Summary - Management Action Committee (MAC) Meeting
Centredale Manor Restoration Project
North Providence, Rhode Island

January 10, 2006

Attendees:

- Anna Krasko, United States Environmental Protection Agency
- Angela Bonarrigo, United States Environmental Protection Agency
- Lou Maccarone, Rhode Island Department of Environmental Management
- Frank Bursie, Town of North Providence
- Jane Sherman, Woonasquatucket River Watershed Council
- Eugenia Marks, Audubon Society of Rhode Island
- Jenny Pereira, Woonasquatucket River Watershed Council
- John J. Martin, The Cadmus Group, Inc.
- Jeff Loureiro, Loureiro Engineering Associates, Inc.

Agenda
- Technical Update
- Community Outreach
- Other Items

Technical Update

Handouts (attached):

1. *Centredale Manor Restoration Project Superfund Site – Feasibility Study Preliminary Alternatives (12 pages), dated December 22, 2005*
2. *The Nine Criteria for Choosing a Cleanup & Four Kinds of Cleanup, undated.*

Presentation: Using the handout (*Feasibility Study Preliminary Alternatives*), Anna provided an overview of each alternative and facilitated a discussion of the same. Anna noted that EPA believes that all of the alternatives presented in the handout can likely meet the two "threshold" criteria which are statutory requirements which must be satisfied by any alternative in order for it to be eligible for selection. She also noted that none of the alternatives include removal of the dams on Lyman Mill Pond or Allendale Pond.

Using the handout as a guide, Anna walked through a general description of the alternatives identified for consideration for 1) source area soils, 2) source area groundwater, 3) Allendale and Lyman Mill Pond and river sediments, and 4) oxbow and Allendale pond wetland soils. During the discussions, Jane and John asked about the potential impact of the October 2005 flood. Anna responded that EPA did not think contaminant distribution in the ponds has been impacted to an extent to change the conceptual site model and that EPA hasn't ruled out further study of the river system downstream of Lyman Mill Pond. Nonetheless, Anna agreed to take a look at the sediment transport modeling performed previously and see if it can be used to evaluate the October 2005 flood.

Anna also briefly reviewed the second handout, *The Nine Criteria for Choosing a Cleanup & Four Kinds of Cleanup,* noting that the nine criteria are divided into three groups – Threshold Criteria, Primary Balancing Criteria, and Modifying Criteria. She summarized the application of these criteria in the evaluation of alternatives under CERCLA, noting that the Modifying Criteria are typically not fully considered until after the formal public comment period on the proposed plan. As noted below, she explained that EPA is willing to try to give consideration to these factors earlier in the process.

Community Outreach

Angela explained that EPA would like to increase the level of community involvement in the identification and evaluation of cleanup alternatives and that the agency is willing to engage a neutral facilitator such as Marion Cox to assist in these efforts. Angela inquired as to whether or not this is the proper time to reinitiate this activity given that the draft RI and risk assessments have been published and the alternatives evaluation process has begun. Jane responded that she would like to wait until the Watershed Council has completed its review of, and comment on, the published documents. John commented that he thought Cadmus will complete their review and deliver comments to their clients by mid-February.

Other Items

The next MAC meeting is tentatively scheduled for Tuesday, February 7, 2006.

The Nine Criteria For Choosing a Cleanup

EPA has developed nine criteria to be used to evaluate remedial alternatives to ensure all important considerations are factored into remedy selection decisions. These criteria are derived from the statutory requirements of Section 121 CERCLA, particularly the long-term effectiveness and related consideration specified in Section 121(b)(1), as well as other additional technical and policy considerations that have proven to be important for selecting among remedial alternatives.

Threshold Criteria: The two most important criteria are statutory requirements that must be satisfied by any alternative in order for it to be eligible for selection.

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway (assuming a reasonable maximum exposure) are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)** addresses whether a remedy will meet all of the applicable, relevant or appropriate federal and state environmental statutes, regulations and requirements or whether a waiver can be justified.

Primary Balancing Criteria: Five primary balancing criteria are used to identify major trade-offs between remedial alternatives. These trade-offs are ultimately balanced to identify the preferred alternative and to select the final remedy.

3. **Long-term effectiveness and permanence** refers to the ability of a remedy to maintain reliable protection of human health and the environment overtime, once cleanup goals have been met.

4. **Reduction of toxicity, mobility or volume through treatment** is the anticipated performance of the treatment technologies a remedy may employ, that is, does the alternative reduce the harmful effects of the contaminants, the spread of contaminants, and the amount of contaminated material through treatment?

5. **Short-term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. **Implementability** is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option (i.e. treatment machinery, space at an approved disposal facility).

7. **Cost** includes estimated capital and operation and maintenance costs, and net present worth costs.

Modifying Criteria: These criteria may not be considered fully until after the formal public comment period on the Proposed Plan and RI/FS report is complete, although EPA works with the State and community throughout the project.

8. **State Acceptance** addresses the support agency's comments. Where the State or other Federal agency is the lead agency, EPA's acceptance of the selected remedy should be addressed under this criterion. State views on compliance with State ARARs are especially important.

9. **Community Acceptance** refers to the public's general response to the alternatives described in the Proposed Plan and the RI/FS report.

Four Kinds of Cleanup

EPA looks at numerous technical approaches to determine the best way to reduce the risks at a Superfund Site. EPA then narrows the possibilities to approaches that would protect human health and the environment. Although reducing risks often involves combinations of highly technical processes, there are really only four basic options.

Take limited or no action: Leave the site as it is, or just restrict access and monitor it.

Contain contamination: Leave contamination in place and cover or contain it to prevent exposure to, or spread of, contaminants. This method reduces risks from exposure to contamination, but does not destroy or reduce it.

Move contamination off site: Remove contaminated material and dispose of it or treat it elsewhere.

Treat contamination on site: Use a chemical or physical process at the site to destroy or remove the contaminants. Treated material can be left on site. Contaminants captured by the treatment process are disposed of in an off-site hazardous waste facility.

Centredale Manor Restoration Project Superfund Site
Feasibility Study Preliminary Alternatives
December 22, 2005

Conceptual Remedial Alternative	Advantages	Disadvantages	Technical Approach for Evaluation	Data Sources
SOURCE AREA SOILS - SOURCE AREA				
No further action	• No short-term impacts from construction activities • Low cost	• Potential future migration of contaminants due to erosion of interim caps • Cost & logistics of long-term monitoring requirements	• Assess potential releases from surface water flow, groundwater leaching, volatile emissions, and plant uptake or animal bioaccumulation	• Source Area Tech Memo • RI Report • Records from interim cap construction
Convert interim soil caps and parking lots to permanent caps	• Limited impacts to residents • Routine implementation	• Institutional controls required to limit future exposure • Cost & logistics of long-term monitoring requirements & institutional controls	• Assess potential releases from surface water flow, groundwater leaching, volatile emissions, and plant uptake or animal bioaccumulation	• Source Area Tech Memo • RI Report • Records from interim cap construction • Experience with placing low-permeability caps
Excavate contaminated soil and residual waste and dispose offsite: • Option A – Cap areas only • Option B – Entire site, except under building	• Waste above cleanup level is removed from site	• Short term impacts during excavation & capping activities • Cost	• Assess dust generation and possible emissions of volatiles during excavation	• RI Report • Experience with soil removal

Conceptual Remedial Alternative	Advantages	Disadvantages	Technical Approach for Evaluation	Data Sources
SOURCE AREA GOUNDWATER – SOURCE AREA				
Remove any identifiable source and monitor natural attenuation	• Addresses small volumes of soil near the surface	• Length of time to lower concentrations in groundwater • Cost & logistics of long-term monitoring requirements	• Identify soil that potentially impacts groundwater • Assess rate of natural attenuation	• RI Report • Semi-permeable Membrane Device Investigation
Vertical in-ground barrier between contamination and discharge to the River	• Restricts contaminant migration into river • Can treat volatile contaminants	• Does not treat non-volatile contaminants • Cost & logistics of long-term monitoring requirements	Assess location, depth and various materials for a barrier	• RI Report • Semi-permeable Membrane Device Investigation

Conceptual Remedial Alternative	Advantages	Disadvantages	Technical Approach for Evaluation	Data Sources
POND AND RIVER SEDIMENT – ALLENDALE AND LYMAN MILL POND ACTION AREAS (need to evaluate whether institutional controls required to maintain dams are likely to be effective)				
Monitored Natural Recovery	• No short term impacts • Existing benthic community remains intact • Flood storage capacity remains intact	• No control over contaminant migration during future high flow events • Relatively long time may be needed to achieve Remedial Action Objectives • A natural recovery trend is not yet apparent due to the source control (interim caps) being only recently completed • Cost & logistics of extensive long-term monitoring requirements	• Use Conceptual Site Model to identify and quantify major processes that affect contaminant mobility and bioavailability over time in order to predict how the river system is expected to recover • Use sedimentation rate data to assess the time needed to achieve cleanup goals	• Sediment Stability Report • Geomorphology Report Sedimentation Rate Data • RI Report • Scientific literature
Enhanced Natural Recovery (thin-layer capping)	• Reduces contact between benthic community and contaminated sediment • Less short term exposure to contaminated sediments than Monitored Natural Recovery	• Reduction in water depths will change flow velocities and may change habitat types • Contaminated sediment remains under water • Destroys existing benthic community • May not resist flooding (e.g., 100-yr flood) • Cost & logistics of long-term monitoring requirements & institutional controls	• Analyze river flow velocities, deposition areas and erosion areas • Assess contaminant migration through cap • Use literature values for bioturbation depth	• Sediment Stability Report • Geomorphology Report • RI Report • Hydrodynamic analysis after capping • Experience with capping • Scientific literature

Conceptual Remedial Alternative	Advantages	Disadvantages	Technical Approach for Evaluation	Data Sources
POND AND RIVER SEDIMENT – ALLENDALE AND LYMAN MILL POND ACTION AREAS (cont'd) (need to evaluate whether institutional controls required to maintain dams are likely to be effective)				
Isolation (thick-layer capping)	• Prevents contact between benthic community and contaminated sediment • Cleanup goals achieved at end of construction • Thicker cap may be more stable (resistant to flooding) in long term compared to thin cap	• Reduction in water depths will change flow velocities and habitat types • Contaminated sediment remains under water • Cost & logistics of long-term monitoring requirements & institutional controls	• Analyze river flow velocities, deposition areas and erosion areas • Assess contaminant migration through cap • Use literature values for bioturbation depth • Cap foundation support based on experience at similar sites	• Sediment Stability Report • Geomorphology Report • RI Report • Hydrodynamic analysis after capping • Experience with capping • Scientific literature

Conceptual Remedial Alternative	Advantages	Disadvantages	Technical Approach for Evaluation	Data Sources
POND AND RIVER SEDIMENT – ALLENDALE AND LYMAN MILL POND ACTION AREAS (cont'd) (need to evaluate whether institutional controls required to maintain dams are likely to be effective)				
Removal by "excavation" or "dredging" (applies to all removal alternatives) • "Excavation" is defined as removal by land-based equipment after overlying pond water had been drained. • "Dredging" is defined as removal of sediment under water and may be done using floating, amphibious, or land-based equipment.	• Removes contaminated sediment from pond areas • Deeper ponds provide greater flood flow capacity	• Short-term impacts to water quality and potential downstream migration of contaminants • Destroys existing benthic community and existing vegetation • Residual contamination after dredging, although less residual contamination after excavation • Odor if ponds lowered for "dry" excavation • Presence of a large volume of sediment with dioxin concentrations exceeding background levels	• Quantify the areas and volumes for removal using GIS and RI data • Use surface-weighted average concentrations to delineate areas for cleanup • Assess water quality impacts at dredge site and from return water • Assess post-removal residual contamination	• RI Report • Sediment Stability Study • Source Area Evaluation data • Semi-permeable Membrane Device Investigation • Lyman Mill Pond Sediment Investigation • Human Health and Ecological Risk Assessments • PRG Report • Dam Inspection Reports • Flood Inundation Maps • LEA reports on previous remedial actions

Conceptual Remedial Alternative	Advantages	Disadvantages	Technical Approach for Evaluation	Data Sources
POND AND RIVER SEDIMENT – ALLENDALE AND LYMAN MILL POND ACTION AREAS (cont'd) (need to evaluate whether institutional controls required to maintain dams are likely to be effective)				
Removal and onsite upland confinement: • Source Area • Oxbow Area • Other Areas?	• Reduces risk by isolating contaminants from the environment • Placement of contaminated sediment over contaminated soil limits impacted area and reduces overall costs of soil/sediment cover	• Short-term impacts from odor at disposal site • On-site capacity may be insufficient • Destroys existing benthic community • Cost & logistics of long-term monitoring requirements & institutional controls	• Assess potential releases from disposal site by surface water flow, groundwater leaching, volatile emissions, and plant uptake or animal bioaccumulation	• RI Report • Sediment Stability Study • Source Area Evaluation data • Semi-permeable Membrane Device Investigation • Lyman Mill Pond Sediment Investigation • Human Health and Ecological Risk Assessments • PRG Report • Dam Inspection Reports • Flood Inundation Maps • LEA reports on previous remedial actions
Removal and onsite near-shore confinement including mitigation for loss of open water: • Along shoreline of Allendale and Lyman ponds - may require excavation of non-impacted sediment and offsite disposal • Other Areas?	• Reduces risk by isolating contaminants from the environment • Less impact to community because sediment remains in pond areas • Potential greater disposal capacity if non-impacted sediments can be dredged and taken offsite for disposal • Creates new wetland or upland area for beneficial use in areas that are now open water	• Loss of water area including benthic habitat in ponds • Limited area and disposal capacity in ponds • Special design and construction required to build containment berms over very soft sediment • Cost & logistics of long-term monitoring requirements & institutional controls	• Assess potential releases from disposal site by surface water flow, groundwater leaching, volatile emissions, and plant uptake or animal bioaccumulation • Design containment berm based on experience with similar sites	• RI Report • Sediment Stability Study Source Area Evaluation data • Semi-permeable Membrane Device Investigation • Lyman Mill Pond Sediment Investigation • Human Health and Ecological Risk Assessments • PRG Report • Dam Inspection Reports Flood Inundation Maps • LEA reports on previous remedial actions

Conceptual Remedial Alternative	Advantages	Disadvantages	Technical Approach for Evaluation	Data Sources
POND AND RIVER SEDIMENT – ALLENDALE AND LYMAN MILL POND ACTION AREAS (cont'd) (need to evaluate whether institutional controls required to maintain dams are likely to be effective)				
Removal and onsite confinement in one or more Confined Aquatic Disposal cells - may require excavation of non-impacted sediment and offsite disposal	• Reduces risk by isolating contaminants from environment • No loss of pond surface area • Potential greater disposal capacity if non-impacted sediments can be dredged and taken offsite for disposal or reuse	• Need to dispose of excavated non-impacted sediment from pond bottom • Special design required to build containment berms over soft sediment • Destroys existing benthic community • Cost & logistics of long-term monitoring requirements & institutional controls	• Assess potential releases from disposal site by surface water flow, groundwater leaching, volatile emissions, and plant uptake or animal bioaccumulation • Design containment berm based on experience with similar sites	• RI Report • Sediment Stability Study • Source Area Evaluation data • Semi-permeable Membrane Device Investigation • Lyman Mill Pond Sediment Investigation • Human Health and Ecological Risk Assessments • PRG Report • Dam Inspection Reports • Flood Inundation Maps • LEA reports on previous remedial actions
Removal and offsite disposal at a hazardous waste landfill or incineration	• Removes contaminated sediment from the site • No restrictions on future use of the site • Incineration permanently treats organic contaminants	• Short term impacts from sediment dewatering and transport • Potential air emissions at incineration site • High cost • Destroys existing benthic community	• Contact landfill/incinerator operators to determine chemical, water content and regulatory criteria for disposal	• RI Report • Sediment Stability Study • Source Area Evaluation data • Semi-permeable Membrane Device Investigation • Lyman Mill Pond Sediment Investigation • Human Health and Ecological Risk Assessments • PRG Report • Dam Inspection Reports • Flood Inundation Maps • LEA reports on previous remedial actions • landfill license requirements and transport regulations

