North Branch Potomac River Mine Pool Assessment Study

(2007 – 2011)

2017 Joint Conference of WV Task Force, ASMR & ARRI

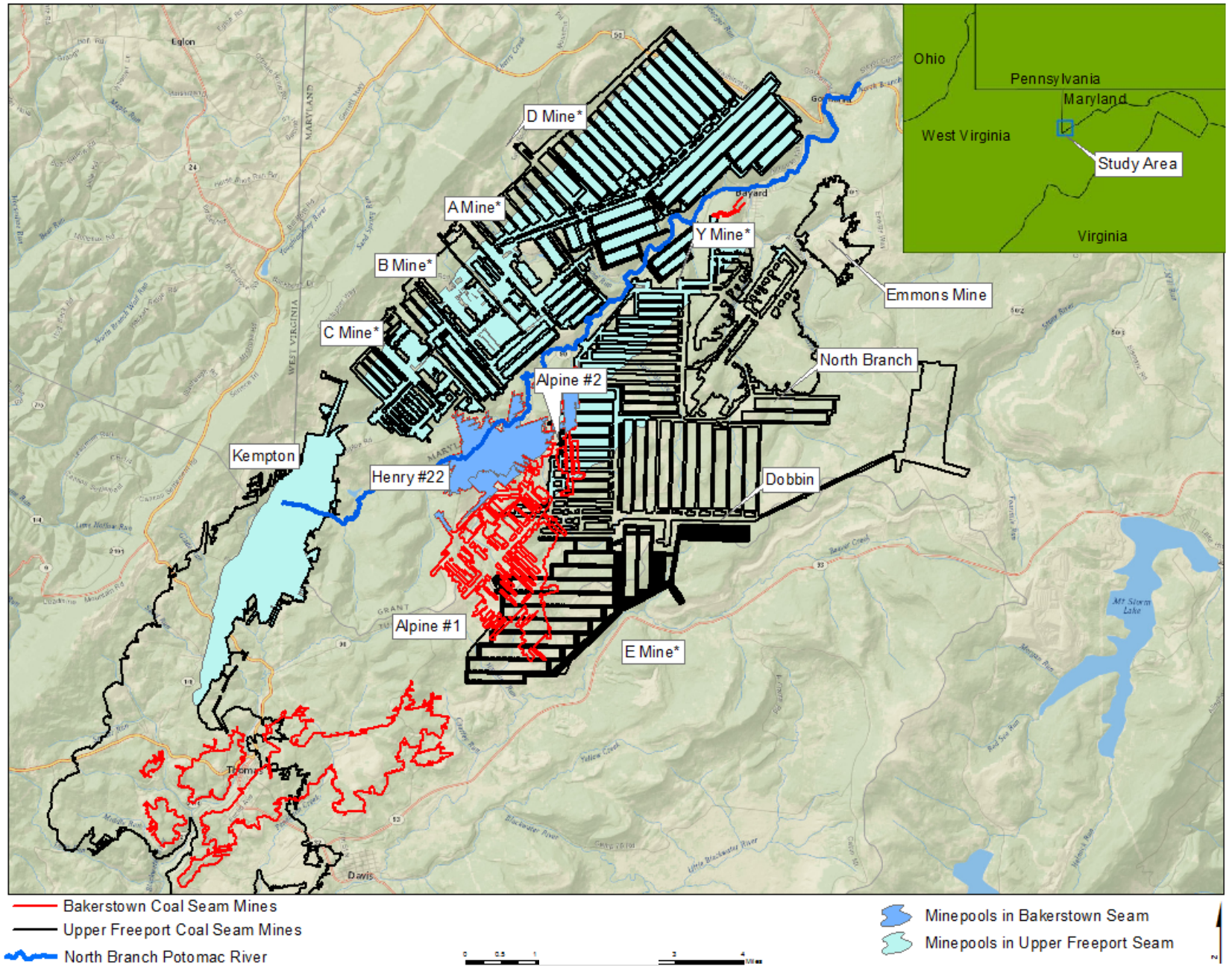
Morgantown, WV

Presenters - Nancy Pointon & Jack Felbinger

Presentation Topics

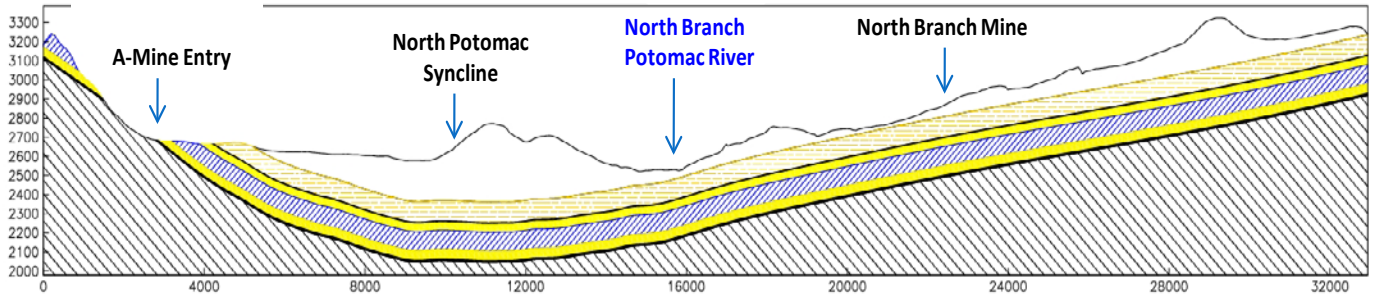
- *Discuss the hydrologic conditions of the mine pools located within the project area at the time of the study.*
- *Discuss the future potential hydrologic conditions of the mine pools if unmanaged.*
- *Provide a simplistic approach to predicting potential future hydrologic conditions of mine pools.*

The study utilized water balance equations and groundwater flow principles to characterize several mine pools in a complex geologic and topographic basin


Ohio
Pennsylvania
Maryland
West Virginia
Study Area
Virginia
D Mine*
A Mine*
Y Mine*
B Mine*
Emmons Mine
C Mine*
North Branch
Alpine #2
Kempton
Henry #22
Dobbin
Alpine #1
E Mine*
Bakerstown Coal Seam Mines
Upper Freeport Coal Seam Mines
North Branch Potomac River
Minepools in Bakerstown Seam
Minepools in Upper Freeport Seam

