

CITY OF GLOUCESTER COMMUNITY PRESERVATION COMMITTEE PROJECT APPLICATION COVER SHEET

I: Project Information

Project Title: Restoration of the Marine Railway at Maritime Gloucester

Project Summary: The marine railway at Maritime Gloucester is the oldest continuously operating marine railway in the United States. Built in 1849 by Crandall Dry Dock Company for Parker and Elias Burnham, the railway was very busy as the fleet of nearly 300 fishing vessels in Gloucester changed from small boats to larger boats that could fish Grand and Georges Banks. We are seeking funds to make necessary repairs, recommended by Crandall Dry Dock Company in 2015, and other necessary measures to ensure that the railway can continue to haul traditional wooden schooners, such as the Ardelle and Schooner Adventure which both call Maritime Gloucester home. The timing for this grant application is particularly opportunistic as a significant portion of the railway, including the "sheave," will be exposed during the fall/winter of 2016/2017 when National Grid builds a cofferdam around the railway, drains/pumps water within the cofferdam and remediates contaminated soil around the railway. This period presents a unique opportunity to repair certain portions of the railway, such as the sheave, which would normally be under water.

Estimated start date: September 2016 Estimated completion date: October 2017

CPA Program Area: Historic Preservation

II: Applicant/Developer Information

Contact Person with primary responsibility for project: Thomas Balf

Organization (if applicable): Maritime Gloucester

Mailing Address: 23 Harbor Loop, Gloucester, MA 01930

Daytime phone #: 978-281-0470

Fax #:

E-mail address: tbalf@maritimegloucester.org

Federal ID# 04-3480870

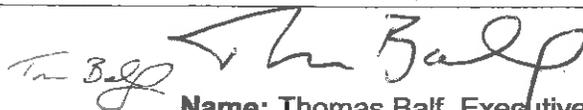
III: Budget Summary

Total budget for project: \$197,500

CPA funding request: \$110,000

CPA request as percentage of total budget: 55%

Applicant's Signature:



Name: Thomas Balf, Executive Director

NARRATIVE

PROJECT AND DESCRIPTION

The marine railway at Maritime Gloucester is the oldest continuously operating marine railway in the United States. Built in 1849 by Crandall Dry Dock Company for Parker and Elias Burnham, the railway was very busy in the 19th century as the fleet of nearly 300 fishing vessels in Gloucester required constant work.

We are seeking Gloucester Community Preservation funds to make necessary repairs to ensure that the railway can continue to haul traditional wooden schooners, such as **the *Ardelle* and *Schooner Adventure*** which currently dock at Maritime Gloucester. In fact, this grant application has their strongest support as they envision themselves on this site into the future. Upgrades/repairs to the railway are particularly critical to ensure that we can haul 200+ ton vessels, such as the *Schooner Adventure*. The repairs contemplated in this grant proposal are recommendations from Crandall Dry Dock Company based on their inspection of our railway. In addition, we seek funds to support the development of training materials, and the implementation of training, for a next generation “haul master” as few people under the age of 65 have been trained to operate a traditional railway nor have sufficient experience. We seek funds to sustain the skill sets necessary to successfully haul a vessel on the ways.

The timing for this grant application is particularly opportunistic as a significant portion of the railway, including the “sheave” and other portions of the railway in deeper water, will be exposed during the fall/winter of 2016/2017 when National Grid builds a cofferdam around the railway, drains/pumps out water from within the cofferdam, and remediates contaminated soil around the railway. The potential for repairs was included in the Remediation and Settlement Agreement that Maritime Gloucester negotiated with National Grid. Such repairs are allowed under this Agreement, although Maritime Gloucester is solely responsible for any additional costs. Furthermore, repairs to the railway are authorized under the remediation project’s Chapter 91 consolidated permit (from DEP), as well as the Army Corp of Engineers permit that governs this work in the harbor and our property. Both permits were submitted by and granted to the Massachusetts Electric Company, operating as National Grid.

RAILWAY DESCRIPTION AND FUNCTION

The following description of the railway operations is taken from a document, attached to this grant submittal, developed by KPFF Consulting Engineers out of Seattle, Washington. They inspected the railway, at the request of National Grid, when it was contemplated that the railway would be deconstructed and re-installed. Subsequently, the decision was made to construct a cofferdam around the railway and then remediate the contaminated marine sediments surrounding the railway from within the cofferdam. (A copy of their inspection report is included with this grant submittal.)

The primary railway is comprised of two main pile-supported timber rail beams sloped at an approximate slope of 1:15 (6.7%). The rails extend approximately 370’ from the upland end of the railway out into the harbor. Vessels are hauled out using a cradle that traverses on the rail beams up and down the sloped railway. The cradle runs on steel “dog-bone” roller sets, which roll on steel flat-bar tracks. One track is mounted on the underside of the cradle, and the other is mounted to the main beams. The roller sets are independent of the cradle and main beams, so that for every 1’ of travel of the roller sets, the cradle moves 2’. The railway is set in a narrow slip with timber hauling pier structures on both sides of it.

The cradle is hauled via a link chain assembly, which is driven by a winch in the upland machinery shed. The main haul chain is attached via a yoke at about the upper ¼ point of the cradle. The main haul chain

is connected at its tail end to a back haul chain, which is reeved around an underwater turning sheave at the far end of the railway and led back to a keeper on the front of the cradle. The chain and cradle assembly then make a continuous loop that is driven by the winch in the upland machinery shed (i.e., Mill Building). The lengths of the chains are such that the main haul chain is driven by the winch sprocket, and the back haul chain never reaches that sprocket. Likewise, the back haul chain is reeved around the turning sheave, but the main haul chain never reaches the turning sheave.

SCOPE OF WORK FOR THIS GRANT REQUEST

Maritime Gloucester seeks CPA funds to conduct the following work, based on the recommendations of Crandall Dry Dock Engineers (See both their Inspection Report and Recommendations Report in the Appendix) and review of our Waterfront Committee. We seek to do the following work.

Hardware/Railway Repair Work

1. **Repair / Replacement and/or Addition of Cross Ties to Maintain Track Alignment:** This work entails adding cross ties to further support and ensure alignment of the existing track
2. **Replacement and/or repair of Chain Slides:** This is the “trench” within which the chain slides along the railway. Work would focus on spot repairs within the coffer dam area, and more significant repairs closer to the head of the railway where the chain tends to slide.
3. **Repair of Winch Drum Electrical Contacts (Severe Arcing Evident)** The winch and resistor brake is found in the Mill Building and can be repaired during the fall season.
4. **Clean / Inspect Resistor Bank for Hauling Winch –** The winch and resistor brake is found in the Mill Building and can be repaired during the fall season.
5. **Repair Inoperative Automatic Brake on Hauling Winch –** This brake is found in the Mill Building and can be repaired during the fall season.
6. **Removal of Sand/Mud Accumulation Covering Track from Station 150 outboard to end of Track –** This work will be done by National Grid/Charter Environmental as part of the remediation work.
7. **Identify / Remove Damaged Track Sections –** We anticipate replacing four roller track sections, including all new rollers for these new sections.
8. **Inspect and Replace Deteriorated Fasteners, as necessary, and/or paint all hardware, below the waterline, that is exposed during the remediation process.**
9. **Replace Bilge Blocks (as required) –** The bilge blocks, used to position and stabilize the vessel on the cradle, will be replaced, as necessary, for the hauling of the Adventure, or a similar sized, larger vessel.
10. **Repair / Upgrade Safety Stanchions –** The vertical timbers upon which the scaffolding will be built will be inspected, and replaced as necessary.
11. **Repair Upgrade Underwater Sheave - Change to a Horizontal Assembly Stabilized by the Track.** The vertical sheave design is the original design, but it is outdated. Crandall suggests a horizontal layout. They would modify the design to derive its stability from the track, and reorient the sheave. They would also replace the grey iron sheave with a bronze bushing.

Haul Master Training

We seek funds to develop training materials to train the next generation (e.g., <55 years of age) to haul vessels on a historic marine railway. There are currently few people in this community that can carry on the tradition of hauling a vessel "on the ways". Training will involve interviews/tapings of skilled haul masters discussing issues associated with planning, blocking, hauling and launching. We intend to videotape hauls on other railways (e.g., Gloucester Marine Railways) for the purpose of overdubbing commentary after the fact. Finally, on-the-job training will involve hauling a variety of vessels on our railway, with appropriate supervision and demonstrations of proficiency. Monies will be used for videographers, stipends to existing haul masters, development of training materials, and on-the-job training compensation.

GENERAL EVALUATION CRITERIA

In accordance with the grant requirements, this proposal meets the following general evaluation criteria, as described below.

