

MEND MANITOBA WORKSHOP

The 1B Hydraulic System

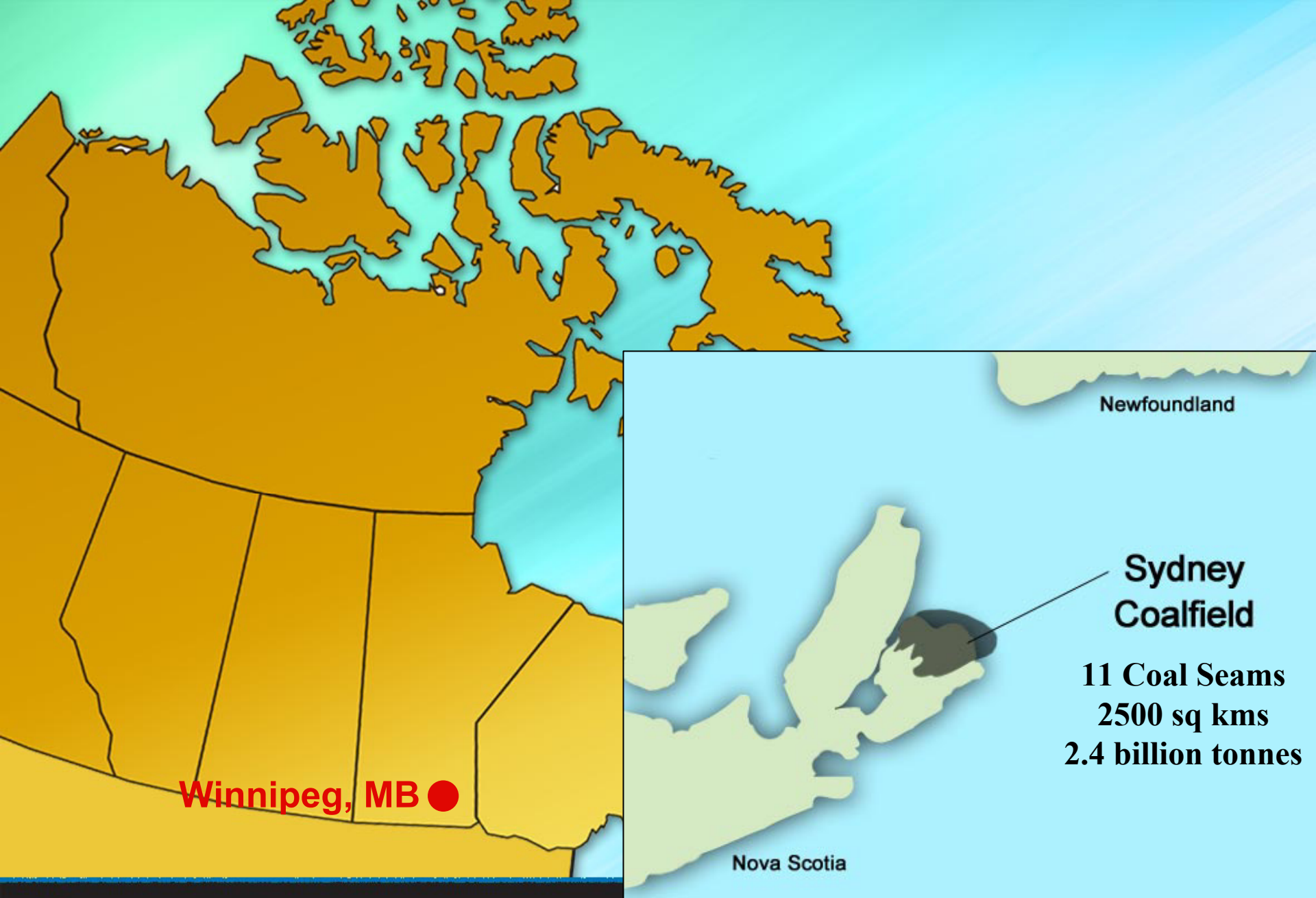
Winnipeg, Manitoba

June 5, 2008



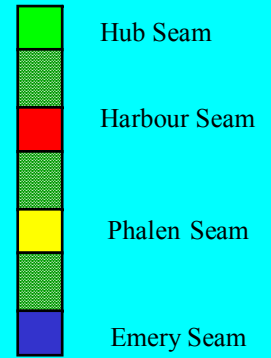
**CAPE BRETON
DEVELOPMENT
CORPORATION**

Canada



Sydney Coalfield

Sequence of Coal Seams

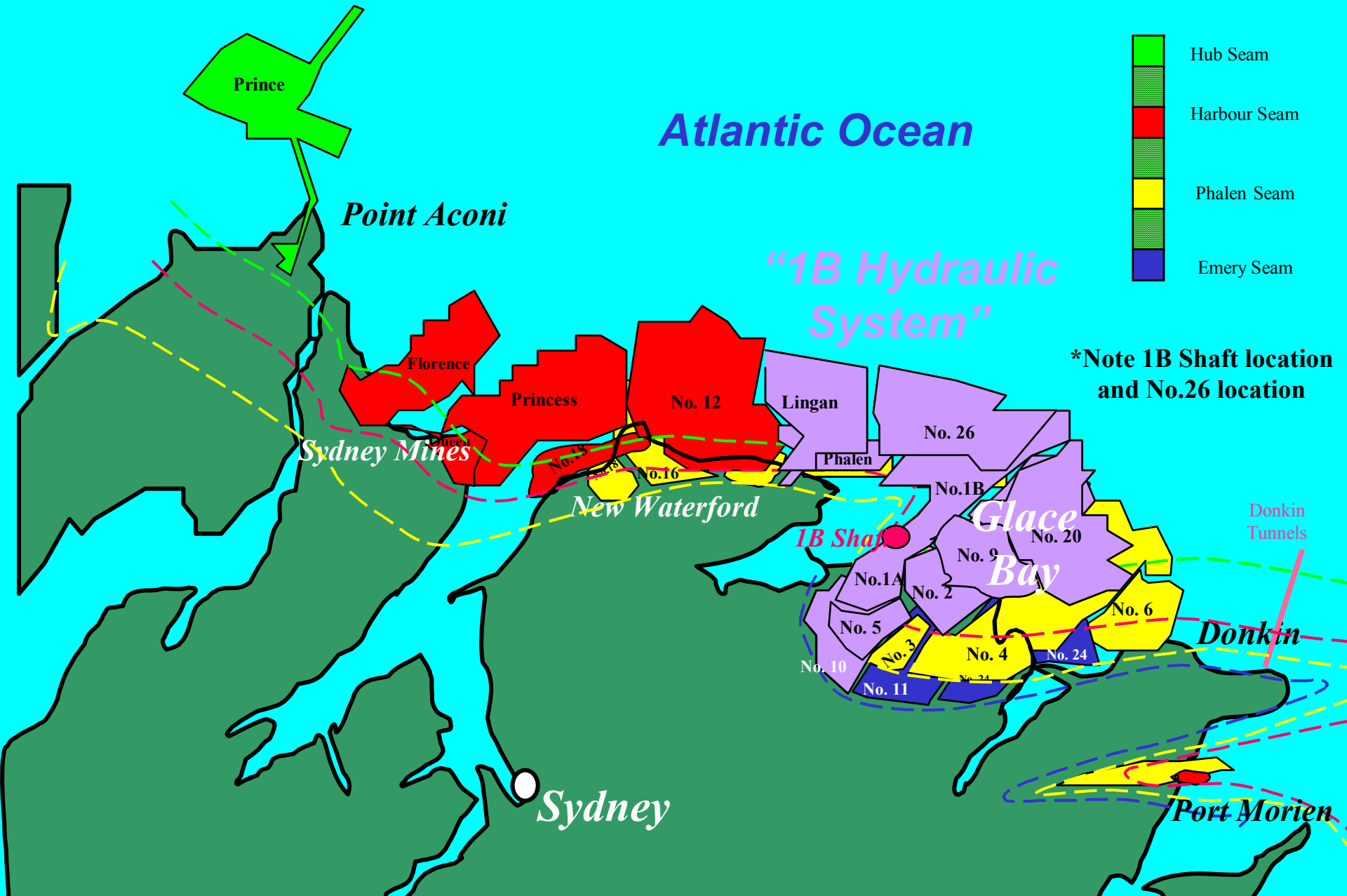
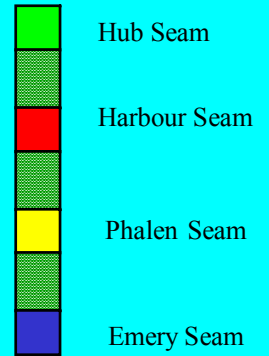