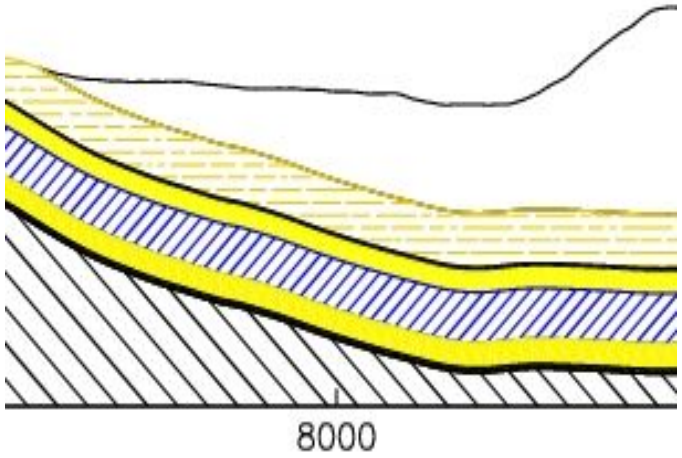
Elevation

Maryland Mines River WV Mines



Distance (feet)

160’-200’



Bakerstown Mudstone
Buffalo Sandstone
Bakerstown Coal
Brush Creek Shale
Mahoning Sandstone
Upper Freeport Coal

D/Y, A,B and C MINE POOLS

UPPER FREEPORT SEAM

Pool is maintained by pumping then directed to treatment facility

Discharge to South Branch Sand Run

Managed by Coal Company

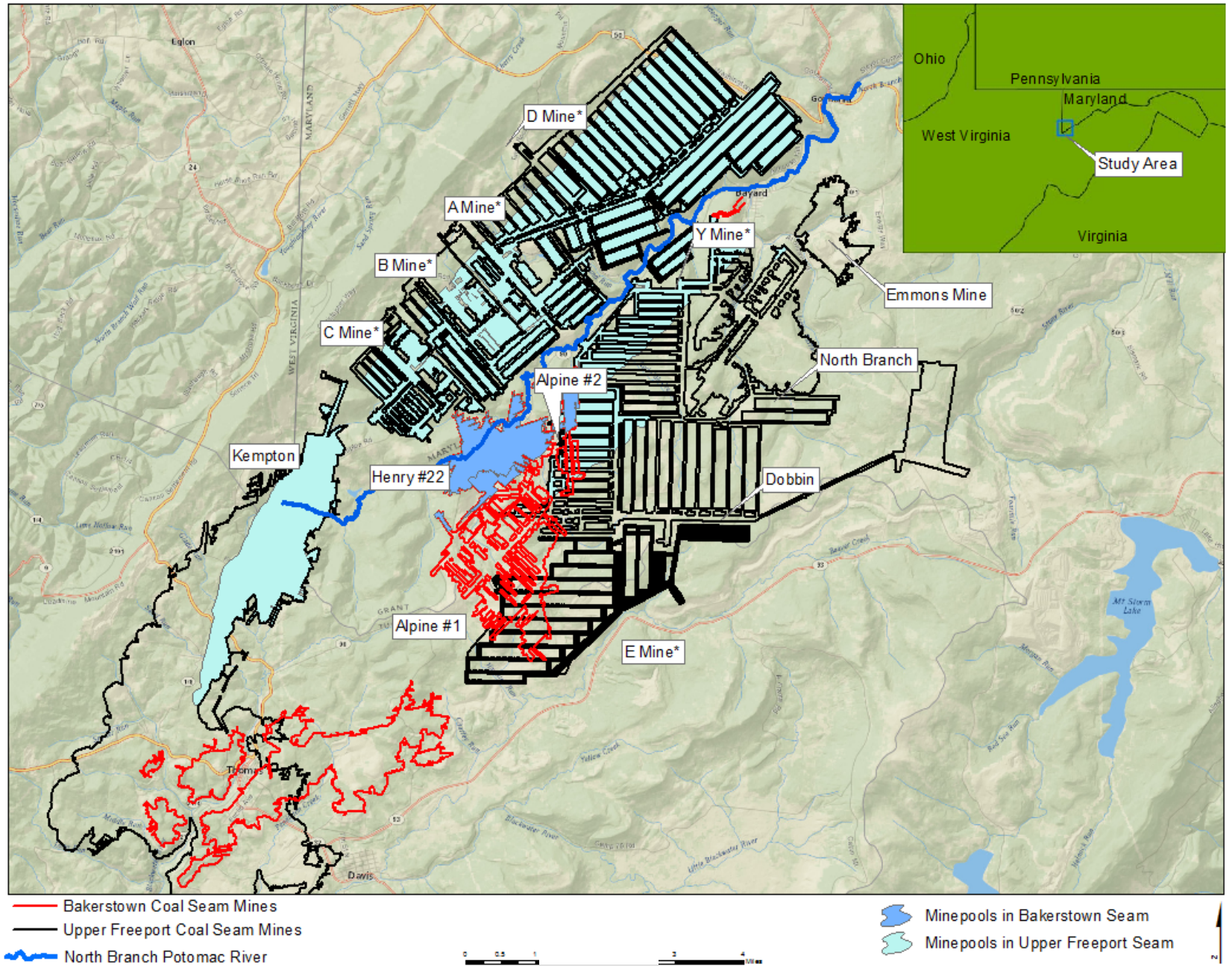
KEMPTON NORTHERN MINE POOL

UPPER FREEPORT SEAM

Flowing Discharges from Borehole and Air Shaft

Treatment at Laurel Run using lime dosers

Managed by Maryland Abandoned Mine Lands Division


Ohio
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D Mine*
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Bakerstown Coal Seam Mines
Upper Freeport Coal Seam Mines
North Branch Potomac River
Minepools in Bakerstown Seam
Minepools in Upper Freeport Seam

EMMONS DISCHARGE

UPPER FREEPORT COAL SEAM

Discharges from free draining underground mine and surface mine

Collected and treated at Bayard Treatment Facility

Managed by Coal Company

NORTH BRANCH UPPER & LOWER POOLS

UPPER FREEPORT SEAM

Pool is maintained by pumping and is part of water collection and transfer scheme at Bayard Treatment Facility managed by Coal Company

