Lincoln Lace and Braid Remediation Project

Prepared for:

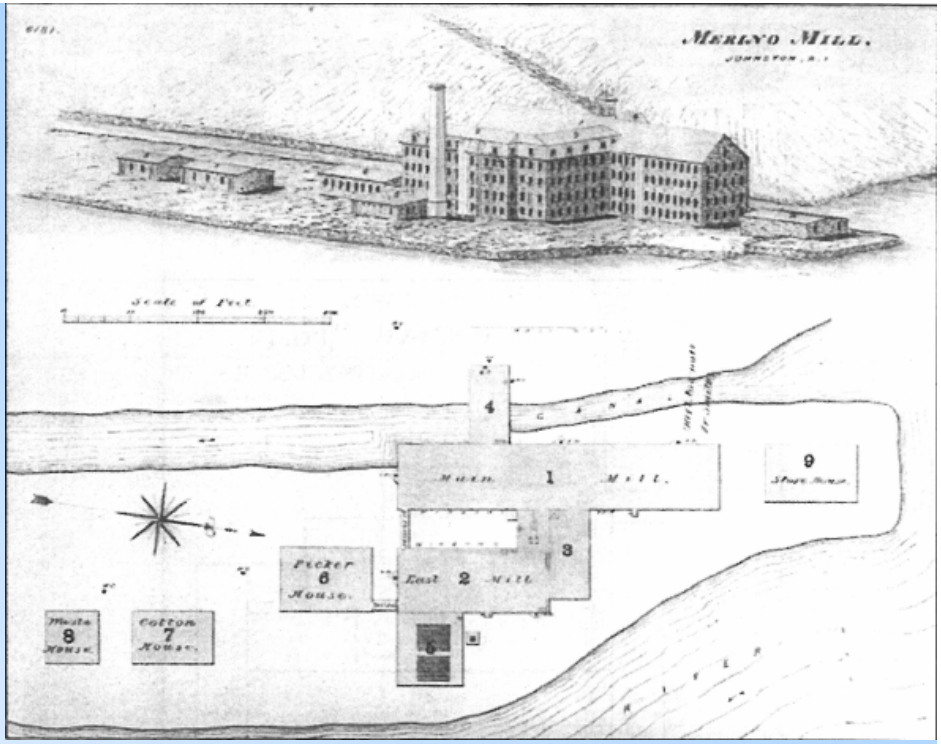
Providence Parks Department

Prepared by:

EA Engineering, Science, & Technology, Inc.

March 2010

Site History



- Merino Mill
  - First Developed in 1812
  - Initially produced wool
  - Changed to cotton production after two years
  - Dammed River to power turbine
  - Sold to Lincoln Lace and Braid in 1930s
  - Mill burned down in 1994
  - Mill remnants demolished in 1997

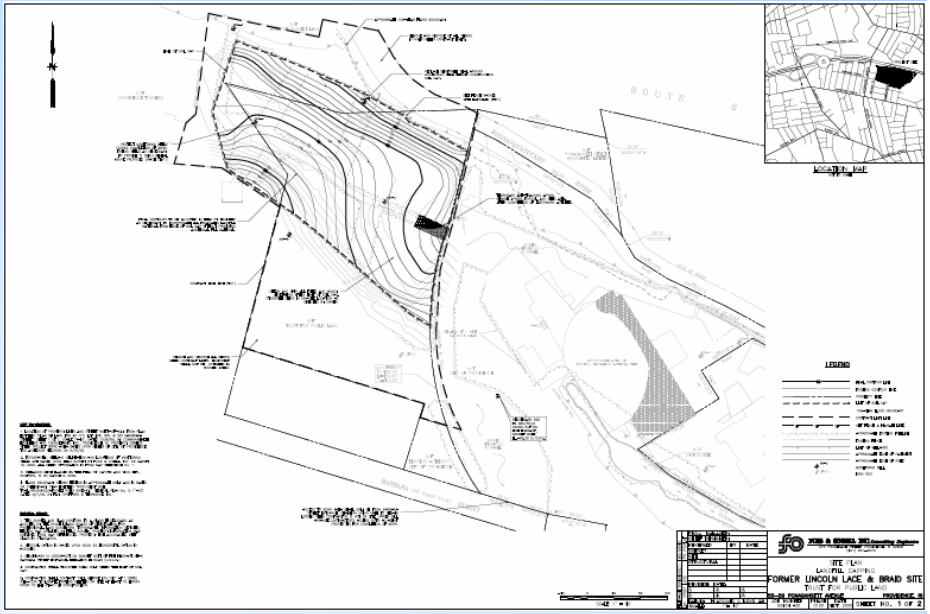
1939 Aerial Photograph of Site

RIDEM Investigations/Clean-Ups

- RIDEM notified of oil leaking into River in 1996
  - 23,000-gal underground oil storage tank removed
- RIDEM discovers oil again leaking into River
  - Conducts excavation, caps pipes, removes source
- RIDEM Conducts Site-wide Investigation in 1996
  - Identifies four Areas of Concern (AOCs)

