VALMONT STATION

Groundwater Program and Remedy Evaluation

May 23, 2023 Public Meeting/Open House

WHAT IS CCR? (OR COAL ASH?)

- CCR = Coal Combustion Residuals (or Coal Ash)
- Created when coal is burned to produce electricity
- Similar to ash from a wood burning fireplace
- Comprised of rocks, minerals and other natural materials that cannot be burned
- Contains less than 1% of trace elements, such as metals, which are also found in soil
- Stored temporarily in ponds, disposed in a landfill or recycled for beneficial use

WHAT COAL ASH IS REGULATED AT VALMONT?

- 3 Coal Ash Units
  - 1 Landfill
  - 2 Former Bottom Ash ponds
  - 1 Former Settling Pond
  - All ash has been removed from all ponds

HOW IS COAL ASH REGULATED UNDER FEDERAL LAW?

- U.S. Environmental Protection Agency (EPA) CCR (Coal Ash) Rule
  - Regulated as a non-hazardous solid waste
  - Waste storage requirements
  - Groundwater monitoring
    - To ensure meeting Groundwater Protection Standards (GPS)
    - GPS set to protect people and the environment
    - Exceeding a GPS doesn't mean there is a specific immediate health concern
    - However, additional evaluation and action is needed to meet GPS
    - The area of impacted groundwater that is not meeting GPS is called the 'plume'
  - Corrective Action
    - To clean up groundwater within the plume to meet GPS
  - Closure
    - Close in place with protective cover
    - Close by removal of all coal ash
    - Continued groundwater monitoring

VALMONT GROUNDWATER MONITORING

- We regularly sample and test groundwater in monitoring wells around our coal ash units
- Our test results show levels of some substances in groundwater above GPS
- In this presentation we will discuss
  - What these levels mean
  - What we have done to date
    - We removed all ash from regulated impoundments in 2017-2018
  - Our recommended action plan to address impacts to groundwater from our site
    - Removal and recycling of ash from regulated landfill areas
    - Groundwater extraction and treatment remedy (“Pump and Treat”)

HOW ARE CHEMICALS IN GROUNDWATER MEASURED?

How are chemicals in groundwater measured?

Chemicals in groundwater are typically measured as the mass of the chemical (milligrams or mg) per volume of water (liter or L). This is usually written as mg/L. One mg/L is the same as one part per million (or ppm). To understand this concept of one ppm, think of one tablespoon of salt in an above-ground residential pool, which holds about 4,000 gallons of water.

One mg/L or one ppm is similar to:

1 tablespoon of salt

in an above-ground backyard pool

GROUNDWATER MONITORING 'BASICS'

- Groundwater is sampled from specially designed monitoring wells
- Samples are tested by specialized laboratories certified in methods and procedures
- Background groundwater quality
  - 'Natural' conditions, no potential to be affected by activity at a site
  - Groundwater sampled and tested 'up-gradient' of site activity
  - Natural variability, rock types
- Compliance monitoring
  - Evaluate if groundwater is affected by coal ash landfill and ponds
  - Groundwater sampled and tested 'down-gradient' of the landfill and ponds, at waste unit boundary
  - 'Detection' monitoring – short list of tests, are levels higher than site specific background?
  - 'Assessment' monitoring – longer list of tests, are levels higher than groundwater protection standards (GPS)?
- Corrective Action
  - Steps taken to return levels to below GPS

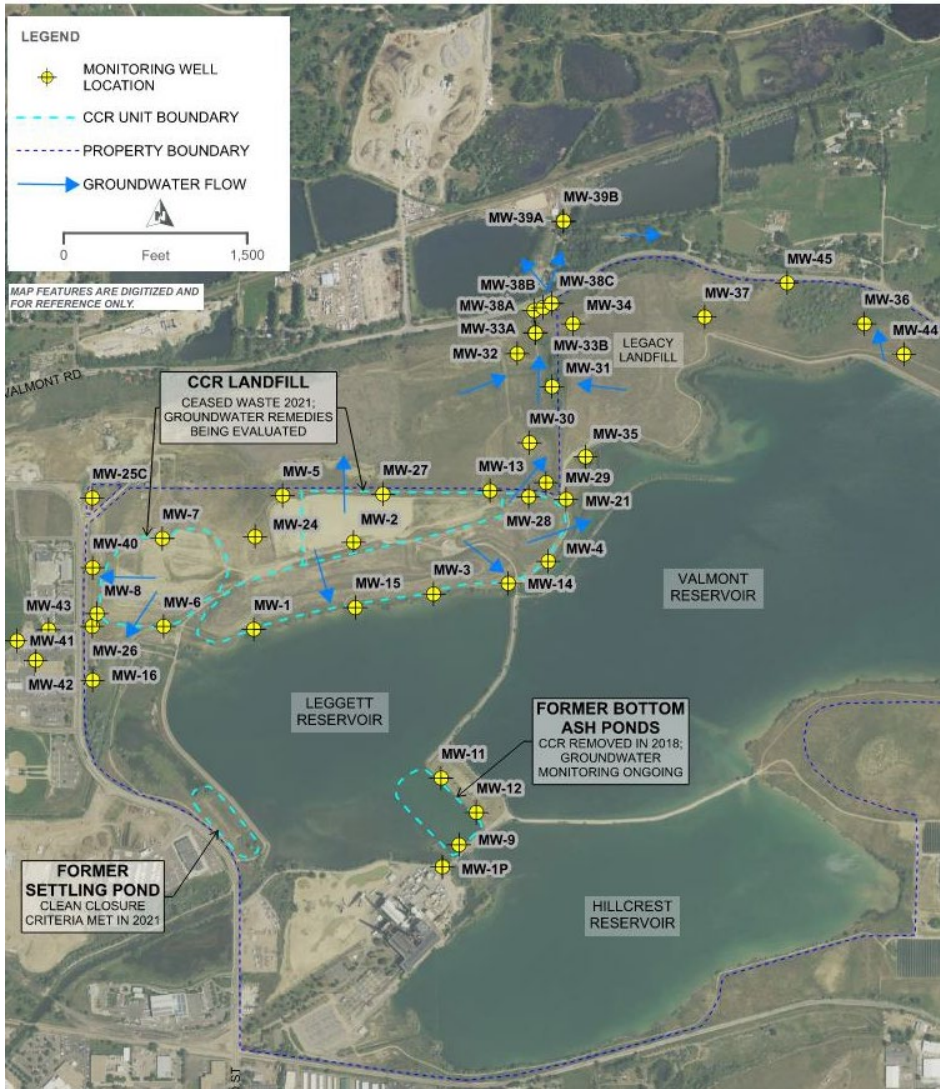
SITE OVERVIEW - 3 REGULATED COAL ASH UNITS

Units regulated by the CCR Rule:

- Landfill:
  - Ceased receiving waste in 2021
  - Interim closure, planned ash removal for beneficial use project
  - Groundwater monitoring ongoing
    - Lithium and selenium (on- and off-site)

- Former Inactive Impoundment (Settling Pond):
  - Closed by removal of all coal ash in 2017
  - Clean closure completed in 2021
  - Groundwater standards met

- Former Bottom Ash Impoundments/Ponds:
  - Removed all coal ash in 2018
  - Groundwater monitoring ongoing
    - Cobalt and molybdenum (on-site)