ALPINE #1, ALPINE #2, HENRY #22 POOLS

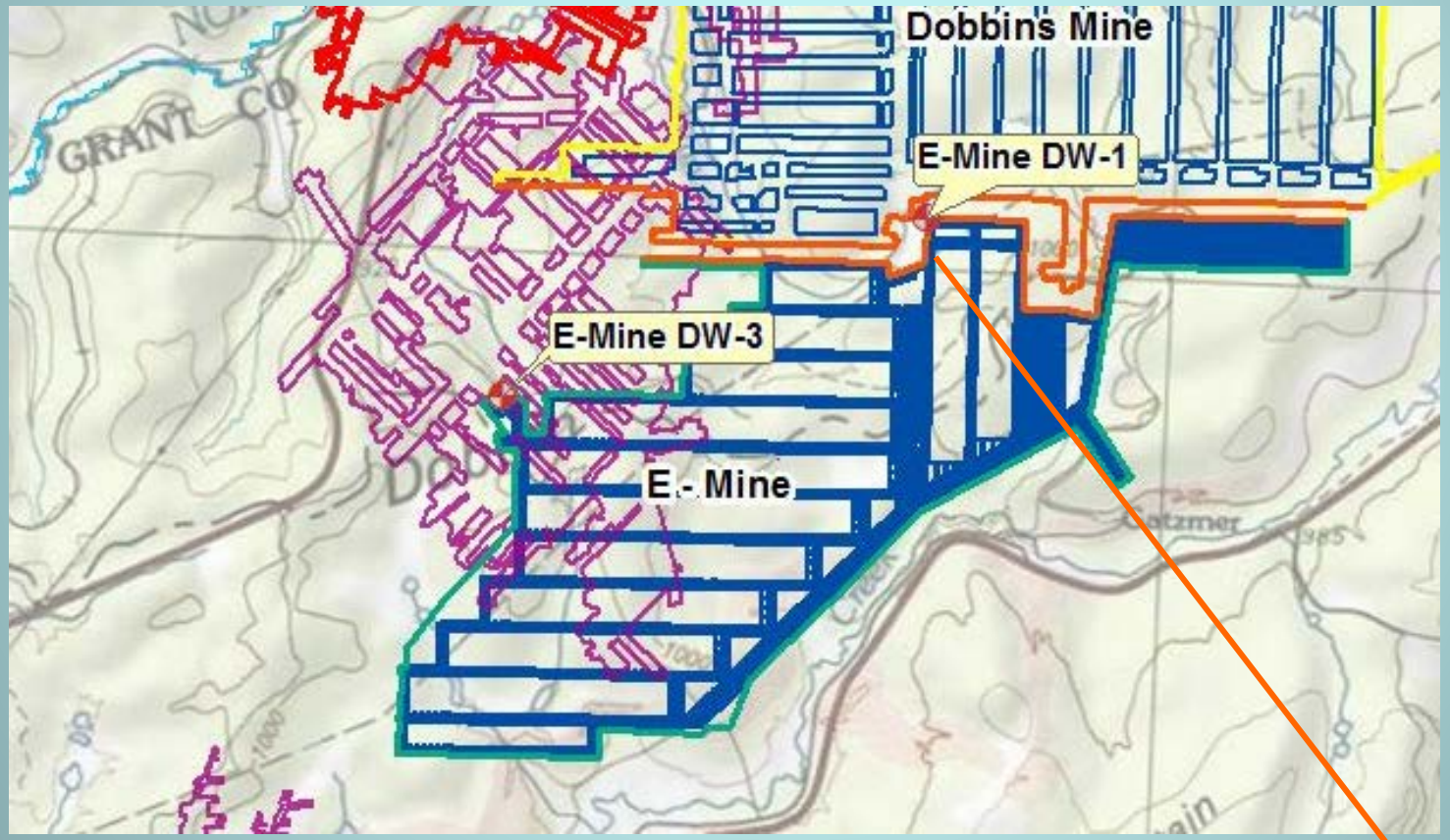
BAKERSTOWN COAL SEAM

Pool is maintained by pumping and is part of water collection and transfer scheme at Bayard Treatment Facility managed by Coal Company

