Surface mine pool reclamation with direct ash placement: lessons to be learned for the Gorbi Mine

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Research represents components of Dr. Caroline Loop's M.S. and Ph.D.. thesis research

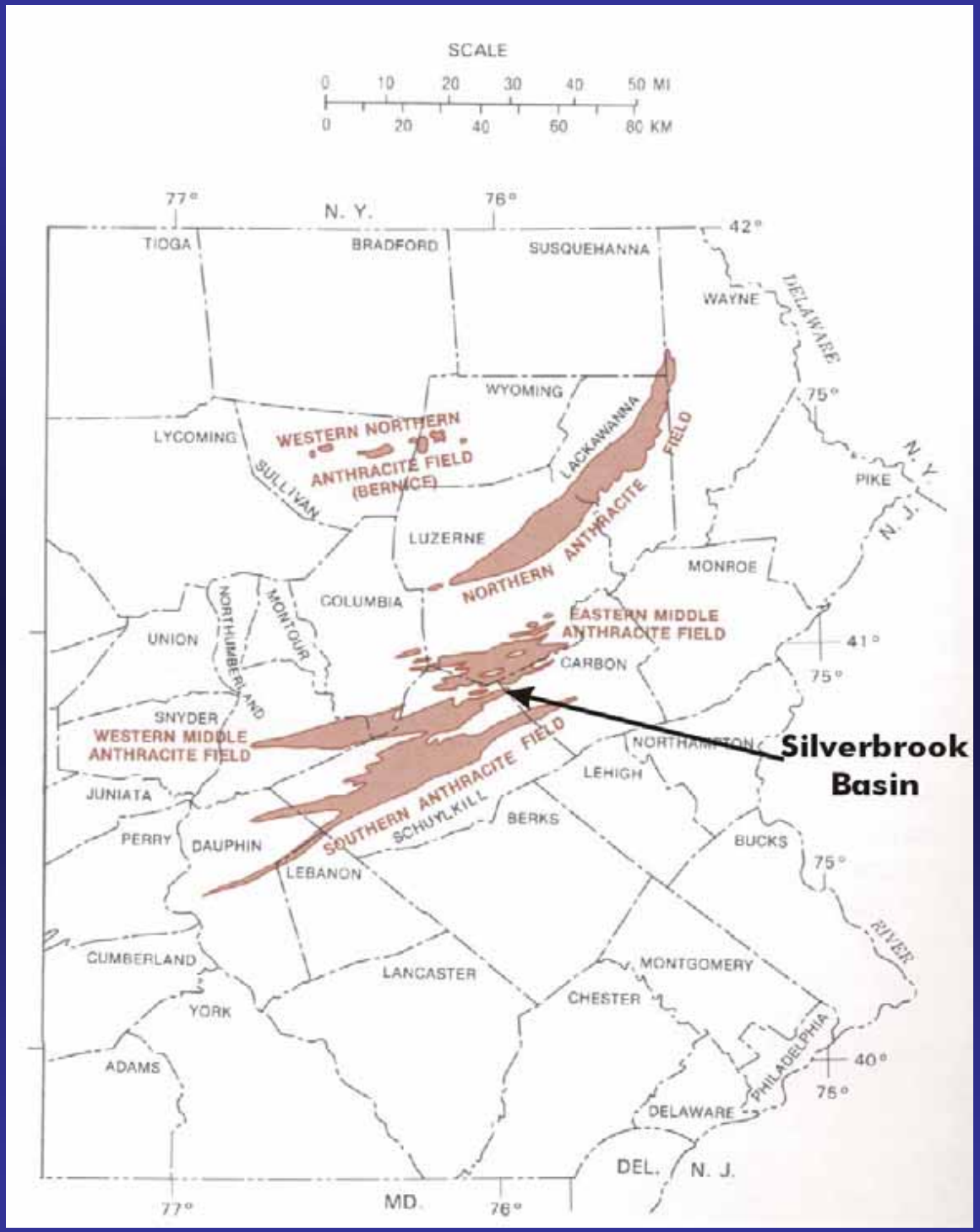
PENNSTATE 1855

The motivation for the Gorilla Site is common to the Gorbi Site:

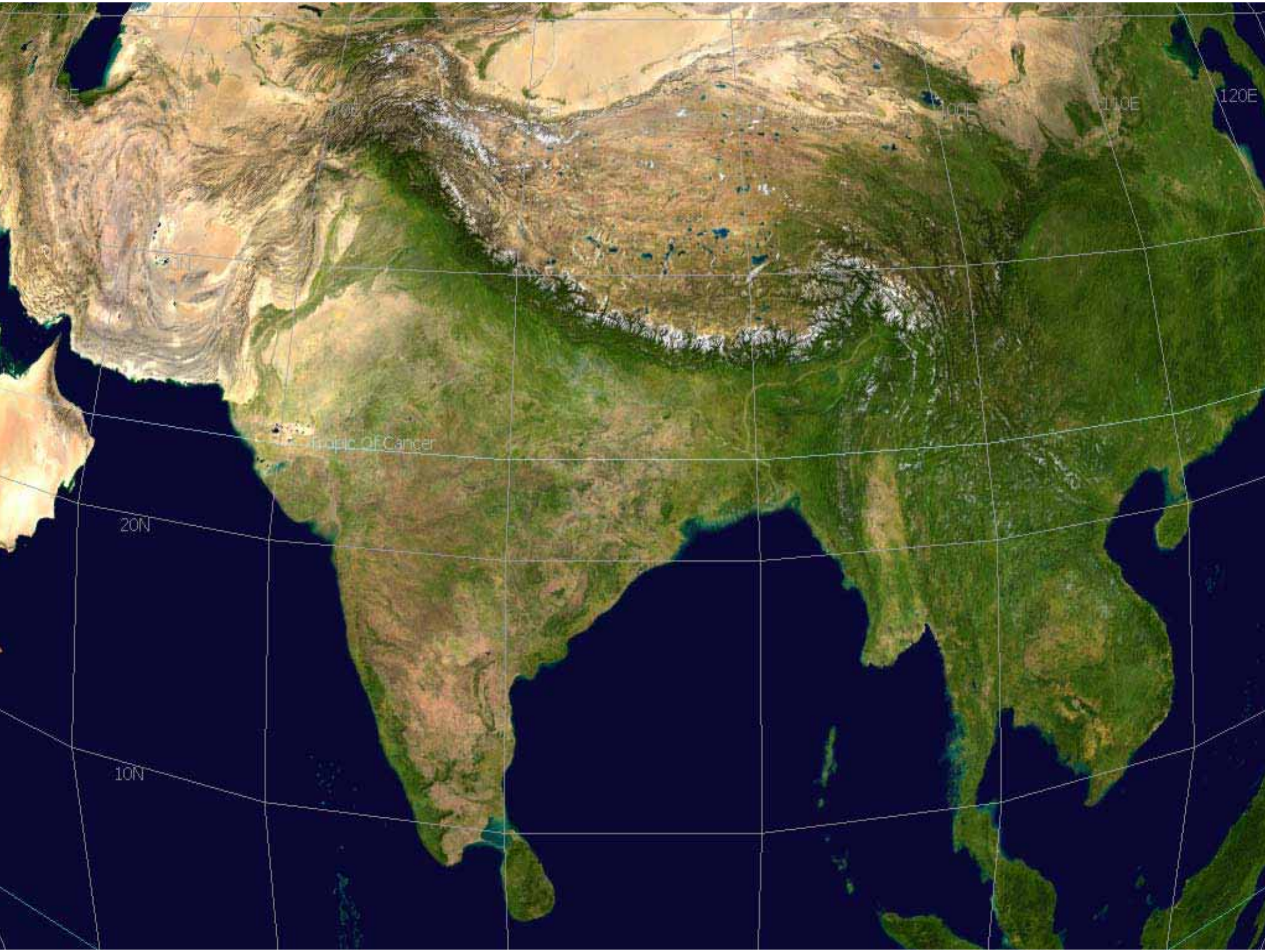
- > environmental restoration of mineland
- > human health and safety
- > reuse of coal combustion products

India under mandate to use 100% by 2012

The Anthracite Region of Pennsylvania



Eggleston et al., 1999
modified from PA
Geological Survey, 1992


Tropic Of Cancer
20N
10N

Silt Deposited from Coal Washing

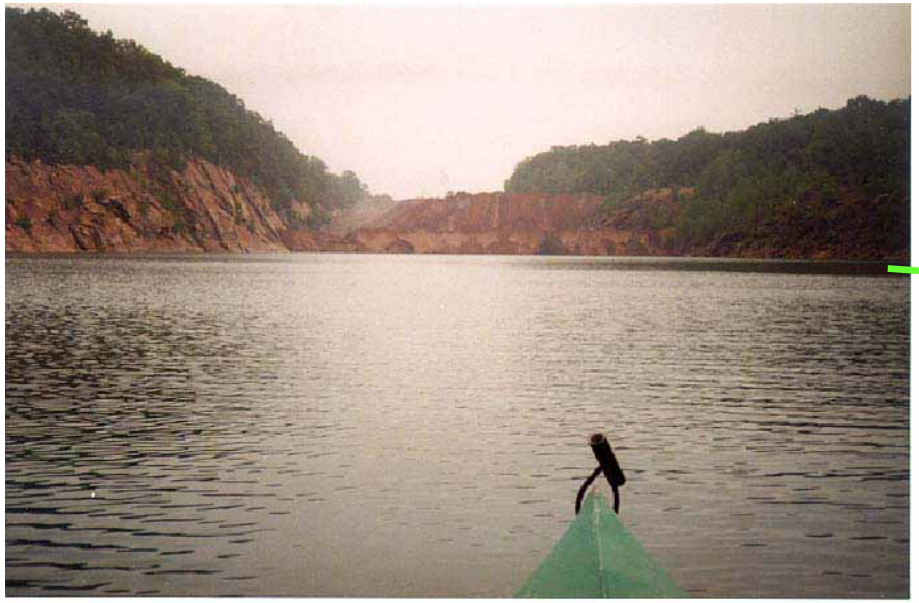
The two sites are equally complex geologic setting

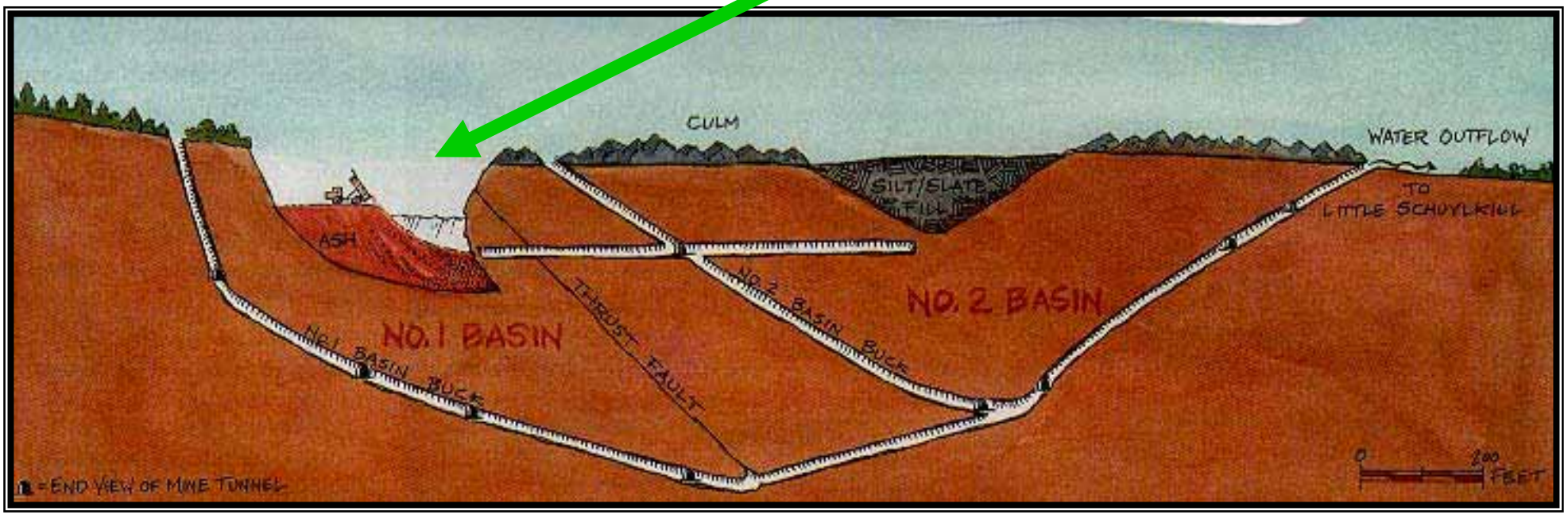
> the Gorilla has an underground component
> Gorbi is larger

