Rehabilitation Study Report for the Hampton Harbor Bridge

15904 Seabrook-Hampton

Hampton Br. No. 235/025

HDR Engineering, Inc.

September 18, 2018

Revised July 2019

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APPENDICES

1 EXECUTIVE SUMMARY

The Neil R. Underwood Memorial Bridge (Bridge No. 235/025) carries NH Route 1A (Ocean Boulevard) over the Hampton River, supporting up to 18,000 vehicles per day during peak times. The bridge, built in 1949, is structurally deficient and functionally obsolete. It is on the NHDOT Red-List of deficient bridges (since 1999) due to the poor condition of the superstructure. The bridge is considered both scour critical and fracture critical. The bridge will be referred to as the Hampton Harbor Bridge for purposes of this project.

There have been numerous efforts to repair and rehabilitate the bridge over its life, with recent repairs including a deck replacement in 2010 and emergency repairs to the bascule span mechanical system in 2018. The Hampton Harbor Bridge Project, NHDOT Project 15904, will address the long-term needs of the state and region by assessing, designing and constructing a rehabilitation or replacement for this bridge and its roadway approaches.

This overall project will evaluate four alternatives for addressing the bridge structure: Bridge Rehabilitation, Bridge Replacement with a Bascule Bridge, Bridge Replacement with a Fixed Bridge, and a Twin Bridge Alternative. This Rehabilitation Study has been prepared to investigate the requirements and approach for the Rehabilitation Alternative only. The information developed in this Rehabilitation Study will be carried forward and utilized in the Type, Size & Location (TS&L), which will evaluate and compare all four alternatives. The selected alternative must meet the project's purpose and need by providing a safe, reliable, structurally sound crossing that provides access for the traveling public through proper vehicle, bicycle, pedestrian and marine accommodations.

This Rehabilitation Study assesses the approach to bridge rehabilitation, as well as temporary and permanent impacts a rehabilitation will cause. This study is administered through Preliminary Design Part "A" Services Agreement with the NHDOT, and the investigation was conducted in a manner consistent with the American Association of State Highway and Transportation Officials (AASHTO) and NHDOT Bridge and Road Design Manuals.

This investigation considers a number of factors, including proper serviceability to multi-modal transportation, impacts to this structure as a potential historic resource, feasibility of design, and constructability of a rehabilitated structure. While cost estimates and service life analysis are not being developed as part of this study, both were qualitatively considered when assessing the approach to rehabilitation. They will be developed for all project alternatives in the TS&L Study.

Existing bridge plans, field topographical survey, photographs taken during site visits, and various other data sources were utilized in the development of this study. The intent of this study is to evaluate existing conditions and project goals, and to outline what will be required in order for a bridge rehabilitation to accomplish those goals.

Many options were considered for the Bridge Rehabilitation Alternative, as outlined in Section 5 of this document. Three options were developed for inclusion in the report.

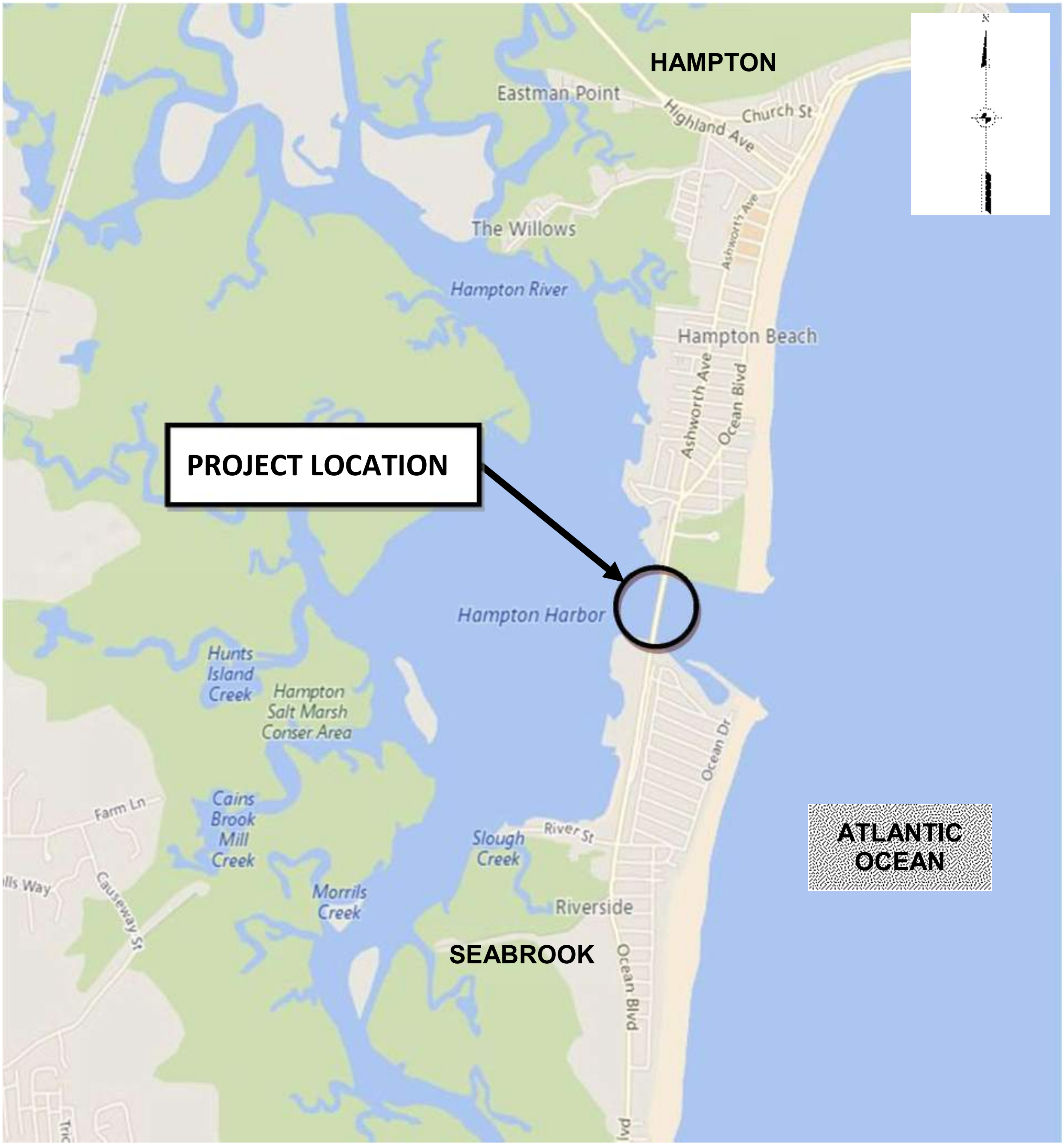
- Option 1 - Superstructure Replacement (38' Clear Width), Shifted Alignment
- Option 2 - Superstructure Replacement (50' Clear Width), Shifted Alignment, Pier Widening
- Option 3 - Superstructure Replacement (50' Clear Width), Centered Roadway, Pier Widening

Option 2 meets the purpose and need of the project, providing a width 53' out-to-out, comprised of two 11' lanes, two 8' shoulders, and two 6' sidewalks. Among other items, this option will require an alignment shift of 11’-10” to the east, approximately 20’ widening of all existing piers and abutments, scour mitigation and other repairs of the existing piers, and a replacement of the mechanical and electrical systems of the bascule span.

Option 1 minimizes impacts to the structure but does not meet the purpose and need of the project. To ascertain the level of impacts to the existing structure by using a minimum permissible roadway width, Option 1 (38’) was also developed.

The recommended Rehabilitation Alternative, as informed by the project purpose and need, is Option 2, a superstructure replacement with a 50’ clear bridge width and a shifted alignment. This option will be further investigated, along with other alternatives during the TS&L and will be further studied during the TS&L Study. This study will compare the Rehabilitation Alternative to other alternatives and provide a recommendation for how the Department of Transportation should move forward with design, permitting and construction of the project.

2 LOCATION MAP



NH RTE. 1A (OCEAN BOULEVARD)
OVER HAMPTON RIVER
SEABROOK – HAMPTON, NH

3 DESCRIPTION OF EXISTING CONDITIONS

3.1 Bridge No. 235/025: NH Rte. 1A over Hampton River – General Description

The existing bridge is owned by the New Hampshire Department of Transportation, consists of thirteen spans, and is 1,193' long. The bridge is 34'-9" out-to-out and conveys a roadway which is 26'-0" curb-to-curb and a 4'-7" sidewalk to the east. The approach spans are 94' in length and are comprised of twin steel girders supporting floor beams and stringers with a composite concrete deck. The approach substructure units consist reinforced concrete piers and abutments, some of which are founded on timber piles. The navigation span is a steel single leaf bascule with steel open grid deck. The control house, counterweight, and mechanical systems are located to the north of the navigation span. The bascule span is 65'-6" long, from centerline of trunnion to centerline of bearings, rotates to 79 degrees when fully opened, and provides a 51' wide x 20' high navigational channel (at MHW) when closed. The substructure components have no skew, and are square to the roadway baseline. The bridge is fracture critical due to the two girder system, and scour critical due to the piers not founded on piles.

The structure has both functional and structural inadequacies including:

- "E-2" Load Posting, which restricts the bridge from being crossed by certified vehicular loads.
- 26'-0" curb to curb roadway width comprised of 12'-0" lanes and 1'-0" shoulders.
- 4'-7" sidewalk that narrows at the barrier gates
- Substandard bridge rail, approach rail, and terminal units.
- Deteriorated steel components including open grid deck, girders, stringers, and floor beams.
- Spalling and cracking of concrete pier walls.
- Deteriorated steel bearings with section loss and pack rust.
  Federal Highway Administration (FHWA) National Bridge Inventory status of "Structurally Deficient".
- The bridge is both scour critical and fracture critical.
- FHWA Sufficiency rating of 26%.

The Bridge has been repaired or rehabilitated at least six times since it was constructed in 1949. Table 1 contains a list of available information on repairs and rehabilitation that have been implemented on the bridge.

Figure 1. Existing Bridge, looking northwest from south bank.

Figure 2 - Existing Typical Section at Bridge

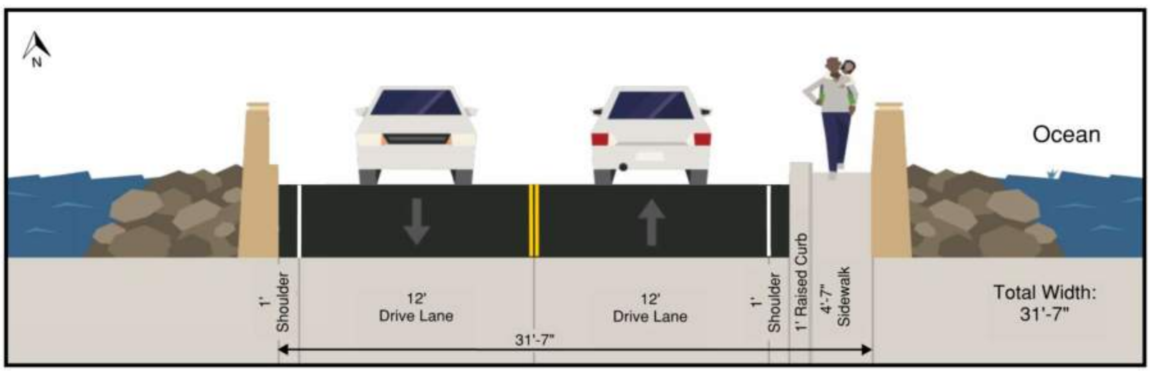


Table 1 – Partial Repair and Rehabilitation History of Bridge No.235/025

Project Description	Plan Set Date	DOT Project #	Plan Set Description
Original Bridge Construction	1946	1600	Design plans
	1947	1600	Bridge shop drawings
	1946	1600	Design plans with fed aid project cover sheet
Pier Repair	1957	Unknown	Jacking of Pier 4N to plumb.
Scour Mitigation	1963	P-2737	Install rip-rap at Piers 3N through 6N
Bridge Painting	1976	S-2842	Painting of bridge structural steel
Bridge Approach Rail	1978	P-2295-H	Replace bridge approach rail
Scour mitigation	1978	P-3212	Channel survey
Fender Installation	1978	PSNH	Fender system installation
Rehabilitation	1983	S3314A	Deck repair, bascule span repairs, control house repairs, bridge rail replacement.
Scour mitigation	1990	P7400	Channel survey
Bascule span repairs	2002	13676A	Limited mechanical, electrical, and structural repairs of lift mechanism.
Rehabilitation	2008	14188	Approach Deck Replacement, made composite, miscellaneous rehabilitation
Emergency Repairs	2018	41510	Emergency repairs of pinion coupling

3.2 NH Route 1A (Ocean Boulevard) General Description

NH Route 1A is classified as a NH Tier 2, Urban Minor Arterial road within the anticipated project limits. The roadway begins in Seabrook at the New Hampshire-Massachusetts state line and extends north approximately 18.4 miles through the towns of Hampton, North Hampton, and Rye to the intersection with U.S. Route 1 in Portsmouth. Bridge 235/025 is located at mile marker 1.6, near the Town line between Seabrook and Hampton. The bridge is a vital link for traffic, with an Average Annual Daily Traffic (AADT) of 9466 vehicles per day (VPD) (2017), which increases to over 18,000 VPD per day during peak times and special events.

The project study area begins at the intersection of NH Route 1A and River Street in Seabrook, and ends at the intersection of NH Route 1A and Harbor Rd in Hampton. The roadway approach consists of a long 0.8 mile horizontal tangent beginning at the southern project limit and ending at the State of NH Hampton Beach State Park entrance. The 1,193-foot long Hampton River Bridge is located on the horizontal tangent approximately 600 linear feet south of the Hampton Beach State Park. Continuing north, as NH Route 1A approaches Hampton Beach, the horizontal alignment consists of two broken back curves, 2546.7’ and 573’ respectively, prior to transition to a one-way two-lane segment through Hampton Beach Village District. NHDOT District 6 is responsible for the maintenance and operation of NH Route 1A within the study limits, which end at the Town of Hampton Urban Compact Limits at the intersection of Harbor Road and NH Route 1A/Ocean Boulevard.

The existing vertical geometry is relatively flat with grades less than 1.0%, except for the immediate bridge approaches. The 1940’s record plans indicate that the approach south of the bridge has vertical tangent grades of 3%, that there is a 1300’ vertical curve over the channel, which returns to a 3% vertical tangent grade constructed north of the bridge. The rate of change or “K” values for all existing vertical curves within the study limits meet or exceed the K-value required per the AASHTO Policy on Geometric Design of Highways and Streets, for the posted speed limits of 30 and 35 mph. These K-values for the 35 mph design speed are 29 for crest vertical curves and 49 for sag vertical curves.

The existing roadway and bridge typical section vary within the project limits, as this segment of NH Route 1A transitions from rural roadway in Seabrook to a more densely populated urban arterial within Hampton Beach Village District. For the purposes of the 15904 Seabrook-Hampton engineering studies, the roadway segments include:

NH-Massachusetts State Line to 500’ South of the Hampton River Bridge:

The roadway segment includes –

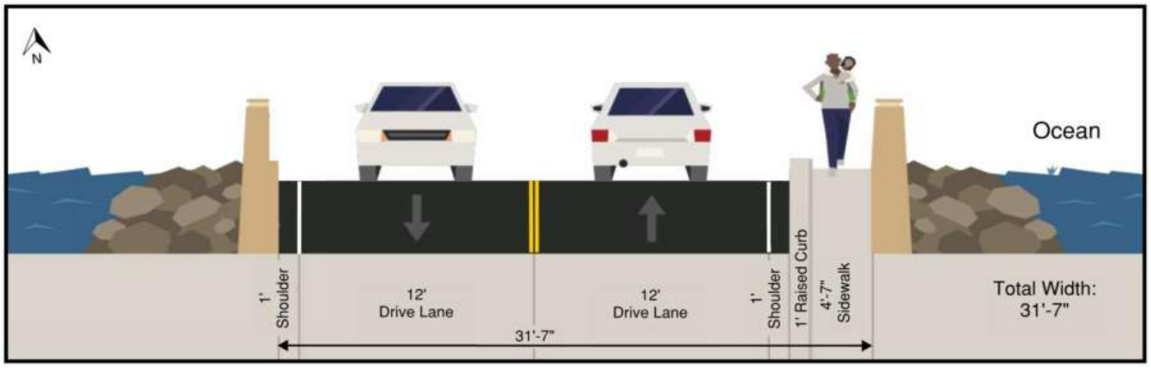
- Posted Speed – 35 mph
- Four (4) 11’-0” travel lanes – two northbound and two southbound
- Uncurbed shoulders, which vary between 8’ to 12’ in width
- No sidewalk or guardrail
- A sand berm is constructed between NH Route 1A and Eisenhower Street
- The segment also contains uncontrolled parking on wider gravel shoulders and paved parking areas adjacent to the Yankee Fisherman’s Coop.

Hampton River Bridge – 500’ south of Bridge to State Park Entrance:

The roadway segment includes –

- Posted Speed – 30 mph
- two (2) 11’-0” travel lanes – one northbound and one southbound
- curbed shoulders, which vary between 1’ and 5’ in width
- 5’ sidewalk adjacent to the roadway along the south approach, 4’-7” sidewalk on the Hampton River Bridge, and 5’ separated sidewalk along the north approach. The sidewalk is connected via boardwalks or paths to Eisenhower Street.
- The roadway segment’s access is controlled with only one access point at the Hampton Beach State Park.
- The typical section across the bridge is as follows:

Figure 3. Existing Bridge Typical Section



State Park Entrance to the Intersection of Harbor Road

The roadway segment includes –

- Posted Speed – 30 mph
- two (2) 11'-0" travel lanes – one northbound and one southbound lanes
- one (1) 11'-0" southbound left turn lane for access to the Hampton Beach State Park
- curbed shoulders, which vary between 1' to 5' in width
- 5'-7' separated sidewalk
- This roadway segments is accessed by only one driveway and two intersections (Epping Avenue and Harbor Road).

Lastly, the study area is utilized by vehicles, pedestrians, and bicycles as well as other recreationalists and transit vehicles as further described below in the Traffic section. This segment of NH Route 1A is a designated section of the U.S. Bicycle Route 1, State Bicycle Route, the NH Coastal Scenic Byway, and the on-road route for the East Coast Greenway through New Hampshire, and as a result has been a focal point for long-term planning of bicycle usage by organizations such as the Rockingham Planning Commission.

3.3 Bridge No. 235/025 Description of Existing Mechanical and Electrical System

The bascule span is operated via two 15 horsepower (HP) wound rotor type motors under its normal operation and the span speed is controlled by varying the resistance on the secondary resistors of the main motors. This is controlled via the operator house, located at the northwest corner of the bascule span, which has four levels.

- The upper level (first level) contains the control desk and is where the operator is located during operation.
- The span level (second level) contains the motor control center (MCC), control relays, secondary motor resistors, two lighting panels, and the emergency auxiliary drive control panel.
- The motor level (third level) contains the two main motors, brakes, rotating cam limit switch, and span level indicator.
- The generator level (fourth level) contains the emergency diesel generator, an air compressor, two lighting panels, and the submarine cable termination box.

Operations of the bridge are controlled from the control house on the first level. The span stops automatically when it reaches the nearly closed or nearly open positions. The operator then drives the bridge manually at a slower speed to fully open or fully closed positions. The bridge power is fed from a utility feeder at the north abutment. The submarine cables provide power and control to the span lock motors and instruments, span seated limit switches, far side gates, warning bell, and traffic lights.

The main drive system for the bridge uses one set of open gearing after the main motors, differential reduction gearing above the machinery pier (which shares torque between the two main pinions), and secondary open gearing before each main pinion. The main pinions operate the bridge via the curved racks which are mounted to each of the bascule girders.

The bridge is also equipped with an emergency auxiliary drive system located at the machinery level. The auxiliary system couples to the main drive shafts from the first set of open gearing using a disconnect coupling. The system consists of a motor with rear mounted brake, enclosed gear reducer, and three sets of open gear reduction. Hand wheel operation of the bridge is also provided through two of the open gear sets in the auxiliary machinery room on the machinery pier.

The two span locks located on the rest pier are operated using a motor with rear mounted brake and enclosed speed reducer. The output shafts on the speed reducer rotate the crank arms which drive and pull the lock bars. The live load supports are also located at the rest pier and mate with live load shoes on the bottom of the bridge to support the bridge against load due to traffic on the span.

3.4 Bridge No. 235/025 – Condition of Structural System

To inform our assessment of the bridge's structural condition, HDR reviewed available inspection information, which is included in Appendix H - Available Inspection Reports Developed by Others:

- July 2018 Inspection Report by NHDOT
- October 2010 Coating Assessment by KTA-Tator, Inc.
- July 2015 Underwater Inspection Report by Terracon Consulting Engineers

In addition to the above information, HDR performed a field assessment of the bridge's structural elements utilizing an Unmanned Aerial Vehicle (UAV) in August 2018. Reporting of this UAV assessment can be found in Appendix G.

The current NBIS condition ratings were found based on the July 2018 Inspection Report:

- Deck – Very Good Condition
- Superstructure – Poor Condition
- Substructure – Satisfactory Condition

The following key findings were noted:

- As noted above, the bridge is both scour and fracture critical and therefore requires supplemental inspection criteria.
- Superstructure elements exhibit paint failure and areas of surface rust throughout.
- Pack rust was noted between girder plate elements in numerous areas throughout the bridge.
- Bracing and floor beams have areas of corrosion and pack rust throughout the bridge.
- Significant section loss was noted on structural elements adjacent to deck joints.

- The majority of piers have steel sheet pilings and/or rip rap installed around the pier to mitigate scour. Sheeting was exposed in a number of locations to varying heights, and scour pockets were noted around Pier 4S.
- Pier 4N is tilted out of plumb. It should be noted that repair plans dated 1957 addressed a repair to this pier, which was shown to be approximately 1'-4" out of plum in those plans. The tilting observed in the field during HDR's field visit appears to be significantly less than 1'-4".
- Pier 4N has significant spalling and cracking on its cap.
- Pier 4S has scour pockets noted in the 2015 underwater inspection.
- Bearings at deck joints has severe corrosion on the assemblies, especially at anchor bolt nuts.

Other findings include damage to deck joints, minor cracking in deck, and corrosion on stairway supports. See Appendix H – Available Inspection Reports By Others and Appendix G – Structural Condition Assessment.

<u>3.5 Bridge No. 235/025 – Condition of Mechanical and Electrical Systems</u>

The mechanical and electrical systems were evaluated by HDR on July 19, 2018. At the time of our field observations, HDR found that the mechanical and electrical systems are in poor condition with a few components in severe condition.

While no critical electrical or mechanical deficiencies were noted that need immediate attention, several deficiencies were noted that should receive attention within the next few years. The systems are unlikely to operate the current span reliably for the next 10 years and most systems would need replacement for an expected service life up to 50 years.

The main operating machinery is in fair to poor condition due to several deficiencies, including but not limited to:

- There are no machinery brakes
- There is no "brake set" limit switch on the motor brakes
- The bridge has no redundant means of operations
- Severe section loss was noted on machinery support and bearing fasteners
- There are leaks at couplings.
- The emergency drive system is in severe condition and inoperable due to severe physical deterioration of the motor, brake, bearings, and reducer.
- The system is also difficult to engage, is not interlocked with the normal drive system brakes, and has poor accessibility for maintenance.
- The span lock machinery and live load bearings are in poor condition due to physical deterioration of couplings and fasteners, gaps at the live load shoes, and a lack of adjustability in the system.

The instrumentation machinery and limit switches are generally outdated and in poor condition due to damaged linkages, physical deterioration, and poor maintenance.

The motor control center and control system are in poor condition due to deterioration, periodic tripping of motor overloads, and a lack of working clearances to meet National Electrical Code (NEC) requirements. The control desk is in poor condition due to several inoperable components including the voltmeters and current meters. The condition of the secondary reducers is poor due to deterioration of wires and a lack of safety guards on the open resistors.

4 DESIGN CRITERIA

4.1 Design Speed

The project study area has two (2) posted speed zones transitioning on the southern bridge approach approximately 500' south of the Hampton Harbor Bridge. It is general Federal Highway Administration (FHWA) practice to define a design speed above the regulatory speed and consistent with operational speed and driver habits. The current posted and suggested design speed for the project study is:

NH-MA State Line to 500' South of the Hampton Harbor Bridge:

- Posted Speed: 35 mph
- Design Speed: 40 mph

500' South of Hampton Harbor Bridge to Intersection of Harbor Road:

- Posted Speed: 30 mph
- Design Speed: 35 mph

4.2 Typical Cross Section

A Recommended Typical Section has been produced by utilizing design guidance in accordance with current AASHTO and NHDOT bridge design specifications. In addition for this evaluation, the following references were utilized:

- AASHTO *A Policy on Geometric Design of Highways and Streets, 6th Edition*
- AASHTO *Guide for the Development of Bicycle Facilities, 4th Edition*
- NACTO *Urban Street Design*
- NACTO *Urban Bikeway Design*
- NHDOT *Bridge Design Manual (NHDOT BDM), v2.0.*
- NHDOT *Highway Design Manual, Vol. 1*
- *NHDOT Statewide Bicycle and Pedestrian Plan*
- United States Access Board *Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (Technical Requirements)*

This proposed typical section was developed based on a review of existing vehicular, pedestrian and bicycle volumes collected by automatic traffic recorder and video turning movement counts conducted. The turning movements are provided in Appendix J. The multi-modal traffic data collection was supplemented through a review of video footage of pedestrian and bicycle activity on the bridge to understand cyclist's comfort and experience levels along with pedestrian desire lines and travel behavior.

Recommended Typical Section:

- Roadway and Bridge must provide adequate widths for multimodal use. Minimum recommended configuration is:
    - (2) 11'-0" lanes
    - (2) 8'-0" shoulders
    - (2) 6'-0" sidewalks
    - These minimums result in 50'-0" clear width, 53'-0" out-to-out.

Selected typical sections for rehabilitation are informed by the project purpose. See Section 5 of this study for analysis of recommended typical sections, and development of subsequent options related to the Bridge Rehabilitation Alternative.

4.3 Bridge No. 235/025: NH Rte. 1A over Hampton River

The replacement or rehabilitated bridge will be designed in accordance with current AASHTO and NHDOT bridge design specifications.

The NHDOT embraces a multi-modal approach to transportation planning. Although the existing roadway is not designed for multimodal traffic, the proposed bridge alternative should not restrict future plans for the corridor. There is currently a sidewalk on the eastern side of the bridge and therefore a sidewalk on the bridge will be accommodated.

Recommended Design Criteria:

- Design Loading: HL-93.
- Railing Height: 42" min. (sidewalk side) 42" min. (roadway side, assuming bike use)

Recommended Bridge Design Specifications:

- AASHTO Load and Resistance Factor Design Bridge Design Specifications (AASHTO LRFD), 8th Ed.
- NHDOT Bridge Design Manual (NHDOT BDM), v2.0 when available, v1.0 otherwise.
- NHDOT Standard Specifications for Road and Bridge Construction, 2016.

4.4 Mechanical and Electrical Systems

The following is a summary of design criteria for the mechanical and electrical systems.

4.4.1 Machinery Systems

Recommended bridge design specifications for all bridge machinery:

- AASHTO LRFD Movable Bridge Design Specifications 2nd Ed - 2018 Interims

The rehabilitated Hampton Harbor Bridge will be a hydraulically operated single leaf trunnion bascule, in conjunction with the structural superstructure replacement. Hydraulic operation is necessitated due to space constraints, which will be further discussed in Section 7.5 of this study. As an alternative rehabilitation design, a redundant electric motor driven machinery system comprised of open gearing similar to the existing arrangement will also be considered during design development.

4.4.2 Design Life Requirements

- Bridge hydraulic machinery will be sized for a minimum design life of 25 years of operation.
- Bridge open gear machinery will be sized for a minimum design life of 75 years of operation.

4.4.3 Operating Conditions

- Hydraulic machinery shall be installed such that cylinders will be in the retracted state in their most frequent configuration.
- All machinery will be designed for ease of maintenance accessibility.

4.4.4 Electrical Systems

- All electrical systems for the bridge shall be in conformance with AASHTO LRFD Movable Highway Bridge Design Specifications and the National Electric Code.
- The bridge shall have modes of operation. Normal with maximum speed available, Emergency with reduced speed.
- The bridge control system shall be relay based with Programmable Logic Controller (PLC) monitoring and a Human-Machine Interface (HMI) for bridge status and alarm monitoring.
- A standby diesel generator capable of powering the bridge under normal operating parameters shall be provided. The generator shall be provided with fuel tank capable of operating the bridge for a period of 24 hours (including 24 span openings).
- The interconnection between bascule piers shall be via Submarine HDPE duct. The duct shall permit the installation of submersible electrical cables.
- Each bascule pier shall have a sump pump system.
- All external water and sewer connections above the frost line shall be heat traced on a temperature controlled circuit.
- Navigation and pier lighting shall be per USCG requirements.
- A PA system will be installed in the bascule piers, equipment room, and control room and machinery areas to facilitate communication with the bridge operator.
- The bascule pier, equipment room and control room shall be equipped with a fire and intrusion alarm system tied to the Transportation Management Center (TMC) and the local emergency services.

4.5 Operation Time for Bascule Span

Time of Operation: The approximate time of operation necessary to either open or close the bascule span exclusive of any time to lock or unlock the span shall be as follows:

Hydraulic:

- Normal Condition (Condition A)
- Two cylinders—90 sec.
- One cylinder—180 sec.

Electromechanical:

- Normal Condition (Condition A)
- Redundant (2) motor arrangement
- One main drive motor—90 sec.
- Auxiliary drive motor—7.5 min.

5 BRIDGE REHABILITATION OPTIONS DEVELOPMENT

5.1 Introduction

A number of factors were considered in the Rehabilitation Study. These include proper serviceability to multi-modal transportation, impacts to the existing structure as a potential historic resource, impacts to natural resources in the area, feasibility of design, and constructability. While cost estimates and service life analyses are not being developed at this phase, they were qualitatively considered when assessing the approach to rehabilitation.

This section will review five “scenarios”, which address potential typical sections for the roadway. Selected scenarios are then incorporated into the assessment of three “options”, which consider the roadway typical sections in conjunction with potential roadway alignments.

The three “options” for rehabilitation are assessed in Section 7, and the recommended option is described in detail in Section 8. The recommended option is the “Rehabilitation Alternative” which will be further reviewed in the Type, Size & Location Study.

5.2 Alignment Considerations

Three methods of realigning the bridge to account for a widened roadway section were considered. They are listed below, and ranked in order from least impactful to most impactful on modification to the existing structure:

1) Shifting alignment to the east to avoid impacts to the bascule pier, holding the westerly edge of the existing roadway and avoiding major impacts to the bascule pier.
2) If the superstructure cannot reasonably support the shifted alignment, consider widening of the bridge piers to the east.
3) Center the roadway on the existing alignment and consider major modifications to the bascule pier.

5.3 Minimum Width Typical Section

5.3.1 Screening Criteria

In order to facilitate a review of the developed scenarios for the minimum width typical section, several screening criteria were identified which included the following:

- The potential bridge width available based on the bridge rehabilitation options
- Roadway width consistency both on and off the bridge (consistent typical width)
  - Consistency with the corridor, urban arterial typical travel lane widths, and the Department’s guidelines.
- Bicycle comfort level (wider shoulder provides increased safety and comfort)
- Pedestrian accessibility (wider sidewalk width to accommodate side by side mobility devices and pedestrians)
  - Review of video surveillance footage of the sidewalk identified a wide mix of users including through on-road bicyclists, pedestrians, recreational fishermen and sightseers.
  - The proposed widths shown strive to balance widths to promote multi-use opportunities and accessible widths to accommodate the passing of two mobility devices.
  - Presently the only sidewalk off the bridge is provided on the east side of NH Route 1A and facilitates access to and from Hampton Beach State Park and the residences to the south.
- Bridge constructability (required modifications to the structure in order to accommodate the proposed cross-section)
  - Roadway impacts were deduced based on the potential alignment shift and maintaining the existing vertical alignment.
- Speed management (narrower travel lane and shoulder width generally decrease driver travel speed)
- Construction cost (wider facility width will require increased superstructure and overall project costs)

- An opinion of construction cost is beyond the scope of study at this stage; however, engineering judgment was used to deduce potential costs.
- A preliminary estimate will be conducted as the project advances through the Bridge Type, Span, and Location (TS&L) Phase.

5.3.2 Typical Section Scenario Development

Through the evaluation of the available roadway width in relation to multi-modal facility needs and applicable requirements and guidelines, typical section scenarios were developed for consideration under the Rehabilitation Alternative. Initially, more scenarios were developed but were removed from further study based on the inability to meet one or more of the criteria noted above. The primary difference between the scenarios is found through varying the provided shoulder and sidewalk/multi-use path width, as seen in Figure 4.

Figure 4. Minimum Width Typical Roadway Section Scenarios Considered

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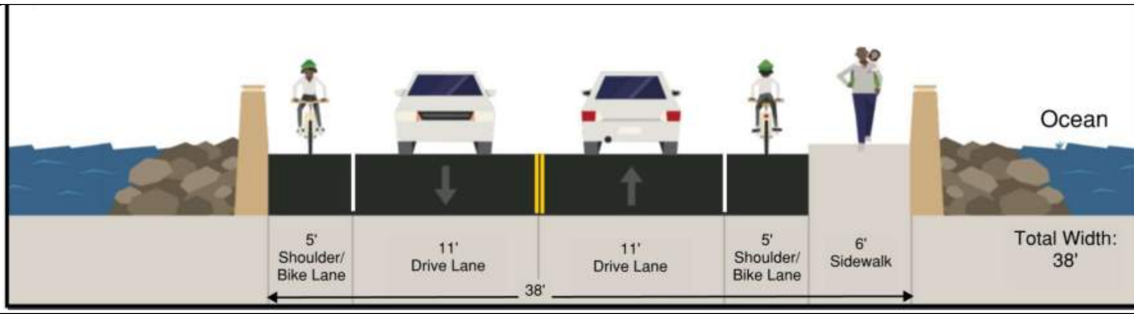

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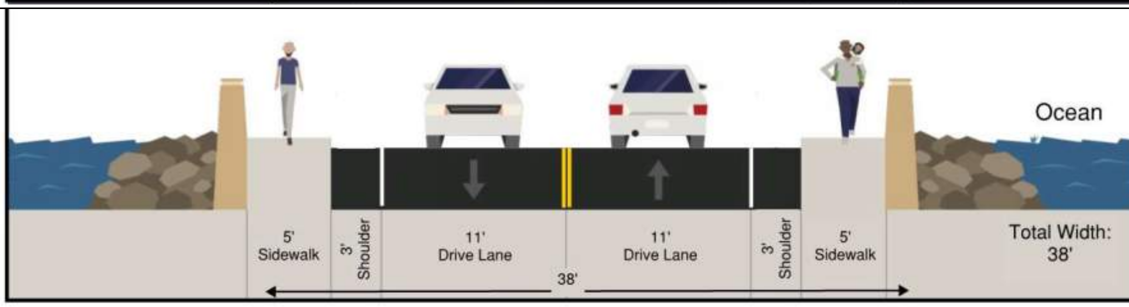

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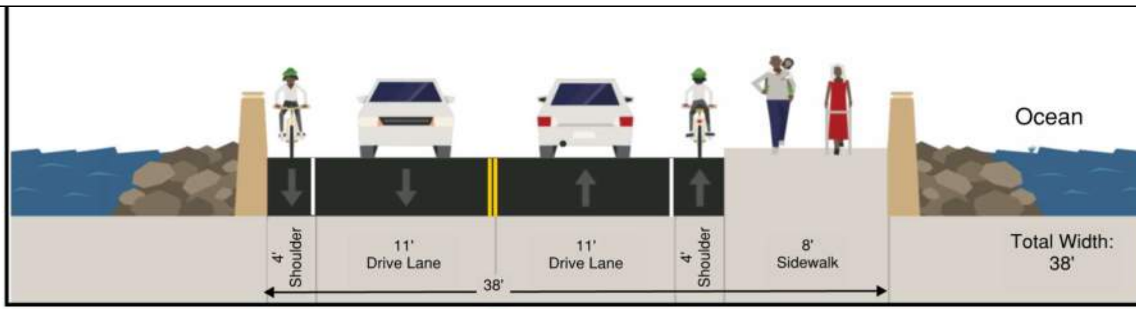

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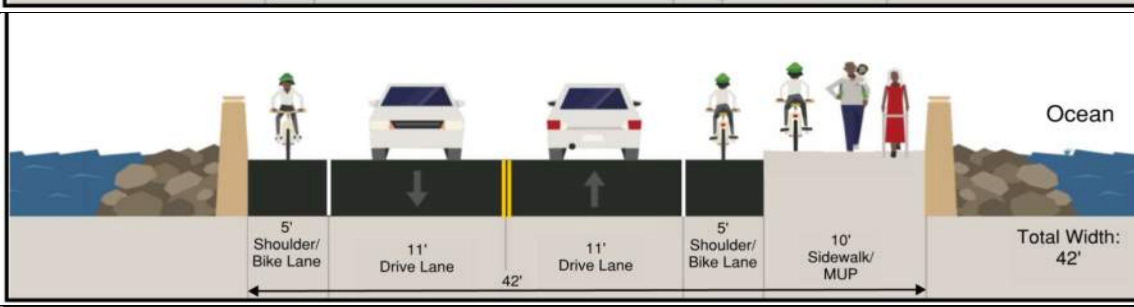

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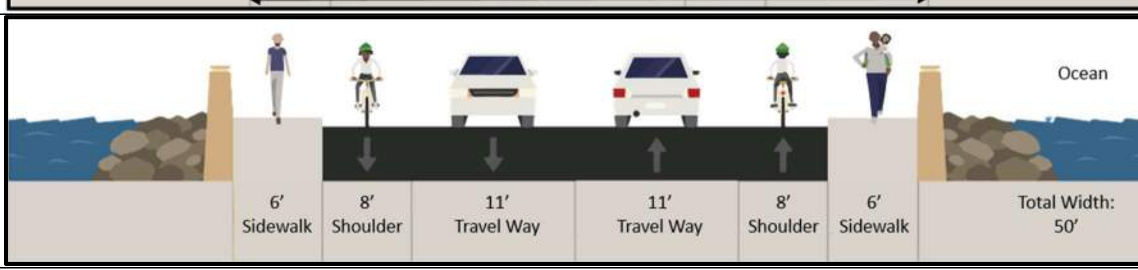


5.3.3 Typical Section Scenario Analysis

Scenarios 2 and 3 meet or exceed the AASHTO minimum shoulder width of 3' per Table 5-6 of the AASHTO's *A Policy on Geometric Design of Highways and Streets*, but do not provide the NHDOT minimum shoulder width of 5' when adjacent to curbs.

Scenarios 1, 3, and 4 provide improved sidewalk conditions over existing, but requires pedestrians to cross the road in order to utilize the sidewalk. Scenario 2 provides access for pedestrians on both sides of the roadway, but is the least desirable scenario for bicyclists due to the 3' wide shoulders. Scenario 1 provides a more balanced approach with generally acceptable widths being provided for both the bicycle shoulder and sidewalk facility.

Scenarios 1, 2 and 3 provide a roadway width of 38'. Based on assessment of the superstructure, this width provides the approximate maximum allowable bridge width on the existing piers. Beyond this width, the cantilevered overhang on the east side causes uplift at the western bearing supports. Additional assessment of the piers and geotechnical information in subsequent design phases will be required to confirm whether piers would require widening or reinforcement to support a 38' superstructure.

Scenario 5 incorporates 8' shoulders, which were recommended by the project's Public Advisory Committee to improve access for emergency vehicles as well as increased comfort for bicyclists. This scenario also increases sidewalk width beyond the minimum to 6' to match best practices for accessibility.

Scenario 5 is the recommended typical section because it meets or exceeds AASHTO and NHDOT standards, the needs of the community, and best practices for accessibility. However, this scenario significantly impacts the structure, as described in Section 7. Therefore, scenario 1 will also be considered when reviewing options for the rehabilitation, assessing the bridge for reduced structural impacts.

5.4 Preliminary Load Rating Summary

Three load ratings were performed. First to investigate the existing structure to determine a baseline for rehabilitation. Second to investigate deck replacement, and third to investigate a full superstructure replacement.

The bridge was rated for HL-93 live load according to the AASHTO Manual for Bridge Evaluation (MBE). The analysis concluded the approach spans in their current configuration rate at 0.60 at the inventory level and 0.77 at the operating level. The rating was controlled by negative moment in the west girder. Note that the movable span was not rated in the existing condition.

An assessment of the proposed typical section (Scenario 5) was conducted to determine its feasibility with deck and superstructure replacement investigations. Under the shifted alignment option (Alignment #1), the proposed typical section would result in an east overhang of over 21' on the existing superstructure. Under the centered alignment option (Alignment #3), both overhangs would be over 12'. Based on this assessment, incorporating the proposed typical section would require replacement of the entire superstructure and significant widening of all substructure units.

In order to provide a rehabilitation option that minimizes impacts to the existing structure, the minimum acceptable roadway width from Section 5.3.2 was used. The minimum acceptable roadway width was Scenario 1, and consisted of:

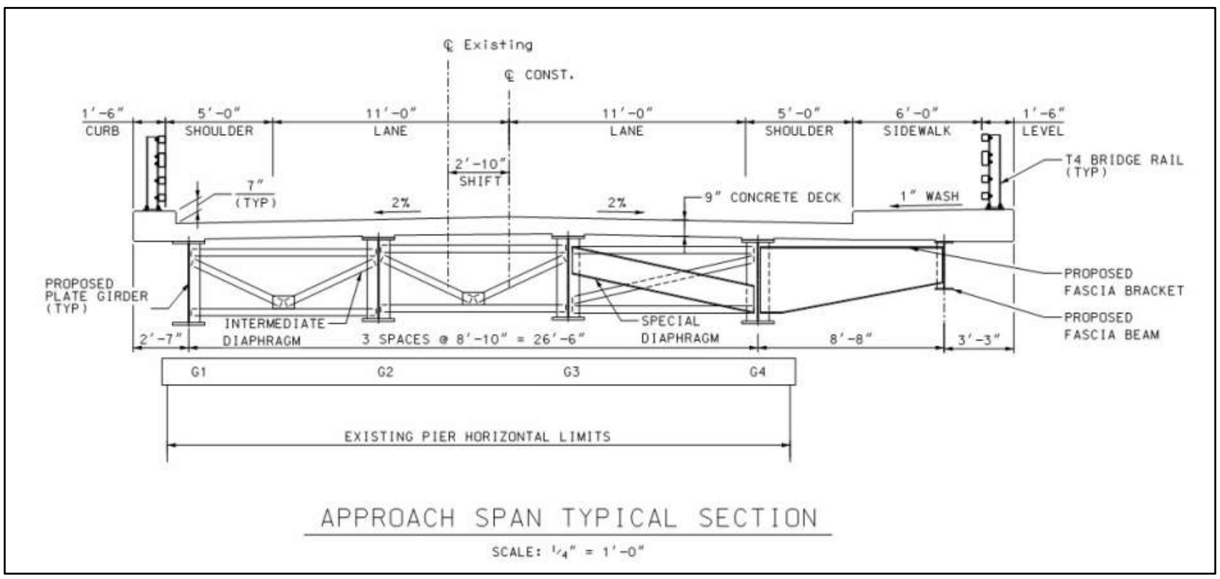
- (2) 11'-0" lanes
- (2) 5'-0" shoulders
- (1) 6'-0" sidewalks
- These minimums result in a 38'-0" clear width, 41'-0" out-to-out.

As previously discussed, this minimum acceptable section does not meet the purpose and need of the project, but is considered to assess the feasibility of a rehabilitation alternative that minimizes impacts to the existing structure.

A load rating of the existing approach span superstructure assuming a deck replacement, the minimum acceptable roadway width, and the shifted alignment showed that the existing girders would not be adequate to support this minimally widened roadway. Both the inventory and operating level ratings are controlled by negative moment in the east girder and would be less than 0.20. The movable span analysis showed that the existing structural elements could not support the dead load of the widened deck, resulting in a negative rating. Based on these results, the superstructure would require replacement in order to accommodate the minimum width roadway section on a shifted alignment.

A preliminary girder layout and overhang support bracket system was establish to confirm the feasibility of a minimum width superstructure replacement on a shifted alignment. The approach span east exterior girder controlled the rating with a 1.17 inventory rating and 2.04 operating rating. The superstructure was also checked for overturning stability. See Figure 5.

Figure 5. Superstructure replacement option with a minimum roadway width on a shifted alignment



With the feasibility of a rehabilitation section on a shifted alignment verified, the rehabilitation study could investigate superstructure replacement options centered on the alignment options in Section 5.5. The results of the preliminary load rating are presented in Table 2.

The recommended typical section of 50' would supported by a typical multi-girder framing system as shown in Figure 6. This superstructure would be designed to provide rating factors greater than 1.

Table 2. Summary of Preliminary Load Ratings for 38' Roadway Section – HL93 Rating Factors

Option	Approach Spans		Movable Span	
	Inventory Rating	Operating Rating	Inventory Rating	Operating Rating
Existing Superstructure	0.60	0.77	N/A	N/A
38' Width Deck Replacement/Widening	0.15	0.19	< 0.00	<0.00
38' Width Superstructure Replacement	1.17	2.04	>1.00	>1.00

5.5 Rehabilitation Options Considered

In order to meet the project goals and satisfy transportation user needs, HDR identified the following options for a rehabilitated bridge. All of the presented options result in significant modification of the existing structure.

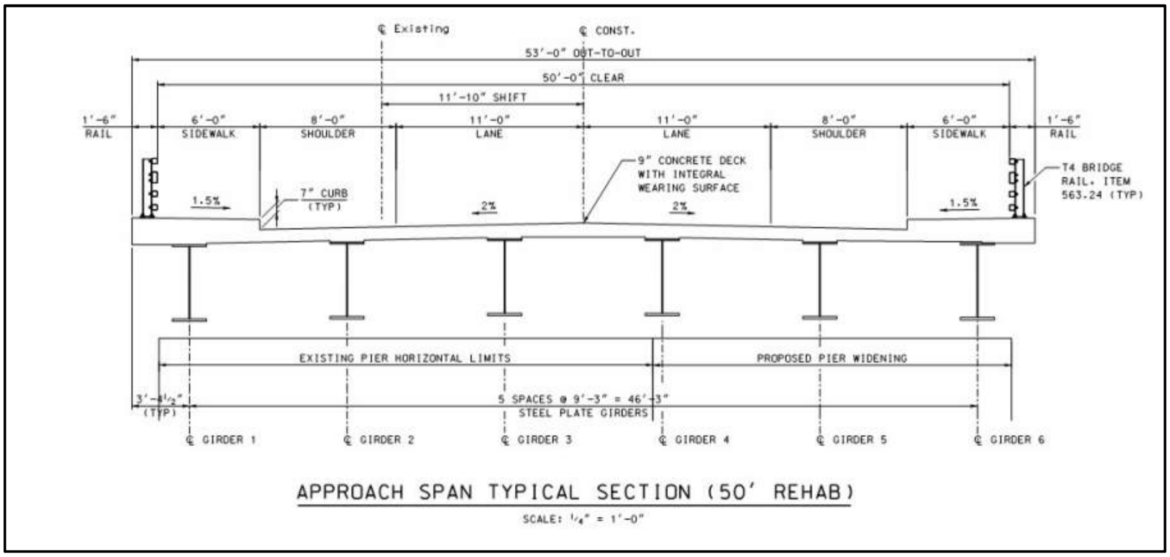
5.5.1 Option 1 - Superstructure Replacement (38' Clear Width), Shifted Alignment

This option was investigated in the rating analysis of Section 5.4, based on a roadway width of 38'. In order to accommodate this typical section, the Bridge Rehabilitation Alternative must replace the entire existing superstructure. This roadway width provides significant improvements to the existing roadway width, but cannot accommodate the desired sidewalks on both sides and does not meet the purpose and need of the project. The bascule span substructure units would require widening under this option and the piers not founded on piles would remain scour critical, and would need to be analyzed to determine if they can carry the additional loads. Conceptual plans for this option were developed and are included in Appendix B.

5.5.2 Option 2 - Superstructure Replacement (50' Clear Width), Shifted Alignment, Pier Widening

This option provides the recommended 50' roadway width and typical section in the design criteria (53' out-to-out), but results in major in-water work due to the widening of all piers and abutments. The piers not founded on piles would remain scour critical, and would need to be analyzed to determine if they can carry the additional loads. An alignment shift of 11'-10" to the east would be required. Conceptual plans for this option were developed and are included in Appendix A.