BAYARD TREATMENT FACILITY DISCHARGES TO BUFFALO CREEK

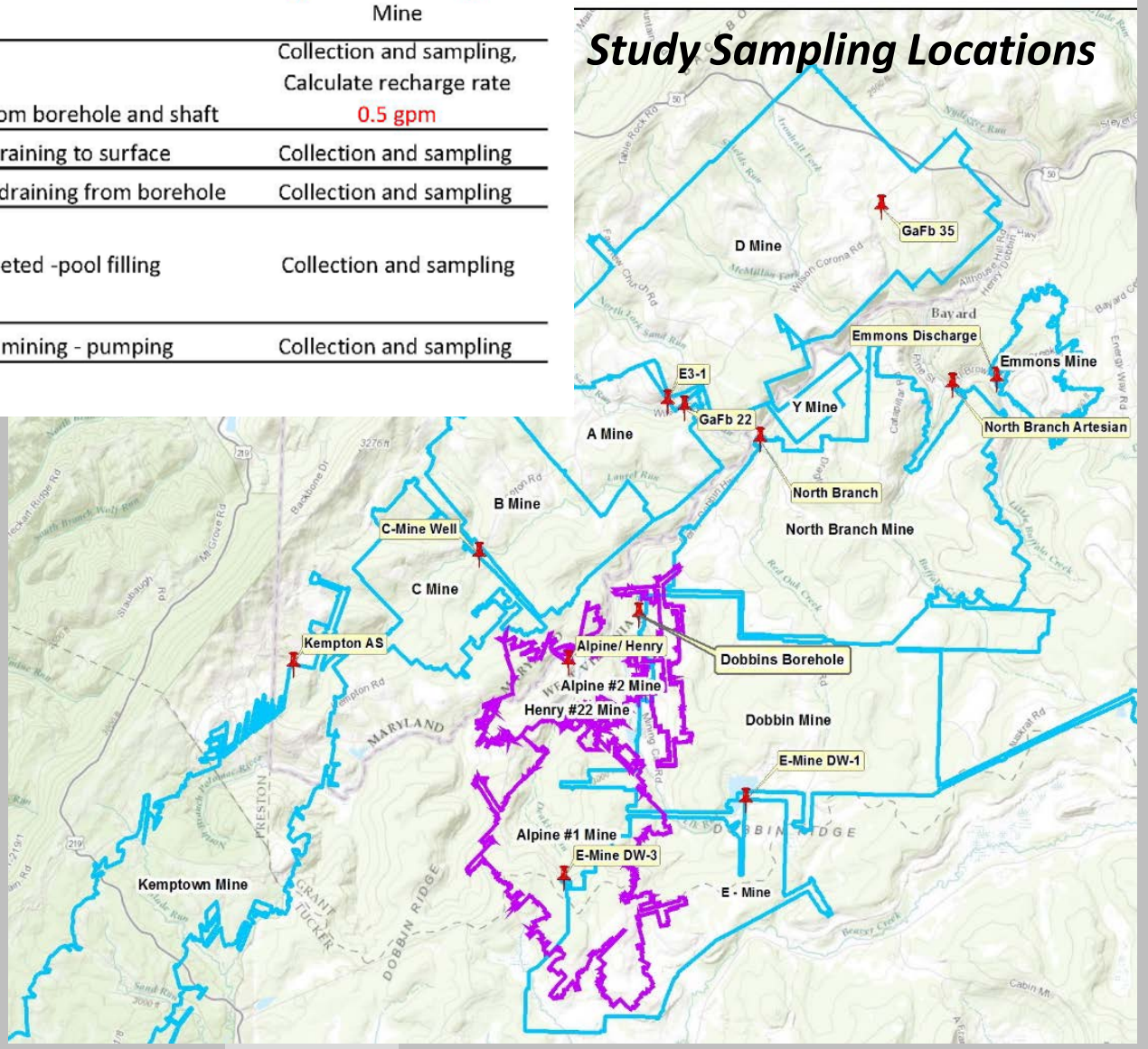
E-MINE

UPPER FREEPORT COAL SEAM
Active longwall mining operations
Pumping to Elk Run Treatment Facility
Managed by Coal Company

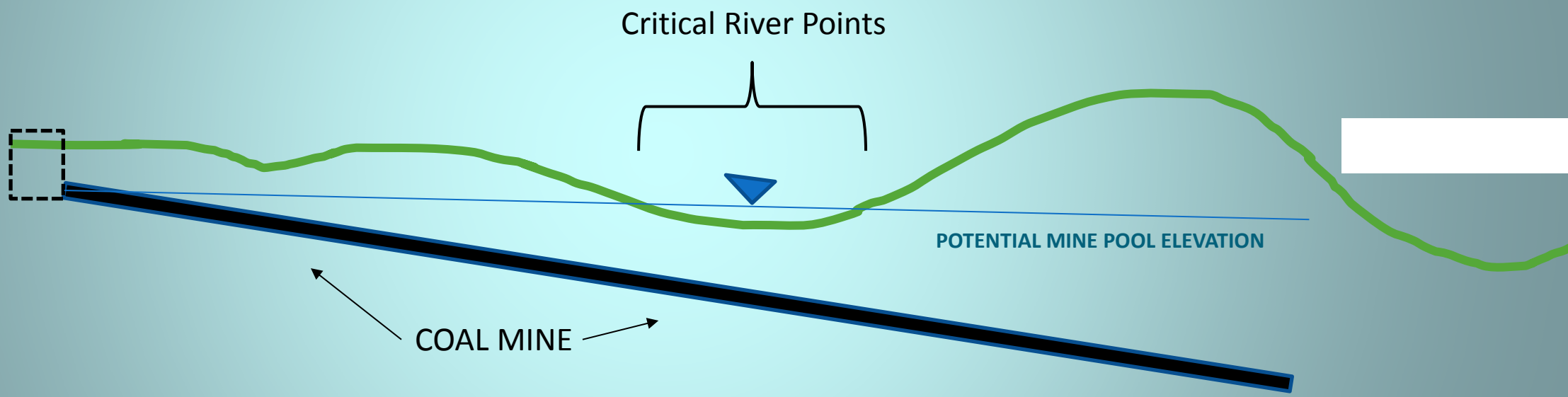


Underground Mines	*Mining Status*	*Mine Pool*
A Mine B Mine C Mine D/Y Mine	Mining completed -pool filling	Collection and sampling, Calculate re-saturation rate 0.7 gpm A-Mine, 0.5 gpm D-Mine
Kempton	Pre-law, draining from borehole and shaft	Collection and sampling, Calculate recharge rate 0.5 gpm
Emmons	Pre-law, free draining to surface	Collection and sampling
North Branch - Upper	Mining completed - draining from borehole	Collection and sampling
North Branch Dobbins Alpine#1,#2, Henry#22	Mining completed -pool filling	Collection and sampling
E Mine	Active longwall mining - pumping	Collection and sampling