TIMELINE

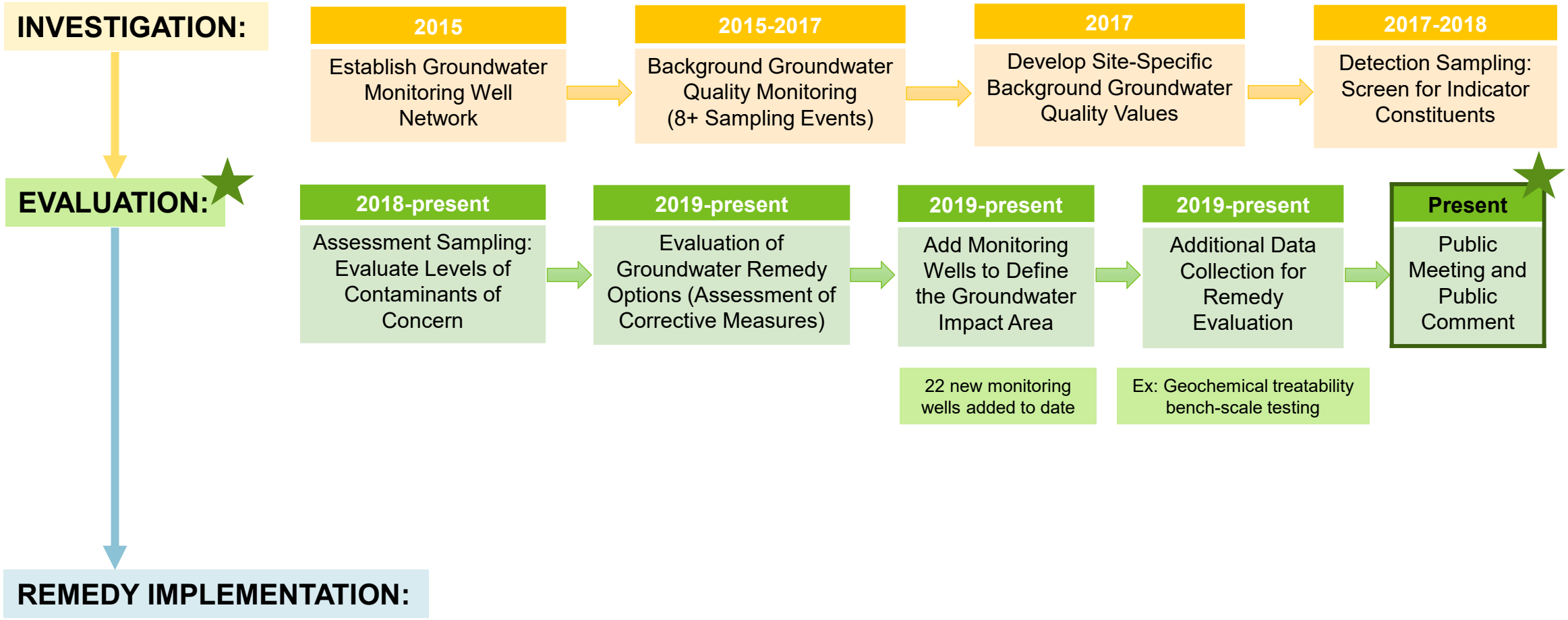
INVESTIGATION:

2015	2015-2017	2017	2017-2018
Establish Groundwater Monitoring Well Network	Background Groundwater Quality Monitoring (8+ Sampling Events)	Develop Site-Specific Background Groundwater Quality Values	Detection Sampling: Screen for Indicator Constituents

EVALUATION: 2018 – Present

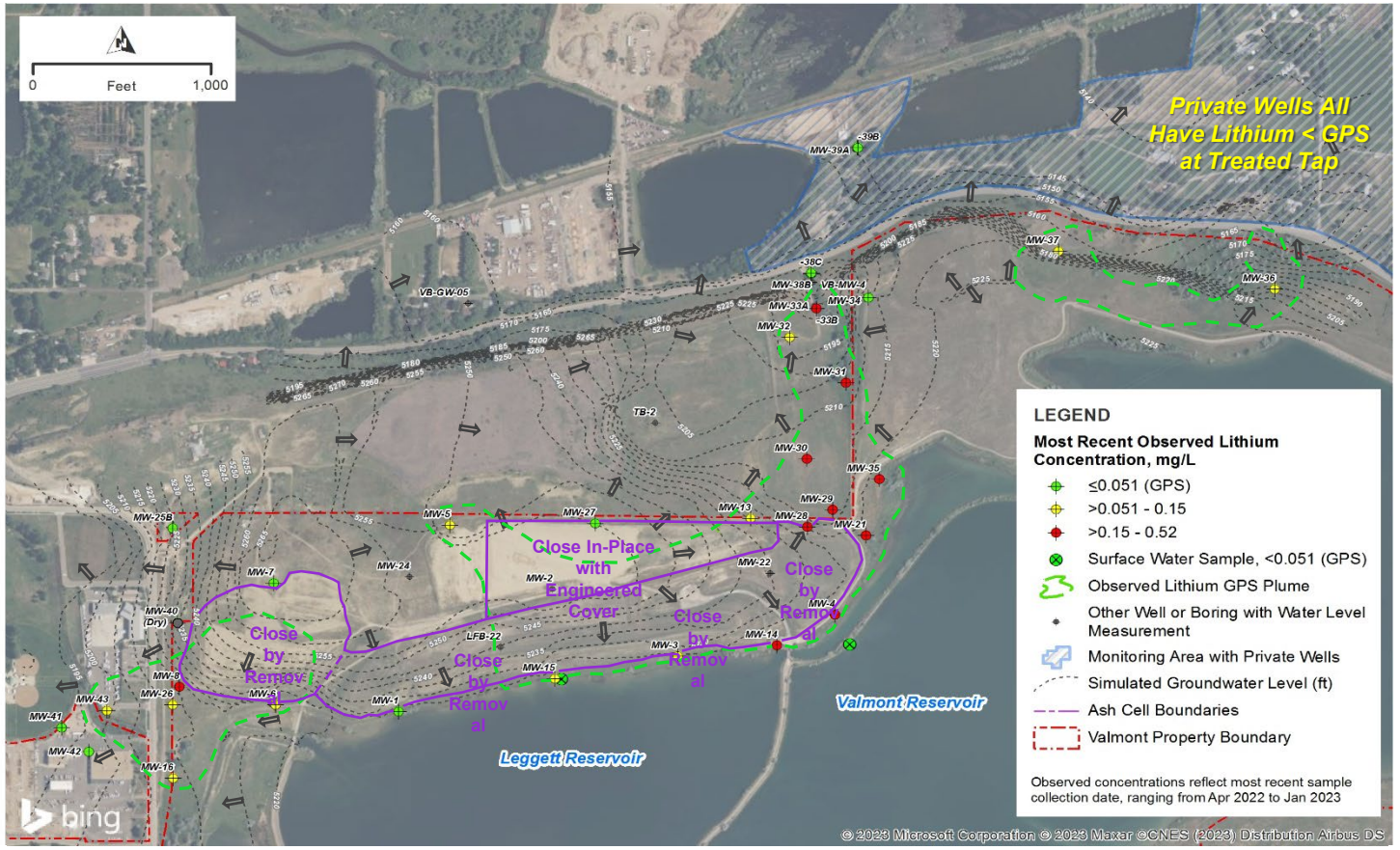
REMEDY IMPLEMENTATION: 2023 +

TIMELINE



LANDFILL: LITHIUM EXCEEDANCES

- GPS = 0.051 mg/L = **Cleanup std**
- Lithium plume onsite
  - Reservoirs < GPS
- Lithium plume offsite northeast
  - No drinking water risk
  - Private wells < GPS at tap
- Lithium plume offsite west
  - No drinking water risk
  - No receptor wells