More than 50 u/g mine produced over 500 million tons

Left behind voids for more than 50 billion gal of AMD And so began the

1B Hydraulic System

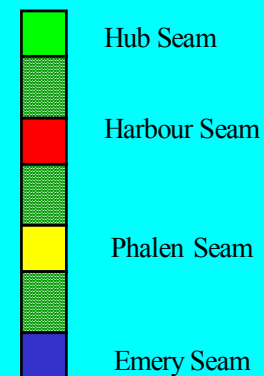
Sequence of Coal Seams



***Note 1B Shaft location and No.26 location**

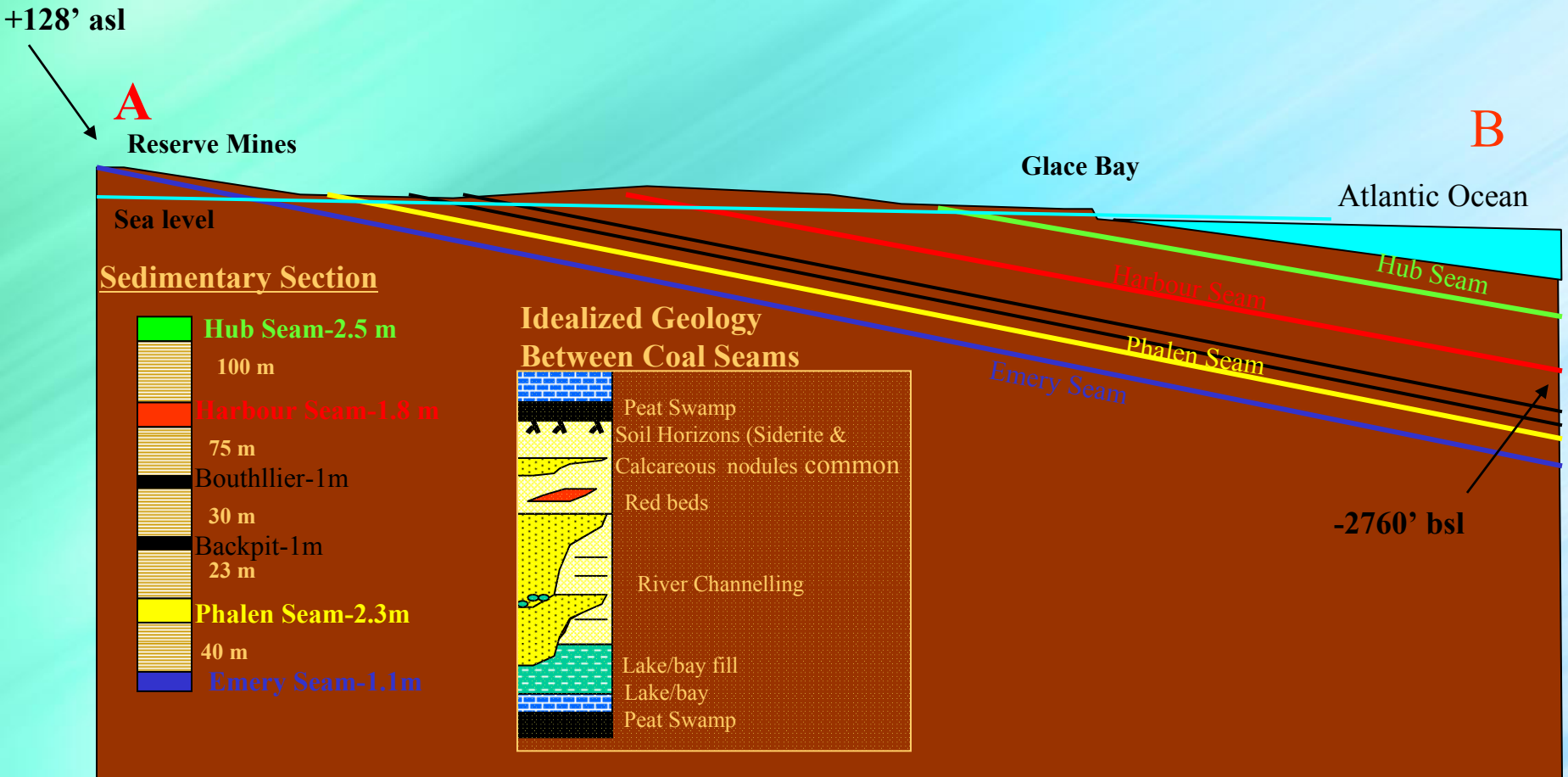
1B System Geologic Structure

Sequence of Coal Seams



Stratigraphic Section Through Coal Seams Mined in the 1B Hydraulic System

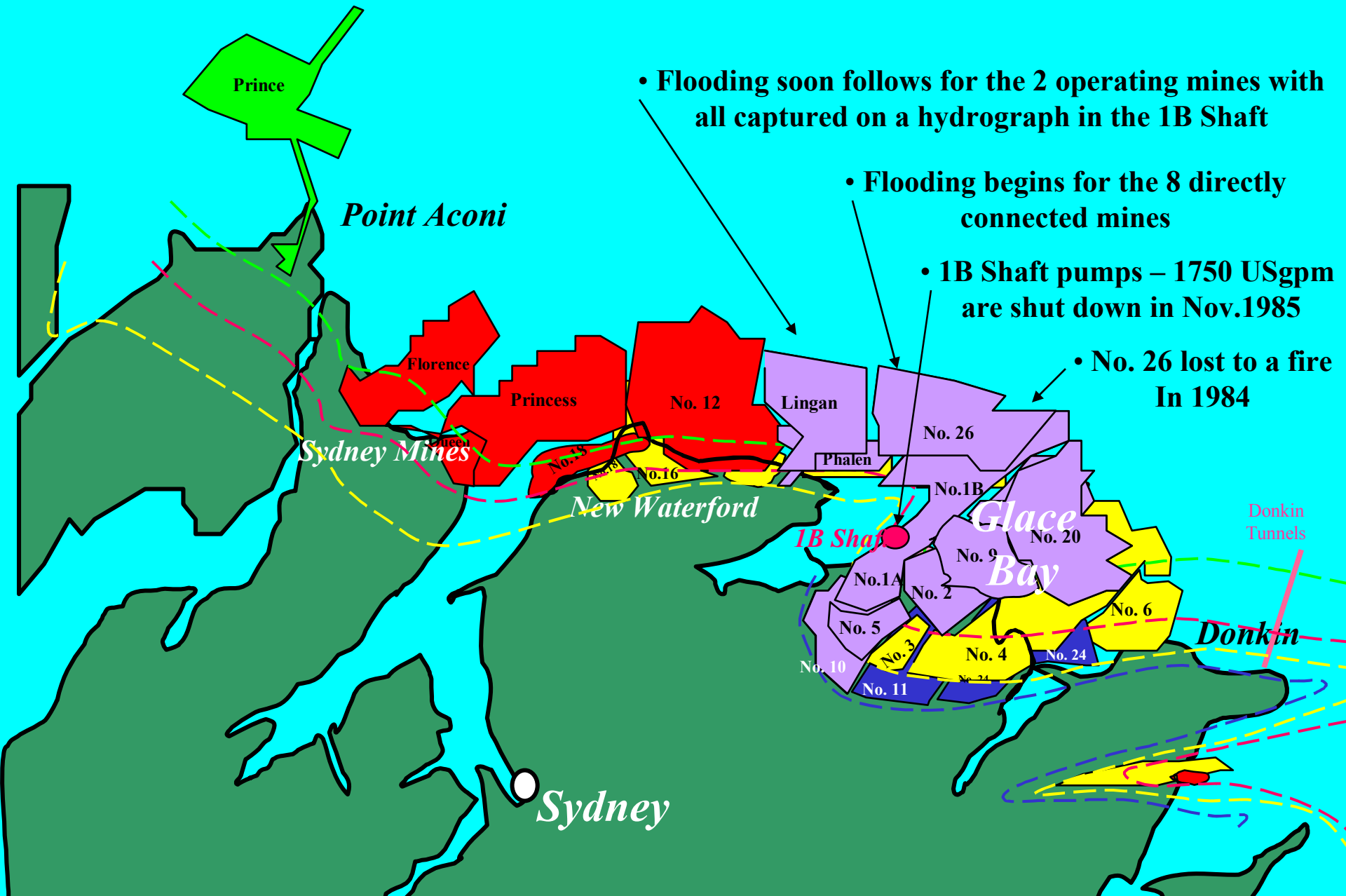
(Section A - B through the Glace Bay Syncline)