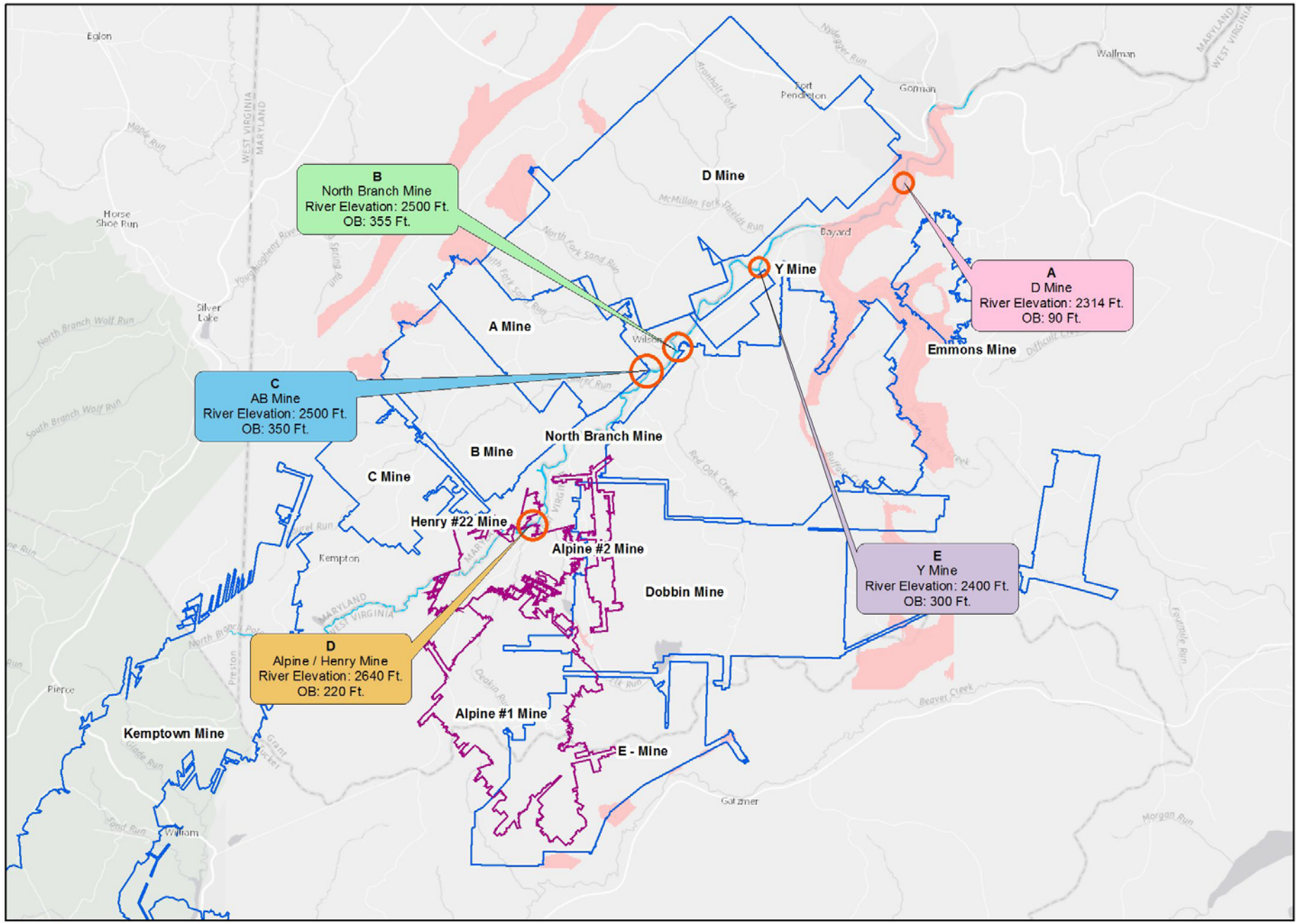
Study Sampling Locations



Predicting Future Potential Risk to the Potomac River
Critical Leak Points at the River

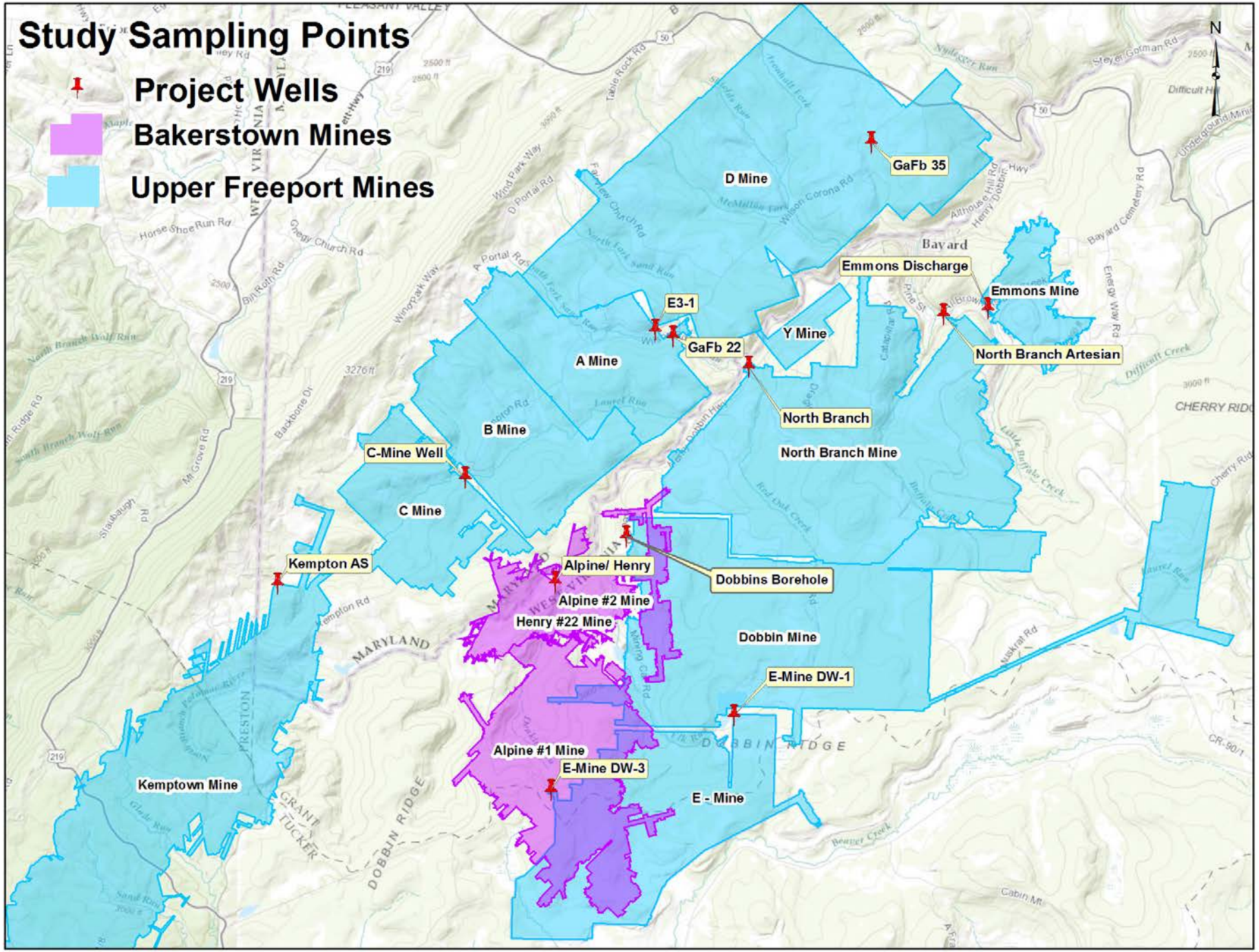


- Knowing the potential mine pool elevation allows you to predict potential leakage areas.