RIDEM Investigations/Clean-Ups

- Area of Concern 1
  - Former Municipal Landfill in Northern portion of Site
    - Formerly Owned by Trust for Public Land
    - RIDEM approved engineered barrier constructed in 2006

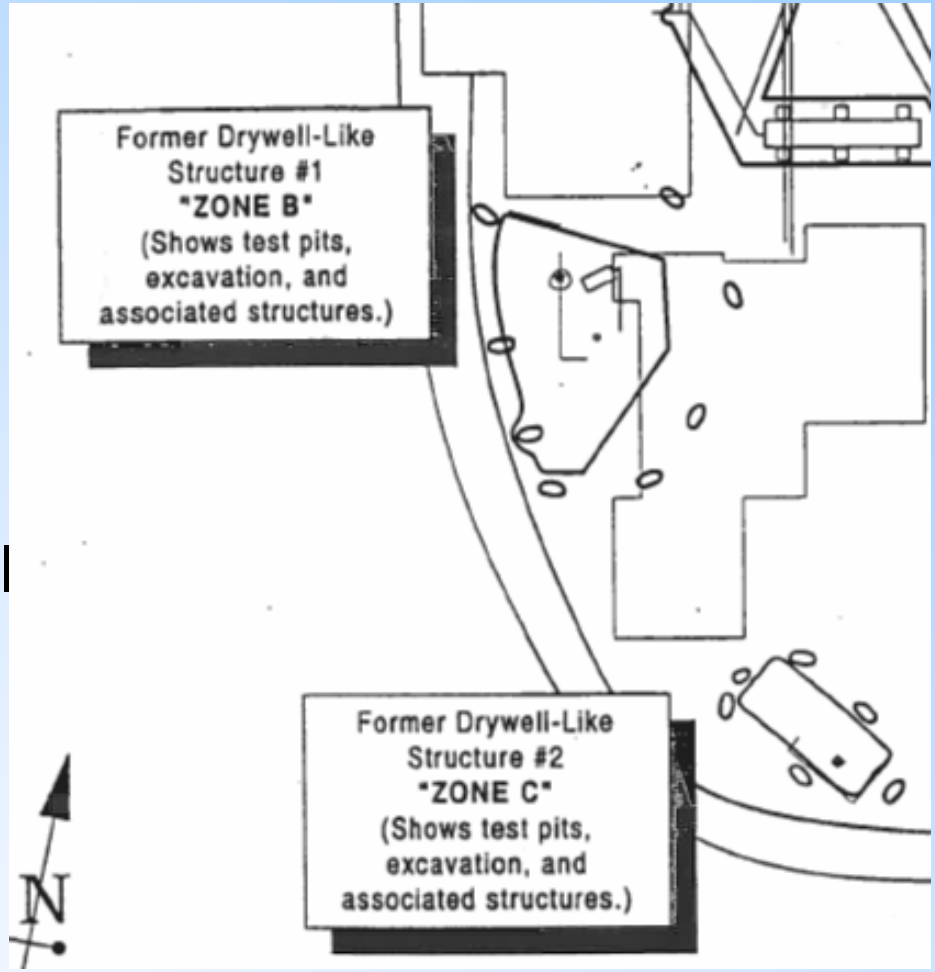


RIDEM Investigations/Clean-Ups

- Area of Concern 2
  - UST Removal
    - Completed by RIDEM in 1996

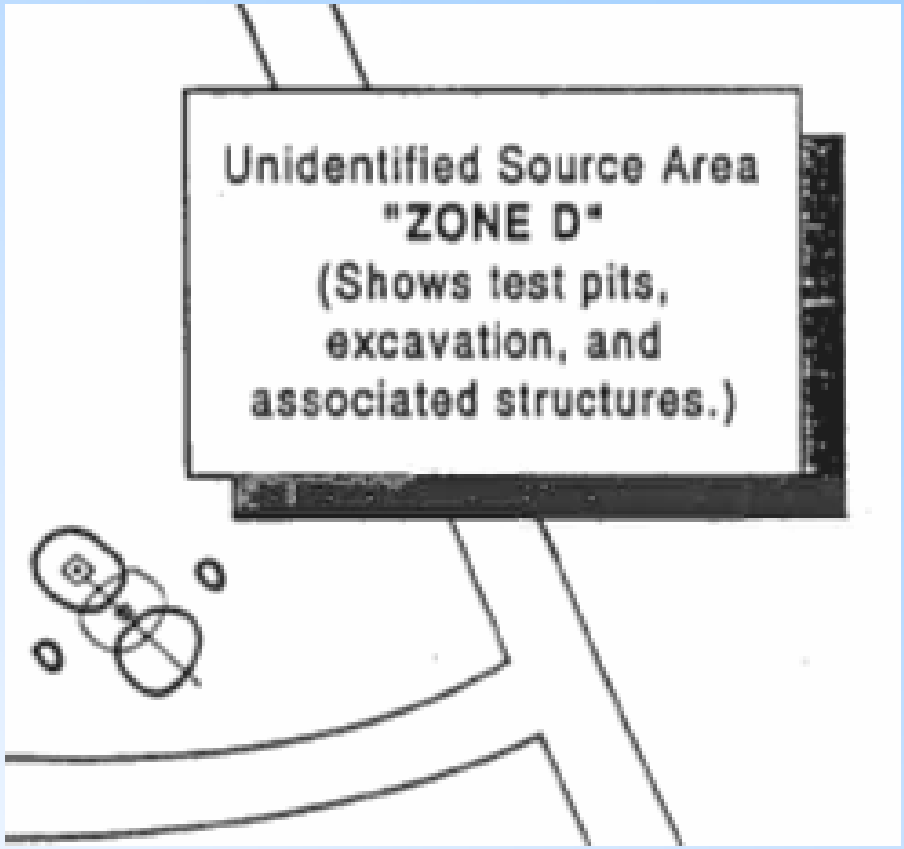
RIDEM Investigations/Clean-Ups

- Area of Concern 3
  - Two Drywells
    - Excavated and Remediated by RIDEM in 1996
    - Petroleum and Coal Ash Concerns



RIDEM Investigations/Clean-Ups

- Area of Concern 4
  - Oil Stained Surficial Soils
    - Excavated and Remediated by RIDEM in 1996