1. Consistent with various plans which are relevant to and utilized by the City regarding Open Space, Recreation, Historic Resources and Affordable Housing.
This restoration is consistent with plans for the City of Gloucester. In fact, Maritime Gloucester is part of the City's Harborwalk and part of the Harbortown Cultural District based, in part, on the historic features of this working waterfront site.
2. Preserve and enhance the essential character of the City.
Yes. It is the oldest, continuously operated marine railway in the country and the brick Mill Building is one of the last remaining examples of this architectural style on the waterfront.
3. Protect resources that would otherwise be threatened.
Yes. The historic railway is in need of protection/restoration and use. In the absence of such continued use, the viability of the railway is threatened.
4. Serve more than one CPA purpose or demonstrate why serving multiple needs are not feasible.
While we are seeking funds for historic preservation, the railway is used for education and skill training that includes teaching physical science principles and traditional boat building and repair techniques.
5. Demonstrate practicality and feasibility, and that the project can be implemented within budget and on schedule.
Maritime Gloucester has a proven record of accomplishment with respect to its growth and investment in our working waterfront campus. This work is feasible based on our experience with the railway and the expert opinions/recommendations offered by Crandall Dry Dock Engineers, Inc. and esteemed members of our Waterfront Committee.
6. Produce an advantageous cost/benefit value.
*This restoration work is necessary for us to continue to use the marine railway which will be used to haul traditional wooden schooners such as the *Ardelle*, Gloucester's flagship vessel the *Adventure* and other wooden schooners offered by non-profit organizations that share our educational mission. The ability to haul the *Adventure*, for example, provides economic, mission and educational value to both Maritime Gloucester and the Schooner *Adventure* organizations.*

7. Leverage additional public and/or private funds (e.g. qualify the project for additional grants from other sources) or receive partial funding from other sources and/or voluntary contributions of goods or services.

I am not sure that a CPA grant will leverage other funds, but the grant further supports our own private investment over the past two years, as well as the funds we have received for the railway/operations by the Tower Family Fund, and a National Maritime Heritage Administration Grant (administered through the Massachusetts Historical Commission) for the purpose of constructing a viewing platform around the railway. (See the Chapter 91 attachment which illustrates the viewing platform)

8. Preserve or improve use or intended purpose of City-owned city assets.

N/A, but it is tied to the expanded vision of Harbor Loop as a center of maritime activity, which includes further investment in the Harbormaster's Office and Boater Center, and Solomon Jacobs Park.

9. Receive endorsement by other municipal boards, committees and commissions or departments and broad-based support from community members.

We have not sought formal endorsement for this project by other boards, committees or commissions, but we believe that we have broad support for the mission of Maritime Gloucester, and specific support from various entities within City Government for our educational programs for school children, adult programs for the community, and as host, and the center of activity, for the Gloucester Schooner Festival.

CATEGORY SPECIFIC CRITERIA – HISTORIC PRESERVATION

We believe that our proposal meets the following category specific criteria, as described below.

1. Protect, preserve, enhance, restore and/or rehabilitate city-owned properties, features or resources of historical significance.

Built in 1849, the Burnham Brothers marine railway is the oldest continuously operating marine railway in the United States. The railway is on the Massachusetts Historical Commission's (MHC) inventory of Historical and Archaeological Assets of the Commonwealth, and it is the documented opinion of MHC staff that the railway meets the criteria of eligibility (36 CFR 60) for listing in the National Register of Historic Places.



2. Protect, preserve, enhance, restore and/or rehabilitate the historical function of a property or site.

This grant would do all of the above and would serve to enable this 167-year old structure to continue to serve the purpose, in Gloucester, for which it was originally constructed – to haul out boats for repair and restoration. Moreover, we have conferred with the Massachusetts Historical Commission and they support various upgrades to ensure that the historic functioning of this marine railway is sustained.

3. Demonstrates a public benefit.

The public enjoys Chapter 91 public access to our site, and our intention to construct a viewing platform, will further enhance the public's appreciation for the functioning of the railway and the boat repair activities that take place upon it.

4. Ability to provide permanent protection for the historic resource.

Permanent is a strong word. This work supports the preservation of this historical resource, and allows us, going forward, to proactively maintain the railway, and its function.

WHAT COMMUNITY NEED DOES THIS PROJECT SERVICE?

This project serves multiple needs and constituencies.

1. It serves Gloucester resident's desire to preserve, understand and sustain its industrial harbor heritage.
2. The hauling and launching of a vessel is a historic "community" event in this city. At our public site, this activity will continue. This location, and event, is particularly relevant to the hauling of the Schooner Adventure which is typically hauled three out of every five years for repairs and/or U.S. Coast Guard inspections. These repairs will ensure that we can routinely haul the Adventure.
3. It serves the student population of the area. They will benefit from the experience of viewing and learning about historic vessels, the design and use of a railway (and the physical science principles involved in its operation) and the visceral experience of the size of the vessel and spars, and the engagement of watching workers tend to the vessel in manner that transcends time.
4. As a leading marine and maritime education center, the marine railway is available to all visitors. Based on Maritime Gloucester's past visitor estimates, we anticipate a minimum of 30,000 visitors per year to our site. Many have never seen a boat hauled or launched on a railway, nor been up close to a vessel "on the ways."

WHAT SPECIFIC GUARANTEES THE LONG-TERM PRESERVATION?

Maritime Gloucester is self-sustaining 501(c)(3) organization that has been in operation since 1999. We own the railway and the site, as previously described. As we previously executed for the Mill Building (a 2013 recipient of CPA Funds), we would agree to a deed restriction for the continued functional use of this historic marine railway.

HOW WILL THE SUCCESS OF THIS PROJECT BE MEASURED?

This project will be measured by:

- Our ability to successfully haul wooden schooners, such as the Adventure and other large wooden vessels
- Our success in training new "haul masters" to sustain the traditional art and science of supervising the haul of a vessel on a marine railway
- An estimate of the number of visitors observing schooners on the railway
- The annual number of days/year that a schooner is on the ways
- The number of students who participate in relevant curriculum that includes learning about the railways and the Mill Building.

IS ONGOING MAINTENANCE AND REPAIR REQUIRED?

Yes. Maritime Gloucester maintains its buildings, machinery, piers, boats, exhibits and other equipment as part of its routine operations as a working waterfront museum, visitor attraction and marine education center. Monies will be budgeted for routine maintenance and repair as we do for other facility assets.

PROJECT BUDGET

The Project Budget is itemized below.

CITY OF GLOUCESTER**COMMUNITY PRESERVATION COMMITTEE**

BUDGET FORM

Project Name: Restoration of the Marine Railway at Maritime Gloucester

Applicant: Maritime Gloucester

SOURCES OF FUNDING		
Source	Amount	
Community Preservation Act Fund	\$110,000	
(List other sources of funding)*		
Lynch Foundation	\$20,000	Concept paper submitted by 5/5/2016
Maritime Gloucester	\$20,000	In Kind (volunteer)
Private Donations	\$10,000	To be pursued
Burnham Boatbuilding	\$2,000	Donation – Wood for new bilge blocks/assemblies
Crowd Sourcing	\$40,000	To be pursued
Total Project Funding	\$202,000	

*We will continue to search for granting organizations that support historic preservation and maritime activities.

PROJECT EXPENSES		
Expense	Amount	Please indicate which expenses will be funded by CPA Funds:
Repair/Replace Cross-Ties	\$50,000	
Replace/Repair Chain Slides	\$15,000	
Repair Winch Drum Contacts	\$2,500	
Clean Hauling Winch	\$2,500	
Repair Automatic Brake	\$2,000	
Removal of Sand/Mud	\$3,000	
Identify/Replace Track Sections (with New Rollers - 500)	\$90,000	X
Replace Bilge Blocks	\$7,500	
Repair Safety Stanchions	\$5,000	
Repair/Upgrade Underwater Sheave	\$10,000	X
Develop Training Materials and Train Next Generation of Haul Masters	\$10,000	X

PROJECT SCHEDULE

The Project Schedule is described on the next page.

CITY OF GLOUCESTER

COMMUNITY PRESERVATION COMMITTEE

PROJECT SCHEDULE

	Activity	Estimated Date
Project Start Date:	Begin railway restoration	October 2016
Project Milestone:	Repair/replace on-shore components	December 15, 2016
50% Completion Stage:	Complete in water work	February 15, 2017
Project Milestone:	Complete Remediation Project around Railway; Haul Schooner Ardelle	May 2017
Project Completion Date:	Haul Schooner Adventure	October 2017

ATTACHMENTS

1. KPFF Inspection Report
2. Crandall Inspection Report
3. Crandall Recommendations
4. Chapter 91 Plan, with Viewing Platform
5. Site Map
6. Cofferd Dam Site Map

LETTERS OF SUPPORT

Letters of support from the Schooner Adventure and the Schooner Ardelle are included with this grant submittal.