Conceptual Remedial Alternative	Advantages	Disadvantages	Technical Approach for Evaluation	Data Sources
POND AND RIVER SEDIMENT – ALLENDALE AND LYMAN MILL POND ACTION AREAS (cont)				
Partial removal, thin-layer capping of residuals and disposal with any of the onsite or offsite alternatives. Removal could be selected for high scour areas, areas of high concentrations, or areas that are too shallow to cap. Removal depth could be equal to cap thickness so that there would not be any change in flood flow capacity.	• Removes highest concentrations of contaminated sediment • Lower cost and less short term impact than removal to PRG levels • Does not require dredging • Flood flow capacity remains the same	• Some contaminated sediment remains under water • Disposal disadvantages same as removal, capping and disposal • Cost & logistics of long-term monitoring requirements & institutional controls	• Same as removal, capping and disposal	• RI Report • Sediment Stability Study • Source Area Evaluation data • Semi-permeable Membrane Device Investigation • Lyman Mill Pond Sediment Investigation • Human Health and Ecological Risk Assessments • PRG Report • Dam Inspection Reports • Flood Inundation Maps • LEA reports on previous remedial actions

Conceptual Remedial Alternative	Advantages	Disadvantages	Technical Approach for Evaluation	Data Sources
FLOODPLAIN (WETLAND) SOILS – OXBOW AND ALLENDALE POND ACTION AREAS				
Monitored Natural Recovery	• No short term impacts • Existing habitat remains intact • Flood storage capacity remains the same	• No control over future migration during high flow events • Relatively long time may be needed to achieve cleanup goals • Cost & logistics of extensive long-term monitoring requirements	Use Conceptual Site Model to identify and quantify major process that affects contaminant mobility and bioavailability over time in order to predict how system is expected to recover.	• Geomorphology Report • RI Report • Scientific literature
Enhanced Natural Recovery (thin-layer capping)	• Reduction of contact between environment and contaminated floodplain soil • Less short term exposure to contaminated floodplain soils than Monitored Natural Recovery	• Increase in ground surface elevation will reduce water depths during flood flows which will change flow velocities and may change habitat types (for areas in 100-yr flood zone) • Contaminated floodplain soil remains on site • Destroys existing habitat (forested wetland would need to be cleared) • Cost & logistics of long-term monitoring requirements & institutional controls	• Assess contaminant migration through cap	• Geomorphology report • RI Report • Capping experience • Scientific literature

Conceptual Remedial Alternative	Advantages	Disadvantages	Technical Approach for Evaluation	Data Sources
FLOODPLAIN (WETLAND) SOILS – OXBOW AND ALLENDALE POND ACTION AREAS (cont'd)				
Isolation (thick-layer capping)	• Prevents contact between ecological receptors and contaminated soils • Thicker cap may be more stable in long term compared to thin cap	• Increase in ground surface elevation would reduce water depth during flood flow which will change flow velocities and habitat types • Wetland area likely converted to upland area • Contaminated floodplain soil remains onsite • Cost & logistics of long-term monitoring requirements & institutional controls	• Assess contaminant migration through cap	• Geomorphology report • RI Report • Capping experience • Scientific literature
Removal by "excavation" (applies to all removal alternatives)	• Contaminated floodplain soil removed from site	• Short-term impacts to habitat and destruction of existing wetland vegetation • Destroys existing habitat • Short-term impact to community (noise, truck traffic, etc.) • Potential dust generation	• Quantify the areas and volumes for removal using GIS and RI data • Use surface-weighted average concentrations to delineate areas for cleanup	• RI Report • Human Health & Ecological Risk Assessments • PRG Report • Flood Inundation Maps • LEA reports on previous remedial actions • (Oxbow Area – risk assessment in progress; need for PRGs will be determined upon completion of the risk assessment)

Conceptual Remedial Alternative	Advantages	Disadvantages	Technical Approach for Evaluation	Data Sources
FLOODPLAIN (WETLAND) SOILS – OXBOW AND ALLENDALE POND ACTION AREAS (cont'd)				
Removal and onsite upland confinement: • Over contaminated soil at Centerdale Manor site • Oxbow Area • Other areas?	• Reduces risk by isolating contaminants from the environment • Placement of contaminated floodplain soil over contaminated soil limits impacted area and reduces overall costs of soil/sediment cover	• Short-term impacts from odor at disposal site • On-site capacity may be insufficient • Destroys existing habitat • Cost & logistics of long-term monitoring requirements & institutional controls	• Assess potential releases from disposal site by surface water flow (during flood), groundwater leaching, volatile emissions, and plant uptake or animal bioaccumulation • Assess increase in floodplain soil volume post-excavation	• RI Report • Human Health & Ecological Risk Assessments • PRG Report • Flood Inundation Maps • LEA reports on previous remedial actions • (Oxbow Area – risk assessment in progress; need for PRGs will be determined upon completion of the risk assessment)
Removal and onsite nearshore confinement including mitigation for loss of open water area: • Along shoreline of Allendale and Lyman Mill ponds • Other Areas?	• Reduces risk by isolating contaminants from the environment • Less impact to community because floodplain soil remains in pond areas • Would create new wetland or upland land for beneficial use in areas that are not open water	• Loss of water area in ponds • Limited area and disposal capacity in ponds or oxbow area • Special design and construction required to build containment berms over very soft sediment • Destroys existing habitat • Cost & logistics of long-term monitoring requirements & institutional controls	• Assess potential releases from disposal site by surface water flow (during flood), groundwater leaching, volatile emissions, and plant uptake or animal bioaccumulation • Assess increase in floodplain soil volume post-excavation • Design perimeter containment berm based on experience with similar sites	• RI Report • Human Health & Ecological Risk Assessments • PRG Report • Flood Inundation Maps • LEA reports on previous remedial actions • (Oxbow Area – risk assessment in progress; need for PRGs will be determined upon completion of the risk assessment)

Conceptual Remedial Alternative	Advantages	Disadvantages	Technical Approach for Evaluation	Data Sources
FLOODPLAIN (WETLAND) SOILS – OXBOW AND ALLENDALE POND ACTION AREAS (cont'd)				
Removal and onsite confinement in one or more Confined Aquatic Disposal cells	• Reduces risk by isolating contaminants from the environment • Pond surface area remains the same • Potential greater disposal capacity (if non-impacted floodplain soils can be dredged and taken offsite for disposal or reuse)	• Will need to dispose of excavated non-impacted floodplain soil • Special design required to build containment berms over soft sediment • Destroys existing habitat • Cost & logistics of long-term monitoring requirements & institutional controls	• Assess potential releases from disposal site by surface water flow (during flood), groundwater leaching, volatile emissions, and plant uptake or animal bioaccumulation • Assess increase in floodplain soil volume post-excavation • Design perimeter containment berm based on experience with similar sites	• RI Report • Human Health & Ecological Risk Assessments • PRG Report • Flood Inundation Maps • LEA reports on previous remedial actions • (Oxbow Area – risk assessment in progress; need for PRGs will be determined upon completion of the risk assessment)
Removal and offsite hazardous waste landfill disposal or incineration	• Contaminated floodplain soil removed from site and no future restrictions of site use • Incineration would permanently treat organic contaminants	• Short term impacts from soil dewatering and transport • Potential air emissions at incineration site • High cost • Destroys existing habitat	• Contact landfill/incinerator operators to determine chemical, water content and regulatory criteria for disposal	• RI Report • Human Health & Ecological Risk Assessments • PRG Report • Flood Inundation Maps • LEA reports on previous remedial actions • (Oxbow Area – risk assessment in progress; need for PRGs will be determined upon completion of the risk assessment) • Landfill license requirements and transportation regulations

Summary - Management Action Committee (MAC) Meeting
Centredale Manor Restoration Project
North Providence, Rhode Island

November 10, 2005

Attendees:

- Anna Krasko, United States Environmental Protection Agency
- Angela Bonarrigo, United States Environmental Protection Agency
- Cornell Rosiu, United States Environmental Protection Agency
- Chao Vu, United States Environmental Protection Agency
- Michael Murphy, MACTEC Engineering and Consulting, Inc.
- Heather Sullivan, United States Army Corps of Engineers
- Lou Maccarone, Rhode Island Department of Environmental Management
- Jane Sherman, Woonasquatucket River Watershed Council
- Eugenia Marks, Audubon Society of Rhode Island
- Jenny Pereira, Woonasquatucket River Watershed Council
- John J. Martin, The Cadmus Group, Inc.
- David Scotti, Loureiro Engineering Associates, Inc.

Agenda
- Technical Update
- Community Outreach
- Other Items

Note: Angela Bonarrigo, USEPA, opened the meeting. The prior meeting was held on October 11, 2005.

Technical Update
Handouts:

1. *Draft Risk-Based Sediment PRGs at the Centredale Manor Superfund Site, dated November 10, 2005*
2. *Summary data report (2004 and 2005 surface water and sediment investigations) dated October 25, 2005*

Presentation: Using the handout (*Draft Risk-Based Sediment PRGs at the Centredale Manor Superfund Site, dated November 10, 2005)*, Mike Murphy presented a general summary and led a discussion on the PRG report to be issued by EPA. As presented, the PRGs provided in the handout apply to the Allendale Pond reach (from the Site source area to the Allendale dam) and Lyman Mill Pond reach (from Allendale Dam to Lyman Mill Dam). The report to be issued in the future by EPA will compare the Site sediment concentrations to the PRGs. The report contains intermediate calculations for PRGs for the Manton and Dyerville reaches but the report summary does not include these PRGs due to data limitations and demonstrated uncertainties. It was noted during the meeting that additional investigations may need to be conducted for the reaches downstream of Lyman Mill Dam in order to assess the need for PRGs for the downstream reaches. With regard to the Draft information provided in the handout, Mike discussed the following:

- The establishment of PRGs is just the beginning of the process used to establish cleanup criteria and to screen potential remedies (PRGs are not clean-up standards).
- The PRGs were calculated using the exposure assumptions presented in the Baseline Human Health and Ecological Risk Assessments. For human health, direct contact with river sediment and fish consumption scenarios were discussed. PRGs for ecological receptors were also presented.
- As recommended by the CSTAG (Contaminated Sediments Technical Advisory Group), additional evaluations were completed on the pre- and post-breach data (the biota data from Lyman Mill Pond were obtained prior to the restoration of Allendale Dam and the sediment data from Lyman Mill Pond were obtained after the restoration of Allendale Dam). For fish consumption PRGs, biota-sediment accumulation factors (BSAFs) were found to be comparable in all reaches; except the Lyman Mill pond. In Lyman Mill pond, average of the BSAFs for all other ponds was used.
- Calculated PRGs were compared with the upstream sediment background levels. Background sediment levels are one of the considerations for determining cleanup levels as part of the FS. For a number of chemicals, including 2,3,7,8-TCDD, some PRGs for biota consumption are below the background level.
- Dioxin (2,3,7,8-TCDD) is the biggest contributor to risk, then Aroclor-1254.
- Because there was no specific site information on fish consumption (could not perform a fish consumption survey, in part due to the in-place Fishing Advisory), a combined fish diet based on three species was used, including eel, white sucker and largemouth bass. PRGs based on risk from fish diet consisting of individual species, including the highest risk species, were also calculated.

It was noted that the most recent fish tissue samples were obtained from each of the reaches (Greystone Mill, Allendale Pond, Lyman Mill Pond, Manton, Dyerville, and Assapumpset) in 2001, prior to Allendale Dam being restored. Some effects of the dam breach on the Allendale pond data were also discussed. Based on risk levels shown in the risk assessments and other evaluations, no additional biota sampling is proposed at this time.

Anna discussed the *Summary Data Report, dated October 25, 2005* that summarizes the results from the surface water and sediment investigations conducted at the Site in 2004 and 2005. The recently acquired data will be evaluated during the FS. It was noted that if the assumptions change regarding land-use, then additional data may be necessary, depending on what questions need to be answered.

Community Outreach
No items discussed.

Other Items

Lou mentioned that he has placed calls to RIDOT regarding the need to clean out the sediment trap located within the former tailrace at the terminus of the RIDOT Smith Street drainage system.

A discussion ensued regarding recent flooding that occurred in the area of the Site and in Providence. Sediment was reported to have been deposited on park grounds and city streets after the Woonasquatucket River over-topped its banks. It was noted that parking areas at the site as well as Lee Romano Field areas were flooded and need to be examined.

The next MAC meeting is scheduled for January 10, 2006 was scheduled.

Summary - Management Action Committee (MAC) Meeting
Centredale Manor Restoration Project
North Providence, Rhode Island

October 11, 2005

Attendees:

- Anna Krasko, United States Environmental Protection Agency
- Angela Bonarrigo, United States Environmental Protection Agency
- Eugenia Marks, Audubon Society of Rhode Island
- Jenny Pereira, Woonasquatucket River Watershed Council
- Tim Mooney, Senator Chaffee's Office
- Jenny Pereira, Woonasquatucket River Watershed Council
- Julie Blue, The Cadmus Group
- John Martin, The Cadmus Group
- Patrick Gwinn, AMEC
- Jane Sherman, Woonasquatucket River Watershed Council
- Alan Brodd, Town of Johnston
- Lisa Lefkovits, Battelle
- Deidre Dahlen, Battelle
- Beverly Lawrence, US Army Corps of Engineers

Agenda

- Presentation on the Remedial Investigation Report
- Other Items

Note: Angela Bonarrigo, USEPA, opened the meeting. The prior meeting was held on August 9, 2005.

Presentation: Remedial Investigation Report

Deidre of Battelle presented the results of the June 2005 Remedial Investigation Report. The RI report was previously released to the public and copies of the report were placed in the Administrative Record File and Site Repositories, and made available on CD-Rom.

The presentation focused on the investigations conducted since 2000 and the results of the data obtained from these investigations. The presentation included Remedial Investigation objectives; historical sources of contamination; characterization of source area soil and groundwater; and sediment sampling results. Results of the sediment transport modeling and an overview of the human health and ecological risk assessments were also included.

Deidre then outlined the next steps of the project, including: status of additional data collection, developing cleanup goals, and the feasibility study to evaluate cleanup options.

A package of information with copies of the presentation slides and data summary tables from the Remedial Investigation report were distributed at the meeting.