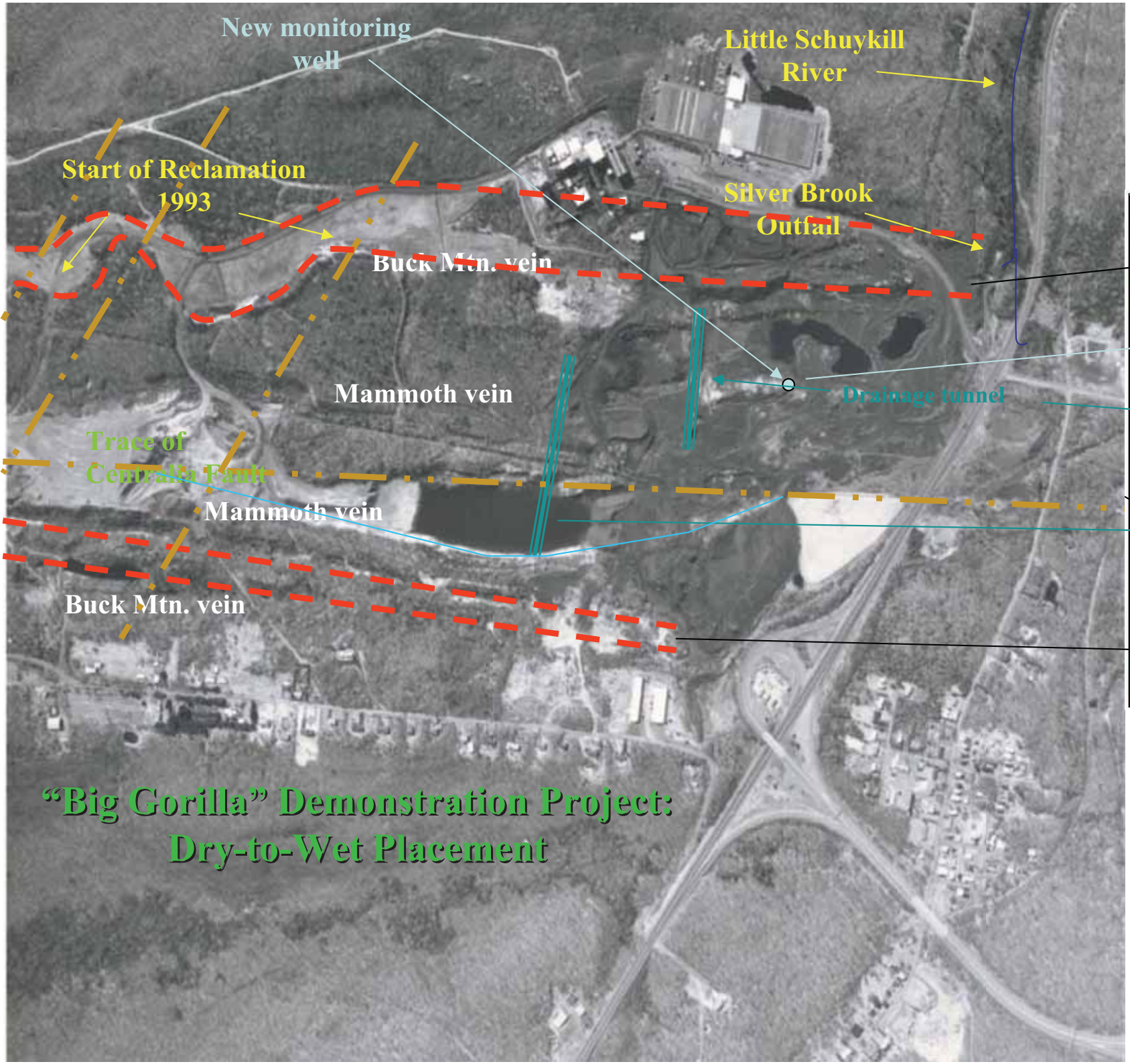
Both sites have bad water reacting with pyrite to generate acid mine drainage

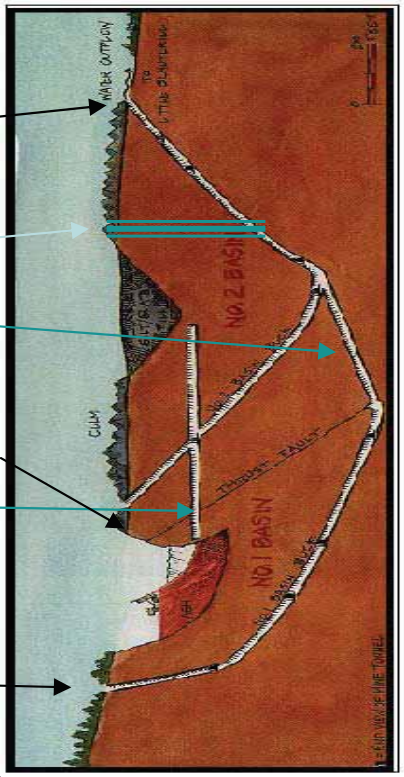
> both have pH 3.8 water
> both have high dissolved iron