THE GLOUCESTER 
Adventure

P.O. BOX 1306 • GLOUCESTER, MA 01931-1306
TEL. (978) 281-8079 • FAX (978) 281-2393

OFFICERS

John Morris, Ph.D.
President
John Thompson
Vice President
Peter Madsen
Vice President
Harry Harutunian
Vice President
Stephen Hall
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David Rhineland
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State Sen. Bruce Tarr
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Ann-Margaret Ferrante
Ex-officio
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Director Emeritus
J. Linzee Coolidge
Director Emeritus
Ernest Godshalk
Director Emeritus
Captain Jim Sharp
Director Emeritus
Peter Souza
Director Emeritus
Jeffrey Thomas
Historic Interpreter

14 April 2016

Community Preservation Act Committee
City Hall
Gloucester, Ma 01930

Honorable Members of the Committee-

This letter is submitted in support of the Community Preservation Grant proposal submitted by Maritime Gloucester for the repair and restoration of the historic Burnham Brothers Marine Railway on their campus at 23 Harbor Loop. Maritime Gloucester and the Gloucester Adventure, Inc. have established a valuable and ever-improving collaborative relationship as both organizations work toward the goals of education and community engagement to Gloucester's maritime past, present, and future.

The railway, Gloucester's oldest, is unique in that it is owned by a nonprofit maritime educational facility. Many such railways have been removed, replaced, or allowed to fall into disrepair as newer technologies have become available. The Burnham Brothers' rail is one of the few remaining in existence, and preserving it will have a significant impact to both our organizations and the community.

At present, the railway requires repair and renewal as specified in a Spring 2015 survey by Crandall Drydock in order to accommodate a vessel of *Adventure's* tonnage. The plan by the National Grid contractors to isolate and drain the area around the railway via a cofferdam presents a rare opportunity and moment in time to pursue these repairs at considerable savings of time and expense. The proposed repairs are designed to ensure the railway's successful operation far into the future, and could so serve the interests of both of our organizations for many years to come.

The schooner *Adventure* has hauled out on the Burnham Brothers Railway on many occasions throughout her 90-year history. In her current status as a U.S. Coast Guard Inspected Passenger Vessel, the vessel is required to haul for inspection at least three times in any five year interval, and will require additional maintenance and preservation. Access to this facility would be an invaluable resource to our operations, as it would allow us to more closely manage costs than when engaging the resources of a commercial shipyard. We view such cost management as central to the vessel's future survival and success. It would also have the additional benefit of opening access to participation for volunteers, apprentices, and students as we seek to further connect to the community as part of our mission.

Please see page two on the reverse.

A non-profit organization formed to preserve the historic fishing schooner *Adventure* as a living symbol of Gloucester's maritime heritage, and to provide related programs and facilities for the education and pleasure of the public.

www.schooner-adventure.org

The sight of the schooner *Adventure* sitting high out of the water on the Burnham Brothers Railway would provide significant visual impact and visitor attraction. The repaired railway would again become available to other historic vessels with educational missions, particularly schooners. This would add the presence of varied representatives of Gloucester's storied maritime heritage to the waterfront, enhancing both visitor appreciation and community experience alike.

Maritime Gloucester is one of the treasures of the Gloucester waterfront, and the Burnham Brothers Railway is an important part of a site that has been documented in paint, photograph, and literature for more than 150 years. Its repair and preservation would provide significant benefit to our organization. As collaborators and fellow stewards of Gloucester's maritime history, we wholeheartedly support Maritime Gloucester's request for Community Preservation Act funding for that purpose.

Please do not hesitate to request any additional information should you require.

Sincerely,

A handwritten signature in black ink, appearing to read 'Stefan Edick', written over a circular stamp or seal.

Captain Stefan Edick
Executive Director
The Gloucester Adventure, Inc.



BURNHAM BOAT BUILDING.

11 Burnham Ct. / P. O. Box 541

Essex Ma 01929-USA

Phone 978-491-7666

E-mail haburnham@gmail.com

April 11, 2016

To: Community Preservation Committee
From: Harold Burnham
Subject: Maritime Gloucester Railway Request for CPA Funds

I am writing in support of Maritime Gloucester's application for community funds to restore its marine railway.

When I was growing up -- as wood was replaced by fiberglass and steel -- it felt our maritime culture and the skills of our heritage were dwindling along with our once vast fishing fleet. At that time it was unimaginable that I would one day look back at a career largely focused around the design, construction, operation, and repair of indigenous, historic, traditional watercraft. Now these vessels, used for education and cultural tourism have done much to preserve our maritime heritage here on Cape Ann.

None of what I accomplished over in Essex would have been possible had my family, the Essex Shipbuilding Museum, and the town of Essex not kept the shipbuilding properties and enough of the infrastructure around for my use when I needed them.

Unlike the "ways" in Essex with no moving parts that can sit idle for long periods of time, the Railway at Maritime Gloucester needs constant work and needs to be worked in order to preserve it and the skills necessary for its safe operation. Thankfully while there is not always a need to build new boats, every boat needs to be hauled for maintenance and repair every year. Using the railway at Maritime Gloucester to haul traditional wooden vessels not only helps preserve this important part of the harbor culture and infrastructure, it offers these historic craft an almost unique opportunity to bring support and notoriety to this work.

Having hauled and worked on boats on the railway where students and the public can share in the experience, with the education staff at the center interpreting what was going on, I have seen what this amazing historic machine has to offer toward the preservation of our maritime traditions and culture. Therefore, I wholeheartedly endorse any and all efforts to help Maritime Gloucester preserve their Railway as a working exhibit.

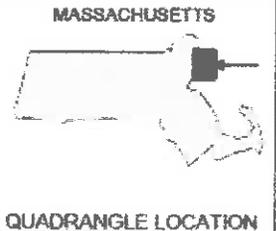
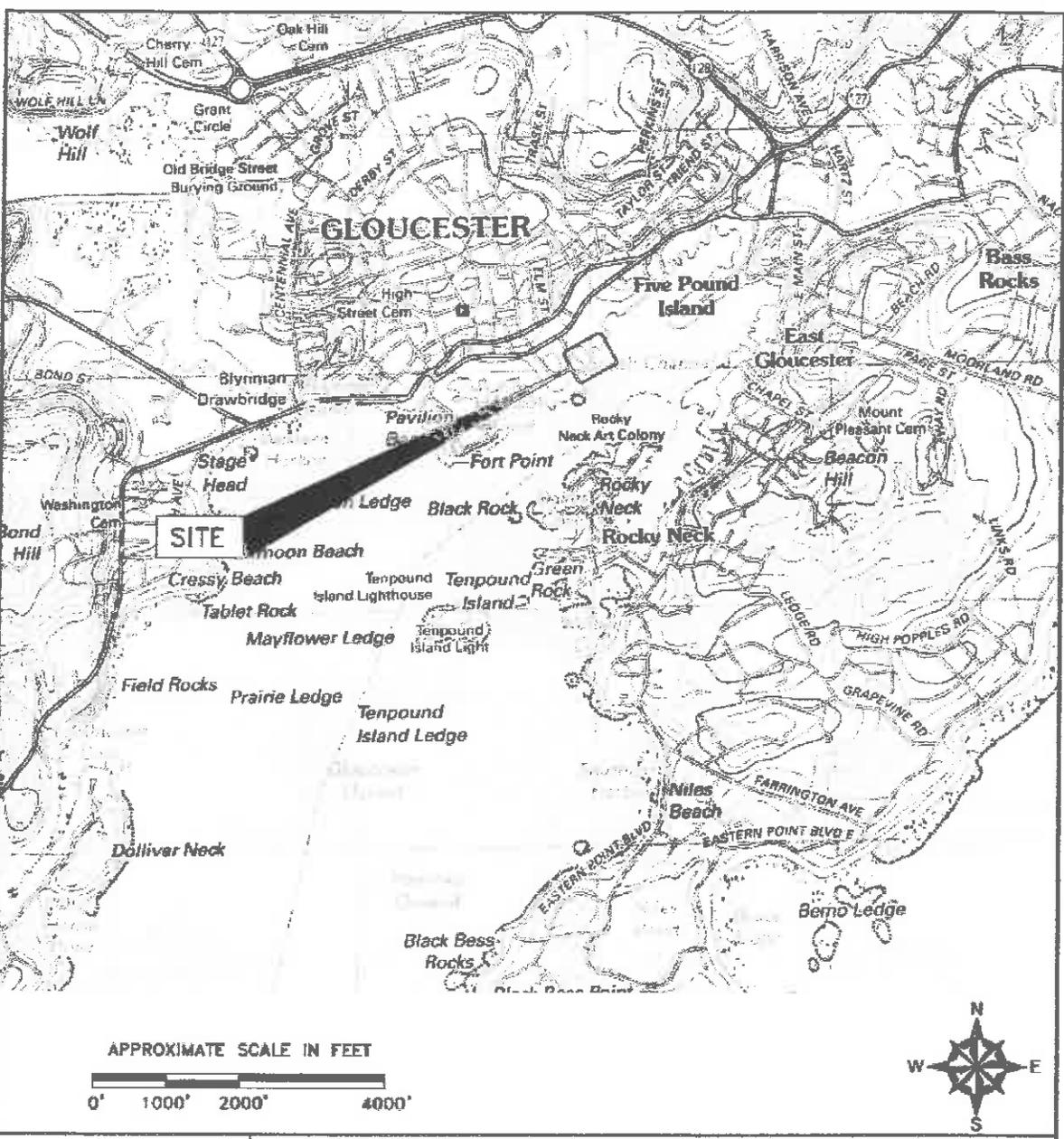
Sincerely,

A handwritten signature in black ink, appearing to read "Harold A. Burnham". The signature is fluid and cursive, with a long horizontal stroke at the end.