Mining Methods within the 1B System

- Room and pillar
- Room and pillar with pillar extraction
- Longwall

Flooding of the 1B System



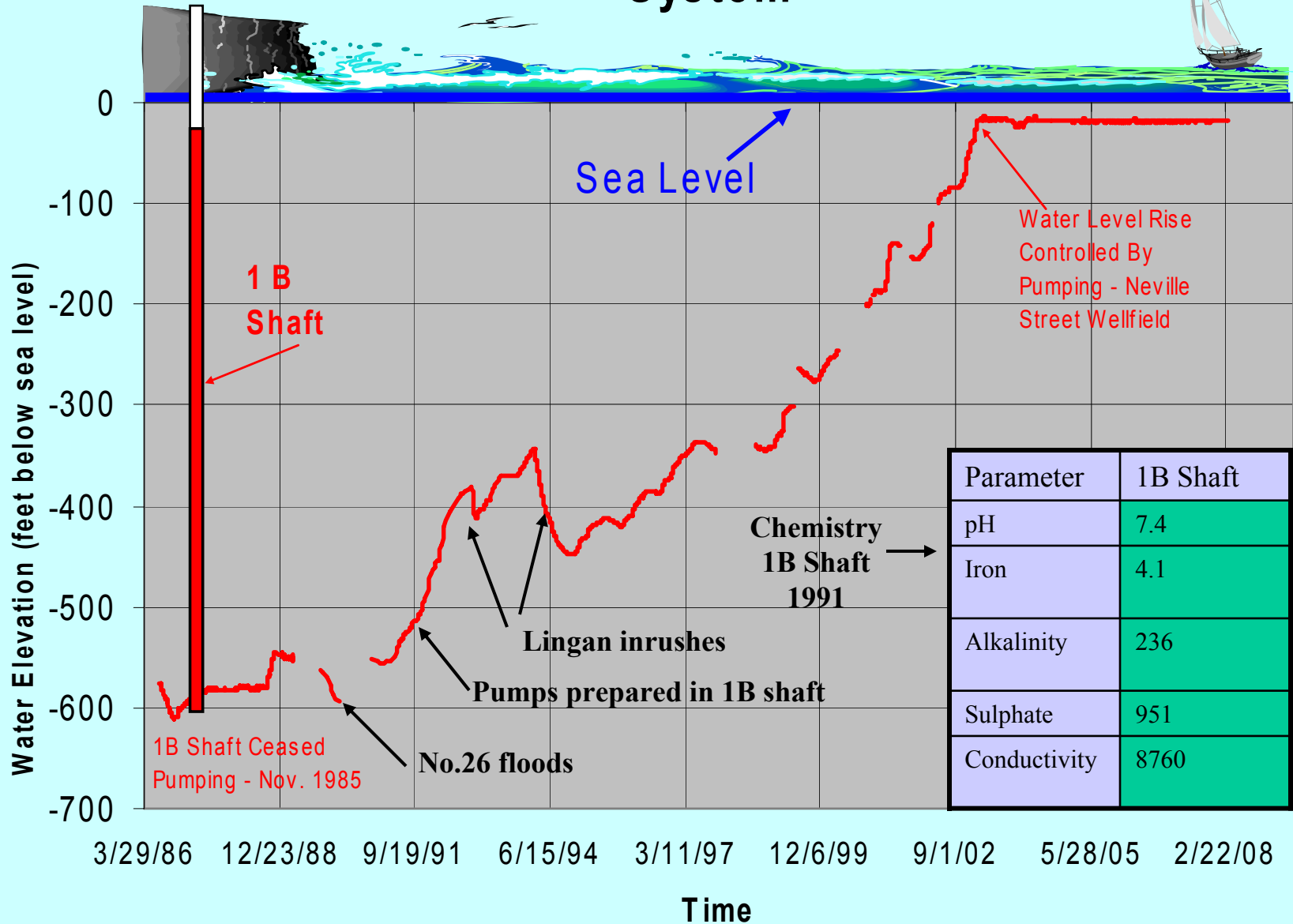
• Flooding soon follows for the 2 operating mines with all captured on a hydrograph in the 1B Shaft

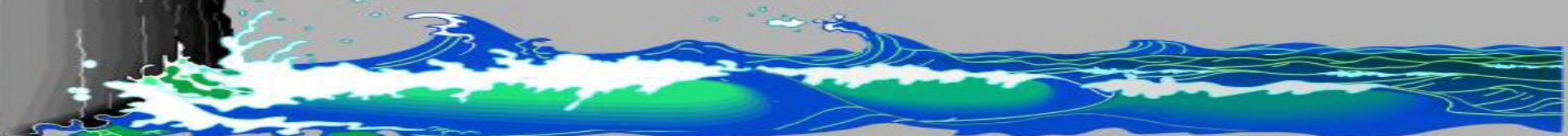
• Flooding begins for the 8 directly connected mines

• 1B Shaft pumps – 1750 USgpm are shut down in Nov.1985

• No. 26 lost to a fire In 1984

Hydrograph of Water Level Rise - 1B Hydraulic System





Atlantic Ocean

1100 ft

Start the pumps
in the 1B Shaft!

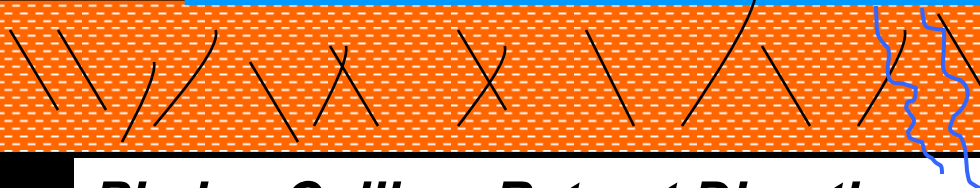
Harbour Seam

Lingan Colliery

Coal Barrier – 1100'