Figure 6. Superstructure replacement (50' clear width) with shifted alignment and pier widening



5.5.3 Option 3 - Superstructure Replacement (50' Clear Width), Centered Roadway, Pier Widening

This option provides the recommended 50' roadway width and typical section in the design criteria (53' out-to-out), but results in major in-water work due to the widening of all piers and abutments, as well as the reconstruction of the control house. Since pier widening on both faces may be required, it is feasible that those piers not founded on piles may be improved to a non-scour critical state, but all substructure units would need to be analyzed to determine if they can carry the additional loads. Conceptual plans for this option were not developed for this report.

5.6 Rehabilitation Options Summary

Three rehabilitation options were investigated on conceptual alignments. All three options recommend replacement of the superstructure. The options will be assessed along with traffic control options in Section 7.

6 TRAFFIC CONTROL PLAN CONSIDERATIONS

6.1 Traffic Control Alternatives

The following traffic control alternatives were considered for the bridge replacement alternatives:

- Bridge closure with detour
- Staged bridge construction with one lane alternating signalized traffic.
- Two lane temporary bridge upstream of the proposed bridge alternative.

6.1.1 Bridge Closure with Detour

The best detour option available has a trip length of approximately 12.0 miles. For vehicles on Seabrook traveling to Hampton, the detour option is to travel westbound on NH Route 286, north on Lafayette Road (US Route 1), east on NH Route 101 and then south on Ocean Boulevard and Ashworth Avenue (NH Route 1A). Vehicles traveling from Hampton to Seabrook would take the same route in a reverse direction. Trip distance one-way is approximately 25 minutes. NH Route 286 is a two-way major collector road. 2016 average annual daily traffic (AADT) on this road was 16,011. Lafayette Road (US Route 1) is a two-way minor arterial road. 2016 AADT on this road was 20,400. NH Route 101 is a two-way principal arterial road. 2016 AADT on this road was 8,930.

A bridge closure will cause significant inconvenience to the daily commuters who are currently using Hampton Harbor Bridge. Businesses on either side of the Bridge will also be impacted as patrons most likely will seek alternative resources.

For marine traffic, the superstructure of the bascule span would remain operational until the bascule superstructure was removed. Brief outages of the navigational channel would be required during removal of the existing and installation of the new bascule spans.

The bridge closure with traffic detour option is not feasible due to the trip length and travel distance associated with the detour, as well as the potential impacts to local commuters and local businesses.

6.1.2 Staged Construction with one lane alternating signalized traffic.

In this alternative, the new bridge would be constructed on an alignment approximately 5'-0" east or west of the existing alignment. Alternating one-way traffic would be maintained by temporary traffic signals on both approaches.

The existing bridge is fracture critical, supported by only two girder lines. Therefore staged construction can only be utilized by installing an additional girder line under the existing deck.

Potential roadway traffic delays associated with one-lane alternating traffic is anticipated to range from 2 to 7 minutes due only to the alternating traffic and not accounting for any delays due to lifts. Actual delays would be significantly longer, depending on the cycle time of a temporary lift system to accommodate marine traffic.

Bridge operations for marine traffic would have to be maintained throughout a staged construction approach and would require temporary operational systems to account for the varying span weights during construction.

Staged construction is not feasible due to the fracture critical nature of the existing bridge, the anticipated traffic delays associated with one-way alternating signalized traffic, and the complexities of staging construction of a movable bridge while maintaining continuous operation.

6.1.3 Two-Lane Temporary Bridge

In this alternative, two-way traffic would be maintained on a temporary bridge with an alignment approximately 33 feet west of the existing alignment, based on the assumption of a 12'-0" travel way. Additional survey north and south of the site would be required in order to design the temporary alignment.

A temporary bridge must allow for continued use by marine and pedestrian traffic during construction. Further coordination with the USCG will be required to determine whether a temporary bridge can be a fixed structure, but any fixed temporary bridge would likely be required to provide a vertical under-clearance that is significantly greater than the 18' provided by the existing bascule span in its lowered position.

6.2 Traffic Control Summary

Three options for traffic control were considered. Based on our analysis, a two-lane temporary bridge built west of the existing bridge is the most feasible traffic control option in terms of travel distance and travel time and potential impacts to local businesses.

7 ASSESSMENT OF REHABILITATION OPTIONS

7.1 Discussion

In total, three rehabilitation options are considered in this section.

1. Superstructure Replacement (38' Roadway Clear Width), Shifted Alignment
2. Superstructure Replacement (50' Roadway Clear Width), Shifted Alignment, Pier Widening
3. Superstructure Replacement (50' Roadway Clear Width), Centered Roadway, Pier Widening

Roadway width and bicycle and pedestrian accommodations. Options 2 and 3 provide the total width of the typical section recommended in the design criteria. Option 1 provides shoulder widths to meet minimum standards for a rehabilitation project.

Traffic control considerations. All options would require construction of a temporary bridge to convey traffic during construction. The detour length and impacts to local businesses rule out a bridge closure. Traffic delays from a temporary signal rule out staged construction. Furthermore, the existing bridge is fracture critical, and Options 1 and 3 cannot be staged without construction of a temporary girder line.

Superstructure Modifications. All options provide a complete superstructure replacement.

Substructure modifications. Option 2 would require pier and abutment widening to the east. Option 3 would require pier and abutment widening on both the east and west, as well as reconstruction of the control house. Option 1 will require widening of abutments and Piers 2N and 2S. It may require widening of all piers, pending additional analysis and geotechnical information. All options will require scour mitigation measures, as the structure is scour critical.

Mechanical and Electrical System Improvements.

All options are superstructure replacements and will require replacement of the mechanical and electrical systems.

7.2 Summary

Based on the purpose and need of the project, the superstructure replacement with a 50' clear width on a shifted alignment (Option 2) is recommended. Option 2 provides roadway, bicycle, and pedestrian lanes that meet or exceed current standards, meets the purpose and need of the project, and avoids major impacts to the existing control house by building to the east, although still requires impacts to the substructure. Conceptual plans for this option are found in Appendix A.

The superstructure replacement with a 38' clear width on a shifted alignment (Option 1) meets acceptable roadway standards for a rehabilitation project with general minimum widths being provided for both the bicycle shoulder and sidewalk facility, minimizes impacts to the substructure, and retains the existing control house, but does not meet the purpose and need of the Project. Although Option 2 will be carried forward during the TS&L Phase, conceptual design of Option 1 was also developed, and included in Appendix B.

8 DESCRIPTION OF BRIDGE REHABILITATION

8.1 Proposed Roadway Typical Cross Section

As outlined in Sections 4.2 and 5.3, the recommended roadway typical section for the project provides a 50' clear roadway (53' out-to-out) consisting of two 11' travel lanes, two 8' shoulders, and two 6' sidewalks.

This section will assess Option 2, the option for rehabilitation which provides the recommended typical cross section. Conceptual design of Option 1, with a 38' clear roadway (41' out-to-out), can be found in Appendix B and Figure 5.

8.2 Proposed Roadway Alignment

As outlined in Section 5, the typical section meets the purpose and need of the project, but requires substantial widening of the existing roadway and bridge, to 50'-0. The resultant typical section and superstructure improvements will shift the bridge centerline and profile grade line 11'-10" easterly, while maintaining the alignment bearing to utilize the existing substructures as much as possible.

To accommodate the shift within the southern approach, a 2.5 degree reverse curve is proposed immediately south of the bridge. At the north approach, a reverse curve (2.25 degree left, 4.5 degree right, was required in order to meet the horizontal curve through the Hampton State Park driveway.

The vertical geometry for the immediate roadway approaches and bridge matches the historic vertical geometry to minimize impacts to the abutments and piers. The conceptual superstructure section depth is less than the existing allowing crown line to match the existing.

The conceptual horizontal alignment, roadway layout, profile, and potential impacts are illustrated in Appendix A.

8.3 Proposed Superstructure Modifications

As previously discussed, the superstructure will be completely replaced under the Rehabilitation Alternative. This would include bearings, with the locations of fixed bearings changing as described in Section 8.3.1 below. Appendix A provides conceptual design plans of the Rehabilitation Alternative.

8.3.1 Approach Spans

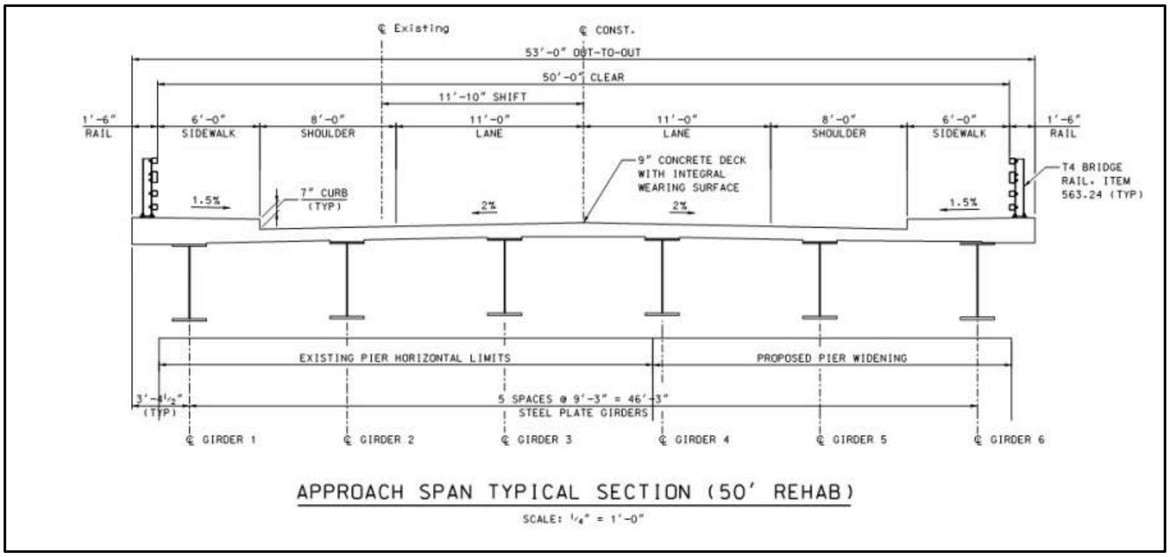
In order to support the new roadway width, the entire superstructure will need to be replaced. The replacement approach spans, shown in Figure 7, will consist of (6) steel plate girders with composite concrete deck. The copings consist of 6'-0" wide sidewalks and T4 guardrail.

The framing plan will provide six continuous spans for each approach, with an overall length of 563'-6" on the south approach and 562'-6" on the north approach. The fixed bearing is proposed to be located at each bridge abutment under this conceptual study. This will be further assessed during future design development.

The approach span girder depths will be reduced from the existing girders to allow for the use of block-outs in the bascule span's counterweight and avoid conflicts with approach span girders. Pedestals will be constructed at bearing locations to make up the difference between existing and proposed girder heights.

New barrier and warning gates and their associated foundations will be provided.

Figure 7. Proposed Approach Span Typical Section



8.3.2 Movable Span

The replacement bascule span will retain the same span length as existing, and will provide the proposed widened roadway. The bascule span will be further developed under the TS&L phase, and is anticipated to provide a longitudinal multi-girder system supporting floorbeams and stringers. Similar to the approach span, the superstructure will be substantially wider than the existing bridge.

The deck of the bascule span will be a half-filled grid deck, to provide a solid riding surface across the navigational channel. The widened deck will require armored longitudinal and transverse joints at the bascule span, to accommodate lifting of the bridge.

An inspection/maintenance walkway located below the roadway will be included on the bascule span.

The back-span, which supports the counterweight, will require steel framing between girders in order to support the heavier counterweight. The counterweight will provide box-outs at approach girder locations to accommodate the new approach span system.

<u>8.4 Proposed Substructure Modifications</u>

Substructure modifications will substantial. In order to accommodate the widened roadway, superstructure and counterweight on the movable spans, all piers will require widening to the east. Piers 2-S and 2-N may require widening beyond the limits of the 53'-0" superstructure to account for the barrier gates supports.

The abutments will now support the fixed bearings for the approach spans, and will require reinforcement or replacement. Regardless of reinforcement or replacement, the abutments will require widening to the east to support the widened roadway approach. The eastern wingwalls would also require removal and replacement. It is anticipated that additional piles will need to be driven to accommodate the additional pier and abutment width.

The concrete pedestals atop all piers and abutments will be modified to accommodate new bridge seat elevations. All piers will require new bearing assembly pads to support the new girder system that will be implemented on the bascule and approach spans. New bearing pads will be required on the rest pier to account for the changed spacing of the bascule girders.

The deteriorated conditions of Pier 4N found during the August 2018 field would require the following actions under Rehabilitation:

- The concrete cap of Pier 4N is spalled and corroded. Repairs to spalls, and epoxy injection of cracks will be required.
- Pier 4N is tilted out of plumb and will be monitored during construction.

Scour mitigation will be required at Pier 4S, which was noted to have pocket scour in the 2015 underwater inspection report. Options for mitigation of the scour critical piers will be investigated. Since the bridge is scour critical, mitigation at additional piers will likely be required.

The bascule pier will require modifications to support the widened superstructure, trunnion and trunnion bearings. The westerly wall of the counterweight pit will need to be widened to support new columns. The pier will be widened to the east, and new buttress walls will need to be installed on the easterly side of the pier to support new girder and the portion of the deck over the bascule pier. Additionally, new columns will be installed to support the additional approach span girders at the bascule pier.

Modifications to the operator house would be minimized, as this will likely be a defining feature of the structure in the upcoming historic review process. The existing operator house has 9” reinforced concrete walls with #5 and #6 reinforcing bars at 12” spacing, so modifications to enlarge the operator house through connecting cantilevered additions onto the existing house will likely not be feasible. Equipment within the operator house would be replaced, as discussed in the following section.

8.5 Description of Mechanical and Electrical System

With replacement of the superstructure, new mechanical and electrical systems will be required for the structure. Two mechanical systems are under consideration:

1) Hydraulic System Option:
    - Hydraulic cylinders will be positioned beneath each bascule girder.
    - The hydraulic system will be designed to be capable of operating the bascule span on one cylinder at half speed.
    - The hydraulic system will be designed to operate two cylinders on one pump at half speed.
    - A single reservoir with two pumps is proposed for the existing motor room. Should space be limited, the hydraulic power unit (HPU) can be mounted to an enclosed platform on the approach span.

2) Electromechanical System Option:
   - A primary reducer with three input shafts is proposed to accommodate two redundant vector duty motors and an auxiliary gear motor.
   - A spring released, electrically engaged clutch shall be specified to engage the auxiliary drive system. The auxiliary drive system shall not rotate when the main drive motors are operable.
   - Remaining gear reduction will be achieved through intermediate sets of open gearing, shafting, and antifriction pillowblock bearings.
   - All shaft couplings shall be gear type flex-rigid or full flex couplings as appropriate unless noted. Motor couplings shall be fully flexible tapered grid couplings with a dual load path.
   - New racks & pinions are proposed since the existing racks & pinions do not rate. The racks will be installed to the bottom flange of each bascule girder.
   - Motor Brakes - Motor brakes shall be provided for each span motor and mounted either off main motor shaft extensions or extended drive shafts.
   - Machinery Brakes. – Two machinery brakes shall be provided and located in the drive train as close as practical to the main pinions.

The following are a description of machinery elements that will be implemented regardless of whether a hydraulic or electromechanical system is implemented.

- The bascule span will pivot about new simply supported trunnions, each supported in trunnion bearings. The existing bascule trunnion shafts do not rate for the current structure for bending stress and with the application of higher loads with superstructure replacement will also not rate for bearing stress and fatigue.
- The trunnion bearings shall be bronze-bushed and set in cast steel pillow blocks with steel caps. The caps shall have eye loops for future inspection removal. Grease grooves shall be machine cut into the bushings (not the shaft journals) and provided with standard accessible grease fittings.
- The trunnions shall be interference-fitted into their sheave hubs and furnished with dowels. The hubs will be tolerance fitted into the new bascule girder webs.
- Span locks will be installed at the toe of the leaf, one adjacent to each bascule girder. Each lock bar shall be driven by a heavy duty standard manufactured lock bar operator complete with a hand crank, brake release, and safety interlock for emergency operation. The span lock operators shall be mounted to the bascule span. The lock bars shall be sized to prevent inadvertent lifting of the span under motor stall torque conditions.

Air buffers shall not be required on the bascule span if the control system provides for ramp down at seating with sufficient adjustment.

The following is a description of requirements for the electrical system under the proposed superstructure replacement:

> With replacement of the structural and mechanical systems, the electrical system would also require complete replacement. This will pose a number of challenges due to the limited space in the bridge's operator house. Replacement of all major components, including Programmable Logic Controllers (PLC), Motor Control Centers, motors and breakers will be required.

According to the findings during field visit, outlined in Appendix F, the existing electrical equipment does not have the required work space clearance per the National Electrical Code (NEC). To support the widened structure and new mechanical systems, the electrical system will have to be upsized which will result in the installation of electrical cabinets with larger foot prints. Given the space limitation, a bridge rehabilitation would not be able to conform to NEC requirements. Major modification to, or replacement of the bascule pier would be required to meet the NEC requirements, by providing larger equipment rooms for the installation of larger electrical equipment.

Mechanical and Electrical Systems Summary

Due to space limitations on the existing bascule pier, a hydraulic system option is the most probable option for a Rehabilitation. An electromechanical system will be further investigated during the Type, Size & Location Study to determine its viability. Additionally, a bridge rehabilitation would not be able to meet NEC requirement for electrical equipment clearances without replacement or major modifications to the bascule pier.

9 SUMMARY

The recommended approach to rehabilitation considered a wide array of factors in making design decisions. These factors include constructability, improving service for all modes of transportation, maintenance and life cycle costs and impacts to resources. The approach to bridge rehabilitation was assessed for its ability to service the travelling public, meet the project's purpose and need, and minimize impacts.

The recommended Rehabilitation Alternative, as informed by the project purpose and need, is a superstructure replacement with a 50' clear width bridge and will be further studied during the TS&L Study. This study will compare the Rehabilitation Alternative, to other alternatives and provide a recommendation for how the Department of Transportation should move forward with design, permitting and construction of the project.

The following summarizes the recommended approach to the Rehabilitation Alternative:

- Widening of the roadway to accommodate the recommended typical section:
  - Two 11' lanes
  - Two 8' shoulders
  - Two 6' sidewalks
- A shift in the roadway alignment 11'-10" to the east on the bridge structure.
- Replacement of existing bridge and approach guardrail with rails that meet modern crash standards – TL4 on the bridge, as well as terminal sections meeting current standards on the roadway approaches.
- Replacement of the bridge superstructure, in order to support the widened roadway
- Replacement of the deck to support the widened roadway, including a solid deck surface on the bascule span.
- Replacement of the bridge abutments. Widening is also a viable option.
- Widening of all bridge piers approximately 20' to the east to support the new superstructure
- Additional widening of Bridge Piers 2N and 2S to the west to account for the barrier gates.
- Modifications to pier pedestals to support new girder elevations.
- Modifications to the bascule pier to support the new location of trunnion bearings, as well as additional approach span girders.
- Replacement of the mechanical system with a hydraulic system.
- Replacement of the bridge's electrical systems, including operational components, CCTV, communications and warning systems.
- Repairs to the existing piers, including spall patching, crack repair, and scour mitigation.

Rehabilitation of this structure provides a number of benefits and challenges that will need to be considered when assessing the Rehabilitation Alternative as part of the Type, Size & Location Study to be developed in the next phase of this project. The following table summarizes these for consideration.

Table 3. Rehabilitation Alternative Benefits and Challenges

Consideration	**Benefits**	**Challenges**
Design Considerations	- Bridge with a new superstructure will adhere to current AASHTO and NHDOT requirements for design of the bridge and roadway.	- Achieving conformance with the National Electrical Code (NEC) may not be possible with the current geometry of the bascule pier. - Significant changes to the operator house would eliminate a potentially defining feature of the existing structure. Given that the Rehabilitation Alterative requires a superstructure replacement, replacement or major modifications of the operator house would remove all significant existing features of the bridge.
Maintenance and Life Cycle Costs	- New superstructure will reduce life cycle costs when compared to existing riveted built-up steel structure. - Rehabilitated bridge will have a design life of 75 years, with the exception of the mechanical system (~25 years).	- Design life of the mechanical system will be substantially less (~25 years) than new structure (~75 years) due to the use of a hydraulic system in the limited space on the existing bascule pier. - Limited space on the bascule pier will create challenges in future repairs - Retaining a bascule structure requires substantial annual operational costs, as well as significantly greater maintenance costs when compared to a fixed structure.
Constructability	- Providing new superstructure will eliminate risk associated with rehabilitating riveted, built-up structures.	- The current structure capacity does not allow retaining the existing superstructure, and therefore a superstructure replacement is required under rehabilitation, increasing capital costs and lead times for ordering materials. - Due to the fracture critical nature of the bridge, a temporary bridge may be required. This will increase costs and impacts substantially. - In-water work will be required to widen the piers.
Serviceability to Travelling Public – Land	- The widened shoulders meet current standards and provide significant improvements to bicyclist comfort. - The widened sidewalks meet current best practices for accessibility.	- A fixed structure would provide improvement over a bascule, since there would be no interruption of service due to bridge lifts.
Serviceability to Travelling Public - Water	- Rehabilitation reduces risk of bridge lift outages when compared to the existing bridge. - Cycle times of lifts will be reduced.	- No substantial increase in the dimensions of the navigational channel can be achieved.
Impact to Cultural Resources	- While the proposed Rehabilitation Alternative will likely be considered an Adverse Effect in the Section 106 review process, this alternative will reduce impacts to the bridge when compared to replacement.	- Replacement of the superstructure will likely result in an adverse effect to the bridge. - The temporary bridge will result in disturbances on the approaches, increasing potential for disturbing archeological resources.
Impact to Natural Resources	- A bridge rehabilitation will reduce the permanent impacts on the riverbed when compared to a replacement structure.	- While the rehabilitation will have reduced permanent impacts compared to bridge replacement, it may require a temporary bridge to support traffic

		during construction, creating substantial temporary impacts in the waterway and potentially to listed species in the waterway. - Work platforms may also be required in addition to the temporary bridge, furthering temporary impacts to the riverbed and potentially to listed species in the waterway. - The temporary bridge will result in disturbances on the approaches, increasing potential for disturbing tidal and wetland areas.

The Rehabilitation Alternative is one alternative which will be considered in the Type, Size & Location Study.

Upon completion of that study, one of these alternatives will be selected as the Preferred Alternative for the bridge project, and the design team will move forward with design and permitting.

APPENDIX A:
Conceptual Plans (50’ Clear Width)

GENERAL PLAN

SCALE: 1" = 40'-0"

ELEVATION

SCALE: 1" = 40'-0"

50' CLEAR
SUPERSTRUCTURE REPLACEMENT

CONCEPTUAL PLANS
7/26/2019

HDR

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN SEABROOK-HAMPTON BRIDGE NO. 235/025 STATE PROJECT 15904

LOCATION NH 1A OVER HAMPTON RIVER

GENERAL PLAN AND ELEVATION - REHAB. ALT.

BRIDGE SHEET 1 OF 2

REVISIONS AFTER PROPOSAL

	BY	DATE		BY	DATE
DESIGNED	NDC	8/18	CHECKED	JFM	9/18
DRAWN	NDC	8/18	CHECKED	JFM	9/18
QUANTITIES	---	--/--	CHECKED	---	--/--

FILE NUMBER -

ISSUE DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	--	1	4

PLOT DATE	.DGN LOCATOR	SHEET SCALE
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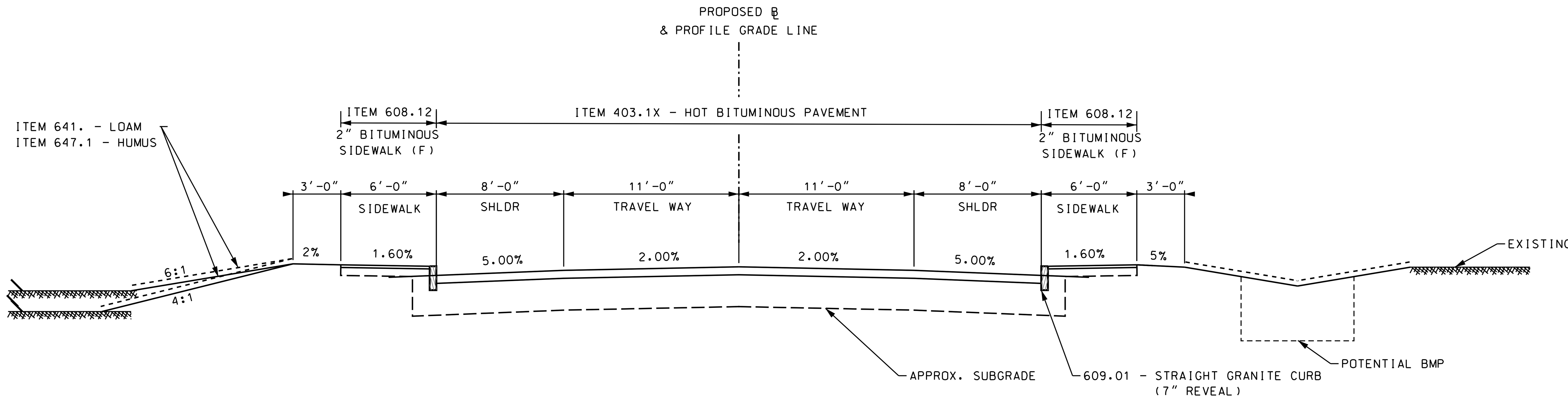
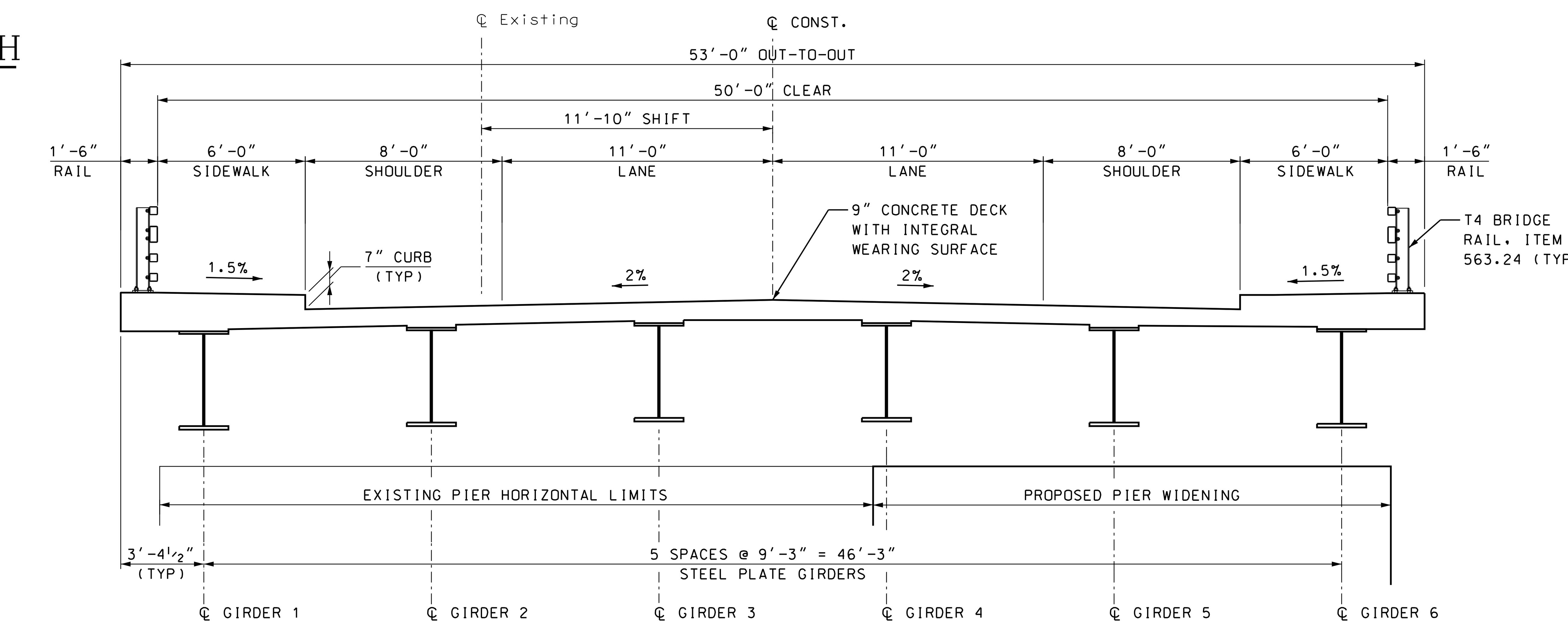


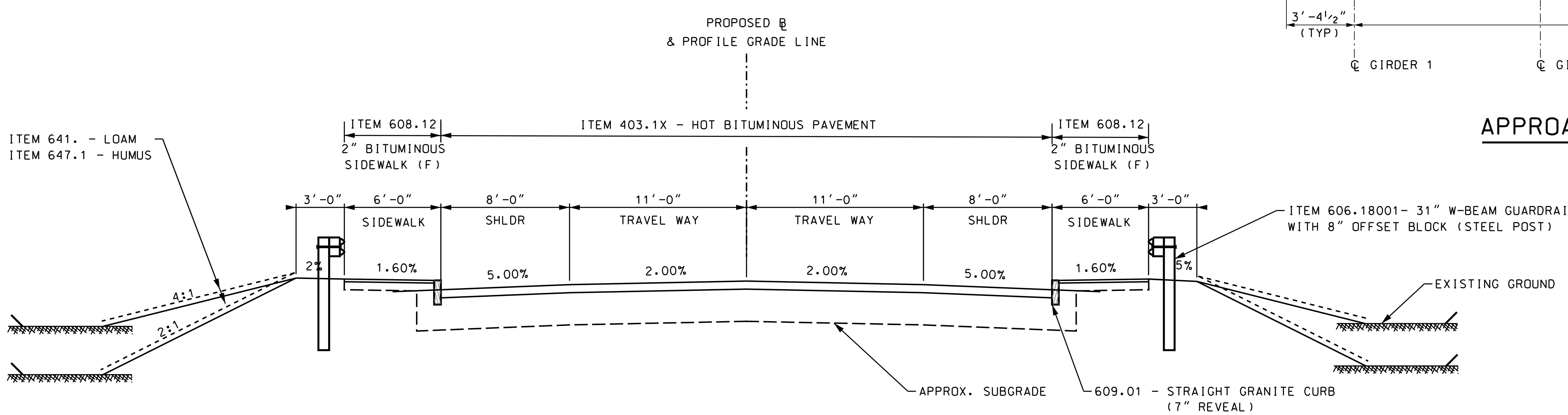
NH ROUTE 1A TYPICAL SECTION NORTH APPROACH

NOT TO SCALE



APPROACH SPAN TYPICAL SECTION (50' REHAB)

SCALE: ¼" = 1'-0"



NH ROUTE 1A TYPICAL SECTION SOUTH APPROACH

NOT TO SCALE

50' CLEAR
SUPERSTRUCTURE REPLACEMENT

CONCEPTUAL PLANS
7/26/2019

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STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN SEABROOK-HAMPTON | BRIDGE NO. 235/025 | STATE PROJECT 15904

LOCATION NH 1A OVER HAMPTON RIVER

TYPICAL SECTIONS - REHAB. ALTERNATIVE (50')

REVISIONS AFTER PROPOSAL		BY	DATE		BY	DATE
	DESIGNED	NDC	08/18	CHECKED	JFM	09/18
	DRAWN	NDC	08/18	CHECKED	JFM	09/18
	QUANTITIES	---	--/--	CHECKED	---	--/--

BRIDGE SHEET	FILE NUMBER
2 OF 2	-

ISSUE DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	--	2	4

PLOT DATE	.DGN LOCATOR	SHEET SCALE
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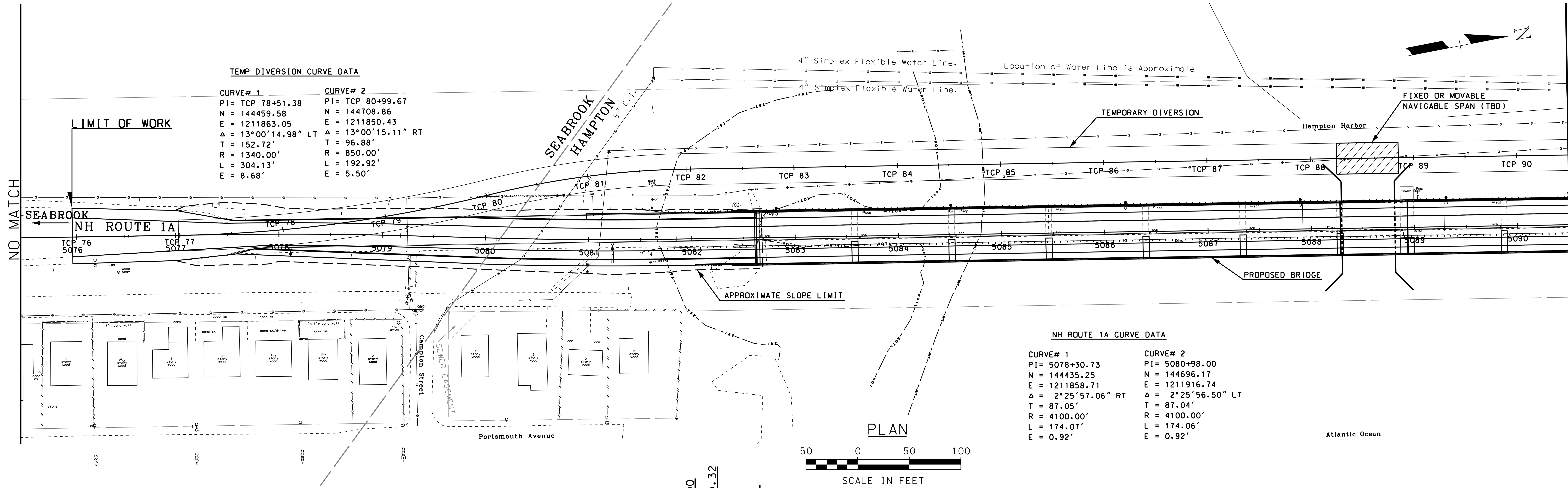


PROFILE

50' CLEAR
SUPERSTRUCTURE REPLACEMENT

SCALE:
1" = 50' HORIZ.
1" = 10' VERT.

CONCEPTUAL PLANS
7/26/2019

PLOT DATE	.DGN LOCATOR	SHEET SCALE
7/30/2019	15904_genplans_50FTCLR	AS NOTED

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN SEABROOK-HAMPTON BRIDGE NO. 235/025 STATE PROJECT 15904
LOCATION NH 1A OVER HAMPTON RIVER

BRIDGE REHABILITATION ALTERNATIVE - ROADWAY

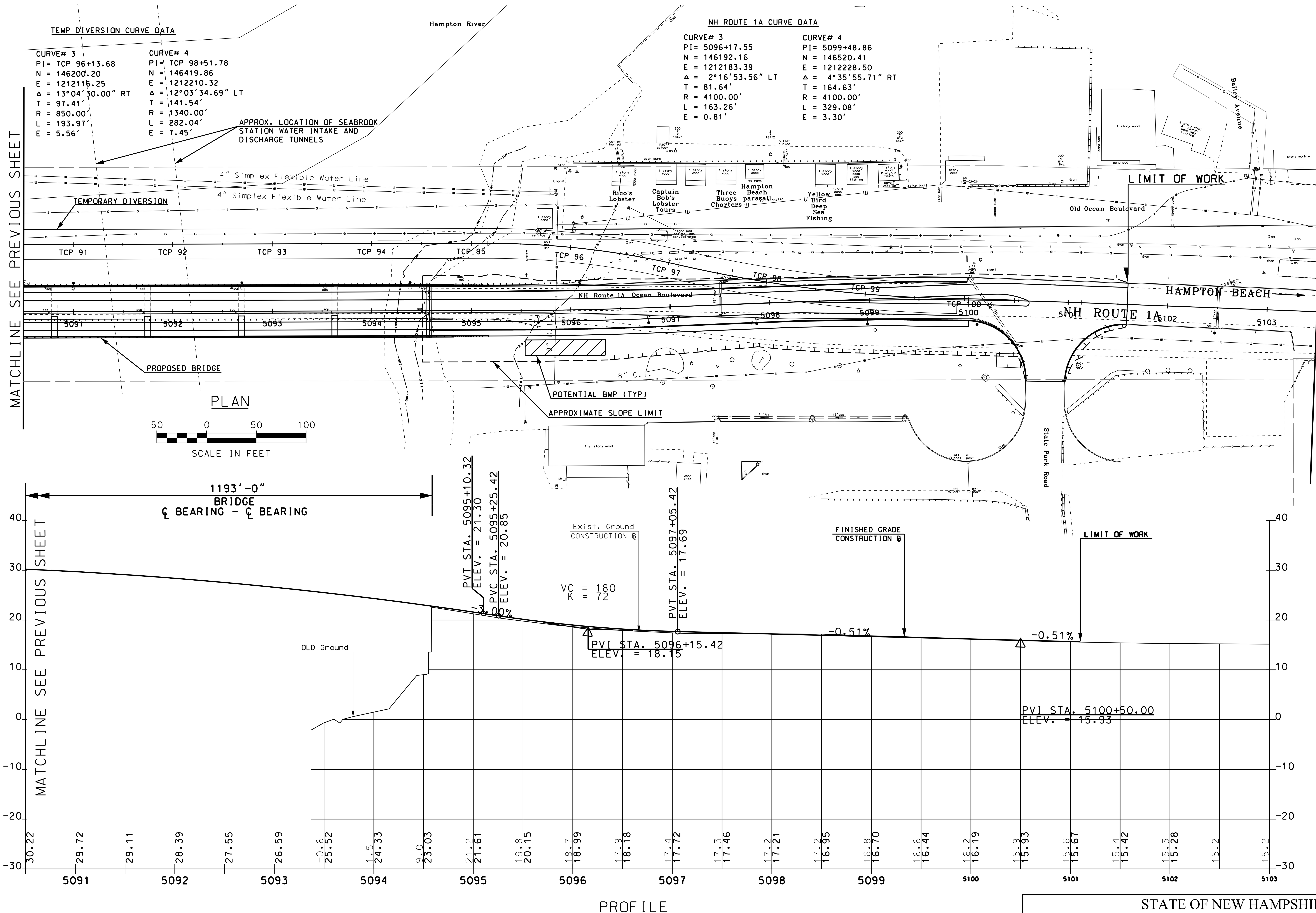
BRIDGE SHEET - OF -

REVISIONS AFTER PROPOSAL

	BY	DATE		BY	DATE
DESIGNED	JA	09/18	CHECKED	JA	09/18
DRAWN	KH	09/18	CHECKED	JM	09/18
QUANTITIES			CHECKED		

FILE NUMBER -

ISSUE DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	--	3	4



50' CLEAR
SUPERSTRUCTURE REPLACEMENT

CONCEPTUAL PLANS
7/26/2019

HDR

PLOT DATE	.DGN LOCATOR	SHEET SCALE
7/30/2019	15904_genplans_50FTCLR	AS NOTED

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN SEABROOK-HAMPTON BRIDGE NO. 235/025 STATE PROJECT 15904
LOCATION NH 1A OVER HAMPTON RIVER

BRIDGE REHABILITATION ALTERNATIVE - ROADWAY

REVISIONS AFTER PROPOSAL

	BY	DATE		BY	DATE
DESIGNED	JA	09/18	CHECKED	JA	09/18
DRAWN	KH	09/18	CHECKED	JM	09/18
QUANTITIES			CHECKED		

ISSUE DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	--	4	4

BRIDGE SHEET - OF -
FILE NUMBER -

APPENDIX B:
Conceptual Plans (38’ Clear Width)

GENERAL PLAN

SCALE: 1" = 40'-0"

ELEVATION

SCALE: 1" = 40'-0"

38' CLEAR
SUPERSTRUCTURE REPLACEMENT

CONCEPTUAL PLANS
7/26/2019

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN SEABROOK-HAMPTON | BRIDGE NO. 235/025 | STATE PROJECT 15904

LOCATION NH 1A OVER HAMPTON RIVER

GENERAL PLAN AND ELEVATION - REHAB. ALT.

BRIDGE SHEET 1 OF 5

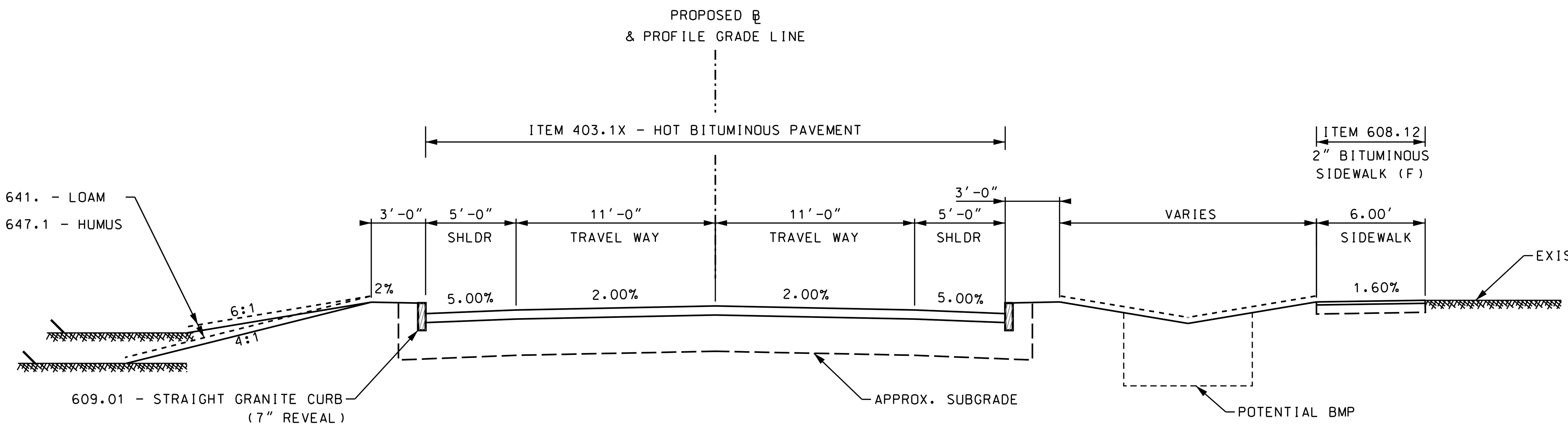
REVISIONS AFTER PROPOSAL

	BY	DATE		BY	DATE
DESIGNED	NDC	8/18	CHECKED	JFM	9/18
DRAWN	NDC	8/18	CHECKED	JFM	9/18
QUANTITIES	---	--/--	CHECKED	---	--/--

FILE NUMBER -

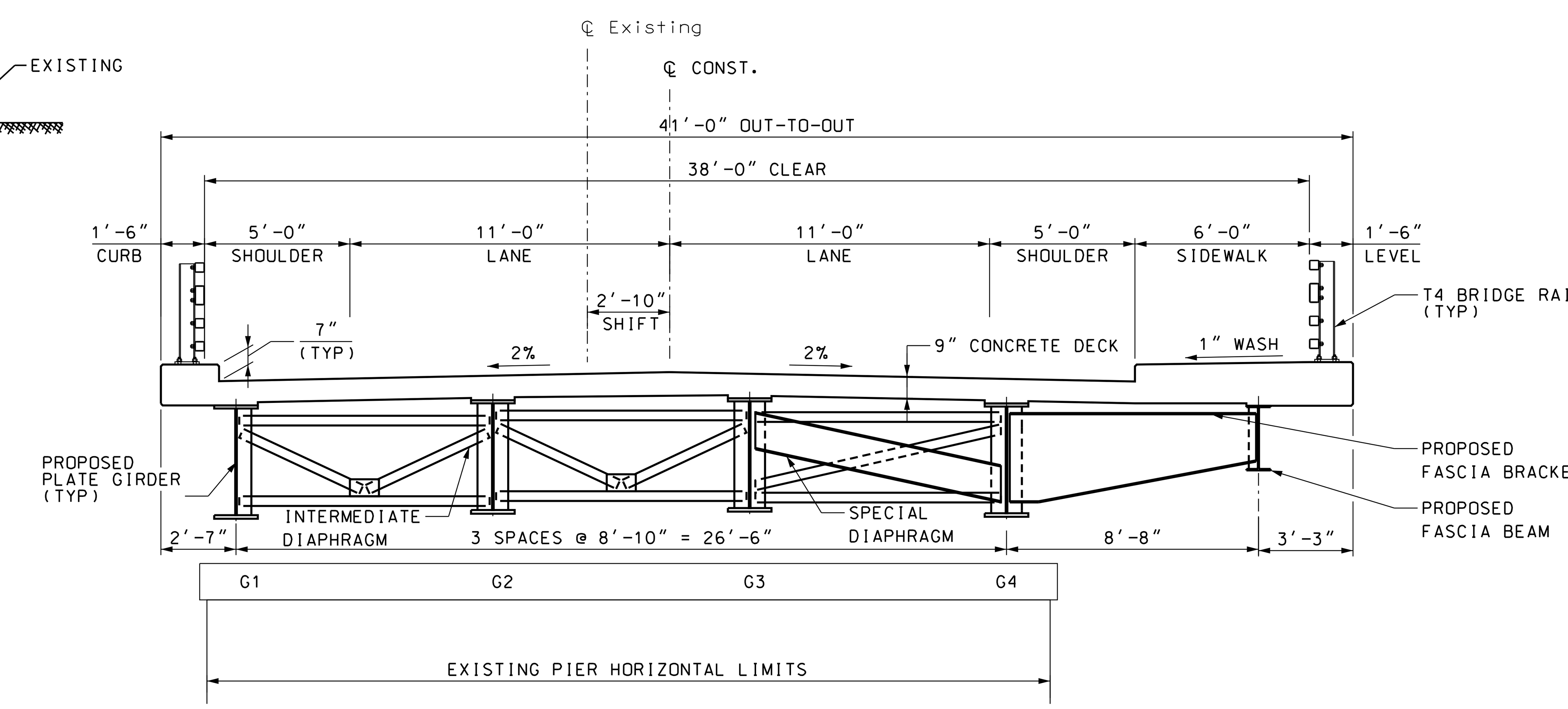
ISSUE DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	--	1	7

PLOT DATE	.DGN LOCATOR	SHEET SCALE
7/29/2019	15904Rehab_GenPlan	AS NOTED



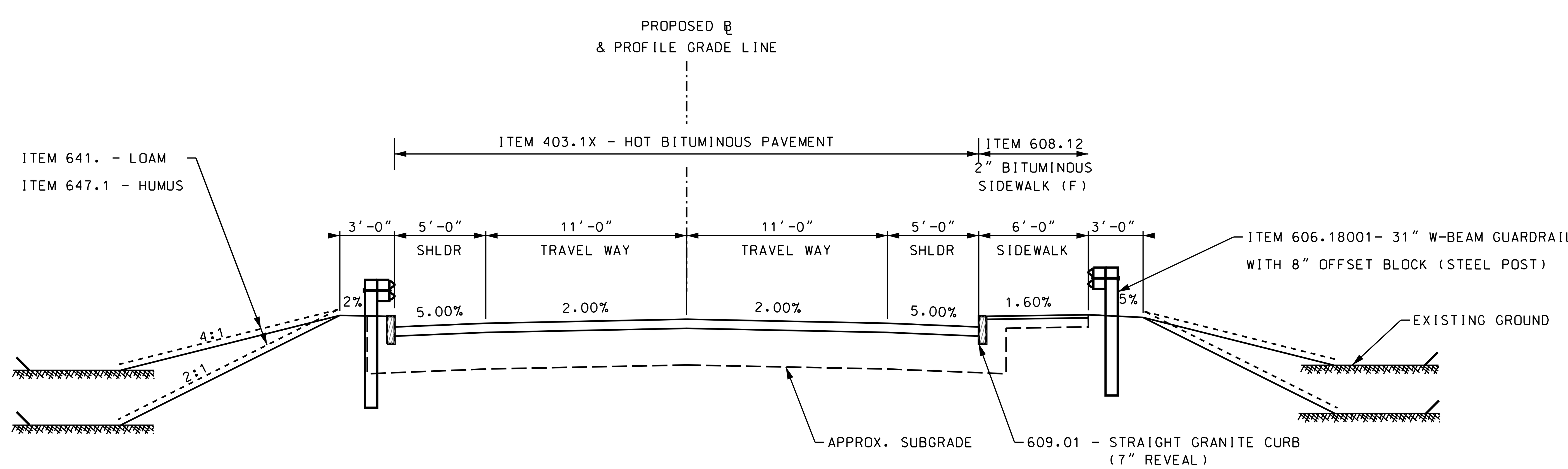
NH ROUTE 1A TYPICAL SECTION NORTH APPROACH

NOT TO SCALE



APPROACH SPAN TYPICAL SECTION (38')