Harold A. Burnham

2012 National Endowment of the Arts Master Shipwright National heritage Fellow

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SOURCE:

BASE MAP FROM THE FOLLOWING USGS QUADRANGLE MAP:
GLoucester, MASSACHUSETTS (2012)
 DIGITAL TOPOGRAPHIC MAPS PROVIDED BY USGSSTORE.GOV.

CONTOUR ELEVATIONS REFERENCE NAVD 88.
 CONTOURS ARE SHOWN IN FEET AT 10 FOOT INTERVALS

THE INFORMATION ON THIS MAP WAS DERIVED FROM THE NATIONAL MAP INFORMATION PROGRAM (NMIP) DATA. THE NATIONAL MAP INFORMATION PROGRAM (NMIP) DATA IS THE PROPERTY OF THE UNITED STATES GOVERNMENT AND IS FREELY AVAILABLE TO THE PUBLIC. THE INFORMATION ON THIS MAP WAS DERIVED FROM THE NATIONAL MAP INFORMATION PROGRAM (NMIP) DATA. THE NATIONAL MAP INFORMATION PROGRAM (NMIP) DATA IS THE PROPERTY OF THE UNITED STATES GOVERNMENT AND IS FREELY AVAILABLE TO THE PUBLIC.

QUADRANGLE LOCATION

PREPARED BY:
GZA GeoEnvironmental, Inc.
 Engineers and Scientists
 www.gza.com

PREPARED FOR:

ABOVE-WATER EXISTING CONDITIONS INSPECTION
MARITIME GLOUCESTER MARINE STRUCTURES
GLOUCESTER, MASSACHUSETTS

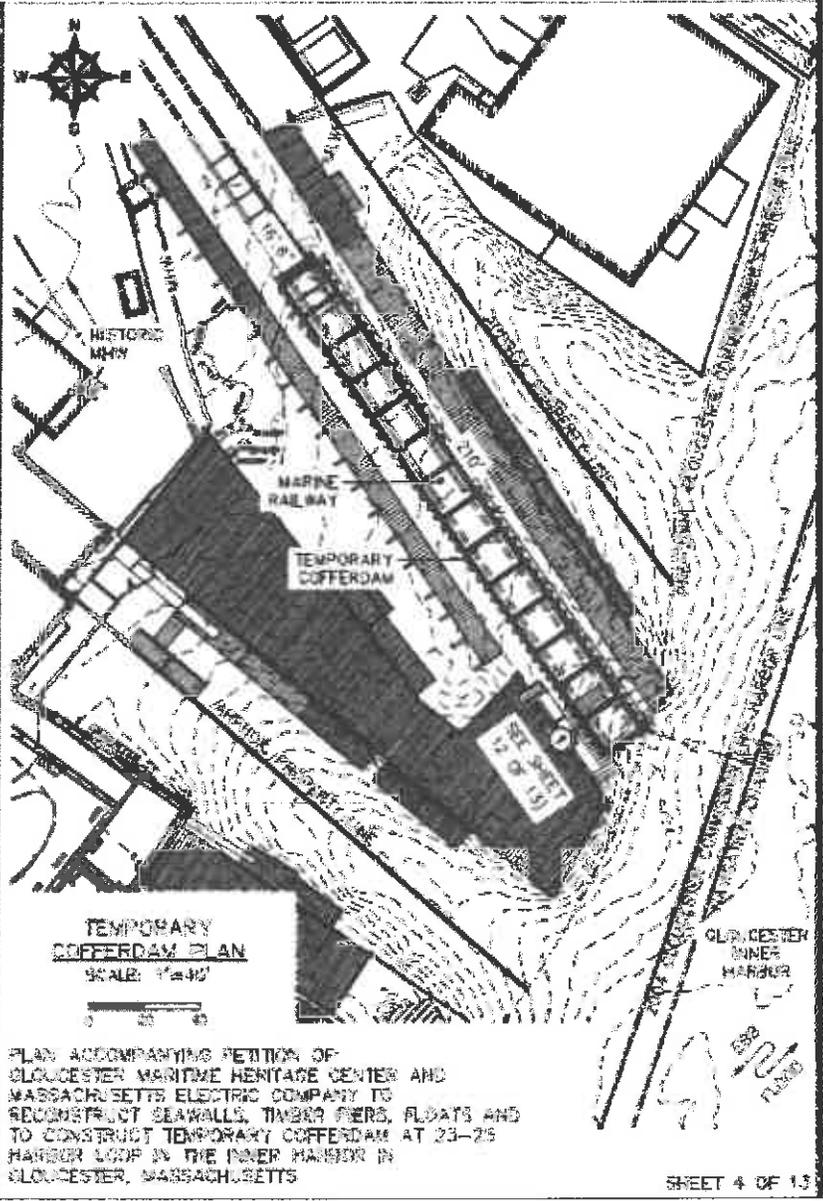
LOCUS PLAN

DESIGNED BY: MJP
 DATE: MAY 2014

REVIEWED BY: DMC
 DRAWN BY: MEA
 PROJECT NO.: 09.25623.00

CHECKED BY: MJP
 SCALE: AS NOTED
 REVISION NO.: 0

FIGURE 1
 SHEET NO. 1 OF 7



PLAN ACCOMPANYING PERMIT OF
 GLOUCESTER MARITIME HERITAGE CENTER AND
 MASSACHUSETTS ELECTRIC COMPANY TO
 RECONSTRUCT SEAWALLS, TIMBER PIERS, FLOATS AND
 TO CONSTRUCT TEMPORARY COFFERDAM AT 23-25
 HARBOR LOOP IN THE INNER HARBOR IN
 GLOUCESTER, MASSACHUSETTS

INSPECTION RE: NATIONAL GRID DREDGE

350 Short Ton Marine Railway #S333B

Maritime Gloucester

Gloucester, Massachusetts

March 2015

Material Condition Report

350 Short Ton Marine Railway #S333B

Maritime Gloucester

Gloucester, Ma.

On 11 March 2015, Brian Duffy and Bill Avilla of CRANDALL DRY DOCK ENGINEERS, INC of Bourne, Massachusetts, conducted a material condition survey of the 350 Short ton Marine Railway #S-333B, located in Gloucester, MA.