The presentation was followed by question and answers period: Some questions were related to sampling which had been done on Johnston site of Lyman Mill Pond. [At the time of the non-time critical removal action in 2000, public use of the Johnston and North Providence shores of Allendale and Lyman Mill areas was evaluated. A single gravel operation occupies the west side (Johnston) of Lyman Mill pond. No public access points to that shore were found]. Other questions related to transport of particles and potential exposures to air emissions from the Allendale Pond dry bed in the 1990s when the dam was breached. [Modeling of such past exposures is beyond technical capabilities of this project and the scope of the Superfund program. Concerned citizens may consult with RIDOH regarding epidemiological studies such evaluation would entail]

<u>Outreach</u>

EPA plans to provide a site update with the Remedial Investigation results.

<u>Other Items</u>

Next meeting in November will be on the Preliminary Remediation Goals (PRGs) after the PRG report is made available to the stakeholders. PRGs are being developed for exposure pathways and chemicals associated with elevated ecological and human health risks.

The next MAC meeting is scheduled for Thursday, November 10, 2005.

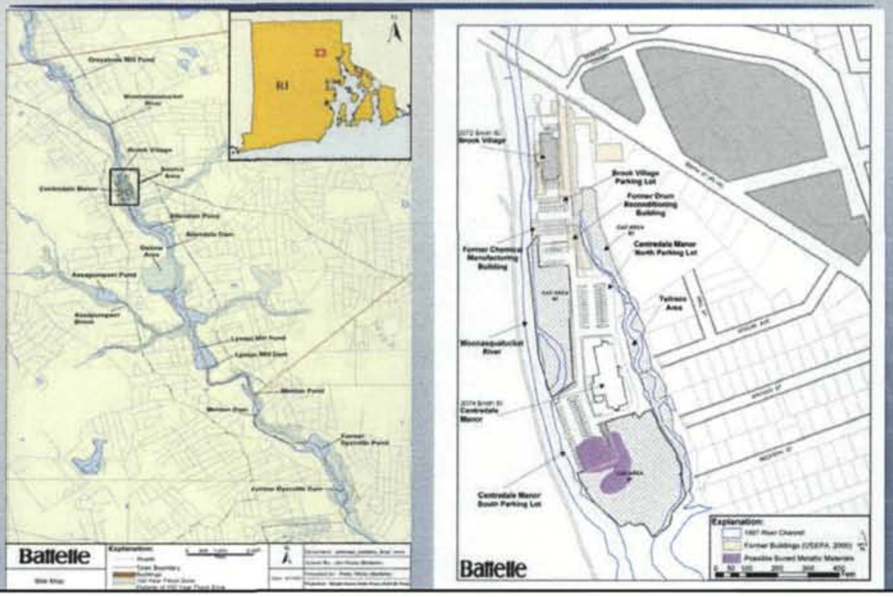
next Nov 1

MAC meeting, Oct. 12th, 2005

Introduction

- CMRP site formerly used for chemical manufacturing and drum recycling operations
- Site currently occupied by Brook Village and Centredale Manor apartment complexes
- Study area includes 3-mile reach of the Woonasquatucket River, and parts of three Rhode Island towns
  - North Providence
  - Providence
  - Johnston

Site Map



RI Objectives

- Determine the sources, nature and extent of contamination
  - Numerous site investigations
  - More than 950 soils, 85 groundwater, 290 sediment and 50 surface water collected
- Characterize fate and transport of contaminants
  - Site-related contaminants migrate to human and ecological receptors
- Evaluate potential human health and ecological risks
  - More than 150 biota (fish, diet, swallow) collected

Summary of Samples Evaluated in RI

Media/Exposure Area	VOCs	SVOCs	Herbicides	Pesticides	PCBs	Metals	Metals (Diss)	Dioxin	AVS/SEM	GS	TOC	Ancillary
Soil												
Source Area	146	154	74	148	423	146		763	7	9	15	9
Allendale	2	5	2	5	5	3		68	–	–	2	–
Lyman Mill	–	41	–	41	41	41		143	–	7	7	7
Groundwater												
Source Area	88	48	–	41	45	50	41	43	0	0	41	41
Sediment												
Assapumpset	–	5	–	6	6	6	NA	5	6	6	6	6
Upstream	–	24	–	30	30	22	NA	28	9	13	22	13
Allendale	2	88	2	98	148	90	NA	296	29	58	133	53
Oxbow area floodplain	–	–	–	4	4	5	NA	9	–	–	4	–
Lyman Mill	–	60	–	66	66	59	NA	84	27	39	70	44
Manton	–	13	–	13	13	13	NA	13	10	10	12	10
Downstream of Manton	–	15	–	15	16	6	NA	16	3	3	15	3
Surface water												
Assaumpset	*1*	2	–	2	2	2	2	*1*	–	–	*1*	*1*
Upstream	2	5	–	5	5	6	5	3	–	–	2	3
Source Area	–	5	–	5	5	5	5	4	–	–	–	–
Allendale	4	20	–	20	20	20	18	16	–	–	4	5
Lyman Mill	3	20	–	20	20	21	19	17	–	–	3	4
Manton	–	–	–	–	–	–	–	–	–	–	–	2
Downstream of Manton	–	–	–	–	–	–	–	–	–	–	–	3

Potential Historical Sources of Contamination

- **Chemical manufacturing activities** – improper storage and disposal of chemicals in drums, stockpiles and surface impoundments
- **Hexachlorophene manufactured** in approximately 1965 – HCX and dioxin are byproducts of process
- **Drum reconditioning operations** – chemical residues dumped or burned prior to reconditioning

Primary Release and Transport Mechanisms (Historical)

Chemicals were apparently released directly to the ground, buried, and possibly discharged directly to the Woonasquatucket River.

- Direct infiltration of chemicals and leaching through ground surface led to surface and subsurface soil contamination
- Leaching of contaminants from source area soil to groundwater led to localized groundwater contamination
- Possible direct discharge of chemical waste to the river contributed to downstream contamination
  - Dioxin and HCX could have been carried downstream in the water column adsorbed to sediment particles
- Surface runoff and erosion of contaminated source area soils led to contamination of surface water and sediment in adjacent river and ponds
  - likely occurred over longer period of time (throughout duration of waste-related activities at site)

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Nature and Extent, Source Area Soil

- Dioxin/furans, VOCs, PCBs, SVOCs, pesticides and inorganics detected
- Majority of contaminated soils are in areas that are paved or capped
- Dioxin concentrations decrease with increasing depth, with only localized contamination at depths > 5-ft bgs
- Selected VOCs and metals exceed RIDEM direct exposure criteria for residential soils
- PCBs highest in central and southern regions of the source area, and in the upper 2-ft of soil
- Other detected contaminants measured at lower concentrations or were less widely distributed compared to dioxins and PCBs

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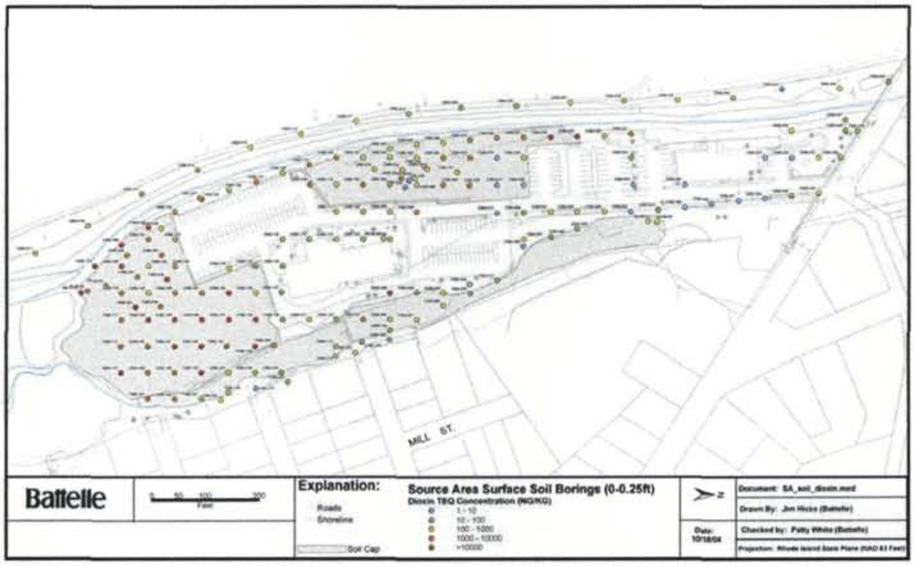
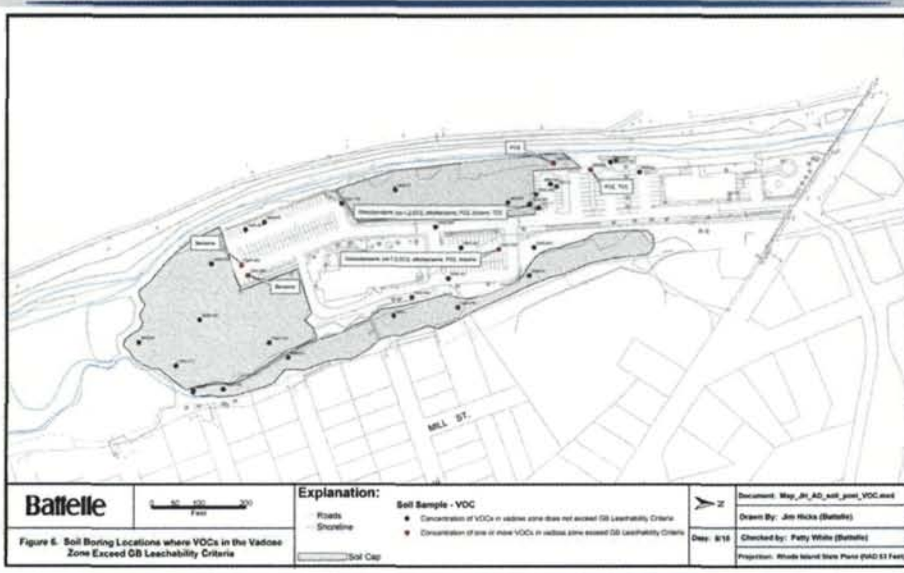
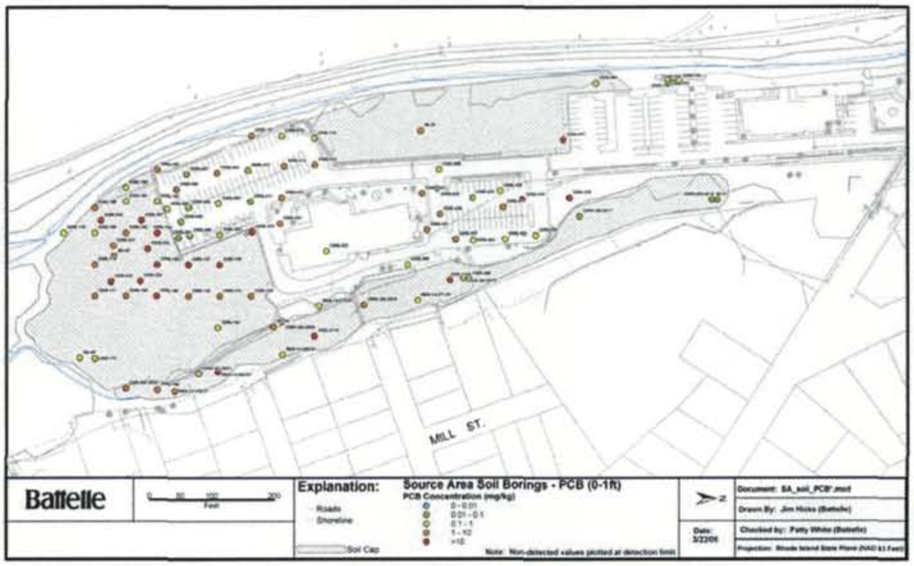
Source Area Soil, Dioxin



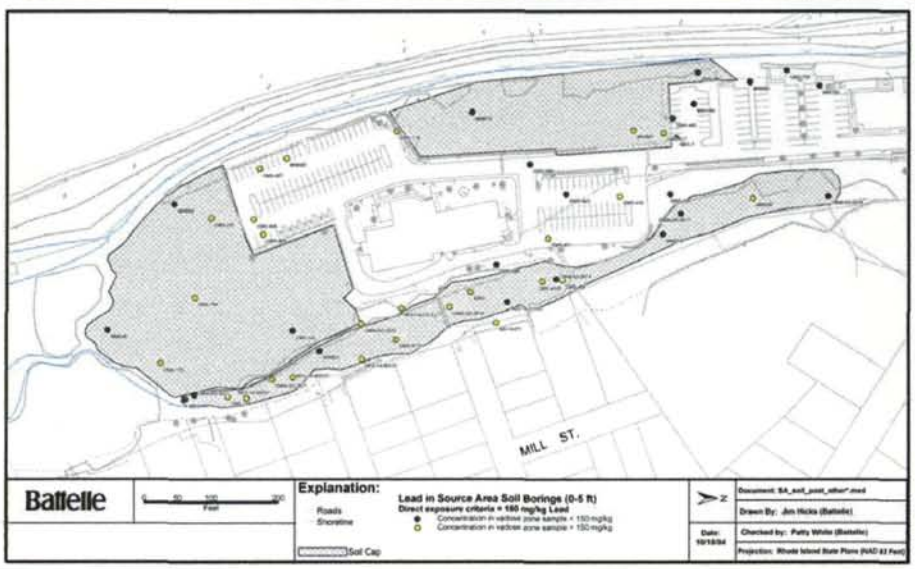
Source Area Soil, VOCs



Source Area Soil, PCB



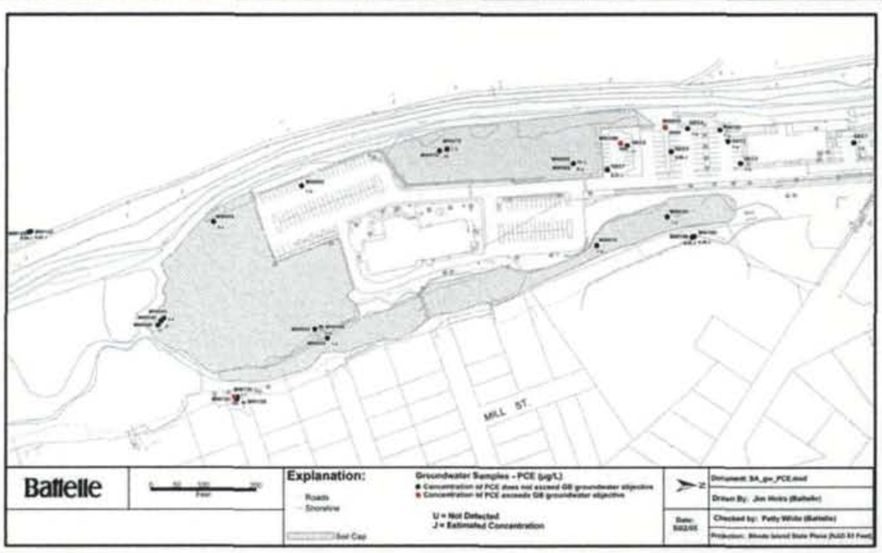
Source Area Soil, Lead



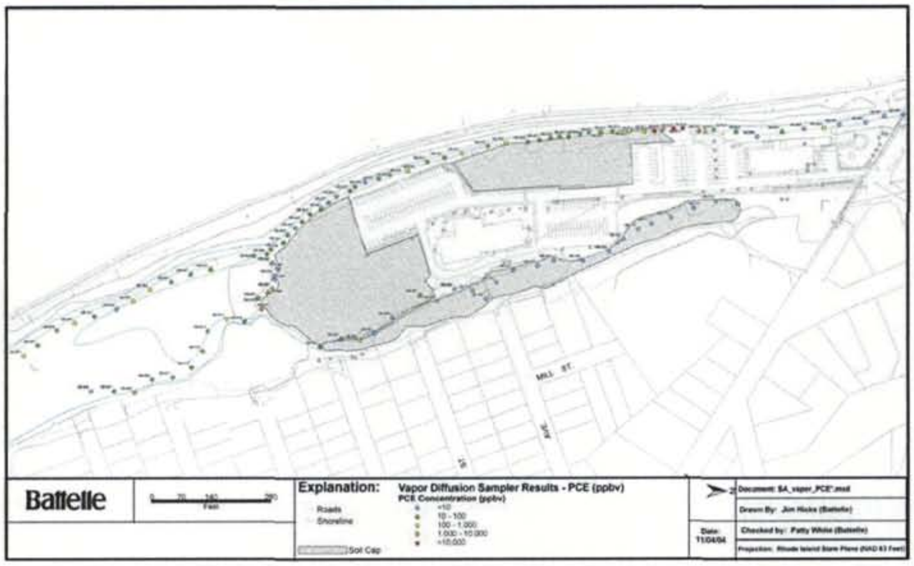
Nature and Extent, Source Area Groundwater