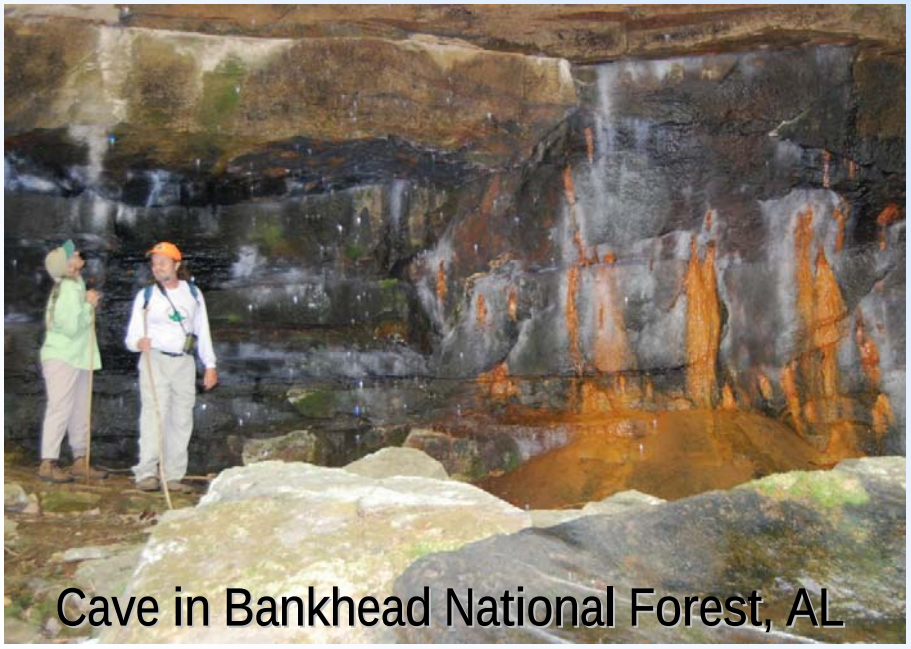


RIDEM Investigations/Clean-Ups

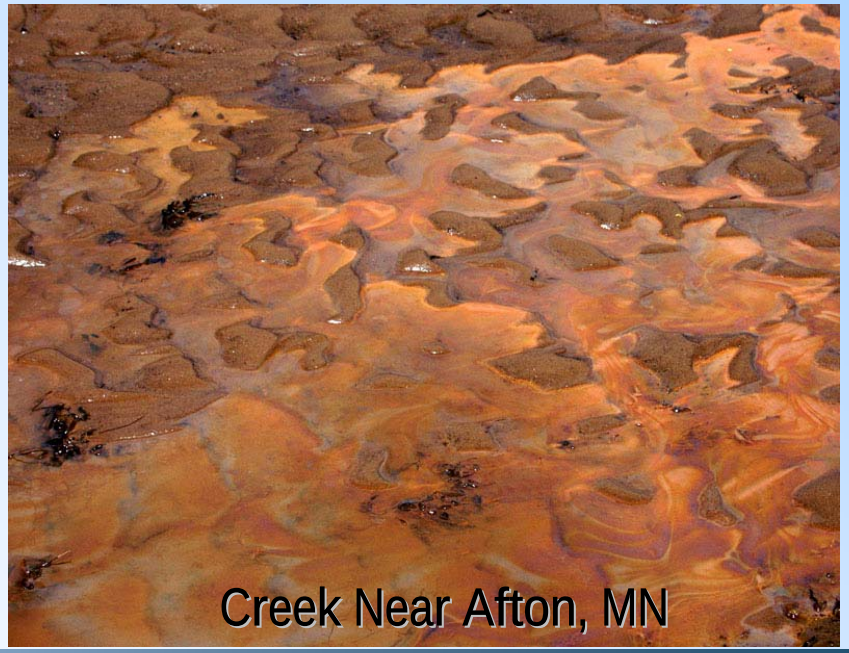
- Additional Areas Addressed
  - Demolition Debris and Bulk Waste
    - Mostly removed during building demo in 1997
  - Iron Staining in Raceway
    - Iron staining remains today but is not hazardous

Iron Flocculent

- Found naturally when oxygen, water, and iron are present
- Ferric iron precipitate is primarily an aesthetic problem



Cave in Bankhead National Forest, AL