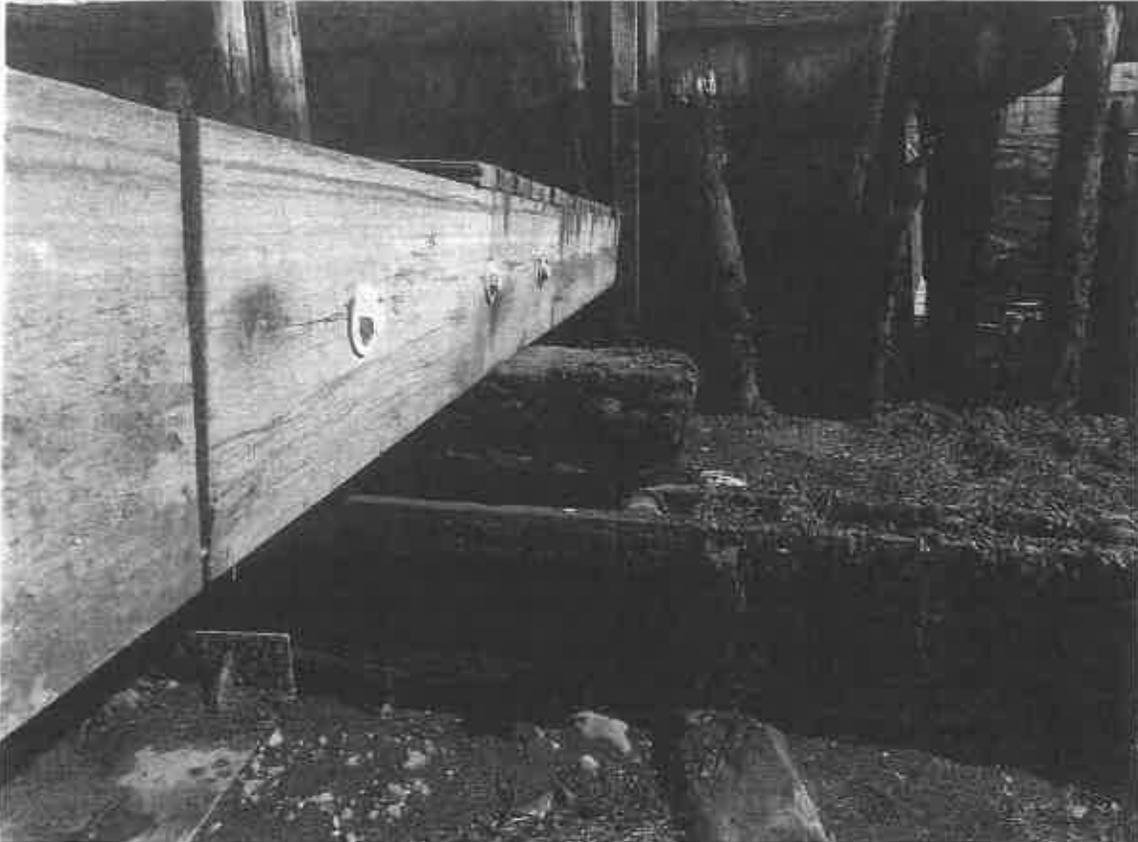
The purpose of the inspection was to ascertain the overall condition of the dock and issue a capacity certification if the condition of the facility so warrants. This report outlines the findings of the survey.

DESCRIPTION OF FACILITY

The dock is one of the original Burnham Docks, previously Parkhurst Marine Rwy. Co., built in 1911. Crandall Dry Dock Engineers, Inc. electrified the machine in 1946, investigated a haul chain break in 1953 and provided a design upgrade for the haul machine in 1954. Crandall has made several condition reports throughout the years.

FOUNDATION

The outshore portion of the foundation has extensive worm damage where caps are exposed. Caps that were submerged in the mud seemed to be in better condition. There are many deep cuts in the caps. In several places outshore the back haul chain has cut completely through. This condition is caused by the lack of chain slides.

**TRACK**

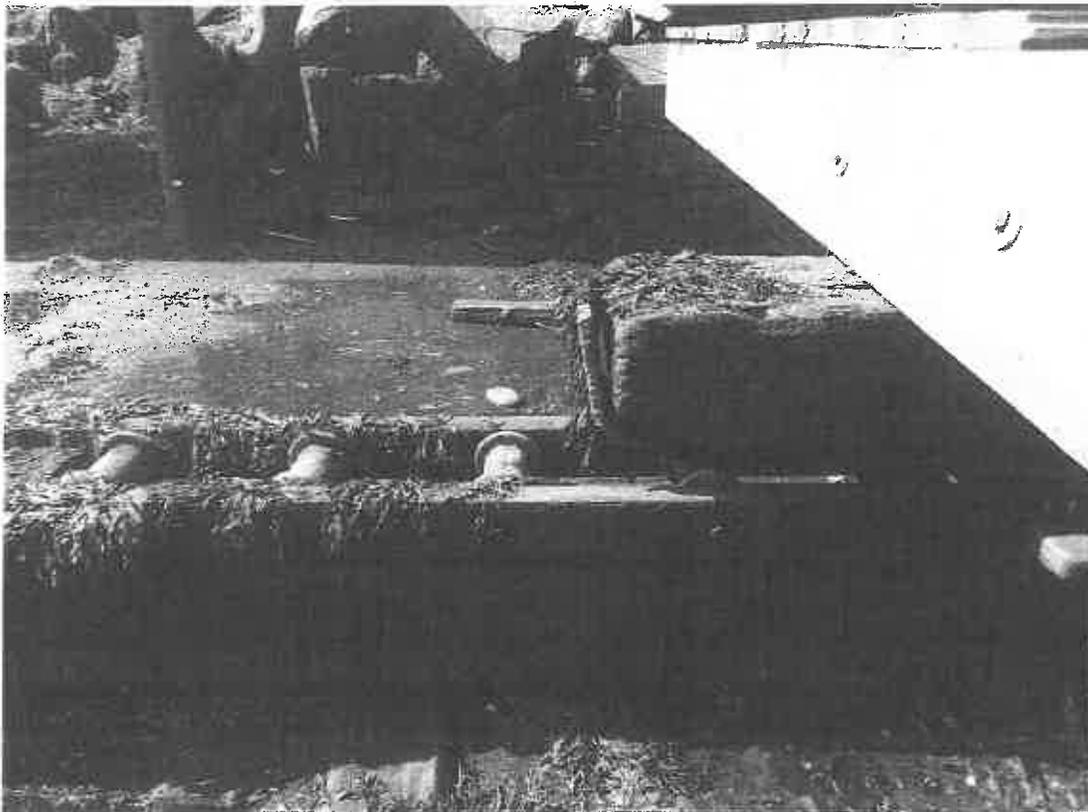
Original track length is 374'; upon inspection, it measured approximately 300' due to mud accumulation. The underwater outshore portion of the track also has extensive worm damage throughout. The fasteners are deteriorated and exposed. There is deterioration and misalignment of the shim stock between the track timber and the timber caps. Some of the caps have shifted off their pilings due to fastener failure. The worst areas of infestation are where the track is mostly out of the sediment. The rail plate and its fasteners were intact. The track's construction is the same outshore as it is inshore; consisting of two tiers of 6"x12" timbers with ship's splice at joints. All joints are tight and aligned. Sheathing is recommended to create a protective barrier for exposed timbers.

GENERAL RAIL PLATES AND FASTENERS

Rail was in good condition and fasteners appeared intact. Rails were square on sides with minimal wear.

ROLLERS, BUSHINGS, AND FRAMES

Rollers were in good condition, measuring 5.5" across and 3 5/16" dia. Pintels were in good condition. Frames are of wood construction and in fair condition. All fasteners are intact.

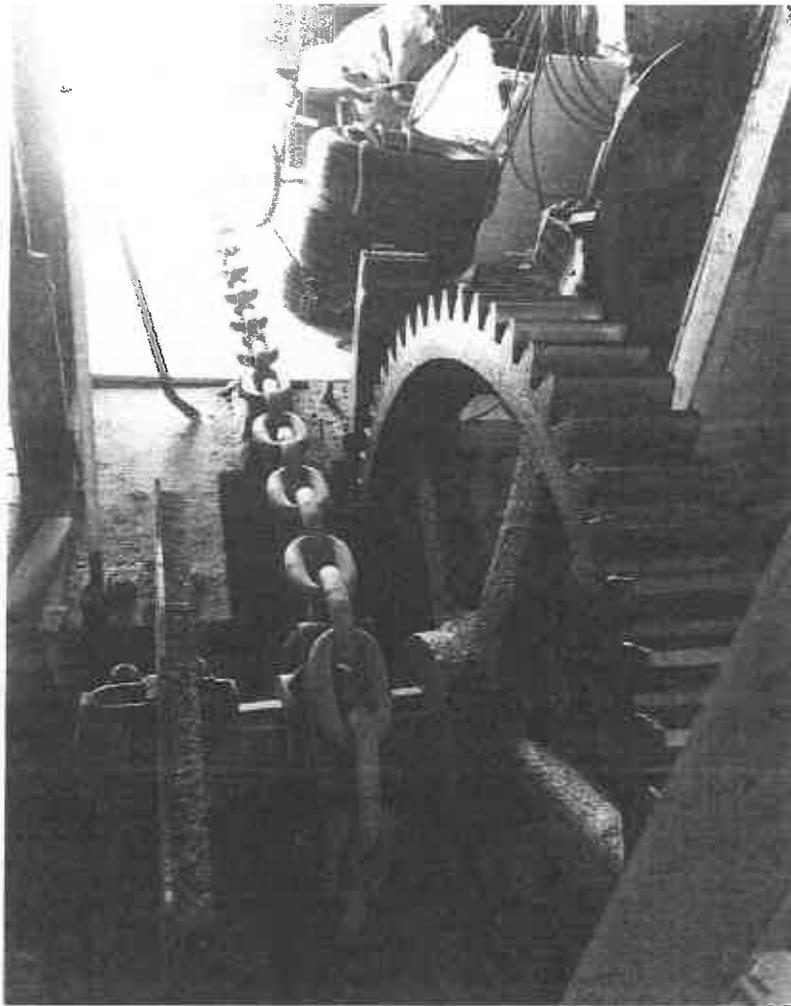
**CRADLE**

Cradle runners are timber and in fair condition. Runner shoe plates are in good condition. Fasteners are intact.