SCALE: 1/4" = 1'-0"



NH ROUTE 1A TYPICAL SECTION SOUTH APPROACH

NOT TO SCALE

38' CLEAR
SUPERSTRUCTURE REPLACEMENT

CONCEPTUAL PLANS
7/26/2019

HDR

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN SEABROOK-HAMPTON BRIDGE NO. 235/025 STATE PROJECT 15904

LOCATION NH 1A OVER HAMPTON RIVER

TYPICAL SECTIONS - REHAB. ALTERNATIVE (38')

BRIDGE SHEET 2 OF 5

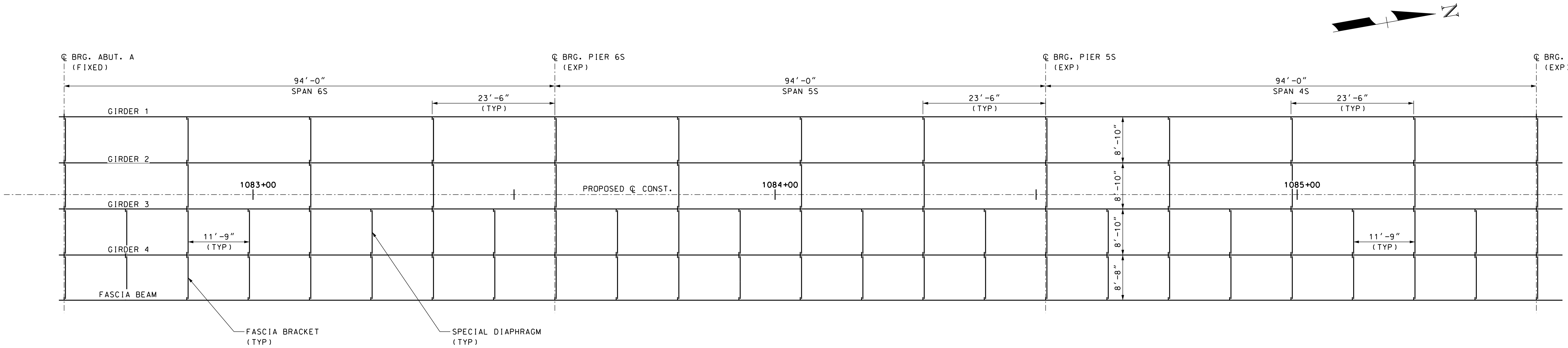
REVISIONS AFTER PROPOSAL

	BY	DATE		BY	DATE
DESIGNED	NDC	08/18	CHECKED	JFM	09/18
DRAWN	NDC	08/18	CHECKED	JFM	09/18
QUANTITIES	---	--/--	CHECKED	---	--/--

FILE NUMBER -

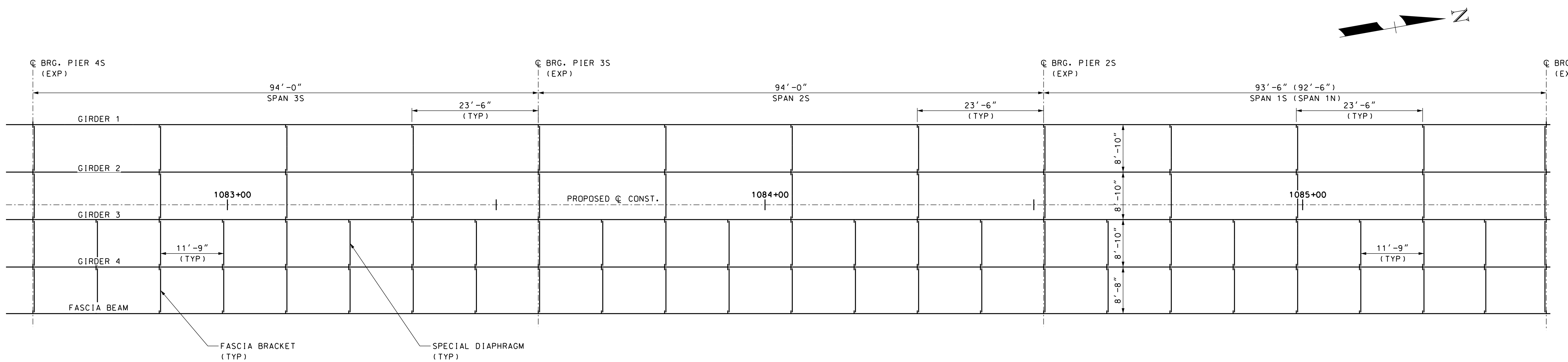
PLOT DATE	.DGN LOCATOR	SHEET SCALE
7/29/2019	15904Rehab_DeckSect	AS NOTED

ISSUE DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	--	2	7



FRAMING PLAN SPANS 6S - 4S

SCALE: 1" = 10'-0"
SPANS 6N - 4N SIMILAR



FRAMING PLAN SPANS 3S - 1S

SCALE: 1" = 10'-0"
SPANS 3N - 1N SIMILAR
(EXCEPT AS NOTED)

38' CLEAR
SUPERSTRUCTURE REPLACEMENT

CONCEPTUAL PLANS
7/26/2019

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN SEABROOK-HAMPTON BRIDGE NO. 235/025 STATE PROJECT 15904

LOCATION NH 1A OVER HAMPTON RIVER

APPROACH FRAMING PLAN - REHAB. ALTERNATIVE

BRIDGE SHEET 3 OF 5

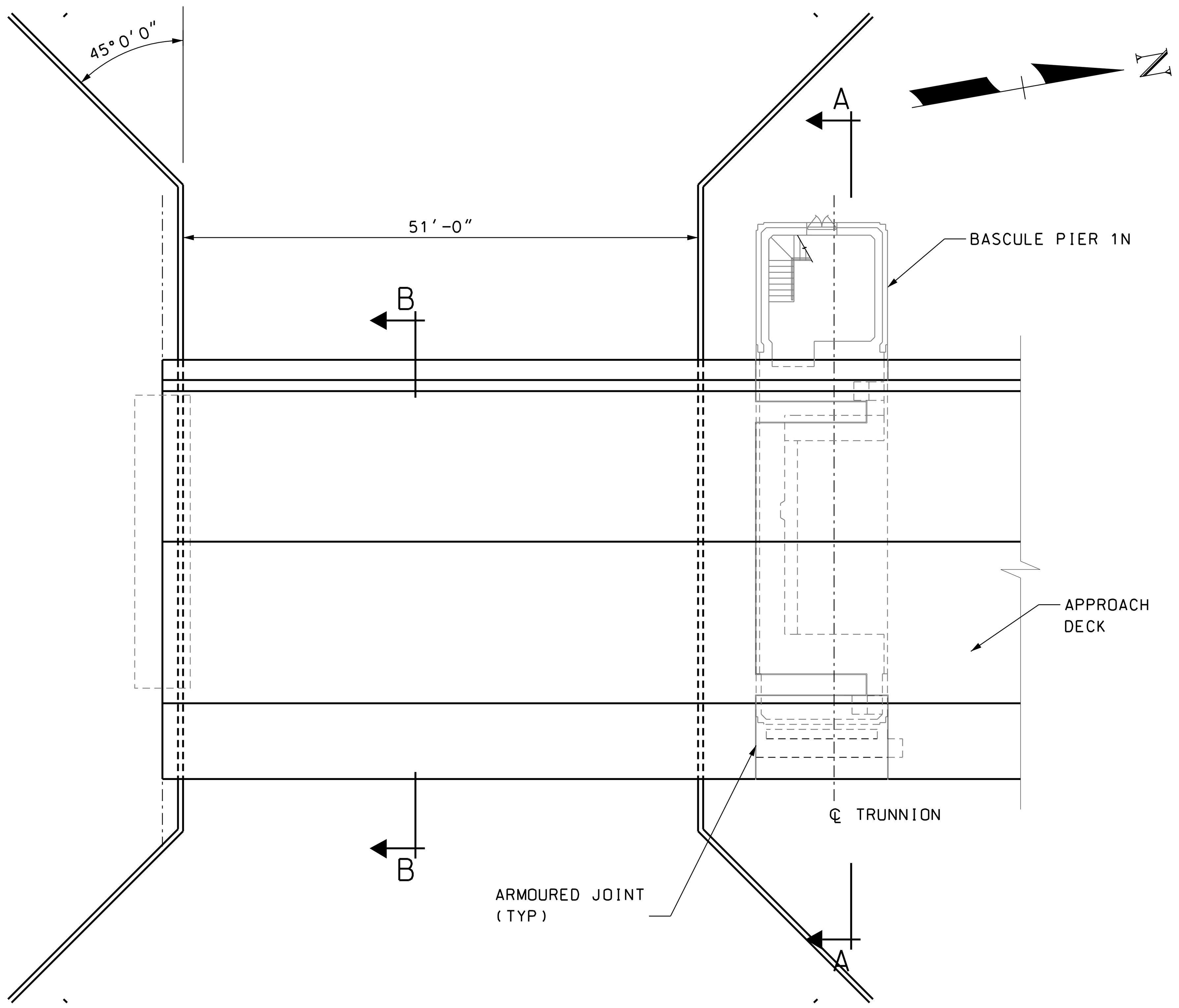
REVISIONS AFTER PROPOSAL

	BY	DATE		BY	DATE
DESIGNED	NDC	9/18	CHECKED	JFM	9/18
DRAWN	NDC	9/18	CHECKED	JFM	9/18
QUANTITIES	---	--/--	CHECKED	---	--/--

FILE NUMBER -

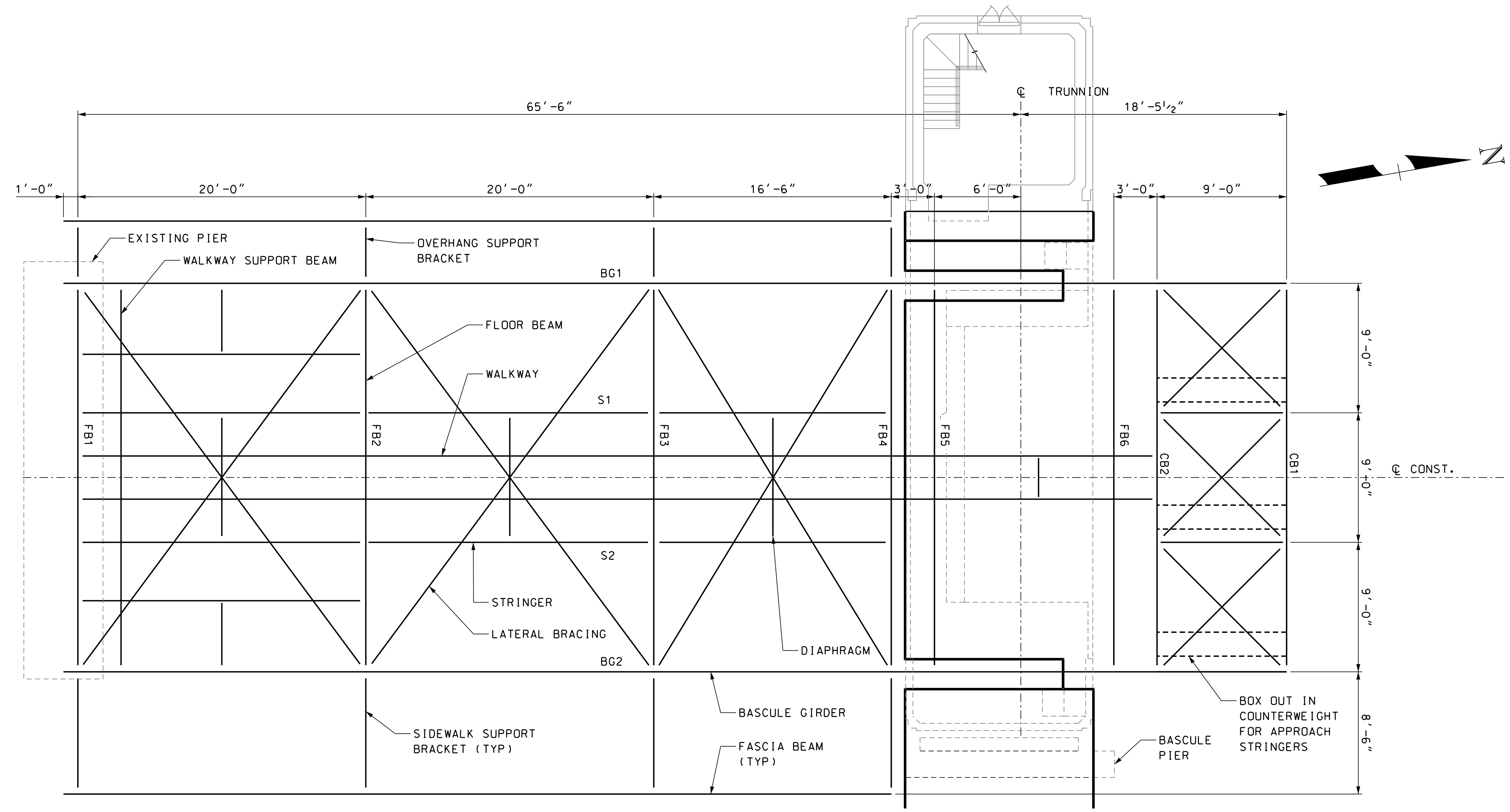
ISSUE DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	--	3	7

PLOT DATE	.DGN LOCATOR	SHEET SCALE
7/29/2019	15904Rehab_FramePlan	AS NOTED



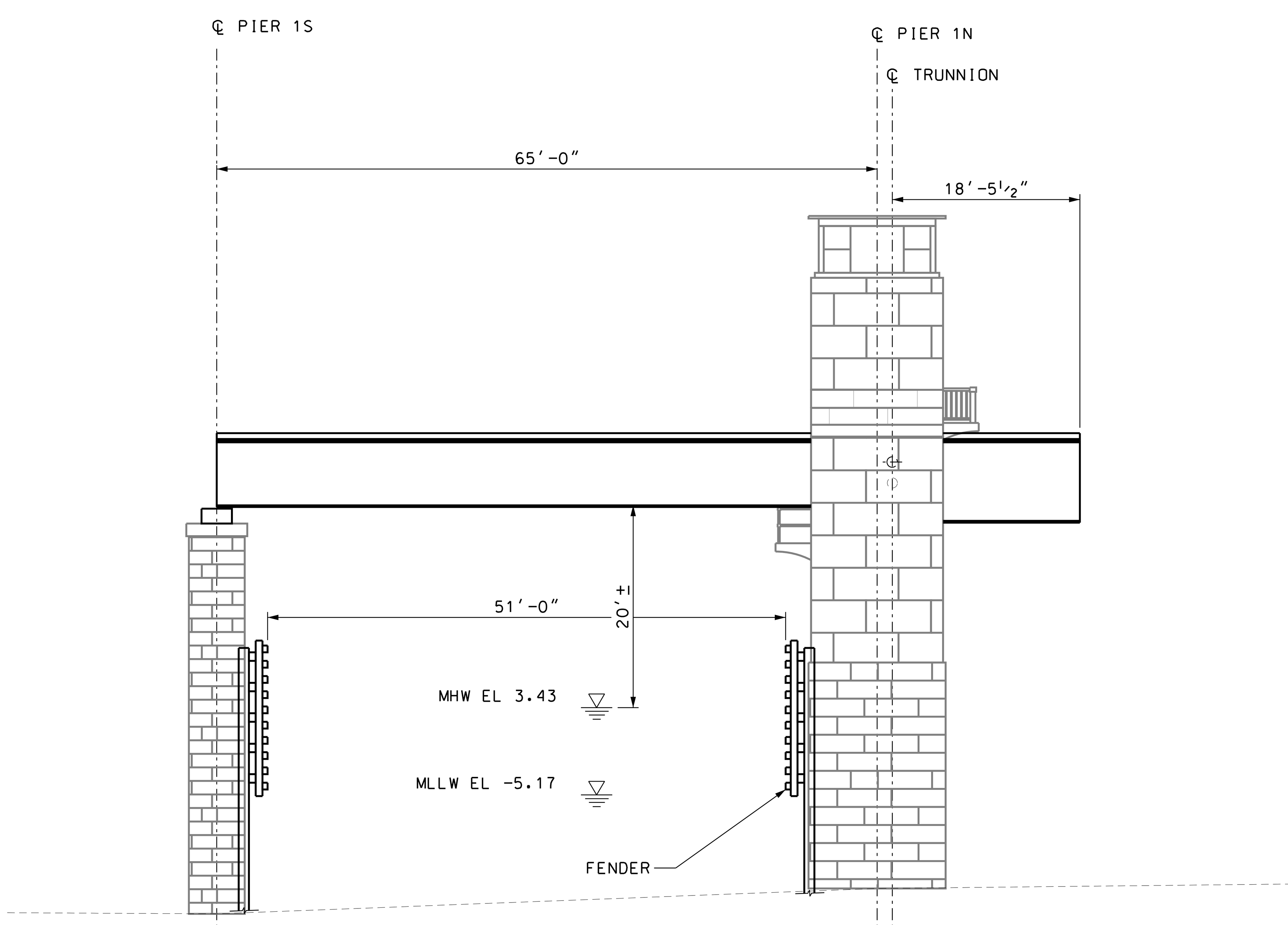
BASCULE PLAN

SCALE: 3/32" = 1'-0"



BASCULE FRAMING PLAN

SCALE: 3/16" = 1'-0"



BASCULE GIRDER ELEVATION

SCALE: 3/32" = 1'-0"

38' CLEAR
SUPERSTRUCTURE REPLACEMENT

CONCEPTUAL PLANS
7/26/2019

HDR

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN SEABROOK-HAMPTON | BRIDGE NO. 235/025 | STATE PROJECT 15904

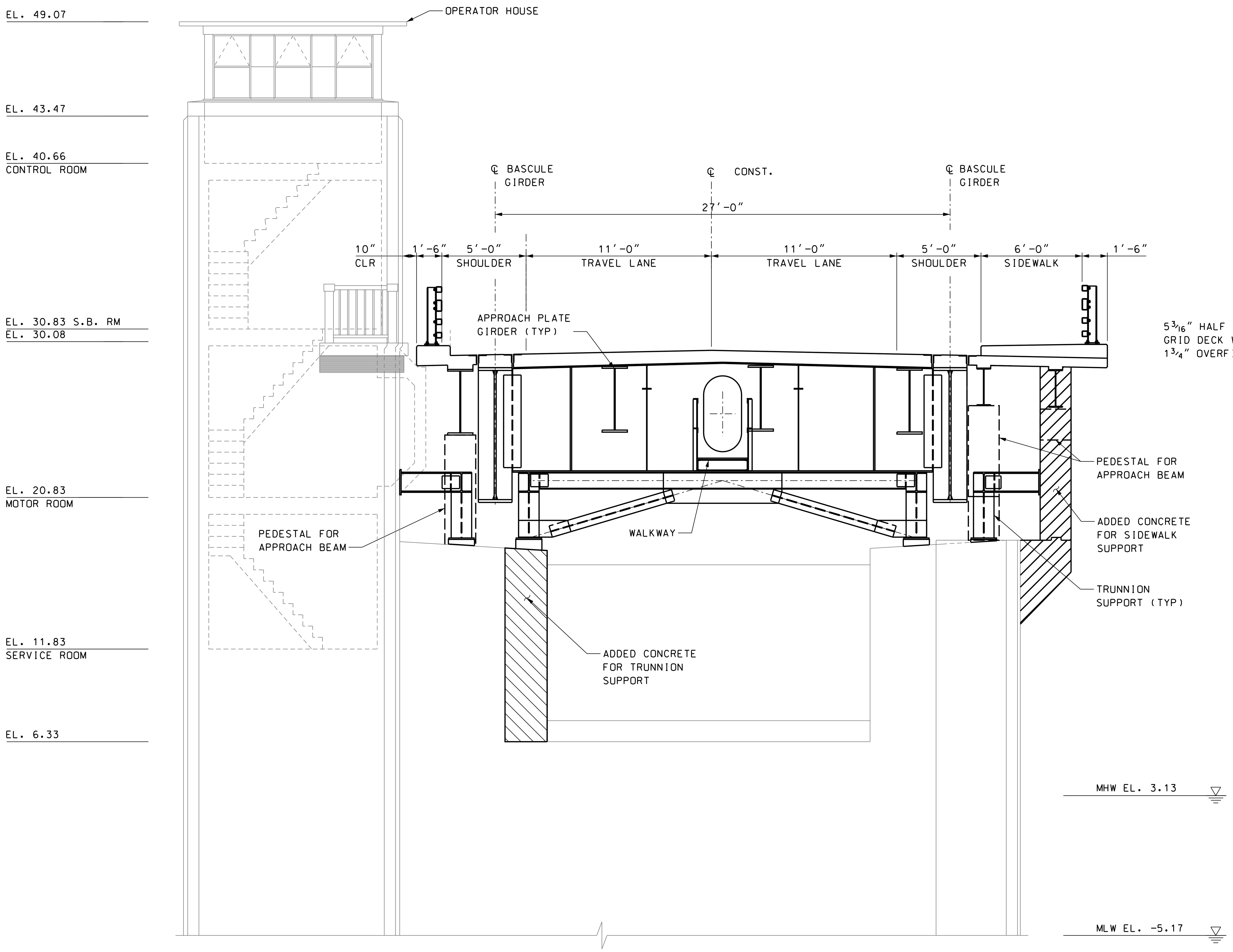
LOCATION NH 1A OVER HAMPTON RIVER

BASCULE SPAN DETAILS - REHABILITATION ALTERNATIVE

REVISIONS AFTER PROPOSAL		BY	DATE		BY	DATE	BRIDGE SHEET
	DESIGNED	HFP	08/18	CHECKED	JFM	09/18	4 OF 5
	DRAWN	SS	08/18	CHECKED	JFM	09/18	FILE NUMBER
	QUANTITIES	---	--/--	CHECKED	---	--/--	-

ISSUE DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	--	4	7

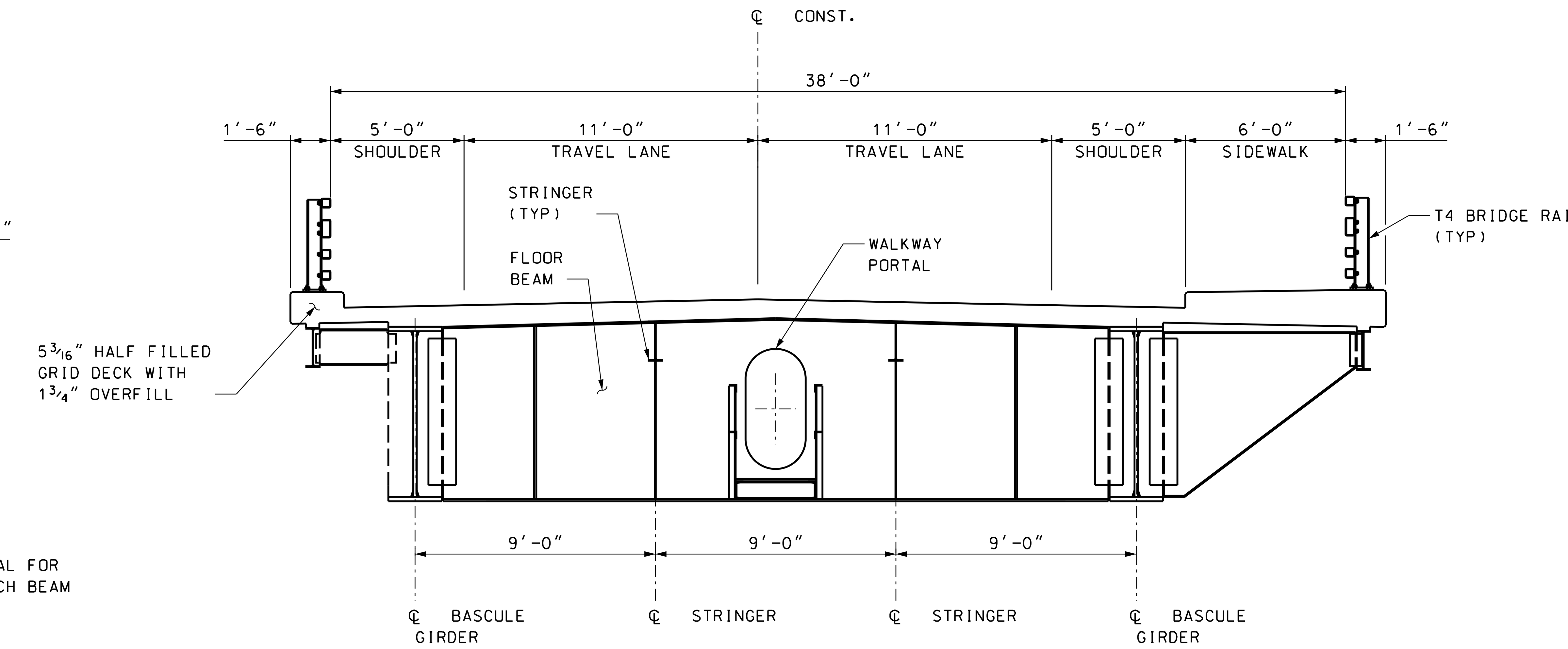
PLOT DATE	.DGN LOCATOR	SHEET SCALE
7/29/2019	15904Rehab_Bascule	AS NOTED



BASCULE SPAN TYP. SECTION A/4

SCALE: 1/4" = 1'-0"

NOTE:
COUNTERWEIGHT NOT SHOWN FOR CLARITY; COUNTERWEIGHT WILL PROVIDE BOX-OUTS FOR BEARING OF APPROACH SPAN GIRDERS WITHOUT CONFLICT



BASCULE SPAN TYP. SECTION B/4

SCALE: 1/4" = 1'-0"

38' CLEAR
SUPERSTRUCTURE REPLACEMENT

CONCEPTUAL PLANS
7/26/2019

HDR

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN SEABROOK-HAMPTON | BRIDGE NO. 235/025 | STATE PROJECT 15904

LOCATION NH 1A OVER HAMPTON RIVER

BASCULE SPAN SECTIONS - REHAB. ALTERNATIVE

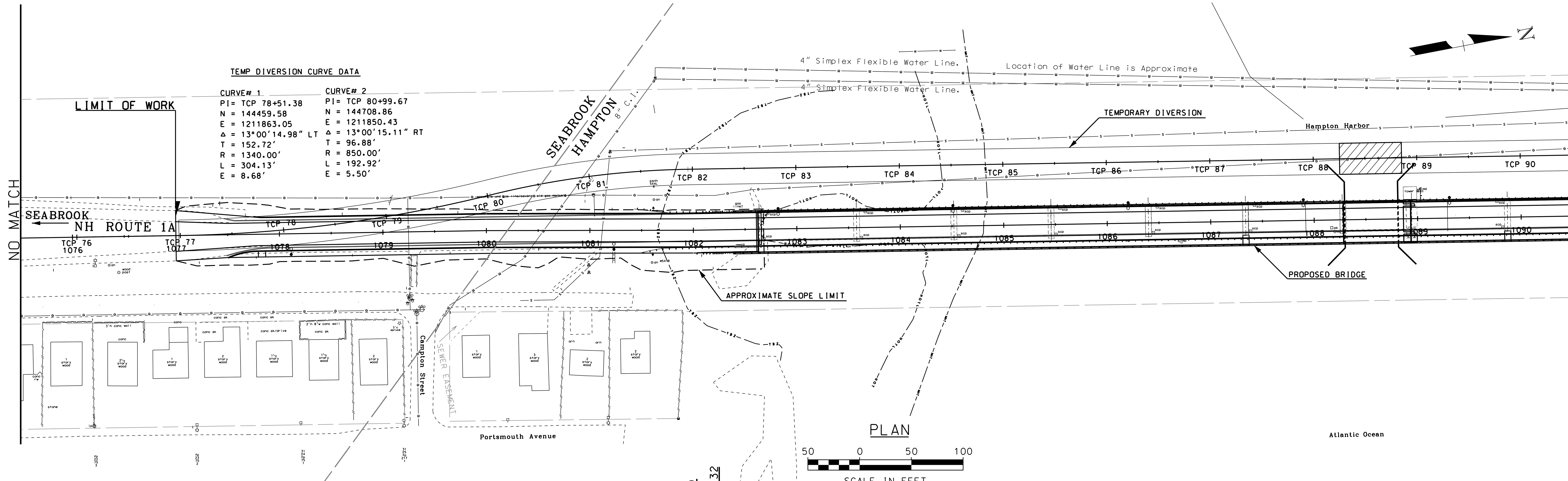
BRIDGE SHEET 5 OF 5

FILE NUMBER -

REVISIONS AFTER PROPOSAL		BY	DATE		BY	DATE
	DESIGNED	HFP	9/18	CHECKED	JFM	9/18
	DRAWN	SS	9/18	CHECKED	JFM	9/18
	QUANTITIES	---	--/--	CHECKED	---	--/--

ISSUE DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	--	5	7

PLOT DATE	.DGN LOCATOR	SHEET SCALE
7/29/2019	15904Rehab_Bascule	AS NOTED



PROFILE

SCALE:
1"= 50' HORIZ.
1"= 10' VERT.

38' CLEAR
SUPERSTRUCTURE REPLACEMENT

CONCEPTUAL PLANS
7/26/2019

HDR

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN SEABROOK-HAMPTON — BRIDGE NO. 235/025 — STATE PROJECT 15904

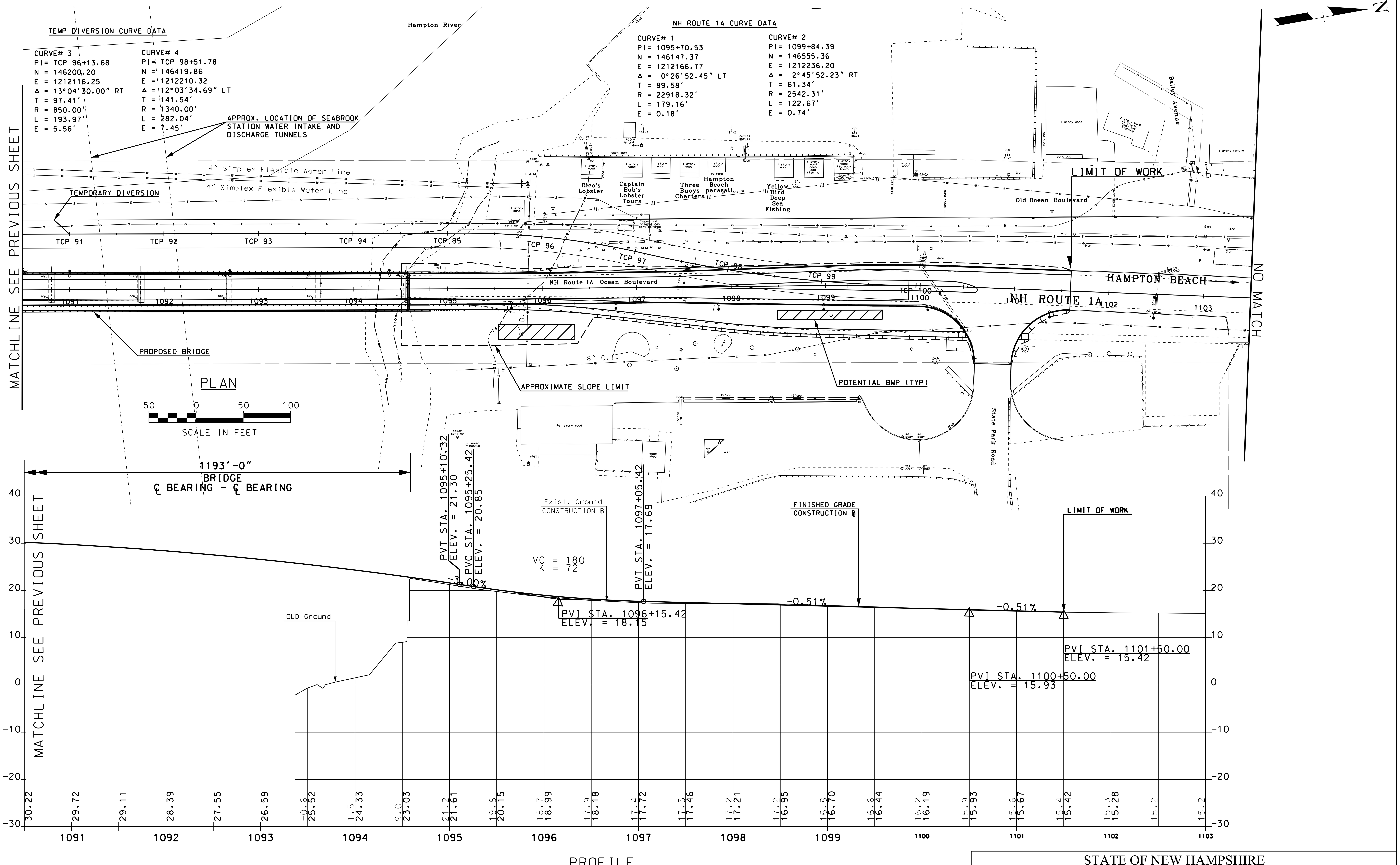
LOCATION NH 1A OVER HAMPTON RIVER

BRIDGE REHABILITATION ALTERNATIVE - ROADWAY

REVISIONS AFTER PROPOSAL		BY	DATE		BY	DATE
	DESIGNED	JA	09/18	CHECKED	JA	09/18
	DRAWN	KH	09/18	CHECKED	JM	09/18
	QUANTITIES			CHECKED		

BRIDGE SHEET	FILE NUMBER	ISSUE DATE	REV. DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
- OF -	-			--	6	7

PLOT DATE	.DGN LOCATOR	SHEET SCALE
7/29/2019	15904_genplans	AS NOTED



38' CLEAR
SUPERSTRUCTURE REPLACEMENT

CONCEPTUAL PLANS
7/26/2019

HDR

PLOT DATE	.DGN LOCATOR	SHEET SCALE
7/29/2019	15904_genplans	AS NOTED

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN SEABROOK-HAMPTON | BRIDGE NO. 235/025 | STATE PROJECT 15904

LOCATION NH 1A OVER HAMPTON RIVER

BRIDGE REHABILITATION ALTERNATIVE - ROADWAY

BRIDGE SHEET - OF -

REVISIONS AFTER PROPOSAL

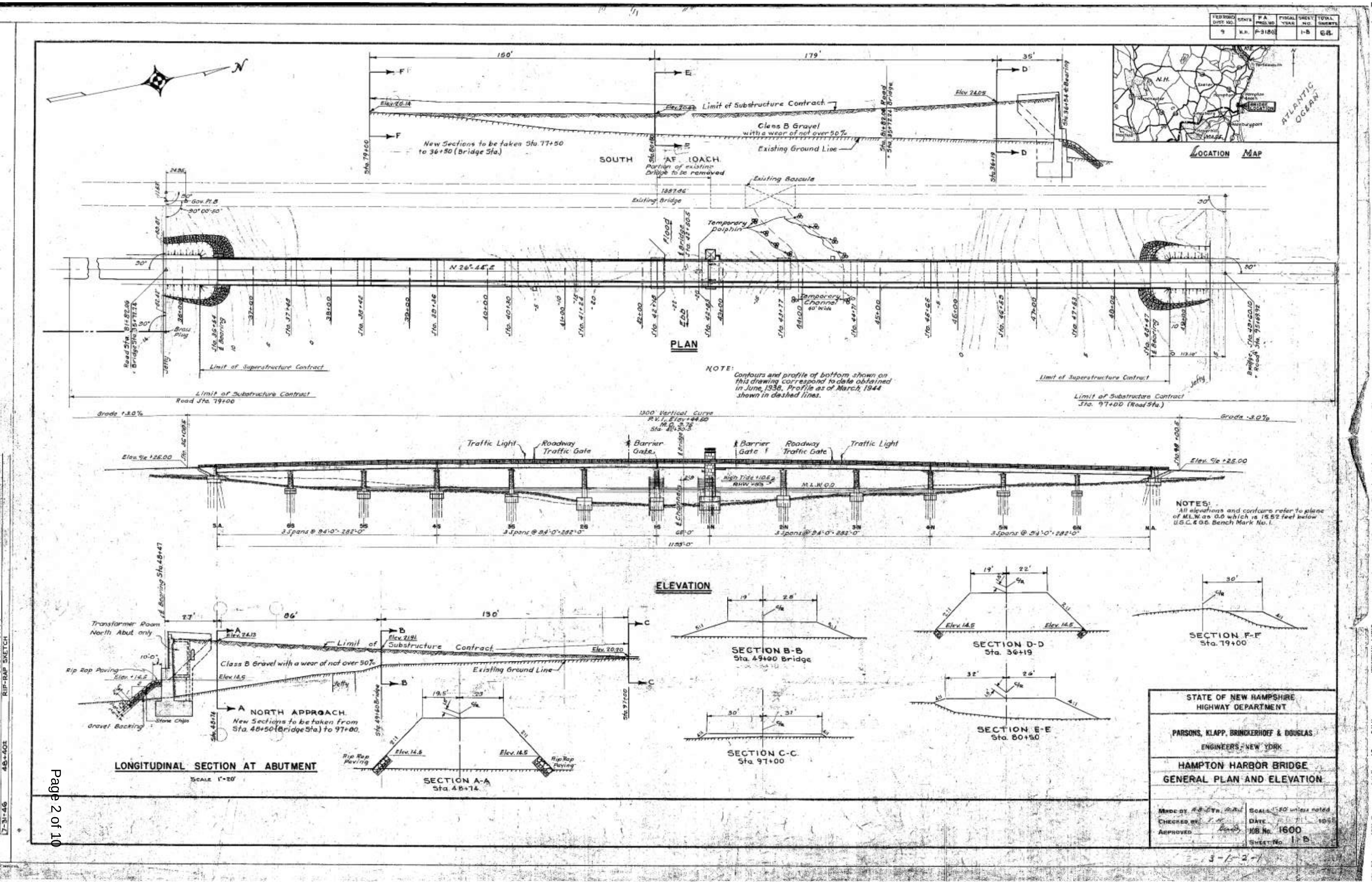
	BY	DATE		BY	DATE
DESIGNED	JA	09/18	CHECKED	JA	09/18
DRAWN	KH	09/18	CHECKED	JM	09/18
QUANTITIES			CHECKED		

FILE NUMBER -

ISSUE DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	--	7	7

Appendix C:

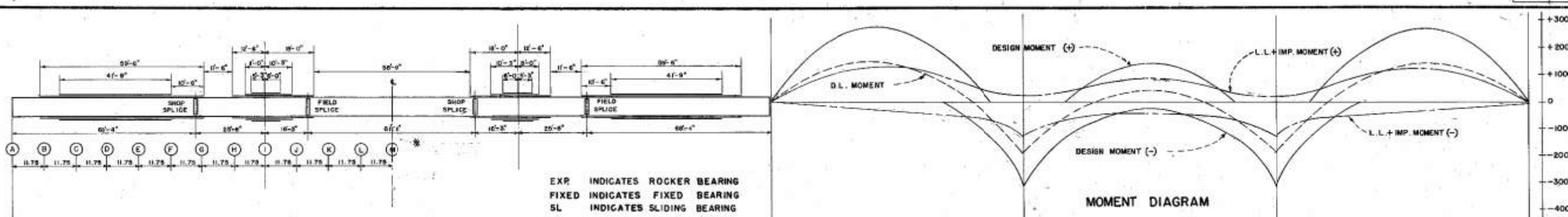
Existing Bridge Plan, Elevation and Sections



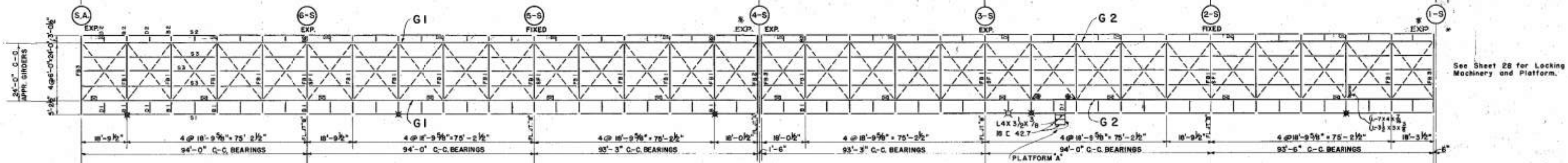
LOCATION MAP
N.H.
MASS.
ATLANTIC OCEAN
BRIDGE LOCATION
SOUTH APPROACH
Portion of existing Bridge to be removed
New Sections to be taken Sta. 77+50 to 36+50 (Bridge Sta.)
Limit of Substructure Contract
Class B Gravel with a wear of not over 50%
Existing Ground Line
Existing Bascule
Existing Bridge
Temporary Dolphin
Temporary Channel 60' Wide
N 26°-44' E
PLAN
NOTE: Contours and profile of bottom shown on this drawing correspond to data obtained in June, 1938. Profile as of March, 1944 shown in dashed lines.
Limit of Superstructure Contract
Limit of Substructure Contract Road Sta. 79+00
Limit of Substructure Contract Sta. 97+00 (Road Sta.)
Grade +3.0%
Grade -3.0%
1300' Vertical Curve
Traffic Light
Roadway Traffic Gate
Barrier Gate
Elev. Gr. +25.00
High Tide +10.5
M.L.W. 0.0
3 Spans @ 94'-0" = 282'-0"
1155'-0"
NOTES: All elevations and contours refer to plane of M.L.W. as 0.0 which is 16.52 feet below U.S.C.&G.S. Bench Mark No. 1.
ELEVATION
Transformer Room North Abut. only
Rip Rap Paving
Gravel Backing
Stone Chips
NORTH APPROACH
New Sections to be taken from Sta. 48+50 (Bridge Sta.) to 97+00.
LONGITUDINAL SECTION AT ABUTMENT
Scale 1"=20'
SECTION A-A Sta. 48+74
SECTION B-B Sta. 49+00 Bridge
SECTION C-C Sta. 97+00
SECTION D-D Sta. 36+19
SECTION E-E Sta. 80+50
SECTION F-F Sta. 79+00
STATE OF NEW HAMPSHIRE HIGHWAY DEPARTMENT
PARSONS, KLAPP, BRINCKERHOFF & DOUGLAS ENGINEERS - NEW YORK
HAMPTON HARBOR BRIDGE
GENERAL PLAN AND ELEVATION
JOB No. 1600
SHEET No. 1-B

Page 2 of 10

FED. ROAD DIST. NO.	STATE	F.A. PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N.H.	F-318(1)		7	64

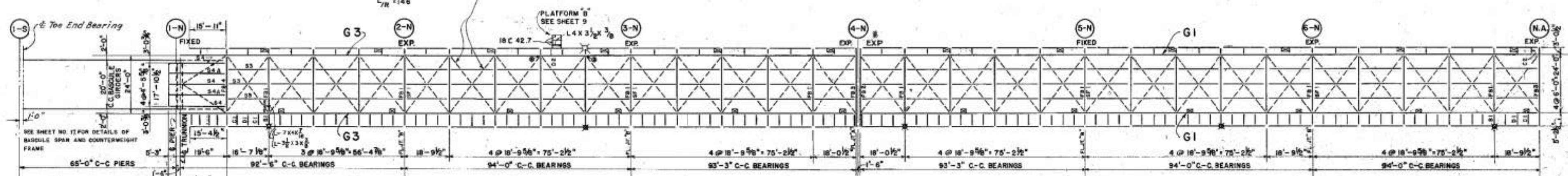


MOMENT DIAGRAM



FRAMING PLAN—SOUTH APPROACH

ALL LATERALS -2∠-4X3½X⅜ L/R =146



FRAMING PLAN—NORTH APPROACH

GIRDER

SECTION		A	B	C	D	E	F	G	H	I	J	K	L	M
FLANGE	∠S	6X6X½	6X6X½	6X6X½	6X6X½	6X6X½	6X6X½	6X6X½	6X6X½	6X6X½	6X6X½	6X6X½	6X6X½	6X6X½
	Cov.			14X7/16	14X7/16	14X7/16	14X7/16			14X⅜	14X⅜			
	Cov.			14X7/16	14X7/16	14X7/16				14X⅜				
	Cov.									14X⅜				
WEB PLATE		80X5/16	80X5/16	80X5/16	80X5/16	80X5/16	80X5/16	80X5/16	80X5/16	80X5/16	80X5/16	80X5/16	80X5/16	80X5/16
NET AREA OF FLANGE SQ. IN.	∠S	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50
	⅛ Web	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
	Cov.			5.25	5.25	5.25	5.25			4.50	4.50			
	Cov.			5.25	5.25	5.25				4.50				
	Cov.									4.50				
	Σ	13.25	13.25	23.75	23.75	23.75	18.50	13.25	13.25	26.75	17.75	13.25	13.25	13.25
MAXIMUM WEB SHEAR KIPS	D.L.	+78.7	+54.0	+29.3	+3.0	-13.0	-44.7	-69.4	-94.1	-119.4	+73.9	+49.2	+16.0	0
	L.L.	+59.7	+46.9	+35.5	+36.7	-39.3	-40.1	-50.8	-61.9	-73.9	+58.4	+47.0	+46.3	+41.0
	I	+10.3	+ 8.2	+ 6.3	+ 6.7	- 7.1	- 7.0	- 8.7	-10.6	-12.2	+ 9.9	+ 8.1	+ 8.1	+ 7.2
	Σ	+148.7	+109.1	+71.1	+46.4	-59.4	-91.8	-128.9	-166.5	-205.1	+142.2	+104.3	+70.4	+48.2
MAX. POSITIVE MOMENT FT. KIPS	D.L.	0	+ 779	+1265	+1466	+1380	+995	+ 331				-101	+291	+434
	L.L.	0	+ 531	+890	+1074	+1091	+939	+ 643				+448	+682	+762
	I	0	+ 88	+147	+176	+178	+ 153	+ 105				+ 77	+114	+127
	Σ	0	+1400	+2302	+2716	+2649	+ 2087	+1079				+424	+1087	+1323
MAX. NEGATIVE MOMENT FT. KIPS	D.L.							+ 232	- 630	-1881	- 873	- 144	+ 204	+ 304
	L.L.							- 434	- 584	-1083	- 626	- 444	- 421	- 398
	I							- 70	- 93	- 165	- 98	- 71	- 66	- 60
	Σ							- 272	-1307	-3129	- 1596	- 659	+ 283	- 154
DESIGN MOMENT		0	+1400	+2302	+2716	+2649	+ 2087	+1215	-1307	-3129	- 1596	- 671	+1229	+1400
EFFECTIVE DEPTH FT.		6.43	6.43	6.61	6.61	6.61	6.54	6.43	6.43	6.65	6.53	6.43	6.43	6.43
NET. FLG. REQD. @ 18K/□"		0	12.1□"	19.4□"	22.8□"	22.3□"	17.8□"	10.5□"	11.3□"	26.2□"	13.6□"	7.6□"	10.6□"	12.1□"

DESIGN MOMENT = MAX (+) OR (−) MOMENT PLUS ½ THE SMALLER MOMENT

FLOORBEAMS

MARK		END F.B.		INTERM. F.B.	
		F.B.2	F.B.3	F.B.1	F.B.4
MAX. PANEL LENGTH		18'-0½"	18'-9½"	18'-9⅝"	19'-6"
SECTION		21 WF 103#	27 WF 91#	27 WF 98#	
GROSS S.M. (IN.³)		213.1	233.2	255.3	
MAX. SHEAR IN KIPS	D.L.	10	10	17	18
	L.L.	34	34	34	34
	I	10	10	10	10
	Σ	54	54	61	62
MAX. MOMENT IN FT. KIPS	D.L.	72	74	129	122
	L.L.	179	181	181	182
	I	54	54	54	55
	Σ	306	309	364	359
S.M. REQD @ 18K/□"		204	206	242	240

STRINGERS

MARK		FASCIA STRINGERS		ROADWAY STRINGERS		
		S 1	S 2	S 3	S4	S4A
MAX. PANEL LENGTH		18'-9⅝"	18'-9⅝"	18'-9⅝"	19'-6"	19'-6"
SECTION			18 WF 47#		12 WF 50#	12 WF 58#
GROSS S.M. (IN.³)			82.3		64.7	78.1 *
MAX. SHEAR IN KIPS	D.L.	3	5	5	5	5
	L.L.	5	12	15	11	11
	I	–	2	5	3	3
	Σ	8	19	25	19	19
MAX. MOMENT IN FT. KIPS	D.L.	14	22	25	18	18
	L.L.	29	67	68	52	51
	I	–	11	20	16	15
	Σ	43	100	113	86	84**
S.M. REQD @ 18K/□"		30	67	76	57	56

* NET S.M. = 64.0 IN³
** MAXIMUM MOMENT AT LATERAL CONNECTION.