Overview of AMD/ash systems

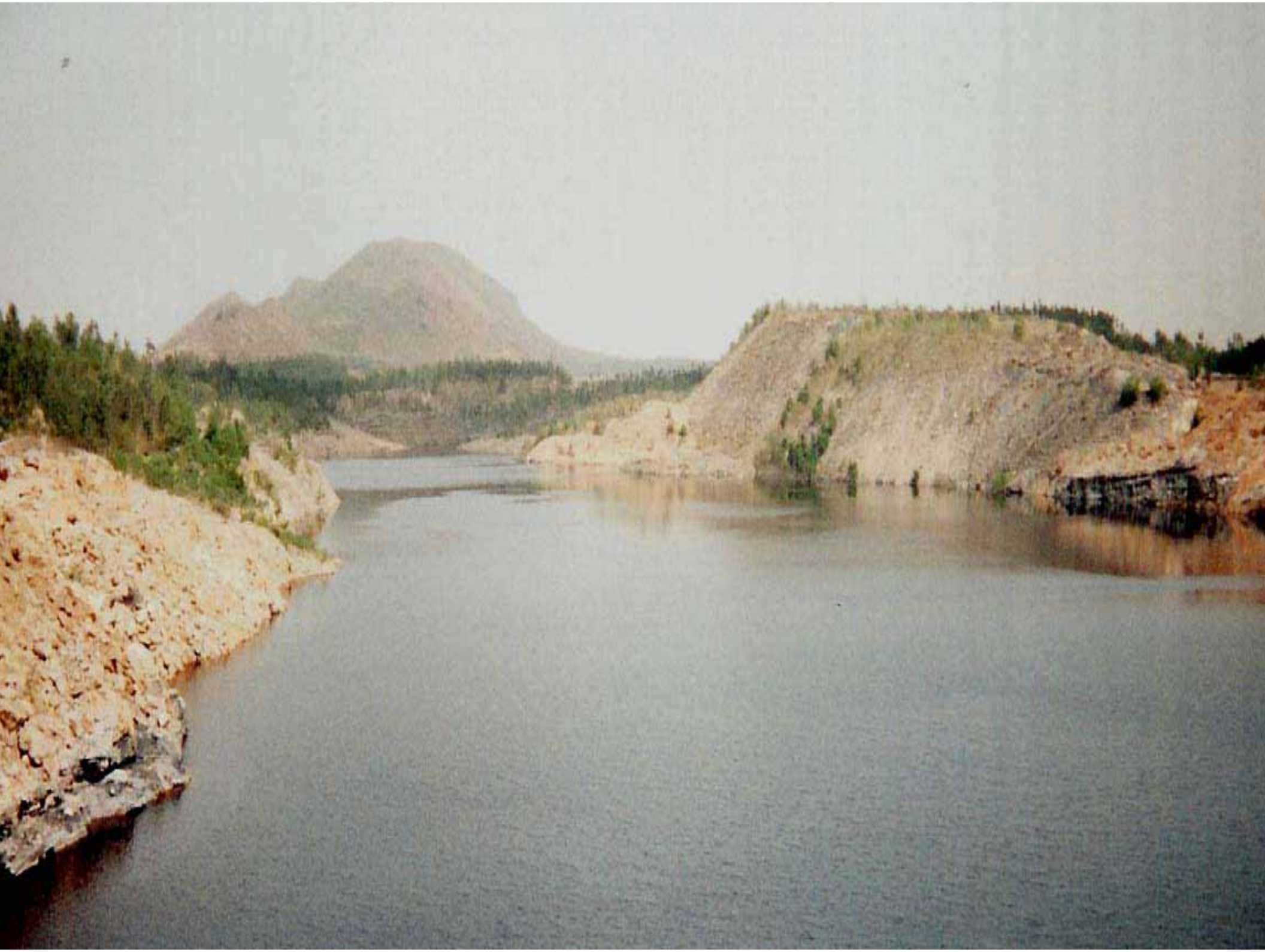





New monitoring well
Little Schuykill River
Start of Reclamation 1993
Silver Brook Outfall
Buck Mtn. vein
Mammoth vein
Drainage tunnel
Trace of Centralia Fault
Mammoth vein
Buck Mtn. vein
"Big Gorilla" Demonstration Project:
Dry-to-Wet Placement


NO.2 BASIN
NO.1 BASIN
THRUST FAULT
CULM


Gorbi
Coal mine
Fly ash
Disposal pond
Singrauli
Super Thermal Power Station
Kaohni



At the Gorilla, the ash was delivered to the site by truck, less than 1.6 Km away

At Gorbi, the ash would need to be delivered by unit trains at distance of 35Km away

