GENERAL SITE INFORMATION, CHARACTERISTICS, AND STATUS

Project Name	***FORMER MESSER STREET MGP***	***ProjectID:*** 01-12
Last Updated:	08/08/02	

City:	Laconia
County:	Belknap
State:	NH
Country:	USA
Bodies of Water:	Winnipesaukee River; Lake Opechee; Lake Winnisquam
US EPA Region:	I
Status (Active, Complete, or Monitoring Only):	Complete
Date On NPL:	N/A
ROD/ESD Date:	N/A
Operable Unit:	N/A
Areas of Concern (length or acres):	Multiple areas of varying size are targeted; the combined targeted removal area is approximately 3 acres.
Other Characteristics of Water Body:	The Winnipesaukee River is approximately 1 ¼ mile in length and connects Lake Opechee (upriver) to Lake Winnisquam (downstream). The water elevation drops 11 feet as it moves from Lake Opechee to Lake Winnisquam resulting in relatively high average flow velocities within the main river channel. Flow velocities can also vary considerably (typically increase) as a result of lake seiche effects caused by northerly winds. Mean daily flow in the river is estimated to be about 500 to 900 cfs. A recorded discharge of 2,465 cfs occurred at the downstream Avery Dam during a high flow event in mid-June 1998.
Contaminants of Concern:	PAHs
Source of Contamination:	Coal tar discharges from a former manufactured gas plant located adjacent to the river.
Contaminated Area Physical Characteristics:	Sediments are fine to medium sands. Sediment samples collected in the river in Summer 1998 indicated TPH levels as high as 88,000 ppm in sediment at 0-2 ft. deep and as high as 87,000 ppm in sediment at 4-6 ft. deep.
Type of Regulatory Action:	Final. Voluntary PRP cleanup with State oversight.
Overall Status Summary:	The removal was performed as Phase II of a voluntary action under an agreement between two primary PRPs and the State. Phase I work was completed in 1999 and included construction of a 420 foot long slurry wall and collection trench to eliminate NAPL migration to the river, vacuuming of free phase tar globules from the sediment surface, and remediation of a former gas holder structure that was part of the former manufactured gas plant. The Phase II project targeted two one-half-acre areas and multiple smaller, localized areas in the Winnipesaukee River and one three-quarter-acre area in Lake Opechee; the total removal area was approximately 3 acres. Removal was to a target depth of two feet in nearly all areas that was to result in the removal of an estimated 80% of free product existing in the river. Mechanical dredging, with a Cable Arm clamshell bucket designated as the primary method, was to be used to remove about 40% of the sediment; the remaining sediment was to be removed by dry excavation during a 5-foot lowering of both lakes that was scheduled to occur between about October 9 and November 9, 2000. The lakes are typically lowered for two weeks annually or semi-annually to allow for maintenance of nearshore structures (e.g., docks, ramps). The State of New Hampshire owns the dams on both lakes and leases them for hydroelectric generation. The State negotiated with the leasees to allow the water level to remain lowered for an additional two weeks to provide additional time for sediment removal by dry excavation.

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Sediment removal began on or about September 18, 2000 in a 20-foot deep backwater area adjacent to the site of the former manufactured gas plant considered to be the source of coal tar to the river. The removal contractor began sediment removal using a 2 ½ cy Cable Arm clamshell bucket attached to land-based 200-ton crane, resulting in a production rate of about 80 cy per day. The automated GPS system (WINOPS) for bucket placement was nonfunctional at startup and bucket locations were being directed manually using survey equipment. Reportedly, the Cable Arm bucket was unable to effectively penetrate the sandy sediment, resulting in the bucket being less than full capacity during each bucket cycle; this negatively impacted production rates. The 2 ½ cy Cable Arm bucket was replaced with a similar type 4 cy bucket the first week of October (the 4 cy bucket was proposed in the bid specifications). Incomplete sediment penetration continued to limit production. A 100-ton crane located at the site was equipped with the 2 ½ cy Cable Arm bucket, positioned on a modular barge and used to remove sediment from areas of the river unable to be accessed by the land-based 200-ton crane. The dredge contractor used both a conventional clamshell bucket and a hydraulic clamshell bucket (built by the removal contractor) to remove sandy sediment unable to be removed using the Cable Arm clamshell buckets.