BRACKETS

MARK		B 1	B 2
MAX. PANEL LENGTH		18'-9⅝"	18'-9⅝"
SECTION		18 WF 47#	
GROSS S.M.		82.3 IN³	
MAX. SHEAR IN KIPS	D.L.	6	9
	L.L.	12	21
	I	–	2
	Σ	18	32
MAX. MOMENT IN FT. KIPS	D.L.	30	30
	L.L.	66	63
	I	–	7
	Σ	96	100
S.M. REQ'D @ 18K/□"		64	67
STRESS IN TIE ℞		64 K	67 K
NET AREA REQ'D @ 18K/□"		3.56 □"	3.72 □"
⊕ TIE ℞ USED		9½ X ½	9½ X ½
NET AREA OF TIE ℞		3.75 □"	3.75 □"

⊕ D.L. MOMENTS FOR BRACKETS B1 AND B2 ON EACH SIDE OF PLATFORMS "A" AND "B" ARE 13'K GREATER THAN IS SHOWN IN THE ABOVE TABLE. MAKE TIE PLATES AT THESE POINTS 9½X 5/16

SHOE LOADS IN KIPS

	LOADS	END REACTION	INTERIOR REACTION
VERTICAL	D.L.	78.7	217.5
	L.L.	59.7	121.9
	I	10.3	19.0
	Σ	148.7	358.4
HOR.	TRANSV. WIND	13.6	36.5
	LONG. WIND	22.0	22.0

▩ INDICATES LAMP POST BASE

▩ LOCATION OF SCUPPERS

FOR LOCATION OF UTILITY CONDUITS SEE SHEET NO. 34

⌖ TRAFFIC LIGHT STANDARD

NOTES

MATERIAL: STRUCTURAL CARBON STEEL.

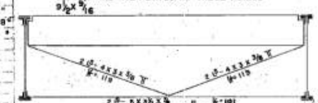
RIVETS: CARBON RIVET STEEL ⅞" ϕ UNLESS NOTED.

CAMBER: GIRDERS SHALL BE CAMBERED FOR FULL DEAD LOAD AND THE VERTICAL CURVE OF THE ROADWAY.

SPECIFICATIONS: 1941 A.A.S.H.O. STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES

LOADING: H-15 LOADING

THIS BRIDGE HAS BEEN CHECKED FOR A SINGLE LANE OF H20 LOADING AND WAS STRENGTHENED FOR THAT LOADING CONDITION.



INTERMEDIATE BRACKETS (D1) & (D2)-18 WF 47 UTILITY SUPPORT (C1)+(C2)-1L 3½X3X⅜

TYPICAL SWAY FRAME
SF1
SCALE 1"=5'-0"

REVISIONS
* Bearing at 1-S changed to SL 5/11/47
§ Note on field splice removed. S.L. Bearings changed to Exp. 4/24/47

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT

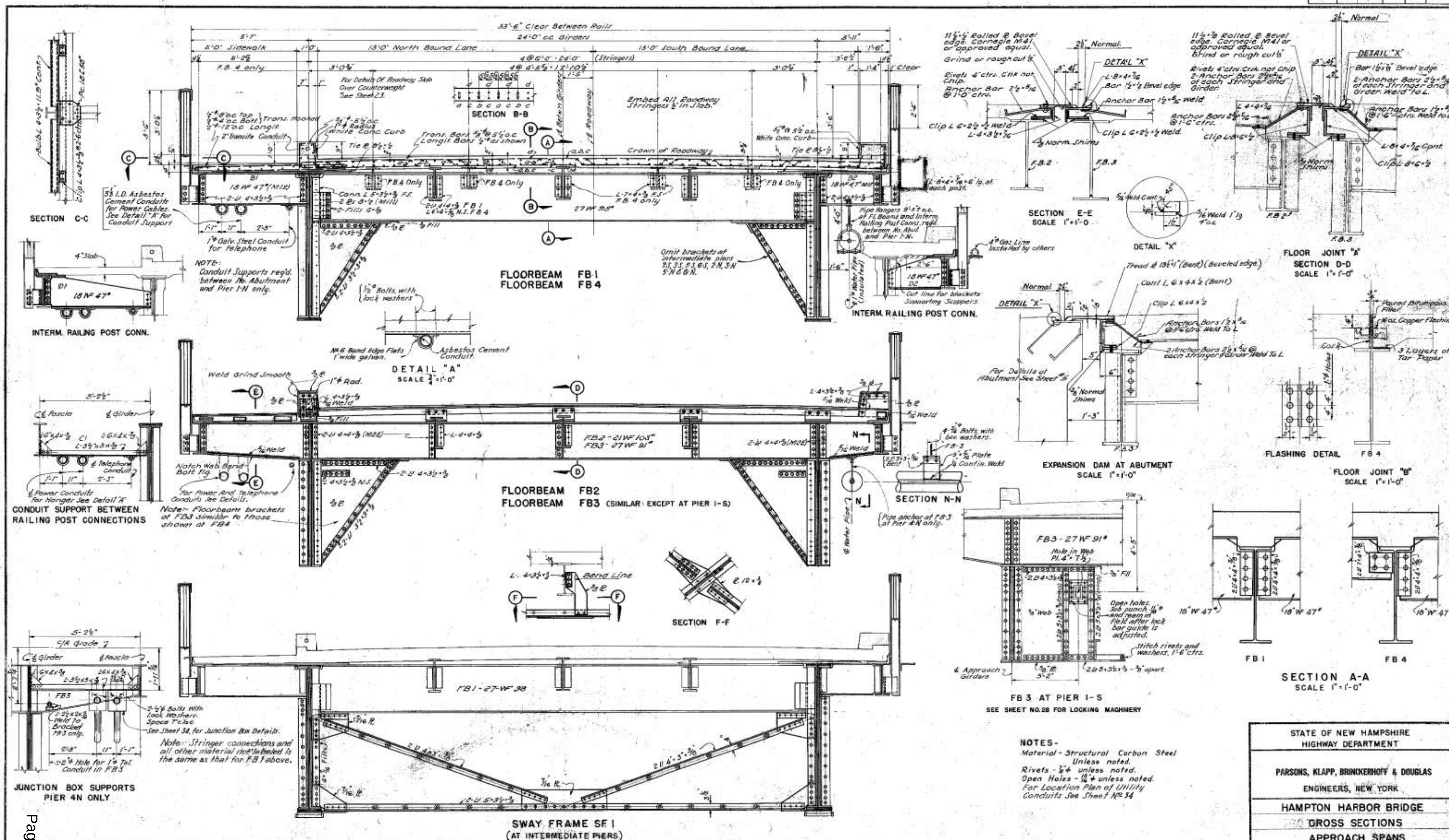
PARSONS, KLAPP, BRINCKERHOFF & DOUGLAS
ENGINEERS-NEW YORK

HAMPTON HARBOR BRIDGE
STRESS SHEET
APPROACH SPANS

MADE BY F.P. TR. T.F.K.
CHECKED BY M.E.F.
APPROVED
SCALE 1"=20' AND AS NOTED
DATE MARCH 1946
JOB No. 1600
SHEET No. 7

3-1-2-1

FED. ROAD DIST. NO.	STATE	F.A. PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N.H.	F-91801		8	64



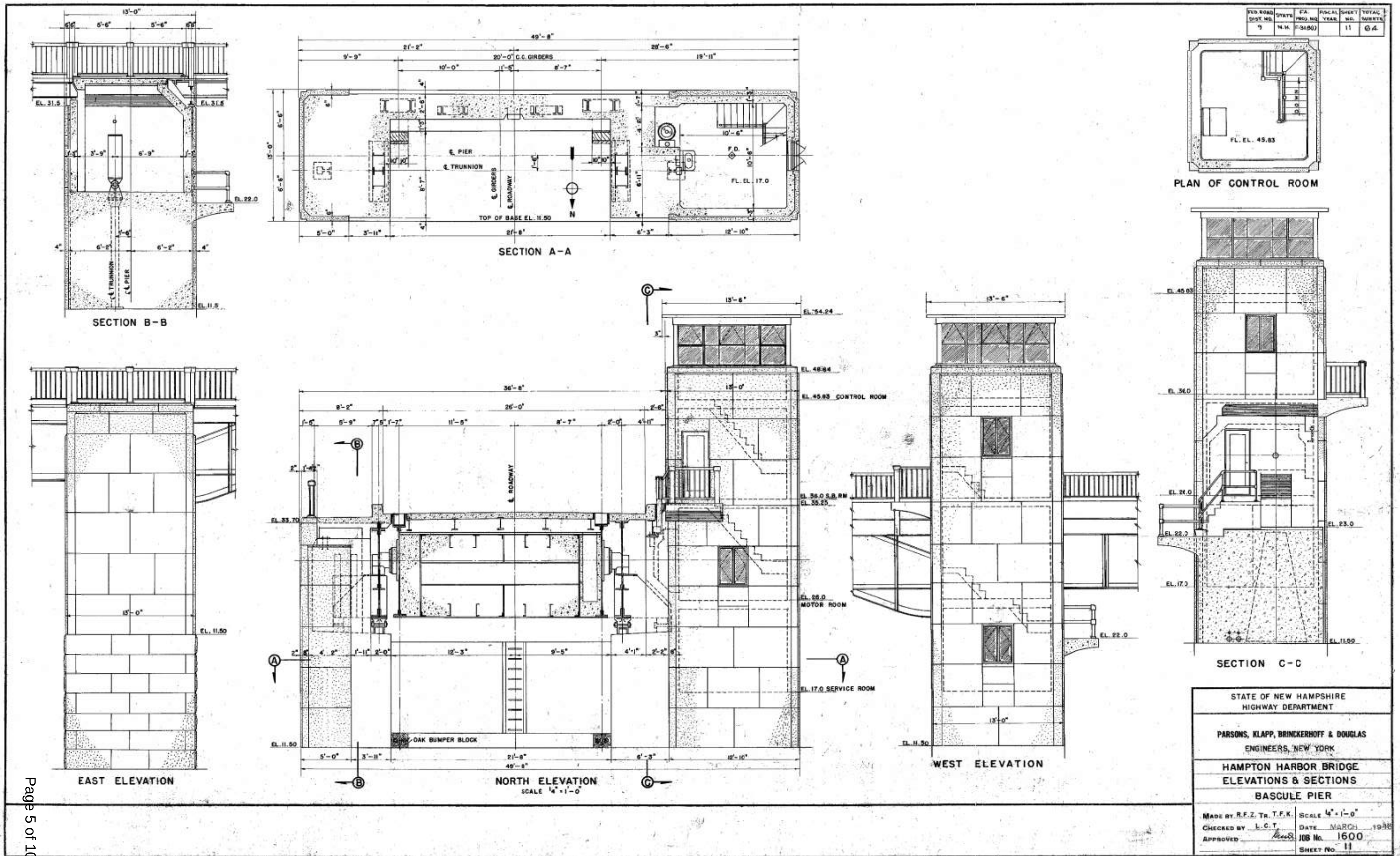
STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT

PARSONS, KLAPP, BRINCKERHOFF & DOUGLAS
ENGINEERS, NEW YORK

HAMPTON HARBOR BRIDGE
CROSS SECTIONS
APPROACH SPANS

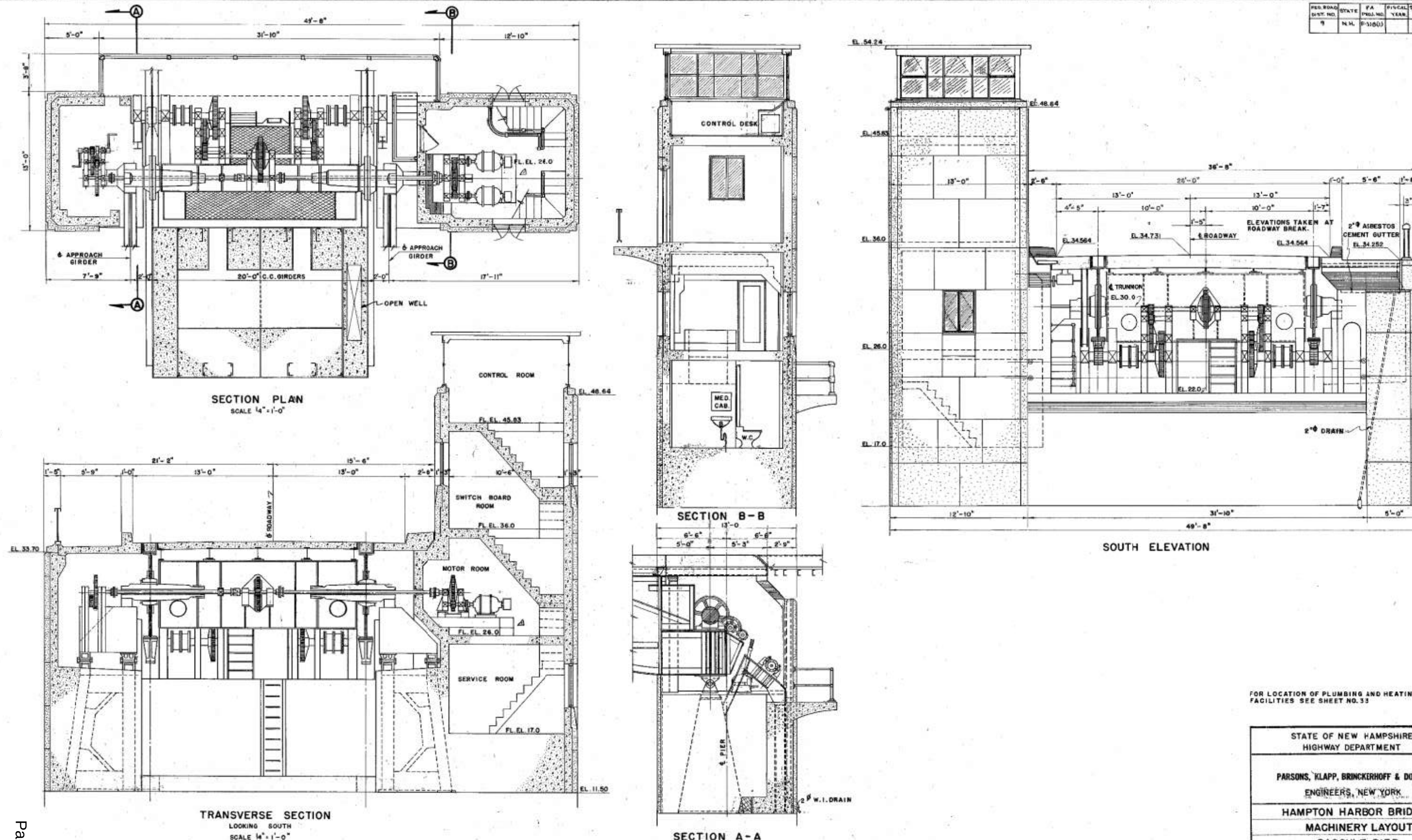
MADE BY M.I. TR. A.B.J. SCALE 1/2"=1'-0" UNLESS NOTED
CHECKED BY F.P. DATE MARCH 1946
APPROVED JOB No. 1600
SHEET No. 8

3-1-2-1


SECTION B-B
SECTION A-A
PLAN OF CONTROL ROOM
EAST ELEVATION
NORTH ELEVATION
SCALE 1/4" = 1'-0"
WEST ELEVATION
SECTION C-C
EL. 45.83 CONTROL ROOM
EL. 26.0 MOTOR ROOM
EL. 17.0 SERVICE ROOM
OAK BUMPER BLOCK
TOP OF BASE EL. 11.50
FL. EL. 45.83
STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT
PARSONS, KLAPP, BRINCKERHOFF & DOUGLAS
ENGINEERS, NEW YORK
HAMPTON HARBOR BRIDGE
ELEVATIONS & SECTIONS
BASCULE PIER
MADE BY R.F.Z. TR. T.F.K.
CHECKED BY L.C.T.
APPROVED
SCALE 1/4" = 1'-0"
DATE MARCH 1948
JOB No. 1600
SHEET No. 11
3-1-2-1

Page 5 of 10

FED. ROAD DIST. NO.	STATE	F.A. PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N.H.	F-318(1)		12	64



SECTION PLAN
SCALE 1/4" = 1'-0"

TRANSVERSE SECTION
LOOKING SOUTH
SCALE 1/4" = 1'-0"

SECTION B-B

SECTION A-A

SOUTH ELEVATION

FOR LOCATION OF PLUMBING AND HEATING FACILITIES SEE SHEET NO. 33

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT

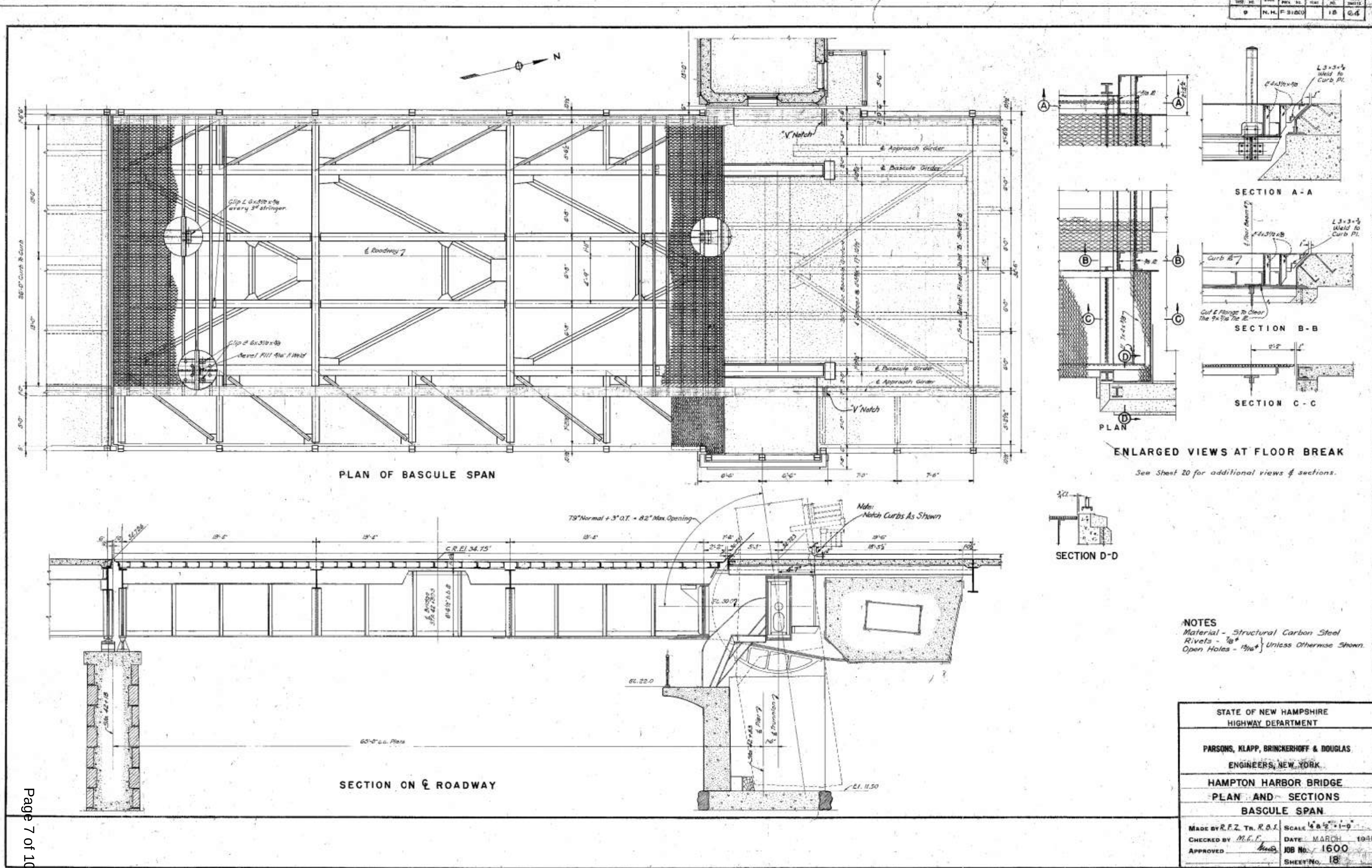
PARSONS, KLAPP, BRINCKERHOFF & DOUGLAS
ENGINEERS, NEW YORK

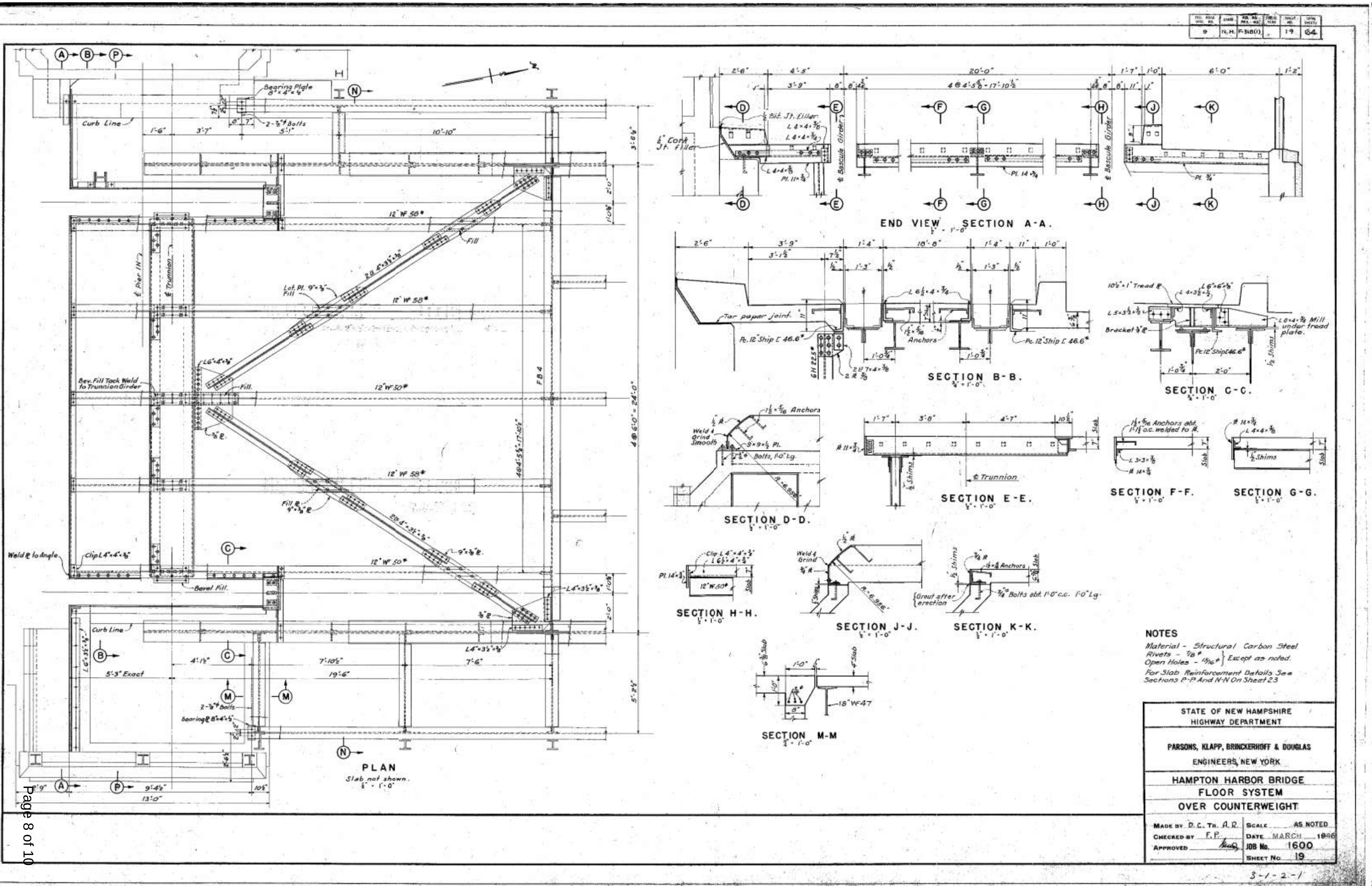
HAMPTON HARBOR BRIDGE
MACHINERY LAYOUT
BASCULE PIER

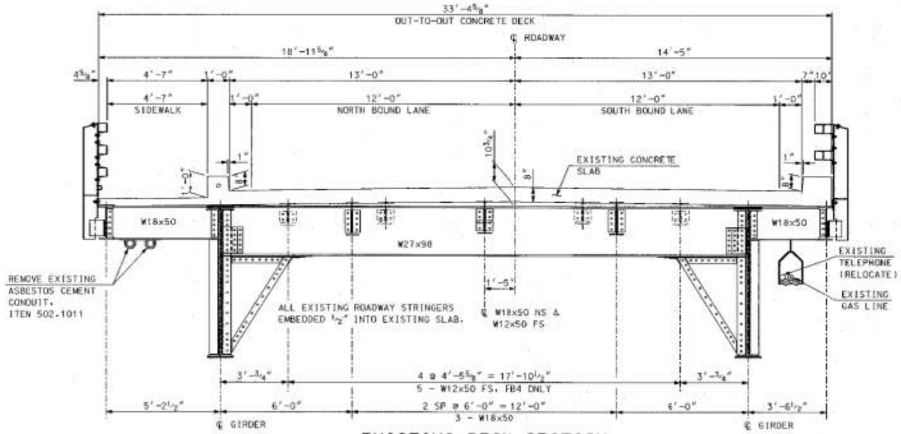
REVISIONS
△ Motor base revised 8/11/49.

MADE BY R.F.Z. TR. T.F.K. SCALE 1/4" = 1'-0"
CHECKED BY L.C.T. DATE MARCH 1946
APPROVED JOB No. 1600
SHEET No. 12

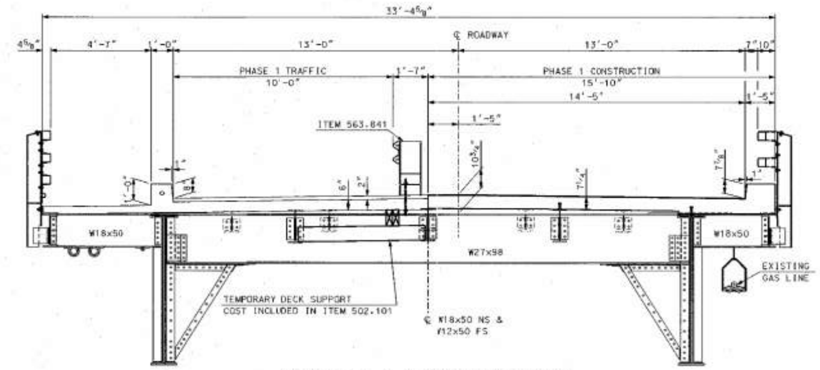
3-1-2-1


9 N.H. F 318(3) 18 64
PLAN OF BASCULE SPAN
℄ Roadway
Clip L 6x3½x⅜ every 3rd stringer.
Clip & 6x3½x⅜
Bevel Fill ⅜ Weld
"V" Notch
℄ Approach Girder
℄ Bascule Girder
See Detail Floor Joint 'B' Sheet 8
SECTION ON ℄ ROADWAY
79" Normal + 3" O.T. = 82" Max. Opening
Note: Notch Curbs As Shown
C.R. El. 34.75'
El. 22.0
El. 11.50
65'-0" c.c. Piers
SECTION A-A
SECTION B-B
SECTION C-C
SECTION D-D
PLAN
ENLARGED VIEWS AT FLOOR BREAK
See Sheet 20 for additional views & sections.
NOTES
Material - Structural Carbon Steel
Rivets - ⅞"ø
Open Holes - 15/16"ø } Unless Otherwise Shown.
STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT
PARSONS, KLAPP, BRINCKERHOFF & DOUGLAS
ENGINEERS, NEW YORK
HAMPTON HARBOR BRIDGE
PLAN AND SECTIONS
BASCULE SPAN
MADE BY R.F.Z. TR. R.B.S.
CHECKED BY M.E.F.
APPROVED
SCALE ¼" & ½" = 1'-0"
DATE MARCH 1946
JOB No. 1600
SHEET No. 18
3-1-2-9

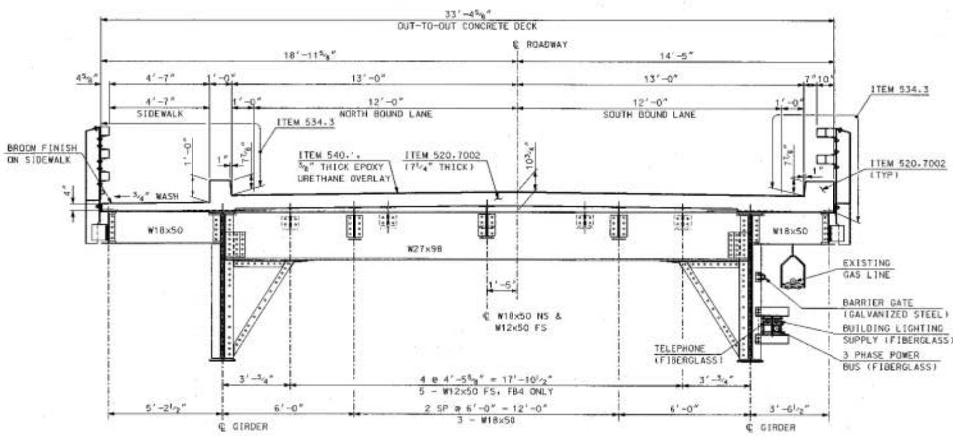

9 | N.H. | F-318(1) | 19 | 64
END VIEW SECTION A-A.
1/2" = 1'-0"
SECTION B-B.
3/4" = 1'-0"
SECTION C-C.
3/4" = 1'-0"
SECTION D-D.
1/2" = 1'-0"
SECTION E-E.
1/2" = 1'-0"
SECTION F-F.
1/2" = 1'-0"
SECTION G-G.
1/2" = 1'-0"
SECTION H-H.
1/2" = 1'-0"
SECTION J-J.
1/2" = 1'-0"
SECTION K-K.
1/2" = 1'-0"
SECTION M-M
3/4" = 1'-0"
PLAN
Slab not shown.
1/8" = 1'-0"
Curb Line
Bearing Plate
12" WF 50#
12" WF 58#
℄ Pier IN
℄ Trunnion
℄ Bascule Girder
Tar paper joint.
Anchors
Shims
Grout after erection
℄ Trunnion
NOTES
Material - Structural Carbon Steel
Rivets - 7/8"
Open Holes - 15/16" } Except as noted.
For Slab Reinforcement Details See Sections P-P And N-N On Sheet 23
STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT
PARSONS, KLAPP, BRINCKERHOFF & DOUGLAS
ENGINEERS, NEW YORK
HAMPTON HARBOR BRIDGE
FLOOR SYSTEM
OVER COUNTERWEIGHT
MADE BY D.C. TR. A.R.
CHECKED BY F.P.
APPROVED
SCALE AS NOTED
DATE MARCH 1946
JOB No. 1600
SHEET No. 19
3-1-2-1



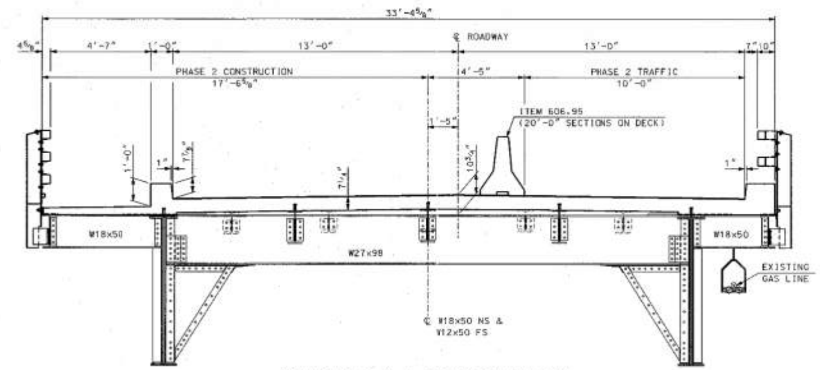
EXISTING DECK SECTION
AT FLOORBEAM 1 & 4
SCALE: ⅜" = 1'-0"



PHASE 1 & 3 CONSTRUCTION
AT FLOORBEAM 1 & 4
SCALE: ⅜" = 1'-0"



PROPOSED DECK SECTION
AT FLOORBEAM 1 & 4
SCALE: ⅜" = 1'-0"



PHASE 2 & 4 CONSTRUCTION
AT FLOORBEAM 1 & 4
SCALE: ⅜" = 1'-0"

NOTE: ALL SECTIONS LOOKING SOUTH

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN HAMPTON — BRIDGE NO. 235/025 — STATE PROJECT 14188
LOCATION NH ROUTE 1A over HAMPTON RIVER

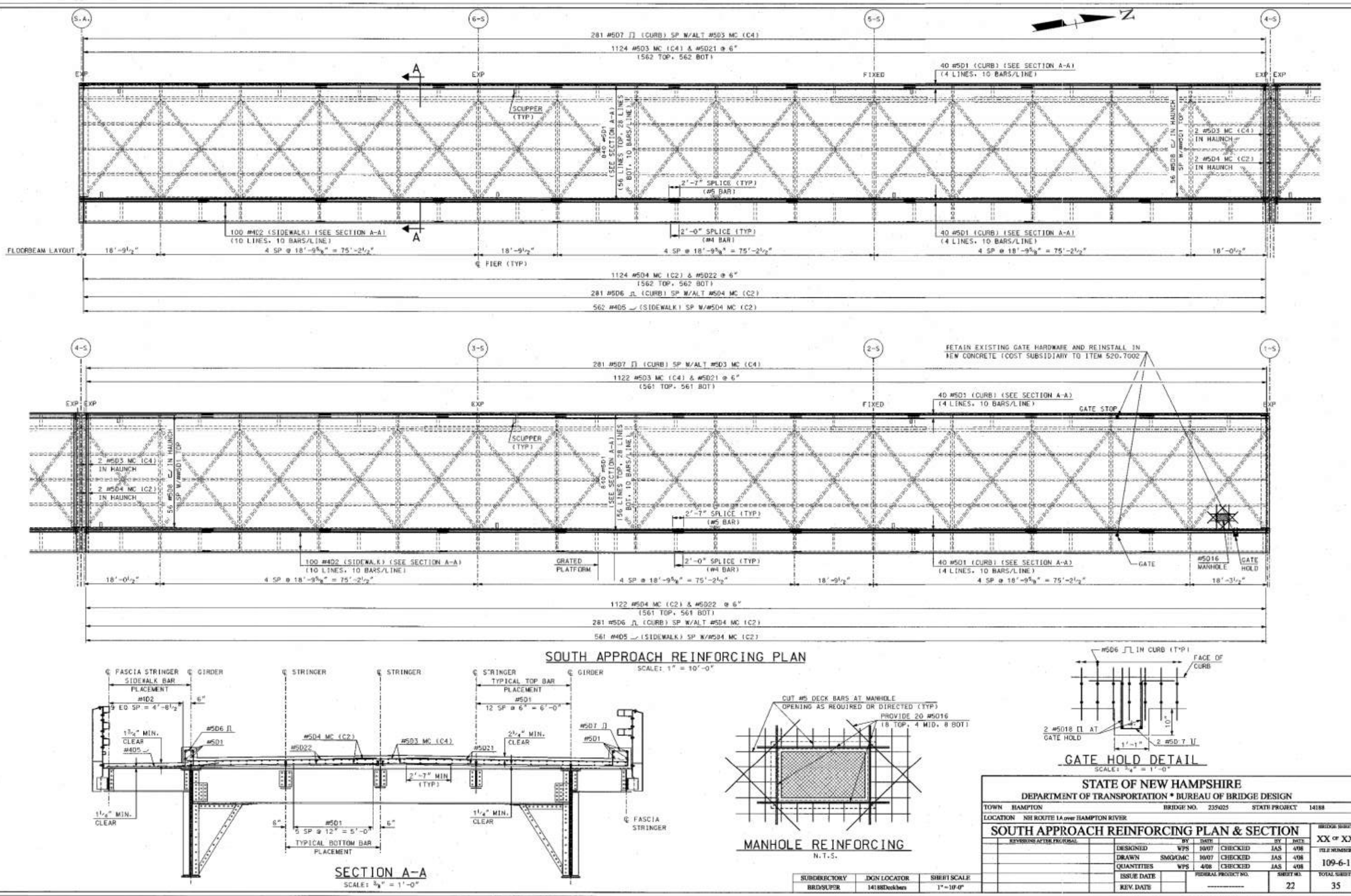
DECK SECTIONS AND PHASING

	BY	DATE		BY	DATE
DESIGNED	JAS	8/07	CHECKED	SWJ	4/08
DRAWN	SMG	8/07	CHECKED	SWJ	4/08
QUANTITIES	JAS	4/08	CHECKED	WPS	4/08

REVISIONS AFTER PROPOSAL

BRIDGE SHEET: XX OF XX
FILE NUMBER: 109-6-1

SUBDIRECTORY	DGN LOCATOR	SHEET SCALE	ISSUE DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
BRD/SUPER	14188decksect	AS NOTED	REV. DATE	----------	21	35



STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN: HAMPTON — BRIDGE NO. 235/025 — STATE PROJECT 14188
LOCATION: NH ROUTE 1A over HAMPTON RIVER

SOUTH APPROACH REINFORCING PLAN & SECTION

	BY	DATE		BY	DATE
DESIGNED	WPS	10/07	CHECKED	JAS	4/08
DRAWN	SMG/GMC	10/07	CHECKED	JAS	4/08
QUANTITIES	WPS	4/08	CHECKED	JAS	4/08

BRIDGE SHEET: XX OF XX
FILE NUMBER: 109-6-1
SHEET NO. 22 — TOTAL SHEETS 35

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
BRD/SUPER	14188Deckbars	1" = 10'-0"

Appendix D:
Existing Utility Information

VICTORIA F. SHEEHAN
COMMISSIONER

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION
JOHN O. MORTON BUILDING, P.O. BOX 483, CONCORD, NH 03301

LETTER OF TRANSMITTAL

RECEIVED
OCT - 4 2016
BUREAU OF BRIDGE DESIGN
NH DEPT. OF TRANSPORTATION

BUREAU OF HIGHWAY DESIGN
UTILITY SECTION

TO: **David Scott**
In-House Design Chief
Bureau of Bridge Design

DATE: October 4, 2016
PROJECT: Seabrook-Hampton
15904

WE ARE SENDING YOU THE FOLLOWING: ☒ Attached ☐ Under Separate Cover via __________the following:

☒ Shop Drawings ☐ Prints ☐ Specifications ☒ Plans
☒ Copy of Letter ☐ Falsework ☐ Catalog Cuts ☐ Other

COPIES	DATE(S)	NO. OF SHEETS	DESCRIPTION
1	October 4, 2016	5	Shop Drawings from FairPoint Communications showing their telephone facilities
1	October 4, 2016	1	Copy of Letter from FairPoint Communications describing their telephone facilities

THESE ARE TRANSMITTED as checked below:

☐ For Approval ☐ Approved As Submitted ☐ RETURNED for Corrections
☒ For Your Use ☐ Approved As Noted ☐ RETURN Originals
☐ As Requested ☒ For Review and Comment ☐ RESUBMIT copies for approval ___ Ea.
☐ For Info. Only ☐ Investigate and Report ☐ SUBMIT for distribution ___ Ea.

REMARKS: Please incorporate this information into a base plan. There will be anticipated impacts to the telephone facilities. If you have any questions feel free to ask Brett McCrea in Design Services – Utilities.

COPY TO: Utility File

SIGNED: Brett D. McCrea
Brett McCrea
Utility Coordinator

FairPoint communications

RECEIVED
OCT 09 2015
NHDOT
Highway Design

October 6, 2015

Brett McCrea
NHDOT
Bureau of Highway Design
7 Hazen Drive
Concord, NH. 03302

Hampton-Seabrook
NH DOT#15904
Route 1A Bridge Replacement

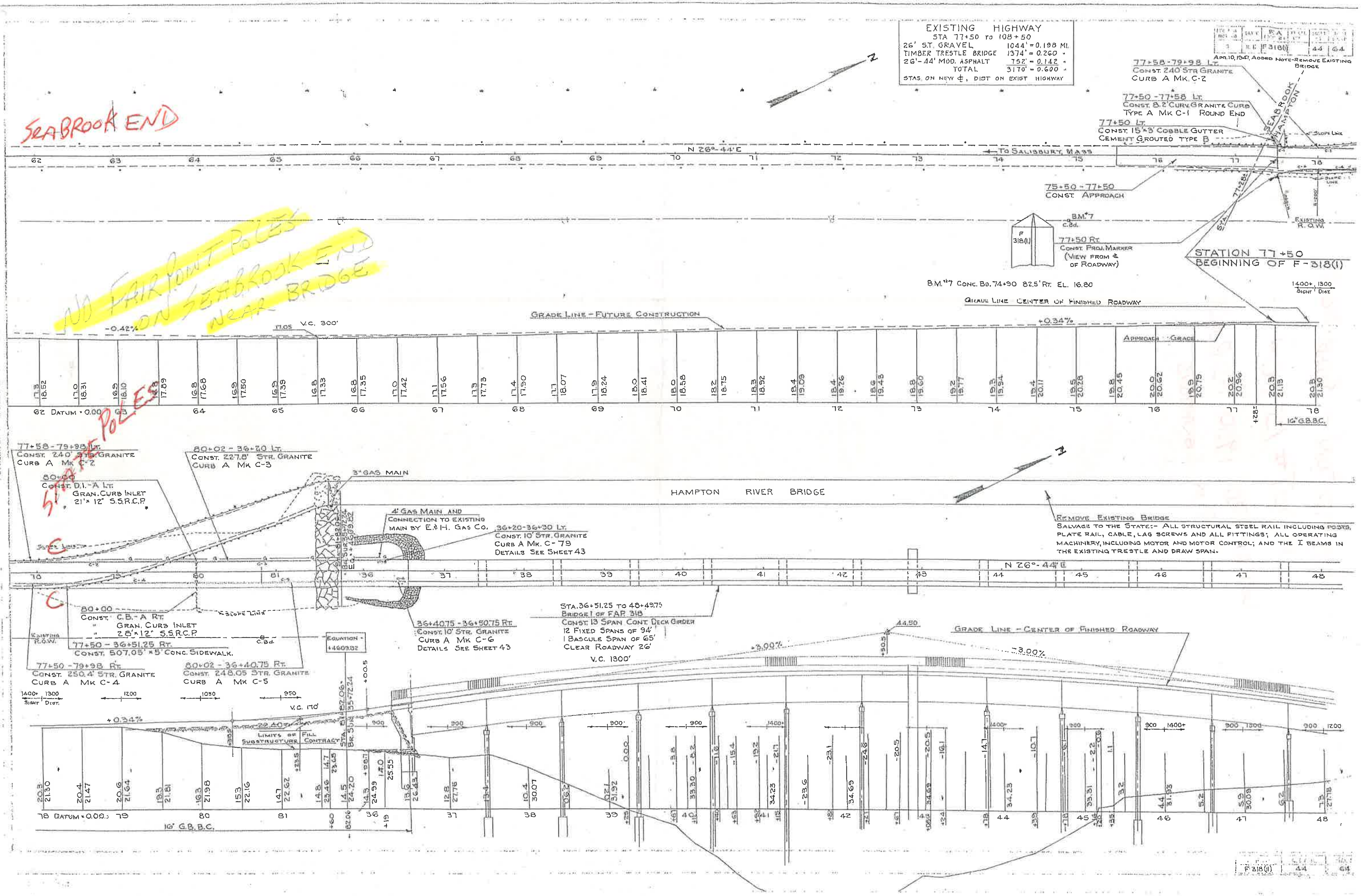
Dear Brett,

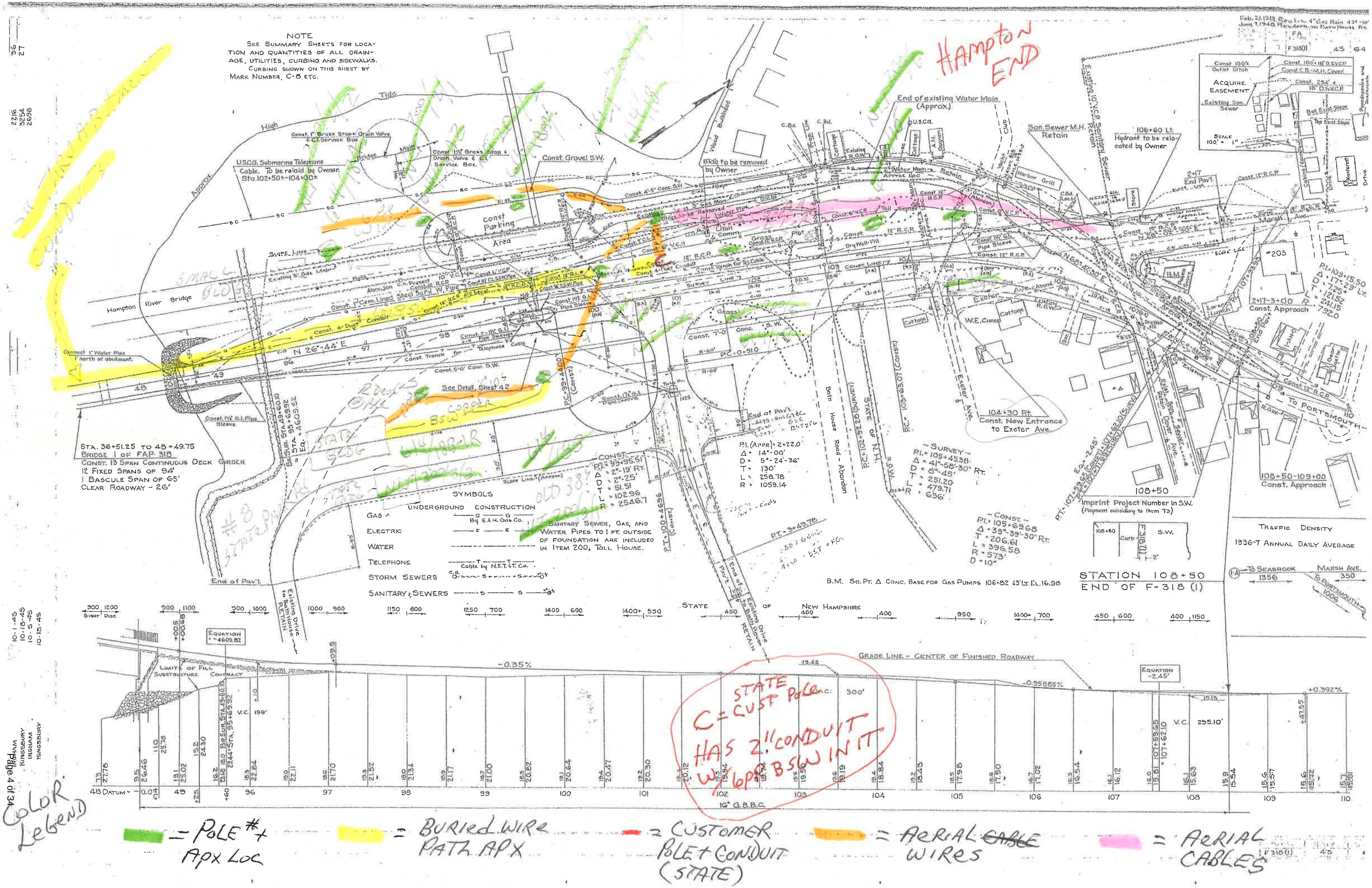
Enclosed are the marked up Google photos/plans showing our aerial facilities in the area of the proposed bridge work. I used the Google photos due to the 1950 as builts that were sent were lacking in many of the existing land and roadway features which exist out here today. We have a buried service wire in a 2" conduit which feeds off a State owned riser pole opposite P614/18 that feeds the control tower on the bridge high lighted in yellow. The exact location of that conduit going along the island area would need to be verified in the field via DIG-SAFE if needed in the future.

If you have any questions please call me at 433-2119.