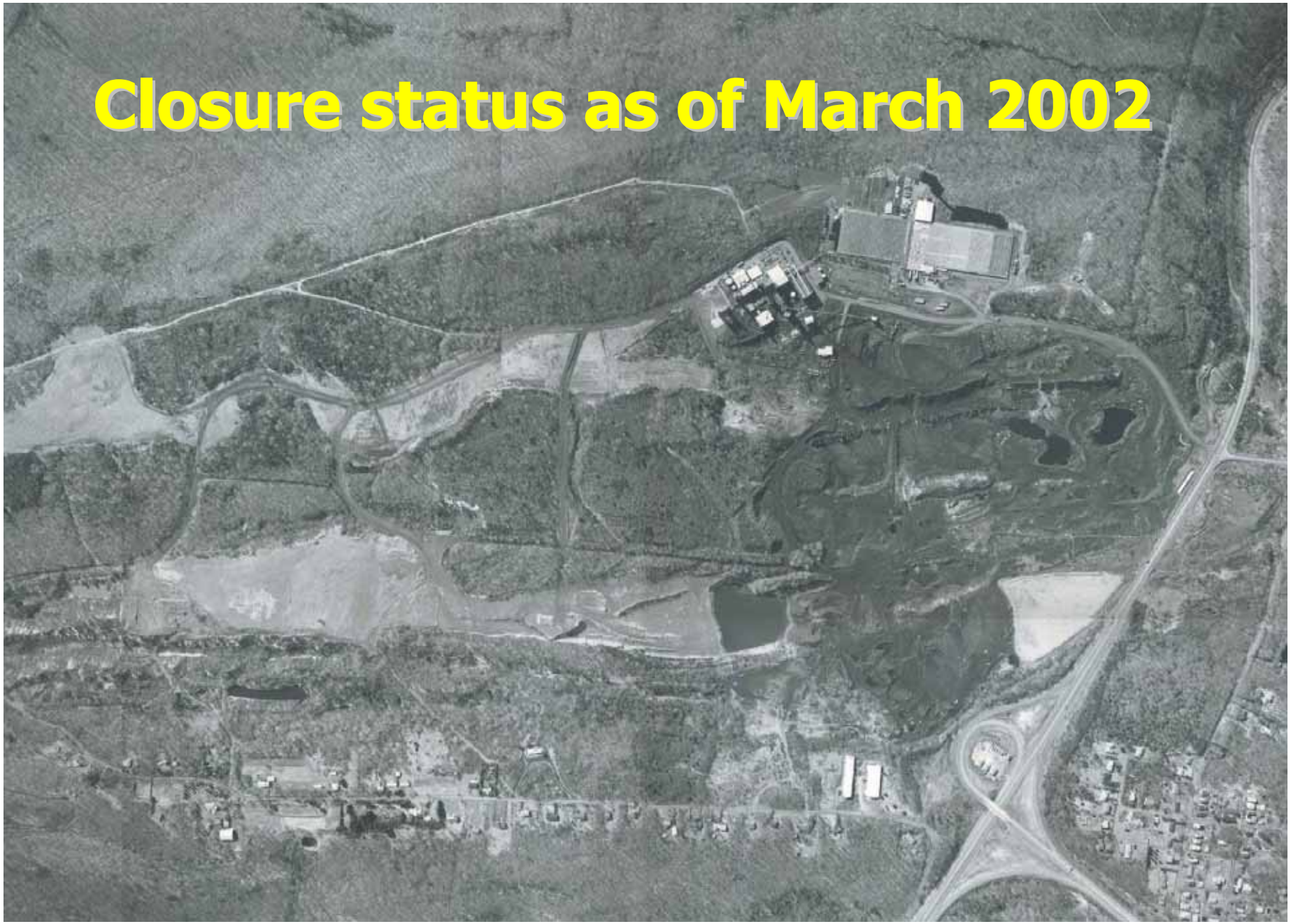

17 10:30AM


Spring 1991

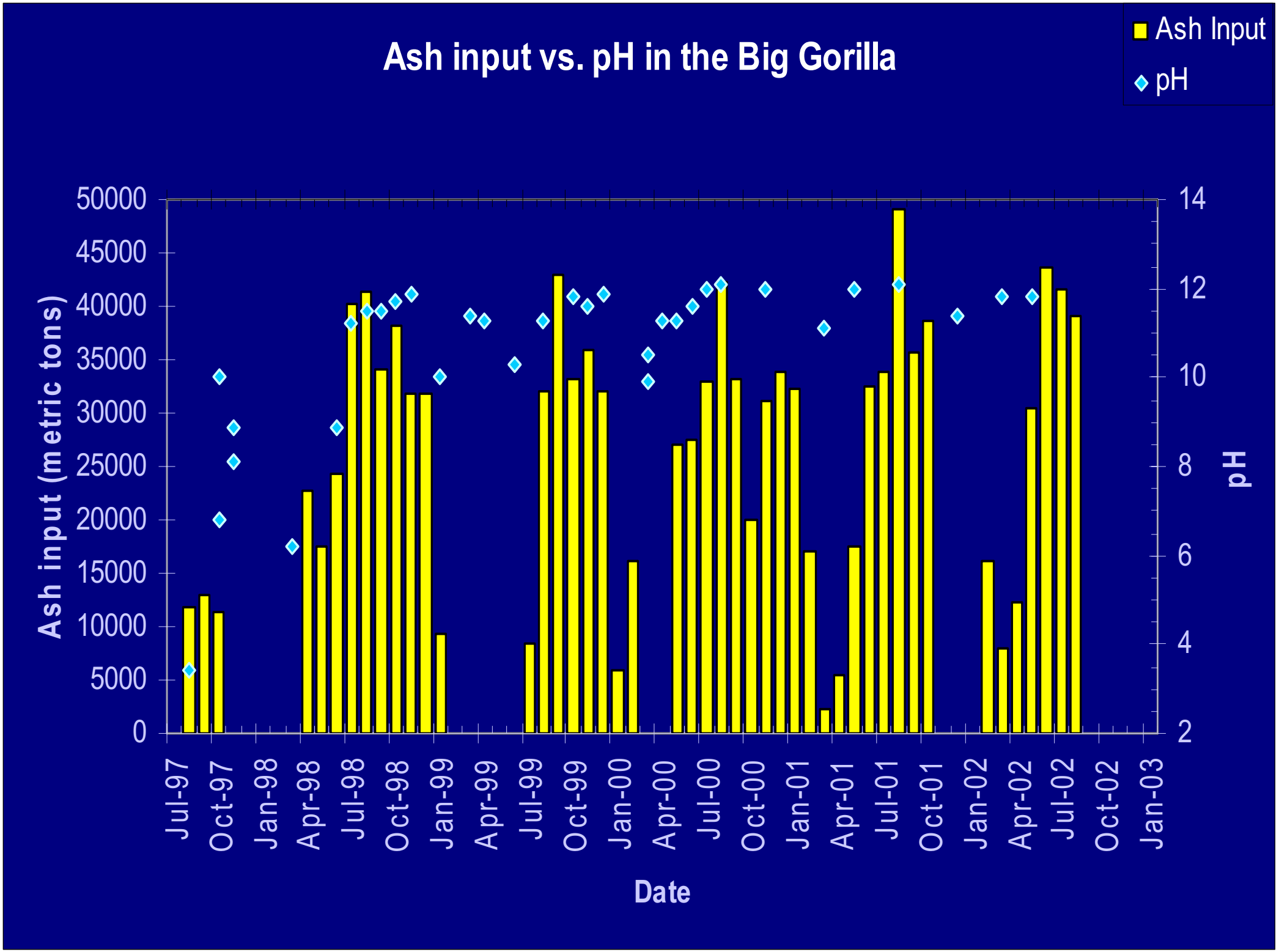

Spring 2001
Ash front

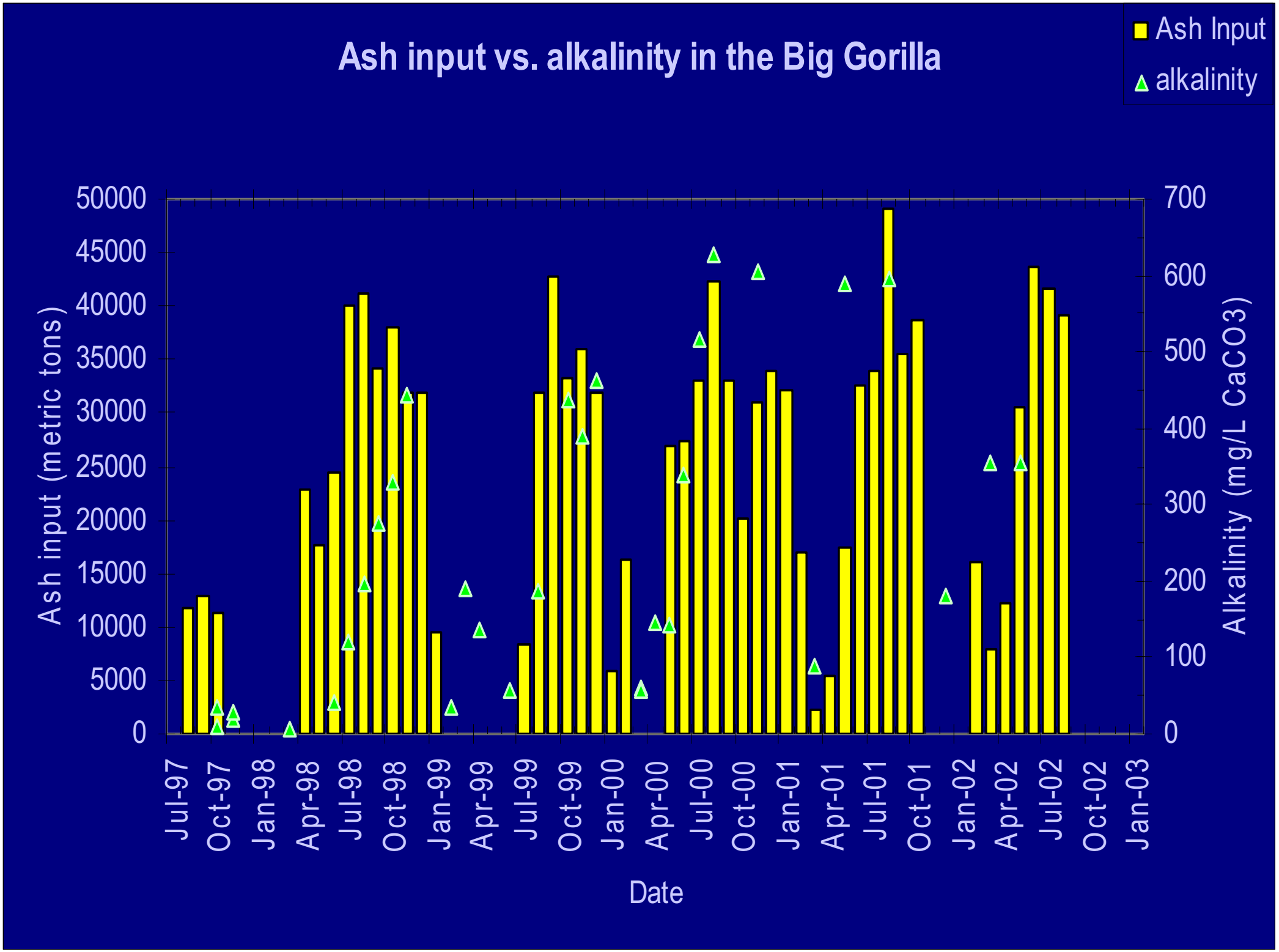

Boreholes
17 11:39AM

Closure status as of March 2002



Status of Closure as of February 2003


Ash input vs. pH in the Big Gorilla
Ash Input
pH
Ash input (metric tons)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
14
12
10
8
6
4
2
pH
Jul-97
Oct-97
Jan-98
Apr-98
Jul-98
Oct-98
Jan-99
Apr-99
Jul-99
Oct-99
Jan-00
Apr-00
Jul-00
Oct-00
Jan-01
Apr-01
Jul-01
Oct-01
Jan-02
Apr-02
Jul-02
Oct-02
Jan-03
Date