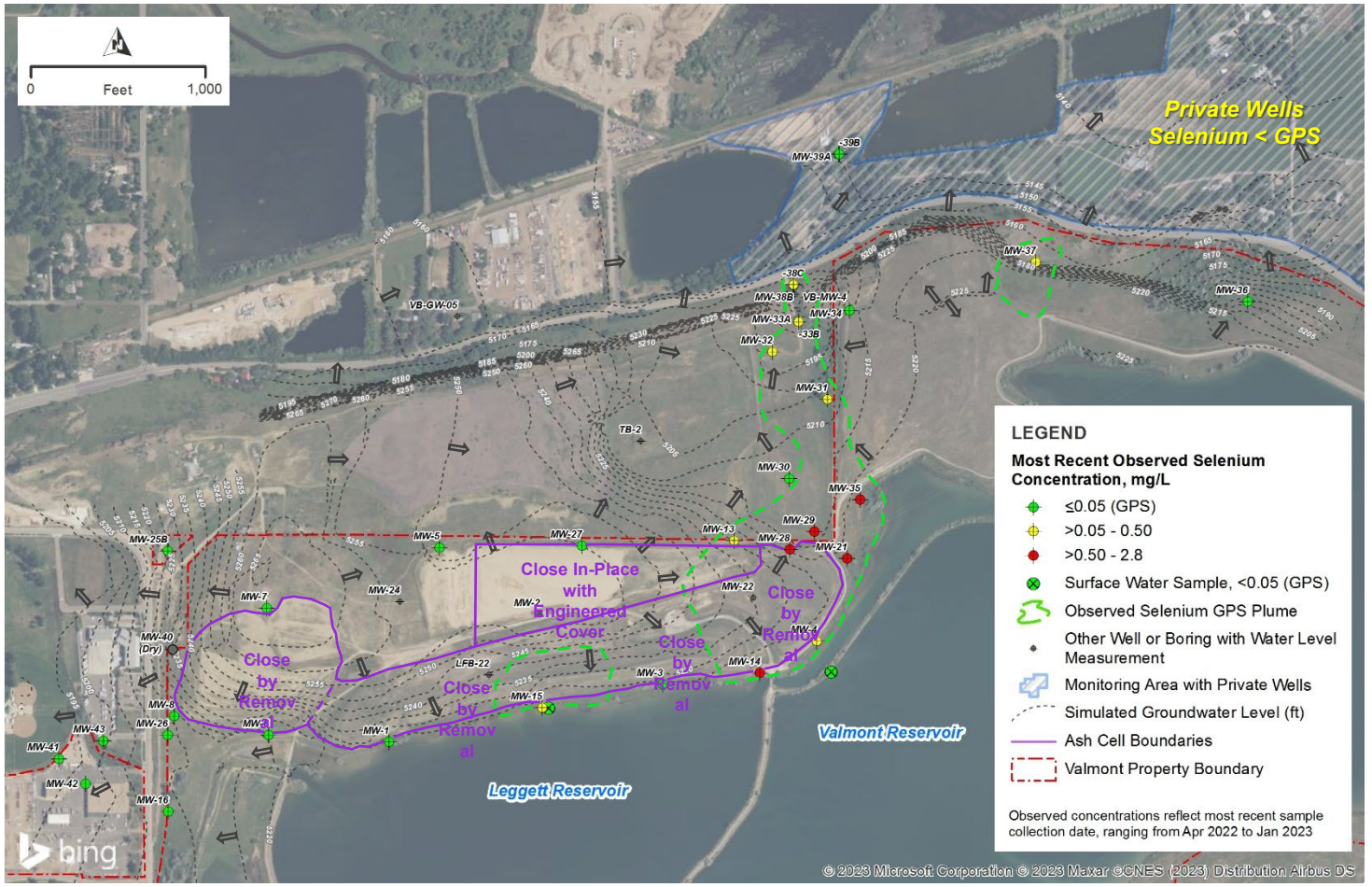


LITHIUM IN THE ENVIRONMENT

- Lithium is present naturally in the environment in rocks, soils, and minerals such as coal.
- Like most substances, lithium can be potentially harmful if very large amounts are ingested
- Nearly everyone is exposed to low levels of lithium every day through
    - the food we eat - cereals, potatoes, tomatoes, cabbage
    - the beverages and water we drink
    - the air we breathe and contact with soils.
- Lithium is the critical component of items we use every day
    - lithium-ion batteries in cellphones, power tools and, more recently, electric vehicles
    - has been used as a sanitizing agent in pools and hot tubs before demand for use in batteries increased
    - used in certain medicines.

LANDFILL: SELENIUM EXCEEDANCES

- GPS = 0.05 mg/L = **Cleanup std**
- Selenium plume onsite
  - Reservoirs < GPS
- Selenium plume offsite northeast
  - No drinking water risk
  - Private wells < GPS



