for Source Area soil and sediment. These soil cleanup levels must be met at the completion of the remedial action throughout the Allendale Floodplain Soil as demonstrated by confirmatory soil samples**.** For residential-use properties, incremental composite sampling of floodplain soil on approximately 28 properties will be used during the design to evaluate which properties require excavation. Precautionary measures to prevent exposure, such as fencing or spreading a cover (e.g., mulch or clean soil) will be taken on residential-use properties in the interim.

The selected 2,3,7,8-TCDD soil cleanup level was a conservative Site-specific number, taking background into consideration. This cleanup level also takes into account the newly released EPA RfD value for 2,3,7,8-TCDD to meet EPA protective risk range, non-cancer risk level, and meet ARARs.

As part of pre-design, additional background characterization will be conducted to extend the current limited background dataset, verify background data and statistical analysis. Background soil samples would be analyzed for dioxin/furans, including 2,3,7,8-TCDD, Coplanar PCBs, pesticides, PCBs, VOCs, SVOCs, and metals. If necessary, floodplain soil cleanup levels which are based on human health risk with consideration of background levels will be adjusted using these data and documented in subsequent decision documents. Soil cleanup levels based on background may result in elevated risk to receptors, since cleanup levels cannot be established below background to avoid potential recontamination.

## 6. Lyman Mill Stream Sediment and Floodplain Soil (Including Oxbow) (Alternative 3A)

### *Description of Remedial Components for Lyman Mill Stream Sediment and Floodplain Soil (including Oxbow)*

This portion of the remedy includes excavation and removal of contaminated sediment and floodplain soil from targeted areas within the ecological habitat and recreational-use cleanup areas and/or placement of a thin-layer cover over the other areas where soil/sediment remains above cleanup levels to accelerate the natural recovery processes by placing clean material over the underlying contaminated material. Areas targeted for excavation include 1) erosional areas with contaminant concentrations above the cleanup levels where a thin-layer cover is not suitable and contaminated sediment/soil could be transported downstream if remobilized during flooding events and 2) areas with contaminant concentrations in excess of RIDEM's residential direct exposure criteria (except where background is an issue, i.e., human health and ecological risk assessments and ARARs are the basis for developing cleanup levels. Background is subsequently taken into consideration to ensure that cleanup levels below background are not selected), and EPA's site-specific non-cancer health effects threshold level for dioxin in soil for recreational visitors. Floodplain soil above cleanup levels on residential use properties is also targeted for excavation, with specific areas to be based on additional sampling. Excavated material will be placed in an upland CDF with an estimated 10 percent to be shipped off-site for treatment.

Pre-design and design investigations will include physical and ecological surveys to further delineate wetlands functions and to identify any potential vernal pools and collection of benthic,

soil, sediment and surface water samples. It is estimated that 10 animal tissue samples, 10 surface water samples and 80 soil/sediment samples would be analyzed for dioxin and other contaminants. Habitat features would need to be updated during design based on the finalized excavation and thin-layer cover areas.

The addition of baffles within preferred floodwaters flow paths in the Oxbow will be evaluated during the design phase of the project. The flow control structures and situated baffles will be designed to increase the amount of the sediment load that is deposited into the Oxbow while minimizing the likelihood that floodwater flows would retain sufficient energy to erode surface soils and transport residual contamination into Lyman Mill Pond. Hydrodynamic modeling over a range of peak flows will also be conducted in concert with the engineering design to ensure that the engineered structures will function as intended.

If the combined engineering and hydrodynamic modeling analysis are unable to reduce the uncertainties related to deposition (and length of time to achieve the desired level of risk reduction) and stability (and risks of downgradient migration), an increase in the excavation footprint beyond the area identified (resulting in a reduction in the proportion of the remedial footprint receiving the thin-layer cover) can be required by EPA if: (i) the size of area requiring cleanup is increased based upon design sampling and data evaluations, (ii) deposition rates are slower than estimated, (iii) engineered structures are less effective at preventing "short-circuiting" of the Oxbow Area than estimated, and (iv) in-place contamination is less stable than estimated in the FS. Increases in the excavation footprint will need to consider any additional information concerning the possible presence of sensitive species in the Oxbow (e.g. vernal pools).