Sincerely,

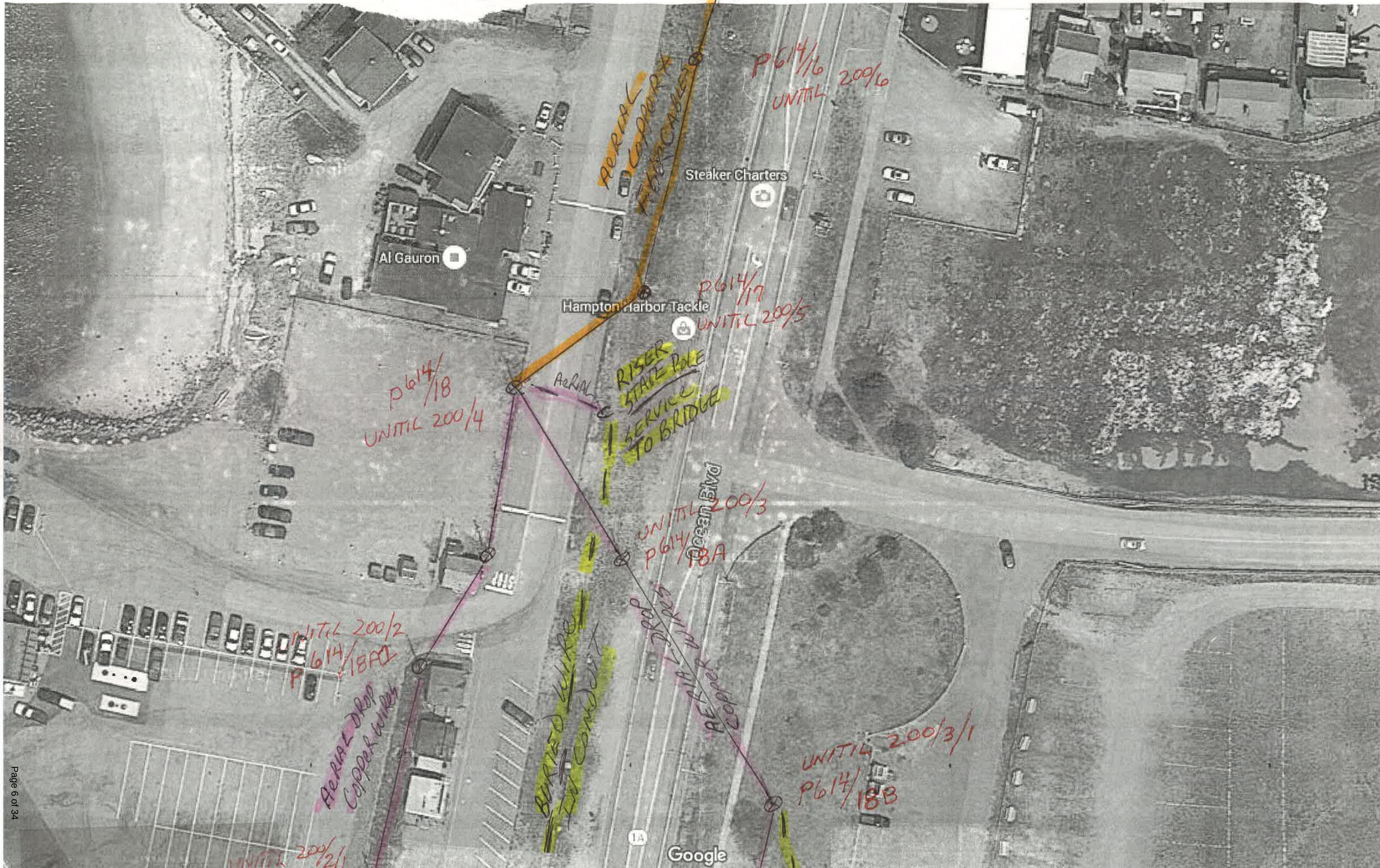
David Kestner
Fairpoint Engineer

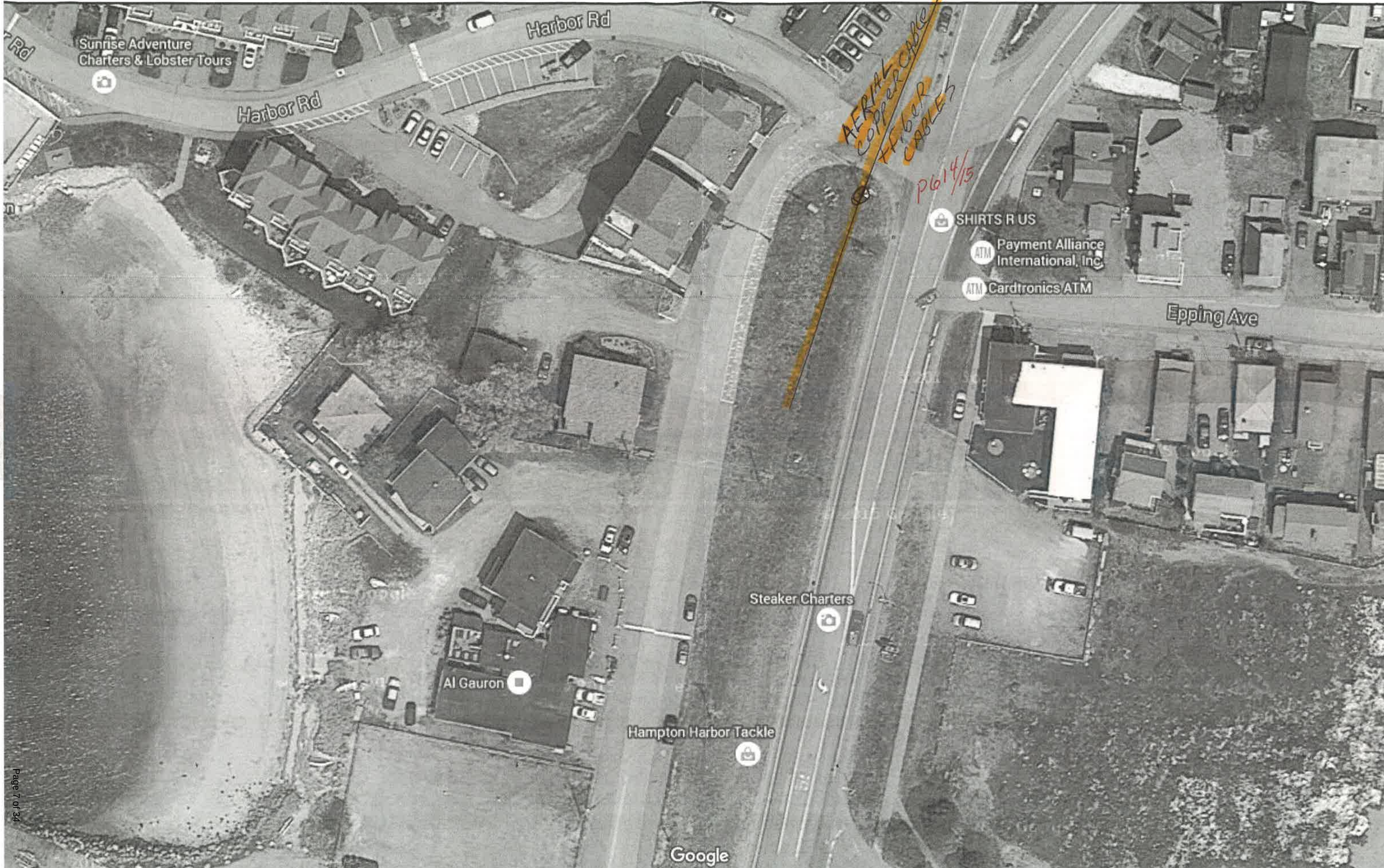

SEABROOK END
NO FAIRPOINT POLES ON SEABROOK END NEAR BRIDGE
5 FAIRPOINT POLES
EXISTING HIGHWAY
STA 77+50 TO 108+50
26' ST. GRAVEL 1044' = 0.198 MI.
TIMBER TRESTLE BRIDGE 1374' = 0.260
26'-44' MOD. ASPHALT 752' = 0.142
TOTAL 3170' = 0.600
STAS. ON NEW ℄, DIST ON EXIST HIGHWAY
APR. 10, 1947, ADDED NOTE-REMOVE EXISTING BRIDGE
77+58 - 79+98 LT.
CONST. 240' STR. GRANITE
CURB A MK. C-2
77+50 - 77+58 LT.
CONST. 8.2' CURV. GRANITE CURB
TYPE A MK C-1 ROUND END
77+50 LT.
CONST. 15'x3' COBBLE GUTTER
CEMENT GROUTED TYPE B
SEABROOK
HAMPTON
N 26°-44' E
TO SALISBURY, MASS
75+50 - 77+50
CONST. APPROACH
BM 7
77+50 RT.
CONST. PROJ. MARKER
(VIEW FROM ℄ OF ROADWAY)
EXISTING R.O.W.
STATION 77+50
BEGINNING OF F-318(1)
B.M. 7 CONC. BO. 74+90 82.5' RT. EL. 16.80
GRADE LINE CENTER OF FINISHED ROADWAY
GRADE LINE - FUTURE CONSTRUCTION
+0.34%
-0.42%
V.C. 300'
APPROACH GRADE
62 DATUM = 0.00
16" G.B.B.C.
80+02 - 36+30 LT.
CONST. 227.8' STR. GRANITE
CURB A MK C-3
80+00
CONST. D.I.-A LT.
GRAN. CURB INLET
21"x 12" S.S.R.C.P.
3" GAS MAIN
HAMPTON RIVER BRIDGE
4" GAS MAIN AND
CONNECTION TO EXISTING
MAIN BY E.&H. GAS CO.
36+20 - 36+30 LT.
CONST. 10' STR. GRANITE
CURB A MK. C-7B
DETAILS SEE SHEET 43
REMOVE EXISTING BRIDGE
SALVAGE TO THE STATE:- ALL STRUCTURAL STEEL RAIL INCLUDING POSTS, PLATE RAIL, CABLE, LAG SCREWS AND ALL FITTINGS; ALL OPERATING MACHINERY, INCLUDING MOTOR AND MOTOR CONTROL; AND THE I BEAMS IN THE EXISTING TRESTLE AND DRAW SPAN.
80+00
CONST. C.B.-A RT.
GRAN. CURB INLET
2.5"x 12" S.S.R.C.P.
77+50 - 36+51.25 RT.
CONST. 507.05' x 5' CONC. SIDEWALK.
77+50 - 79+98 RT.
CONST. 250.4' STR. GRANITE
CURB A MK C-4
80+02 - 36+40.75 RT.
CONST. 248.05 STR. GRANITE
CURB A MK C-5
EQUATION +4609.82
36+40.75 - 36+50.75 RT.
CONST. 10' STR. GRANITE
CURB A MK C-6
DETAILS SEE SHEET 43
STA. 36+51.25 TO 48+49.75
BRIDGE I OF FAP 318
CONST. 13 SPAN CONT. DECK GIRDER
12 FIXED SPANS OF 94'
1 BASCULE SPAN OF 65'
CLEAR ROADWAY 26'
V.C. 1300'
GRADE LINE - CENTER OF FINISHED ROADWAY
+3.00%
-3.00%
44.50
V.C. 170'
LIMITS OF FILL
SUBSTRUCTURE CONTRACT
78 DATUM = 0.00
10' G.B.B.C.
F 318(1) 44 64
KINGSBURY
TUTTLE



NOTE
See Summary Sheets for location and quantities of all drainage, utilities, curbing and sidewalks. Curbing shown on this sheet by Mark Number, C-8 etc.
Hampton River Bridge
Sta. 36+51.25 to 48+49.75
Bridge 1 of FAP 318
Const. 13 Span Continuous Deck Girder
12 Fixed Spans of 94'
1 Bascule Span of 65'
Clear Roadway - 26'
U.S.C.G. Submarine Telephone Cable. To be relaid by Owner. Sta.102+50±-104+00±
Connect 1" Water Pipe 1' north of abutment.
Const. Parking Area
N 26°-44' E
Hampton END
End of existing Water Main (Approx.)
Bldg to be removed by Owner
Harbor Grill
San. Sewer M.H. Retain
Existing 10" V.C.P. Sanitary Sewer Retain
106+60 Lt. Hydrant to be relocated by Owner
Acquire Easement
Bath House Road - Abandon
State of N.H.
104+30 Rt. Const. New Entrance to Exeter Ave.
To Portsmouth
SYMBOLS
UNDERGROUND CONSTRUCTION
GAS
ELECTRIC
WATER
TELEPHONE
STORM SEWERS
SANITARY SEWERS
Sanitary Sewer, Gas, and Water Pipes to 1 pt. outside of foundation are included in Item 200, Toll House.
B.M. Sq. Pt. Δ Conc. Base for Gas Pumps 106+82 45' Lt. El. 16.98
STATION 108+50
END OF F-318 (1)
Traffic Density
1936-7 Annual Daily Average
To Seabrook 1356
Marsh Ave. 350
To Portsmouth 1006
Imprint Project Number in S.W. (Payment subsidiary to Item 73)
Grade Line - Center of Finished Roadway
-0.35%
-0.95885%
+0.392%
Equation -2.45'
Equation +4609.82
Limits of Fill Substructure Contract
48 Datum
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
C = STATE CUST Pole
HAS 2" CONDUIT W/ 6PR BSW IN IT
COLOR LEGEND
= POLE # + APX LOC
= BURIED WIRE PATH APX
= CUSTOMER POLE + CONDUIT (STATE)
= AERIAL ~~CABLE~~ WIRES
= AERIAL CABLES
10-1-45
10-18-45
10-5-45
10-15-45
Marsh
Kingsbury
Ingham
Kingsbury


P6 14/18A2
UNTIL 200/2/2
P614/18A3
Three Buoys Charters
Ocean Blvd
AERIAL Fiber WIRE
BURIED SERVICE WIRE
P614/18B-1R
UNTIL 200/3/3
BURIED SERVICE WIRE
IN CONDUIT TO BRIDGE
ATTACHED TO BRIDGE
Locke Point
Ocean Blvd
Google


AERIAL COPPER FIBER CABLES
P614/16 UNTIL 200/6
Steaker Charters
Al Gauron
Hampton Harbor Tackle
P614/17 UNTIL 200/5
RISER STATE POLE SERVICE TO BRIDGE
AERIAL
P614/18 UNTIL 200/4
Ocean Blvd
UNITIL 200/3 P614/18A
UNITIL 200/2 P614/18A1
AERIAL DROP COPPER WIRES
BURIED WIRE IN CONDUIT
AERIAL DROP COPPER WIRES
UNITIL 200/3/1 P614/18B
UNITIL 200/2/1
1A
Google


Harbor Rd
Sunrise Adventure Charters & Lobster Tours
Harbor Rd
AERIAL COPPER CABLE + FIBER CABLES
P614/15
SHIRTS R US
Payment Alliance International, Inc.
Cardtronics ATM
Epping Ave
Steaker Charters
Al Gauron
Hampton Harbor Tackle
Google

VICTORIA F. SHEEHAN
COMMISSIONER

RECEIVED
OCT - 4 2016
BUREAU OF BRIDGE DESIGN
NH DEPT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION
JOHN O. MORTON BUILDING, P.O. BOX 483, CONCORD, NH 03301

LETTER OF TRANSMITTAL

BUREAU OF HIGHWAY DESIGN
UTILITY SECTION

TO: **David Scott**
In-House Design Chief
Bureau of Bridge Design

DATE: October 4, 2016
PROJECT: Seabrook-Hampton
15904

WE ARE SENDING YOU THE FOLLOWING: ☒ Attached ☐ Under Separate Cover via _________ the following:

☒ Shop Drawings ☐ Prints ☐ Specifications ☒ Plans
☒ Copy of Letter ☐ Falsework ☐ Catalog Cuts ☐ Other

COPIES	DATE(S)	NO. OF SHEETS	DESCRIPTION
1	October 4, 2016	2	Shop Drawings from Hampton Public Works Department showing their sewer facilities
1	October 4, 2016	1	Email from Hampton Public Works Department describing their sewer facilities

THESE ARE TRANSMITTED as checked below:

☐ For Approval ☐ Approved As Submitted ☐ RETURNED for Corrections
☒ For Your Use ☐ Approved As Noted ☐ RETURN Originals
☐ As Requested ☒ For Review and Comment ☐ RESUBMIT copies for approval ___ Ea.
☐ For Info. Only ☐ Investigate and Report ☐ SUBMIT for distribution ___ Ea.

REMARKS: Please incorporate this information into a base plan. There will be anticipated impacts to Hampton Public Works Department's sewer facilities. If you have any questions feel free to ask Brett McCrea in Design Services – Utilities.

COPY TO: Utility File

SIGNED: Brett S. McCrea
Brett McCrea
Utility Coordinator

McCrea, Brett

From:	Brett McCrea
Sent:	Thursday, October 01, 2015 12:53 PM
To:	'tspainhower@town.hampton.nh.us'
Cc:	Lennart Suther
Subject:	Seabrook-Hampton 15904 NH 1A Bridge over Hampton River
Attachments:	14188 As-Built General Plan.pdf; 14188 Site Plan.pdf; 1950 As-Built Roadway Plan.pdf; 1950 As-Built Roadway Plan (2).pdf

Tracking:	**Recipient**	**Read**
	'tspainhower@town.hampton.nh.us'	
	Lennart Suther	Read: 10/1/2015 12:58 PM

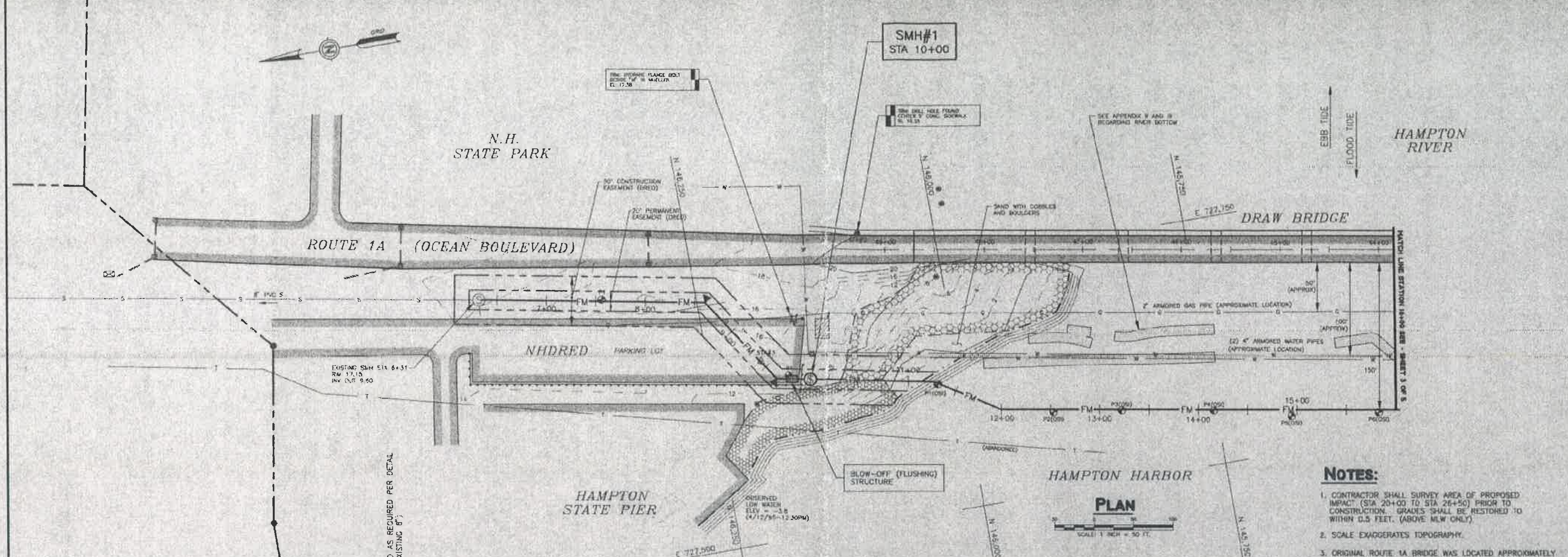
Tobey,

The State requests your company in the re-verification of your sewer facilities for the above noted State project. This project is the currently being advertised as the removal of lead based paint, rehabilitation and recoating of steel stringers on the NH 1A bridge over the Hampton River in Seabrook and Hampton, New Hampshire. This bridge painting project is currently being re-evaluated as a potential bridge replacement project and the Department's normal verification process is not being used for this study. The bridge deck was recently rehabilitated in the Hampton 14188 project that was completed in 2010.

Hampton Public Works Department verified the sewer facilities for that project in 2005 and stated that there is sewer force main from a manhole on the south end of the bridge continuing under the harbor to the north end of the bridge to a manhole near the existing pump house. The Department requests your department update and mark up the attached "as-built" plans with the size, type of pipe, and depth below the existing grade of all existing sewer main lines and services along with the abandoned sewer facilities if any on the plan. Attached for your review process is the 14188 general plan and site plan and the 1950 roadway plans north and south of the bridge. Please reply with this information by October 23, 2015 as an internal Department meeting to discuss the study is scheduled for November 2, 2015. If you have any questions feel free to ask.

Sincerely,

Brett McCrea
Utility Coordinator
New Hampshire Department of Transportation
John O. Morton Building
7 Hazen Drive
P.O. Box 483
Concord, NH 03302-0483
Tel (603) 271-1988
Fax (603) 271-7025
bmccrea2@dot.state.nh.us



NOTES:

1. CONTRACTOR SHALL SURVEY AREA OF PROPOSED IMPACT (STA 20+00 TO STA 26+50) PRIOR TO CONSTRUCTION. GRADES SHALL BE RESTORED TO WITHIN 0.5 FEET. (ABOVE MLW ONLY)
2. SCALE EXAGGERATES TOPOGRAPHY.
3. ORIGINAL ROUTE 1A BRIDGE WAS LOCATED APPROXIMATELY WITHIN PROPOSED FORCE MAIN CORRIDOR. ABANDONED COMPONENTS MAY BE PRESENT.
4. ARMORED PIPE SHALL BE INSTALLED WITH 2% SLACK BETWEEN STA 12+00 AND 19+00. ACTUAL PIPE LENGTH REQUIRED IS APPROXIMATELY 1520 FEET.

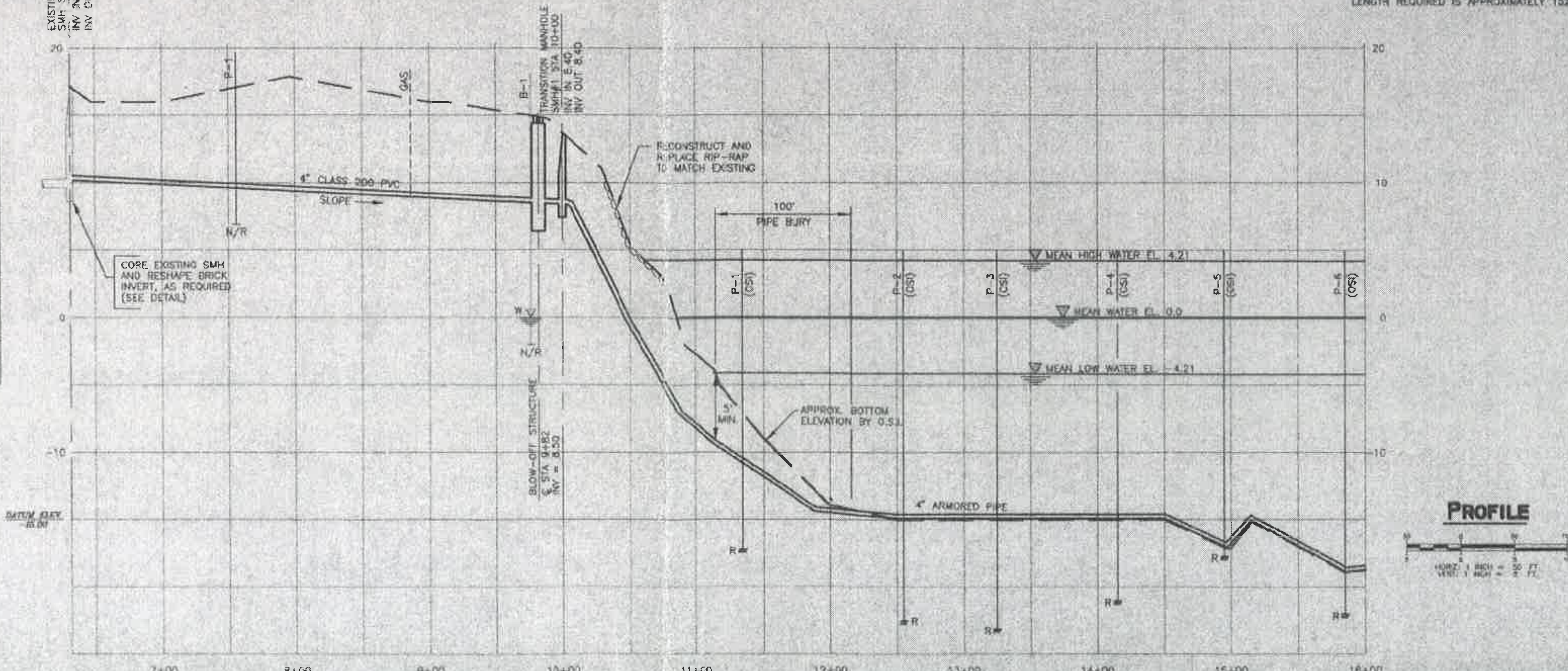
CONSTRUCTION LAYOUT INFORMATION:

SEWER FORCE MAIN

STATION	NORTHING	EASTING	DESCRIPTION
8+60	146242.16	727753.21	45° BEND IN FORCE MAIN
9+86	146183.85	727664.25	45° BEND IN FORCE MAIN
10+00	146150.90	727657.72	SMH#1 (START ARMORED PIPE)
11+25	146027.12	727633.17	BEND IN FORCE MAIN
12+00	145905.17	727593.48	BEND IN FORCE MAIN
15+00	145669.59	727540.78	FORCE MAIN
18+00	145374.25	727488.22	FORCE MAIN
22+10	144969.46	727415.99	BEND IN FORCE MAIN
24+70	144713.94	727456.35	BEND IN FORCE MAIN
25+00	144588.86	727473.00	SMH#2 (END ARMORED PIPE)
26+00	144559.55	727564.33	FORCE MAIN
26+50	144635.43	727595.39	END CONTRACT #1

SURVEY CONTROL:

STATION	NORTHING	EASTING	DESCRIPTION
STA#2	146076.03	727795.49	DRILL HOLE
STA#3	146195.96	727584.44	BOLT IN PVMT
STA#4	144734.22	727421.91	PL IN VALVE
STA#5	144500.88	727538.22	HUB + TACK
STA#6	144484.19	727364.53	PK NAIL



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TOWN OF HAMPTON
HAMPTON, NEW HAMPSHIRE

SUN VALLEY SEWERS

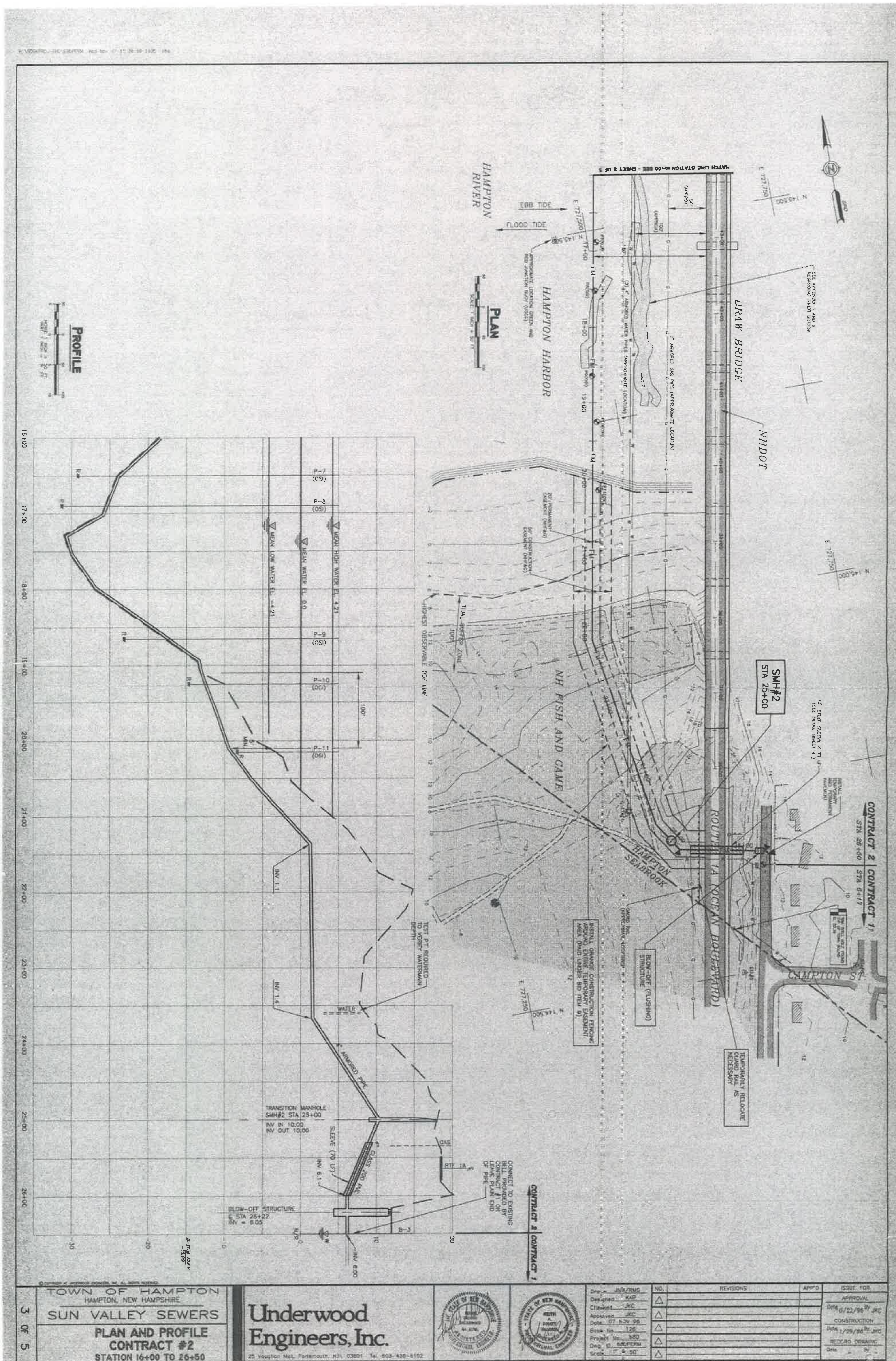
PLAN AND PROFILE
CONTRACT #2
STATION 6+31 TO 16+00

2 OF 5

Underwood Engineers, Inc.
25 Vaughan Mall, Portsmouth, N.H. 03801 Tel. 603-436-6192

Drawn: JRM/RMG
Designed: KAF
Checked: JKC
Approved: JKC
Date: 07 NOV 96
Book No. 126
Project No. 580
Dwg. ID: 460PEPLN
Scale: 1" = 50'

NO.	REVISIONS	APP'D	ISSUE FOR
			APPROVAL Date 10/22/96 By JKC
			CONSTRUCTION Date 1/29/96 By JKC
			RECORD DRAWING Date - By -



TOWN OF HAMPTON
HAMPTON, NEW HAMPSHIRE
SUN VALLEY SEWERS
PLAN AND PROFILE
CONTRACT #2
STATION 16+00 TO 26+50
3 OF 5
Underwood Engineers, Inc.
DRAW BRIDGE
NHDOT
HAMPTON HARBOR
HAMPTON RIVER
NH FISH AND GAME
ROUTE 1A OCEAN BOULEVARD
CAMPTON ST.
SMH#2
STA 25+00
PLAN
PROFILE
EBB TIDE
FLOOD TIDE
MEAN HIGH WATER EL 4.21
MEAN WATER EL 0.0
MEAN LOW WATER EL -4.21
TRANSITION MANHOLE
SMH#2 STA 25+00
INV IN 10.00
INV OUT 10.00
BLOW-OFF STRUCTURE
STA 25+22
INV = 8.05
BLOW-OFF (FLUSHING) STRUCTURE
CONTRACT 2
CONTRACT 1
REVISIONS
ISSUE FOR
APPROVAL
CONSTRUCTION
RECORD DRAWING

VICTORIA F. SHEEHAN
COMMISSIONER

RECEIVED
OCT - 4 2016
BUREAU OF BRIDGE DESIGN
NH DEPT OF TRANSPORTATION

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION
JOHN O. MORTON BUILDING, P.O. BOX 483, CONCORD, NH 03301

LETTER OF TRANSMITTAL

BUREAU OF HIGHWAY DESIGN
UTILITY SECTION

TO: **David Scott**
In-House Design Chief
Bureau of Bridge Design

DATE: October 4, 2016
PROJECT: Seabrook-Hampton
15904

WE ARE SENDING YOU THE FOLLOWING: ☒ Attached ☐ Under Separate Cover via _________ the following:

☒ Shop Drawings ☐ Prints ☐ Specifications ☒ Plans
☒ Copy of Letter ☐ Falsework ☐ Catalog Cuts ☐ Other

COPIES	DATE(S)	NO. OF SHEETS	DESCRIPTION
1	October 4, 2016	2	Shop Drawings from Seabrook Water Department showing their water facilities
1	October 4, 2016	1	Copy of Letter from Seabrook Water Department describing their water facilities

THESE ARE TRANSMITTED as checked below:

☐ For Approval ☐ Approved As Submitted ☐ RETURNED for Corrections
☒ For Your Use ☐ Approved As Noted ☐ RETURN Originals
☐ As Requested ☒ For Review and Comment ☐ RESUBMIT copies for approval ___ Ea.
☐ For Info. Only ☐ Investigate and Report ☐ SUBMIT for distribution ___ Ea.

REMARKS: Please incorporate this information into a base plan. There will be anticipated impacts to Seabrook Water Department's water facilities. If you have any questions feel free to ask Brett McCrea in Design Services – Utilities.

COPY TO: Utility File

SIGNED: Brett S. McCrea
Brett McCrea
Utility Coordinator

Seabrook Water Department
Groundwater Treatment Facility
550 Route 107 ~ PO Box 456
Seabrook, NH 03874
(603) 474-9921

October 6, 2015

Brett McCrea, Utility Coordinator
New Hampshire DOT
John O. Morton Building
7 Hazen Drive
P.O. Box 483
Concord, NH 03302-0483

Re: SEABROOK-HAMPTON 15904 NH 1A Bridge over Hampton River

Dear Mr. McCrea:

Per your request we have enclosed two drawings showing our water system facilities in the area south of the Seabrook-Hampton Route 1A Bridge.

Should you have any questions, please call.

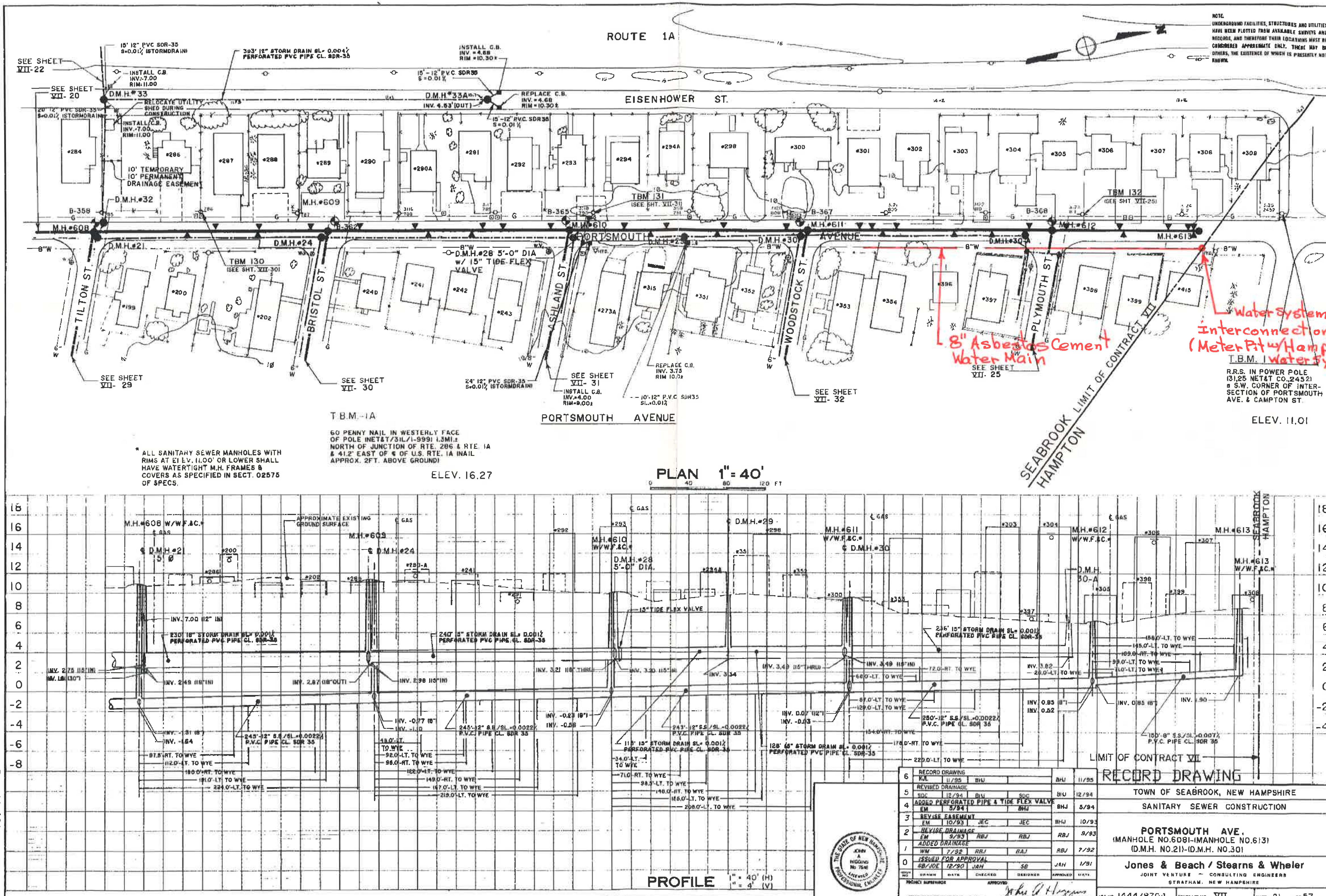
Very truly yours,

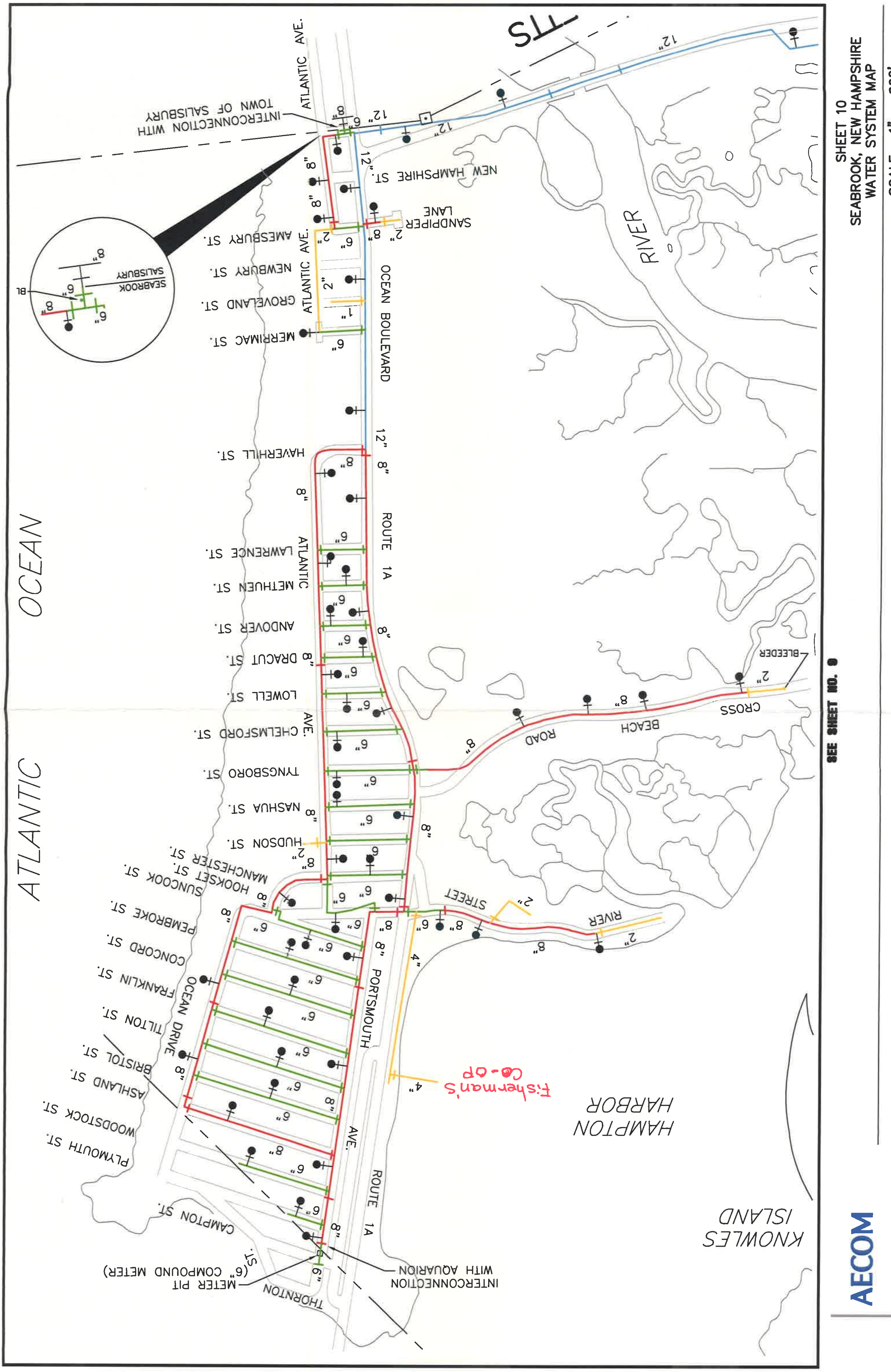
Seabrook Water Department

Curtis Slayton
Water Superintendent

Enclosures

RECEIVED
OCT 08 2015
NHDOT
Highway Design


NOTE
UNDERGROUND FACILITIES, STRUCTURES AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS AND RECORDS, AND THEREFORE THEIR LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY. THERE MAY BE OTHERS, THE EXISTENCE OF WHICH IS PRESENTLY NOT KNOWN.
ROUTE 1A
EISENHOWER ST.
PORTSMOUTH AVENUE
TILTON ST.
BRISTOL ST.
ASHLAND ST.
WOODSTOCK ST.
PLYMOUTH ST.
SEABROOK LIMIT OF CONTRACT VII
HAMPTON
Water System Interconnection (Meter Pit w/ Hampton Water System)
8" Asbestos Cement Water Main
T.B.M. 1
R.R.S. IN POWER POLE (31,25 NET&T CO.,2452) @ S.W. CORNER OF INTERSECTION OF PORTSMOUTH AVE. & CAMPTON ST.
ELEV. 11.01
T.B.M.-1A
60 PENNY NAIL IN WESTERLY FACE OF POLE (NET&T/31L/1-999) 1.3MI.± NORTH OF JUNCTION OF RTE. 286 & RTE. 1A & 41.2' EAST OF ℄ OF U.S. RTE. 1A (NAIL APPROX. 2FT. ABOVE GROUND)
ELEV. 16.27
* ALL SANITARY SEWER MANHOLES WITH RIMS AT ELEV. 11.00' OR LOWER SHALL HAVE WATERTIGHT M.H. FRAMES & COVERS AS SPECIFIED IN SECT. 02575 OF SPECS.
PLAN 1" = 40'
PROFILE 1" = 40' (H) 1" = 4' (V)
LIMIT OF CONTRACT VII
RECORD DRAWING
TOWN OF SEABROOK, NEW HAMPSHIRE
SANITARY SEWER CONSTRUCTION
PORTSMOUTH AVE.
(MANHOLE NO.608-MANHOLE NO.613)
(D.M.H. NO.21-D.M.H. NO.30)
Jones & Beach / Stearns & Wheeler
JOINT VENTURE ~ CONSULTING ENGINEERS
STRATHAM, NEW HAMPSHIRE
JOB NO. 1444/8704
CONTRACT NO. VII
SHEET 21 OF 57


SHEET 10
SEABROOK, NEW HAMPSHIRE
WATER SYSTEM MAP
SCALE: 1" = 600'
AECOM
MARCH 2009
PROJECT NO. 46630
SEE SHEET NO. 9
ATLANTIC OCEAN
HAMPTON HARBOR
KNOWLES ISLAND
RIVER
INTERCONNECTION WITH TOWN OF SALISBURY
INTERCONNECTION WITH AQUARION
METER PIT (6" COMPOUND METER)
SEABROOK
SALISBURY
BL
BLEEDER
Fisherman's Co-op
ATLANTIC AVE.
OCEAN BOULEVARD
ROUTE 1A
NEW HAMPSHIRE ST.
SANDPIPER LANE
AMESBURY ST.
NEWBURY ST.
GROVELAND ST.
MERRIMAC ST.
HAVERHILL ST.
LAWRENCE ST.
METHUEN ST.
ANDOVER ST.
DRACUT ST.
LOWELL ST.
CHELMSFORD ST.
TYNGSBORO ST.
NASHUA ST.
HUDSON ST.
MANCHESTER ST.
HOOKSET ST.
SUNCOOK ST.
PEMBROKE ST.
CONCORD ST.
FRANKLIN ST.
TILTON ST.
BRISTOL ST.
ASHLAND ST.
WOODSTOCK ST.
PLYMOUTH ST.
CAMPTON ST.
THORNTON ST.
OCEAN DRIVE
PORTSMOUTH AVE.
CROSS BEACH ROAD
RIVER STREET

VICTORIA F. SHEEHAN
COMMISSIONER

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION
JOHN O. MORTON BUILDING, P.O. BOX 483, CONCORD, NH 03301

LETTER OF TRANSMITTAL

RECEIVED
OCT - 4 2016
BUREAU OF BRIDGE DESIGN
NH DEPT. OF TRANSPORTATION

BUREAU OF HIGHWAY DESIGN
UTILITY SECTION

TO: **David Scott**
In-House Design Chief
Bureau of Bridge Design

DATE: October 4, 2016
PROJECT: Seabrook-Hampton
15904

WE ARE SENDING YOU THE FOLLOWING: ☒ Attached ☐ Under Separate Cover via ________ the following:

☒ Shop Drawings ☐ Prints ☐ Specifications ☒ Plans
☒ Copy of Letter ☐ Falsework ☐ Catalog Cuts ☐ Other

COPIES	DATE(S)	NO. OF SHEETS	DESCRIPTION
1	October 4, 2016	2	Shop Drawings from Unitil Energy Systems showing their electric facilities

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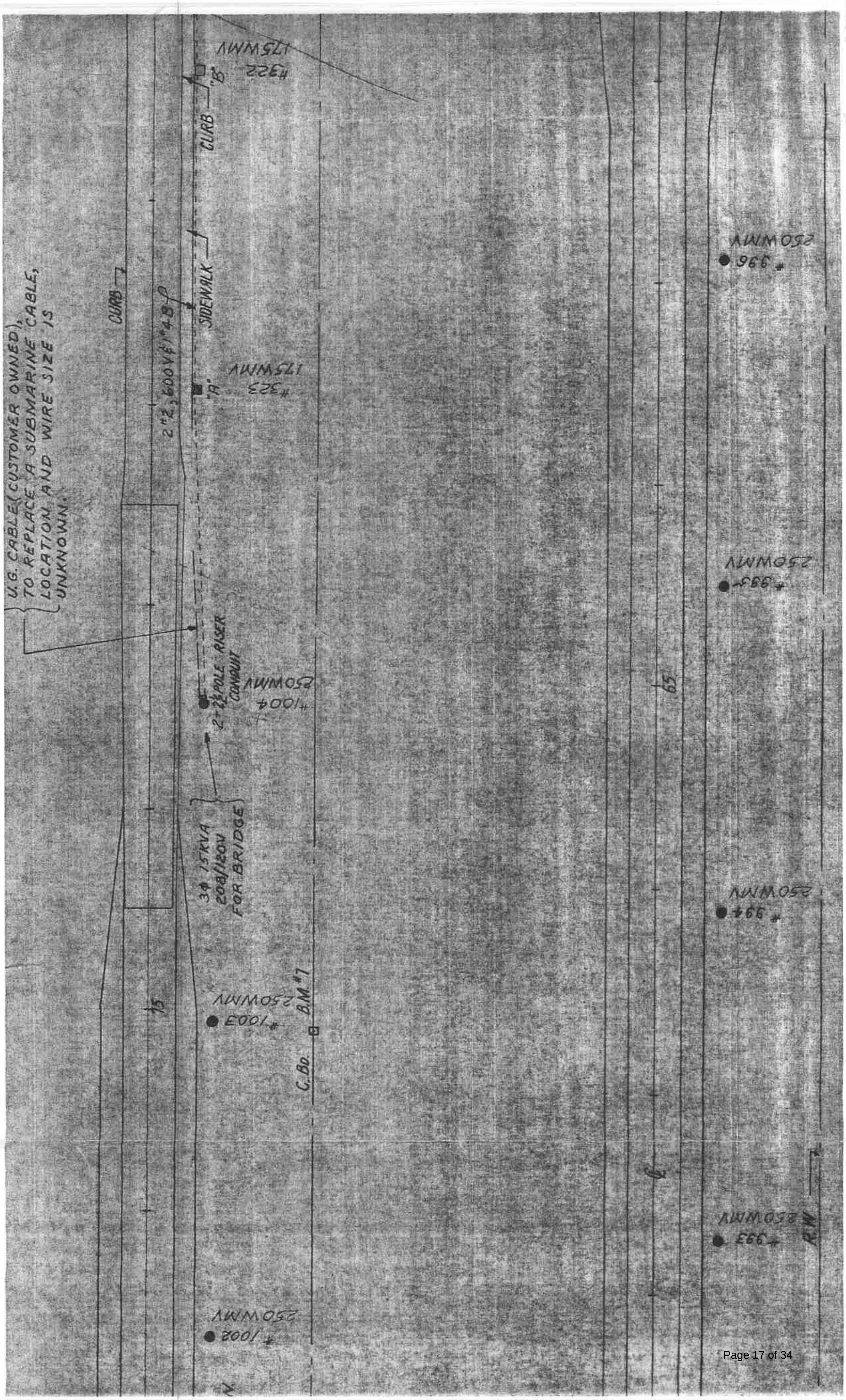
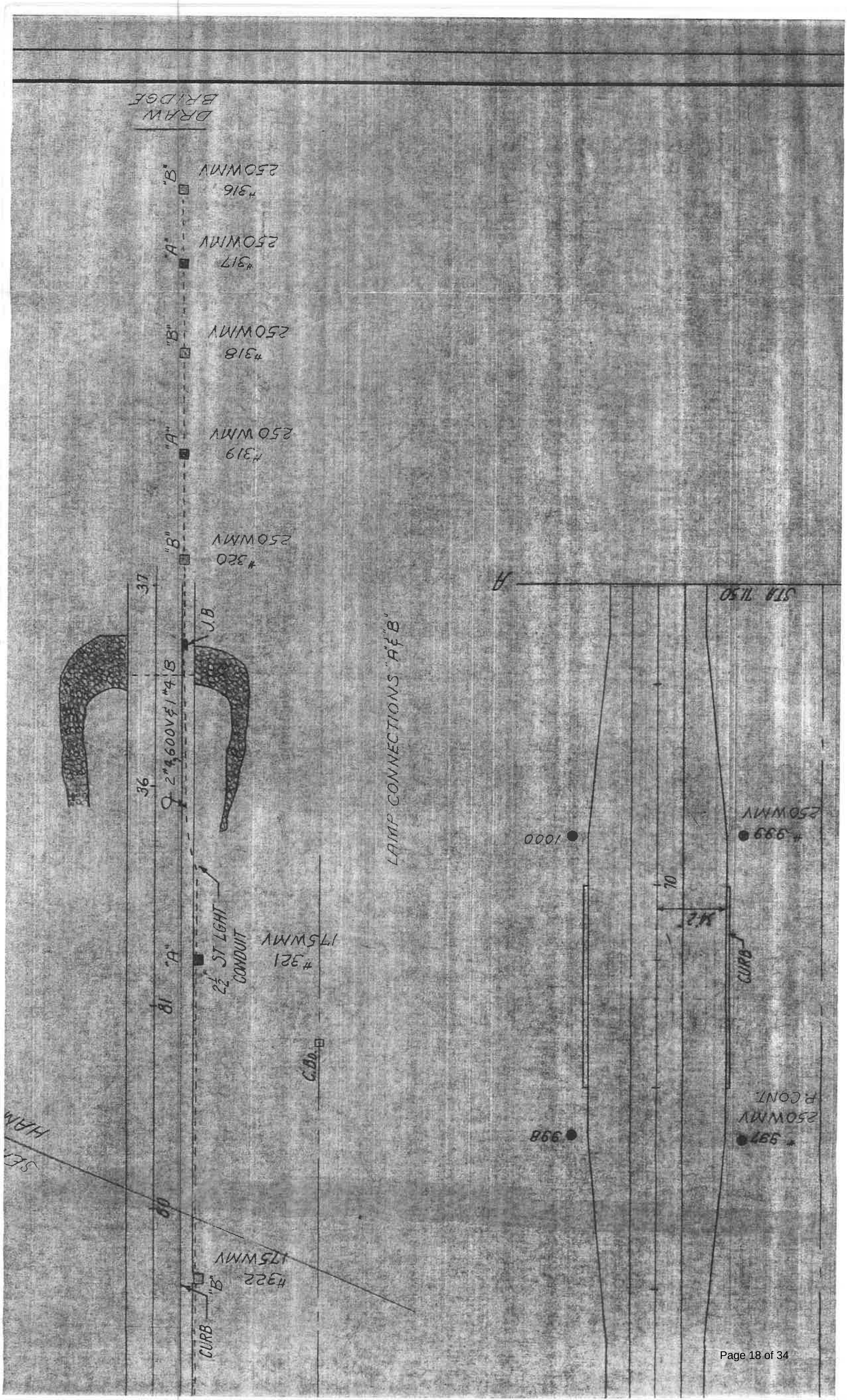
☐ For Info. Only ☐ Investigate and Report ☐ SUBMIT for distribution ___ Ea.