B
North Branch Mine
River Elevation: 2500 Ft.
OB: 355 Ft.
A
D Mine
River Elevation: 2314 Ft.
OB: 90 Ft.
C
AB Mine
River Elevation: 2500 Ft.
OB: 350 Ft.
E
Y Mine
River Elevation: 2400 Ft.
OB: 300 Ft.
D
Alpine / Henry Mine
River Elevation: 2640 Ft.
OB: 220 Ft.
D Mine
Y Mine
A Mine
Emmons Mine
North Branch Mine
B Mine
C Mine
Henry #22 Mine
Alpine #2 Mine
Dobbin Mine
Alpine #1 Mine
E - Mine
Kemptown Mine
Egion
Horse Shoe Run
Silver Lake
Kempton
Pierce
William
Gatzmer
Wallman
Gorman
Fort Pendleton
Bayard
Wilson
Bakerstown Mine Outlines
Upper Freeport Mine Outlines
Overburden < 200 feet
0 0.375 0.
25
3
Miles
N

Future Potential Risk to River

- All current mine pools have a potential to leak or discharge to the river or contribute to adjacent pools which will reach a head elevation greater than the river.
- Leakage from the pools may be directly into the river through existing boreholes or seepage zones.
- Long term monitoring of the pools is necessary to protect the river and determine impacts.


Study Sampling Points
Project Wells
Bakerstown Mines
Upper Freeport Mines
N
GaFb 35
D Mine
Emmons Discharge
Emmons Mine
E3-1
GaFb 22
Y Mine
A Mine
North Branch Artesian
North Branch
B Mine
North Branch Mine
C-Mine Well
C Mine
Kempton AS
Alpine/ Henry
Dobbins Borehole
Alpine #2 Mine
Henry #22 Mine
Dobbin Mine
E-Mine DW-1
Alpine #1 Mine
E-Mine DW-3
E - Mine
Kemptown Mine
Bayard
MARYLAND
DOBBIN RIDGE
CHERRY RIDGE

Piper Diagram for West Virginia Samples

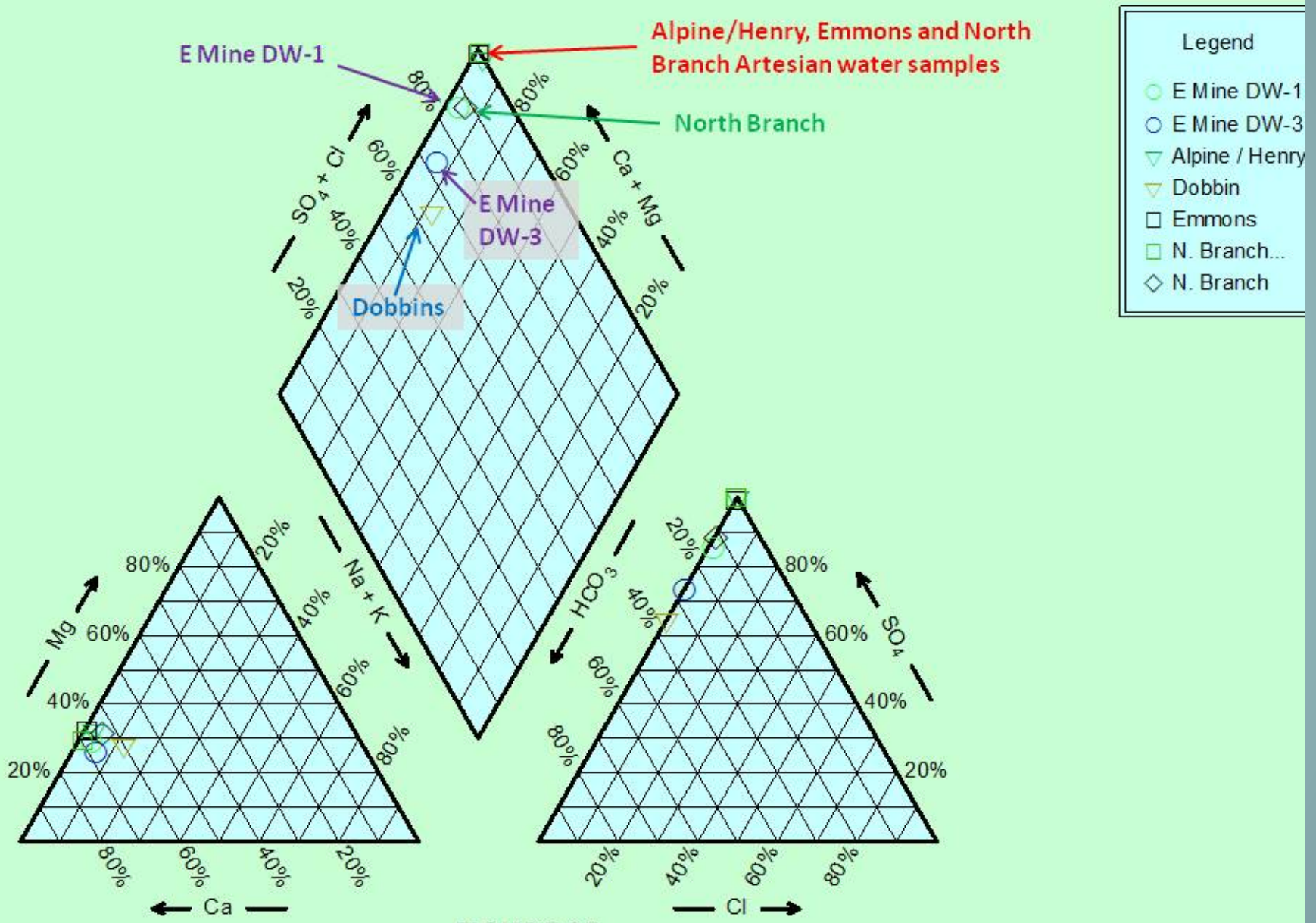


FIGURE 35


Emmons mine discharge and surface water runoff prior to treatment.