GENERAL HAULING MACHINE

The overall condition appears sound. There are several items in need of attention. The drum control contacts are showing evidence of severe arcing, which is scoring the contact surfaces and will continue to diminish the contact surfaces. The resistor bank should be cleaned and inspected thoroughly. If either of these components should fail during hauling operations the haul safety would be compromised.

The automatic brake is not operating properly. These items should be addressed during your rebuild. Conduct a good spring-cleaning of the entire machine and its components to assure all is well. Enclosed are several pages on automatic brakes to assist with the rebuild.



HAULING CHAIN

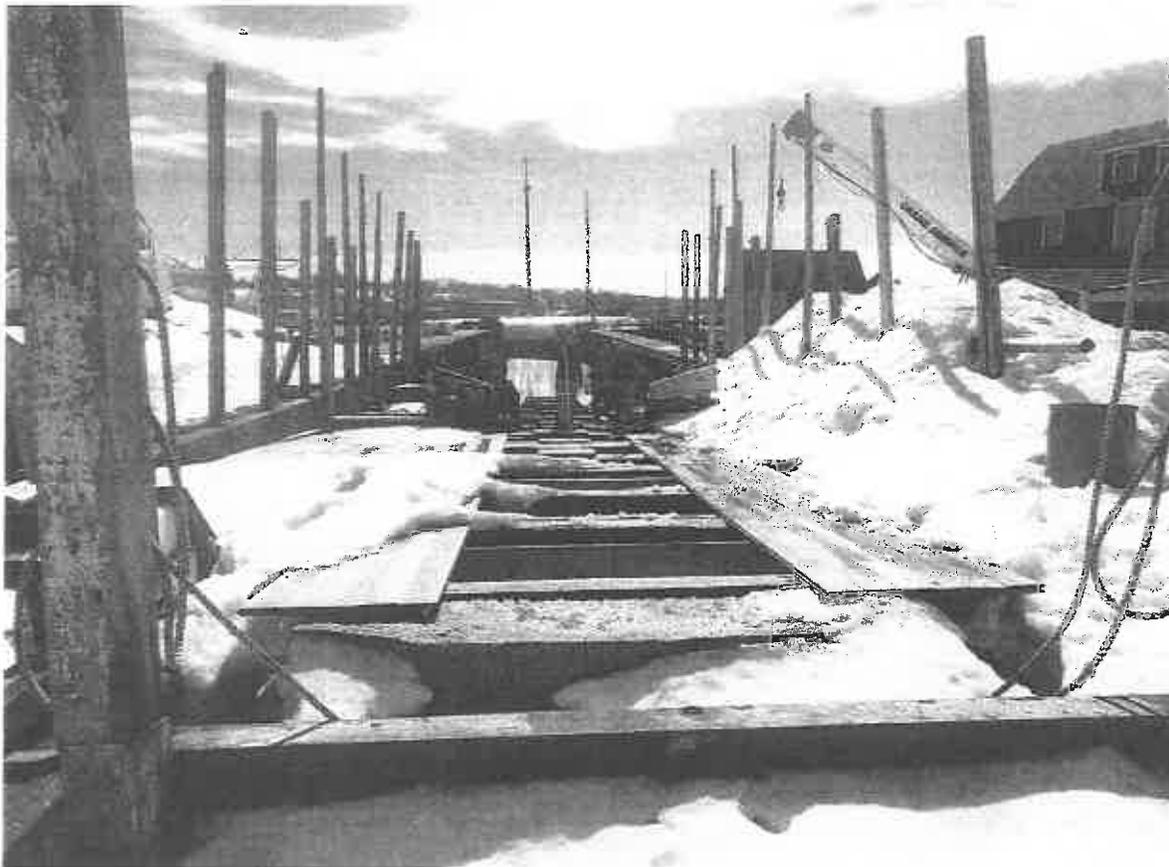
Haul chain is 1 1/2" open link chain with the average wire size measuring 1 7/16" and a double wire size average of 2 3/4".

MUD ACCUMULATION

The sand/mud accumulation is heavy outshore of the tidal area. With the track rail the only portion exposed from approx. Sta. 150' out board to the end of the track.

BLOCKING

All blocking is intact and in good condition.



GENERAL NOTES

The cradle's new decking looks adequate. Several beams have been sistered or replaced altogether. All bilge block slides and rigging appeared recently replaced and in good order.

RECOMMENDATIONS

The existing track was assembled using two 6"x12" timbers one on top of the other with ship-spliced joints attaching each section. Steel pins fasten the timber track to timber caps and in some areas straight to a piling directly under track timbers. There are no crossies to maintain track gauge as was witnessed aft of cradle when gauged with a survey pole. The replacement track would be much stronger and structurally stable if built with a three-tier timber design with wooden cross members at regular intervals. This would still be "historic" just much more structurally stable. Attached is a copy of the design style.

Add crossies and chain slide with a typical underwater sheave (laying flat). The limnoria and terido action is enhanced in cleaner water. Sheathing and a UV barrier are recommended and standard for the track after disturbing the accumulation protection.



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23 Harbor Loop
Gloucester, MA 01930
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April 14, 2015

RE: National Grid Plan for Railway Reconstruction: Issues and Recommendations
Dear Jay/Thomas,

The following items in National Grid's plan should be altered to preserve the integrity of the railway.

1. U/W Sheave Bearing:

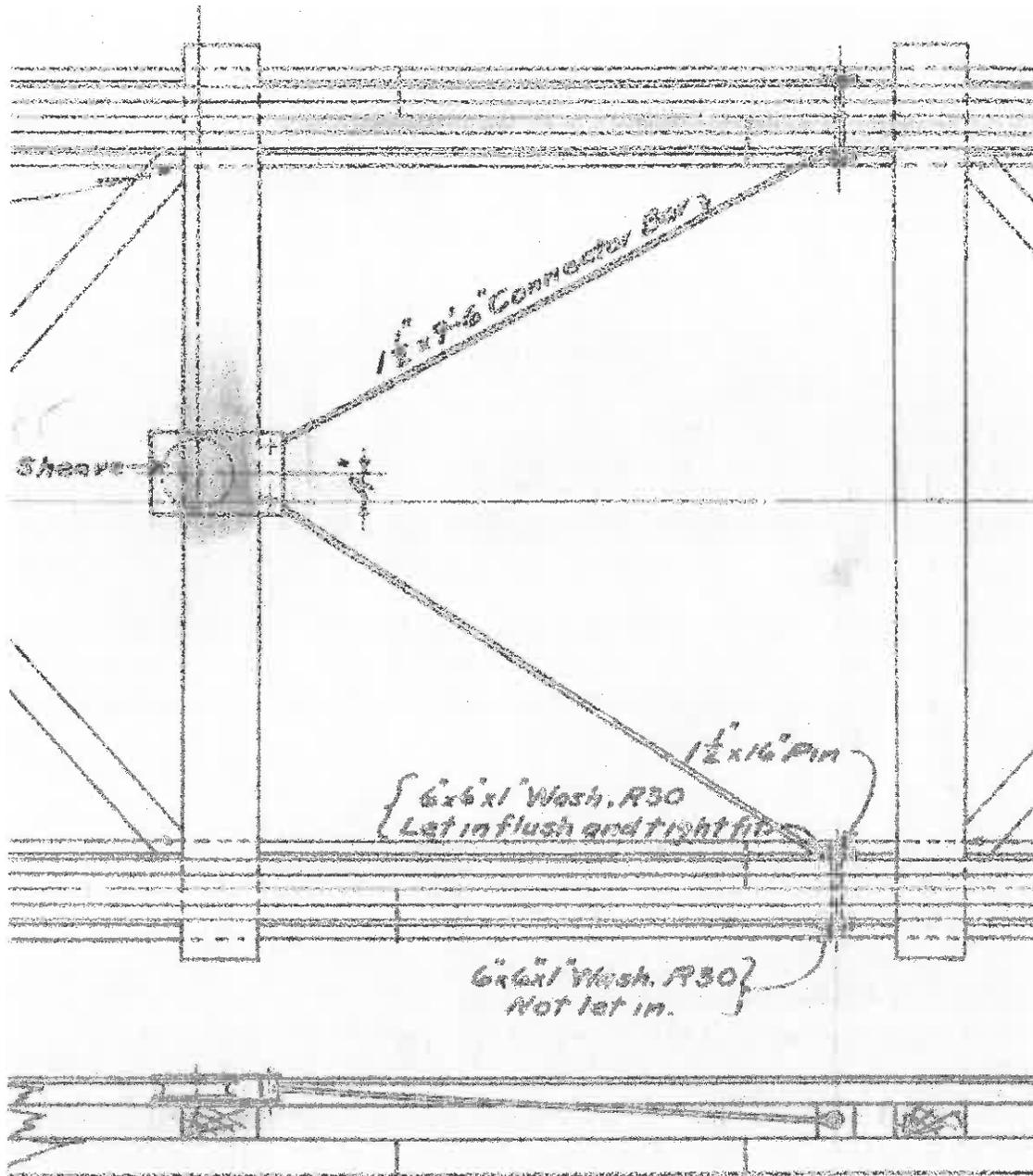
Orkot is not suitable for use for the underwater sheave as a bearing surface. I spoke directly with an engineer from Trelleborg (a supplier of the product), who said that it is unsuitable for underwater use at or below the mud line. In that environment, the orkot undergoes premature wear of its components; i.e. pin and bearing surface from grit.