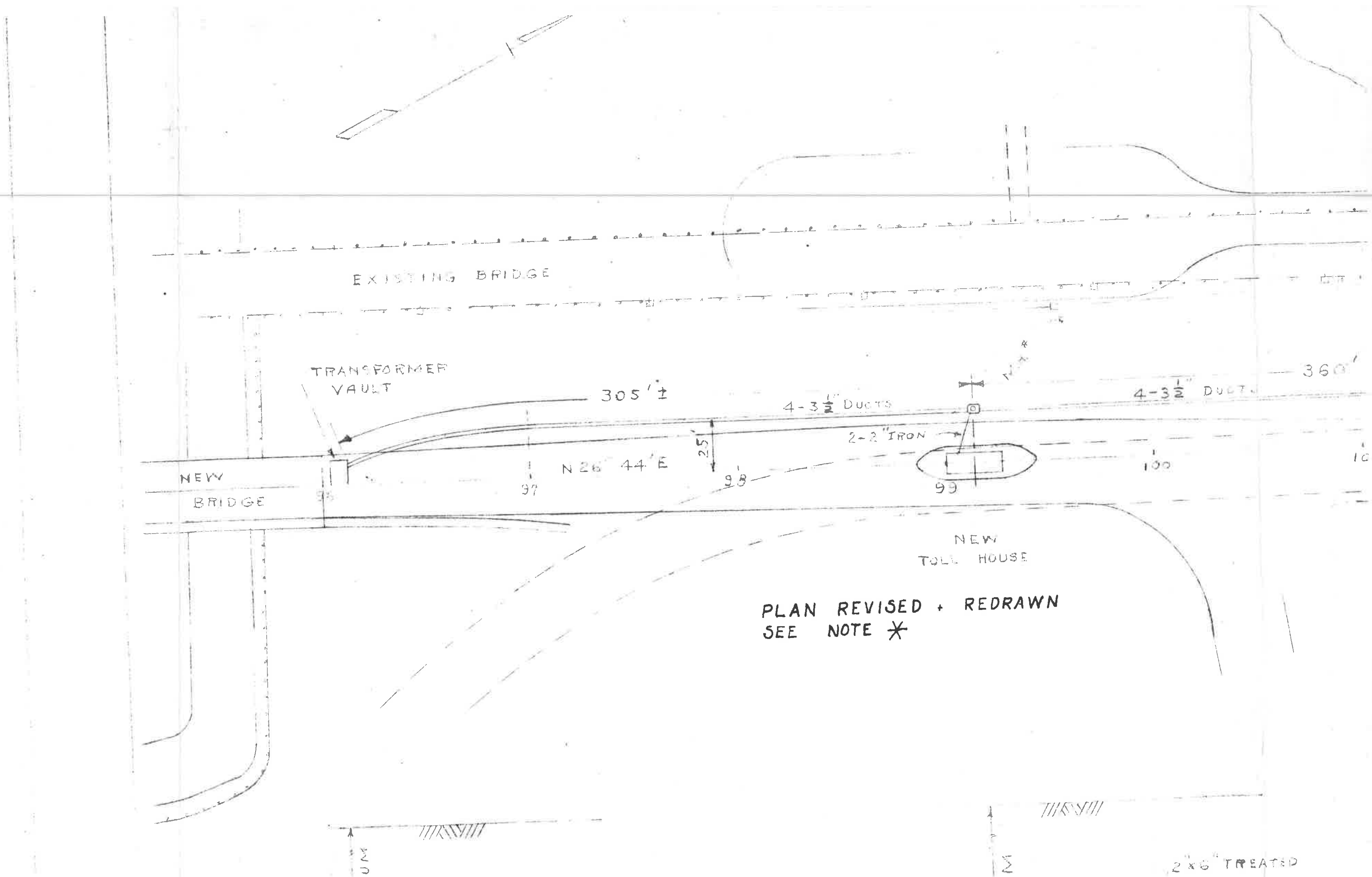
REMARKS: Please incorporate this information into a base plan. There will be anticipated impacts to the electric facilities. If you have any questions feel free to ask Brett McCrea in Design Services – Utilities.

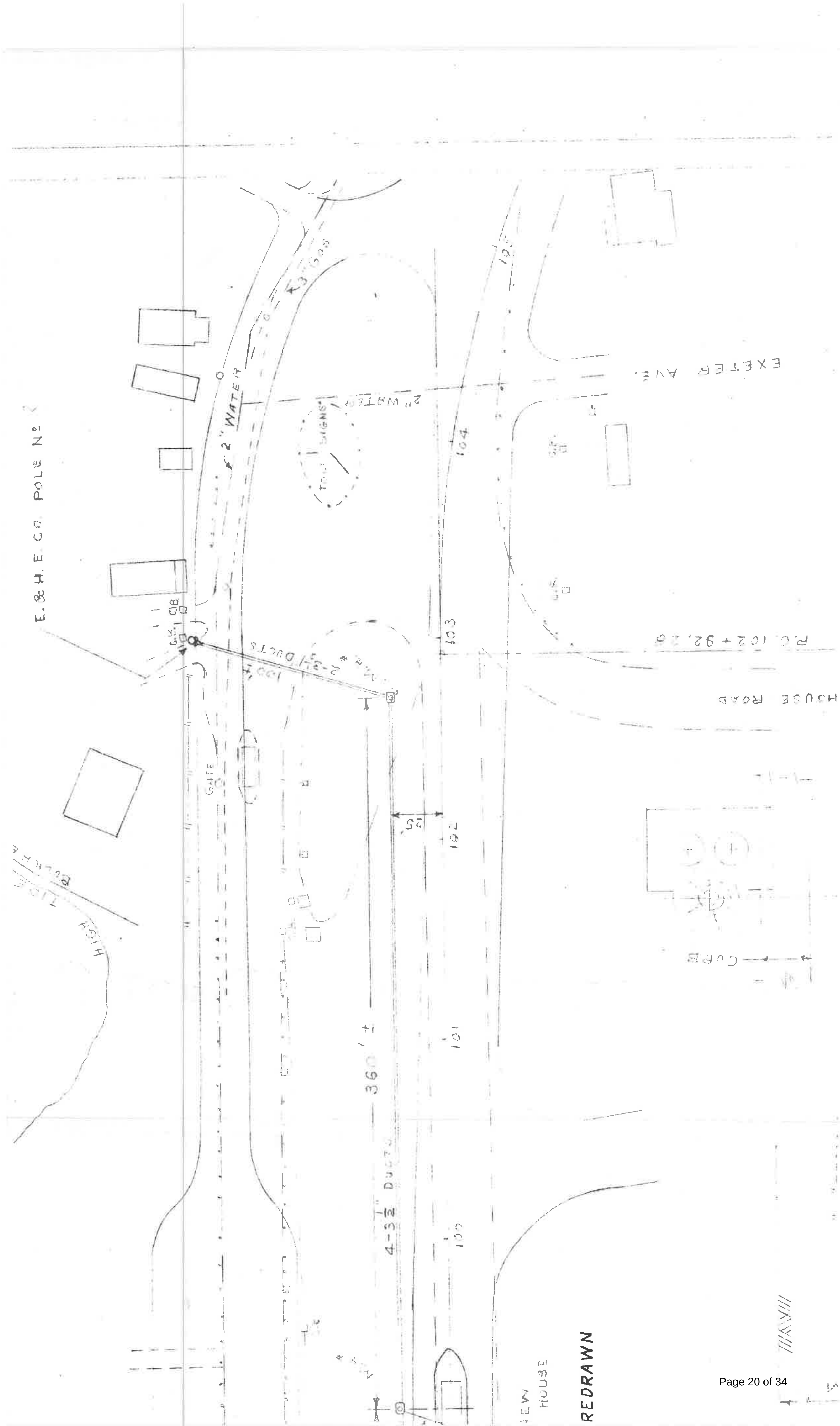
COPY TO: Utility File

SIGNED: Brett S. McCrea
Brett McCrea
Utility Coordinator


U.G. CABLE (CUSTOMER OWNED), TO REPLACE A SUBMARINE CABLE, LOCATION AND WIRE SIZE IS UNKNOWN.
CURB
2" 2,600V E/#4B
SIDEWALK
CURB
"B"
#322 175WMV
"A"
#323 175WMV
2-2½ POLE RISER CONDUIT
#1004 250WMV
3φ 15KVA 208/120V FOR BRIDGE
#1003 250WMV
B.M. #7
C.Bo.
15
#1002 250WMV
65
#996 250WMV
#995 250WMV
#994 250WMV
#993 250WMV
R/W


DRAW BRIDGE
#316 250WMV "B"
#317 250WMV "A"
#318 250WMV "B"
#319 250WMV "A"
#320 250WMV "B"
J.B.
2" #4 600V & 1 #4 B
LAMP CONNECTIONS "A" & "B"
2½" ST LGHT CONDUIT
#321 175WMV "A"
C.BD.
#322 175WMV "B"
CURB
STA. 71.50
1000
#999 250WMV
998
#997 250WMV R.CONT.
CURB
70
37
36
81
80


EXISTING BRIDGE
TRANSFORMER
VAULT
305'±
4-3½" DUCTS
360'
4-3½" DUCTS
2-2" IRON
N 26° 44' E
25'
97
98
99
100
NEW
BRIDGE
NEW
TOLL HOUSE
PLAN REVISED + REDRAWN
SEE NOTE *
2"x6" TREATED



E. & H. E. CO. POLE No 2
2" WATER
3" GAS
EXETER AVE.
P.C. 102+92.28
HOUSE ROAD
CURB
GATE
360' ±
4-3½" DUCTS
25'
105
104
103
102
101
100
REDRAWN
HOUSE

VICTORIA F. SHEEHAN
COMMISSIONER

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION
JOHN O. MORTON BUILDING, P.O. BOX 483, CONCORD, NH 03301

LETTER OF TRANSMITTAL

RECEIVED
OCT - 4 2016
BUREAU OF BRIDGE DESIGN
NH DEPT. OF TRANSPORTATION

BUREAU OF HIGHWAY DESIGN
UTILITY SECTION

TO: **David Scott**
In-House Design Chief
Bureau of Bridge Design

DATE: October 4, 2016
PROJECT: Seabrook-Hampton
15904

WE ARE SENDING YOU THE FOLLOWING: ☒ Attached ☐ Under Separate Cover via ________the following:

☒ Shop Drawings ☐ Prints ☐ Specifications ☒ Plans
☒ Copy of Letter ☐ Falsework ☐ Catalog Cuts ☐ Other

COPIES	DATE(S)	NO. OF SHEETS	DESCRIPTION
1	October 4, 2016	12	Shop Drawings from Unitil Service Corp showing their gas facilities
1	October 4, 2016	1	Email from Unitil Service Corp describing their gas facilities

THESE ARE TRANSMITTED as checked below:

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REMARKS: Please incorporate this information into a base plan. There will be anticipated impacts to Unitil's gas facilities. If you have any questions feel free to ask Brett McCrea in Design Services – Utilities.

COPY TO: Utility File

SIGNED: Brett S. McCrea
Brett McCrea
Utility Coordinator

Brett McCrea

From:	Powell, Sean <powells@unitil.com>
Sent:	Wednesday, October 07, 2015 8:22 AM
To:	Brett McCrea
Cc:	Bickford, Timothy; Dunn, Michael; Dupuis, Mark; Patterson, Timothy
Subject:	Hampton Seabrook Draw Bridge - Unitil Gas Co. Services
Attachments:	Hamption-Seabrook Bridge.pdf; Main and service location.pdf

Mr. McCrea,

My name is Sean Powell and I work for Unitil Gas. I have researched our information regarding our piping in that location as well as customer services near the bridge. Attached I have the locations of our 2" distribution main that runs parallel to the bridge under water. There is gas service from our gas distribution main to the meter fit on the pump house. There is a 2" service from the meter to the bridge tower. New Hampshire DOT owns this 2" service from the outlet of the meter to the bridge tower. If you have any questions, just let me know.

Thanks,

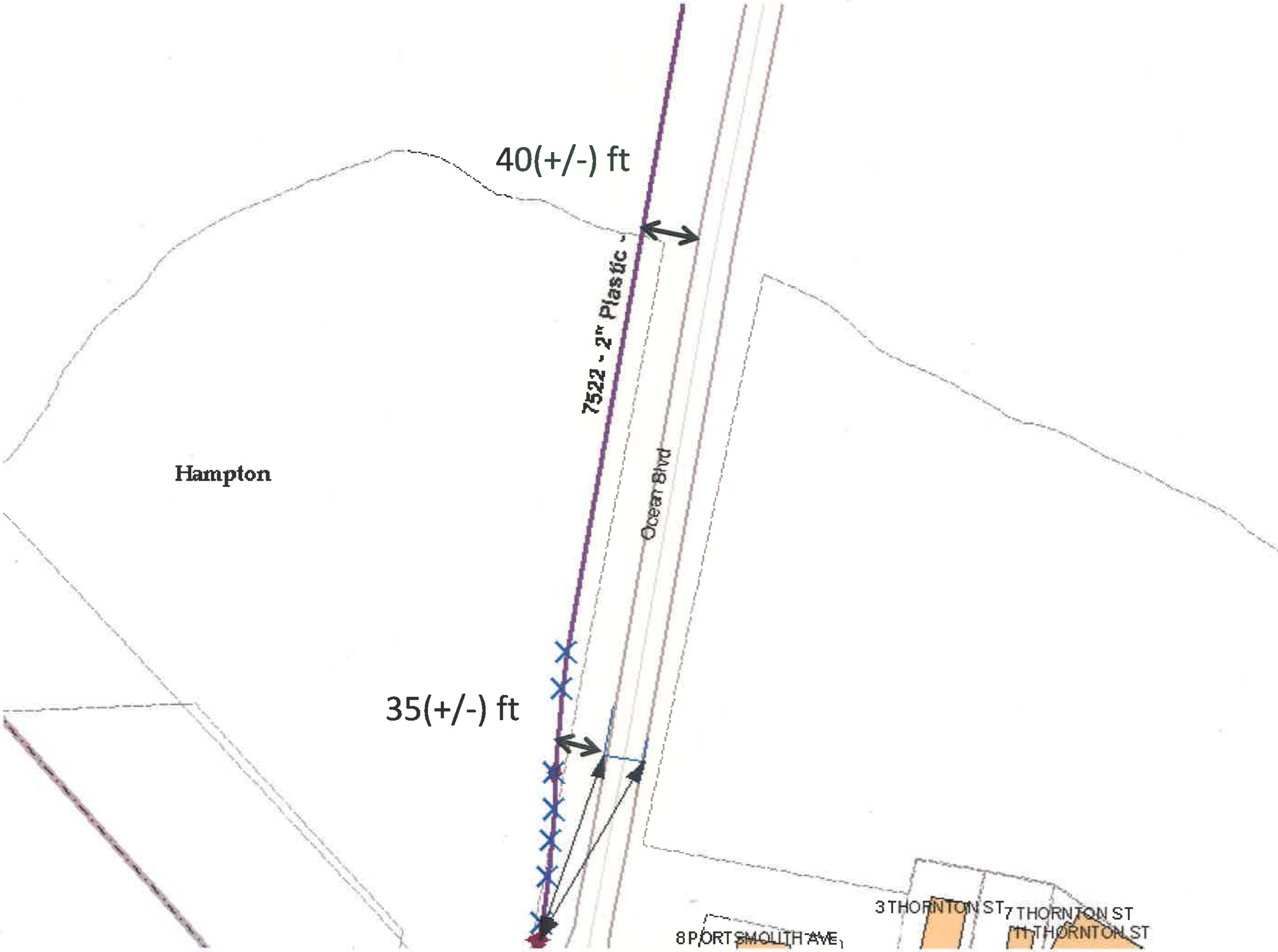
Sean Powell
Gas Engineering Intern
powells@unitil.com
C: (617)-285-8863

Unitil Service Corp (Gas)

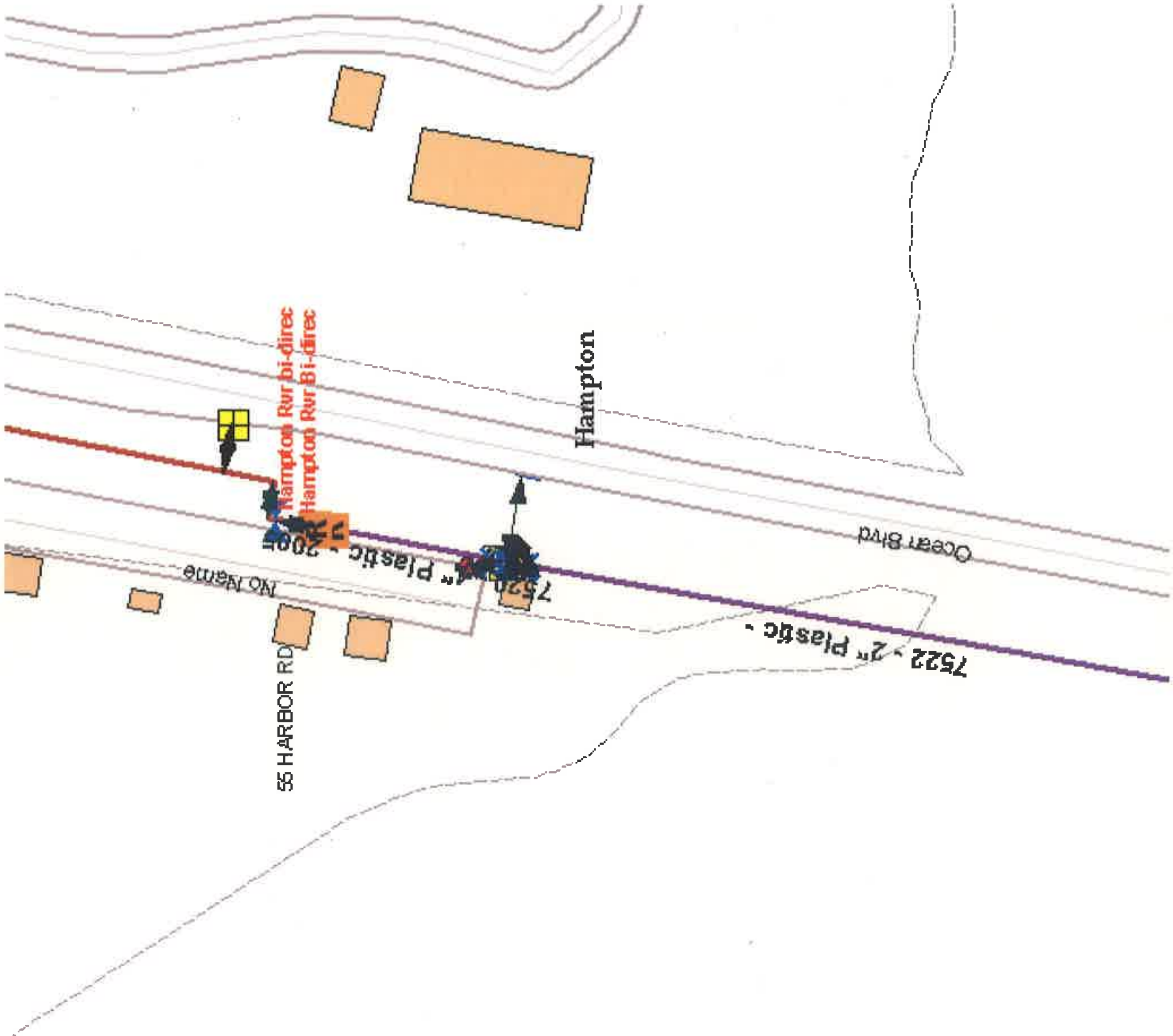
Hampton-Seabrook Bridge
0 Ocean Blvd, Hampton, NH

Records of our distribution line under water next to bridge

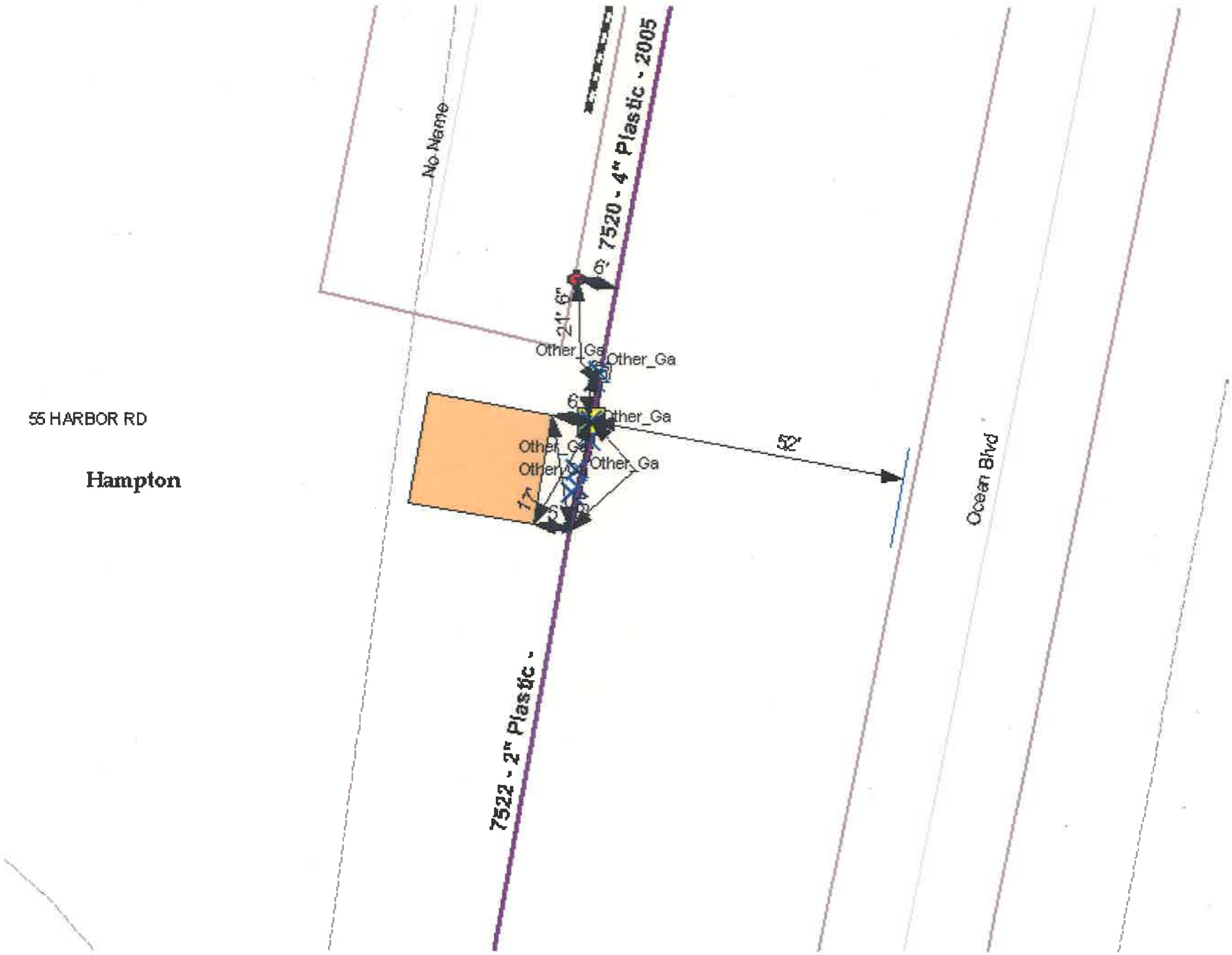
Seabrook Side of Bridge

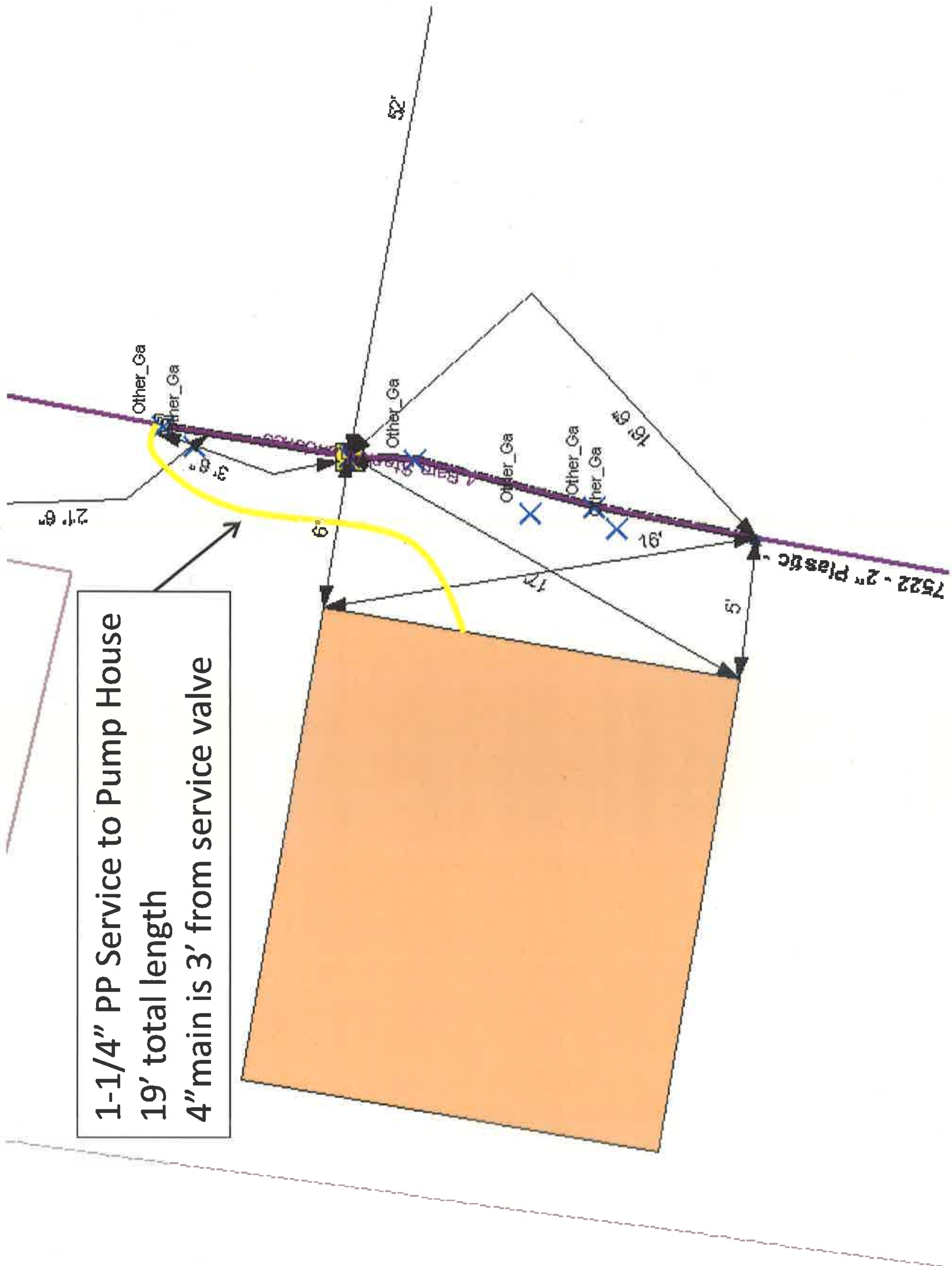


Hampton Side of Bridge

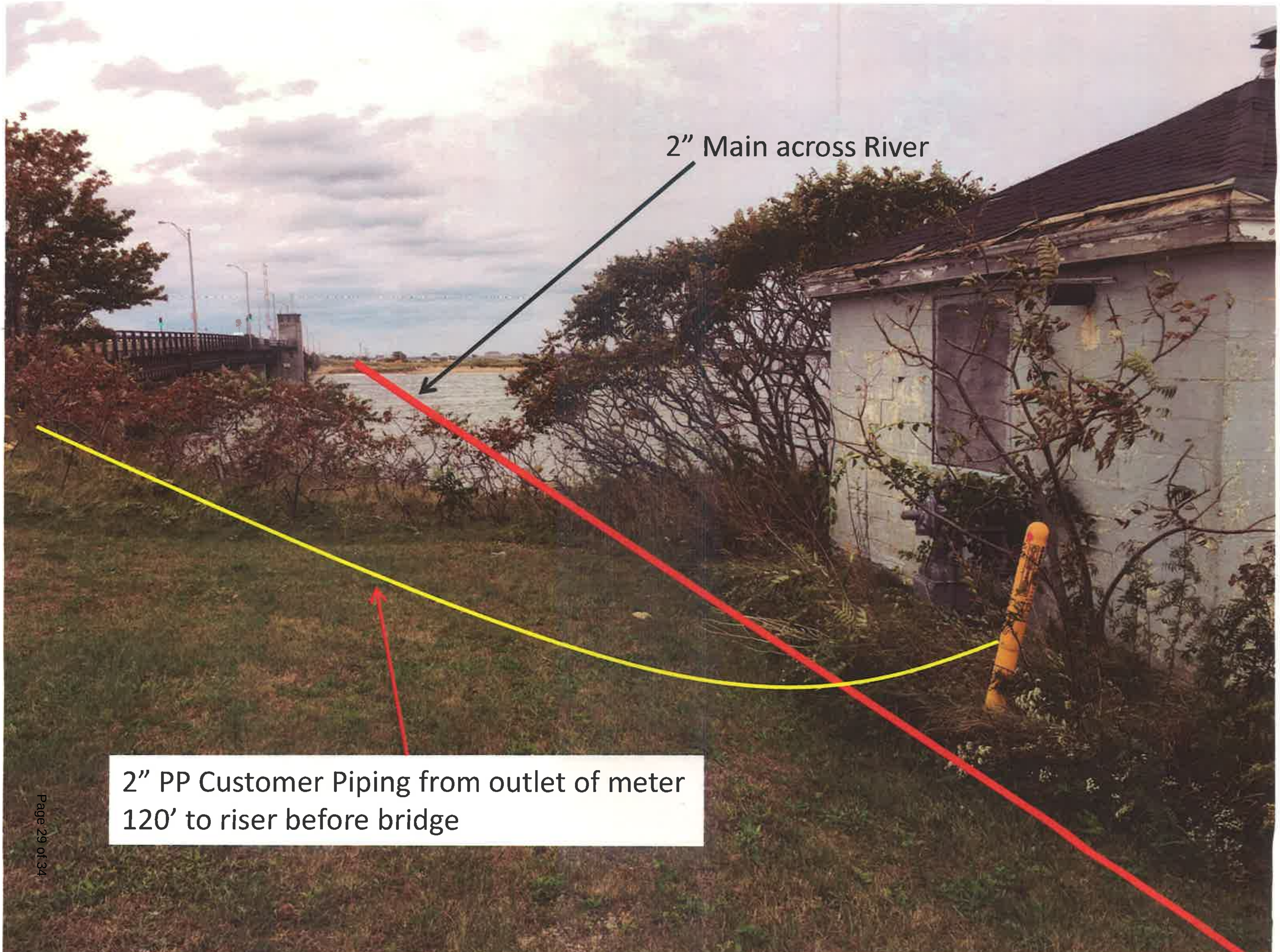


Gas Main is 52 ft away from roadway

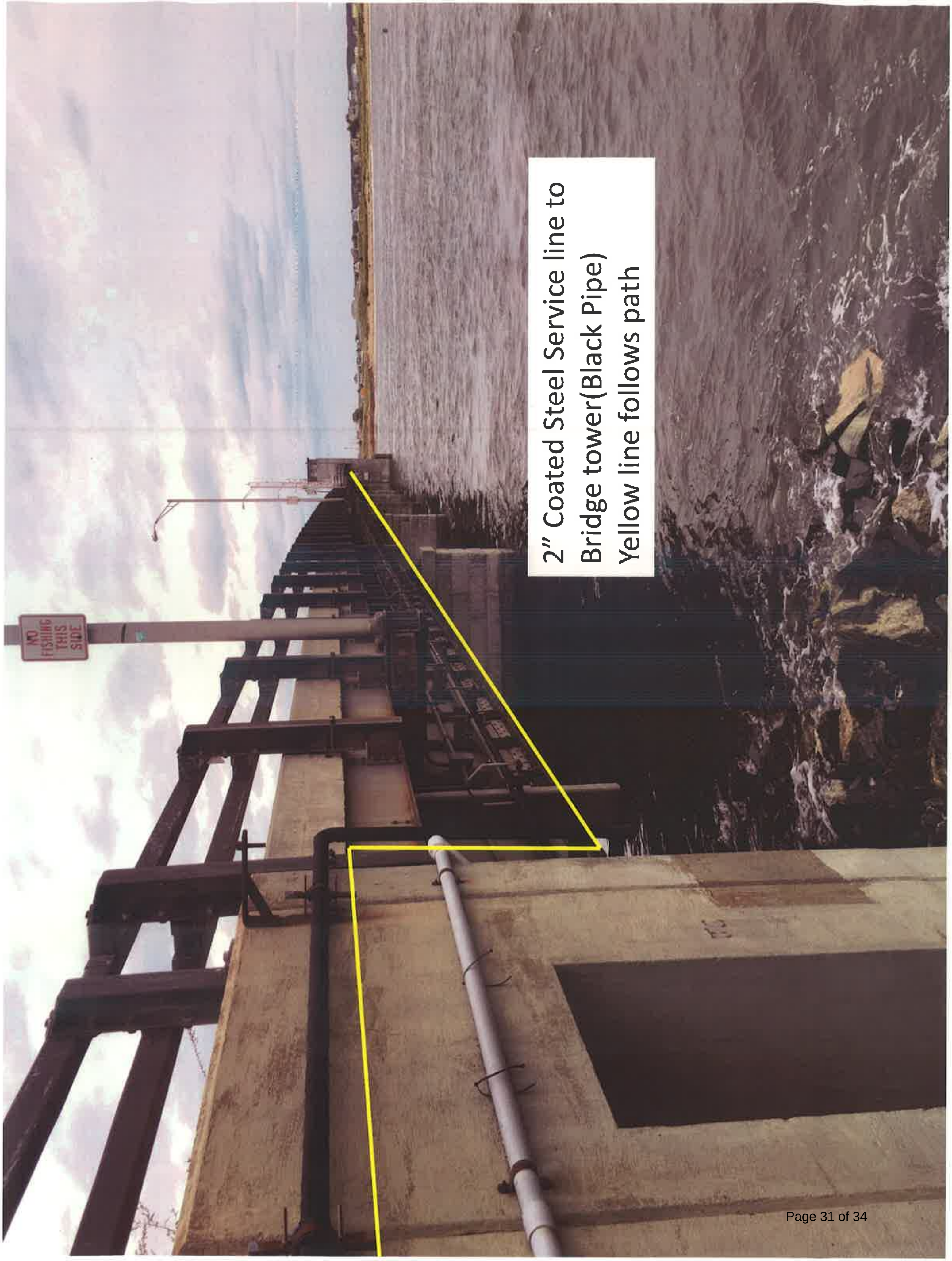



1-1/4” PP Service to Pump House
19’ total length
4”main is 3’ from service valve
7522 - 2" Plastic
52'
Other_Ga
Other_Ga
Other_Ga
Other_Ga
Other_Ga
Other_Ga
16' 9"
16'
17'
5'
6'
21' 6"
3' 6"

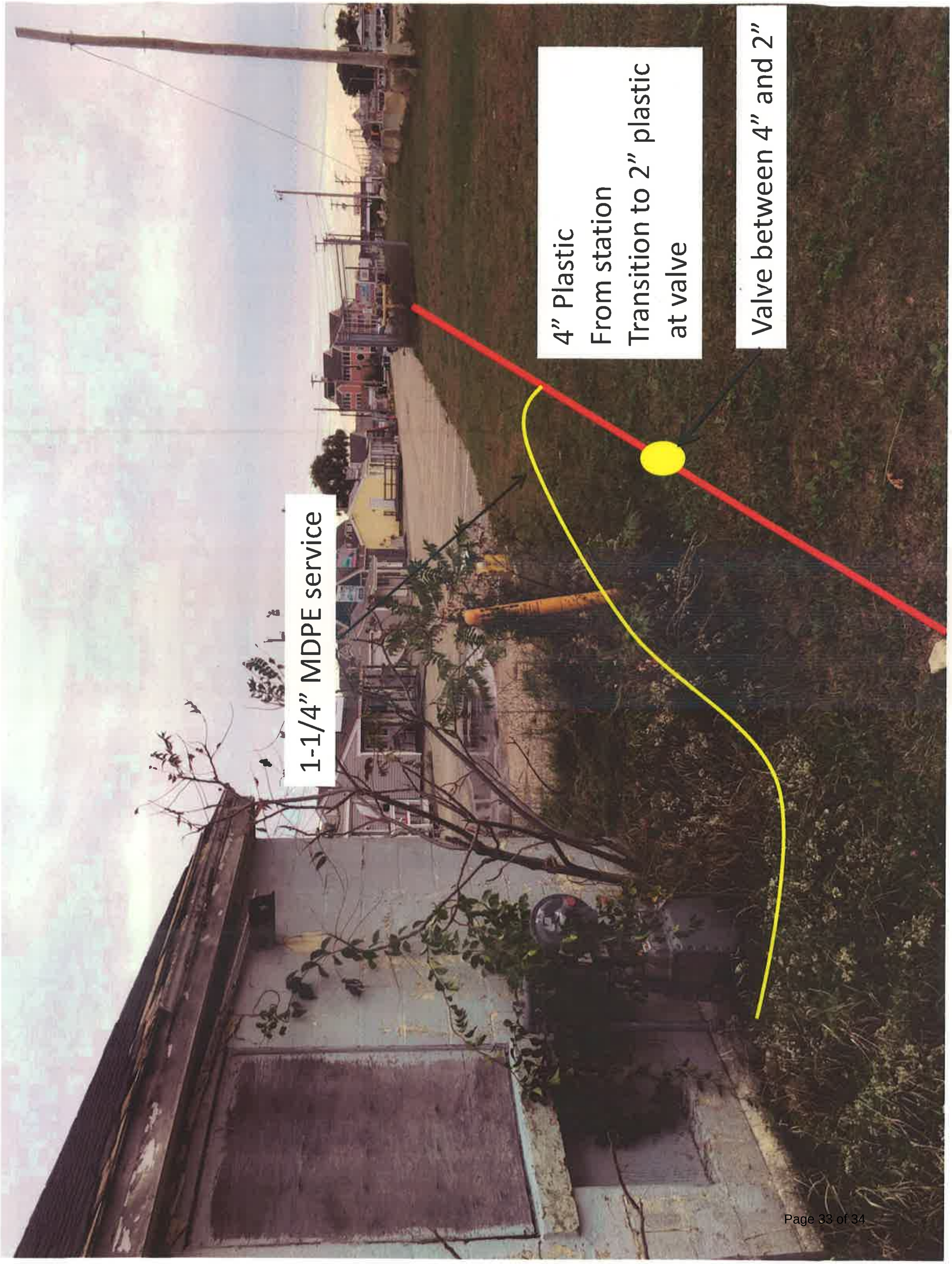
RBOR RD

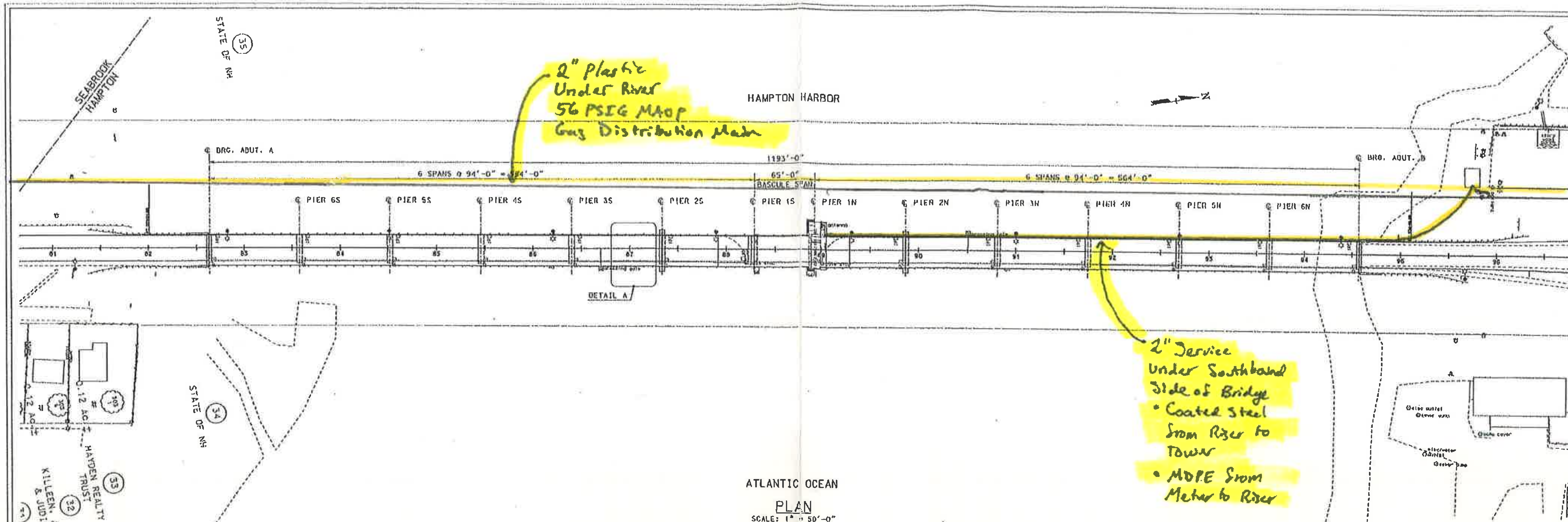

2” Main across River
2” PP Customer Piping from outlet of meter
120’ to riser before bridge


2” Riser


2” Coated Steel Service line to
Bridge tower(Black Pipe)
Yellow line follows path
NO FISHING THIS SIDE

From Seabrook
Looking north


1-1/4" MDPE service
4" Plastic
From station
Transition to 2" plastic
at valve
Valve between 4" and 2"

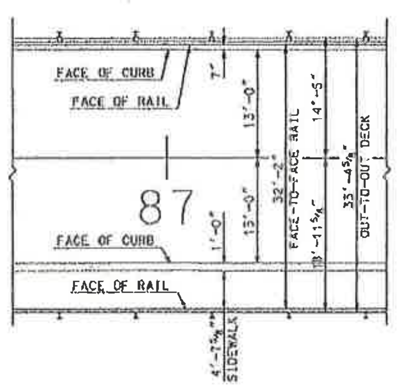


PLAN

SCALE: 1" = 50'-0"

SUMMARY OF BRIDGE QUANTITIES

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT
206.19	COMMON STRUCTURE EXCAVATION - EXPLORATORY	~~40~~ 0	CY
502.101	REMOVAL OF EXISTING BRIDGE STRUCTURE	1	U
502.1011	REMOVAL OF EXISTING BRIDGE STRUCTURE (ASBESTOS CEMENT PIPE)	1	U
512.0201	PREPARATION FOR CONCRETE REPAIRS, CLASS II	154.70	SY
520.01	CONCRETE CLASS AA	9.44	CY
520.7002	CONCRETE BRIDGE DECK (QC/QA) (F)	900	CY
534.1	WATER REPELLENT (LINSEED OIL)	~~4~~ 5	GAL
534.3	WATER REPELLENT (SILANE-SILOXANE)	~~426~~ 378	GAL
540.1	EPOXY-URETHANE WATERPROOFING OVERLAY FOR BRIDGE DECKS	3265	SY
540.2	FENDER SYSTEM	1	U
544.2	REINFORCING STEEL, EPOXY COATED (F)	260925	LB
544.21	REINFORCING STEEL, EPOXY COATED, MECHANICAL CONNECTORS (F)	35451	LB
547.101	SHEAR CONNECTORS (F)	15028	EA
550.1101	STRUCTURAL STEEL (F) (PLATFORM FRAMING)	27000	LB
550.1102	STRUCTURAL STEEL (F) (STRINGER REPLACEMENT)	3300	LB
550.1103	STRUCTURAL STEEL (F) (BRIDGE RAIL MODIFICATIONS)	2000	LB
556	PAINTING EXISTING STRUCTURAL STEEL	1	U
559.5	SILICONE JOINT SEALANT (F)	95	LF
563.041	TEMPORARY BRIDGE RAIL	660	LF
606.95	TEMPORARY TRAFFIC CONTROL BARRIER	~~1000~~ 0	LF
618.61	UNIFORMED OFFICERS WITH VEHICLE	*	$
618.7	FLAGGERS	~~5000~~ 2099	HR
619.1	MAINTENANCE OF TRAFFIC	1	U
619.25	PORTABLE CHANGEABLE MESSAGE SIGN	2	U
621.5	RETROREFLECTIVE BRIDGE RAIL DELINEATOR	~~42~~ 6	EA
632.0104	REFLECTIVE PAINT PAVE. MARKING, 4" LINE	~~6800~~ 11151	LF
632.1104	PREFORMED RETROREFLECTIVE TAPE, TYPE 1 (REMOVABLE) 4" LINE	~~9500~~ 0	LF
632.1118	PREFORMED RETROREFLECTIVE TAPE, TYPE 1 (REMOVABLE) 18" LINE	~~88~~ 212	LF
632.9104	OBLITERATE PAVEMENT MARKING, 4" LINE	~~4000~~ 927	LF
645.3	EROSION STONE	~~50~~ 0	CY
645.531	SILT FENCE	~~200~~ 0	LF
645.7	STORM WATER POLLUTION PREVENTION PLAN	1	U
645.71	MONITORING SWPPP AND EROSION AND SEDIMENT CONTROLS	~~150~~ 0	HR
670.95	TEMPORARY SAFETY FENCE	~~2000~~ 40	LF
692	MOBILIZATION	1	U
693	ON-THE-JOB TRAINING OF UNSKILLED WORKERS	* 440	$
698.12	FIELD OFFICE TYPE B	~~30~~ 21	MON
699	MISCELLANEOUS TEMPORARY EROSION AND SEDIMENT CONTROL	*	$
902.1	RACEWAY AND WIRING	1	U
910.1	BARRIER GATE	1	U
1002.1	REPAIRS OR REPLACEMENTS AS NEEDED	*	$
1010.15	FUEL ADJUSTMENT	*	$
1010.41	QUALITY CONTROL QUALITY ASSURANCE (QC/QA) FOR CONCRETE	*	$



DETAIL A

SCALE: 1" = 10'-0"

AS-BUILT PLANS

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION • BUREAU OF BRIDGE DESIGN

TOWN HAMPTON — BRIDGE NO. 235/025 — STATE PROJECT 14188
LOCATION NH ROUTE 1A over HAMPTON RIVER

GENERAL PLAN

REVISIONS AFTER PROPOSAL		BY	DATE		BY	DATE
	DESIGNED	JAS	8/07	CHECKED	SWJ	4/08
	DRAWN	SMG	8/07	CHECKED	SWJ	4/08
	QUANTITIES	SWJ	4/08	CHECKED	JAS/WPS	4/08
	ISSUE DATE		FEDERAL PROJECT NO.		SHEET NO.	5
	REV. DATE				TOTAL SHEETS	35

DESIGN SHEET XX of XX — FILE NUMBER 109-6-1

SUBDIRECTORY	DGN LOCATOR	SHEET SCALE
BRDMR-SITE	genpln	AS NOTED

Appendix E:
Natural Resource Maps

CONFIDENTIAL – NH Dept. of Environmental Services review

Memo

NH NATURAL HERITAGE BUREAU
NHB DATACHECK RESULTS LETTER

To: Daniel Hageman, Fitzgerald & Halliday, Inc.
72 Cedar Street
Hartford, CT 06106

From: Amy Lamb, NH Natural Heritage Bureau
Date: 7/2/2018 (valid for one year from this date)
Re: Review by NH Natural Heritage Bureau
NHB File ID: NHB18-2036 Town: Seabrook, Hampton Location: NH Rte. 1A bridge over the Hampton River (Neil R. Underwood Bridge)

Description: Rehabilitation or replacement of NH Rte. 1A bridge and associated improvements. An Environmental Assessment is currently being prepared for the project, which is located in Seabrook and Hampton. The bridge is structurally deficient and functionally obsolete, and is on the NHDOT "red list". There have been numerous efforts to repair and rehabilitate the bridge over its life, with recent repairs including a deck replacement in 2010 and emergency repairs to the bascule span mechanical system in 2018. A structural analysis and assessments of mechanical and electrical systems will be performed as part of this study and will serve as the basis for developing rehabilitation options. The impact area provided includes the maximum potential disturbance, including a replacement alternative.

cc: Kim Tuttle

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments: Please address the potential for impacts to the following rare plant species and exemplary natural communities. Please contact the NH Fish & Game Department to address wildlife concerns.