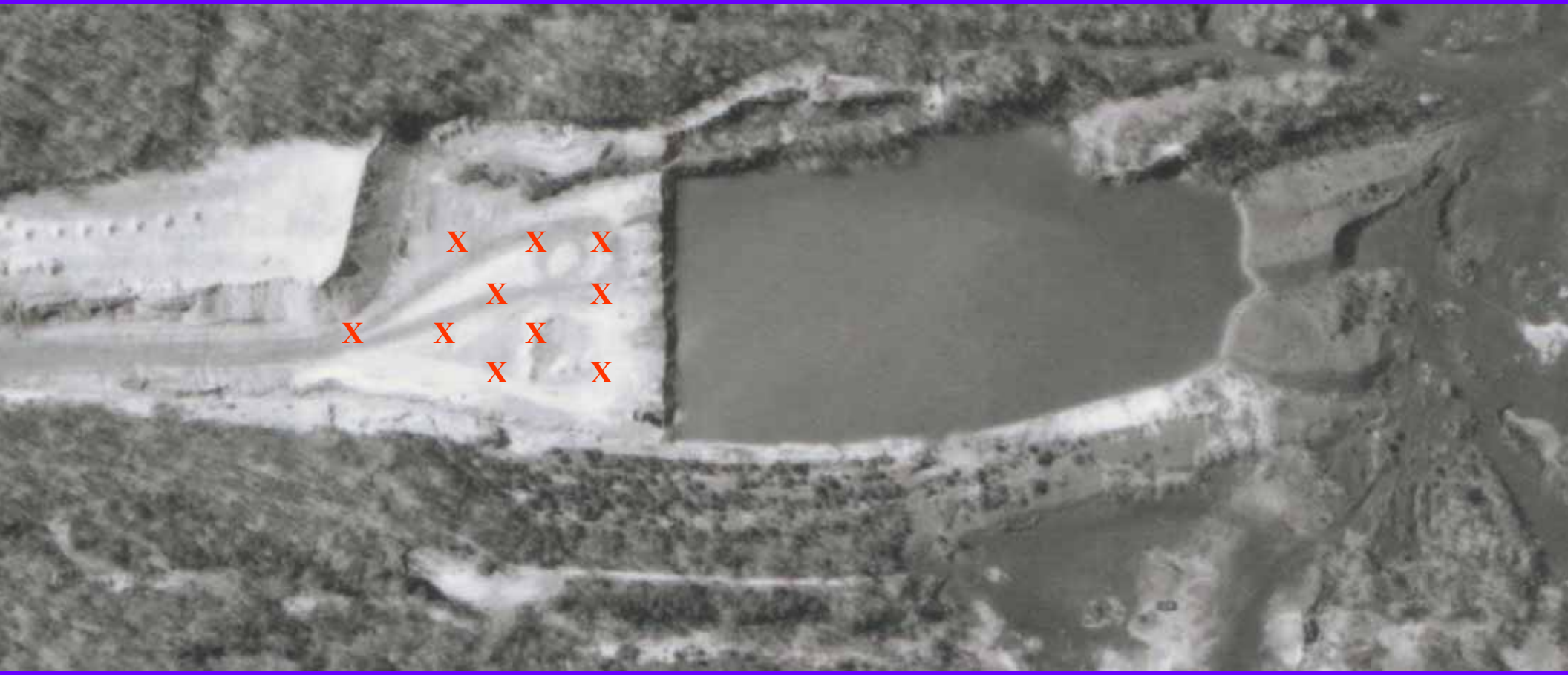

Ash input vs. alkalinity in the Big Gorilla
Ash Input
alkalinity
Ash input (metric tons)
Alkalinity (mg/L CaCO3)
Date
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50000
0
100
200
300
400
500
600
700
Jul-97
Oct-97
Jan-98
Apr-98
Jul-98
Oct-98
Jan-99
Apr-99
Jul-99
Oct-99
Jan-00
Apr-00
Jul-00
Oct-00
Jan-01
Apr-01
Jul-01
Oct-01
Jan-02
Apr-02
Jul-02
Oct-02
Jan-03

Changes in water chemistry

Concentration (mg/L)	6/7/93	7/2/93	10/28/97	10/27/99	8/28/01
Al	3.5	4.2	0.57	0.38	0.41
Fe	0.52	0.40	0.11	<0.020	0.15
Mn	0.71	0.72	0.011	0.010	0.014
Zn	0.22	0.20	0.008	0.052	<0.010

Field Bearing Capacity Testing

[average >10,000 psf]



Status of work completed:

> environmental impact statement

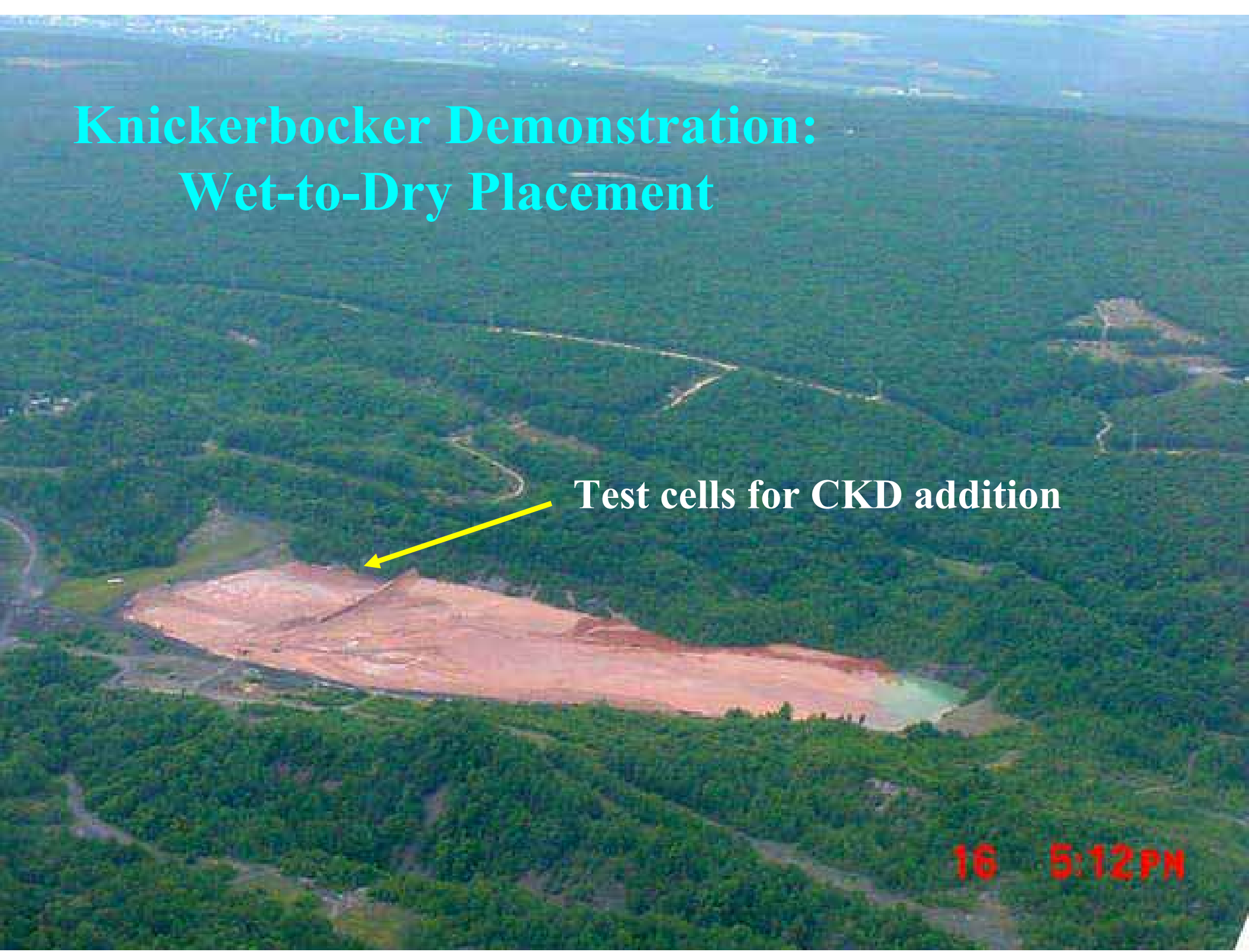
> preliminary design of materials handling at Sangrali