The lowering of lake water levels began the week of October 9, allowing sediment removal by dry excavation to begin. Two long-boom excavators located on an exposed sand bar and one conventional excavator positioned on a modular barge were used to remove sediment and place it directly into trucks for transport to the solids handling area. Following the start of dry excavation in the river areas, the removal contractor then began dry excavation of the target area located in Lake Opechee. Maximum production rates for the project are estimated at 200-300 cy per day (including both dredging and dry excavation working simultaneously).

Removed sediment was discharged to roll-off containers for unloading in the solids handling area by excavator. Sediment was allowed to gravity dewater prior to being loaded onto trucks for disposal at a commercial thermal desorption facility, ESMI, located in Louden, NH. The reported cost for disposal was $60-65 per ton of material. Water drained from the sediment collected in sumps located in the solids handling area and was pumped to a small (average 60K gal/day) wastewater treatment system consisting of (in sequence of operation) one sand filtration unit, one bag filtration unit, polymer addition, and one carbon filtration unit followed by discharge to local POTW. In-river monitoring during removal was for turbidity only; the limit was 10 NTUs above background (background was at 100 feet upstream of any work area). The prime contractor was Haley & Aldrich and the removal contractor was Maxymillian Technologies.

Following sediment removal, areas were backfilled with one foot of mostly gravel material. Backfilling was performed throughout the project as dredging was completed in individual areas. The dredge contractor used the same equipment used to remove sediment from each area to place the backfill material. A total of about 8,250 cy of gravel and stone (higher flow areas) was used as backfill material; both were obtained from local sources.

In-river operations were completed the first week of February 2001. Total volume of sediment removed was 12,000-13,000 cy.

Remedial Action Planned: ☑

Risk Assessment: ☑

Remedial Action Implemented: ☑

Status of Dredging ☐

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PRPs:	☑
Contacts:	☑
References:	☑
Modeling:	☐
Fishing Advisory:	☐

Key Conditions: capping, dredging, floating oil, post monitoring, specialty dredge, thermal desorption

REMEDIAL ACTION PLANNED

Project Name	***FORMER MESSER STREET MGP***	***ProjectID:*** 01-12
Last Updated:	08/08/02	

Target Sediment Cleanup Standards (TSCS): N/A

How TSCS Established: N/A

Target Bank and Floodplain Cleanup Levels (if applicable): N/A

Other Target: Depth target of 2 feet, in less than five feet of water.

Environmental Sample Data References:

- ***Sediment:*** Reference A-823
- ***Water:***
- ***Fish:*** Reference A-824

Estimated Target Volume: 13,000 cy using a combination of mechanical dredging and wet and dry excavation.

Planned Disposal Method: Commercial thermal desorption facility located in Louden, N.H.

Estimated Calendar Time to Implement Remedy: September 2000 to January 2001

Estimated Time to Implement Remedy: 5 months

Estimated Cost to Implement Remedy: $13 million

Stated Remedial Action Objectives (and Source): (Source: Reference A-823):

"The purpose of cleaning up tarry sediments is to remove potential adverse risks posed by the contaminants to human health and the environment. The unacceptable risks to human health, as defined in the Risk Assessment approved by the New Hampshire Department of Health and Human Services, are from two pathways; 1) swimming in potentially contaminated water and 2) eating potentially contaminated fish. Therefore, to return the river to fishable and swimmable conditions with no unacceptable risks, the goals of remediation must be to reduce exposure of tarry sediments to surface water and benthic organisms (benthos)."