- Contamination is not pervasive or widespread
- VOCs typically below RIDEM GB groundwater criteria, except for at three wells
- High concentration of dioxin measured at Well MW-05S; *dioxin may be mobilized by the solvents*
- Trace levels of several other contaminants were detected in some samples
- Plume of VOC-contaminated groundwater discharges into Woonasquatucket River along east bank
- Additional investigations in process to assess whether dioxin is discharging to river
- Groundwater discharge to Allendale Pond contains low levels of VOCs

Source Area Groundwater, VOCs



Source Area, VOC-contaminated Groundwater Discharge to River



Nature and Extent, Sediment

- Dioxin concentrations highest in Allendale Pond, and decrease in downstream direction
- Allendale and Lyman Mill Ponds – dioxin concentration highest in top 1-ft of sediment
- Mean concentrations of other contaminants also highest in Allendale Pond
- No significant dioxin contamination deposited prior to 1940
- Maximum dioxin concentrations generally correspond to sediments deposited between 1950 to 1970
- Dioxin concentrations are lowest in coarse-grained sediments, and typically higher in fine-grained sediments
- Additional data collection activities in process to better define extent of contamination at Lyman Mill Pond

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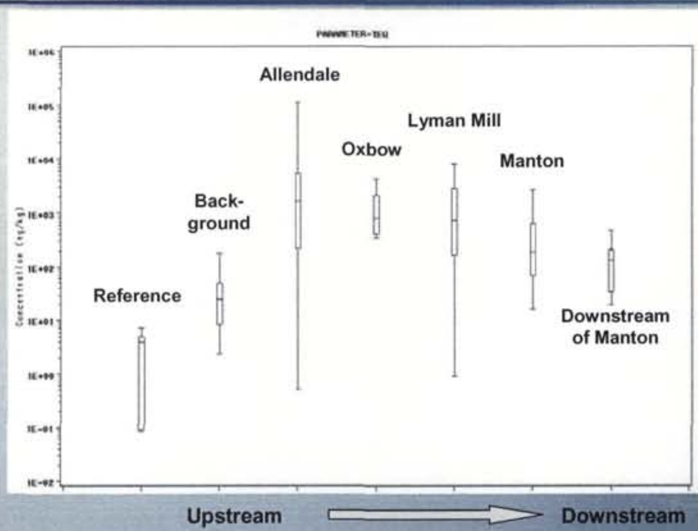
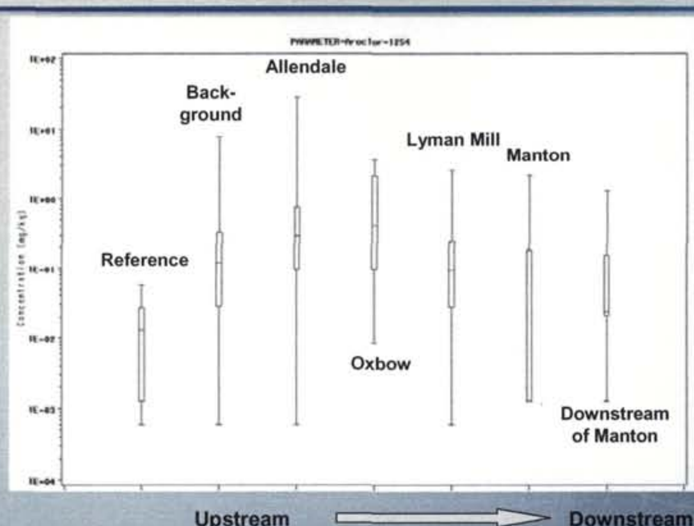
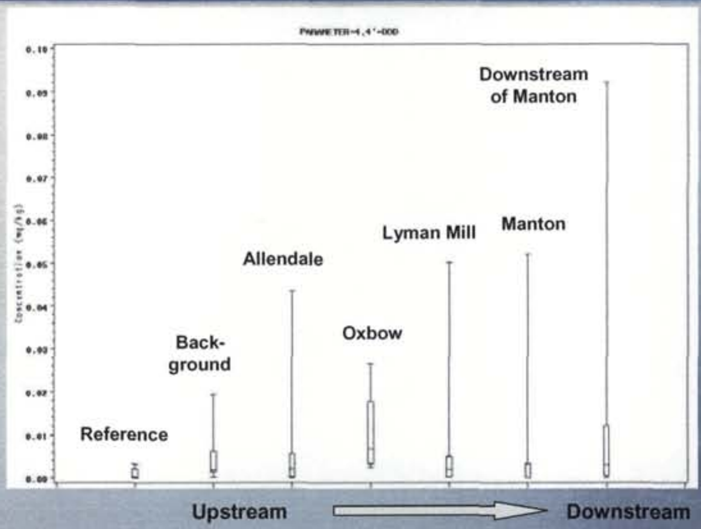
Sediment, Dioxin



Sediment, PCB (Aroclor 1254)



Sediment, 4,4'-DDD



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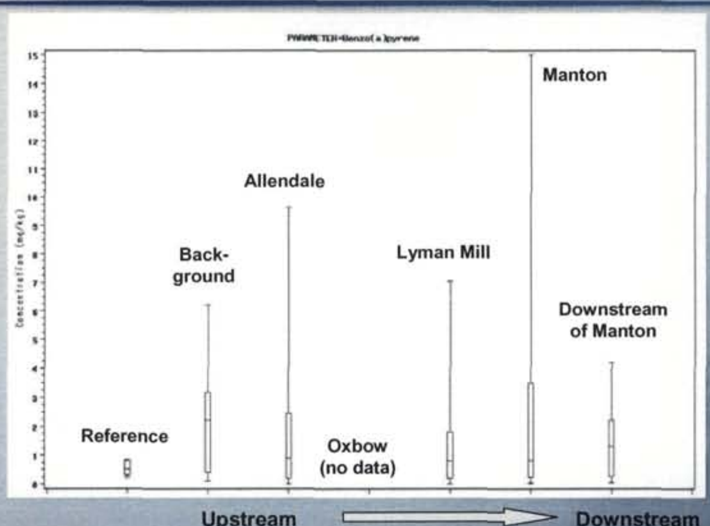
Sediment, Benzo(a)pyrene



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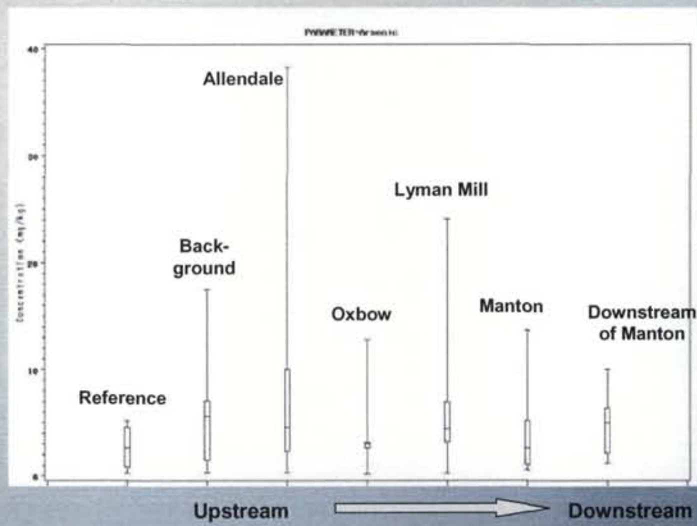
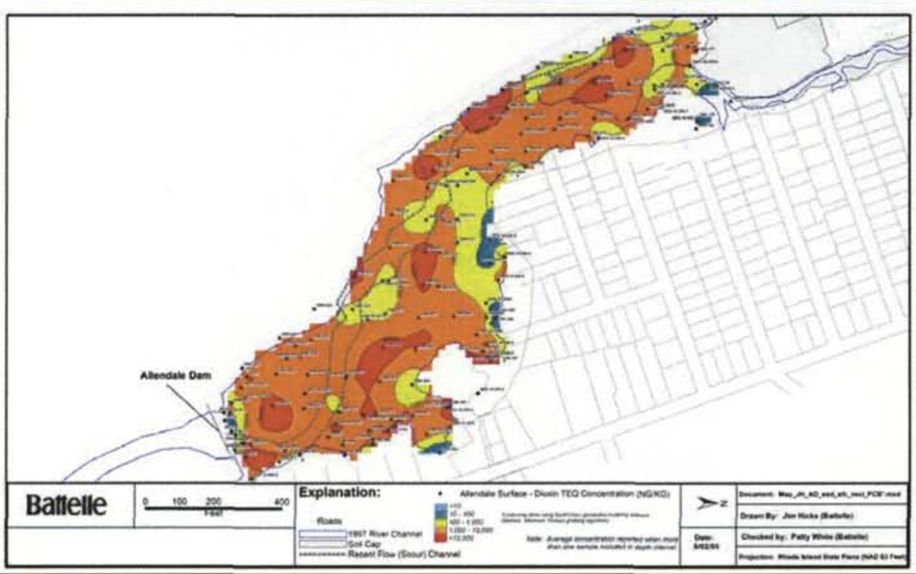
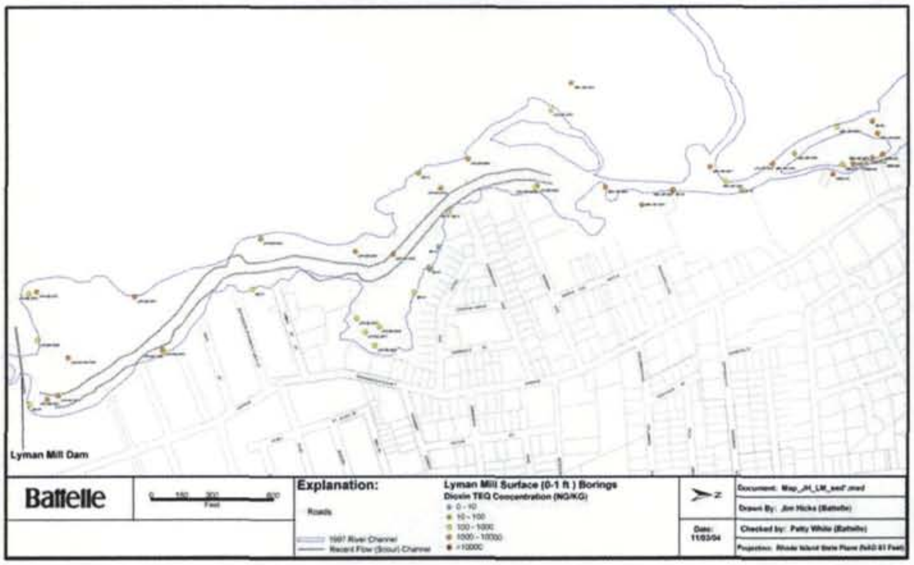
Sediment, Arsenic



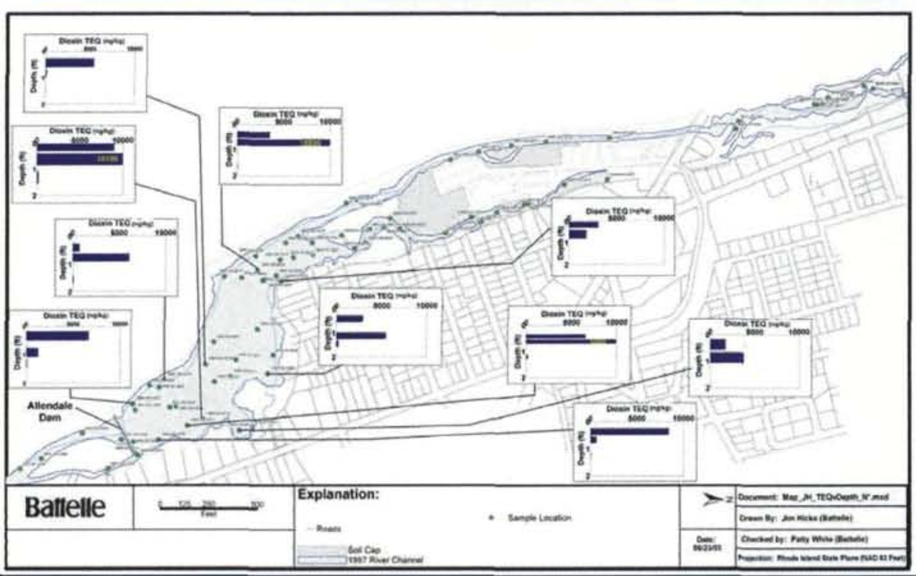
Allendale Pond, Surface Dioxin



Lyman Mill Pond, Surface Dioxin



Allendale, Vertical Dioxin Contamination



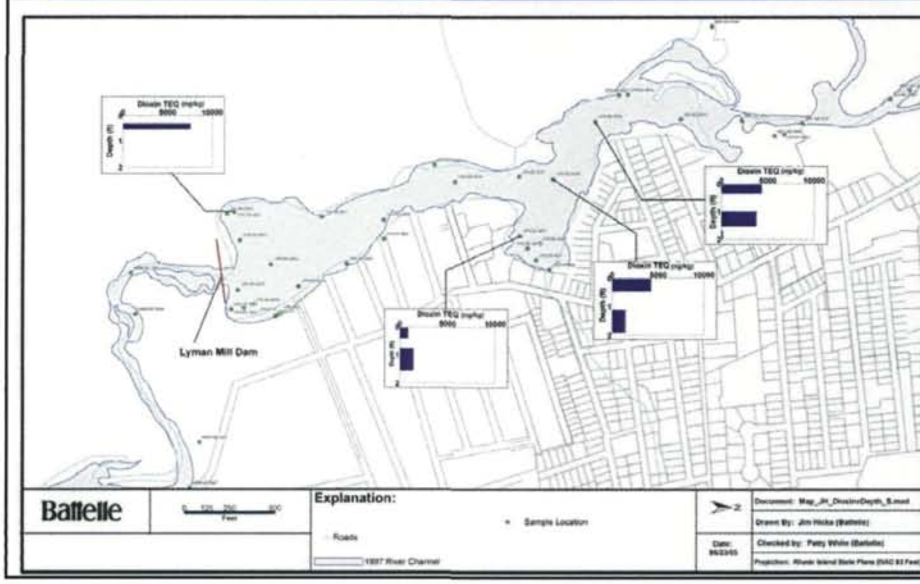
Allendale, Core Log

PROJECT NAME: Centredale Manor Restoration Project
LOCATION: Woonasquatucket River, North Providence, RI
BORING NUMBER: CMS-SD-4206 161-A
LOCATION (lat/long): 280475.87265 332782.43328