Flooded No. 26 Colliery

430 ft



Phalen Seam



Phalen Colliery Retreat Direction

130 ft

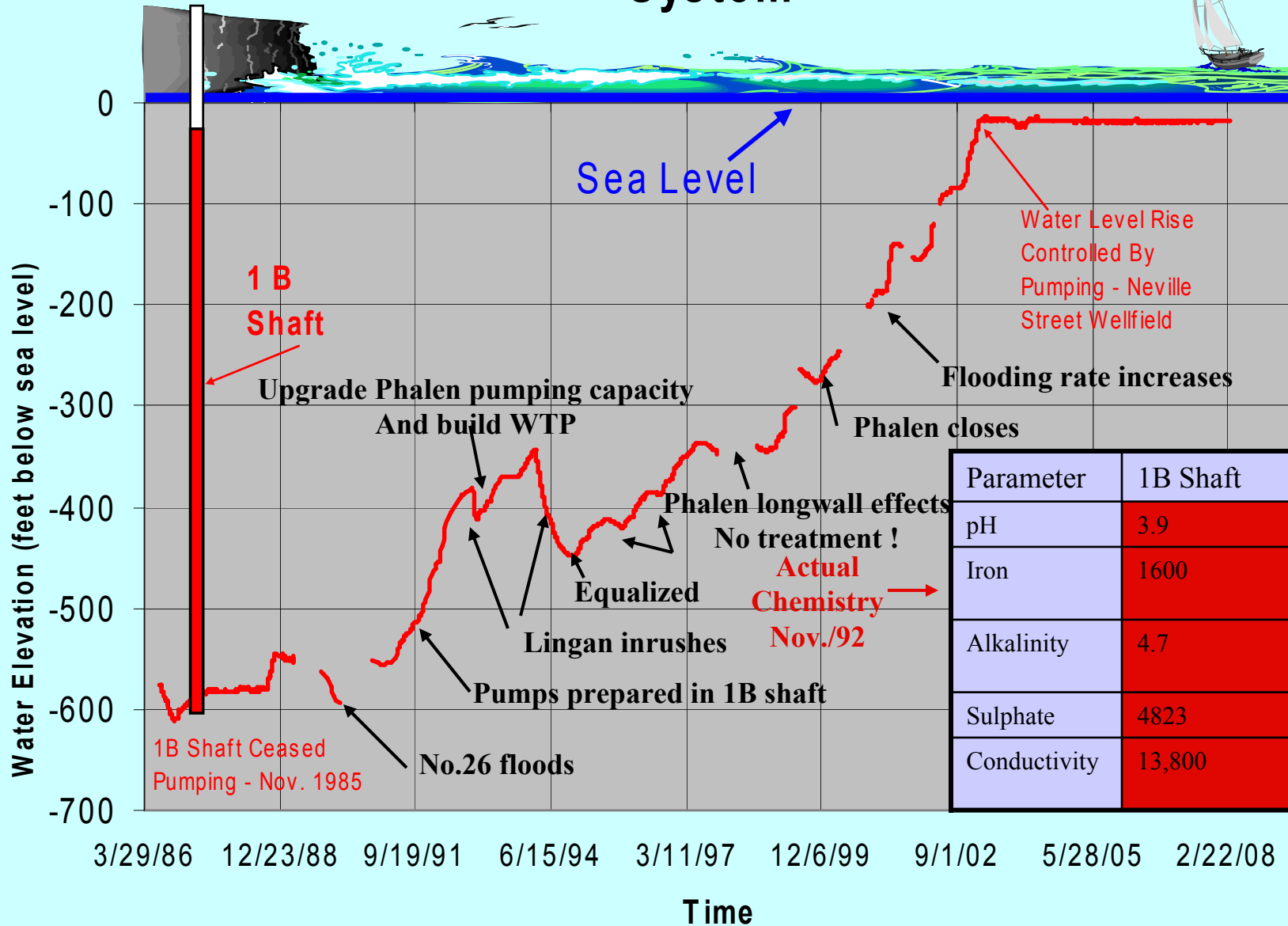
Emery Seam

Flooding of Lingan Colliery starts – Nov./92

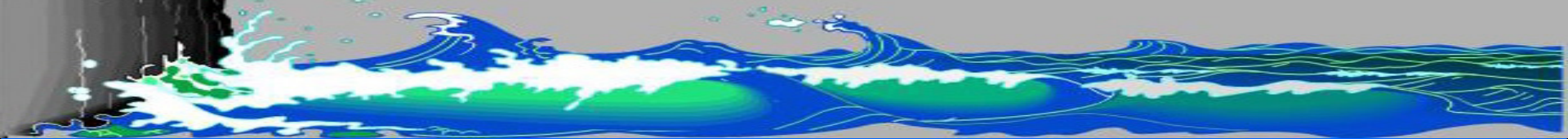
1B Discharge Nov. 1992 – 10 days of pumping



Hydrograph of Water Level Rise - 1B Hydraulic System



Parameter	1B Shaft
pH	3.9
Iron	1600
Alkalinity	4.7
Sulphate	4823
Conductivity	13,800



Atlantic Ocean

1100 ft

Harbour Seam

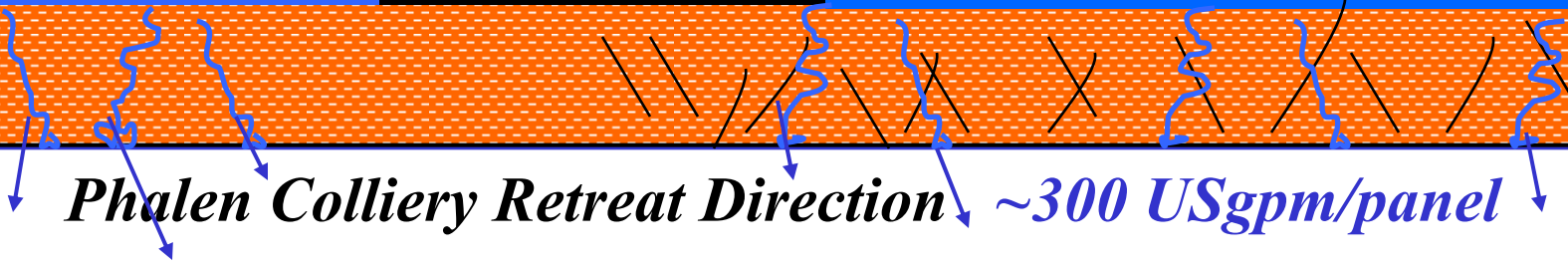


Flooded Lingan Colliery

Pillars >200'

Flooded No. 26 Colliery

430 ft



Phalen Colliery Retreat Direction ~300 USgpm/panel

130 ft

Emery Seam

Phalen Longwalls receive mine water

Mine water is Getting Close !

- In mid 2002, monitoring boreholes along the shoreline intercept bad quality mine water
- Less than 100 ft to overflow

WHERE DO WE GO FROM HERE !

CBDC Developed a Stepped Approach to Deal With Rising Mine Water

- (1) Late 2002, all focus is now on mine water
- (2) The location, quantity and mine water overflow date was calculated
- (3) All surface water entrance points sealed
- (4) Established expert groups to give advice
- (5) Additional boreholes drilled to sample mine water chemistry and geology in upper areas
- (6) Began immediate construction of an emergency WTP at the 1B Shaft site



1A Outfall projected to discharge by April 2003 at elev. +6' asl

No.1A Outfall at shoreline



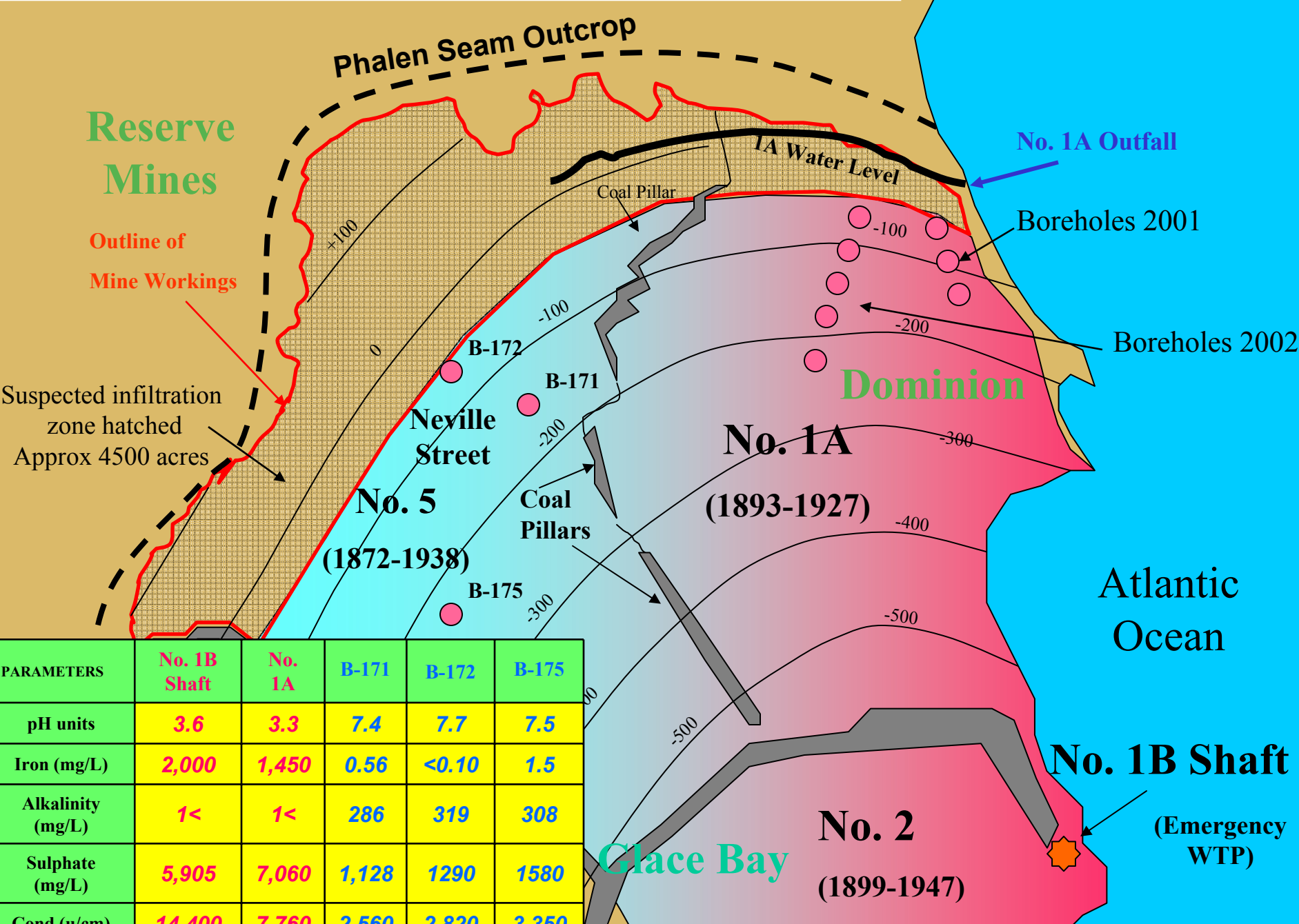
MacKay's Corner "bootleg" workings and AMD formation



