Consumption 1997 to 2002



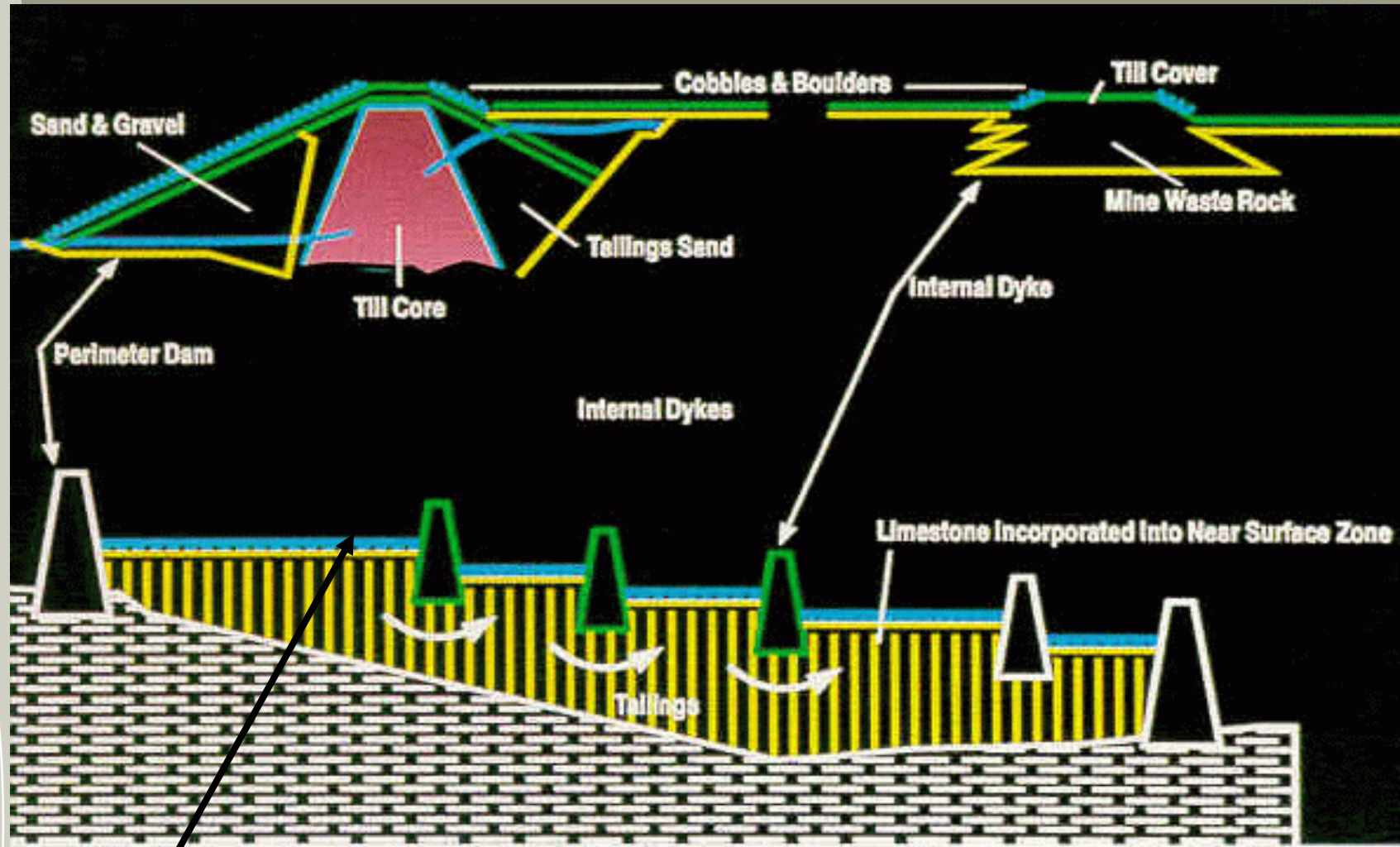


# Quirke Radium Levels

Radium 226 in treatment plant inflow (t) 1997 to 2002



# QUIRKE – History and Characteristics



— Radium levels in Cell 14 –20 ppm

# Monitoring

- Monitoring phases include a transition period to demonstrate the closure performance has been achieved
- Long term monitoring includes:
  - Inspections - identify maintenance requirements, confirm dam stability, and confirm hydraulic performance
  - Routine Monitoring - flow monitoring, water quality, meteorological data
  - Special Surveys - confirm environmental conditions - fish, sediment, benthic invertebrate surveys
  - Special Studies – update risk assessment periodically to verify management controls

# Conclusions

- Water covers performing well and as expected
- Monitoring data confirms expected environmental effects, achieving environmental protection
- Dams and dykes designed, constructed, operated and inspected to assure continued performance
- Care, maintenance and monitoring program established to ensure continued performance
- Performance monitoring of seepage till barrier at Quirke Cell 14 TMA to determine effectiveness.