DATE: 5/6/03
TOTAL DEPTH: 2.5'

Depth (ft)	Color	210-Pb / 137-Cs 1940 Time Horizon	Dioxin ppb (dry)	TOC (%)	Lithology	Field Description	Interval for Analysis	Lab Description	Clay (%)	Silt (%)	Fine Sand (%)	Medium Sand (%)	Coarse Sand (%)	Gravel (%)	Liquid Limit	Plastic Limit	Plasticity Index	Specific Gravity	Water Content (%)	Ash (%)	Moisture (%)	Organic Matter (%)	Solids (%)
0 – -2	10Y 4/2		2.74; 5.45; 0.216	13.12; 13.29; 13.30		Rootlets, wet, no odor, organic; Leaf litter, wood; Gravel		MH/OH Organic silt, dark yellowish brown	50.01	47.11	2.40	0.49	0.00	0.00	174	171	3	1.97	334	5.9	75.7	18.4	24.3

Lyman Mill, Vertical Dioxin Contamination



Lyman Mill, Core Log

PROJECT NAME: Centredale Manor Restoration Project
LOCATION: Woonasquatucket River, North Providence, RI
BORING NUMBER: LPX-SD-4208 223-A
LOCATION (lat/long): 277580.65722 333388.51628

DATE: 5/6/03
TOTAL DEPTH: 2.8'

Depth (ft)	Color	210-Pb / 137-Cs 1940 Time Horizon	Dioxin ppb (dry)	TOC (%)	Lithology	Field Description	Interval for Analysis	Lab Description	Clay (%)	Silt (%)	Fine Sand (%)	Medium Sand (%)	Coarse Sand (%)	Gravel (%)	Liquid Limit	Plastic Limit	Plasticity Index	Specific Gravity	Water Content (%)	Ash (%)	Moisture (%)	Organic Matter (%)	Solids (%)
0	[illegible]		4.31	7.88		Organic, wet, hydrocarbon odor		MH/OH Sandy organic silt, dark yellowish brown	18.17	50.26	29.43	1.53	0.60	0.00	79	67	12	2.22	214	5.7	66.6	27.8	33.5
-1	[illegible]		3.75	10.80		Organic, sand lens (1/4')		MH/OH Organic silt with sand, dark yellowish brown	11.74	66.25	19.96	1.89	0.15	0.00	61	54	7	2.10	223	5.2	67.0	27.8	27.8
-2			0.013																				
						Lag deposits, coarse sand																	

Potential Secondary Release and Transport Mechanisms (Current)

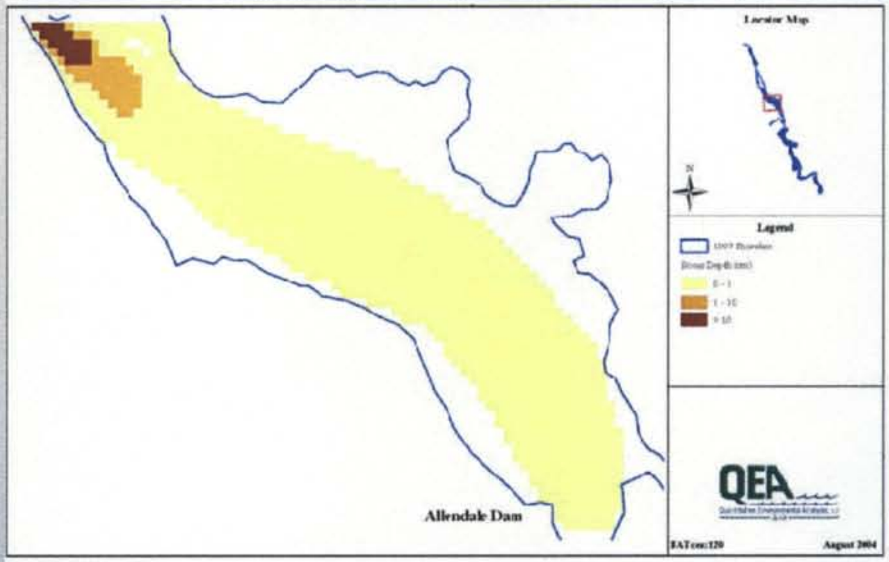
Source Area

- Leaching of contaminants from source area soil to groundwater
  - Leachability evaluation suggests not major pathway of concern, except in vicinity of Brook Village parking lot
  - VOC-contaminated groundwater may be mobilizing dioxin to river
- Volatilization of VOCs from vadose zone soils
  - Not likely to be significant pathway given localized nature of VOC contamination; apparent lack of VOC migration into buildings; presence of soil caps and pavement

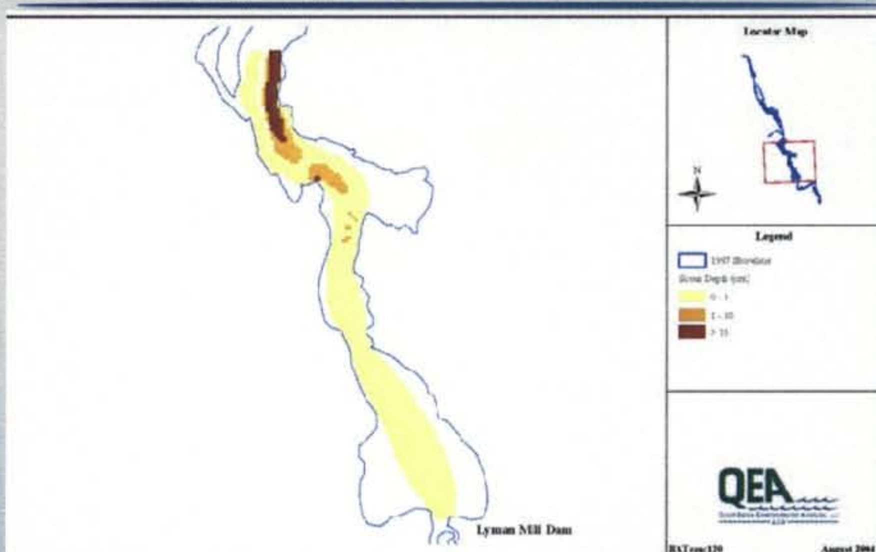
Woonasquatucket River

- Sediment resuspension and downstream transport
  - For 100-yr flood, significant scour will occur over less than 5% of the bed area in Allendale Pond and up to 10 to 15% in Lyman Mill Pond
  - Erosion generally occur in northern regions of the ponds, near the upstream inlets
  - Eroded sediment transported downstream
  - Portion of eroded sediment likely re-deposit within each pond
- Bioaccumulation – chemicals bioaccumulate in biota and transfer up the food chain as wildlife and humans consume contaminated prey

Potential Scour, Allendale Pond



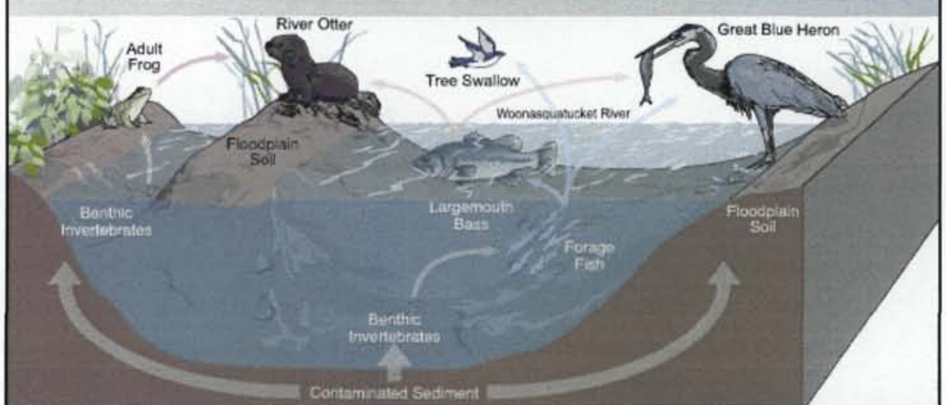
Potential Scour, Lyman Mill Pond



Baseline Ecological Risk Assessment

- Overall, greatest ecological risks associated with exposure to sediments, which pose bioaccumulation hazard
- Allendale and Lyman Mill pond sediments pose greater risk than downstream sediments
- Primary exposure pathway is ingestion of contaminated prey
- Chemicals that contribute to ecological risk
  - Dioxins/furans
  - PCBs (coplanar PCBs, Aroclor 1254 and total Aroclors)
  - Pesticides (4,4'-DDD, 4,4'-DDE, technical chlordane)
  - Metals (Al, As, Ba, Cd, Se, V, Zn)
- Concentrations of predominant risk contributors in tissue are directly related to corresponding sediment concentrations

Ecological Food Web



Baseline Human Health Risk Assessment

- Study areas downstream of site have higher potential cumulative lifetime risks (cancer risks) and hazards (non-cancer risks) compared to background and reference
- Eating fish appears to present higher risk than direct contact with surface water, sediment or soil, especially at Allendale and Lyman Mill ponds
- Workers who come into contact with soil at the Fogarty Center do not appear to be at risk.
- Contaminants of concern
  - Dioxins/furans
  - PCBs (coplanar PCBs, Aroclor 1254 and Aroclor 1268)
  - Pesticides (4,4'-DDE, dieldrin, technical chlordane, Benzo(a)pyrene, Dibenz(a,h)anthracene and n-nitroso-di-n-propylamine)
  - Metals (As and MeHg)

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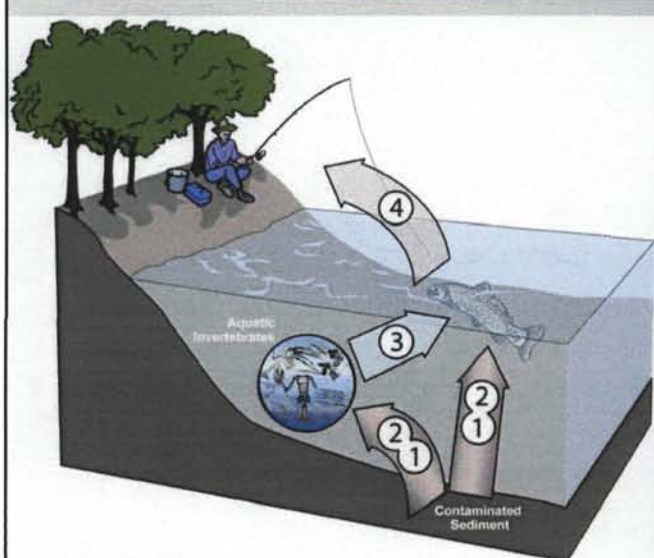
Human Health Exposure Model



1) Direct (contact) exposure of aquatic insects and fish with sediment
2) Indirect (bioaccumulation) exposure of aquatic insects and fish
3) Fish consume insects
4) People eat contaminated fish

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Summary and Conclusions

- Primary sources of contamination are no longer active
- VOC-contaminated groundwater may be mobilizing dioxin
- Nature and extent of contamination

Source Area

- Majority of contaminated soils are in areas that are paved or capped
- Six solvent- and fuel-related VOCs exceed RIDEM direct exposure criteria for residential soils
- Groundwater contamination not pervasive, but exceeds RIDEM GB groundwater criteria at three wells

River and Pond Sediments

- Dioxin concentrations in all reaches of river adjacent to and downstream of the site were significantly higher compared to background
- Dioxin concentration decrease in downstream direction
- Mean dioxin concentrations highest in top 1-ft (Allendale and Lyman Mill)
- Concentrations of other chemicals of concern not significantly higher than background, except for Aroclor 1254 in Allendale Pond
- Maximum dioxin concentrations correspond to 1950 to 1970 time horizon

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Summary and Conclusions

- Current Potential Release and Transport Mechanisms
  - Leaching
  - Sediment resuspension and downstream transport
  - Bioaccumulation
- Ecological Risk Assessment
  - Greatest ecological risks associated with exposure to sediments, which pose bioaccumulation hazard
  - Primary exposure pathway to ecological receptors is ingestion of contaminated prey
  - Sediments in Allendale and Lyman Mill ponds pose greater risk
- Human Health Risk Assessment
  - Areas downstream of site have higher cancer and non-cancer risks compared to background
  - Fish consumption is primary pathway of concern
  - Allendale and Lyman Mill ponds pose greater human health risks

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Next Steps

- **Additional Data Collection Activities –** Fill data gaps and address uncertainties
- **Develop PRGs** for pathways and contaminants associated with unacceptable ecological and human health risks
- **Feasibility Study** – Evaluate risk management strategies and remedial alternatives for contamination that poses unacceptable risk
- **Develop Proposed Plan** – recommend remedial actions that will result in overall protection of human health and the environment

Table 1-1. Chronology of Events at the CMRP Site

Date	Event
1930s	Site occupied by Centredale Worsted Mills and Olneyville Wool Combing Co.
1943	Atlantic Chemical Company began operating on the properties
1952	The New England Container Company, Inc. began operating an incinerator-based drum reconditioning facility on a portion of the site
1953	Atlantic Chemical Company changed its name to Metro-Atlantic, Inc. and subsequently to Crown-Metro Inc.
1965	Metro Atlantic manufactured hexachlorophene
1971	Crown-Metro and New England Container Company ceased operating on the site
1972	Fire destroyed most property structures
1977	Brook Village apartments constructed
1982	Centredale Manor apartments constructed
1991	Allendale Dam breached, reducing the surface water level in Allendale Pond
1996	Dioxin first identified in fish collected from the Woonasquatucket River by U.S. EPA
1999	RIDOH and U.S. EPA issue a fish consumption advisory for dioxin and mercury (advisory was updated in 2003)
1999 – 2000	TCRA implemented by U.S. EPA. Major activities included construction of fencing, installation of two interim soil caps, and placement of riprap along the east bank of the Woonasquatucket River
2000	Final NPL listing
2001	Allendale Dam breached again, exposing most of the Allendale Pond bottom adjacent to residential properties along the eastern bank of the pond
2000 – 2003	NTCRA conducted at the site. Activities included: • Reconstruction of the Allendale Dam and restoration of Allendale Pond • Delineation and excavation of contaminated soils in eleven action areas on residential properties and recreational access points along Allendale and Lyman Mill Ponds, and restoration of the remediated areas
2003 – 2004	TCRA performed in the tailrace on the east side of the source area. The TCRA activities included soil grading, construction of a permeable protective cap over contaminated soils and sediments, installation of a precast modular stormwater control structure at the terminus of a storm drain at the north end of the tailrace, and construction of a drainage swale along the length of the capped area
1999 – 2004	Remedial investigation conducted at site