1B Shaft WTP
1500 US gpm capacity

1B Treatment Plant and Settling Pond

January 2003 – Less than 100' to overflow

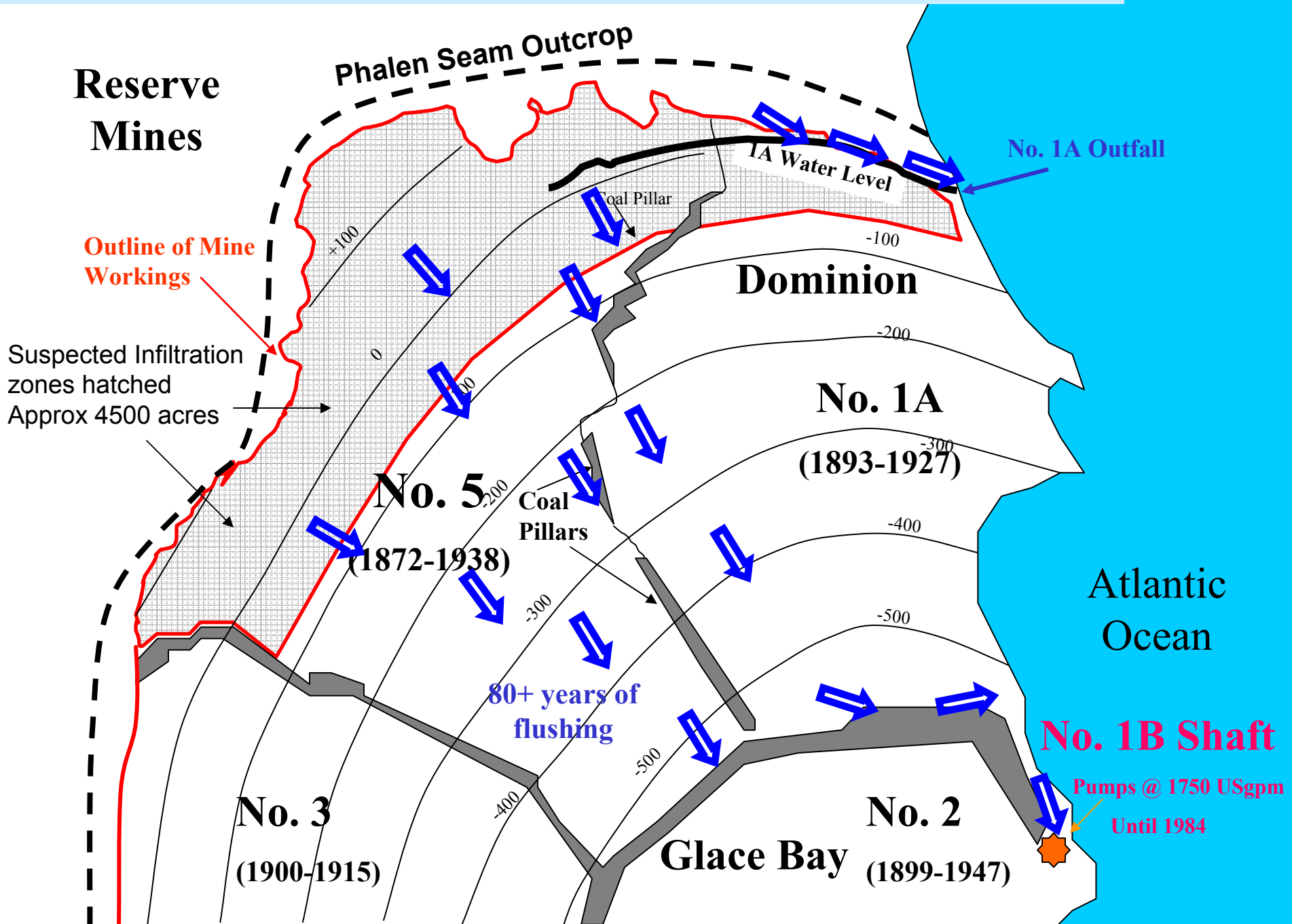


PARAMETERS	No. 1B Shaft	No. 1A	B-171	B-172	B-175
pH units	3.6	3.3	7.4	7.7	7.5
Iron (mg/L)	2,000	1,450	0.56	<0.10	1.5
Alkalinity (mg/L)	1<	1<	286	319	308
Sulphate (mg/L)	5,905	7,060	1,128	1290	1580
Cond (u/cm)	14,400	7,760	2,560	2,820	3,350

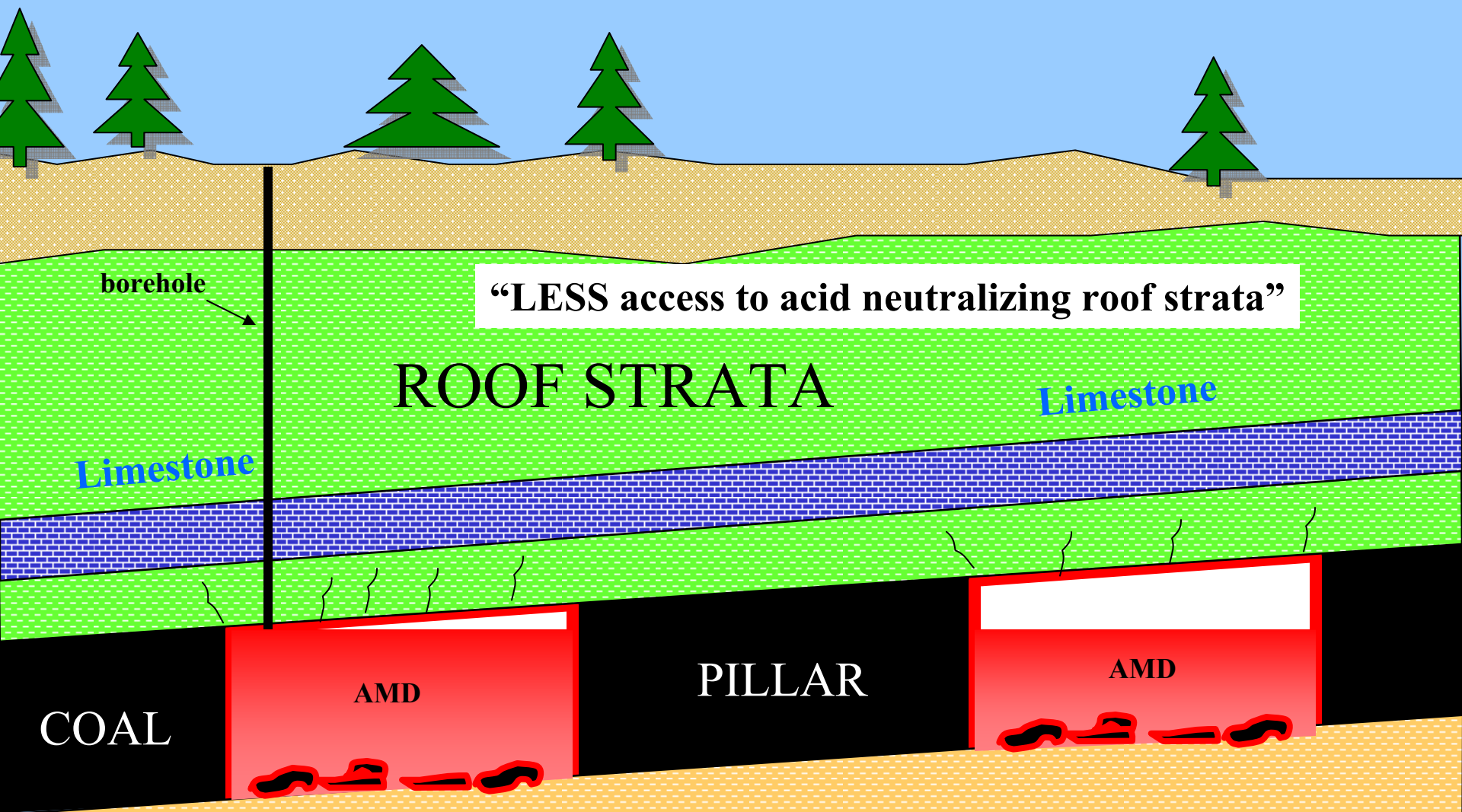
CBDC Stepped Approach Continued

- (7) In January 2003, borehole sampling in upper area of No.5 showed good mine water chemistry
Needed to understand the reasons why
- (8) Intensive study of mine water flow paths, local geology, mining methods and infiltration areas carried out
- (9) Recommended that an untreated discharge should be established in area of good mine water chemistry

Probable infiltration zone and flow path prior to flooding of 1B System



No.1A Room and Pillar workings



Mining Method – 92% Room and pillar
Only 45% of coal removed

No.5 Pillar Extraction



“MORE access to acid neutralizing strata”

Limestone

borehole

AMD

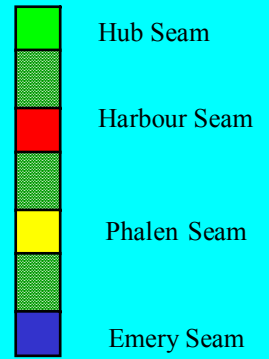
Mining Method – 75% Room and Pillar with pillar extraction
Almost 85% of coal removed

Establish an Untreated Discharge

- In Feb 2003 a pilot pumping program was implemented in upper area of No.5 near Neville Street. Very positive mine water chemistry – zero fish mortality – results accepted by regulators.
- In March 2003, Neville Street upgraded to 3500 gpm capacity, discharge quality remained stable.
- The flooding of the 1B System was now under control.(mine water level had reached 12' bsl)
- The operation of the WTP at 1B Shaft was halted and the plant was put in a state of readiness.