For residential-use properties, incremental composite soil sampling will be conducted on each property to determine excavation areas, consistent with *User Guide - Uniform Federal Policy Quality Assurance Project Plan Template For Soils Assessment of Dioxin Sites* (September 2011). Precautionary interim measures to prevent exposure, such as fencing or spreading a cover (e.g., mulch or clean soil) will be taken in the interim. Such measures will be considered on an individual property basis, to be coordinated with residents and/or property owners. An interim measure will also include a fence along the Allendale Mill raceway southern end which is located in a wooded area next to the Allendale Mill condominium complex.

To implement this portion of the cleanup, access areas will be created so that all areas requiring cleanup can be reached. Additionally, staging areas to stockpile the cover material will be required. This component of the remedy will likely be implemented concurrently with the remedy for Lyman Mill Pond sediment and will use the staging areas and access roadways installed for the sediment remediation. Any excavation activities will be conducted after the pond water levels are temporarily lowered. During construction, work zone perimeter air monitoring will be performed similar to procedures described for Source Area Soil to ensure protection of workers and nearby residents.

Figure L-7 shows areas for excavation and thin-layer cover within the Lyman Mill stream sediment and floodplain soil cleanup area based on currently available data. Moving north to south, targeted excavation will:

- Remove the top 1 foot of sediment from the stream channel connecting Allendale and Lyman Mill Ponds.
- Remove the top 1 foot of floodplain soil from areas where contaminant concentrations are in excess of state ARARs for residential direct exposure (except where background is an issue) or site-specific risk-based dioxin level in soil for recreational visitors; and
- Remove the top 1 to 3 ft of sediment in abutting channel areas in the southern Oxbow Area.
- Remove floodplain soil from residential-use properties as required by the design delineation sampling.

A 1-foot excavation depth is estimated for the stream channel and floodplain soil areas because this is generally considered the depth to which the majority of relevant ecological exposures occur as a result of foraging or burrowing activities, as well as human exposure. For floodplain soil, the actual depth of excavation could extend deeper within the vadose zone as necessary to meet RAOs. The excavation depth of 1 ft bgs for sediment in the stream channel and 1 to 3 ft bgs for sediment in the southern Oxbow Area are based on the depth needed to reach clean substrate according to currently available data. The excavation depth for sediment and soil areas will be determined during design based on sampling and analysis of deeper sediment/soil samples. Excavation and backfill volumes will also be evaluated during design to ensure no net loss of flood storage capacity from placement of the thin-layer cover in wetland/floodplain areas. Additional data needs include the collection of floodplain soil and sediment samples as well as a survey to more precisely delineate the boundaries between the various vegetation types represented.

Following removal, an estimated 28 confirmation soil and sediment samples will be collected to verify that the cleanup levels were achieved, and to determine whether excavated sediment/soil will require treatment for non-residential properties. On residential-use properties, where depth of excavation is required throughout the vadose zone (depth less than 10 feet) , confirmatory sampling will be done in accordance with *User Guide - Uniform Federal Policy QAPP Template For Soils Assessment of Dioxin Sites*. The likely sequence of excavation activities, excavation/backfill volumes and rates, cover placement, sediment/soil processing, flow control structures, mitigation activities, long-term monitoring and ICs, and disposal or treatment options are described below.

*Construction Sequence*

A typical construction sequence is presented below:

1. Construct temporary access roads and staging areas.
2. Clear debris and vegetation as necessary.
3. Excavate contaminated sediment/soil in an upstream to downstream direction, stockpile and dispose.

4. If material must be disposed of off site, testing would be conducted to determine the appropriate disposal designation.
5. Evaluate confirmation samples and backfill excavated areas with clean material.
6. Place enhanced natural cover in areas that were not remediated with excavation, which could be performed concurrently with backfill placement.
7. Plant appropriate types of vegetation within the excavation footprint to enhance ecosystem recovery.

*Excavation/Backfill Volumes and Rates*

Sediment and floodplain soil will be removed after the pond water levels are temporarily lowered (for the sediment remedy at Lyman Mill). Approximately 6.5 acres, excluding residential-use soil, would be excavated and backfilled with clean material to provide subgrade for re-vegetation of the area.