Summary of Site Investigations

Table 1-2. Summary of Previous Investigations at the CMRP Site

Date	Description	Testing Parameters	Original Use of Data	Reference
May, 1996	Fish collected at two locations: 15 sunfish collected at Valley St. site, Providence. 3 American eel collected at Smith St. site (near Centredale), N. Providence. Fillet and offal samples for each.	Selected metals, PCB congeners, pesticides, dioxin/furans, and dioxin-like PCBs (#77, 126, 169)	Fish analyzed to provide an indicator of the quality of the river system.	*Human Health Risk Screening Analysis for a Subsistence Fisherman in the Woonasquatucket River* (U.S. EPA, 1996); *Human Health Risk Screening Analysis for Recreational Exposure to Sediments in the Woonasquatucket River* (U.S. EPA, 1998b)
October, 1997	Water and sediment collected behind 7 dams on Woonasquatucket River – Esmond, Allendale, Lyman Mill, Manton, Dyerville, Olneyville, Lonigan.	Water: DO, temperature, conductivity, pH Sediment: metals, PAHs, PCBs, pesticides, dioxin/furans, and TOC	First sediment evaluation to locate possible source of dioxin.	*Sediment Water Quality Analysis* (U.S. EPA, 1998c)
September, 1998	Soil and sediment samples collected from the following locations: 5 soil samples at Centredale Manor property, 1 soil sample at Brook Village property, 35 sediment samples on Woonasquatucket River, and 4 sediment samples in Centredale tailrace.	Dioxin/furans and HCX, SVOCs, pesticides, PCBs, and TOC	Sediment investigation to confirm high concentrations of chemicals in sediment near the Centredale Manor property.	*Final Summary Report for Expanded Site Inspection, Centredale Manor* (Roy F. Weston, 1999a)
January, 1999	Soil samples collected from 17 locations at Centredale Manor, No. Providence Boys and Girls Club, Early Years Learning Center, Lee Romano Baseball Field.	2,3,7,8-TCDD only	Determine possible risks to persons using these areas for recreational purposes. Ballfield and Boys/Girls club properties were found to not pose a risk to humans.	*Final Summary Report for Expanded Site Inspection, Centredale Manor* (Roy F. Weston, 1999a)
	Three drinking water samples collected collected – 2 at Yacht Club Bottling Works Co. and 1 at the Pied Piper School.	Dioxin/furans and HCX	Determine possible risks to persons drinking water at these locations.	*Final Summary Report for Expanded Site Inspection, Centredale Manor* (Roy F. Weston, 1999a)

Table 1-2. (continued)

Date	Description	Testing Parameters	Original Use of Data	Reference
February, 1999	222 soil samples collected from Centredale Manor and Brook Village properties and several residential properties located adjacent to Centredale Raceway.	2,3,7,8-TCDD only	Determine extent of surface contamination, and develop approach for short-term actions under emergency response.	*Final Site Investigation Report* (IT Group, 2000)
March, 1999	ATSDR Health Consultation	N/A	Evaluated expanded site inspection results for public health implications. Recommended measure to restrict public access to areas where dioxin in surface soil was >1,000 ng/kg.	*Health Consultation, Woonasquatucket River and Centredale Manor* (ATSDR, 1999)
February and April, 1999	Geophysical surveys conducted in source area	N/A	Determine if buried objects existed on the site.	*Geophysical Investigation Report, Centredale Manor Site* (Roy F. Weston, 1999b)
June - July, 1999	A total of 424 soil samples collected from Centredale Manor and Brook Village properties	All samples: 2,3,7,8-TCDD Most samples: PCBs 20% of samples also analyzed for SVOCs, metals, and pesticides	Determine extent of contamination and provide support for the selected approach for short-term actions.	*Final Site Inspection Report* (IT Group, 2000)
July, 1999	12 soil samples collected from the footprint of Allendale Dam	Dioxin/furans, pesticides, PCBs, PAHs, metals, and TOC	Determine extent of contamination.	*Final Site Inspection Report* (IT Group, 2000)
July, 1999	23 soil samples collected at the Narragansett Electric Company greenway	2,3,7,8-TCDD only	Identify presence of contaminants.	*Final Site Inspection Report* (IT Group, 2000)
July - August, 1999	63 soil samples collected at residential properties adjacent to Allendale Pond.	Dioxin/furans	Identify presence of contaminants on residential property, and determine appropriate location of fence to control access to contaminated areas.	*Final Site Inspection Report* (IT Group, 2000)

Table 1-2. (continued)

Date	Description	Testing Parameters	Original Use of Data	Reference
August, 1999	5 indoor air samples collected in Centredale Manor and Brook Village.	VOCs	Performed to identify possible hazards to residents from air quality inside building. No significant VOCs were found to be migrating into buildings.	*Final Report, Centredale Manor Indoor Air Survey* (U.S. EPA, 1999a)
September, 2000	Engineering Evaluation/Cost Analysis	N/A	The EE/CA was performed as the basis for a NTCRA. The EE/CA included a streamlined human health risk assessment and screening ecological risk assessment (ERA). An action level of 1,000 ng/kg dioxin as a toxic equivalency (TEQ) was selected as the action level for the NTCRA.	*Final Engineering Evaluation/Cost Analysis* (TTNUS, 2000a)
September – October, 1999	43 sediment samples collected from Allendale Pond.	2,3,7,8-TCDD and PCBs	Begin to evaluate downstream extent of contamination	*Final Site Inspection Report* (IT Group, 2000)
November, 1999	11 soil samples collected from the river bank near Brook Village. Soil now covered with rip-rap.	All samples analyzed for 2,3,7,8-TCDD and PCBs; selected samples also analyzed for VOCs, SVOCs, pesticides, herbicides, and metals.	Determine need to cap bank soils at Brook Village property	*Final Site Inspection Report* (IT Group, 2000)
April, 2002	*40 soil samples collected by LEA for the Centredale Manor Performing Parties Group*	Dioxins/furans	Define dioxin concentrations between NTCRA action areas	*Centredale Manor Restoration Project – 8290 Data* (LEA, 2002b)
July, 2002	51 soil samples collected by LEA for the Centredale Manor Performing Parties Group	Dioxin using immunoassay screening method and dioxin/furans using laboratory method	Further delineate excavation limits of action areas for NTCRA	*Additional Sampling Activities, Centredale Manor Restoration Project* (LEA, 2002a)

Modified from TTNUS (2000a).
N/A = Not applicable.

Table 2-1. Summary of RI Activities for the CMRP Site

Date	Description	Testing Parameters	Original Use of Data	Reference
September, 1999	165 vapor diffusion samples installed by the USGS in the Woonasquatucket River and tailrace	Selected VOCs	Located discharge locations of VOC-contaminated groundwater from source area into the river.	*Distribution of Selected Volatile Organic Compounds Determined with Water-to-Vapor Diffusion Samplers at the Interface Between Groundwater and Surface Water, Centredale Manor Site* (USGS, 2000a)
October – November, 1999	50 aquatic and floodplain sediment samples collected from river, Allendale and Lyman Mill ponds, and upstream locations	Dioxin/furans and HCX, SVOCs, metals, pesticides, PCBs, grain size, TOC, and AVS/SEM	Determine nature and extent of contaminants in sediment downstream of source area and provide data for risk assessments.	*Final Technical Memorandum, Woonasquatucket River Sediment Investigation* (TTNUS, 2000b)
	36 water samples collected from river, Allendale and Lyman Mill ponds, and upstream locations	Dioxin/furans and HCX, SVOCs, metals (total and dissolved), pesticides and PCBs	Determine nature and extent of contaminants in surface water downstream of source area and provide data for risk assessments.	*Final Technical Memo-randum, Woonasquatucket River Sediment Investigation* (TTNUS, 2000b)
	24 bank sediment samples collected from upstream locations and south to Lyman Mill Dam	Dioxin/furans and HCX, SVOCs, pesticides and PCBs	Determine nature and extent of contaminants in bank sediment and provide data for risk assessments.	*Final Technical Memo-randum, Woonasquatucket River Sediment Investigation* (TTNUS, 2000b)
	126 soil samples collected from residential use soils along Centredale tailrace, Allendale Pond, and Lyman Mill Pond.	All samples: Dioxin/furans and HCX Approximately half of samples also analyzed for SVOCs, metals, pesticides and PCBs	Determine nature and extent of contaminants on residential use property adjacent and downstream of source area and support NTCRA.	*Final Technical Memorandum, Woonasquatucket River Sediment Investigation* (TTNUS, 2000b)
July, 2000	N/A	N/A	Identified historical site features and potential sources of contamination.	*Aerial Photographic Analysis, Centredale Manor Site Subarea, North Providence, Rhode Island* (U.S. EPA, 2000)

Table 2-1. (continued).

Date	Description	Testing Parameters	Original Use of Data	Reference
Summer 2000	Tree swallow samples collected by USGS at two locations: 5 nestling, 1 diet, and 7 unhatched eggs collected at Greystone Mill Pond. 5 nestling, 2 diet and 13 unhatched eggs collected at Allendale Pond.	Dioxins/furans, HCX, PCB congeners (100+), and lipid content	Swallows analyzed to provide an indicator of the quality of the river system.	*Task 15 Revised Letter Data Report* (Battelle, 2000)
September, 2000	Sediment samples collected from 11 stations in Manton and Dyerville reaches of the Woonasquatucket River.	Dioxin/furans and HCX, SVOCs, metals, pesticides and PCBs, grain size, TOC, and AVS/SEM	Performed to determine the extent of contamination in the Woonasquatucket River downstream of Lyman Mill Dam.	*Draft Technical Memorandum, Manton and Dyerville Reaches Sediment Sampling* (TTNUS, 2001)
September, 2000 – August, 2001	Soil borings advanced and monitoring wells installed by in the source area; collection of surface and subsurface soil samples; geophysical survey; water level monitoring; and hydraulic conductivity tests.	Dioxin/furans and HCX, VOCs, SVOCs, metals, pesticides, and PCBs	Performed to determine nature of soil contamination in the source area, characterize hydrogeological setting and groundwater flow.	*Draft Technical Memorandum, Source Area Investigation* (TTNUS, 2002)
	Groundwater samples were collected in two events from monitoring wells using low-flow sampling methods. Initial sampling was conducted at 7 shallow overburden wells located in the raceway and source area monitoring wells. The second groundwater event sampled 33 monitoring wells (shallow overburden, deep overburden, and bedrock wells).	Dioxin/furans, HCX, VOCs, SVOCs, pesticides, PCBs, metals (total and dissolved), alkalinity, sulfides, and TOC	Performed to determine the nature and extent of groundwater contamination at and adjacent to the Centredale Manor and Brook Village properties.	*Draft Technical Memorandum, Source Area Investigation* (TTNUS, 2002)
April-July, 2001	Biota (99 fish, 12 crayfish, 12 earthworm, and 2 composite emerging insects) were collected from Allendale Reach, Lyman Mill Reach, Manton Reach and Dyerville Reach, Greystone Mill Pond, and Assapumpset Brook before Alllendale Dam restored.	Dioxins/furans, HCX, PCBs, pesticides, metals, and lipid content; fish also analyzed for SVOCs Approximately 20% of the samples also analyzed for PCB congeners	Performed to support BERA and BHHRA.	*Data Evaluation Report* (MACTEC, 2003)

Table 2-1. (continued).

Date	Description	Testing Parameters	Original Use of Data	Reference
April-July, 2001	19 sediment samples were collected from upstream locations, Greystone Mill Pond, Allendale Reach, Lyman Mill Reach, and Assapumpset Brook before Allendale Dam restored.	Dioxins/furans, HCX, PCBs, pesticides, SVOCs, metals, methyl mercury, AVS/SEM, grain size and total organic carbon Approximately 20% of the samples also analyzed for PCB congeners	Performed to support BERA and BHHRA.	*Data Evaluation Report* (MACTEC, 2003)
	11 floodplain soil samples were collected from upstream locations, Allendale Reach, and Lyman Mill Reach before Allendale Dam restored.	Dioxins/furans, HCX, PCBs, pesticides, SVOCs, metals, methyl mercury, grain size and total organic carbon Approximately 20% of the samples also analyzed for PCB congeners	Performed to support BERA and BHHRA.	*Data Evaluation Report* (MACTEC, 2003)
	9 surface water samples were collected from upstream locations, Allendale Reach, Lyman Mill Reach, and Assapumpset Brook before Allendale Dam restored.	PCBs, pesticides, SVOCs, VOCs, metals (total and dissolved), hardness, biological oxygen demand, and nutrients	Performed to support BERA and BHHRA.	*Data Evaluation Report* (MACTEC, 2003)
April-May, 2001	U.S. Fish and Wildlife Service assessed differences between species and numbers of anuran amphibians (i.e., frogs) at the site and reference areas.	Anuran call survey	Performed to support BERA.	*Anuran Call Survey of the Woonasquatucket River in the Vicinity of the Centredale Manor Superfund Site, North Providence, RI.* (U.S. Fish and Wildlife Service, 2002)

Table 2-1. (continued).

Date	Description	Testing Parameters	Original Use of Data	Reference
Summer 2001	Tree swallow samples collected by USGS at three locations: • 5 nestling, 1 diet, 5 nestling liver, and 9 unhatched eggs collected at Greystone Mill Pond. • 5 nestling, 1 diet, 5 nestling liver and 16 unhatched eggs collected at Allendale Pond. • 5 nestling, 1 diet, 5 nestling liver and 11 unhatched eggs collected at Lyman Mill Pond.	All samples (except nestling liver and 8 out of the 36 nestlings) were analyzed for dioxins/furans, and HCX. Ten percent of all samples (except nestling liver) were also analyzed for approximately 130+ PCB congeners. A subset of samples (except nestling liver) were also analyzed for PCB Aroclor, chlorinated pesticides and lipid content. Nestling liver samples were analyzed for metals and methyl mercury.	Swallows analyzed to provide an indicator of the quality of the river system.	*Post Third Party Validation, Task 22A Tree Swallow Chemistry Data Report* (Battelle, 2002b)
Summer 2001	At the completion of the Early Life Stage (ELS) test, 39 ELS egg and 14 catfish fry samples were collected for chemical analysis.	Dioxins/furans, PCBs 77 and 126, and lipid content	Assess risk to demersal, omnivorous fish from contaminants associated with sediments from Allendale and Lyman Mill Ponds and the Woonasquatucket River. Results from the ELS study used to support the BERA.	*Post Third Party Validation, ELS Egg and Catfish Fry Chemistry Data Report* (Battelle, 2002a)
Summer 2002	Tree swallow samples collected by USGS at four locations: • 4 unhatched eggs and 1 nestling collected at Greystone Mill Pond. • 7 unhatched eggs collected at the Woonasquatucket Reservoir in Smithfield, RI. • 5 unhatched eggs collected at Allendale Pond. • 3 unhatched eggs collected at Lyman Mill Pond.	Dioxin/furans	Swallows analyzed to provide an indicator of the quality of the river system.	*Post Third Party Validation, Task 22H Tree Swallow Chemistry Data Report* (Battelle, 2003d)

Table 2-1. (continued).