Measures of Success to be Used:

Planned Monitoring and Restoration: Periodic monitoring of backfilled dredged areas; potential post-dredging benthic studies; periodic underwater video camera and diver surveys to assess the backfilled areas.

Agency Position on Sediment Removal (and Source):

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Last Updated: 08/08/02

RA Type: Human Health and Ecological

RA Status: Complete

RA Objectives: (Source: Appendix E of Reference A-824):

"The human health risk assessment addresses risk associated with exposures to surface water, sediment, and fish. It includes estimates of risk to recreational users of the Winnipesaukee River and Opechee Bay and individuals who may catch and consume fish from the river."

"The Stage 1 ecological risk assessment demonstrates various areas of ecological risk (defined as readily apparent harm under New Hampshire's Contaminated Sites Risk Characterization and Management Policy, January, 1998) in the Winnipesaukee River due to the presence of separate phase tars in sediment and the discharge of tars from the northern bank of the river. The Stage II ecological risk assessment addressed the area of the Winnipesaukee River defined as being between the area of readily apparent harm and the areas with greater than 4 ppm total PAH in sediment (as agreed upon with New Hampshire DES)."

Company Performing RA: Menzie Cura & Associates

RA Reference Report: Reference A-824 and Appendix E to Reference A-824 (complete RA Report)

RA Summary and Conclusions: (Source: Reference A-824):

HUMAN HEALTH RISK ASSESSMENT

"There were no calculated risks for non-carcinogenic compounds which exceeded the Hazard Index Goal of 1. Therefore, there are no significant risks at the site under the assumed exposure scenarios for non-carcinogenic compounds.

The excess calculated risks at the site for carcinogenic compounds result from two potential exposure scenarios: dermal exposure of swimmers to surface water in the Winnipesaukee River and consumption of fish. The dermal exposure risk is based on an assumed concentration of selected carcinogenic compounds at one half of the laboratory detection limits, as there have never been detected concentrations of these compounds in surface water. The calculated risk from fish consumption is 2E-05, as compared to the goal of 1E-05. This risk results from excess concentrations of carcinogenic compounds detected in one fish, out of 28 fish analyzed from the site."

ECOLOGICAL RISK ASSESSMENT

Stage I Environmental Screening for the Site resulted in identification of sediment exhibiting "readily apparent harm" as defined in the New Hampshire Department of Environmental Services "Contaminated Risk Characterization and Management Policy" (RCMP). Specifically, the presence of tarry sediments and sheens in areas greater than 1000 square feet were observed in selected areas. By definition, these areas represent significant ecological exposures and a remedial action plan is required."

"To estimate whether the remaining sediments represent significant exposures, the RCMP suggests using the Ontario Ministry of the Environment Guidelines as a benchmark. With this benchmark, it was agreed with NHDES, and included in the approved workplan for the site, that sediments exhibiting less than 4 ppm PAHs were, by definition, not a risk to the ecology. A sampling program was developed for the Messer Street Site to collect representative sediment samples for quantitative analyses for PAHs in the top 4 inches. The goal of the sampling was to find locations which were outside of the areas of readily apparent

harm, yet were likely to exhibit greater than 4 ppm PAHs. In addition, representative background stations upstream of the site in Opechee Bay were selected as reference stations for ecological comparison."

"The Stage I environmental screening determined that the tarry sediments would be addressed in the Remedial Action Plan. The results of the ecological risk assessment, which focused on the areas outside the tarry sediments, determined the following risks:

- No risk to fish or shellfish;
- No risk to birds based on food chain doses;
- Excess risk to sediment dwelling invertebrate organisms in selected areas outside of tarry sediment areas."

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Physical Target: Three acres total in the Winnipesaukee River and Lake Opechee. Sediment removal operations targeted the top two feet of sediment in the target areas except for a few small, localized areas where elevated levels of contamination were found at greater depth. Depth of removal was established using physical characterization data collected from the target areas and determined sufficient to reduce human health (exposure via skin contact) and ecological (exposure to the benthic community) risks to acceptable levels.