- Approximately 20,500 cy of floodplain soil and stream sediment will be removed from the excavation footprint under this alternative, including a 0.25 foot over-excavation allowance.
- Approximately 15,600 tons (10,400 cy) of soil will be placed as backfill in the excavation area.
- Approximately 13,500 tons (or 9,000 cy) of soil will be placed for the thin-layer cover.

All excavation areas in recreational-use area/ecological habitat will be backfilled with 1 foot of clean material, which will provide a high quality substrate for restoring the terrestrial (floodplain soil) and aquatic (sediment) invertebrate communities and vegetation in the floodplain. A uniform 1-ft backfill volume will also result in a post-remediation elevation lower than existing conditions in areas where the excavation footprint extends deeper than 1 foot (i.e., sediment areas in southern Oxbow Area), and this will provide mitigation for lost flood storage capacity from the thin-layer cover as well as greater flow capacity in the river. The criteria used during the design to select backfill material and determine excavation depth for the stream channel connecting Allendale and Lyman Mill Ponds will include adequacy of erosion protection during flood flows and benthic habitat suitability.

The excavation rate for sediment and floodplain soil is assumed to be 200 cubic yards per day (cy/d); the placement rate of clean backfill is assumed to be 500 tons/day; placement of thin-layer cover is assumed to be 70 tons/day; and the rate of replanting vegetation is assumed to be 7,400 square feet per day (sq ft/d). Including the required wetland mitigation and streambank restoration activities, it is estimated that this alternative will take approximately one year to implement.

For residential-use properties, the estimated volume of soil that will be excavated is 5,600 cy. Excavation will be done on a property by property basis with work on each property estimated to

take several days to weeks. Excavation of soil on the impacted residential-use properties will be done using a combination of efforts, including hand labor and heavy equipment. Backfill and topsoil will be placed and compacted in the excavated areas. The residential-use properties will be restored to pre-construction grade, disturbed areas will be hydroseeded, and damaged or lost landscaping will be replaced as needed.

*Cover Design and Placement*

The final composition and thickness of the cover will be determined during the design phase; however, a cover thickness of 3 inches with a composition similar to the existing soil is assumed will be needed for floodplain habitat within the Oxbow Area. In aquatic sections of the cleanup area, the cover material would have a particle size distribution and organic carbon content designed to optimize rapid recolonization of the substrate by benthos.

The cover material will be placed over 22.2 acres of contaminated sediment and floodplain soil within the entire 28.7 acres cleanup area (excluding residential-use areas) that are not remediated by excavation (Figure L-7). In order to reduce the need for tree and shrub removal and to minimize the impact on the existing roots, cover material will be placed using a hydraulic slurry method that involves adding water to the cover material to form a slurry and then spraying the slurry over the area until the appropriate thickness is achieved.

In order to create a soil slurry that can be pumped, water would be added to the soil in a hopper and the slurry fed into pumps connected to a network of pipes and hoses for distribution. A temporary network of slurry pipes will be installed to allow access to the cleanup area. These pipes will be placed on the existing ground surface and held in place with temporary earth anchors or weights (such as sand bags). In the alternative, pipes and hoses could be placed using small low-ground pressure equipment commonly used in landscape maintenance work. This would have much less impact on the existing vegetation than conventional heavy earthmoving equipment, which can harm or kill trees through soil compaction.

Placement of 3 inches of clean material will require approximately 13,500 tons of cover material. It is estimated that the slurry will likely be placed using a 4-inch diameter hose with a total slurry (sand plus carriage water) discharge rate of approximately 350 gpm.

*Sediment/Floodplain Soil Processing*

Wetland soil and sediment removed using excavation will likely not be processed with mechanical dewatering because this material contains more vegetation and has a higher in-situ solids content than the river/pond sediment. Additional sediment/soil characterization will be performed during the remedial design phase. The excavated sediment/soil will be stockpiled in the same processing area established for pond sediment.