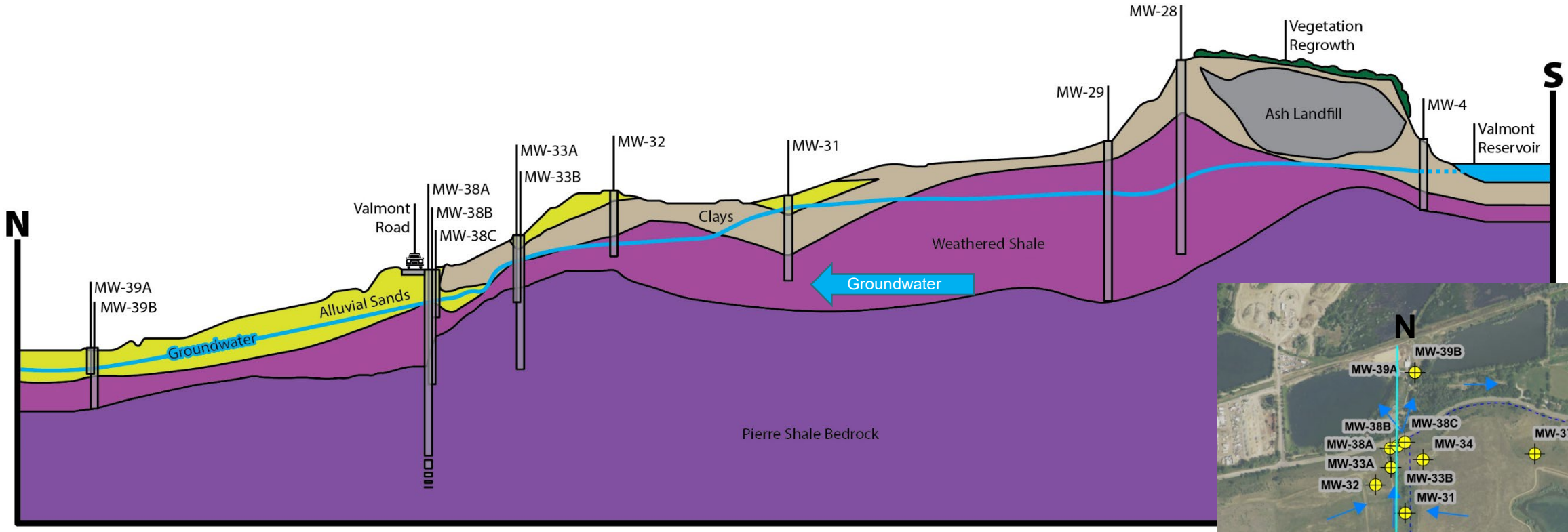
SELENIUM IN THE ENVIRONMENT

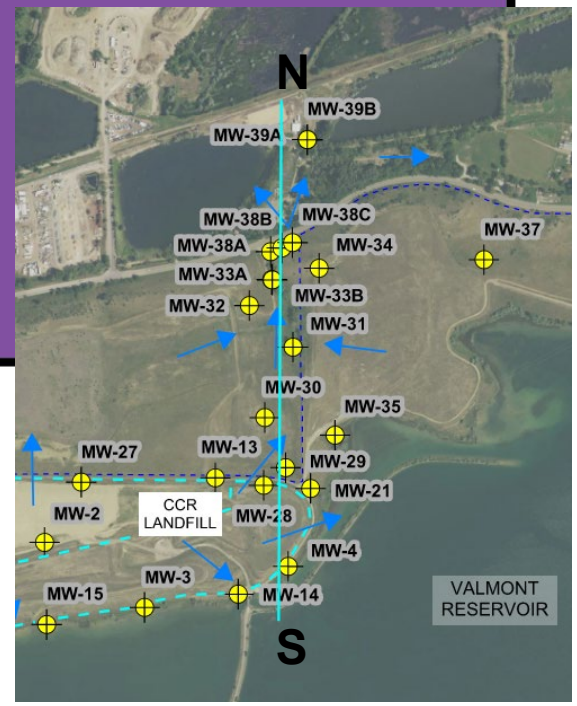
- Selenium is present naturally in the environment in rocks, soils, and minerals such as coal.
- Like most substances, lithium can be potentially harmful if very large amounts are ingested
- Nearly everyone is exposed to low levels of lithium and selenium every day through
    - the food we eat – salmon, tuna, eggs, many nuts and grains
    - the beverages and water we drink
    - the air we breathe
- Selenium is used in a variety of household and consumer products, such as
    - paints, blue-tinted glass
    - personal care products such as
        - the active ingredient in some anti-dandruff shampoos
        - the antioxidant present in many dietary supplements

STATE GROUNDWATER REGULATIONS

- **Dept of Public Health and Environment – Solid Waste Regulations**
  - Similar but separate program – Landfill only - groundwater monitoring, clean-up and closure
  - Potential constituents above State standards
    - Boron (agricultural standard)
    - Fluoride (agricultural standard)
    - Total dissolved solids (contains more minerals, affects taste, considered ‘hard’ water)
  - Assessment of Corrective Measures Report (ACMR) will be submitted to State in June
    - State review prior to public notice
    - 30-day public comment period
    - Review and consideration of public comments
  - Remedy selection and implementation – expected to be the similar to Federal

LANDFILL GEOLOGY AND GROUNDWATER





Understanding the geology and groundwater allows us to design a remedy for how to capture and treat impacted groundwater moving offsite in the area between Valmont Road and the ash landfill.

LANDFILL REMEDY EVALUATION CRITERIA

Assessment of Corrective Measures - 2 Categories of Remedy Alternatives:

1. Ash focused
2. Groundwater focused

Alternatives reviewed for the following Criteria:

- Effectiveness
- Performance and reliability
- Ease or difficulty of implementation
- Potential impacts (safety, cross-media impacts, residual contamination exposure)
- Timeframe to begin the remedy
- Timeframe to complete the remedy
- Institutional requirements (i.e., state/local permits)

TIMELINE

EVALUATION:

2018-present
Assessment Sampling: Evaluate Levels of Contaminants of Concern

2019-present
Evaluation of Groundwater Remedy Options (Assessment of Corrective Measures)

2019-present
Add Monitoring Wells to Define the Groundwater Contaminant Plume & Refine Site Model

2019-present
Additional Data Collection for Remedy Evaluation

Present
Public Meeting and Public Comment

2019-2020
Groundwater Model Developed Estimates Potential Extent of Groundwater Contamination & Periodically Updated

2021
8 Monitoring Wells Installed NE of Landfill & Sampled

2021-2022
Private Wells Sampled (NE of Landfill)

2022
5 Monitoring Wells Installed NE of Landfill & Sampled

2023
4 Monitoring Wells Installed West of Landfill & Sampled

2023
2 Monitoring Wells Installed Far NE of Landfill

PRB Remedy Evaluation

2021
Initiated Feasibility Study for Permeable Reactive Barrier (PRB)

2021
Site Specific Samples Collected & Results Analyzed

2021-2022
Multiple Phases of Bench-Testing of Potential Reagents

2023
Final Results Showed Treatment in PRB not Effective for all contaminants

Ash Removal

2019-2021
Vendor Discussions for Ash Excavation and Recycling

2021
2 Coal Ash Characterization Studies Conducted (31 Borings)

2021
Ash Excavation Phased Plan and Control Measures Designed

2022-2023
Finalized Ash Recycling Agreement with Vendor *(see Station 2)*

Recommended Remedies
- Ash Removal
- Pump Impacted Groundwater & Treat Above-Ground

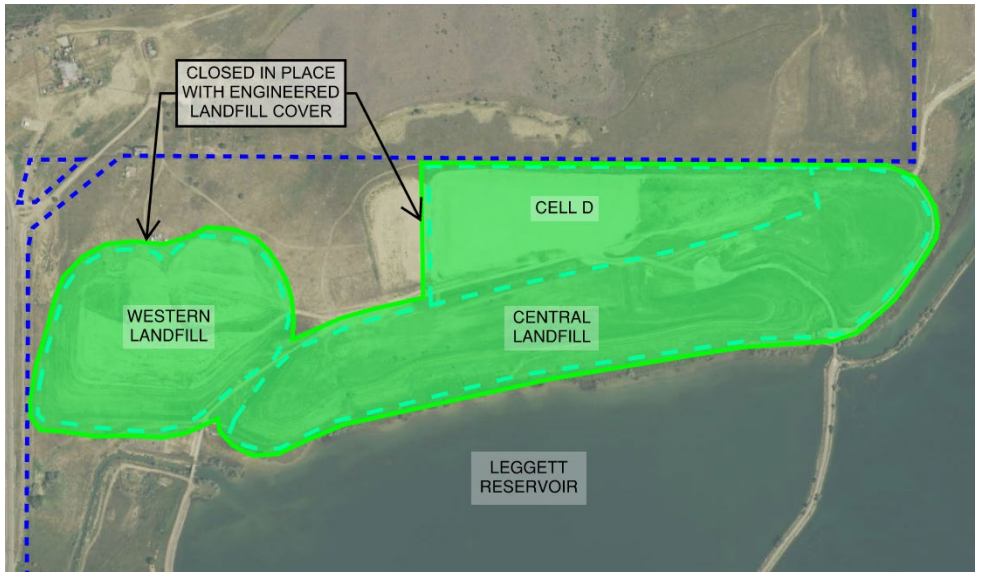
LANDFILL REMEDY ALTERNATIVES EVALUATION

	1. Ash-Focused Remedial Action Alternatives	Pros	Cons
X	1a. Landfill Cover	Keeps rainwater out of landfill	Ash remains in place
✓	**1b. Majority Ash Removal**	Remove ash	Long timeframe to complete

	2. Groundwater Remedial Action Alternatives	Pros	Cons
X	2a. Slurry Wall	Physical barrier for affected groundwater	Large area required; no active groundwater treatment
X	2b. Permeable Reactive Barrier	Passively treats groundwater below ground	Large area required; treatment below ground not effective for all contaminants
X	2c. In-Situ Solidification	Prevents further impacts to groundwater	No active groundwater treatment
X	2d. MNA/Enhanced MNA	Non-invasive	Long-term implementation
✓	**2e. Pump and Treat and/or Evaporation**	Active treatment above ground	Complexity of managing water