Goals:

Primary Contractor: Maxymillian Technologies (dredging); Haley & Aldrich (design and oversight).

Other Contractors:

Generic Remediation Method: Mechanical dredging; dry excavation; wet excavation

Equipment: Dredging required the use of 2 ½ and 4 cy Cable Arm environmental clamshell buckets, a 2 cy conventional clamshell bucket, and a custom-built (by the removal contractor) excavator-mounted hydraulically operated 1 ½ cy enclosed bucket. These were attached to a 100- or 200-ton crane or excavator (enclosed bucket); the 200-ton crane was land-based and the 100-ton crane and excavator were attached to a modular barge for in-river dredging. A second modular barge was used to transport in-river sediment to the land-based solids handling area. Dry excavation required the use of long-reach excavators and other conventional earth moving equipment, and mud mats in areas of soft sediment.

Material Handling: Sediment removal began in the area of the river adjacent to the former MGP site using a land-based 200-ton crane equipped with a 2 ½ cy (and later a 4 cy) Cable Arm clamshell bucket.

The Cable Arm bucket was unable to effectively penetrate the entire two feet of mostly sandy sediment. The oversight contractor and NHDES collectively decided to allow the removal contractor the option of using a conventional clamshell bucket to attempt to meet depth targets; the conventional clamshell bucket also had difficulty penetrating the sediment. Eventually the removal contractor used an enclosed hydraulic bucket, which they had built for a previous removal project and modified for use here. Following modifications, the enclosed hydraulic bucket was able to satisfactorily meet the proposed target removal depth of 2 feet in areas of consolidated sediment unable to be penetrated by the clamshell buckets.

The automated GPS supplied with the Cable Arm bucket, WINOPS, for positioning the bucket, did not function properly during much of the project began as a result of radio wave interference. As a result, initial bucket placement was being determined manually using surveying equipment.

Silt curtain was installed around the perimeter of the dredge areas. Unanticipated current surges required that extra ballast be added to hold the silt curtain in place throughout the project.

Early in the project bucket cycles were long (~4 minutes) due to: 1) manual positioning of the bucket; 2) relatively deep water (~20 feet); 3) a long swing angle from the point of removal to the discharge point (rolloff); 4) the necessity to raise the boom to position the bucket over the rolloffs for discharge; and 5) the operator raising the bucket considerably higher than necessary on the return swing. Average cycle times for each bucket over the course of the project were 2.5, 1.8, and 1.0 minutes for the conventional, 2.5 cy Cable Arm, and enclosed hydraulic, respectively.

Dry excavation involved removal of the top two feet of sediment primarily by long-arm excavators, with placement directly into trucks for transport to the solids handling area. The trucks were

required to cross private railroad tracks located along the southern boundary of the former MGP site to reach the solids handling area. In addition to the land-based excavators, a barge-mounted excavator was also used to remove sediment from this area. Sheetpile was installed along the river side of localized target areas to eliminate river flow into the removal area during the lake drawdown period when construction activities would be underway. The downstream end of these target areas was not sheetpiled and remained open.

Targeted areas in the river that could not be reached using the land-based equipment were removed by dredging using a barge-mounted 100-ton crane equipped with the 2 ½ cy Cable Arm bucket. Dredging in this manner was used to remove isolated areas of contaminated sediment from the river (mostly downstream from the land-based operations) and in the larger targeted areas unable to be reached by either wet or dry excavation methods. Removed sediment was loaded into barge-mounted rolloffs for transport to the solids handling area. The rolloffs were removed from the barges and replaced with empty ones using the 200-ton crane. The filled rolloffs were then moved to the solids handling area for unloading.

Removal in the Lake Opechee target area was performed using dry excavation during the lake drawdown. This area was located across Messer Street about 200 yards from the land-based operations. Sediment was moved from the removal area to the solids handling area by truck.