Selected Water Quality Data from Upper Freeport mine pools in West Virginia

Mine/Well	Dobbin	North Branch Artesian	North Branch	E Mine Well DW-1	E Mine Well DW-3	Emmons
Date	April 14, 2009	April 14, 2009	April 14, 2009	February 25, 2008	February 25, 2008	April 14, 2009
Iron, Dissolved	6.45	25.4	2.53	0.61	0.37	194
Manganese, Dissolved	1.72	3.42	1.29	0.86	0.19	15.1
Chloride	2	1	3	5	1	4
Fluoride	<0.1	0.3	<0.1	0.2	0.2	<0.1
Sulfate	435	795	590	377	344	1,860
Lab, pH	6.84	3.11	6.32	7.63	8.08	5.5
Specific Conductance	1,170	1,350	1,100	984	967	2,350
Total Dissolved Solids	892	1,070	926	698	666	2,650
Total Suspended Solids	<5	<5	10	42	<5	40
Acidity, Total	-289	180	-75	-46	-125	300
Bicarbonate	302	<5	98	75	159	18
Alkalinity, Total	302	<5	98	75	161	18
Calcium, Dissolved	178	179	175	149	148	428
Magnesium, Dissolved	50.2	46.9	52.2	39	33.7	125
Sodium, Dissolved	36.3	1.5	13	4.2	9.8	3.3
Aluminum, Dissolved	<0.1	11.6	0.3	0.1	<0.1	<0.1

Parameters units are in mg/L except for pH-standard units; specific conductance-µS/cm; bicarbonate, total acidity and alkalinity-mg/L as $CaCO_3$

Piper Diagram for Maryland Water Samples

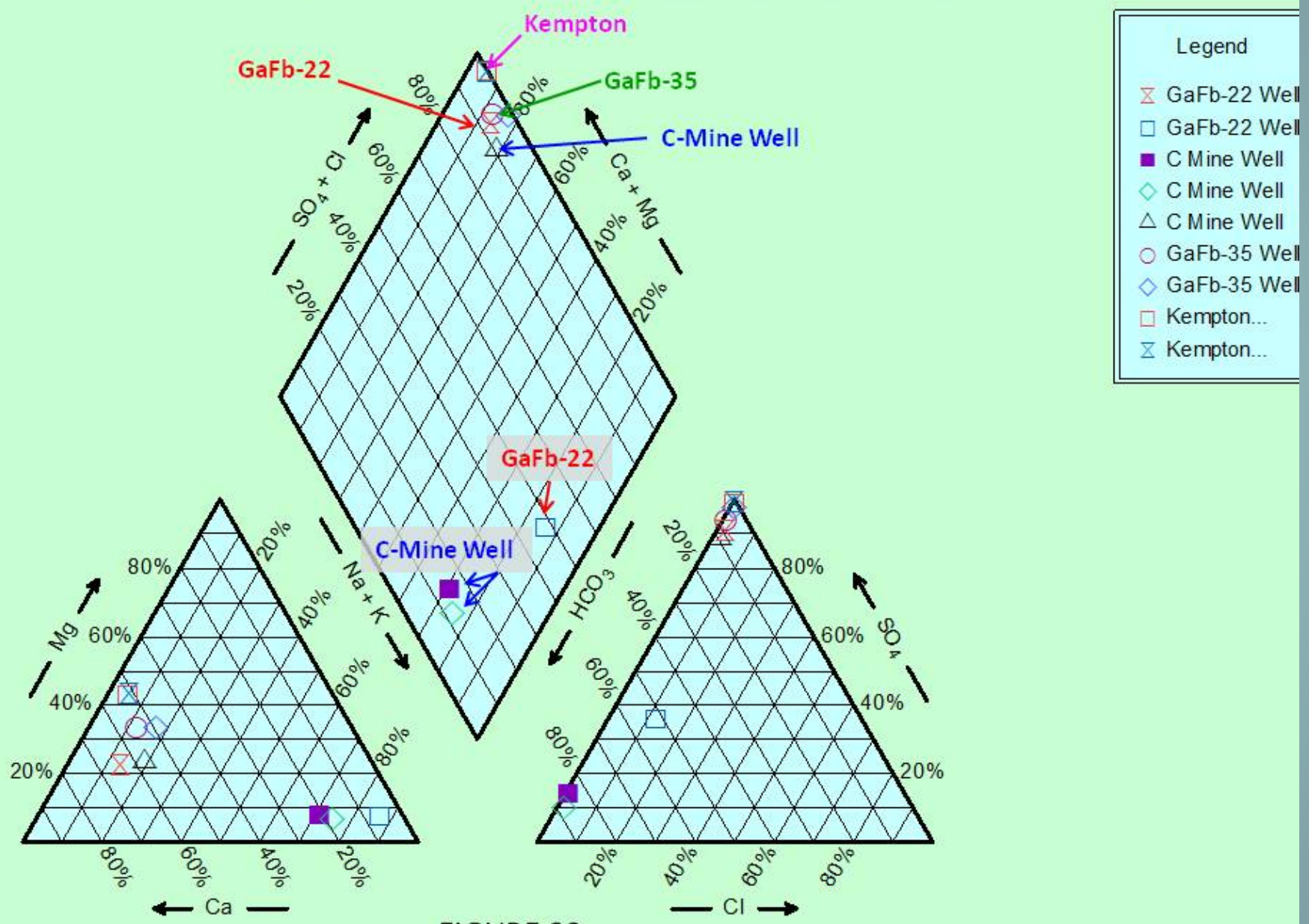
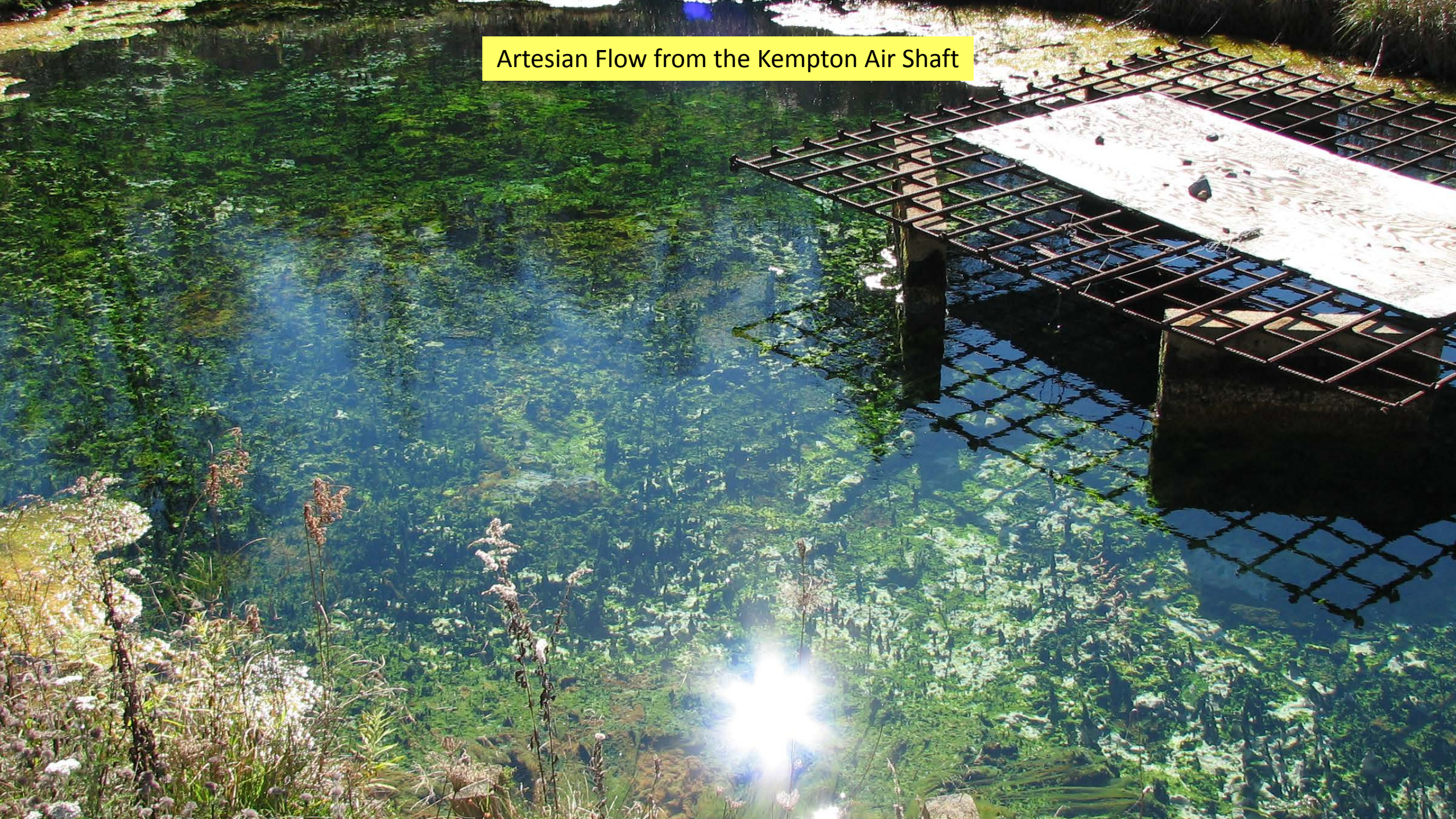