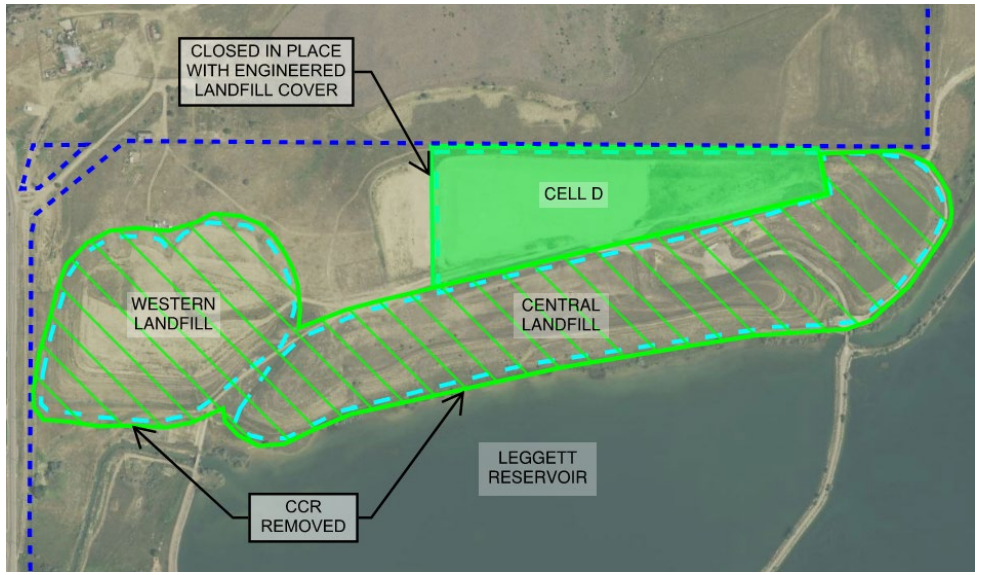
1. ASH FOCUSED REMEDIAL ALTERNATIVES

A. Landfill Cover X



- Engineered cover will prevent additional precipitation and runoff infiltration
- Shorter implementation time
- <u>Reason not recommended:</u>
  Does not remove source of groundwater impacts

B. Majority Ash Removal ✓



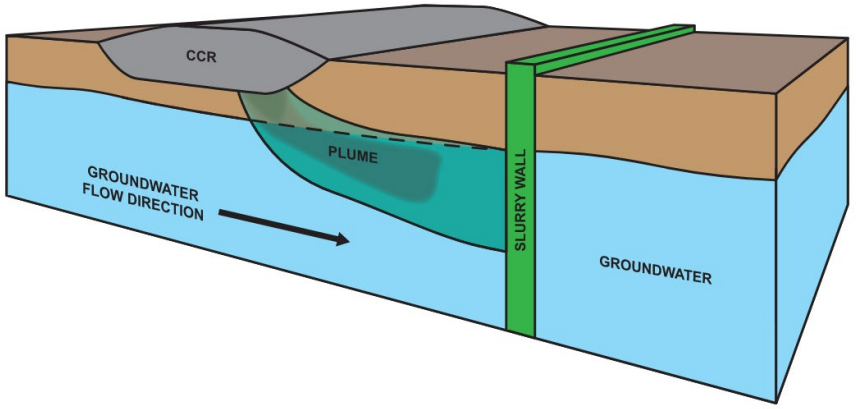
- <u>Why recommended:</u>
  - Removes majority of ash
    (Cell D to remain in place because not impacting groundwater and not suitable for beneficiation)
  - Phased removal prioritizes areas of greatest impact
  - Recycling/beneficial use of ash material in concrete
    (see Station #2 for more details)

2. GROUNDWATER REMEDIAL ALTERNATIVES CONSIDERED BUT NOT RECOMMENDED

x	A. Slurry Wall
x	B. Permeable Reactive Barrier
x	C. In-Situ Solidification
x	D. MNA/Enhanced MNA
✓	E. Pump and Treat and/or Evaporation

A. Slurry Wall

- Remedy Mechanism: Solidified wall acts as physical barrier for affected groundwater travel

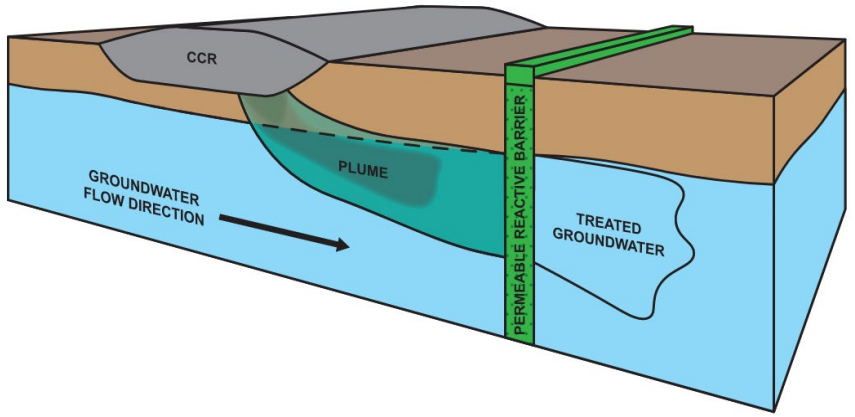


- Reason not recommended:
  no active treatment and large area required

  Note: Slurry wall may be used in targeted areas in conjunction with pump and treat

B. Permeable Reactive Barrier

- Remedy Mechanism: Impacted groundwater treated as it travels through reactive media

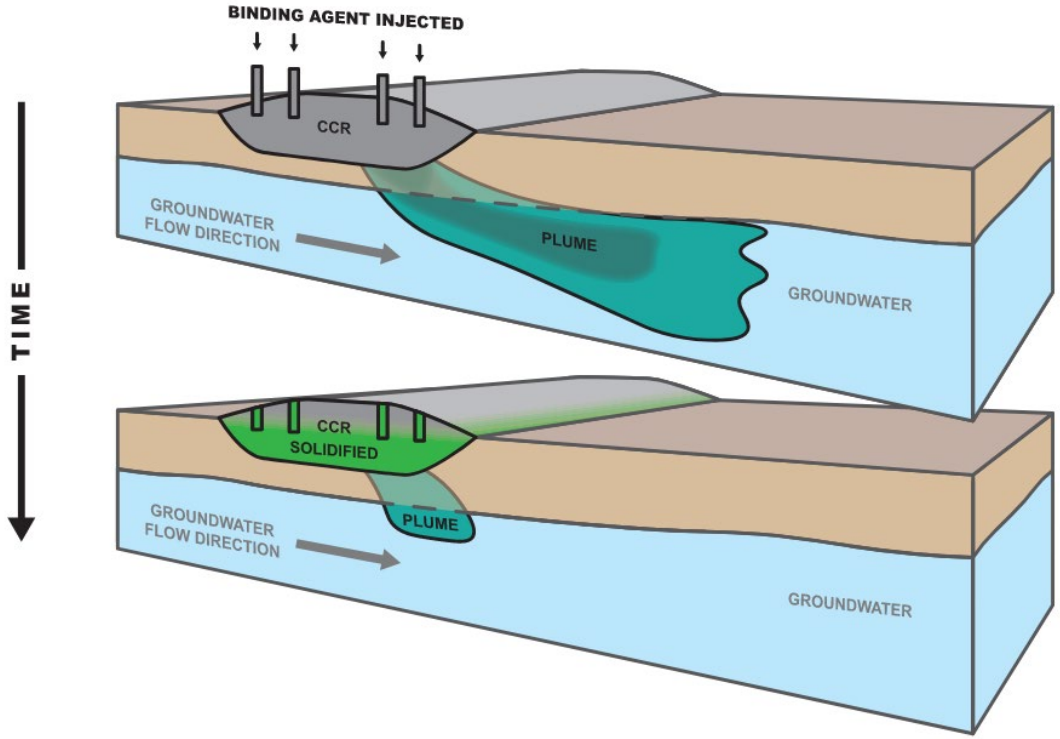


- Reason not recommended:
  below ground treatment testing not successful at reducing all constituents