The solids handling area consisted of an asphalt pad covered by a temporary, tent-like structure. The asphalt pad included berms and drainage pathways to direct water draining from the sediment to a series of sumps. Rolloffs or trucks containing removed sediment were moved to inside the structure. The trucks dumped their load and the rolloffs were unloaded using an excavator.

The sediment was stockpiled and allowed to gravity dewater. No chemicals were added to promote dewatering. The maximum allowable water content prior to shipping for disposal was 18% by weight. The dewatered sediment was then loaded into trucks for transport to a commercial thermal desorption facility.

Volume Removed: 12,000-13,000 cy

Calendar Time: Mid-September 2000 to the first week of February 2001. The removal contractor worked one 10-hr shift per day 5 days per week during dredging and wet excavation; this was increased to 10-12 hours per day 6 days per week during lake drawdown.

Time To Implement: About 5 months.

Total Cost: Not determined; the reported cost for transportation and disposal was $60-65 per ton.

Dredging Cost: Not determined

Disposal of Sediment: Most of the removed sediment was trucked to a commercial thermal desorption facility operated by Environmental Soils Management, Inc. located about 20 miles from the site in Louden, NH. Maxymillian began transporting excess material to their ReSoil thermal treatment facility located approximately 150 miles from the site in North Adams, MA. Reportedly, the cost for transport and disposal was $60-$65 per ton.

Volume of Water: 233,000 gallons

Method of Water Treatment: Water drained from the sediment and water used for decontamination was collected in sumps and pumped to a holding tank (20,000 gal. frac tank) for onsite treatment. The water treatment system design capacity was 60,000 gal/day; the system consisted of primary and secondary frac tanks, a free product removal vessel, and a filtration system. The filtration system consisted of (in sequence

of operation) one sand filtration unit, one 5-micron bag filtration unit, polymer addition, and primary and secondary activated carbon units.

Collected water was pumped to one of the frac tanks, and from the frac tank water, circulated through the filtration system and discharged to the second frac tank. The treated water was tested for total VOCs and then discharged to the local POTW. There was no discharge limit that applied; VOC testing was performed to determine if the water complied with Fume Toxicity Screening Criteria as a measure of safety for workers at the POTW. Approximately 233,000 gallons of water were treated and released to the POTW during the project.

Water Discharge Limit: None required.

Air Monitoring During Remediation: Performed adjacent to the solids handling area; results unknown.

Water Monitoring During Remediation: In-river monitoring during removal was for turbidity only; the limit was 10 NTUs above background (background was originally defined as 100 feet upstream from the area where removal was being performed but data collected at approximately the mid-span of the Messer Street bridge was used for all comparisons). Discrete water samples were collected at or near the water surface from within 5 to 10 feet of the bucket at three-bucket intervals resulting in the collection of a total 75 samples. Turbidity levels near the buckets averaged 3.2 to 4.9 NTU, depending on the bucket used, compared to an average background of 0.74 NTU. Turbidity was also collected between 30 and 65 ft. downstream both inside and outside the silt curtain and within 10 minutes following the stop of dredging to change out roll-off containers. Turbidity levels averaged 1.57 to 2.35 NTU and 0.61 to 0.91 NTU inside and outside the silt curtains, respectively, depending on the bucket used. The background averages collected concurrently ranged from 0.61 to 1.01 NTU.

Outcome: Between 12,000 and 13,000 cy of sediment were removed from approximately three acres in the Winnepesaukee River and Lake Opechee. Removal was to a targeted two-foot uniform depth and most removal areas were backfilled with either gravel or stone. No verification samples were collected. Sediment removal confirmation was by comparison of pre-dredge to post-dredge bathymetric survey results. Dredging and dry and wet excavation methods were used to remove the sediment. Equipment used for dredging included four separate buckets: 2 ½ and 4 cy Cable Arm clamshells, conventional clamshell, and custom-built, hydraulically operated enclosed bucket. The Cable Arm bucket was specified but required augmentation by the other bucket types due to encountering a significantly greater amount of consolidated sediments than was originally estimated. Sediment removal by dry excavation was performed during a four-week period when the river was drawn-down for routine dam maintenance. Removed sediment was gravity dewatered and sent offsite for treatment by thermal desorption as non-hazardous waste.