Date	Description	Testing Parameters	Original Use of Data	Reference
October-November, 2002	27 surface and subsurface soil samples were collected from the tailrace on the east side of the source area	26 out of 27 samples analyzed for dioxin/furans and HCX; 2 samples also analyzed for PCBs, pesticides, SVOCs, metals, methyl mercury, TOC and grain size distribution	Performed in support of the RI to better define the distribution and extent of dioxin contamination, and screen for the presence of other site-related contaminants.	*Data Summary Report, Interim Data Collection for the RI/FS* (Battelle, 2003a)
	Groundwater samples collected from 33 existing monitoring wells located in the source area	VOCs (Well MW-05S also sampled for dioxin/furans)	Performed to evaluate temporal trends in contaminant concentrations in support of the RI.	*Data Summary Report, Interim Data Collection for the RI/FS* (Battelle, 2003a)
	3 surface soil samples collected from the John E. Fogarty Center near Lyman Mill Dam	Dioxin/furans, HCX, PCBs, pesticides, SVOCs, metals, methyl mercury, TOC and grain size distribution	John E. Fogarty Center data collected to support human health risk assessment.	*Data Summary Report, Interim Data Collection for the RI/FS* (Battelle, 2003a)
Summer 2003	Tree swallow samples collected by USGS at four locations: • 1 unhatched egg collected at Greystone Mill Pond (upstream of site) and Firestation (Smithfield, RI). • 2 unhatched eggs collected at Allendale Pond, downstream of the site. • 4 unhatched eggs, 4 nestling, and 1 diet collected at Manton Pond, downstream of Lyman Mill Dam.	Dioxin/furans	Swallows analyzed to provide an indicator of the quality of the river system.	*Post Third Party Validation, Task 221 Tree Swallow Chemistry Data Report* (Battelle, 2004b)
Fall 2002	U.S. EPA Environmental Response Team (ERT) conducted waterborne geophysical surveys at Allendale and Lyman Mill Ponds. Two geophysical methods were attempted: GPR imaging and acoustic sub-bottom profiling. The sub-bottom profiling was unsuccessful due to heavy vegetation and gas bubbles on the pond bottoms.	GPR was used to map soft sediment thickness in both of the ponds. Bathymetric data also were collected.	Data used in conjunction with the results of the geomorphology investigation (2002) to target depositional areas for a sediment coring study.	*Waterborne Geophysical Surveys and Sediment Coring, Centredale Manor Site* (Lockheed Martin, 2003)

Table 2-1. (continued).

Date	Media/Collected By	Testing Parameters	Original Use of Data	Reference
2002	The USACE Environmental Research and Development Center (ERDC) conducted a geomorphology investigation of the Woonasquatucket River	Aerial photographs and maps from different time periods were examined for identification and comparison of geomorphic features (e.g., floodplains, terraces, abandoned channels) and processes over time. Field mapping supported map and photo analysis.	The identification of landforms and processes used to plan future sampling operations by delineating those areas most likely to enhance contaminant concentration and migration.	*Geomorphic Assessment of the Woonasquatucket River* (USACE/ERDC, 2004)
May, 2003	U.S. EPA ERT and USACE ERDC conducted a joint sediment characterization study at Allendale and Lyman Mill Ponds. 20 sediment vibracores were collected from Allendale Pond, 10 sediment vibracores from Lyman Mill, and 6 hand-push cores were collected from the forested wetland south of Allendale Dam	Geologic characteristics of sediment cores were logged. Samples from various depth intervals were analyzed for radioisotopes (^{210}Pb and ^{137}Cs), TOC, dioxin/furans, and geotechnical parameters, (water content, specific gravity, Atterberg Limits, grain size, and moisture, ash and organic matter)	Identify the sediment depth associated with the onset of waste-related activities at the site. Identify any relationships between sediment depth, age, and dioxin (2,3,7,8-TCDD) concentration. Estimate the rate of sediment accumulation in depositional areas and assess the degree to which natural recovery (i.e., burial) appears to be occurring.	*Chemistry Data Report, Task RI-8 Sediment Investigation* (Battelle, 2004c)
Summer 2004	Sediment stability evaluation at Allendale and Lyman Mill Ponds	N/A	Existing data were analyzed to develop a CSM for sediment transport. A hydrodynamic model was developed to evaluate the potential impacts of 5-, 10-, 25-, 50-, and 100-year floods on bed stability, and to identify areas of potential scour during flood events.	*Draft Technical Memorandum, Sediment Stability Study, Centredale Manor Restoration Project Superfund Site.* (QEA, 2004a)

Table 2-1. (continued).

Date	Description	Testing Parameters	Original Use of Data	Reference
Summer 2004	7 surface sediment samples were collected from the Oxbow area (forested wetland located southwest of Allendale Dam)	All samples were analyzed for dioxin/furans; approximately half of the samples were analyzed for PCBs, pesticides, metals, and TOC	Performed in support of the RI.	*Final Work Plan, Sediment Sample Collection and Analysis at the Oxbow Area, Centredale Manor Restoration Project Superfund Site.* (Battelle, 2004a)
Fall 2004	Forensic evaluation of existing sediment and soil dioxin/furan, HCX, PCB and pesticide data	N/A	Performed for the RI to support source characterization and identify potential upstream sources of dioxin contamination.	Appendix E of this document

N/A = not applicable.

Statistical Summary for Chemicals that Contribute to Ecological and Human Health Risk

Table 4-9. Summary of Chemical Concentrations in Sediment

PARAMETER	Allendale Sediment			Oxbow Area Floodplain Soil			Lyman Mill Sediment			Manton Sediment			Downstream of Manton Sediment			Upstream Sediment (Background)			Assapumpset Sediment (Reference)		
	Minimum	Maximum Detected	Geometric Mean [a]	Minimum	Maximum Detected	Geometric Mean [a]	Minimum	Maximum Detected	Geometric Mean [a]	Minimum	Maximum Detected	Geometric Mean [a]	Minimum	Maximum Detected	Geometric Mean [a]	Minimum	Maximum Detected	Geometric Mean [a]	Minimum	Maximum Detected	Geometric Mean [a]
Dioxins/Furans/HCX (ng/kg)																					
TEQ	0.52	110000	972	347	4291	995	0.89	8030	491	16.3	2670	191	19.2	471	95.1	2.30	179	21.0	0.085	7.36	**3.29**
Semivolatile Organic Compounds (mg/kg)																					
Benzo(a)pyrene	0.012	9.62	0.72	NA	NA	NA	0.012	7.04	0.53	0.032	15.0	0.95	0.063	4.20	0.85	0.10	6.20	*2.20*	0.22	0.84	0.50
Dibenz(a,h)anthracene	0.016	2.60	-	NA	NA	NA	0.016	1.24	-	0.078	1.30	0.14	0.038	0.68	0.16	0.016	0.88	*0.45*	0.10	0.18	0.12
n-nitroso-di-n-propylamine	0.023	NA	-	NA	NA	NA	0.0083	NA	-	0.20	1.40	-	0.20	NA	-	0.023	NA	-	0.023	NA	-
PCBs and Pesticides (mg/kg)																					
PCB TEQ	0.00015	0.00015	*0.00015*	NA	NA	NA	0.000017	0.000065	*0.000019*	NA	NA	NA	NA	NA	NA	0.000025	0.000037	*0.000031*	NA	NA	NA
Aroclor-1254	0.0006	28.0	0.27	0.0085	3.58	**1.10**	0.0006	2.60	0.085	0.0013	2.20	-	0.0013	1.30	-	0.0006	7.80	0.11	0.0006	0.058	-
Aroclor-1268	0.034	0.16	0.067	0.0081	0.10	-	0.035	0.31	0.085	0.016	0.017	*0.017*	0.12	0.12	-	0.022	0.25	0.081	0.0046	0.042	*0.023*
Total Aroclor	0.0006	28.0	0.27	0.10	3.58	*0.41*	0.0006	2.92	0.084	0.20	0.39	*0.23*	0.042	1.42	-	0.0006	7.80	*0.17*	0.0006	0.099	*0.028*
4,4'-DDD	0.00002	0.040	-	0.0025	0.027	*0.0067*	0.0002	0.050	-	0.0001	0.052	-	0.0001	0.092	0.0018	0.0002	0.019	*0.0020*	0.0001	0.0032	-
4,4'-DDE	0.00007	0.23	-	0.0025	0.042	*0.0063*	0.0001	0.043	-	0.0001	0.048	-	0.0001	0.012	0.0017	0.0001	0.031	-	0.0001	0.0055	-
4,4'-DDT	0.0002	0.030	-	0.0001	0.003	-	0.0002	0.039	-	0.0001	NA	-	0.0001	0.52	0.0041	0.0002	0.053	-	0.0001	0.0090	-
Dieldrin	0.0001	0.17	-	0.0001	0.063	**0.017**	0.0001	0.017	-	0.0001	NA	-	0.0001	0.030	-	0.0001	0.0094	-	0.0001	0.0019	-
Technical Chlordane	0.0005	0.97	*0.028*	0.0081	0.030	-	0.017	2.21	**1.15**	NA	NA	-	NA	NA	-	0.15	0.74	0.37	0.064	0.15	*0.11*
Inorganics (mg/kg)																					
Aluminum	1790	22168	**8990**	NA	NA	NA	1690	27773	7892	1800	10700	3932	3000	10700	4840	1880	24690	7348	2980	21774	7593
Arsenic	0.31	18.0	3.03	0.18	12.8	2.91	0.27	14.8	4.24	0.60	13.7	1.66	1.20	6.30	-	0.36	13.5	3.83	0.24	5.21	**2.65**
Barium	0.40	326	**110**	163	514	248	10.0	380	81.3	16.3	155	48.6	31.7	228	93.9	7.60	375	**160**	26.4	204	71.9
Cadmium	0.030	5.50	-	0.0075	8.25	**2.61**	0.025	7.00	0.75	0.11	23.9	0.83	0.29	95.1	-	0.030	4.35	*0.71*	0.065	0.86	-
Mercury	0.0061	3.60	0.11	NA	NA	NA	0.0050	1.20	0.16	0.0050	0.31	-	0.0050	1.06	-	0.010	0.81	0.15	0.0050	0.11	-
Methylmercury	0.0002	0.0029	0.0006	NA	NA	NA	0.0003	0.0096	0.0009	NA	NA	NA	NA	NA	NA	0.00008	0.0008	0.0003	0.0003	0.0009	*0.0006*
Selenium	0.30	4.70	-	0.21	2.22	**1.52**	0.24	4.50	-	0.23	2.90	-	0.24	NA	-	0.38	3.60	0.91	0.23	2.20	-
Vanadium	4.85	111	24.7	31.8	71.1	**53.8**	4.00	91.7	27.9	4.80	44.4	11.6	8.90	28.4	13.1	6.80	159	39.8	5.80	32.0	**17.0**
Zinc	0.26	2088	**299**	58.3	1867	240	15.4	2060	232	14.2	1050	107	55.9	1930	355	11.4	856	175	28.0	227	79.4

(a) Central tendency not determined for analytes with less than 50% detected results, as indicated by a dash.
Bold = arithmetic mean (data normally distributed)
Italics = median (data not lognormally or normally distributed)
Yellow shaded cells indicate that mean concentration is significantly higher than background. Oxbow area floodplain soil data were not statistically compared to background data.
Blue shaded cells indicate that mean concentration is significantly lower than background. Oxbow area floodplain soils were not statistically compared to background data.

Summary Risk Assessment Tables

Table 6-3. Summary of BERA Results for each Assessment Endpoint

Assessment Endpoint[a]	Measures of Effect[a]	Inference Weight[a]	Risk/Magnitude
1a. Protection and maintenance (i.e., survival, growth, reproduction) of aquatic invertebrate communities, which are a forage base for fish and wildlife populations	A. Comparison of surface water COC concentrations to criteria/guidelines	L-M	Yes/High
	B. Comparison of sediment COC concentrations to benchmarks/guidelines	M	Yes/High
	C. Whole sediment laboratory bioassays	M-H	Yes/High
	D. Comparison of measured COC concentrations in aquatic macroinvertebrates to CBRs	L-M	Yes/Low
	E_1. Aquatic macroinvertebrate community structure/function	M-H	No/Very Low
	E_2. Emerging aquatic macroinvertebrate productivity	L-M	No/Low
	Risk Conclusion		**Yes/High[b]** **No/Low[c]**
1b. Protection and maintenance (i.e., survival, growth, reproduction) of floodplain invertebrate communities, which are a forage base for wildlife populations	A. Comparison of soil COC concentrations to benchmarks/guidelines	L-M	Yes/High
	B. Comparison of measured COC concentrations in floodplain invertebrates to CBRs	L-M	Yes/High
	C. Floodplain macroinvertebrate community integrity	M	No/Very Low
	Risk Conclusion		**No/Low**
2. Protection and maintenance of demersal, omnivorous fish populations as a forage base or sports fishery.	A_1. Fish length-weight relationships and condition indices relative to habitat characterization	L-M	No/Low
	A_2. Percent gross lesions in individual fish	M	Yes/Low
	A_3. Demographic structure analysis of dominant species (based on fish scales)	M	No/Very Low
	A_4. Species richness and relative abundance of ichthyoplankton	M	Indeterminate
	B_1. Comparison of measured concentrations or toxic equivalencies in fish tissue to literature derived CBRs	M-H	Yes/High
	B_2. Comparison of modeled concentrations or toxic equivalencies (using BSAFs) in eggs and fish tissue to literature derived CBRs	M	Indeterminate
	B_3. Partial life cycle laboratory water exposure of fish eggs dosed with synthetic mixture emulating DLC composition of Allendale Pond fish tissue.	M	Yes/High
	Risk Conclusion		**Yes/High**
3. Protection and maintenance of pelagic, piscivorous, or semi-piscivorous fish populations as a forage base or sports fishery	A_1. Fish length-weight relationships and condition indices relative to habitat characterization	L-M	No/Low
	A_2. Percent gross lesions in individual fish	M	Yes/Low
	A_3. Demographic structure analysis of dominant species (based on fish scales)	M	No/Very Low
	A_4. Species richness and relative abundance of ichthyoplankton	M	Indeterminate
	B_1. Comparison of measured concentrations or toxic equivalencies in fish tissue to literature derived CBRs	M-H	Yes/High
	B_2. Comparison of modeled concentrations or toxic equivalencies (using BSAFs) in eggs and fish tissue to literature derived CBRs	M	Indeterminate
	Risk Conclusion		**Yes/High**
4. Protection and maintenance of piscivorous mammal and bird populations	A. Comparison of estimated ingestion doses in piscivorous wildlife with TRVs and toxic equivalencies	M	Yes/Low
	B. Comparison of estimated piscivorous wildlife residues with CBRs	L-M	Yes/High
	Risk Conclusion		**Yes/High**

Table 6-3. (continued)

Assessment Endpoint[a]	Measures of Effect[a]	Inference Weight[a]	Risk/Magnitude
5. Protection and maintenance of insectivorous mammal and bird populations	A. Comparison of estimated ingestion doses in insectivorous wildlife with TRVs and toxic equivalencies	M	Yes/Low - High, Indeterminate
	B_1. Comparison of measured insectivorous wildlife tissue and/or egg residues with CBR data	M-H	Yes/Low - High
	B_2. Comparison of estimated insectivorous wildlife tissue and/or egg residues with CBR data	M	Yes/Low - High
	C_1. Measurement of reproductive effects in local tree swallow populations	H	Yes/High
	C_2. Survey of calling amphibians	L-M	Indeterminate
	D. Measurement of MFO activity in tree swallow nestling tissue	M	Indeterminate
	Risk Conclusion		**Yes/High**
6. Protection and maintenance of omnivorous mammal and bird populations	A. Comparison of estimated ingestion doses in omnivorous wildlife with TRVs and toxic equivalencies	M	No/Very Low[d]
	Risk Conclusion		**No/Low**

(a) Information obtained from Table 6-1.
(b) Applies to lentic (but not lotic) habitat.
(c) Applies to lotic (but not lentic) habitat.
(d) Omnivorous mammals could be adversely affected from exposure to Site-related contaminants in sediments and aquatic prey; however, the spatially and temporally varied diets and exposures of these receptors minimizes the likelihood of demographically significant effects.