2. U/W Sheave:

Ductile iron is not recommended for the underwater sheave. A grey iron sheave with a bronze bushing is the standard. The pin should be modified to ensure positive containment and to decrease the possibility of dislodging.

3. U/W Sheave orientation and foundation:

The vertical sheave design might be in the original design, but it is outdated. We suggest a horizontal layout. The design of the base structure for the sheave is not standard. The brace structure should derive its stability from the track itself, not the foundation. CDDE can supply drawings to accommodate all of these issues. The sketch on the following page is an example of a horizontal layout.



4. Roller Assemblies:

Roller assemblies should be individually tagged or marked clearly and reassembled in order. Calipers should be used to measure the diameters of each roller and insure each frame's average roller diameter. Frames should be installed with roller diameters from largest to smallest; with each side uniform.

5. Haul Chain:

Haul chain should be sized from end to end during construction. If it is worn at one end, it should be reversed.

6. New Pilings:

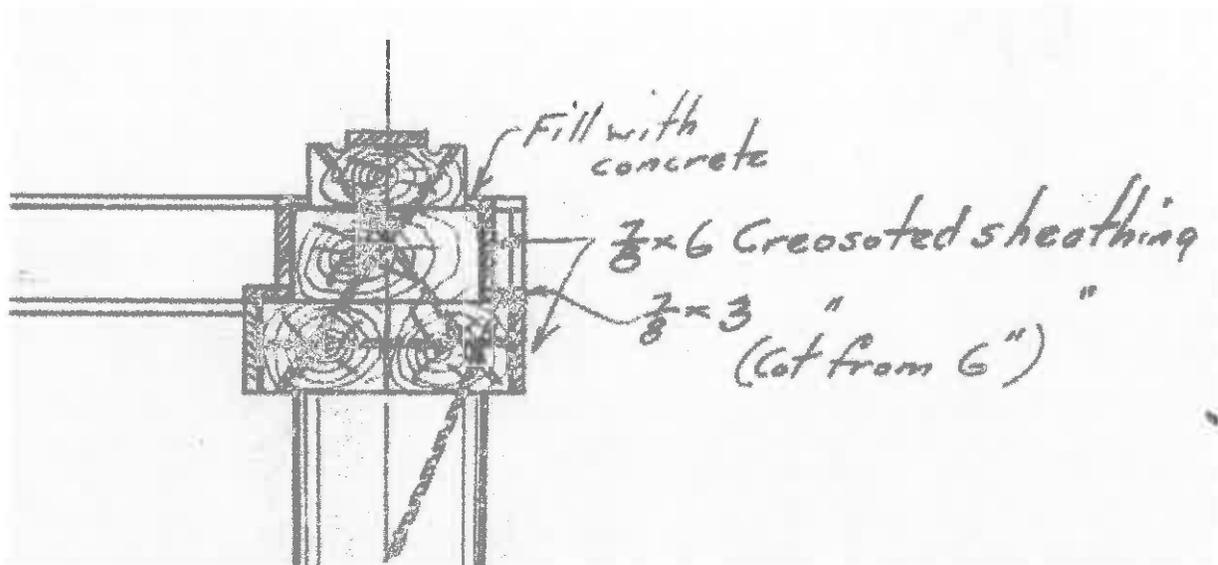
The new pilings should be cut to grade elevation as close as possible to the angle of the track, not horizontally.

7. Hardware:

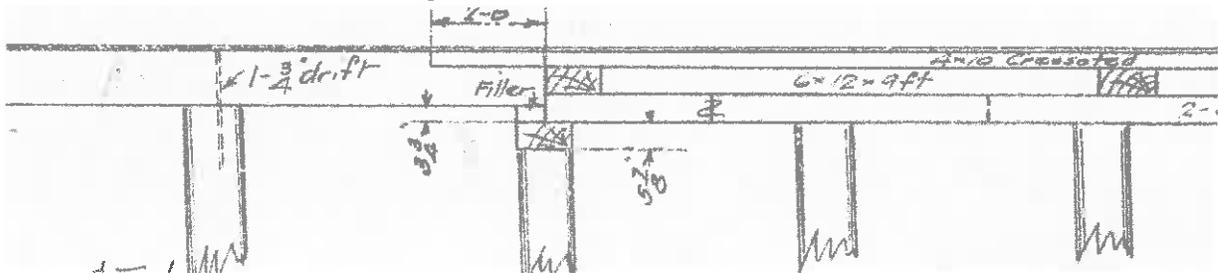
All hardware below the waterline should be painted steel. Zinc or galvanized coatings should be avoided.

8. New Outshore Track:

The new outshore portion of track would be better served if it were constructed in a three-tier design for several reasons. The availability of lumber is greater in the smaller dimensions. A three-tier design also provides the ability to build the structure on land and launch into place with all hardware installed; i.e., chain slides, underwater sheave assembly. The incorporation of crossties in the design ensures that the track gauge is geometrically stable and consistent. The sketch below demonstrates a three-tier design.



9. Track Splice to old track, see drawing below:



10. Sheathing:

Track should be sheathed with a U/V stable barrier and covered by pressure treated ¾" lumber.

Please contact us if you have any questions or concerns.

Regards,



William Avilla
Marine Technician
Crandall Dry Dock Engineers, Inc.

FIELD REPORT



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Seattle, WA 98101
(206) 382-0600 Fax (206) 382-0500

To:	Jaime Harrison Rice Anchor QEA 900 Cummings Center Suite 313-U Beverly, MA 01915	Date:	April 9, 2013
		Job No.	112268
		File No.	
		Location:	Gloucester, MA
By:	Bob Riley & Paul Hauser	Weather:	Rain/sun mix; 50° F
Project:	Maritime Gloucester Marine Railway	Others Present:	Jennifer Wagler (AQ), Mark Mahoney (AQ), Billie-Jo Thibault (AQ), Ken Lento (Nat'l Grid)

Prior to arriving on site at 2:00 PM on March 29, 2013, we met at Anchor QEA's office in Beverly, Massachusetts for two hours to review historical documents, discuss data gaps, and review our methodology for conducting the conditions assessment of the marine railway.

The following was observed:

Overall

The primary railway is comprised of two main pile-supported timber rail beams sloped at an approximate slope of 1:15 (6.7%). The rails extend approximately 370' from the upland end of the railway out into the harbor. Vessels are hauled out using a cradle that traverses on the rail beams up and down the sloped railway. The cradle runs on steel "dog-bone" roller sets, which roll on steel flat-bar tracks. One track is mounted on the underside of the cradle, and the other is mounted to the main beams. The roller sets are independent of the cradle and main beams, so that for every 1' of travel of the roller sets, the cradle moves 2'. The railway is set in a narrow slip with timber hauling pier structures on both sides of it.

The cradle is hauled via a link chain assembly, which is driven by a winch in the upland machinery shed. The main haul chain is attached via a yoke at about the upper ¼ point of the cradle. The main haul chain is connected at its tail end to a back haul chain, which is reeved around an underwater turning sheave at the far end of the railway and led back to a keeper on the front of the cradle. The chain and cradle assembly then make a continuous loop that is driven by the winch in the upland machinery shed. The lengths of the chains are such that the main haul chain is driven by the winch sprocket, and the back haul chain never reaches that sprocket. Likewise, the back haul chain is reeved around the turning sheave, but the main haul chain never reaches the turning sheave.

Based on anecdotal information, we understand that the turning sheave is vertically oriented and mounted on a heavy steel yoke attached to the main beams approximately 300' from the upland end of the railway.

Based on historical documents, it appears the original railway was constructed in the 1850s, with a railway extension constructed in approximately 1911. We understand the dog-bone

rollers and steel flat bar tracks were replaced in 2001. Comprehensive maintenance documents were not available. However, based on anecdotal information, several maintenance events were conducted on the railway since initial commissioning. The number and extent of these maintenance events was not available.