> rail route, unit trains and materials handling

> preliminary materials handling at the Gorbi unloading site

> preliminary materials handling for placement into minepool

Delivery of the ash from the rail unloading facility at Gorbi mine can be facilitated by slurry delivery


Knickerbocker Demonstration:
Wet-to-Dry Placement
Test cells for CKD addition
16 5:12PM

Wet to Dry Placement

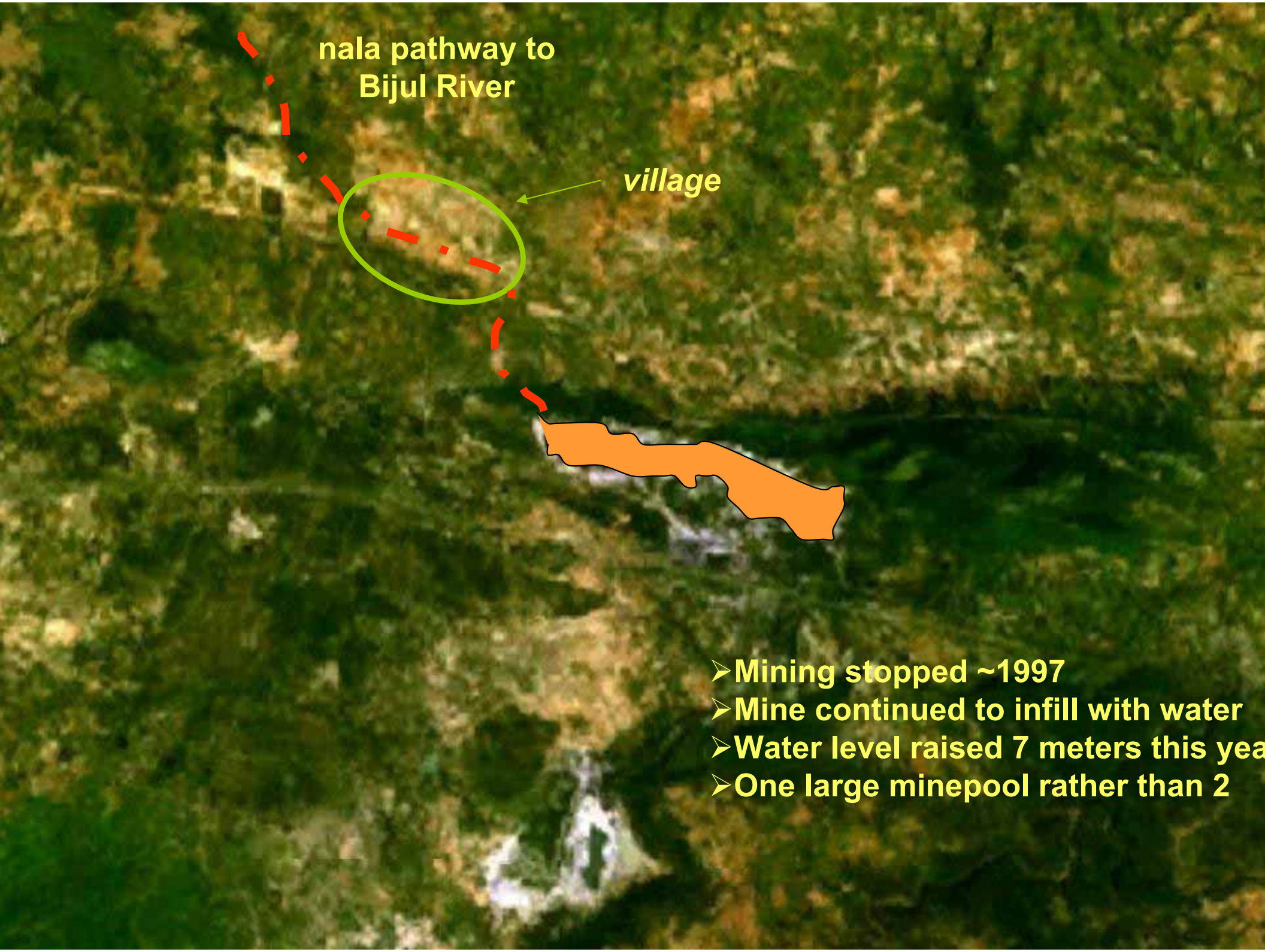
Economics of Ash Handling

Truck transport = $2.65/ton

Belt transport = $1.18/ton

Medium density slurry = $0.06/ton

Progress toward completion of the Gorbi Mine Project has been delayed and the heavy rains this year have completed the inflow of water to the minepool, such that the water level has reached static equilibrium and water is now discharging into the original nala.


nala pathway to
Bijul River
village
➢Mining stopped ~1997
➢Mine continued to infill with water
➢Water level raised 7 meters this yea
➢One large minepool rather than 2


Coal Ash Beneficial Use in Mine Reclamation and Mine Drainage Remediation in Pennsylvania
The Pennsylvania Department of Environmental Protection
Materials Research Institute
coal ash can be safely placed into standing mine pool water !