2. GROUNDWATER REMEDIAL ALTERNATIVES CONSIDERED BUT NOT RECOMMENDED

x	A. Slurry Wall
x	B. Permeable Reactive Barrier
x	C. In-Situ Solidification
x	D. MNA/Enhanced MNA
✓	E. Pump and Treat and/or Evaporation

C. In-Situ Solidification (ISS)



- Remedy Mechanism:
  Cement injected into ash to create solid block of material that does not allow further impacts to groundwater
- Reason not recommended:
  No active groundwater treatment

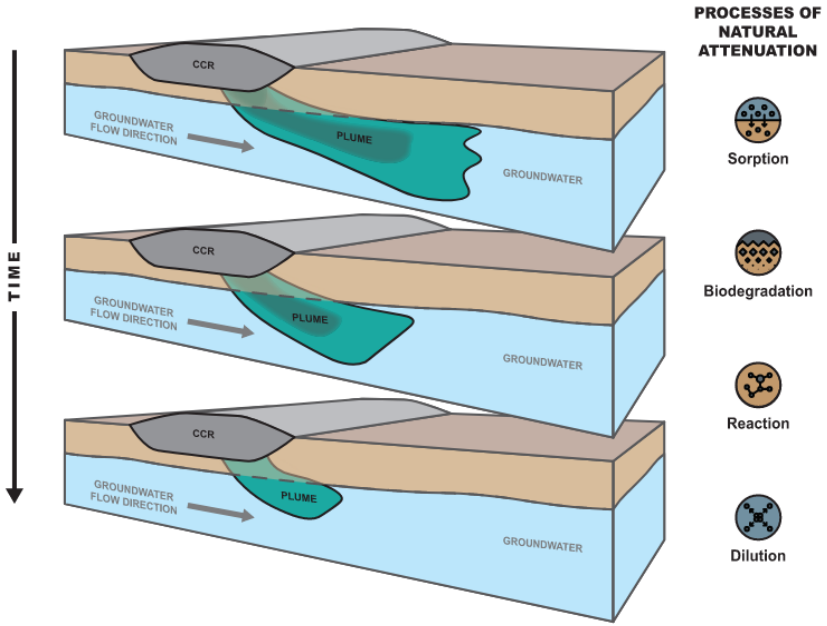
Note: ISS may be used in targeted areas in conjunction with pump and treat

2. GROUNDWATER REMEDIAL ALTERNATIVES CONSIDERED BUT NOT RECOMMENDED

x	A. Slurry Wall
x	B. Permeable Reactive Barrier
x	C. In-Situ Solidification
x	D. MNA/Enhanced MNA
✓	E. Pump and Treat and/or Evaporation

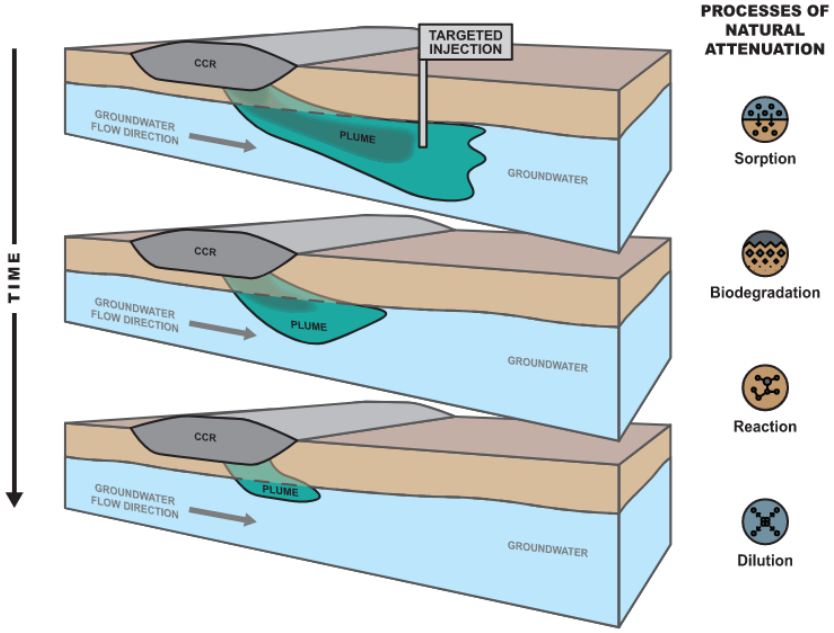
D1. Monitored Natural Attenuation (MNA)

- Remedy Mechanism: Groundwater treated over time through natural attenuation processes



D2. Enhanced MNA

- Remedy Mechanism: Targeted injections increase/enhance the natural attenuation processes