Flooding status halted in March 2003

Sequence of Coal Seams

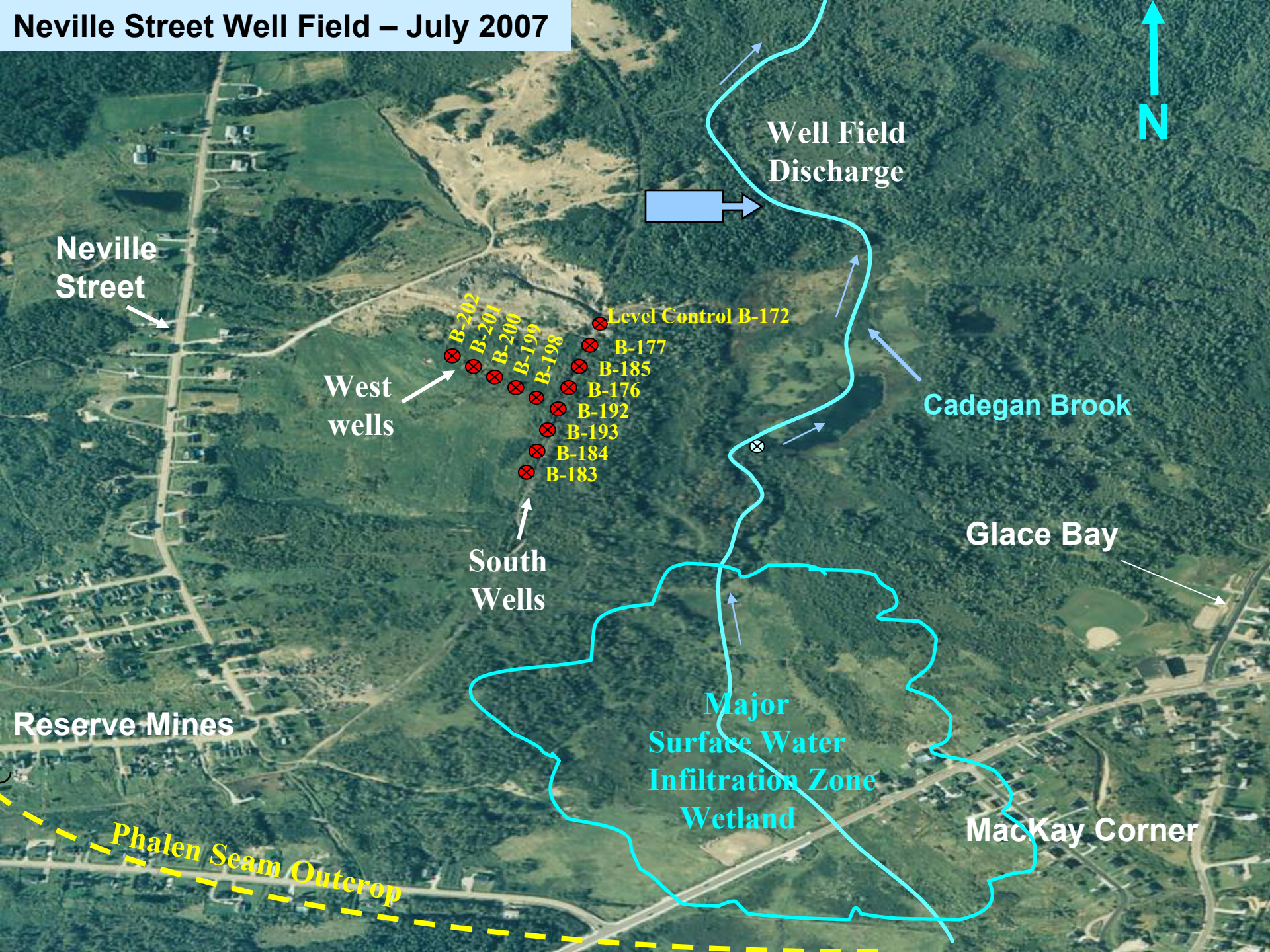


Current Pumping Strategy

- Since 2003 the Neville Street Well field has undergone several infrastructure upgrades.
- It is now fully automated with 12 x 30 hp submersible pumps providing 5700 gpm at full capacity.
- Pump startup priority is based on quality at individual wells. Maintain mine water level at -17' to -19' bsl.
- Normally see increase in mine water volumes 24 hours after precipitation events.



Neville Street Well Field – July 2007



Neville Street Well Field – April 2008



Cadegan Brook

Major Infiltration Zones

South Wells

West Wells

Automation Screen

Neville Street Wellfield

NEW MODEM
To COM1

AUTO On

Minewater Level

-17.979 ft

POWER ON



POWER ON



Surf. Elev +120 ft asl

B-177	B-185	B-176	B-193	B-184	B-192	B-183	B-198	B-199	B-200	B-201	B-202
On	On	On	On	On	On	On	On	Off	Off	Off	Off