Natural Community	State[1]	Federal	Notes
Beach grass grassland	--	--	Dune communities are sensitive to trampling or recreational use that harms the vegetation, since plants growing in the sand serve a critical function in anchoring it in place.
Intertidal flat*	--	--	Threats to these communities are primarily alterations to the hydrology of the wetland (such as ditching or tidal restrictions that might affect the sheet flow of tidal waters across the intertidal flat) and increased input of nutrients and pollutants in storm runoff.
Subtidal system	--	--	Threats to these communities are primarily alterations to the hydrology of the wetland (such as alterations that might affect the sheet flow of tidal waters across the intertidal flat) and increased input of nutrients and pollutants in storm runoff.

Department of Natural and Cultural Resources
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DNCR/NHB
172 Pembroke Rd.
Concord, NH 03301

Memo

NH Natural Heritage Bureau
NHB Datacheck Results Letter

Plant species	State[1]	Federal	Notes
dwarf glasswort (*Salicornia bigelovii*)*	E	--	Threats are primarily alterations to the hydrology of the wetland, such as ditching or tidal restrictions that might affect the sheet flow of tidal waters across the intertidal flat, activities that eliminate plants, and increased input of nutrients and pollutants in storm runoff.
field wormwood (*Artemisia campestris ssp. caudata*)	E	--	This species grows in dry dune systems and is sensitive to disturbances that eliminate its habitat or disturb the natural dynamics of the dune area.
Gray's umbrella sedge (*Cyperus grayi*)	E	--	This species grows in sandplains and disturbed openings, and is sensitive to disturbances that eliminate its habitat.
hairy hudsonia (*Hudsonia tomentosa*)	T	--	This species requires periodic disturbance to its habitat (disturbed openings, river and streambanks). However, existing plants are very sensitive to trampling when growing on open sand.
long-spined sandbur (*Cenchrus longispinus*)	E	--	This species grows in sandplains and disturbed openings, and is sensitive to disturbances that eliminate its habitat.
sand dropseed (*Sporobolus cryptandrus*)*	E	--	This species grows in dry dune systems and is sensitive to disturbances that eliminate its habitat or disturb the natural dynamics of the dune area.
seaside sandmat (*Euphorbia polygonifolia*)	E	--	This species grows on sandy coastal beaches and is sensitive to excessive distubances such as trampling and ATV use as well as a significant reduction in disturbance (loss of dynamic dune movement) from habitat fragmentation.
seaside threeawn (*Aristida tuberculosa*)	E	--	This species grows in dry dune systems and is sensitive to disturbances that eliminate its habitat or disturb the natural dynamics of the dune area.
seaside-sandwort (*Honckenya peploides ssp. robusta*)*	E	--	Threats are primarily alterations to the hydrology of the wetland, such as ditching or tidal restrictions that might affect the sheet flow of tidal waters across the intertidal flat, activities that eliminate plants, and increased input of nutrients and pollutants in storm runoff.

Vertebrate species	State[1]	Federal	Notes
Least Tern (*Sterna antillarum*)	E	--	Contact the NH Fish & Game Dept (see below).
Piping Plover (*Charadrius melodus*)	E	T	Contact the NH Fish & Game Dept and the US Fish & Wildlife Service (see below).

[1]Codes: "E" = Endangered, "T" = Threatened, "SC" = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

Department of Natural and Cultural Resources
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DNCR/NHB
172 Pembroke Rd.
Concord, NH 03301

CONFIDENTIAL – NH Dept. of Environmental Services review

Memo

NH NATURAL HERITAGE BUREAU
NHB DATACHECK RESULTS LETTER

Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544.

A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

Department of Natural and Cultural Resources
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DNCR/NHB
172 Pembroke Rd.
Concord, NH 03301

NHB18-2036


N
Least Tern
field wormwood*
sand dropseed*
Beach grass grassland
Piping Plover
Intertidal flat
field wormwood
Beach grass grassland
Gray's umbrella sedge
hairy hudsonia
Subtidal system
sand dropseed*
seaside threeawn
sand dropseed*
seaside threeawn
dwarf glasswort*
seaside-sandwort*
field wormwood
Piping Plover
long-spined sandbur
Least Tern
seaside sandmat
Legend
Site bounds
Plant (14)
Animal (3)
Community (3)
System (1)
0 0.1 0.2 0.3 0.4 0.5
Miles

New Hampshire Natural Heritage Bureau - Community Record

Beach grass grassland

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Fair quality, condition and/or landscape context ('C' on a scale of A-D).

Comments on Rank:

Detailed Description: 2006: Community observed and photographed.1997: This community occurs on the foredune remnant and is dominated by *Ammophila breviligulata* (beach grass). Common associates include *Solidago sempervirens* (salt marsh goldenrod) and *Lathyrus maritimus* (beach pea). In addition to the beach grass, two other rare plants found in this community are *Artemisia campestris* ssp. *caudata* (tall wormwood) and *Sporobolus cryptandrus* (sand drop-seed).

General Area: 1997: A sandy beach to the east of the foredune is visited by a great number of beach-goers during the summer months. Beyond the park to the north, residential and commercial development have destroyed the dune system. The southern end of the foredune borders Hampton Harbor Inlet.

General Comments: 1997: Coastal dune systems are characterized by actively shifting sand and consist of several community types that correspond to three broad zones, the foredune, interdune, and backdune. The foredune is most exposed to onshore winds and salt spray and typically forms a beach grass grassland dominated by Ammophila breviligulata (beach grass) with few other species. The interdune is also usually dominated by beach grass, but with a broader diversity of species. Maritime dune forest/woodlands, bayberry-beach plum maritime shrublands, and coastal interdunal marsh/swales characterize the more protected backdune zone. The primary physical processes that produce these different communities are the degree of exposure or protection to on-shore winds and therefore degree of sand stabilization, and soil moisture. At Hampton Beach State Park the interdune and backdune have been destroyed by development. In 1997, two pair of the globally rare *Charadrius melodus* (piping plover) hatched chicks but none survived.

Management Comments: 2006: The dune remnants have been roped off and stay-off-the-dune signs have been placed in several locations.

Location

Survey Site Name: Hampton Beach State Park
Managed By: Hampton Beach State Park

County: Rockingham
Town(s): Hampton
Size: 4.2 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: From the junction of Routes 101 and 1A at Hampton Beach, take Rte. 1A south to the parking lot entrance for Hampton Beach State Park, just north of Hampton Harbor Inlet. The dune remnant is directly to the east of the parking lot, extending north to residential development and south to the jetty at Hampton Harbor Inlet.

Dates documented

First reported: 1997-09-17 Last reported: 2006-07-06

New Hampshire Natural Heritage Bureau - Community Record

Beach grass grassland

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Fair quality, condition and/or landscape context ('C' on a scale of A-D).

Comments on Rank:

Detailed Description: 2007: Community observed and photographed.1997: Characterized by *Ammophila breviligulata* (beach grass), *Lathyrus maritimus* (beach pea), and open areas of sand. Less common species included *Artemisia stelleriana* (dusty miller), *Artemisia vulgaris* (common mugwort), *Oenothera biennis* (biennial evening primrose), *Carex silicea* (sandy sedge), *Cyperus lupulinus* (perennial umbrella-sedge), *Polygonella articulata* (jointweed), *Silene antirrhina* (sleepy catchfly), and *Solidago sempervirens* (seaside goldenrod). Rare plants present other than beach grass were *Aristida tuberculosa* (sea-beach needlegrass), *Artemisia campestris* ssp. *caudata* (tall wormwood), *Cyperus grayi* (Gray's umbrella-sedge), *Hudsonia tomentosa* (hairy hudsonia), and *Sporobolus cryptandrus* (sand drop-seed).

General Area: 1997: The site supports six plants rare in New Hampshire and nesting habitat for the globally rare *Charadrius melodus* (piping plover). Several trails leading to the water from Route 1A traverse the grassland. The beach along Hampton Harbor and the inlet is heavily used by beachgoers during the summer months. This beach grass grassland is one of only three remaining in the state larger than 0.4 ha (1 ac). Prior to development, the beach grass grassland at this site was part of a larger dune system that occurred behind much of Seabrook and Hampton Beach and northward along smaller coastal stretches into North Hampton, Rye, and Portsmouth. The largest remnants of this dune system still remaining include this site, The Sands (Seabrook), and Hampton Beach State Park (Hampton). The destruction of most of the state's dune system and the degree of recreational activity occurring on the three largest remaining dune remnants have severely reduced the natural processes, functions, and quality of these areas.

General Comments: 2007: Proposed bridge repairs may impact the dunes near the bridge abutments.1997: A pair of the globally rare *Charadrius melodus* (piping plover) were last documented as nesting here in 1971, producing 4 eggs and 2 fledglings. In 1984, a pair were seen performing a distraction display but a nest was not found.

Management Comments:

Location

Survey Site Name: Hampton Harbor Inlet
Managed By: Former Barge Facility Land

County: Rockingham
Town(s): Seabrook
Size: 9.3 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Dune remnant, primarily on west side of Ocean Blvd (Rte. 1A) just south of bridge at inlet, on northern tip of Seabrook Beach.

Dates documented

First reported: 1997-07-12 Last reported: 2007-05-09

CONFIDENTIAL – NH Dept. of Environmental Services review

New Hampshire Natural Heritage Bureau - Community Record

Intertidal flat

Legal Status		Conservation Status	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Rare or uncommon

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank: Ranks are for an area at Seabrook School Salt Marsh.

Detailed Description: 1997: Observed. No details.

General Area: 1997: The Blackwater - Hampton River Estuary contains the majority of the estimated 6,200 acres of salt marsh in the state. The Blackwater River portion of the estuary continues south into Salisbury, MA. The estuarine system extends seaward to an imaginary line drawn across Hampton Harbor Inlet and upstream and landward to where ocean-derived salts are less than or equal to 0.5 parts per thousand during the period of average annual low freshwater flow (Cowardin et al. 1979). This estuary is surrounded by moderate levels of residential and commercial development. Several exemplary subtidal and intertidal communities occur in this estuary. Subtidal communities include the undifferentiated ***saline/brackish subtidal channel/bay bottom*** and ***tidal creek bottom***. Other intertidal communities are ***brackish marsh***, ***coastal shoreline strand/swale***, and ***high*** and ***low salt marsh***. Exemplary ***dry Appalachian oak - hickory forest*** occurs at the site as "salt marsh islands," forested uplands surrounded by salt marsh. Most of the estuary is unaffected by restricted tidal flow. Other areas are described as having an adequate tidal inlet by the USDA Soil Conservation Service (1994). The largest portions of the estuary determined to have inadequate tidal inlets include the Meadow Pond area, the Taylor River / Drakes River area west of the railroad track, and the Browns River west of the railroad track (USDA Soil Conservation Service 1994).

General Comments: 1997: Extensive areas of this community type were found within the Blackwater - Hampton River Estuary. Intertidal sand and mud flats are gently sloping, sparsely vegetated, habitats. The substrate, exposed completely at extra low spring tide, ranges in composition from sands to muds and silts. Benthic diatoms and other microalgae occurring in this environment are important contributors to the primary productivity of the total estuarine system (Sickley 1989). Macroalgae is typically uncommon across the exposed substrate. Characteristic invertebrates found in New Hampshire's intertidal mudflats include polychaete worms (including Nereis virens, Nephtys caeca, Clymenella tortquata, and Scoloplos spp.) and mollusks (including soft-shelled clam [Mya arenaria], Baltic Macoma [Macoma balthica], gem shell [Gemma gemma], and swamp Hydrobia [Hydrobia minuta]) (NAI 1973). Arthropods are also well represented and include green crabs (Carcinus maenus), rock crabs (Cancer irroratus), flat-clawed hermit crabs (Pagurus pollicaris), and horseshoe crabs (Limulus polyphemis). During the diurnal (twice daily) tidal flooding several species of fish and other aquatic species feed on the benthos and epibenthic algae. This community also provides important foraging habitat for shorebirds and other animals when the intertidal flat is exposed. The diverse variety of primary foods (microalgae, phytoplankton, and detritus) available to consumers supports the high productivity found on intertidal flats. The substrate is composed of sand or silt and clay rich in organic matter. Vascular plants are sparse to more typically absent.

Management Comments: 1997: In the last four years, several salt marsh restoration projects have begun in this estuary (Ammann, A.P. pers. comm., 1997).

Location

Survey Site Name: Hampton Harbor
Managed By: Former Barge Facility Land

County: Rockingham
Town(s): Seabrook

Size: 324.1 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Large area more or less framed by Rte. 1 to the west, Rte. 101 to the north, Rte. 1A to the east, and the Massachusetts state line to the south. Occurs between estuarine marshes or other coastal communities landward and subtidal communities seaward and includes portions of tidal creek channels that are exposed at low tide.

Dates documented

First reported: 1997-07-05 Last reported: 1997-10-08

New Hampshire Natural Heritage Bureau - System Record

Subtidal system

Legal Status		Conservation Status	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Rare or uncommon

Description at this Location

Conservation Rank: Good quality, condition and landscape context ('B' on a scale of A-D).
Comments on Rank:

Detailed Description: A relatively short main channel to Hampton Harbor that quickly branches into large and small tributaries, including the Hampton and Blackwater rivers.
General Area: Borders ***intertidal flat*** community and **salt marsh system** landward.
General Comments:
Management Comments:

Location

Survey Site Name: Hampton Harbor
Managed By: Hampton Beach State Park

County: Rockingham
Town(s): Hampton
Size: 870.6 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Subtidal creeks and bay bottoms in the Hampton Marsh estuary.

Dates documented

First reported: 1997-07-05 Last reported: 2007-10-13

CONFIDENTIAL – NH Dept. of Environmental Services review

New Hampshire Natural Heritage Bureau - Plant Record

dwarf glasswort (*Salicornia bigelovii*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank: Sub-population of a large "A-" population.

Detailed Description: 1982: "Just a few plants." 1971: Specimen collected. 1966: Specimen collected.
General Area: 1982: Low marsh area, inundated at high tides.
General Comments:
Management Comments:

Location

Survey Site Name: The Sands
Managed By: Seabrook Back Dunes

County: Rockingham
Town(s): Seabrook
Size: 2.8 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Seabrook Back Dune. Low area at north end, south of Cross Beach and adjacent to Rte. 1A.

Dates documented

First reported: 1966 Last reported: 1982-10-11

New Hampshire Natural Heritage Bureau - Plant Record

field wormwood (*Artemisia campestris ssp. caudata*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Fair quality, condition and/or landscape context ('C' on a scale of A-D).

Comments on Rank:

Detailed Description: 2007: Population size likely greater than 1000 individuals. Vigor and reproduction appear normal. 1982: Individual plants about 6 inches tall and none in flower. Specimen at NHA. 1958: Specimen collected.

General Area: 2007: Area 1: a remnant patch of ***Hudsonia maritime shrubland*** and the adjacent ***beach grass grassland***. The most common associates are lichens, *Ammophila breviligulata* (beach grass), and *Hudsonia tomentosa* (hairy hudsonia). Less frequent are *Cyperus grayi* (Gray's umbrella sedge), *Cyperus lupulinus* (perennial umbrella sedge), *Carex silicea* (sea-beach sedge), *Festuca rubra* (red fescue), *Bromus tectorum* (drooping brome grass), *Aristida dichotoma* (churchmouse three-awn), *Aristida tuberculosa* (sea-beach needle grass), *Sporobolus cryptandrus* (sand dropseed), *Lechea maritima* (seabeach pinweed), *Polygonella articulata* (jointweed), *Lathyrus japonicus* (beach pea), and *Solidago sempervirens* (seaside goldenrod). Area 2: ***beach grass grassland***, back side of foredune (ca. 60 m wide). The fore and interdune remnant is traversed by boardwalks between the high density residential houses and the heavily impacted recreational beach. 1982: Sea level and few feet above. Sand dunes running north and south, full sun and very dry, loose sand with *Ammophila breviligulata* (beach grass), *Artemisia stelleriana* (dusty miller), and *Lathyrus maritimus* (beach pea).

General Comments: 1982: Plants subjected to foot travel across foredune, some residences have excavated dunes to increase visibility of ocean.

Management Comments:

Location

Survey Site Name: Seabrook Beach
Managed By: Seabrook Dunes and Beach

County: Rockingham
Town(s): Seabrook
Size: 7.9 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2007: Area 1: From Rte. 1A, head east on Manchester Street to beach. Area 2: [beach east of end of Haverhill St.]1982: Area 1: Found in dunes from State Line Street, north to Manchester Street, includes the foredune of Seabrook Beach east of Rte. 1A.

Dates documented

First reported: 1958-09-09 Last reported: 2007-09-06

New Hampshire Natural Heritage Bureau - Plant Record

field wormwood (*Artemisia campestris ssp. caudata*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Fair quality, condition and/or landscape context ('C' on a scale of A-D).

Comments on Rank:

Detailed Description: 2007: More than 30 scattered clumps observed throughout dune area west of Rte. 1A. 1997: West of the road: at least 50 stems distributed across an 8 acre (3.4 ha) area. East of the road: present (< 1% cover).

General Area: 2007: Small sand dune area. Plants in the immediate vicinity include: *Ammophila breviligulata* (beach grass), *Oenothera biennis* (biennial evening primrose), *Lathyrus japonicus* var. *maritimus* (smooth beach pea) and *Artemisia vulgaris* (common mugwort), and *Hudsonia tomentosa* (hairy hudsonia).1997: Dune remnant community characterized by *Ammophila breviligulata* (beach grass), *Lathyrus maritimus* (beach pea), and open areas of sand. Rare plants present other than beach grass were *Aristida tuberculosa* (sea-beach needlegrass), *Artemisia campestris* ssp. *caudata* (tall wormwood), *Cyperus grayi* (Gray's umbrella-sedge), *Hudsonia tomentosa* (hairy hudsonia), and *Sporobolus cryptandrus* (sand drop-seed). Associated dominant species include: *Lathyrus maritimus* var. *glaber*, and *Ammophila breviligulata*. Other associated species include: *Artemisia stelleriana*, *Artemisia vulgaris*, and *Oenothera biennis*. The site also supports nesting habitat for the globally rare Charadrius melodus (piping plover).

General Comments: 2007: DOT will be conducting bridge repairs sometime in the future and this will impact the dunes on both sides of the southern portion of the bridge.

Management Comments: 1997: The beach along Hampton Harbor and the inlet is heavily used by beachgoers during the summer months. Several trails leading to the water from Route 1A traverse the grassland.

Location

Survey Site Name: Hampton Harbor Inlet

Managed By: Former Barge Facility Land

County: Rockingham

Town(s): Seabrook

Size: 10.0 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2007: West side of Ocean Blvd (Rte 1A) just south of bridget. Throughout sand dune area.1997: Both sides of Ocean Blvd (Rte 1A), just south of bridge at inlet.

Dates documented

First reported: 1997-07-12 Last reported: 2007-05-09

New Hampshire Natural Heritage Bureau - Plant Record

field wormwood (*Artemisia campestris ssp. caudata*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank:

Detailed Description: 1997: Over 500 plants distributed across a 5-acre area. 1982: Few plants observed in sand dunes, not flowering (7/1). 100 or more plants, occasional in patches in sand dunes, half were flowering (8/19). Plants mostly on landward side of dune crests. Specimens at NHA and NEBC. 1876: Specimen.

General Area: 1997: ***Beach grass grassland*** on foredune remnant, dominated by *Ammophila breviligulata* (beach grass). Associated dominant species include: *Lathyrus maritimus* var. *glaber* (smooth beach pea), *Solidago sempervirens* (seaside goldenrod), and *Poa compressa* (Canada bluegrass). Other associated species include: *Cakile edentula* (sea-rocket), *Carex silicea* (sandy sedge), *Cyperus lupulinus* (perennial umbrella-sedge), and *Aster ericoides* (white wreath aster). 1982: Full sun and dry loose sand, seaside sand dunes which run north and south, with *Ammophila breviligulata* (beach grass), *Artemisia stelleriana* (dusty miller), and *Lathyrus maritimus* (beach pea).

General Comments: 1997: The beach is heavily used by beachgoers during the summer months. Beyond the park to the north, residential and commercial development have destroyed the dune system. The southern end of the foredune borders Hampton Harbor Inlet.

Management Comments:

Location

Survey Site Name: Hampton Beach State Park
Managed By: Hampton Beach State Park

County: Rockingham
Town(s): Hampton
Size: 2.8 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Just north of Hampton Harbor Inlet. Park in lot at Hampton Beach State Park, just west of dune remnant (lot entrance off of Rte. 1A).

Dates documented

First reported: 1876 Last reported: 1997-09-17

New Hampshire Natural Heritage Bureau - Plant Record

Gray's umbrella sedge (*Cyperus grayi*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank:	Good quality, condition and landscape context ('B' on a scale of A-D).
Comments on Rank:	
Detailed Description:	2007: 3 clumps with 4-5 of last year's dried up stems still present.1997: 101-1000 mature fruiting ramets in a 100-1000 square meter area.
General Area:	1997: Sand dune. Associated plant species include *Ammophila breviligulata* (beach grass), *Solidago sempervirens* (seaside goldenrod), *Carex silicea* (sandy sedge), *Rosa virginiana* (Virginia rose), and *Polygonella articulata* (jointweed). *Cyperus lupulinus* (perennial umbrella- sedge) also occurs at this site.
General Comments:	2007: Probably much larger population but site visit was too early in the growing season, only last year's remnant stems present.
Management Comments:	1997: Beachgoers crossing the dunes are a threat.

Location

Survey Site Name: Hampton Harbor Inlet
Managed By: Former Barge Facility Land

County: Rockingham
Town(s): Seabrook
Size: 2.8 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Follow Rte. 1A south from Hampton Beach and cross the bridge over Hampton Harbor Inlet. Proceed to the dune remnant on either side of Ocean Blvd. just south of the bridge.

Dates documented

First reported: 1997-07-12 Last reported: 2007-05-09

New Hampshire Natural Heritage Bureau - Plant Record

hairy hudsonia (*Hudsonia tomentosa*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Threatened	State:	Imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Poor quality, condition and/or landscape context ('D' on a scale of A-D).
Comments on Rank: Marginal habitat condition and defensibility, poor quality and viability.

Detailed Description: 2007: 8 plants total, one clump of 2 and one clump of 6 plants.1997: 2 plants; 1 mature, in fruit; the other a small immature plant.

General Area: 2007: Remnant sand dune. Associates include: *Ammophila breviligulata* (beach grass), *Cyperus grayi* (Gray's umbrella sedge), and *Lathyrus japonicus* (beach pea).1997: Sand dune. Associated plant species include *Ammophila breviligulata* and *Lathyrus japonicus*.

General Comments: 2007: Could be more plants, area not extensively searched. Search was mostly focused on area surrounding bridge that could be impacted by DOT bridge repairs. No hairy hudsonia was found in immediate vicinity of bridge.

Management Comments:

Location

Survey Site Name: Hampton Harbor Inlet
Managed By: Former Barge Facility Land

County: Rockingham
Town(s): Seabrook
Size: 2.8 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Follow Rte. 1A south from Hampton Beach and cross the bridge over Hampton Harbor Inlet. Proceed to the dune remnant on either side of Ocean Blvd. just south of the bridge.

Dates documented

First reported: 1997-07-12 Last reported: 2007-05-09

CONFIDENTIAL – NH Dept. of Environmental Services review

New Hampshire Natural Heritage Bureau - Plant Record

long-spined sandbur (*Cenchrus longispinus*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2014: Area 2: More than 170 plants in a 400-square-foot area. Varying in size from 3-30 cm. 60% of plants with obvious fertile stems, most seed had dispersed.
1958: Area 1: Specimen collected.

General Area: 1958: In sand dunes near beach.
2014: Front/middle sand dune interface, sterile swale. Associated species: beach grass (*Ammophila breviligulata*), field wormwood (*Artemisia campestris* ssp. *caudata*), beach pinweed (*Lechea maritima*), seaside goldenrod (*Solidago sempervirens*), seaside threeawn (*Aristida tuberculosa*), sand dropseed (*Sporobolus cryptandrus*), and seaside sandmat (*Euphorbia polygonifolia*).

General Comments: 2014: They are immediately in back of 2 homes that abut the dunes. Often owners have modified these areas as extensions of their yard. This is a plant that would likely be extirpated due to its painful nature. Vulnerable due to location.

Management Comments:

Location

Survey Site Name: Seabrook Beach
Managed By: Seabrook Dunes and Beach

County: Rockingham
Town(s): Seabrook
Size: 39.8 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Seabrook Beach.
2014: The challenge is finding parking. Somewhere around the intersection of Rte 286 and Rte 1A near the NH/MA border. Proceed to Atlantic Rd. and head for coordinates. (42.87333N - 70.81709W)

Dates documented

First reported: 1958-09-17 Last reported: 2014-11-10

New Hampshire Natural Heritage Bureau - Plant Record

sand dropseed (*Sporobolus cryptandrus*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank:

Detailed Description: 1982: ca. 10 plants in roadside weedy area, next to houses along highway. Specimen collected.
General Area: 1982: Dry sand, flat, full sun.
General Comments: 1982: Residential area.
Management Comments:

Location

Survey Site Name: Bound Rock
Managed By:

County: Rockingham
Town(s): Seabrook
Size: 2.8 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Seabrook. Bound Rock area, east of Rte. 1A about 0.5 mile south of Hampton Harbor Inlet.

Dates documented

First reported: 1982 Last reported: 1982-08-26

CONFIDENTIAL – NH Dept. of Environmental Services review

New Hampshire Natural Heritage Bureau - Plant Record

sand dropseed (*Sporobolus cryptandrus*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank:

Detailed Description: 1997: One culm noticed during a quick search of the immediate area along the roadside. More likely present. 1982: 3 or 4 plants in weedy area beside houses. Specimen collected.

General Area: 1997: A 3.4 ha (8 ac) dune remnant community characterized by *Ammophila breviligulata* (beach grass), *Lathyrus maritimus* (beach pea), and open areas of sand. Less common species included *Artemisia stelleriana* (dusty miller), *Artemisia vulgaris* (common mugwort), *Oenothera biennis* (biennial evening primrose), *Carex silicea* (sandy sedge), *Cyperus lupulinus* (perennial umbrella-sedge), *Polygonella articulata* (jointweed), *Silene antirrhina* (sleepy catchfly), and *Solidago sempervirens* (seaside goldenrod). Rare plants present other than Sporobolus were *Aristida tuberculosa* (sea-beach needlegrass), *Artemisia campestris* ssp. *caudata* (tall wormwood), *Cyperus grayi* (Gray's umbrella-sedge), and *Hudsonia tomentosa* (hairy hudsonia). The site also supports nesting habitat for the globally rare Charadrius melodus (piping plover).

General Comments: Residential area.

Management Comments: 1997: The beach along Hampton Harbor and the inlet is heavily used by beachgoers during the summer months. Several trails leading to the water from Route 1A traverse the grassland. Plant in more compact soil near the road.

Location

Survey Site Name: Hampton Harbor Inlet
Managed By:

County: Rockingham
Town(s): Hampton
Size: 2.8 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Just south of bridge at Hampton Harbor Inlet, east of Rte 1A.

Dates documented

First reported: 1982-08-26 Last reported: 1997-07-12

CONFIDENTIAL – NH Dept. of Environmental Services review

New Hampshire Natural Heritage Bureau - Plant Record

sand dropseed (*Sporobolus cryptandrus*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Historical records only - current condition unknown.

Comments on Rank:

Detailed Description: 1997: At least 200 culms distributed across a 5-acre area. 1982: About 20 plants scattered in park.

General Area: 1997: ***Beach grass grassland*** on foredune remnant, dominated by *Ammophila breviligulata* (beach grass). Associated dominant species include: *Lathyrus maritimus* var. *glaber*, *Solidago sempervirens*, and *Poa compressa*. Other associated species include: *Cakile edentula*, *Carex silicea*, *Cyperus lupulinus*, and *Aster ericoides*. 1982: Dry sandy site, full sun, flat ground.

General Comments: 1997: The beach is heavily used by beachgoers during the summer months. Beyond the park to the north, residential and commercial development have destroyed the dune system. The southern end of the foredune borders Hampton Harbor Inlet.

Management Comments:

Location

Survey Site Name: Hampton Beach State Park

Managed By: Hampton Beach State Park

County: Rockingham

Town(s): Hampton

Size: 2.8 acres

Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Hampton State Park at Hampton Harbor Inlet, plants in dry sand surrounding parking lot.

Dates documented

First reported: 1898

Last reported: 1997-09-17

New Hampshire Natural Heritage Bureau - Plant Record

seaside sandmat (*Euphorbia polygonifolia*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Fair quality, condition and/or landscape context ('C' on a scale of A-D).

Comments on Rank: Small to medium population in high recreational use area. Multiple (small) patches provide some safeguard. Sea level rise could become a factor.

Detailed Description: 2014: 20 plants total in three widely scattered patches.Good to excellent condition, large plants. All with seed capsules, dehisced capsules and/or achenes. Sub 4: 6 plants, 4 x 8 ft. area. Sub 5: 3 plants, 5 x 5 ft. area. Sub 6: 11 plants, 12 x 12 ft. area. Area 7: >40 plants in 10 x 15 ft. area.
2013: 46 plants total in three widely scattered patches. All with seed capsules, dehisced capsules and/or achenes. Sub 1: 1 4-inch plant. Sub 2: 24 plants, 60 x 30 ft. area. Sub 3: 21 plants, 40 x 40 ft. area.

General Area: 2014, 2013: ***Beach grass grassland***. Associated species include beach grass (*Ammophila breviligulata*), Gray's umbrella sedge (*Cyperus grayi*), field wormwood (*Artemisia campestris* ssp. *caudata*), beach pinweed (*Lechea maritima*), little evening-primrose (*Oenothera perennis*), seaside goldenrod (*Solidago sempervirens*), and seaside threeawn (*Aristida tuberculosa*).

General Comments: 2014: This seed must have an extended dormancy period, as The Sands plants were not in evidence in this location last year.

Management Comments: 2014: Apparently this plant prefers some dune disturbance, because it prefers to grow alone. Some foot traffic adjacent to boardwalks may keep other plants at bay. Yet they are susceptible to being stepped on.

Location

Survey Site Name: Seabrook Beach
Managed By: Seabrook Dunes and Beach

County: Rockingham
Town(s): Seabrook
Size: .2 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: All plants within view of the many dune boardwalks (adjacent to Atlantic Way between Methuen and Haverhill Streets) on the eastern side of The Sands.
2014: Area 2: three locations. Sub 4 at 42.88182 N, -70.821W; Sub 5 at 42.88149 N, -70.82075W; Sub 6 at 42.88521 N, -70.81538W.
2013: Area 1: three locations. Sub 1 at 42.88073N, -70.81614W; Sub 2 at 42.88053 N, -70.81583W; Sub 3 at 42.87868 N, -70.81601W.

Dates documented

First reported: 2013-10-21 Last reported: 2014-10-14

New Hampshire Natural Heritage Bureau - Plant Record

seaside threeawn (*Aristida tuberculosa*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2014: >200,000 plants observed.
2007: Area 3: Population size at least 10-100 culms. Vigor and reproduction appear normal.
1982: Area 1: 50+ plants common along east side of Rte. 1A.

General Area: 2007: Area 3: Occurs in a remnant patch of **Hudsonia maritime shrubland** and the adjacent **beach grass grassland**. The most common associates are lichens, *Ammophila breviligulata* (beach grass), and *Hudsonia tomentosa* (hairy hudsonia). Less frequent are *Cyperus grayi* (Gray's umbrella sedge), *Cyperus lupulinus* (perennial umbrella sedge), *Carex silicea* (sea-beach sedge), *Festuca rubra* (red fescue), *Bromus tectorum* (drooping brome grass), *Aristida dichotoma* (churchmouse three-awn), *Sporobolus cryptandrus* (sand dropseed), *Lechea maritima* (seabeach pinweed), *Polygonella articulata* (jointweed), *Lathyrus japonicus* (beach pea), *Artemisia campestris* ssp. *caudata* (tall wormwood), and *Solidago sempervirens* (seaside goldenrod). The fore and interdune remnant is traversed by boardwalks between the high density residential houses and the heavily impacted recreational beach.
1982: Area 1: Open, dry sand, flat, full sun.

General Comments:
Management Comments:

Location

Survey Site Name: Seabrook Beach
Managed By: Seabrook Dunes and Beach

County: Rockingham
Town(s): Seabrook
Size: 65.6 acres
Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Seabrook Beach. Area 1: East of Rte. 1A Seabrook in vacant lot. Area 2: The Sands. Area 3: From Route 1A, head east on Manchester Street to beach.

Dates documented

First reported: 1982-08
Last reported: 2014-11-10

New Hampshire Natural Heritage Bureau - Plant Record

seaside threeawn (*Aristida tuberculosa*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Fair quality, condition and/or landscape context ('C' on a scale of A-D).
Comments on Rank: Good quality and viability, marginal habitat condition and defensibility.

Detailed Description: 2014: >55,000 plants observed.
1997: 101-1000 mature plants, 15% in bud.
General Area: 1997: Sand dune. Associated plant species include *Ammophila breviligulata* (beach grass), *Solidago sempervirens* (seaside goldenrod), *Carex silicea* (sandy sedge), *Rosa virginiana* (Virginia rose), and *Polygonella articulata* (jointweed).
General Comments:
Management Comments:

Location

Survey Site Name: Hampton Harbor Inlet
Managed By: Former Barge Facility Land

County: Rockingham
Town(s): Seabrook
Size: 5.3 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Follow Rte. 1A south from Hampton Beach and cross the bridge over Hampton Harbor Inlet. Proceed to the dune remnant on either side of Ocean Blvd. just south of the toll bridge.

Dates documented

First reported: 1997-07-12 Last reported: 2014-10-06

New Hampshire Natural Heritage Bureau - Plant Record

seaside-sandwort (*Honckenya peploides ssp. robusta*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Not ranked (need more information)

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank:

Detailed Description: 2005: Searched for but not found. 2004: Searched for but not found. 1982: Single plant. 1973: Small colony. Specimen collected.

General Area: 1982: Back dune, near pavement of Rte. 1A. Loose, sandy site just above strandline. Gentle, west-facing slope, inundated only during very high tides. With *Ammophila breviligulata* (beach grass) and *Lathyrus* sp. (beach pea).1973: Sand dune.

General Comments: 2005: As *Honckenya peploides* seems to require sunlight and open space, it may be that the relatively dense *Spartina* (cordgrass) grasses have out-competed it in the flat areas. The slopes leading up to the roadway were thick with shrubby vegetataion such as beach rose and another, unidentified shrub. Only small patches of open sand were present at the site. Presume extirpated. 2004: Also checked a location west of Rte. 1 ca. 100 m south of bridge. In both locations, searched areas just above strand line. Site description of Cross Beach Rd and Rte. 1A intersection by Dunlop et al 1983 still holds. 1982: Only state occurrence.

Management Comments:

Location

Survey Site Name: The Sands
Managed By: Seabrook Back Dunes

County: Rockingham
Town(s): Seabrook
Size: 2.8 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Seabrook back dune. Where Cross Beach Rd meets Rte. 1A. Just above the strand line, very close to pavement of Rte. 1A.

Dates documented

First reported: 1973 Last reported: 1982-10-11

CONFIDENTIAL – NH Dept. of Environmental Services review

New Hampshire Natural Heritage Bureau - Animal Record

Least Tern (*Sterna antillarum*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Apparently secure but with cause for concern
State:	Listed Endangered	State:	Not ranked (need more information)

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2017: Area 1: 1 pair observed nesting. Area 2: 3 pairs observed nesting.
2015: Area 1: 2 pairs observed nesting, 1 chick fledged.
General Area:
General Comments: 2015: First confirmed nesting since 1950s.
Management Comments:

Location

Survey Site Name: Hampton Beach State Park
Managed By: Hampton Beach State Park

County: Rockingham
Town(s): Hampton
Size: .9 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions:

Dates documented

First reported: 2015-06-30 Last reported: 2017

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

New Hampshire Natural Heritage Bureau - Animal Record

Piping Plover (*Charadrius melodus*)

Legal Status		**Conservation Status**	
Federal:	Listed Threatened	Global:	Rare or uncommon
State:	Listed Endangered	State:	Not ranked (need more information)

Description at this Location

Conservation Rank:	Fair quality, condition and/or landscape context ('C' on a scale of A-D).
Comments on Rank:	Rank is for the combined sub-populations.
Detailed Description:	2008: 1 nesting pair, 3 chicks fledged.2007: 1-3 nesting pairs, 3 chicks hatched (re-nest by one pair after storm destroys first 3 nests).2006: 2 nesting pairs, 5 chicks hatched, 2 may have fledged. No known surviving chicks.2005: 1 nesting pair, 3 chicks hatched, 0 fledged.2004: 2 nesting pairs, 7 chicks hatched, 3 fledged.2003: 2 nesting pairs, 3 chicks hatched, 3 fledged.2002: 2 nesting pairs, 1 chick hatched, 1 fledged.2001: 2 nesting pairs, 4 chicks hatched, 3 fledged.2000: 1 nesting pair, 4 chicks hatched, 2 fledged.1999: 1 nesting pair, 4 chicks hatched, 1 fledged.1998: No nesting pairs.1997: 2 nesting pairs, 6 chicks hatched, 0 fledged.
General Area:	2002: Seacoast shore. 1997: Sand beach.
General Comments:	
Management Comments:	2006: Eggs at two nests lost. One probably due to trampling, one to an unknown predator. Recommend an improved predator control program and enhanced communication with law enforcement and lifeguard staff, as well as the general public.2005: Storms and feral cats contributed to losses.2003: One nest lost due to storms (tidal overwash, wind-blown sand).2002: Two nests lost due to bad weather.2000: Two chicks lost 1-2 days after a severe storm. Vehicle traffic (emergency rescue) or a domestic cat (tracks found near nest exclosure) may have played a role.

Location

Survey Site Name: Hampton Beach State Park
Managed By: Hampton Beach State Park

County: Rockingham
Town(s): Hampton
Size: 7.8 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Hampton Beach State Park, south of Hampton Beach and north of Hampton Harbor Inlet. 2002: A pair nested in front of the dune that is just south of the concrete path from the park to the beach. GPS coordinates are for the location of enclosure that was set up around the nest (Obs_id 215). Another pair nested in front of dune closest to jetty. The GPS coordinates indicate the location of the second nest. The first nest was very close but data was not collected before the nest was lost. (Obs_id 214).

Dates documented

First reported: 1997 Last reported: 2008-08

The U.S. Fish & Wildlife Service has jurisdiction over Federally listed species. Please contact them at 70 Commercial Street, Suite 300, Concord NH 03301 or at (603) 223-2541.

New Hampshire Natural Heritage Bureau - Animal Record

Piping Plover (*Charadrius melodus*)

Legal Status		**Conservation Status**	
Federal:	Listed Threatened	Global:	Rare or uncommon
State:	Listed Endangered	State:	Not ranked (need more information)

Description at this Location

Conservation Rank: Fair quality, condition and/or landscape context ('C' on a scale of A-D).

Comments on Rank: Highly impacted habitat (parking lots, residential, beach use) but 5-6 pairs fledging 2-15 young most years. Rank is for the combined sub-populations.

Detailed Description: 2008: 2 nesting pairs, 3 chicks fledged.2007: 0 fledged.2006: 1 nesting pair, 4 chicks hatched, 0 fledged.2005: 2 nesting pairs, 4 chicks hatched, 0 fledged.2004: 2 nesting pairs, 4 chicks hatched, 1 fledged.2003: 5 nesting pairs, 12 chicks hatched, 4 fledged.2002: 5 nesting pairs, 11 chicks hatched, 0 fledged.2001: 5 nesting pairs, 15 chicks hatched, 12 fledged.2000: 5 nesting pairs, 14 chicks hatched, 12 fledged.1999: 5 nesting pairs, 16 chicks hatched, 15 fledged.1998: 5 nesting pairs, 16 chicks hatched, 12 fledged.1997: 3 nesting pairs, 12 chicks hatched, 3 fledged.

General Area: 2002: Seacoast shore. 1997: Sand beach.

General Comments:

Management Comments: 2006: Four chicks lost, probably to predation.2003: One nest was lost to predation, one to bad weather, and two to unspecified causes. 2002: Several nests and chicks were lost to severe weather, and others (including one parent) were lost to suspected predation.2000: Two chick deaths may have been due to cat predation, or in one case vehicular traffic. Enforcement of the town ordinance related to dogs at the beach continues to be needed. 1998: Threats included a bad storm in June (6 inches of rain in one day), high tides (to within 10 feet of the nests), predators such as skunks, dogs, gulls, and especially young children. Cages, signs, fences, and pamphlets were all employed to increase protection.

Location

Survey Site Name: Seabrook Beach

Managed By: Seabrook Dunes and Beach

County: Rockingham

Town(s): Seabrook

Size: 35.1 acres Elevation:

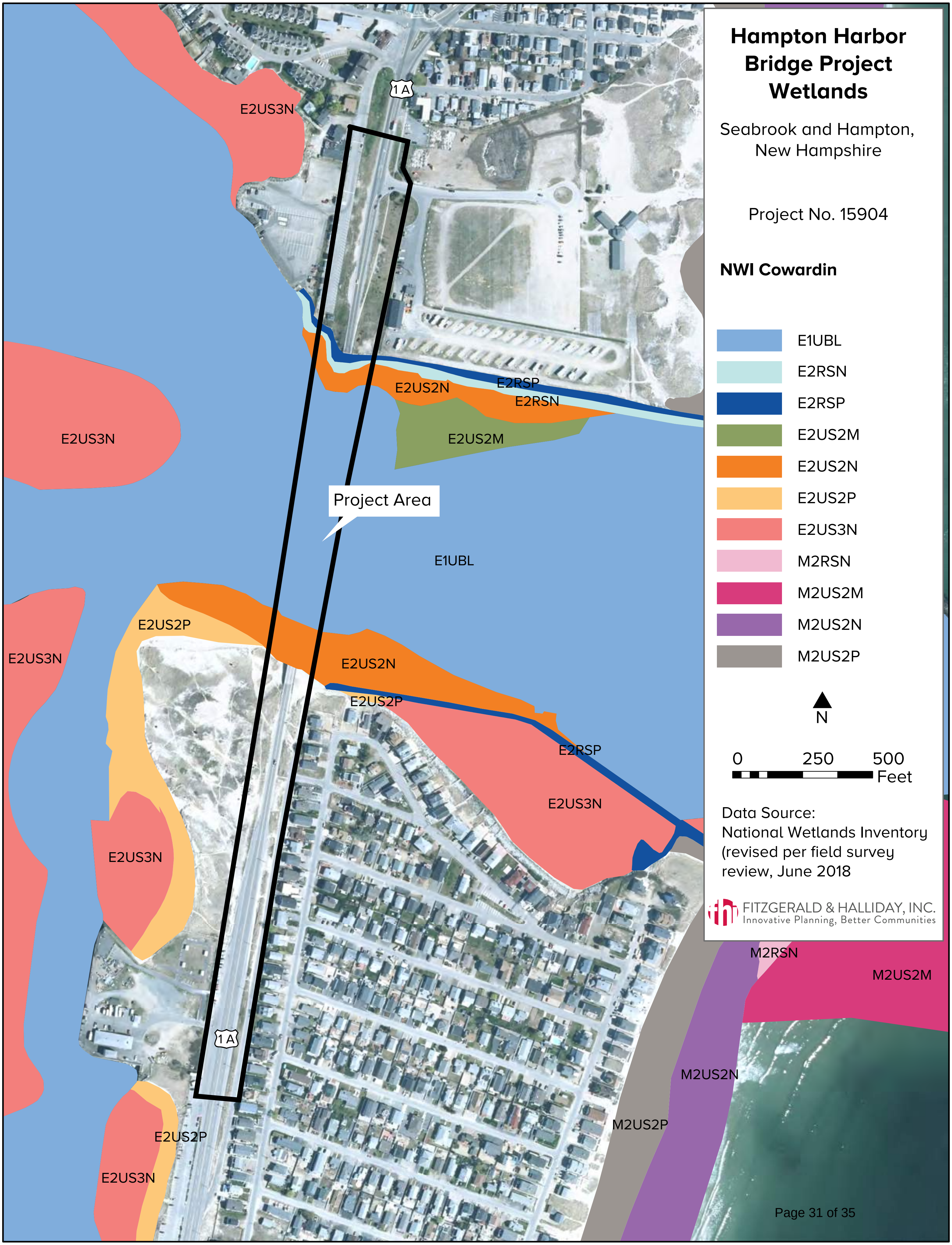
Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Seabrook Beach opposite The Sands area. Nest locations: 2006: North of Hookset Street. 2003: Ocean side of Tilton/Hooksett St. in open beach (Obs_id 327); ocean side of Andover St. in dune slope (Obs_id 326); ocean side of Haberhill St., south in toe of dune (Obs_id 329), north in toe of dune (Obs_id 330); ocean side of Lowell St., toe of dune (Obs_id 328); ocean side of New Hampshire St. in open beach (Obs_id 331). 2002: One nest just south of the beach entrance from Tyngsboro Street and one just south of the beach entrance from Chelmsford Street. The GPS coordinates are for the location of the second nest (Obs_id 216). Two nests near the beach entrance from Dracut Street (Obs_id 217). Three nests just north of the beach entrance from Haverhill Street (Obs_id 218). Two nests just south of the beach entrance from Haverhill Street. The GPS coordinates are for the second nest (Obs_id 219). One nest in the center of the path which leads from the New Hampshire street entrance to the beach. This is at the very south end of Seabrook beach and borders the Mass. state line (Obs_id 220). 2001: Near beach entrance from Groveland Street (Obs_id 227). Near beach entrance from Tyngsboro Street. GPS coordinates are for the second nest (Obs_id 223). Near Hooksett Street (Obs_id 224). Near beach entrance from Dracut Street (Obs_id 226). Near beach entrance from Lawrence Street (Obs_id 225).