*Flow Control Structures*

A study during the design phase will be done to evaluate flow control structures to divert some of the flow from the Woonasquatucket River into and through the Oxbow Area to increase natural sediment deposition rates. Some site regrading will also be conducted within the Oxbow, including filling and the creation of baffles in portions of the abandoned river channel to

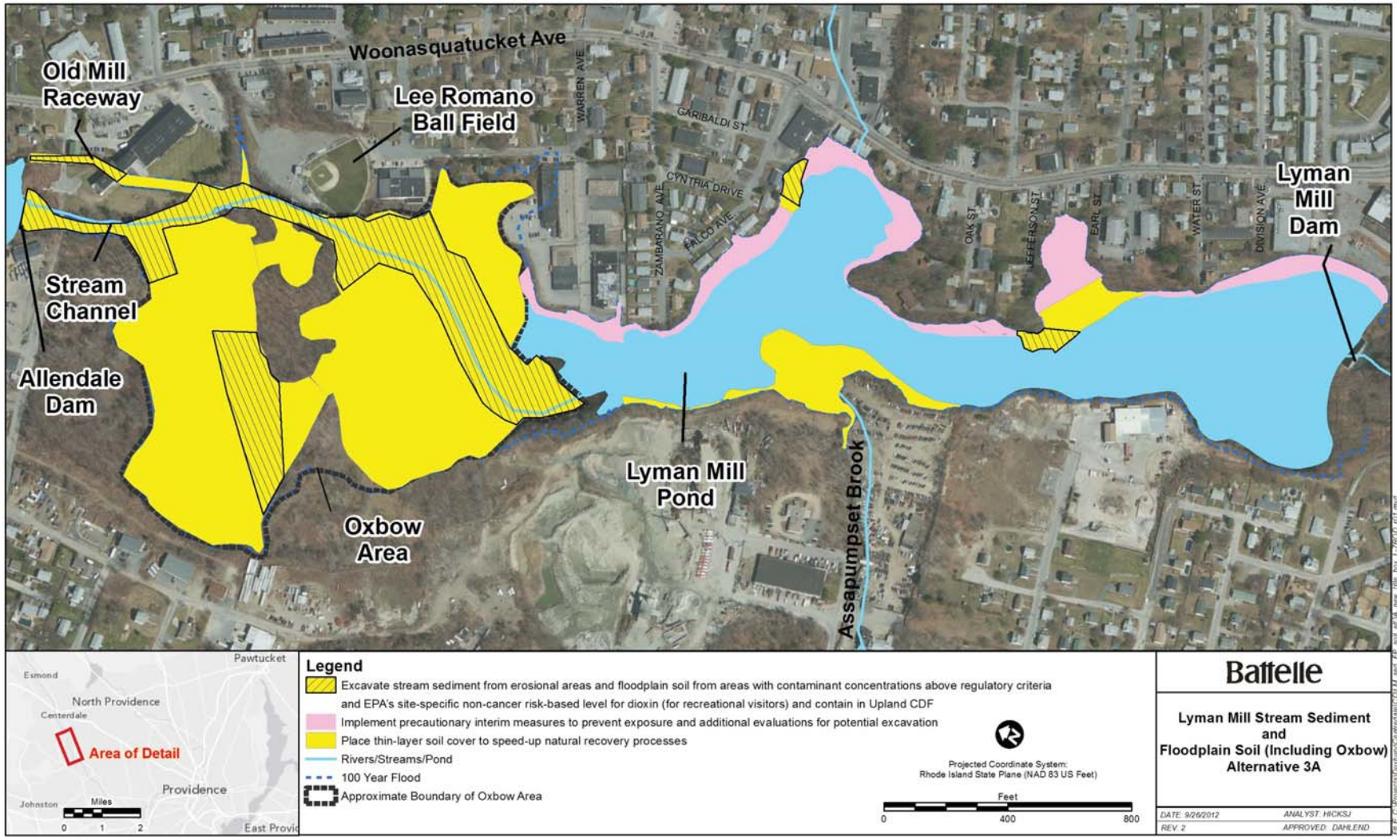


**Figure L-7. Lyman Mill Stream Sediment and Floodplain Soil (Including Oxbow) Alternative 3A**

# REGION 1

# RECORD OF DECISION

# CENTREDALE MANOR RESTORATION PROJECT
# SUPERFUND SITE
# NORTH PROVIDENCE, RHODE ISLAND

# SEPTEMBER 2012