Minewater Control Elev ~ -17 to -19 ft bsl

PHALEN SEAM WORKINGS

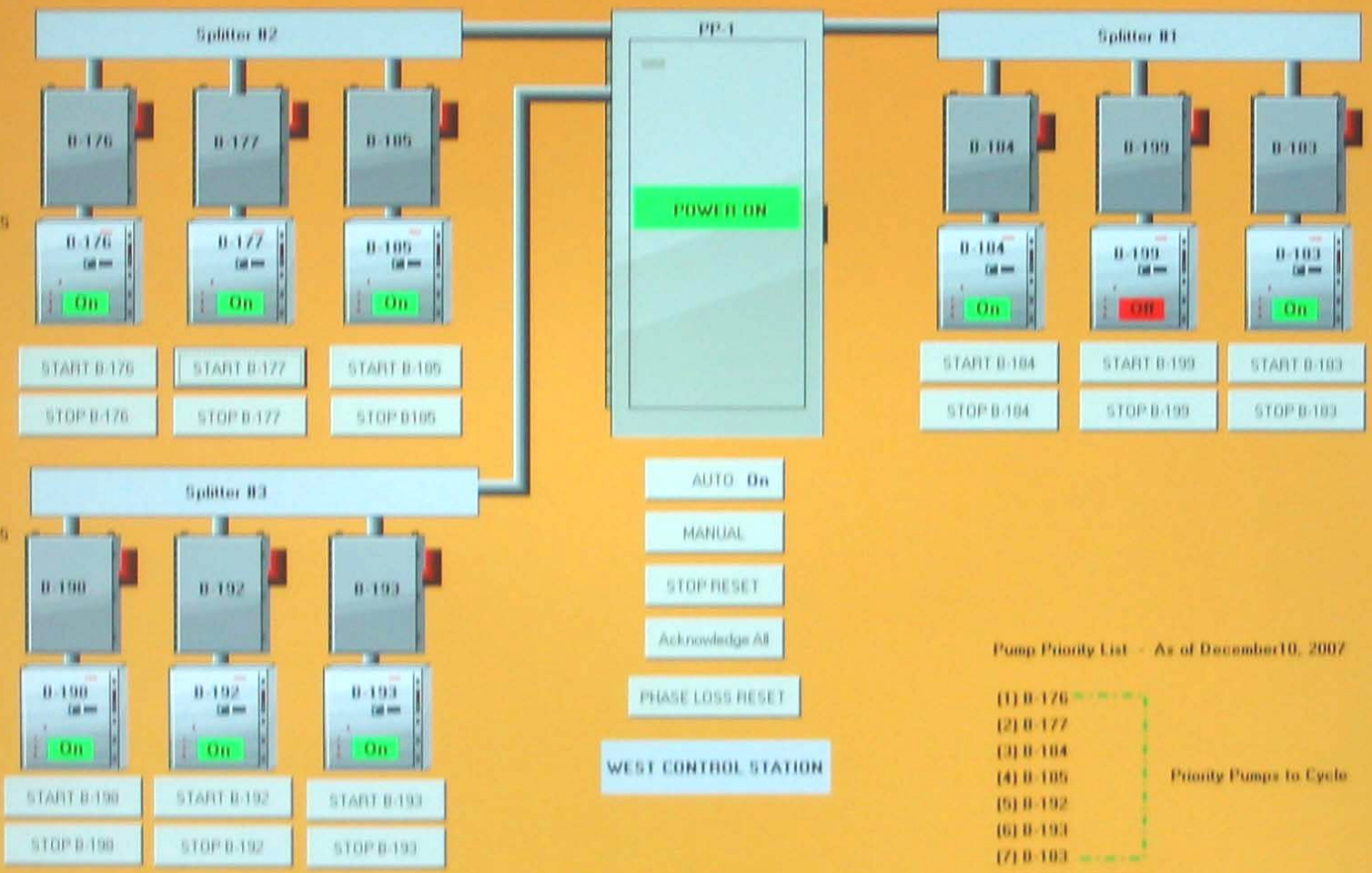
Seam elev. ~ -55 ft bsl

DOMINION NO.5 COLLIERY

Pump Start Screen



Mineewater Level
- 17.882 FT



PLC OUTPUTS
B-176
B-177
B-185

PLC OUTPUTS
B-184
B-189
B-183

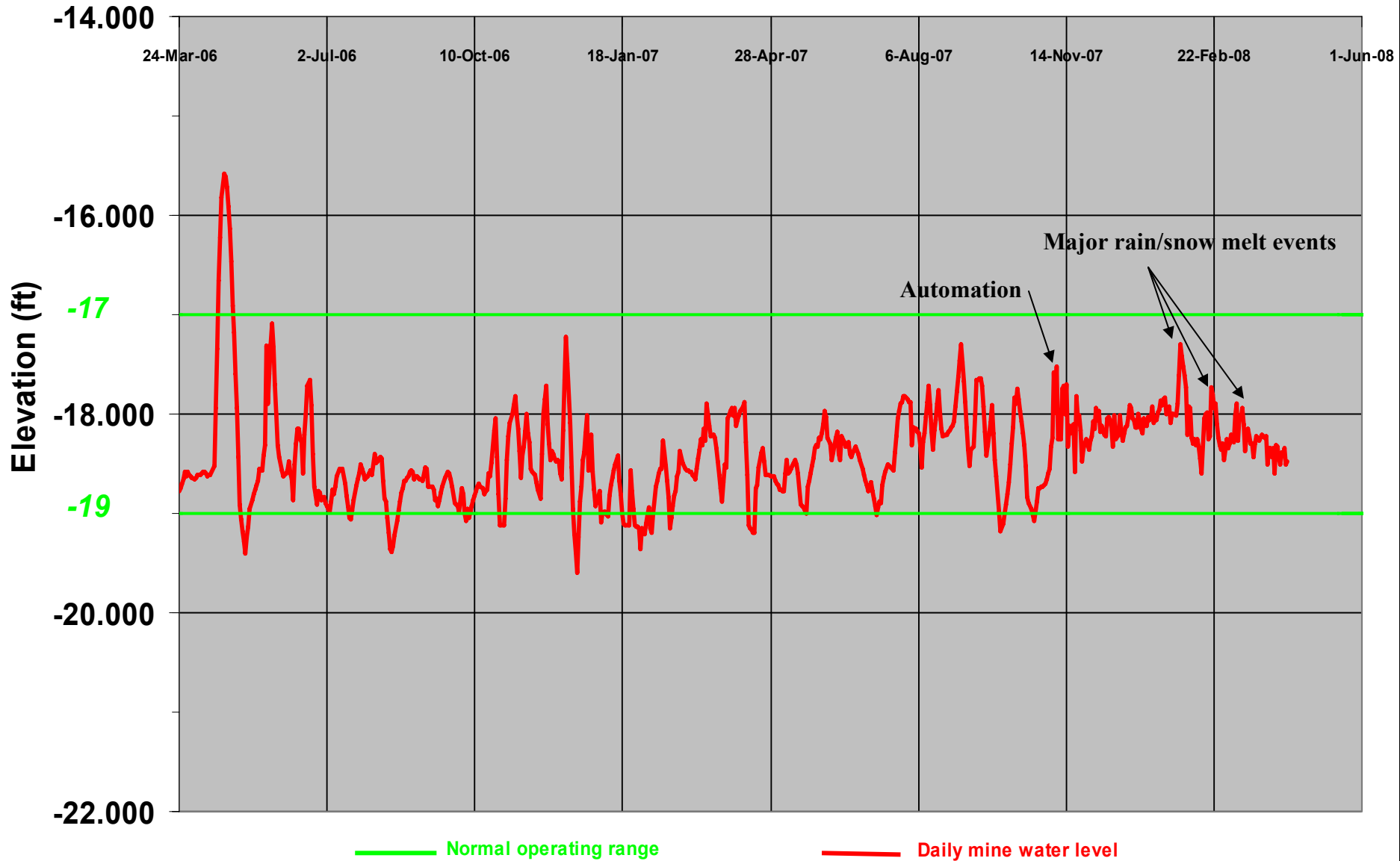
PLC OUTPUTS
B-190
B-192
B-193

AUTO On
MANUAL
STOP RESET
Acknowledge All
PHASE LOSS RESET
WEST CONTROL STATION

Pump Priority List - As of December 10, 2007

- (1) B-176
 - (2) B-177
 - (3) B-184
 - (4) B-185
 - (5) B-192
 - (6) B-193
 - (7) B-183
 - (8) B-190
 - (9) B-201
 - (10) B-199
 - (11) B-202
 - (12) B-200
- Priority Pumps to Cycle
- * Only Start After Priority Pumps are Running

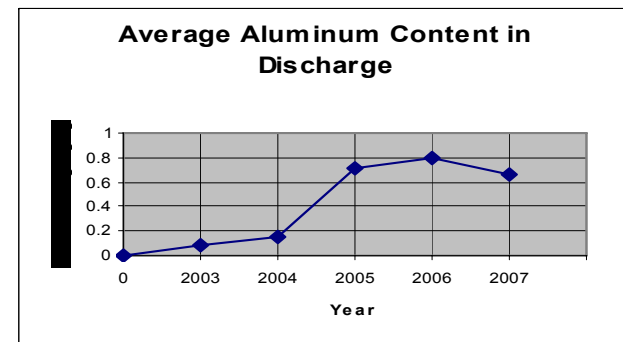
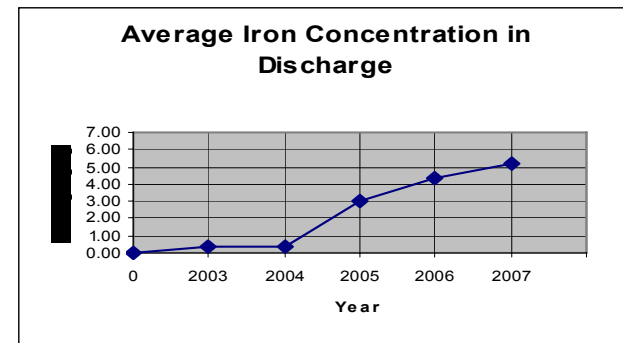
Mine Water Level Maintenance Zone