Table 6-4. Summary of BHHRA Results for Non-Cancer Risks

Receptor	Exposure Area	Combined Fish Diet		Sediment		Surface Water		Bank Soil		Hazard Index		Incremental Hazard Index	
		CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME
Resident Living Along River, Current and Future													
Child	Assapumpset	0.5	2	0.02	0.2	0.003	0.009	N/A	N/A	0.5	2	--	--
Older Child		0.3	1	0.002	0.02	0.003	0.009	N/A	N/A	0.3	1	--	--
Adult		0.3	1	0.001	0.01	0.003	0.007	N/A	N/A	0.3	1	--	--
Child	Greystone	3	5	0.07	0.5	0.003	0.008	0.2	1	4	7	--	--
Older Child		2	4	0.006	0.07	0.003	0.008	0.03	0.2	2	4	--	--
Adult		2	3	0.003	0.04	0.003	0.006	0.02	0.1	2	4	--	--
Child	Allendale	19	30	0.2	0.8	0.04	0.1	NC	NC	19	31	**16**	**24**
Older Child		13	20	0.02	0.1	0.04	0.09	NC	NC	13	20	**10**	**16**
Adult		12	19	0.009	0.06	0.03	0.07	NC	NC	12	19	**10**	**16**
Child	Lyman Mill	21	34	0.08	0.4	0.01	0.04	N/A	N/A	22	34	**18**	**27**
Older Child		14	22	0.007	0.05	0.01	0.03	N/A	N/A	14	22	**12**	**18**
Adult		14	21	0.004	0.03	0.01	0.02	N/A	N/A	14	22	**11**	**18**
Child	Manton	4	5	0.005	0.03	0.01	0.04	N/A	N/A	4	6	0	0
Older Child		1	4	0.0004	0.004	0.01	0.03	N/A	N/A	1	4	0	0
Adult		1	3	0.0003	0.002	0.01	0.02	N/A	N/A	1	4	0	0
Child	Dyerville	4	8	0.05	0.5	0.01	0.04	N/A	N/A	4	8	0.5	**1**
Older Child		3	5	0.004	0.07	0.01	0.03	N/A	N/A	3	5	0.4	**1**
Adult		3	5	0.003	0.04	0.01	0.02	N/A	N/A	3	5	0.4	**1**
Visiting Recreational Angler, Current and Future													
Child	Assapumpset	0.5	2	N/A	N/A	N/A	N/A	N/A	N/A	0.5	2	--	--
Older Child		0.3	1	0.0004	0.004	0.0003	0.0009	N/A	N/A	0.3	1	--	--
Adult		0.3	1	0.0003	0.002	0.0003	0.0008	N/A	N/A	0.3	1	--	--
Child	Greystone	3	5	N/A	N/A	N/A	N/A	N/A	N/A	3	5	--	--
Older Child		2	4	0.001	0.01	0.0003	0.0008	0.002	0.02	2	4	--	--
Adult		2	3	0.0008	0.007	0.0003	0.0007	0.001	0.01	2	3	--	--
Child	Allendale	19	30	N/A	N/A	N/A	N/A	N/A	N/A	19	30	**16**	**25**
Older Child		13	20	0.004	0.03	0.004	0.009	NC	NC	13	20	**10**	**16**
Adult		12	19	0.002	0.01	0.003	0.008	NC	NC	12	19	**10**	**16**
Child	Lyman Mill	21	34	N/A	N/A	N/A	N/A	N/A	N/A	21	34	**18**	**28**
Older Child		14	22	0.002	0.01	0.001	0.003	N/A	N/A	14	22	**12**	**19**
Adult		14	21	0.001	0.006	0.001	0.002	N/A	N/A	14	22	**11**	**18**
Child	Manton	2	5	N/A	N/A	N/A	N/A	N/A	N/A	2	5	0	0
Older Child		1	4	0.0001	0.0007	0.001	0.003	N/A	N/A	1	4	0	0
Adult		1	3	0.00006	0.0004	0.001	0.002	N/A	N/A	1	3	0	0
Child	Dyerville	4	8	N/A	N/A	N/A	N/A	N/A	N/A	4	8	0.7	**2**
Older Child		3	5	0.001	0.01	0.001	0.003	N/A	N/A	3	5	0.4	**2**
Adult		3	5	0.0006	0.007	0.001	0.002	N/A	N/A	3	5	0.4	**2**
Commercial/Industrial Employee													
Employee	Fogarty Center [1]	N/A	N/A	N/A	N/A	N/A	N/A	0.01	0.07	0.01	0.07	NB	NB

[1] Surface Soil; CTE = Central Tendency; RME = Reasonable Maximum Exposure; NB = No background Information for surface soil. Incremental Risk not calculated; N/A = Not Applicable - Medium not assessed for this exposure area.

Incremental Receptor Risk = Difference in risk between the exposure point and the background exposure point.

-- = Incremental risk not calculated for background on reference areas; **BOLDED** incremental risks are above the high end of the Superfund Cancer risk Range (1E-04 to 1E-06).

Table 6-5. Summary of BHHRA Results for Cancer Risks

Receptor	Exposure Area	Combined Fish Diet		Sediment		Surface Water		Bank Soil		Receptor Total		Incremental Receptor Risk	
		CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME
Resident Living Along River (all age groups)													
Current & Future	Assapumpset	6E-06	5E-05	2E-07	6E-06	6E-06	4E-05	N/A	N/A	1E-05	1E-04	--	--
	Greystone	2E-05	8E-05	1E-06	2E-05	6E-06	4E-05	2E-06	4E-05	3E-05	2E-04	--	--
	Allendale	1E-03	5E-03	2E-05	2E-04	1E-03	9E-03	1E-06	2E-05	2E-03	1E-02	**2E-03**	**1E-02**
	Lyman Mill	1E-03	6E-03	6E-06	3E-04	1E-04	7E-03	N/A	N/A	1E-03	1E-02	**1E-03**	**1E-02**
	Manton	2E-04	5E-04	1E-06	4E-05	1E-04	7E-03	N/A	N/A	3E-04	7E-03	**3E-04**	**7E-03**
	Dyerville	2E-04	1E-03	7E-07	2E-05	1E-04	7E-03	N/A	N/A	3E-04	8E-03	**3E-04**	**8E-03**
Visiting Recreational Angler (all age groups)													
Current & Future	Assapumpset	6E-06	5E-05	1E-08	4E-07	6E-07	4E-06	N/A	N/A	7E-06	6E-05	--	--
	Greystone	2E-05	8E-05	5E-08	2E-06	6E-07	4E-06	6E-08	2E-06	2E-05	9E-05	--	--
	Allendale	1E-03	5E-03	8E-07	1E-05	1E-04	9E-04	3E-08	7E-07	1E-03	6E-03	**1E-03**	**6E-03**
	Lyman Mill	1E-03	6E-03	3E-07	2E-05	1E-05	7E-04	N/A	N/A	1E-03	7E-03	**1E-03**	**7E-03**
	Manton	2E-04	5E-04	6E-08	2E-06	1E-05	7E-04	N/A	N/A	2E-04	1E-03	**2E-04**	**1E-03**
	Dyerville	2E-04	1E-03	3E-08	1E-06	1E-05	7E-04	N/A	N/A	2E-04	2E-03	**2E-04**	**2E-03**
Commercial/Industrial Employee													
Current & Future	Fogarty Center [1]	N/A	N/A	N/A	N/A	N/A	N/A	8E-07	2E-05	8E-07	2E-05	NB	NB

[1] Surface Soil

CTE = Central Tendency; RME = Reasonable Maximum Exposure; NB = No background Information for surface soil. Incremental Risk not calculated; N/A = Not Applicable - Medium not assessed for this exposure area.

Incremental Receptor Risk = Difference in risk between the exposure point and the background exposure point.

-- = Incremental risk is not calculated for background on reference areas.

BOLDED incremental risk are above the high end of the Superfund Cancer risk Range (1E-04 to 1E-06).

Summary - Management Action Committee (MAC) Meeting
Centredale Manor Restoration Project
North Providence, Rhode Island

August 9, 2005

Attendees:

- Anna Krasko, United States Environmental Protection Agency
- Angela Bonarrigo, United States Environmental Protection Agency
- Ted Bazenas, United States Environmental Protection Agency
- Lou Maccarone, Rhode Island Department of Environmental Management
- Eugenia Marks, Audubon Society of Rhode Island
- Jenny Pereira, Woonasquatucket River Watershed Council
- Tim Mooney, Senator Chaffee's Office
- David Scotti, Loureiro Engineering Associates, Inc.

Agenda

- Technical Update
- Community Outreach
- Other Items

Note: Angela Bonarrigo, USEPA, chaired the meeting. The prior meeting was held on March 8, 2005.

Technical Update

Ted Bazenas provided an update on the work completed by the Performing Parties Group for the area of the swale behind Centerdale Manor. This work included addressing items identified during the post-construction site walk; namely, re-seeding areas of Cap #1, moving stone from under the utility crossing, trimming the edge of the swale, raking stone to cover the geosynthetic cells, and, in general, improving the drainage of the swale. The remaining item identified by Ted is to coordinate with RIDOT the maintenance of the sediment trap. Ted also provided an update on EPA's efforts to repair the chain-link and cedar fence alongside Allendale Pond. To date EPA's contractor has removed sections of the fence that were found to lie within the limits of the pond (under water) once Allendale Dam was restored. The areas of the new sections of fence have been grubbed and cleared. It is anticipated that the sections of new fence will be installed by the end of August. Approximately 1,000 to 1,200 linear feet of new fence are being installed.

Anna Krasko provided an update on the Remedial Investigation (RI) and Feasibility Study (FS). The Draft RI report has been revised to address EPA's comments and has been released to the public. Copies of the report will be placed in the Administrative Record and Site Repositories, and will be made available on CD-Rom. The report provides a summary of investigations conducted to date. The report also includes the data obtained from these investigations conducted over the past four to five years. Anna also explained that the Baseline Human Health Risk Assessment (BHHRA) is being revised based on corrected calculations for dermal exposure to dioxin through surface water. The revised BHHRA is expected to be issued within the next several months.

With regard to the additional data gathering efforts, Anna noted that the results from the May/June soil cores collected from Lyman Mill Pond are consistent with previously collected data. The analysis of the samples obtained from the Manton area has not yet been received. Likewise, the analysis of the data for the groundwater and pore water samples obtained in the vicinity of the Brook Village south parking lot, to assess the mobility of dioxin in the presence of high concentrations of volatile organic compounds, has not yet been received. Once received, the data for this area will be used to evaluate whether dioxin is entering Allendale Pond via groundwater, pore water, and the Woonasquatucket River.

Anna stated that the EPA contractor will begin to work on the FS tasks in September 2005. These tasks will follow the establishment of Preliminary Remediation Goals (PRGs) and cleanup levels for sediment. Based on the RI data, the human health risks to dioxin are likely to be the driving factor in the clean up decisions.

Jenny Pereira mentioned that at this time the Woonasquatucket River Watershed Council is still looking for a consultant. The Technical Assistance Grant (TAG) proposals are due to the Woonasquatucket River Watershed Council this week.

Outreach

No items discussed.

Other Items

Anna stated that it is anticipated that larger group meetings to be facilitated by EPA's contracted facilitator, Marian Cox, will convene later this fall.

The next MAC meeting is tentatively scheduled for Tuesday, September 6, 2005.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
1 CONGRESS STREET, BOSTON, MA 02114

Management Action Committee (MAC) Meeting
March 8, 2005
Centredale Manor Restoration Project
North Providence, Rhode Island

Attendees:

- Anna Krasko, United States Environmental Protection Agency
- Angela Bonarrigo, United States Environmental Protection Agency
- Lou Maccarone, Rhode Island Department of Environmental Management
- Bob Vanderslice, Rhode Island Department of Health
- Eugenia Marks, Audubon Society of Rhode Island
- Jane Sherman, President-Woonasquatucket River Watershed Council
- Jenny Pereira, Woonasquatucket River Watershed Council
- Frank Bursie, Town of North Providence
- Gina DeMarco, Northern Rhode Island Conservation District
- David Scotti, Loureiro Engineering Associates, Inc.

Technical Update

Anna Krasko discussed the field activities that are scheduled to be conducted by EPA's contractor this year. These activities include additional sediment sampling in Lyman Mill Pond. This sampling will entail the collection of approximately ten sediment cores, each advanced to a depth of three to four feet. The sediments will be analyzed to identify the age (sediment dating) and constituent concentrations of the sediments, similar to the sediment work that was conducted two years ago. The additional evaluation of the Lyman Mill Pond sediments is being conducted for two reasons: (i) to provide better spatial coverage as relatively few samples have been collected and analyzed; and (ii) because the nature of the sediments are different than those found in Allendale Pond. The core sampling is tentatively scheduled to be conducted during late March or April 2005.

Anna also explained that following the Lyman Mill Pond investigation, approximately five or six grab samples of surface sediment will be collected from surface sediment in the Manton area to augment the existing data set. Additional work to be performed by EPA's contractor this year includes sampling the monitoring well MW-5 located in the

Brook Village parking lot. MW-5 has been found to have high concentrations of solvent. During the sampling event, pore water and sediment samples will be collected from along the Woonasquatucket River. EPA will use a semi-permeable membrane device (SPMD) to collect the pore water. The data will be used to evaluate whether dioxin is entering the Woonasquatucket River via the groundwater.

Anna distributed a copy of the comments on the BHHRA provided by Elizabeth Anderson (consultant to the customers of New England Container Corp.Group). Overall, her comments generally support the information presented in the risk assessment report.

David Scotti reported that other than post-removal inspection and maintenance activities, the Time-Critical Removal Action activities in the area of the former tailrace behind Centredale Manor are complete.

Outreach

Angela Bonarrigo provided an update the information-gathering and interview process of EPA's contracted facilitator, Marian Cox. At this time, Marian Cox has completed the scheduled interviews and is in the process of writing an evaluation and proposal for the next course of action.

Angela mentioned that EPA will issue a press release prior to having EPA's contractor implement any additional field activities.

Angela also mentioned that the EPA Fact Sheets for the Baseline Human Health Risk Assessment (BHHRA) and the Baseline Ecological Risk Assessment (BERA) have been published and distributed. The EPA Fact Sheets are now available on the EPA (Centredale Manor) website.

Jenny Pereira mentioned that the Woonasquatucket River Watershed Council received several calls regarding their work that is planned using the Technical Assistance Grant (TAG). A few of the calls were from residents. At this time the Woonasquatucket River Watershed Council is still looking for a consultant.

A discussion ensued regarding the adequacy of notice regarding the site to residents and potential home buyers. Bob Vanderslice mentioned that he would provide information to the attorney for the Rhode Island Realtors Association. This discussion included a discussion on the extent of fish and eel migration and whether or not a "watershed approach" to the Fish Consumption advisory should be considered. Lou Maccarone agreed to look into identifying all of the fishable tributaries south of the Smithfield line.

Other Items

The next MAC meeting is tentatively scheduled for Tuesday, May 3, 2005