FIGURE 32


Artesian Flow from the Kempton Air Shaft

Selected Water Quality Data from Upper Freeport mine pool wells in Maryland

Well Name	GaFB - 22	C - Mine Well	GaFB - 35	Kempton Air Shaft
Date of Sample	April 18, 2007	May 26, 2010	May 26, 2010	May 27, 2010
Iron, Dissolved	27.8	28.0	72.0	52.2
Manganese, Dissolved	1.68	1.60	1.43	3.19
Chloride	21	28	16	2
Fluoride	0.4	<0.1	<0.1	<0.1
Sulfate	584	1,350	1,690	564
Lab, pH	7.24	7.28	5.90	3.07
Specific Conductance	1,060	2,340	2,560	1,070
Total Dissolved Solids	896	2,170	2,370	862
Total Suspended Solids	1,110	213	73	<5
Acidity, Total	-85	-143	22	260
Bicarbonate	112	181	25	<5
Alkalinity, Total	112	181	25	<5
Calcium, Dissolved	343	343	360	51.9
Magnesium, Dissolved	72.8	84.7	148	26.6
Sodium, Dissolved	76.8	124	133	4.3
Aluminum, Dissolved	<0.1	<0.1	<0.1	25.1

Parameters units are in mg/L except for pH-standard units; specific conductance-µS/cm; bicarbonate, total acidity and alkalinity-mg/L as $CaCO_3$

Selected Water Quality Data from the Alpine/Henry Mine in the Bakerstown mine pool.

Mine	Alpine/Henry
Date	April, 14, 2009
Iron, Dissolved	199
Manganese, Dissolved	5.26
Chloride	3
Fluoride	0.4
Sulfate	1,270
Lab, pH	2.8
Specific Conductance	2,000
Total Dissolved Solids	1,950
Total Suspended Solids	33
Acidity, Total	590
Bicarbonate	<5
Alkalinity, Total	<5
Calcium, Dissolved	201
Magnesium, Dissolved	59.8
Sodium, Dissolved	7
Aluminum, Dissolved	20.3

Parameters units are in mg/L except for pH-standard units; specific conductance-µS/cm; bicarbonate, total acidity and alkalinity-mg/L as $CaCO_3$


DO NOT DRINK
WATER
CAUSTIC ACID

Mine Pool Water Quality
(2007-2010)

- Mine pool water quality varies throughout the mine pools and spatially within the pool.
- Mine pool water varies from acidic to alkaline with high metal concentrations.
- Most mine pool water is calcium-sulfate type water and is stratified in the water column.
- Dissolved trace metal values in the mine pools were below USEPA drinking water standards (exceptions were beryllium, lead and nickel).

Potential Water Quality Risks to NBP River

- Mine pool discharges to the NBP River would increase concentrations of TDS, sulfate and iron.
- Mine pool discharges to the NBP river would potentially increase iron and aluminum concentrations and precipitates in streambed substrate.
- Bakerstown, Emmons and North Branch Artesian mine pool discharges (overland) to the NBP River would be acidic (low pH) water with very high metals and sulfate values.

SUMMARY – FUTURE PREDICTIONS

- The future predictions indicate that managing the mine pool elevations at a pool head below the North Branch Potomac River is critical in the protection of the North Branch Potomac River.
- Without pool management, all existing mine pools located in both West Virginia and Maryland have the potential to either increase the flow through the transfer of water from various mines or directly leak and or discharge into the river.

SUMMARY – FUTURE PREDICTIONS

- Accompanying this leakage is a risk for increased total dissolved solids with accompanying metal concentrations and precipitants to the river.


QUESTIONS?