Creek Near Afton, MN

What Is Iron Staining?

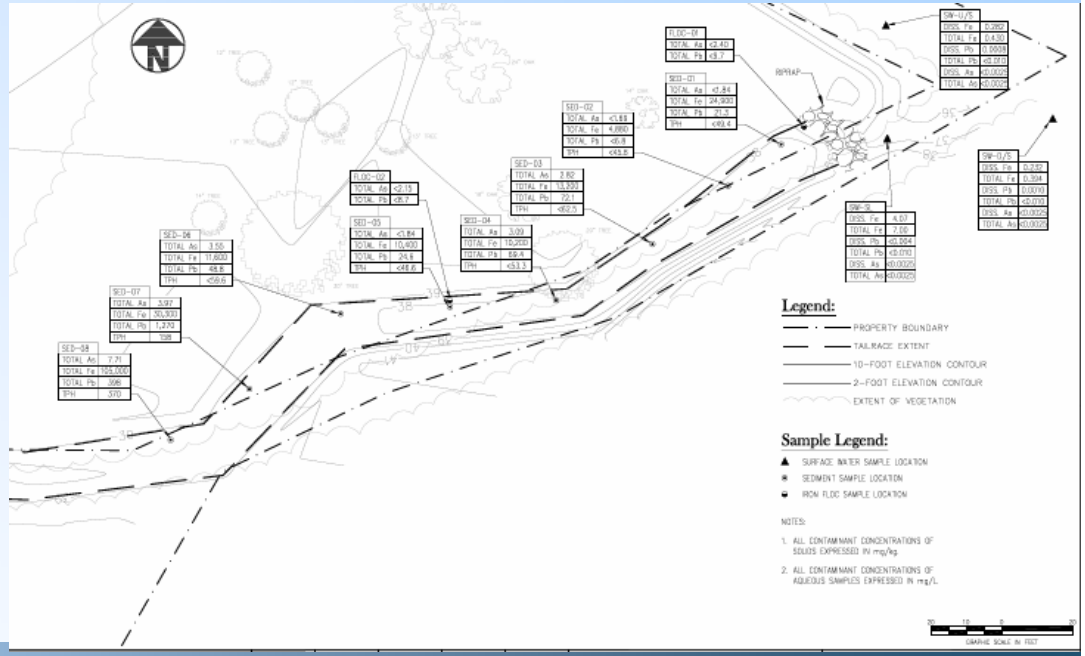
- Iron Staining is caused by iron bacteria
  - Bacteria that “feed” on iron
  - The bacteria oxidize ferrous iron into ferric iron
    - Ferric iron is insoluble and precipitates out of water as a rust colored particle
  - Can happen when iron rich groundwater comes into contact with the atmosphere
  - Iron most likely originates from iron found within adjacent soils