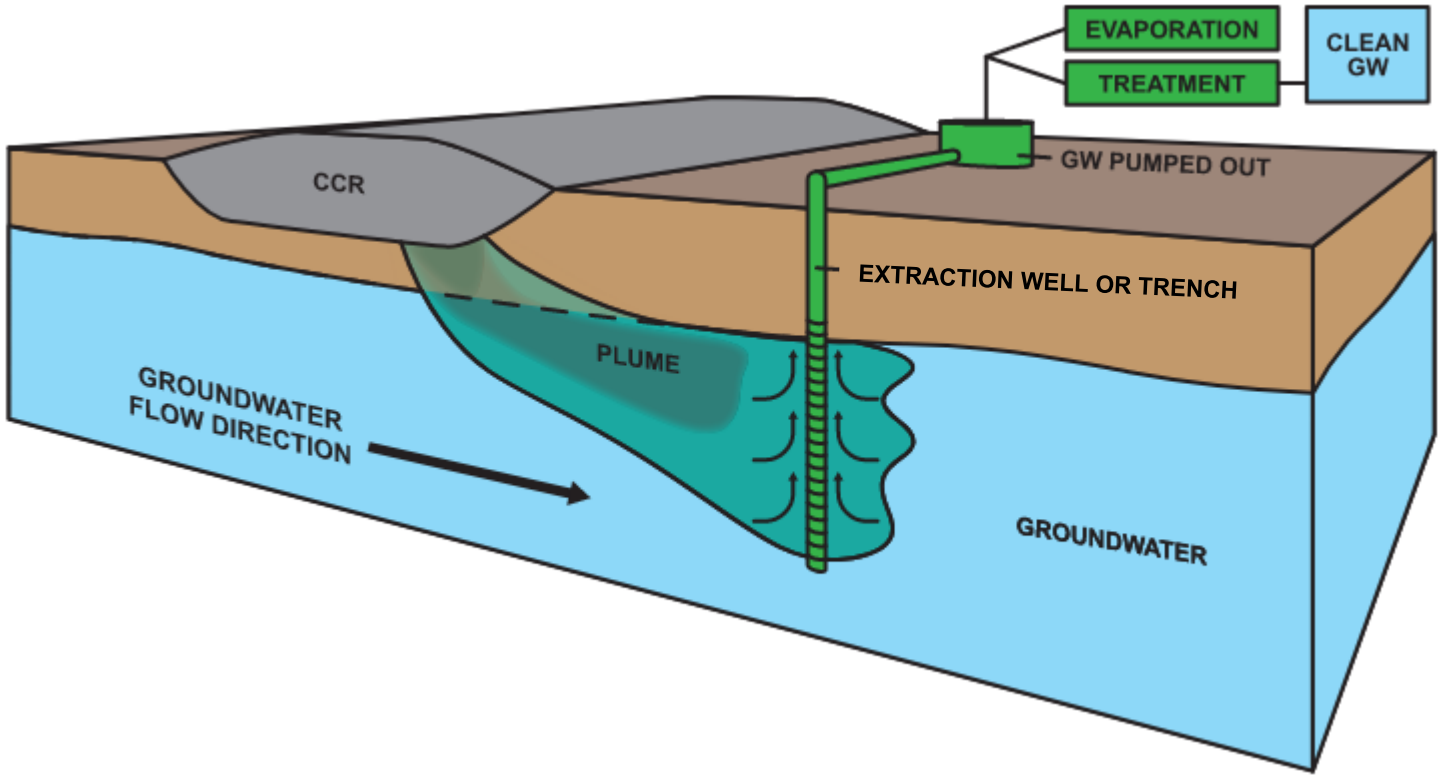


Note: Monitored natural attenuation will not be selected as a sole alternative, but will be a **natural or enhanced component** of the implemented primary remedy

2. RECOMMENDED GROUNDWATER REMEDIAL ALTERNATIVE

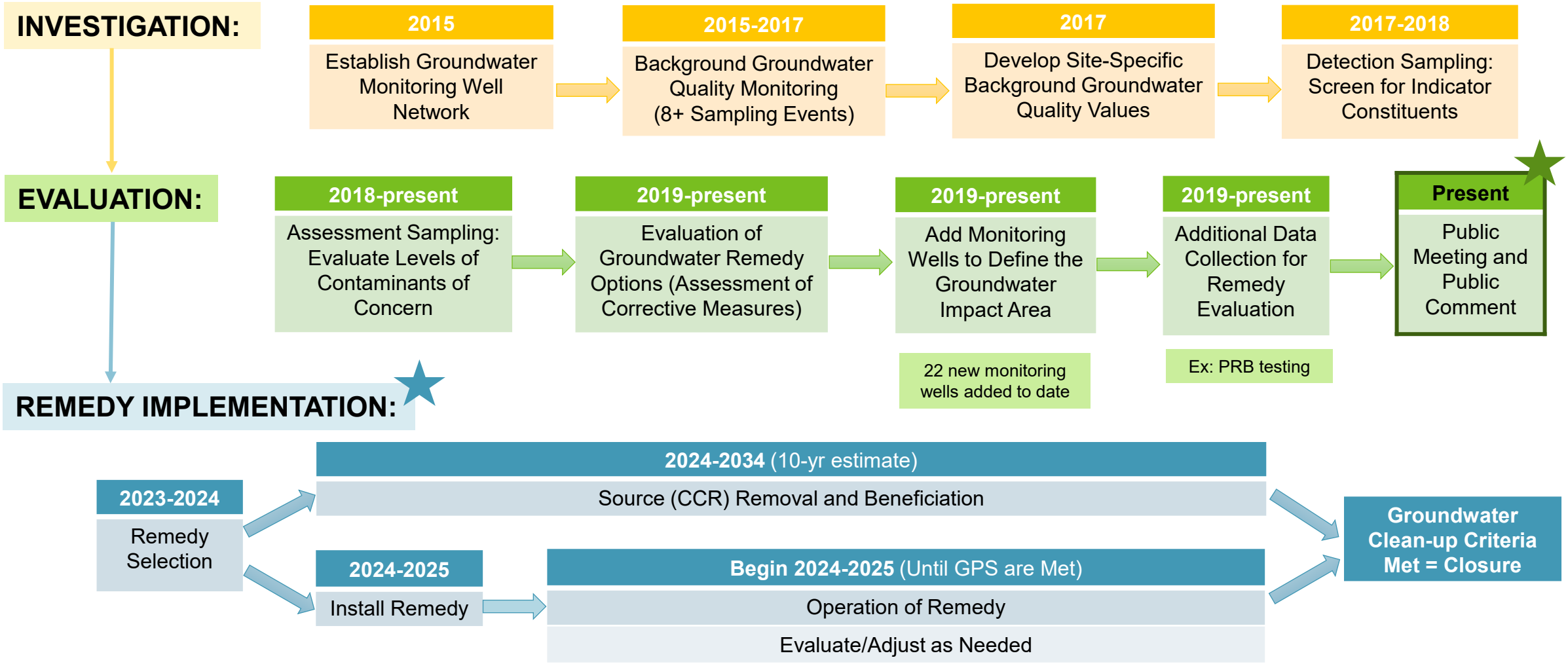
x	A. Slurry Wall
x	B. Permeable Reactive Barrier
x	C. In-Situ Solidification
x	D. MNA/Enhanced MNA
✓	E. Pump and Treat and/or Evaporation

E. Pump and Treat and/or Evaporate ✓



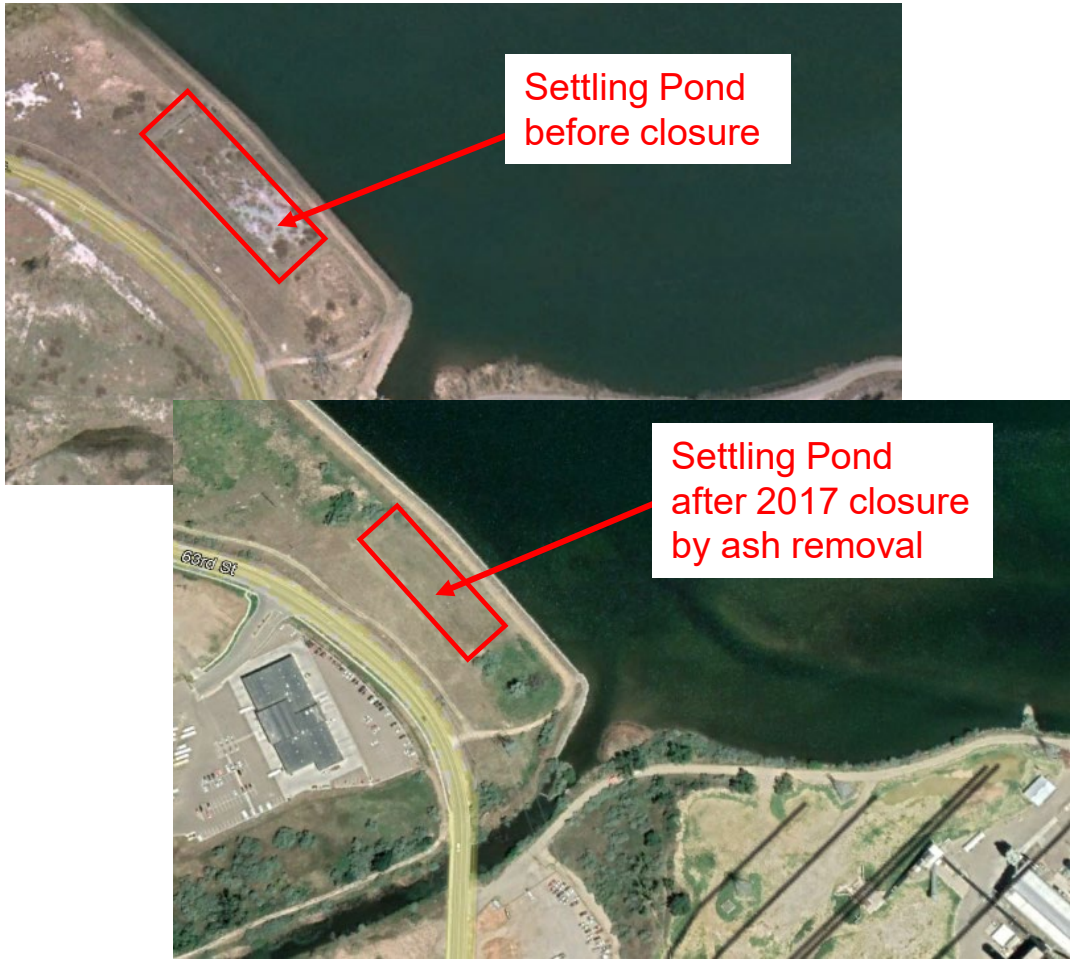
- Remedy Mechanism:
- Extraction wells or trench placed to strategically target capturing groundwater in high concentration areas
- Impacted groundwater pumped out and treated above ground
- Treat Lithium and Selenium
- May combine with other methods
- Why recommended: Most effective and timely remedy for treating groundwater