Cradle:

The cradle beams are 14" wide x 12" high by approximately 100' long. They support a set of bearing beams, on approximately 5' centers. The bearing beams support the set of keel and bilge blocks arranged specifically to support the vessel being hauled. These beams are in relatively good condition, but show damage caused by 150 years of wetting and drying action from exposure to salt water. A number of the beams have been replaced, some obviously fairly recently. Two of the original wood beams (likely oak) have been replaced by steel wide flange section beams. The cradle is ballasted with a number of quarry-cut granite blocks. Uprights are attached to the cradle, on the ends of the bearing beams, which align with matching uprights on the adjacent fixed piers when the cradle is fully raised. This allows for the installation of scaffolding around the hauled-out vessel.

The cradle previously included a locking mechanism on the upper end of each beam that would engage a keyhole notch in the upland abutment, but it has been removed.

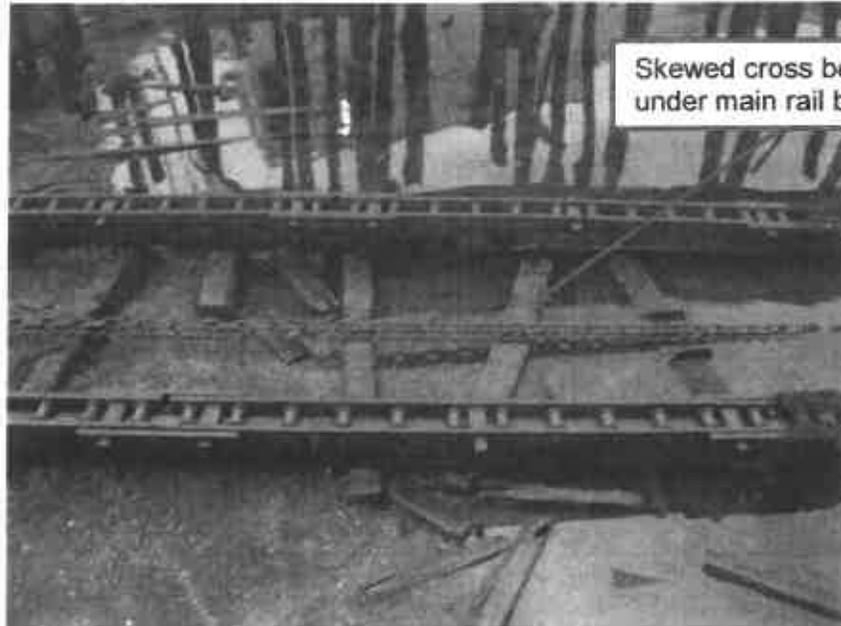
The hauling yoke on the cradle is quite corroded, as is to be expected, but is in overall good condition. There is a tee-section used as a cross beam at the base of the yoke to hold the cradle beams at their gage distance. The original tee was cut out, probably due to corrosion, and the current tee section is welded onto the stubs of the original. The other steel parts on the cradle are visibly newer and not nearly as corroded.

Main Rail Beams:

The main rail beams are 12" wide x 16" high, pile-supported, and connected by a series of scarf splices to create a pair of continuous beams. A number of soft spots are visible, primarily on the exterior of the beams. This is consistent with their age and immersion in salt water, but they are in relatively good condition considering their age.

The primary support piles were completely silted in and therefore not visible. According to available existing drawings, the beams should be supported by timber piles spaced at 8' or 10' on-center. Timber cross beams are also framed under the main rail beams, and likely framed over the primary support piles. These beams help to maintain the rail gage. Many of these beams are skewed, indicating that the piles under each main rail beam are not aligned with each other, contrary to what is indicated in the existing available drawings. To our knowledge, no as-built drawings are available. See photo below.

The track on top of the beams consists of a strip of 1" thick x 10½" wide steel, with a 1 ¾" x 5" flat bar on top centered on the 10½" wide plate. According to reports and anecdotal information, much of the track was replaced during a refurbishment project in 2001.



Skewed cross beams framed
under main rail beams

The outer ends of the main beams are buried in silt and could not be observed. At low tide, the point at which the beams become buried is visible through the shallow water column, which is roughly 100' from the outer end of the rail beams. It should be noted that the starboard rail appears to be buried further upslope than the port rail. This coincides with the fact that the starboard set of rollers is 16' shorter than the port set of rollers. Therefore, it is likely that the areas of the rail that are not regularly used are the portions that have silted in.

Winch and Winch Drive:

The haul winch is driven by a 60 Hp, 860 rpm electric motor (220vac, 3 ph, 60 Hz, 150 FLA) that replaced the steam drive circa 1950. The motor nameplate is difficult to read, but it is a GE motor. It has a double-ended shaft and appears to be late-1930s to mid-1940s vintage, with open conductor connections on the brushes. Even though the motor is over 60 years old, designs of that era were robust so there is no reason to believe it would have any serious issues. For calculation purposes, it would be typical to de-rate the motor to 90% to account for any winding losses due to its age.

The motor drives an open gear set with four reductions, lubricated via an open oil sump. The oil level appeared to be slightly low, as the third gear looks a bit dry. By pitch diameter, the reductions are as follows:

1 st set	12" to 42"	3.5:1
2 nd set	10" to 48"	4.8:1
3 rd set	12" to 50"	4.17:1
4 th set	24" to 64"	2.67:1

The total reduction is 186.7:1. At the motor's full speed of 860 rpm, this would yield a full speed of 4.6 rpm at the output shaft. The output shaft has a hexagonal six-tooth sprocket for use with the main-haul link chain.



There is an electrically released brake on the motor shaft that is applied via a weighted arm. The brake can be manually released via a rope pull attached to the weight. A mechanical pawl can be put in place to lock the main gear. The winch is controlled with a manual potentiometer speed control.

Assuming each gear set has a mechanical efficiency of about 98%, the overall efficiency of the gear train is about 92%. De-rating the motor to 90%, due to its age, yields a maximum output at the sprocket of 49.8 Hp. At the full speed of 4.6 rpm this would yield an output torque of about 56,870 ft-lbs.

The main haul chain is 1½" in diameter, with (nominally) 9" x 5½" links. The chain is not the original. According to reports, it was salvaged during the dismantling of another marine railway in the area.

Roller Assemblies:

Each individual roller consists of a main section measuring 3½" in diameter x 5½" long, with 6" diameter x 1½" thick flanges. The spindle is a 1" diameter x 14½" long round bar that appears to have been shrunk-fit into the center of the roller.

The rollers are mounted into sub-assembled sections, each 16' long, with the roller on 15" centers. The rails of these assemblies are wooden, measuring 2½" by 4¾", and held at a nominal 9" spacing by wooden crossbars held in place by gib pins. The 16' long sub-assemblies are spliced together by 4'-9" long pieces of the same 2½" x 4¾" lumber.

Twelve sections of the roller sub-assemblies sit along the port side rail for a total length of approximately 192'. The upland end of the overall roller assembly sits approximately 7'-6" shy of the upper end of the cradle when the cradle is in the full raised position. The starboard side has 11 sections for a length of about 176', and sits about 11'-6" shy of the upland end of the cradle. Because the cradle is approximately 100' long, the starboard roller assembly extends approximately 87'-6" beyond the lower end of the cradle. This allows for a total cradle travel of about 175 feet before the lower end of the cradle beams would begin to overrun the end of the roller assembly.



Overall, the roller assemblies are in good condition, with several sections that have evidently been refurbished in recent years. A fair amount of vegetation is growing on the lowest 15' to 20' of the assemblies, which are low enough to remain covered at low tide.

Haul Out:

On Saturday, March 30th, the 45 Ton pinky schooner *Ardelle* was hauled out. The operation of the railway appeared to be smooth, and neither the cradle nor the winch and chain system seemed to exhibit any signs of distress.

Initial Conclusions:

According to Ken Lento, the proposed dredging will only reach to a point about even with the upland end of the Maritime Gloucester main pier on the southwest side of the railway (not the narrow pier immediately adjacent to the northeast side of the railway). This is approximately even with the -5' contour (NGVD 29), and is about 150' from the upland end of the main beams. Therefore, the cradle should not need to be dismantled or moved to allow removal of a portion of the main beams and pilings for dredging.

According to reports, the underwater turning sheave is mounted on a yoke similar in shape to the yoke on the cradle, but heavier. Judging from the description, disconnecting the yoke and sheave assembly from the main beams and lifting it from the water should be a relatively simple process. However, one complicating factor is that the assembly appears to be almost completely buried in the silt.

The winch and main haul are in good condition overall, and it should not be difficult to assess them and determine a haul rating if necessary.

At this time, it is assumed that the lower approximately 200' of the railway beams and piling will need to be removed to accomplish the dredging. It is also assumed that all or a portion of that length will be reconstructed using in-kind timber piles and beams spliced to the upland portion of the rail beams that will remain. The beams to remain appear to be in good condition considering their age, and it does not appear that connecting the new beams to the existing beams will pose any significant challenges.