EA Engineering Investigation

- Supplemental Sluiceway Investigation
  - Collected 2 iron flocculent samples
    - Analyzed for arsenic and lead
    - Neither metal was detected above laboratory detection limits

EA Engineering Investigation

- Supplemental Sluiceway Investigation
  - Collected 8 sediment samples
    - Analyzed for arsenic, lead, and petroleum hydrocarbons
    - Impacts found in two upstream samples
    - Exceedances of standards
      - Lead
      - Arsenic



EA Engineering Investigation

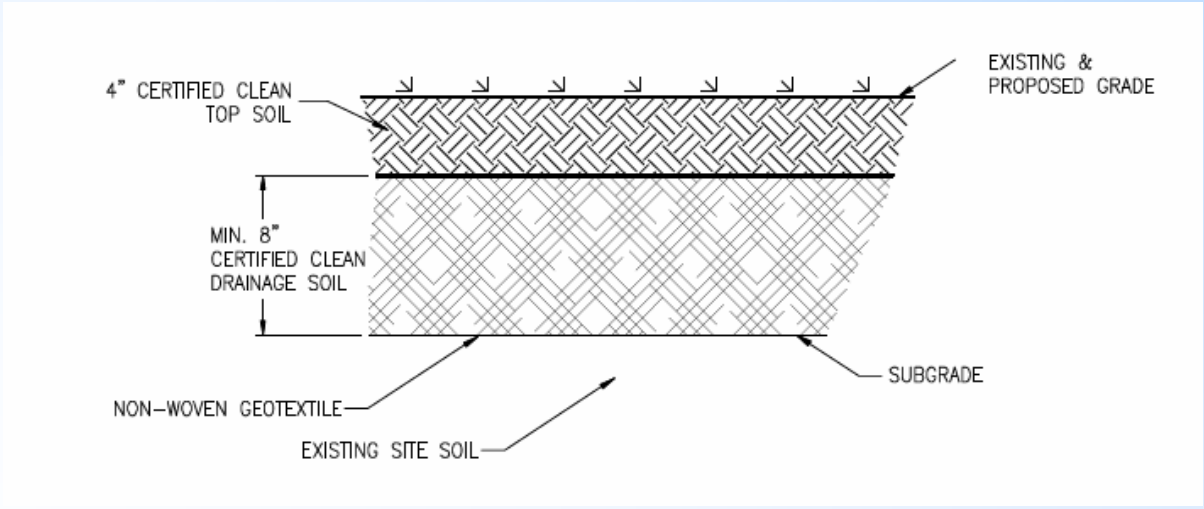
- Supplemental Sluiceway Investigation
  - Collected three surface water samples
    - One sampled collected within sluiceway
    - Two collected in River
      - one collected upstream of sluiceway
      - one collected downstream of sluiceway
    - Analyzed surface water in sluiceway for VOC, SVOC, and total and dissolved lead, arsenic, and iron
    - Dissolved lead in sluiceway lower than found in river
    - No contaminants found above human health criteria
      - » **Sluiceway not impacting Woonasquatucket River**

Soil impacts

- Soil contaminated with metals and PAHs
  - What are PAH's?
    - Polycyclic Aromatic Hydrocarbons
    - Originate from incomplete combustion (burning)
    - Most likely originated from mill fire
  - Metals include iron, arsenic, and mercury
  - Metals and PAH contamination typical of old mill sites
  - Identified across lower portion of property
  - Exceedances of RIDEM Industrial/Commercial Limits