Restoration and Post-Monitoring: Restoration consisted of backfilling the areas where sediment was removed with gravel or stone. Post-monitoring is to include periodic surface water quality sampling and video documentation of remediated river bottom areas.

Site-Specific Difficulties:

- The Cable Arm environmental clamshell bucket was found to be ineffective for removing the sandy sediments encountered at the site, substantially slowing productivity; the contractor augmented the Cable Arm bucket with a conventional clamshell bucket and a modified hydraulic clam to complete sediment removal in affected areas.

- Persistent problems in setting up and operating the GPS positioning system used for bucket placement delayed use of the system, affecting productivity early in the project.

- Gravel was the intended material for use in backfilling areas where sediment was used. Localized areas of high water in and near the main river channel resulted in most of the gravel being

washed away during placement. The removal contractor placed a native stone (3/8" to 1 ½" dia.) in these areas.

- Additional ballast from that required by initial design calculations was required to hold the silt curtains in place during high flow conditions.

Monitoring Data References:

- ***Sediment***
- ***Water:***
- ***Fish:***

POTENTIALLY RESPONSIBLE PARTIES

Project Name ***FORMER MESSER STREET MGP*** ***ProjectID:*** 01-12

PRP Name: **PRP INFORMATION NOT RELEASED** ***PRPID:***

Street Address:

City:

State:

KEY CONTACTS

Project Name ***FORMER MESSER STREET MGP*** ***ProjectID:*** 01-12

Last Name: **KEY CONTACT INFORMATION NOT RELEASED** ***Contact ID:***

First Name:

Title:

Company:

Address:

City:

State:

Postal Code:

Work Phone # : ***Other Phone #:***

Fax # :

Email Address:

Project Name ***FORMER MESSER STREET MGP*** ***ProjectID:*** 01-12

Reference Type: A ***ReferenceID:*** 822

Title: ***Innovative Sediment Remediation Using a Risk-based Mixed Remedy at the Laconia Manufactured Gas Plant Site: Data and Lessons***

Location: AEM

Category: Close-Out Report

Prepared by/Author: Haley & Aldrich, Inc.

Preparer/Author Address: 340 Granite Street
Manchester, NH 03102-4004

Prepared For: Electric Power Research Institute, Inc. Palo Alto, CA

Date Published: November 2001

Key Words and Phrases:

Reference Type: A ***ReferenceID:*** 823

Title: ***Technical Memorandum - Recommended SED-3 Remedy***

Location: AEM

Category: Remedial Action Plan/Work Plan

Prepared by/Author: Haley & Aldrich, Inc.

Preparer/Author Address: 340 Granite Street
Manchester, NH 03102-4004

Prepared For: Northeast Utilities Company; Public Service Company of New Hampshire

Date Published: January 2000

Key Words and Phrases:

Reference Type: A ***ReferenceID:*** 824

Title: ***Remedial Action Plan***

Location: AEM

Category: Remedial Action Plan/Work Plan

Prepared by/Author: Haley & Aldrich, Inc.

Preparer/Author Address: 340 Granite Street
Manchester, NH 03102-4004

Prepared For: EnergyNorth Natural Gas, Inc.; Public Service Company of New Hampshire / Northeast Utilities

Date Published: January 1999

Key Words and Phrases:

Project Name ***FORMER MESSER STREET MGP*** ***ProjectID:*** 01-12

Reference Type: A ***ReferenceID:*** 825

Title: ***Contract Documents for Remediation of Former Manufactured Gas Plant Site***

Location: AEM

Category: Bid Package

Prepared by/Author: Haley & Aldrich, Inc.