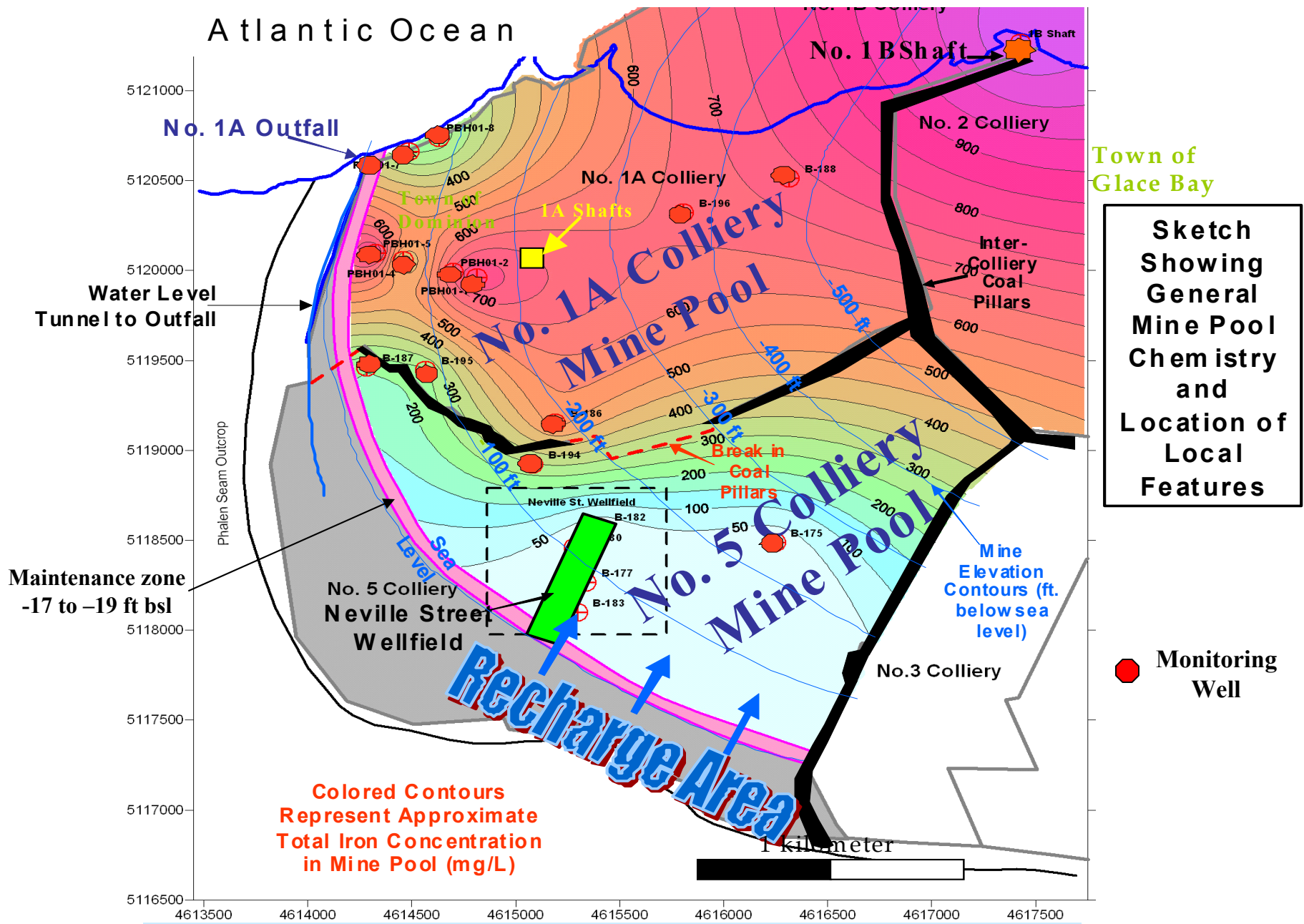


Mine Water Fe/Al Quality Trends 2003-2007

Iron and Aluminum Concentration in the Neville Street Discharge

		2003	2004	2005	2006	2007
Fe	Minimum	0.10	0.14	0.43	0.87	0.20
	Maximum	0.50	16.00	12.00	12.00	9.60
	Mean	0.36	0.40	3.03	4.40	5.06
Al	Minimum	0.02	0.01	0.05	0.13	0.05
	Maximum	0.40	0.83	2.10	2.50	1.80
	Mean	0.09	0.15	0.71	0.79	0.61

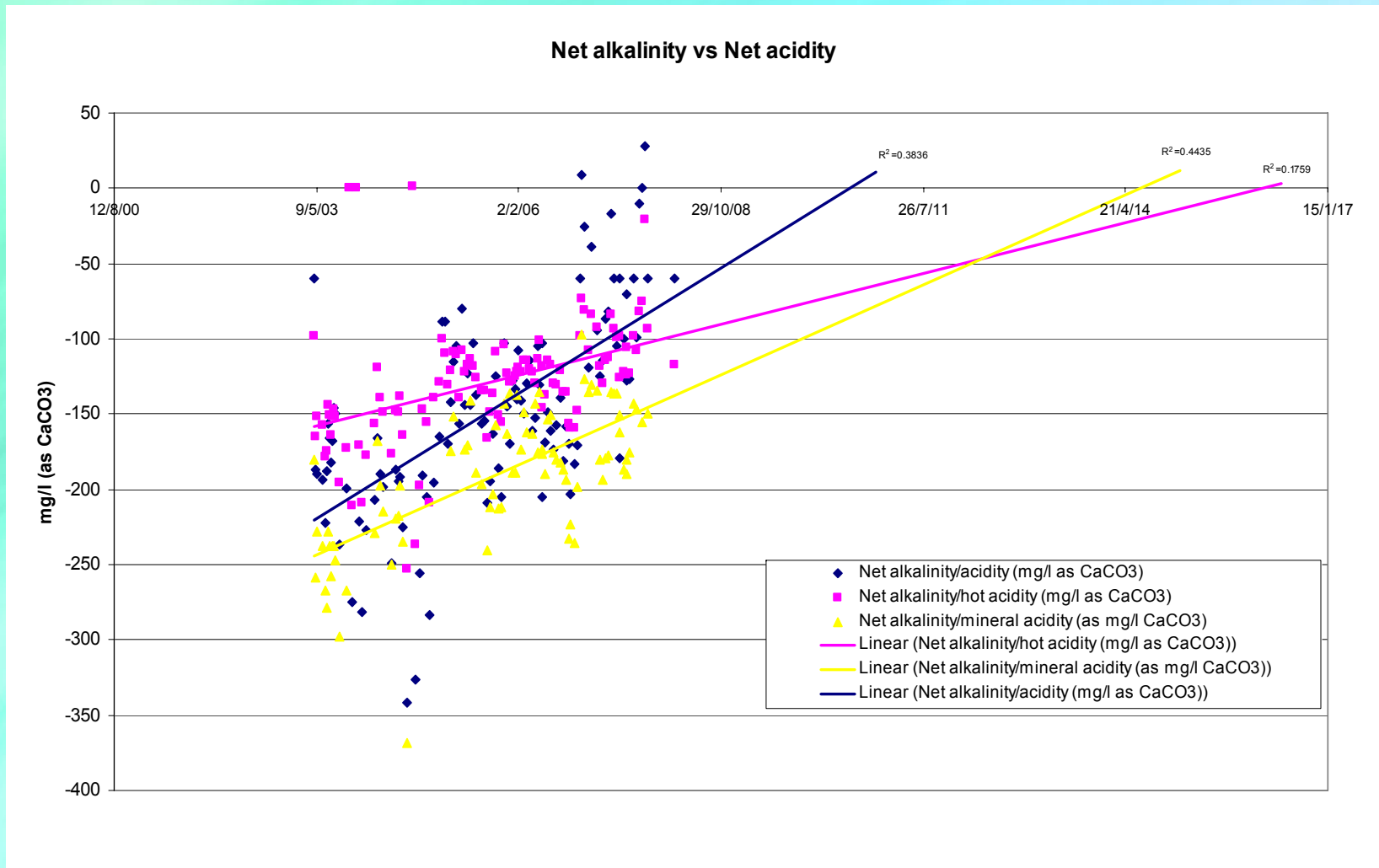




Sketch Showing General Mine Pool Chemistry and Location of Local Features

2007 Contour Map - Mine water iron concentrations in mg/l

Mine Water Alkalinity/Acidity Trends 2003-2007



Neville Street Well Field - Key Statistics

- Annual precipitation of 60", average pumping rate of 2200 US gpm
- Infiltration rate is estimated to be 2.9 gallons per acre. The total infiltration varies from 450 gpm (summer) to 7000 gpm (rain/snow melt)
- Currently pumping 1.2 billion US gallons annually without treatment
- Annual cost to operate the Neville Street Well Field is \$ 250k

Neville Street Well Field at Full Capacity Feb. 2008



The Future – Near Term

- Recognize mine water quality is slowly deteriorating
- Assessing adjacent mines for leakage/pillar failure
- Drilling additional boreholes for strata information and looking for better quality mine water. Plan to use tracers to better identify u/g flowpaths
- Planning for an aerial survey using LIDAR technology to identify surface sinkholes
- Construct passive treatment wetland at Neville St.
- Establish/support research in Mine Water Management at Cape Breton University

The Future – Long Term

- Our ultimate goal is to establish a compliant, passive discharge from the 1B Hydraulic System to the marine environment
- Work closely with CBU Mine Water Chair to help develop the plan to accomplish this goal
- Probable use of active treatment to flush the 2 billion gallons of AMD under the land portion of the 1B System before release – how many times will the 1B System have to be flushed is the question that needs to be answered

Thank you



CAPE BRETON
DEVELOPMENT
CORPORATION

Canada 