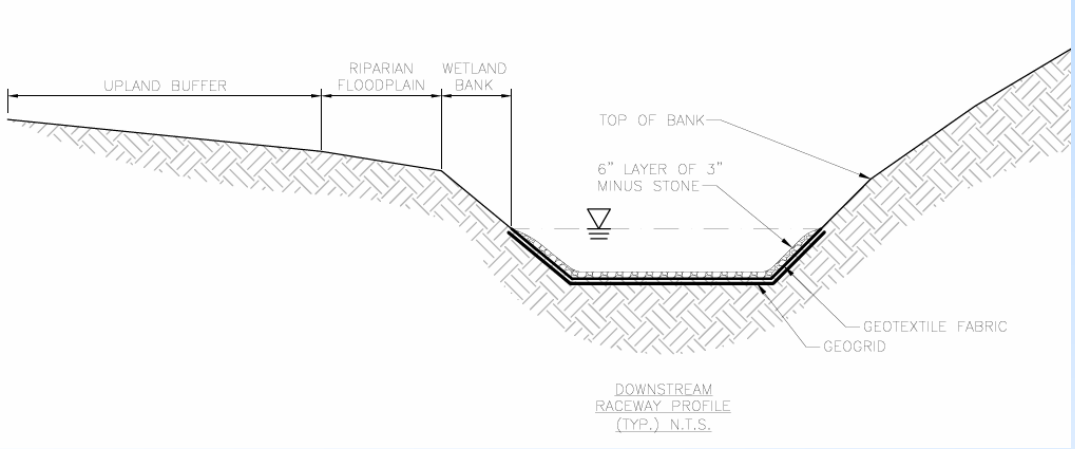
Proposed Remediation

- Construct Engineered Barrier
  - Prevent direct exposure to contaminated soils
    - Geotextile Fabric – notifies workers or others that soil beneath is impacted
    - One foot (compacted) of clean soil



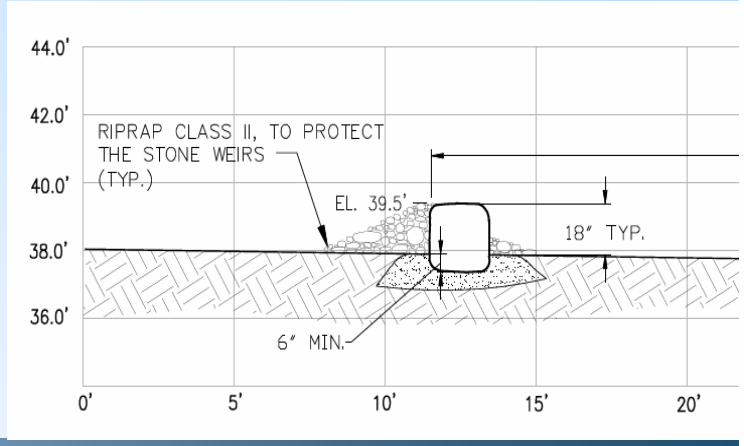
Proposed Remediation

- Sluiceway Remediation
  - Install Engineered Barrier
    - Geogrid – Provides stability to sluiceway
    - Geotextile – Isolates impacted sediment beneath cap
    - 6” Stone layer – Prevents direct exposure to contaminated sediment



Proposed Remediation

- Sluiceway Remediation
  - Install Check Dams
    - Aerate surface water to remove iron prior to entering Woonasquatucket River
    - Allows oxygen to mix with water
    - Oxygen combines with dissolved iron which then turns into rust colored iron flocculent
    - Check dams will “catch” iron flocculent before entering river



Proposed Remediation

- Wetland Plantings and Signage
  - Impede access to sluiceway
  - Increase ecological value of Site
  - Beautify Site and educate public on iron flocculent issue

Arborvitae

American Holly

Proposed Remediation

- Long Term Protection
  - Implementation of an Environmental Land Use Restriction (ELUR)
    - Attached to deed in City land evidence records
    - Restricts property use
    - Prohibits growing of fruit or vegetables on property
    - Soil Management Plan attached
      - Provides direction if cap must be disturbed

Conclusions

- Soil impacted with metals and PAHs
  - Install engineered barrier to prevent exposure
- Sluiceway sediments impacted with metals
  - Install engineered barrier to prevent exposure
- Sluiceway impacted with iron bacteria
  - Aesthetic issue
  - Install check dams for aeration to remove metals before entering River

Next Steps

- March
  - 14-day comment period following this meeting
  - Extension requests to Tim Fleury, RIDEM
  - Remedial Action Work Plan to RIDEM for review
- May
  - City initiates public bidding process
- June
  - Bid award to contractor
  - Remediation begins
- October
  - Complete remediation (Bike Path in spring 2011)

Proposed Reuse

- Open Green Space
  - Site will be seeded – although hilly
- Wetland Plantings
  - Plantings will attract all types of life to Site
- Bike Path Construction
  - RIDOT assumes construction in Spring 2011