TIMELINE



FORMER SETTLING AND BOTTOM ASH PONDS

PONDS BEFORE AND AFTER CLEANOUT



Groundwater Standards Met in 2021 = Clean Closure

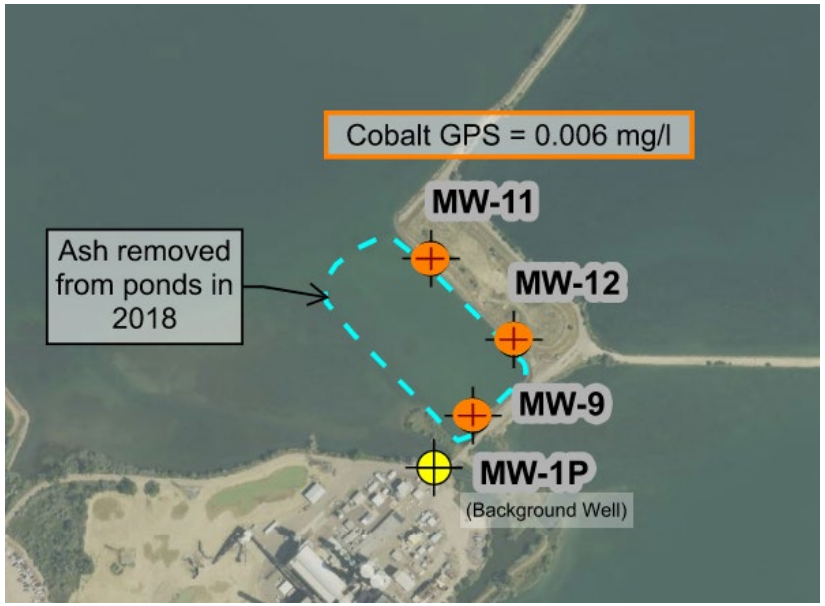
Groundwater Monitoring Ongoing

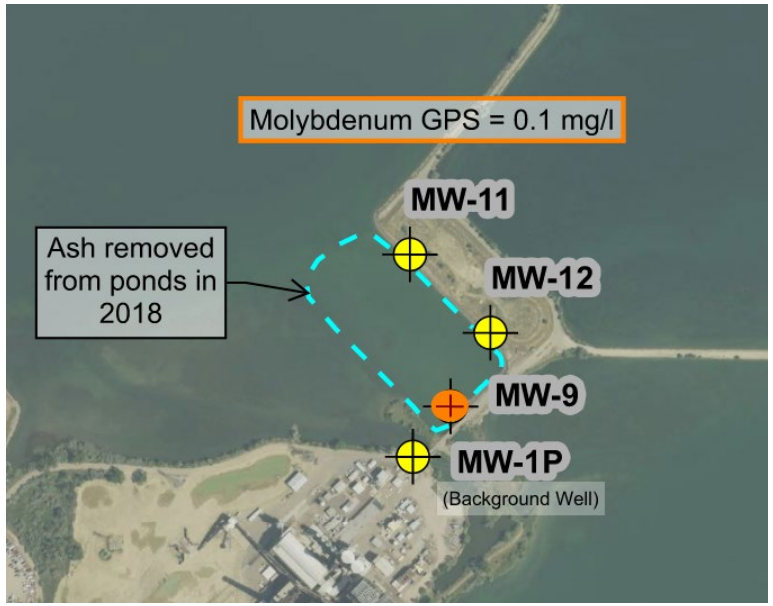
FORMER BOTTOM ASH PONDS

Remedy - Ash Removal and Groundwater Levels Trending Down

- Ash Removed in 2018 = physical closure complete
- Cobalt levels > GPS in 3 wells (on-site only)
- Molybdenum levels > GPS in one well (on-site only)

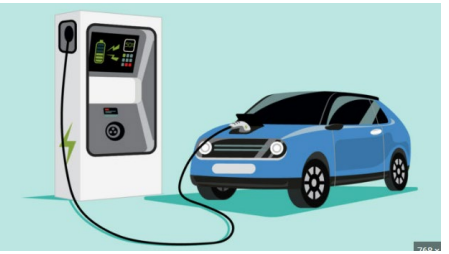
Groundwater levels trending down





COBALT IN THE ENVIRONMENT

- Cobalt is present naturally in the environment in rocks, soils, and minerals such as coal.
- Like most substances, cobalt can be potentially harmful if very large amounts are ingested
- Nearly everyone is exposed to low levels of cobalt every day through
    - the food we eat - cobalt is necessary for vitamin B-12
    - the beverages and water we drink
    - the air we breathe
- Cobalt is used in a variety of household and consumer products
    - an important part of the alloys used in artificial hip and knee joints.
    - a critical component of lithium-ion batteries in cellphones, power tools and, more recently, electric vehicles
    - Cobalt blue is a well-known color in the art world and was used in ancient Chinese porcelains



MOLYBDENUM IN THE ENVIRONMENT

- Molybdenum is present naturally in the environment in rocks, soils, and minerals such as coal.
- Like most substances, cobalt can be potentially harmful if very large amounts are ingested
- Nearly everyone is exposed to low levels of molybdenum every day
    - In the food we eat – beans, cereal grains, leafy vegetables
    - Molybdenum is essential nutrient
    - In small amounts it is needed for proper metabolism
- Molybdenum is used in a variety of household and consumer products
    - Cast iron and steel
    - Lubricants and paints
    - More recently in solar panels and wind turbines

NEXT STEPS

Federal CCR Program:

- Public comment on evaluation and proposed alternative
- Select Final Remedy Following Public Meeting/Comments
  - Already Completed Ash Removal from Impoundments
  - Majority of Ash will be removed from regulated landfill between 2024~2034
  - Pump and Treat Groundwater to meet Selenium and Lithium standards beginning 2024-2025
    - Operate system, evaluate effectiveness and adjust as needed
  - Ongoing Groundwater Monitoring around landfill and impoundments

State Program:

- Submit Assessment of Corrective Measures Report (ACMR) to State in June
  - State review followed by 30-day public comment period to be initiated this summer
  - Review and consideration of public comments
  - Remedy selection and implementation – expected to be similar to Federal

ADDITIONAL QUESTIONS AND DISCUSSION