Preparer/Author Address: 340 Granite Street
Manchester, NH 03102-4004

Prepared For: Northeast Utilities / Public Service Company of New Hampshire

Date Published: June 2, 2000

Key Words and Phrases:

Reference Type: A ***ReferenceID:*** 834

Title: ***Public Health Assessment (Summary)***

Location: AEM

Category: Risk Assessment

Prepared by/Author: Bureau of Health Risk Assessment

Preparer/Author Address: New Hampshire Department of Health and Human Services

Prepared For: U.S. Agency for Toxic Substances and Disease Registry

Date Published: May 11, 2000

Key Words and Phrases:

Reference Type: C ***ReferenceID:*** 657

Title: ***Environmental Clamshell Cleans the Winnipesaukee River***

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author Address:

Prepared For: Dredging and Port Construction (DPC)

Date Published: January 2001

Key Words and Phrases:

Project Name ***FORMER MESSER STREET MGP*** ***ProjectID:*** 01-12

ReferenceID: 15

Reference Type:	H
Title:	***Map of Laconia, NH***
Location:	AEM
Category:	Miscellaneous
Prepared by/Author:	New England Map Company
Preparer/Author Address:	
Prepared For:	General Public
Date Published:	2000
Key Words and Phrases:	

ReferenceID: 74

Reference Type:	L
Title:	***Memo re: Reconnaissance of Former Messer Street MGP Site (Laconia, NH) Remedial Dredging Project***
Location:	AEM
Category:	Site Update
Prepared by/Author:	AEM, Inc.
Preparer/Author Address:	Malvern, PA 19355
Prepared For:	Distribution
Date Published:	November 16, 2000
Key Words and Phrases:	

Project Name: ***FORMER MESSER STREET MGP*** ***ProjectID:*** 01-12

Last Updated: 08/08/02

Modeling Performed: Hydraulic

Modeling Objectives: To determine if previously defined target sediments were susceptible to downstream movement due to river bottom scour.

Modeling Description: Hydraulic Modeling using the one-dimensional HEC-2 Model (1991 version) and the HEC-RAS model. Two-dimensional modeling was performed using the RMA2 model.

Company Performing Modeling: Haley & Aldrich, Inc.

Modeling Status: Complete

Modeling Summary: (Source: Reference A-823):

HYDRAULIC MODELING

"The hydraulic modeling describes maximum flow velocities of less than 4 feet per second throughout this reach of the Winnipesaukee River during a 100-year event. Many areas have maximum velocities of less than 1 foot per second under such conditions. This moderate velocity distribution, even for extreme events, is consistent with the overall conceptual model of a river that is closely controlled by upstream and downstream dam structures."

SCOUR EVALUATION

"A stability analyses was performed to determine whether tarry sediments of concern are likely to be scoured and mobilized during a 100-year flood event. The scour analysis was based on determining whether the bed shear developed during a large flood event would be sufficient to mobilize grain sizes found in the sediment at each location of interest. A modified Shields diagram was used to make this determination."

"Not all locations within the River were evaluated for scour potential. As described in Section 5, many areas of tarry sediments are proposed to be completely dredged as part of the overall remedial action at the Site, eliminating any concern regarding scour. Scour must be evaluated to address concern about "resurfacing" of tarry sediments which are left behind. Scour evaluation was therefore restricted to areas which were not already slated for remedial action, but which showed indications of tarry sediment within the top two feet of sediments or at a depth that might be scoured under extreme conditions."

"In general, the scour evaluation found:

- The Messer Street bridge and the railroad berm create low velocity embayments on the northern bank of the Winnipesaukee River. These low velocities are predicted to be insufficient to mobilize sediments even during a 100-year flood event.

- Most locations in the main river channel are unstable during a 100-year flood event.

- Portions of the main river channel have become armored with sediments of sufficient size to resist scour during a 100-year flood event."