Dates documented

First reported:	1997	Last reported:	2008-08

The U.S. Fish & Wildlife Service has jurisdiction over Federally listed species. Please contact them at 70 Commercial Street, Suite 300, Concord NH 03301 or at (603) 223-2541.


Hampton Harbor Bridge Project Wetlands
Seabrook and Hampton, New Hampshire
Project No. 15904
NWI Cowardin
E1UBL
E2RSN
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0 250 500 Feet
Data Source: National Wetlands Inventory (revised per field survey review, June 2018
FITZGERALD & HALLIDAY, INC.
Innovative Planning, Better Communities
Project Area
1A
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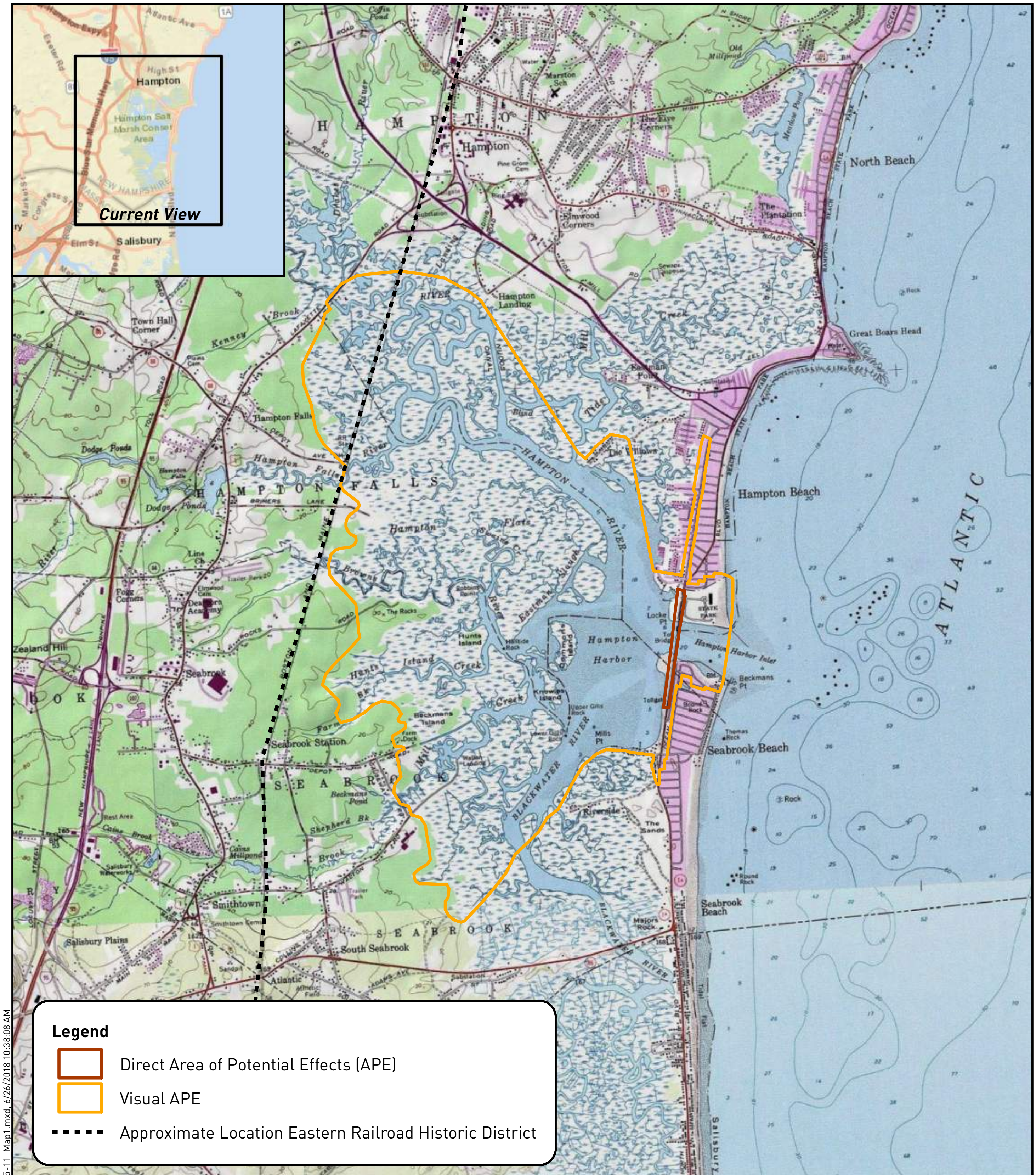

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2,000 0 2,000 4,000 Feet

600 0 600 1,200 Meters

Note: Contour interval is 20 feet.

Project Location

USGS 7.5' Quadrangles: Exeter, 1992, Newburyport, 1987; GIS Services Accessed 6/27/2018: Environmental Systems Research Institute, Inc., World Street Map

HARTGEN archeological associates inc

Map 1

G:\5275\GIS\Documents\HAA_5275-11_Map1.mxd, 6/26/2018 10:38:08 AM

From:	Edith Carson - NOAA Federal
To:	Marc.Laurin@dot.nh.gov
Cc:	Jamie Sikora; Mike Johnson; Reczek, Jennifer; James Murphy; Stephanie Dyer-Carroll; Dan Hageman
Subject:	Re: Seabrook-Hampton, 15904 - Environmental Assessment
Date:	Friday, July 13, 2018 11:37:00 AM

Mr. Laurin,

We received your email on July 10, 2018, regarding the proposed rehabilitation or replacement of the Neil R. Underwood Bridge (NHDOT No. 235/025) and associated roadway improvements. In your letter, you requested any information on the presence of threatened or endangered aquatic species under our jurisdiction. We offer the following comments.

Endangered Species Act

Sea Turtles

Four species of Endangered Species Act (ESA) listed threatened or endangered sea turtles under our jurisdiction are seasonally present in Hampton Harbor including its bays and tributaries: the threatened Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead, the threatened North Atlantic DPS of green, and the endangered Kemp's ridley and leatherback sea turtles. Sea turtles typically occur along the New Hampshire coast from May to mid-November, with the highest concentration of sea turtles present from June through October.

Atlantic Sturgeon

Atlantic sturgeon are present in the waters of Hampton Harbor and its adjacent bays and tributaries. The New York Bight, Chesapeake Bay, South Atlantic and Carolina DPS of Atlantic sturgeon are endangered; the Gulf of Maine DPS is threatened. Adult and subadult Atlantic sturgeon originating from any of these DPS could occur in the proposed project area. As young remain in their natal river/estuary until approximately age 2, and early life stages are not tolerant of saline waters, no eggs, larvae, or juvenile Atlantic sturgeon will occur within the waters of Hampton Harbor and its adjacent bays and tributaries.

Shortnose Sturgeon

Shortnose sturgeon could be present in the waters of Hampton Harbor and could occur in their adjacent bays and tributaries. Shortnose sturgeon are listed as endangered throughout their range. As early life stages are not tolerant of saline waters, no eggs, larvae, or juvenile shortnose sturgeon will occur within the saline waters of Hampton Harbor and its adjacent bays and tributaries.

As project details develop, we recommend you consider the following effects of the project on sea turtles and sturgeon:

- For any impacts to habitat or conditions that temporarily render affected water bodies unsuitable for the above-mentioned species, consider the use of timing restrictions for in-water work.
- For activities that increase levels of suspended sediment, consider the use of silt management and/or soil erosion best practices (i.e., silt curtains and/or cofferdams).
- For pile driving or other activities that may affect underwater noise levels, consider the use of cushion blocks and other noise attenuating tools to avoid reaching noise levels that will cause injury or behavioral disturbance to sea turtles and sturgeon - see the table below for more information regarding noise criteria for injury/behavioral disturbance in sea turtles and sturgeon.

Organism	**Injury**	**Behavioral Modification**
Sturgeon	206 dB re 1 µPaPeak and 187 dB cSEL	150 dB re 1 µPaRMS
Sea Turtles	180 dB re 1 µPaRMS	166 dB re 1 µPaRMS

Depending on the amount and duration of work that takes place in the water, listed species of sea turtles and sturgeon may occur within the vicinity of your proposed project.The federal action agency will be responsible for determining whether the proposed action may affect listed species. If they determine that the proposed action may affect a listed species, they should submit their determination of effects, along with justification and a request for concurrence to the attention of the Section 7 Coordinator, NMFS, Greater Atlantic Regional Fisheries Office, Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930 or nmfs.gar.esa.section7@noaa.gov. Please be aware that we have recently provided on our website guidance and tools to assist action agencies with their description of the action and analysis of effects to support their determination. See - http://www.greateratlantic.fisheries.noaa.gov/section7. After receiving a complete, accurate comprehensive request for consultation, in accordance to the guidance and instructions on our website, we would then be able to conduct a consultation under section 7 of the ESA. Should project plans change or new information become available that changes the basis for this determination, further coordination should be pursued. If you have any questions regarding these comments, please contact me (978-282-8490; Edith.Carson@noaa.gov).

Essential Fish Habitat
In addition, we have received a request for information regarding an Essential Fish Habitat (EFH) consultation under the Magnuson-Stevens Fisheries Conservation and Management Act. The information in your letter for federally-managed species and their EFH appears to be correct. In addition, several other NOAA-trust resources are known to occur in the project area, including American lobster, shellfish (e.g., blue mussel, soft-shell clam), and diadromous fish (e.g., alewife, blueback herring, rainbow smelt, American eel, and striped bass). Some of these species are also prey for federally-managed species, and are therefore considered a component of the EFH for them. Therefore, adverse effects to the species and their habitats should be assessed in the EFH consultation.

An EFH assessment to evaluate the potential adverse effect on EFH for federally-managed species should be prepared and sent to Michael Johnson, Habitat Conservation Division. His contact information is mike.r.johnson@noaa.gov, 978-281-9130.

Thank you,

Edith

Edith Carson-Supino, M.Sc.
Section 7/Shortnose Sturgeon Fish Biologist
NOAA Fisheries
U.S. Department of Commerce
Greater Atlantic Regional Fisheries Office
Phone: 978-282-8490
edith.carson@noaa.gov

For ESA Section 7 guidance please see:
https://www.greateratlantic.fisheries.noaa.gov/section7

On Fri, Jul 13, 2018 at 10:32 AM, Edith Carson - NOAA Federal <edith.carson@noaa.gov> wrote:

> Hi Marc,
>
> Thank you for your request. I will review this and send you my comments shortly.

Thanks!

Edith

Edith Carson-Supino, M.Sc.
Section 7/Shortnose Sturgeon Fish Biologist
NOAA Fisheries
U.S. Department of Commerce
Greater Atlantic Regional Fisheries Office
Phone: 978-282-8490
edith.carson@noaa.gov

For ESA Section 7 guidance please see:
https://www.greateratlantic.fisheries.noaa.gov/section7

---------- Forwarded message ----------
From: **Laurin, Marc** < Marc.Laurin@dot.nh.gov>
Date: Tue, Jul 10, 2018 at 2:37 PM
Subject: Seabrook-Hampton, 15904 - Environmental Assessment
To: Max Tritt <max.tritt@noaa.gov>
Cc: Jamie Sikora <jamie.sikora@dot.gov>, Mike Johnson <Mike.R.Johnson@noaa.gov>, "Reczek, Jennifer" <Jennifer.Reczek@dot.nh.gov>, James Murphy <James.Murphy@hdrinc.com>, Stephanie Dyer-Carroll <sdyer-carroll@fhiplan.com>, Dan Hageman <DHageman@fhiplan.com>

Max,

The NH Department of Transportation is in the process of gathering information on the environmental resources present to prepare an Environmental Assessment on the proposed rehabilitation or replacement of the US Route 1A bridge over Hampton Harbor Inlet in Seabrook and Hampton, NH.

Attached is letter with further details on the project. Your input on the resources of concern is much appreciated.

Please contact me if you have any questions.

Marc

Appendix F:
Condition Evaluation – Mechanical and Electrical Systems

Mechanical & Electrical Inspection Report for the Hampton Harbor Bridge

15904 Seabrook-Hampton

Hampton Br. No. 235/025

HDR Engineering, Inc.

August 13, 2018

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

1.1 Project Description

This Inspection Report has been prepared to propose short term recommendations on the New Hampshire Department of Transportation (NHDOT) Bridge No. 235/025, Hampton Harbor Bridge, to keep the system functional for the next 10 years. The bridge carries NH Rt. 1A (Ocean Boulevard) over the Hampton Harbor Inlet connecting the towns of Seabrook and Hampton. The bridge is programmed in the NHDOT 10 Year Plan for Fiscal Year 2023 as project number 15904 and scheduled for rehabilitation or replacement. The Hampton Harbor Bridge Main Movable Span Electrical and Mechanical systems were inspected on July 19th of 2018.

The following personnel performed the bridge inspection:

Matthew Cassera	HDR/Mechanical Engineer
Yetunde Adelekan	HDR/Senior Electrical Engineer
Vittorio Luchetta	HDR/Electrical Coordinator

The intent of this report is to evaluate existing conditions and project goals, and to recommend a solution which best accomplishes the project goals.

The preliminary investigations show there are no critical electrical or mechanical issues that need immediate attention. There are a few items that should be addressed to prolong the life expectancy of the bridge which are detailed in Section 5 – Repair Recommendations.

1.2 Description of Bridge Systems

The Hampton Harbor Bridge is a single leaf, two-girder, fixed trunnion, bascule designed in 1946. The bridge provides a 26-foot wide two-lane roadway and one 5-foot wide sidewalk on the east side of the bridge. The span has 40’ of horizontal navigational clearance. Information was obtained from the as-built drawings by H&H dated November of 1983 found in the operator’s house as well as a previous inspection report by HDR dated June of 2010.

The operator’s house is located at the northwest corner of the bascule span. The upper level (first level) contains the control desk and is where the operator is located during operation. The span level (second level) contains the motor control center (MCC), control relays, secondary motor resistors, two lighting panels, and the emergency auxiliary drive control panel. The motor level (third level) contains the two main motors, brakes, rotating cam limit switch, and span level indicator. The generator level (fourth level) contains the emergency diesel generator, an air compressor, two lighting panels, and the submarine cable termination box.

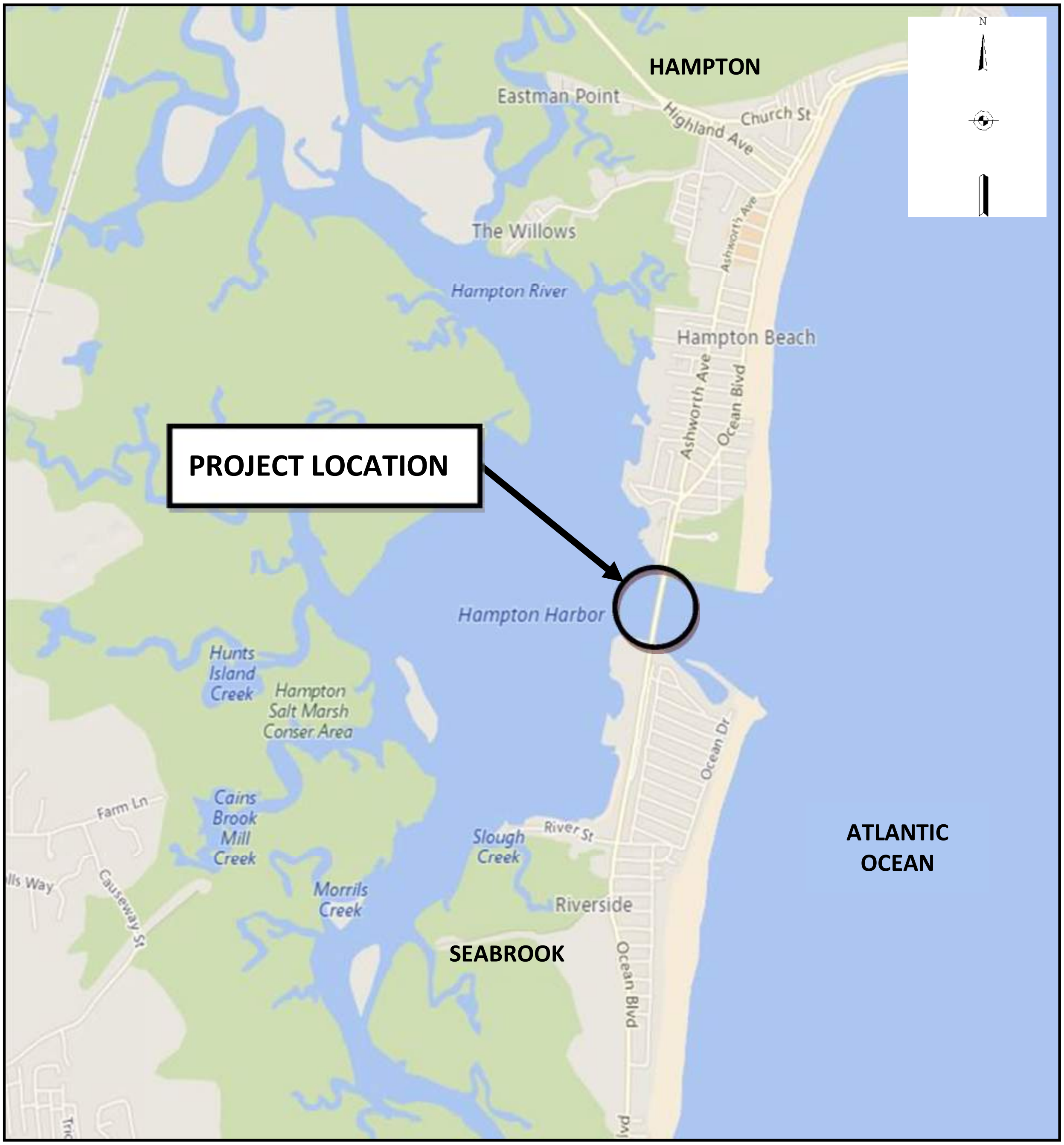
The span is operated via two 15 horsepower (HP) wound rotor type motors under normal operation. The span speed is controlled by varying the resistance on the secondary resistors of the main motors. The bridge operator controls all devices from the control house on the first level. The span stops automatically when it reaches the nearly closed or nearly open positions. The operator then drives the bridge manually at a slower speed to fully open or fully closed positions. The bridge power is fed from a utility feeder at the north abutment. The submarine cables provide power and control to the span lock motors and instruments, span seated limit switches, far side gates, warning bell, and traffic lights.

The main drive system uses one set of open gearing after the main motors, differential reduction gearing above the machinery pier (which shares torque between the two main pinions), and secondary open gearing before each main pinion. The main pinions operate the bridge via the curved racks which are mounted to each of the bascule girders.

The bridge is also equipped with an emergency auxiliary drive system located at the machinery level. The auxiliary system couples to the main drive shafts from the first set of open gearing using a disconnect coupling. The system consists of a motor with rear mounted brake, enclosed gear reducer, and three sets of open gear reduction. Hand wheel operation of the bridge is also provided through two of the open gear sets in the auxiliary machinery room on the machinery pier.

The two span locks located on the rest pier are operated using a motor with rear mounted brake and enclosed speed reducer. The output shafts on the speed reducer rotate the crank arms which drive and pull the lock bars. The live load supports are also located at the rest pier and mate with live load shoes on the bottom of the bridge to support the bridge against load due to traffic on the span.

2 LOCATION MAP



NH RTE. 1A (OCEAN BOULEVARD)

OVER HAMPTON RIVER

SEABROOK – HAMPTON, NH

3 ELECTRICAL INSPECTION

3.1 Inspection Approach

A visual inspection of the bridge electrical and control systems components was conducted. All the accessible cabinets and enclosures were opened and inspected. These include but are not limited to the operator desk, motor control center (MCC), main span motors, span lock platform, warning gates, barrier gates, and the electrical incoming feed room. The following sections describe inspection findings that were found for various components of the system. Each electrical subset is given a condition state rating of good, fair, poor, or severe based on descriptions in the AASHTO Movable Bridge Inspection, Evaluation, and Maintenance Manual (see Appendix D for general descriptions).

3.2 Motor Control Center (MCC) & Control System

The main slate board MCC is located at the span level (MCC room). It is an enclosed unit with doors on both front and back for accessibility. It houses the motor starters and the control relays for the bridge control system (see photo E-01). A number of the original components and wiring has been replaced over time as well as components being added to the system. The remaining device original devices and original wiring show signs of deterioration (see photo E-02). The MCC currently sits too close to the East side wall of the operator's house and does not meet code for working clearances (see photo E-03). There are a number of motor overloads that are tripping periodically on the main span motor starters and main motor brake starters.

Overall Electrical Condition Rating: Poor

3.3 Main Motors

Both main span motors are manufactured by General Electric (see photo E-04) and have the same ratings as follows:

Manufacturer: GE	**Frame**: 404Z	**Duty Cycle**: 30 Mins	**Type**: MR
Model: 5MR1404CA1	**Temp. Rise**: 55 Deg. C.	**Horsepower**: 15 HP	**Primary Voltage**: 220/440V
Phase: 3Ø	**FLC**: 58/29 Amps	**Full Load Speed**: 690 RPM	**Cycle**: 60 Hz
Sec. Voltage: 145V	**Secondary Current**: 49 Amps		

The inspection cover gaskets are deteriorated. The interior of the motor is dirty and has a lot of grease built up which indicates that the bearing seals may be deteriorated (see photo E-05). The brushes are also dirty and have a significant amount of dust built up (see photo E-06).

Overall Electrical Condition Rating: Poor

3.4 Emergency Drive System (AUX)

The emergency drive motor and local disconnect switch are located in the machinery area (see photo E-07). The motor, local disconnect switch, and manual wheel exhibit moderate to severe corrosion. An insulation resistance test was performed on the motor in 2010 by HDR. The result of the test was a 20MΩ reading. The result of a previous IR test, performed by LBG and H&H during an in-depth inspection in 2001 was 100MΩ. The drop in the insulation resistance is a sign the stator insulation may be deteriorated. The test by HDR was over 8 years ago which could mean the insulation may be even more deteriorated now.

The current emergency drive system is not electrically interlocked with the normal drive systems brakes. Operation of the emergency drive system requires manual release of the motor brakes which is not in compliance with ASHTOO LRFD 2007 2nd edition, paragraph 6.9.2.4.

Per the bridge staff, the emergency drive system have not operated in several years, as a result the condition of the emergency drive system could not be verified. See mechanical section for additional information.

The emergency drive controller is attached to the side of the MCC (see photo E-08). The controller contains relays, push buttons, and indicating lights to control the emergency motor. The cabinet itself and its internal components are in good condition.

Overall Electrical Condition Rating: Severe

3.5 Brakes

The two brake motors are similar in type and ratings. They are mounted to the shaft extension of the main motors. The name plate information is as follows:

Manufacturer: Magnetek	**S/N**: 611497.1	**Model**: 103930 08MSTEED23S
Supply: 230/460/3/60HZ	**Amps**: 0.88/0.44	**Max Torque**: 155

The current brakes were recently replaced and are relatively new. However, they are not equipped with local disconnect switches, which make the installation not in compliance with NEC 110.58.

The current system has motor brakes only, which does not meet current code requirements. ASHTOO LRFD 2007 2nd edition, paragraph 5.2.1 requires the presence of a machinery brake.

The current brake assembly is equipped with three limit switches for brake set, brake release and brake hand released limit position. The brake released and hand released limit switches are wired and connected to bridge control system and indicator lights on the control desk. The brake set limit switches are not connected. This could be problematic if the brake gets stuck between set and released, the operator would have no way of knowing since there is no indicator light on the control desk.

Overall Electrical Condition Rating: Severe

3.6 Control Desk

The control desk enclosure has peeling paint and there are a number of indicating lights that need bulb replacement. The voltmeters and current meters on the top side of the control desk are not operational (see photo E-09).

Overall Electrical Condition Rating: Poor

3.7 Indication & Measuring Instruments

3.7.1 Height & Position Indication

The rotary cam limit switch and the span position transmitter are located in the main motors room (see photo E-10). They are in good condition.

3.7.2 Span Seated Limit Switches

The original limit switches for span fully seated were two plunger type limit switches but both have been disconnected and replaced with one lever type limit switch (see photo E-11). It is in good condition.

Overall Electrical Condition Rating: Fair

3.8 Span Locks

The span lock motor along with its local disconnect switch and the span lock rotary limit switch are all located at the span lock platform on the far side. The span lock are equipped with two limit switches, a rotary cam limit switch interlocked coupled to the span lock motor assembly and electrically interlocked with the span lock pulled and driven input control circuit, and a lever type limit switch actuated by the lock bar and electrically interlocked with the span lock position feedback control circuit The span lock motor and the span lock rotary limit switch both showed signs of corrosion.

Overall Electrical Condition Rating: Poor

3.9 Miscellaneous

3.9.1 Secondary Resistors

The secondary resistors are suspended from the ceiling above the MCC. The wiring is old and exhibited some degree of deterioration. The resistors are open type without any safety guards (see photo E-12).

Overall Electrical Condition Rating: Poor

3.9.2 Lighting Panels

There are two lighting panels at the span level (MCC room). Both panels provide 120/240 volts power to lights and other loads. One panel is 3Ø 40 Amps and the other is 1Ø 100 Amps.

There are two additional lighting panels at the fourth level (Generator room). One is 120/208 Volts 3Ø 50 Amps fed from a 240/208 Volts step down transformer. This panel is used to provide power to the new barrier gates. The other panel is 120/240 Volts 1Ø. This panel provides power to the air compressor.

Overall Electrical Condition Rating: Fair

3.9.3 Traffic Lights

There are two traffic lights at each approach. The traffic system appeared to be functional at the time of the inspection.

Overall Electrical Condition Rating: Fair

3.9.4 Lift Siren & Warning Bells

The lift siren is located at the outside North wall of the operator room. There are two warning bells mounted at the traffic light masts one at each approach. The siren and warning bells were all operational.

Overall Electrical Condition Rating: Fair

4 MECHANICAL INSPECTION

4.1 Inspection Approach

A visual inspection of the bridge mechanical systems was conducted. The inspection included the span drive machinery, trunnions, instrumentation, live load shoes, and span locks. Detailed measurements were not taken as a part of this scope. All maintenance and inspection hatches were opened for inspection if they could be easily removed using hand tools or built in handles. The following sections describe inspection findings that were found for various components of the system. Each machinery subset is given a condition state rating of good, fair, poor, or severe based on descriptions in the AASHTO Movable Bridge Inspection, Evaluation, and Maintenance Manual (see Appendix D for general descriptions).

4.2 Operating Machinery

4.2.1 Motors, Brakes, and Mounting

The motors are adequately mounted and the Zerk fittings appear to have been lubricated recently. The sleeves on the motor couplings appear to be slightly misaligned, however this is not uncommon for grid type couplings and does not indicate misalignment of the shafts or coupling hubs. There was no unusual noise or signs of misalignment noted between the shafts during operation. Both motors operate together under normal operation. The control system does not include provisions to operate the bridge on only one of the main motors.

The brakes are in good condition. Both brakes are set to about 155ft-lbs of torque. According to maintenance and bridge staff Brake #2 was replaced around 2011 and Brake #1 was replaced within the last few years. The brakes were replaced when the previous brakes had failed due to exceeding its service life. Neither of the “brake set” limit switches are electrically connected to the control system and the lever arms are not properly set to trigger in the “brake set” position (see Photo M-01). See the electrical section for more details. AASHTO recommends bridges be equipped with machinery brakes as near the racks and pinions as possible. This bridge is not equipped with machinery brakes and should any mechanical component fail between the first open gear set and the pinions, the bridge would have no provision for braking.

The nuts on the Brake #2 mounting fasteners are not fully engaged due to undersized bolt lengths (see Photo M-02). Both brakes use full size shim plates which do not have enough fasteners to meet seal spacing requirements and are not painted. These conditions can lead to accelerated pack rust of the shims and misalignment of the brakes.

Overall Mechanical Condition Rating: Poor

4.2.2 Open Gearing

All open gears are covered with machinery housings and were visually inspected through inspection and maintenance hatches. During operation the machinery room, which houses the motors, emits a continuously loud hammering noise. The noise is the result of spur gear backlash in the primary open gear sets within the machinery room. The large gear is driven by 2 separate pinions which are coupled to each motor. The combination of the high speed of the open gearing and small misalignments between the pinions and gear can result in loud operation of the system. However, the gears appear to be in fair condition with light scoring on the teeth with less than 15% tooth wear. Grease patterns indicate good contact across the tooth faces and minor parallel misalignments between the shafts. Note that tooth dimensions were not measured during this inspection.

The remainder of open gearing is adequately lubricated with no obvious signs of misalignment or advanced tooth wear. From the visual inspection the open gearing appears to have a remaining service life of at least 10 years. Detailed measurements and calculations would be required to more precisely estimate the remaining service life of the gears.

Overall Mechanical Condition Rating: Fair

4.2.3 Shafts and Couplings

The shafts on the outboard sides of the primary open gear housing are not painted and exhibit surface rust. The coupling on the driven end of the primary open gear housing is in good condition with the exception of paint failure and scoring around the driving end of the coupling sleeve (see Photo M-03). This appears to be due to one of the inspection hatches on the open gear housing which rests on the coupling when open. The motor and machinery coupling in the machinery room are not fit with grease fittings. It is unclear if these are properly lubricated.

The shafts are typically painted with isolated areas of paint failure and surface rust. The main pinion shaft couplings were replaced in early 2018 after the previous couplings failed due to inadequate lubrication and an extended service life. The shafts on both ends of the couplings have a center bore along the length of the shafts, allowing the coupling grease to slowly leak through the bores and down the length of the shafts (see Photo M-04). This condition reduces the level of lubrication in the couplings, creates grease buildup on the machinery pier, and allows dirt and moisture to contaminate the inside of the couplings.

Overall Mechanical Condition Rating: Fair

4.2.4 Bearings

The bearings in the machinery room are in fair condition and have adequate lubrication. The main pinion shaft bearings are in a similar condition and had their cap bolts replaced during the coupling replacement in early 2018. The remainder of bearings are adequately painted with isolated areas of paint failure and surface rust. Bearing clearances were checked for a few bearings where measurements were easily accessible and all were under an RC9 fit which is used as a benchmark for maximum clearance before corrective action should be considered.

The bearing cap bolts, housing fasteners, and support fasteners for the open gear sets exhibit varying degrees of paint failure and section loss ranging from moderate to severe. Some nuts and fasteners were noted to have over 50% section loss (see Photo M-05).

Overall Mechanical Condition Rating: Severe

4.2.5 Racks and Pinions

The racks and pinions are in fair condition. The gear teeth are adequately lubricated and exhibit less than 15% wear. The differential gearing on the bridge allows for even load sharing between the two main pinions and grease patterns indicate even face contact between the racks and pinions. The main pinion shafts were removed and re-installed during the coupling replacement in early 2008. The rack connection fasteners exhibit mild to medium paint failure and section loss. From the visual inspection the rack and pinions appear to have a remaining service life of at least 10 years. Tooth wear indicates the bridge has been span heavy for the majority of its service life, however, there is no indication as to the current span balance condition. Detailed measurements and calculations would be required to more precisely estimate the remaining service life of the gears.

Overall Mechanical Condition Rating: Fair

4.3 Emergency Drive

4.3.1 Motors, Brakes, and Mounting

According to maintenance and bridge staff the auxiliary system has not been operated for several years. The auxiliary motor and rear mounted brake exhibit severe external surface corrosion (see Photo M-06). The shaft seals and motor mounts are deteriorating and not painted. It is unclear if the motor and brake are still operable or if they have seized in place due to deterioration of the mechanical and electrical parts.

Overall Mechanical Condition Rating: Severe

4.3.2 Primary Reducer and Mounting

The primary reducer exhibits severe surface corrosion and paint failure (see Photo M-07). There are several holes in the reducer housing due to corrosion and the internal gearing is visible. The reducer is not adequately lubricated. The output shaft is fit with a pinion gear and supported on its end by an external bearing. This mounting configuration is not recommended for enclosed reducers. The support mounting the reducer exhibits sever corrosion and section loss. No attempt should be made to operate the reducer in its current condition.

Overall Mechanical Condition Rating: Severe

4.3.3 Open Gearing

The open gears do not appear to have been used over the course of several maintenance cycles. A layer of surface rust is present on the gears, hidden under several layers of dirt, debris, and old grease from excess lubrication and lack of operation. The gear hubs are not painted and exhibit mild to medium surface corrosion. The gear housings and mounts are rusted with mild section loss.

Overall Mechanical Condition Rating: Poor

4.3.4 Shafts and Couplings

The gear shafts are not painted and are covered in surface rust. The shafting for the primary open gear set may be seized in the bearings due to corrosion and poor lubrication. No attempt was made to move the shafts. The hand-wheel and shaft extension are unpainted and corroding.

The motor coupling is unpainted and covered in dirt and rust. The machinery coupling is in poor condition with section loss on the flanges and fasteners (see Photo M-08). Lubrication is old and contaminated with dirt and debris.

The disconnect coupling hubs exhibit mild paint failure and surface rust. The shifting mechanism and its fasteners are deteriorating due to corrosion. The lever appears warped, but still functional with reduced reliability.

Overall Mechanical Condition Rating: Poor

4.3.5 Bearings

The bearings for the secondary open gearing and disconnect coupling are in fair condition. The bearings, fasteners, and mounts for the primary open gear set are in severe condition. The bearings are dry, corroded, and likely seized with their shafts (see Photo M-09). The mounts and fasteners exhibit severe section loss and may fail if operation is attempted.

Overall Mechanical Condition Rating: Severe

4.4 Span Lock Machinery

4.4.1 Span Lock Operators

The drive machinery is typically covered with surface rust, paint failure, and bird droppings. The motor and brake are in otherwise poor condition. The motor shaft and couplings are also covered in dried grease and dirt. There are signs of previous oil leaks all around the gearbox at the split line and at the elbow of the fill pipe. There is no sight gauge to check the oil level. The breather at the top of the reducer is clogged (see Photo M-10). The input shaft for manual operation is corroded and the lever arm of the hand wheel limit switch is seized due to do built up dirt and old grease (see Photo M-11).

Overall Mechanical Condition Rating: Poor

4.4.2 Shafts, Couplings, Bearings, Crank Arms

All shafts, couplings, bearings, and crank arms are covered in surface rust, debris, and old grease. The couplings between the reducer and crank arms are deteriorating around the fasteners in the connection flanges due to corrosion (see Photo M-12). The crank arm bearing fasteners exhibit severe corrosion and section loss over 50% in some cases (see Photo M-13).

Overall Mechanical Condition Rating: Poor

4.4.3 Lock Bars, Guides, and Receivers

The lock bars, guides, and receivers are typically covered in old grease and debris (see Photo M-14). The east lock bar does not hold the bridge firmly against the live load support and the bridge bounces slightly during live load from vehicular traffic. The guides and receivers do not appear to be shimmable to allow for adjustment to hold the bridge down. The fasteners around the machinery exhibit paint failure and corrosion. About 50% of the fasteners are not fully engaged with their nuts.

Overall Mechanical Condition Rating: Poor

4.5 Instrumentation Machinery

The instrumentation drive for bridge positions is in fair condition. The gearbox and bearings are securely fastened. Although the bearings are adequately lubricated it is not clear whether the gearbox has been receiving proper maintenance. The jaw couplings exhibit light surface rust. The cross-shaft which extends out to the trunnions is not painted and has areas of more than 10% section loss (see Photo M-15). The top of the pushrod which connects to the bascule girder is bent. It is not clear how this occurred, but it was likely due to over travel of the bridge in the open position (see Photo M-16).

The span lock instrumentation machinery on the output shaft of the enclosed reducer is in poor condition. The bearings, gears, and jaw coupling are covered in a thick layer of dirt and debris which decreases reliability of the system and complicates future maintenance (see Photo M-17). The output seal on the rotary cam box is also deteriorating which can allow debris to enter the box and contaminate the equipment.

Overall Mechanical Condition Rating: Poor

4.6 Live Load Bearings and Bumper Blocks

The live load supports are securely anchored to the rest pier and no major defects were noted. The live load shoes on the underside of the bridge exhibit mild paint failure and surface rust. The fasteners for the live load shoes are corroded with severe section loss (see Photo M-18). The east live load shoe is not fully seated against the live load support while the span locks are driven and the bridge bounces about 1/8” under live load from vehicular traffic.

The bumper blocks are securely fastened to the pier and there are no major defects noted on the blocks are reinforcing plates at the underside of the counterweight.

Overall Mechanical Condition Rating: Poor

4.7 Trunnions

The trunnion shafts, supports, and bearings are in good condition. Light scoring is present on the bronze bushings between the trunnion shaft collars and bearings. All fasteners are painted and lubrication appears fresh. The inboard supports for the trunnion shafts exhibit mild to moderate surface corrosion.

Overall Mechanical Condition Rating: Poor

5 REPAIR RECOMMENDATIONS

HDR recommends the following work for repairs to the Hampton Harbor Bridge to continue safe and reliable operations of the bridge. Due to the expected remaining service life of 7-10 years these recommendations have been separated into two categories:
1) Priority Repairs - Recommendations that should be implemented in the next 2-3 years.
2) Other Repairs - Recommendations that are not immediately required, but that will reduce risk of service outages over the next 7-10 years.

5.1 Priority Repairs

The following are recommendations that should be implemented in the next 2-3 years.

1. The main span motors show signs of grease build up and dirt/dust on the brushes. Rehabilitate the existing span motors.
2. The current overloads for the brake motor starters are undersized at 0.81 FLA maximum (actual brake FLA 0.88). Although the overload of the motors are adequately sized, the frequent trips could be a result of a defective overload. Increase the overload size on the motor starters that are tripping (main motors and brakes). Stock spare motor starters, overloads, and machine tool relays at the operator’s house in the event one of these components fails.
3. The current brake control configuration does not provide the operator with the status of the brake when it is set, so the operator would not be informed if the brake were to jam between the set and released positions. Wire the brake set limit switch into the control permissive and add an indicating light on the control desk.
4. During the inspection HDR was unable to test the generator. It is unknown whether or not the generator functions properly. Test the generator once a month to confirm functionality and reliability.
5. It is unclear if the couplings in the machinery room have been receiving proper lubrication. The main pinion shaft couplings failed in 2017 due to poor lubrication. If there are no records of coupling maintenance then the coupling sleeves should be disassembled and the condition of the internal coupling components should be inspected.
6. The main pinion shaft couplings are leaking grease through the center bore in the connecting shafts. Thoroughly clean and install plugs in the bores of the connecting shafts and re-lubricate the couplings.
7. All span lock machinery is covered in dirt, old grease, and bird debris. All machinery should be cleaned and repainted. Spike strips or covers should be supplied over the machinery to deter birds from the area.
8. A new breather should be supplied for the span lock reducer and the oil should be replaced.
9. The east live load shoe is not fully seated against the support and the fasteners on both shoes are in poor condition. Replace the live load shoe fasteners and shim the east live load shoe for full contact.

5.2 Other Repairs

The following are recommendations that are not immediately required, but will reduce the risk of service outages over the next 7-10 years.

1. The auxiliary drive system is in severe condition and should not be operated in its current state. Replace the auxiliary drive system with a new motor, brake, and gearbox coupled to the existing auxiliary drive shaft or secondary open gearing. The new auxiliary motor shall be equipped with

an internal heater to minimize corrosion. The auxiliary drive system should be interlocked with the main motor brake system to provide for additional safety feature in the event of a mechanical failure.

2. Install new local heavy duty stainless steel, NEMA 4X, lockable disconnect switch for the auxiliary system.
3. Install new clutch for auxiliary system?
4. Replace all brake mounting bolts which are not fully engaged with a washer on the bottom and positive locking mechanism. Paint all fasteners and shim plates to avoid accelerated deterioration.
5. Many of the bearing cap bolts, support fasteners, and open gear mount fasteners are corroded and exhibit section loss. All fasteners with more than 20% section loss should be replaced and the remainder should be cleaned and painted.
6. The rack connection fasteners exhibit corrosion and section loss. All fasteners with more than 20% section loss should be replaced and the remainder should be cleaned and painted.
7. If the hand wheel limit switch is integrated with the control system then the switch should be replaced.
8. Many of the span lock coupling and bearing fasteners are corroded. All fasteners with more than 20% section loss should be replaced and the remainder should be cleaned and painted.

APPENDIX A - ELECTRICAL PHOTOS

Photo E-01: Motor Control Center (MCC)

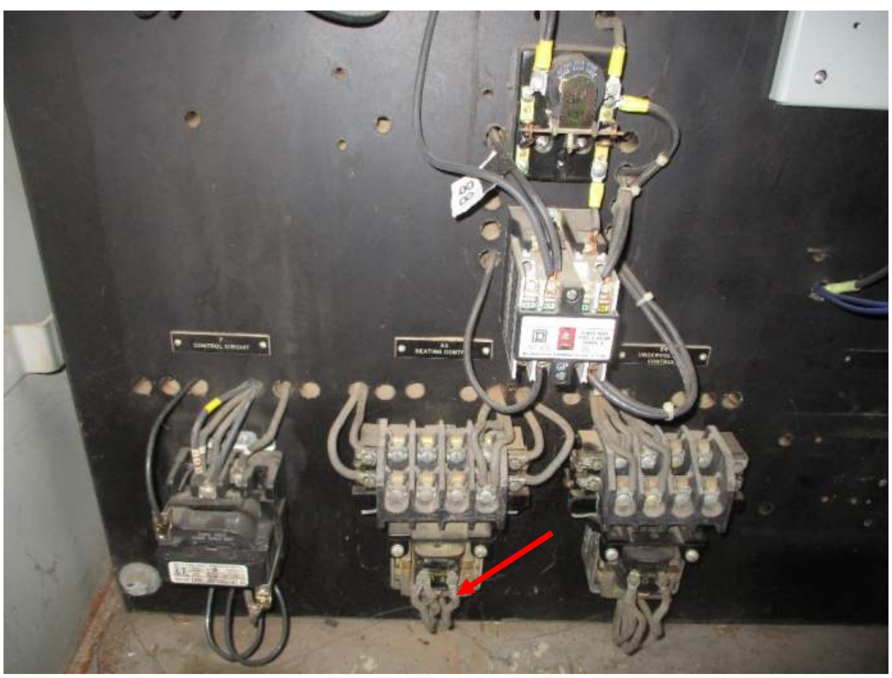


Photo E-02: Motor Starters Showing Deterioration

Photo E-03: MCC Insufficient Working Clearance from East Wall

Photo E-04: Front Nameplate Main Span Motor 2

Photo E-05: Inside View of Main Span Motor 1 Showing Grease Build Up

Photo E-06: Inside View of Main Span Motor 2 Showing Dirt/Dust Build Up

Photo E-07: Emergency Motor Exhibiting Corrosion & Rust

Photo E-08: Emergency Motor Control Panel

Photo E-09: Control Desk

Photo E-10: Span Position Transmitter & Rotary Cam Limit Switch

Photo E-11: Newer Span Seated Limit Switch

Photo E-12: Secondary Resistors (located above the MCC)

APPENDIX B - MECHANICAL PHOTOS

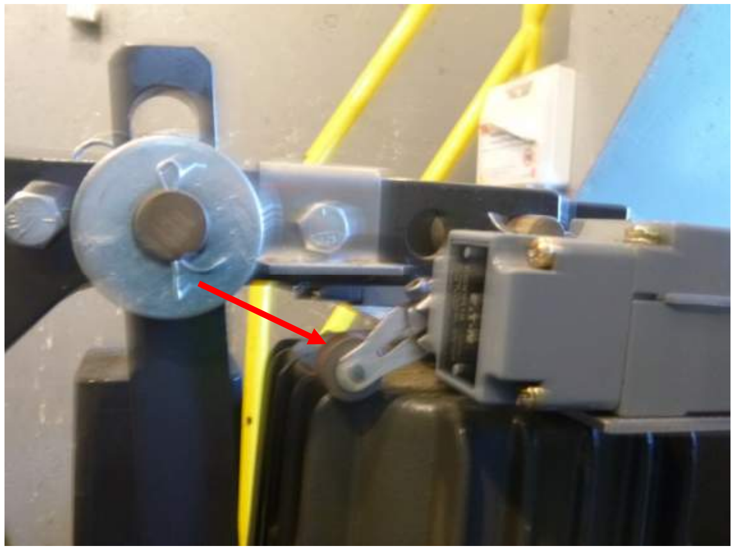


Photo M-01: The brake "set" limit switches are not connected to indicate when the brakes are set.

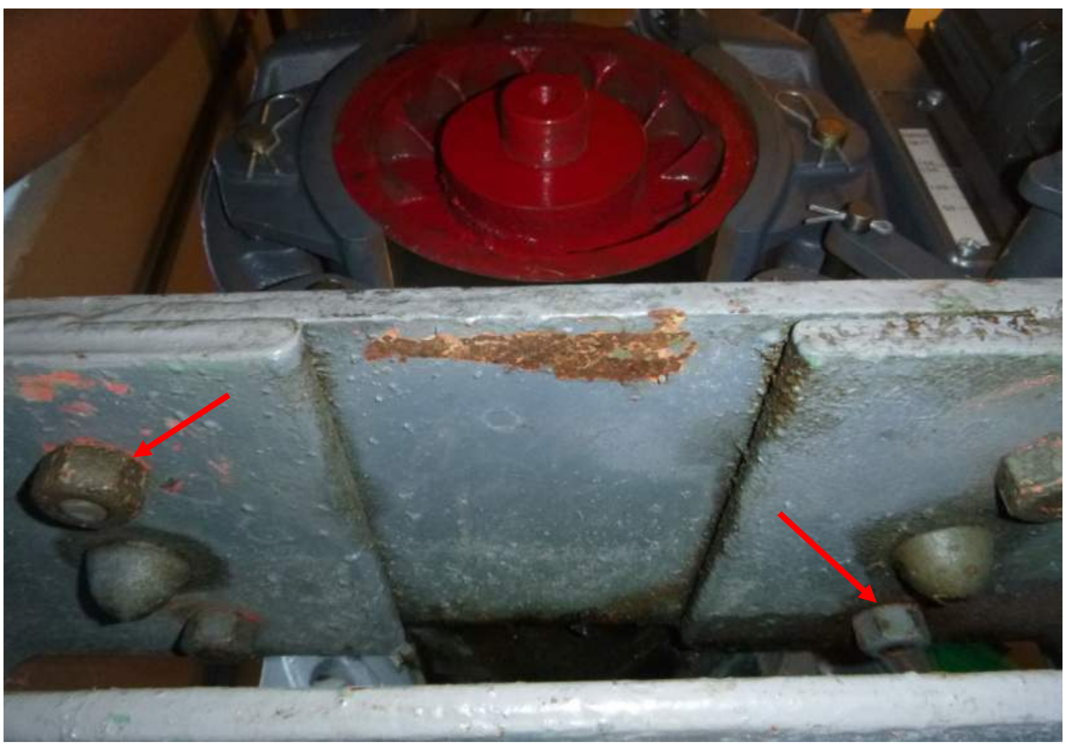


Photo M-02: The bolts for Brake #2 are not full engaged with the nuts.

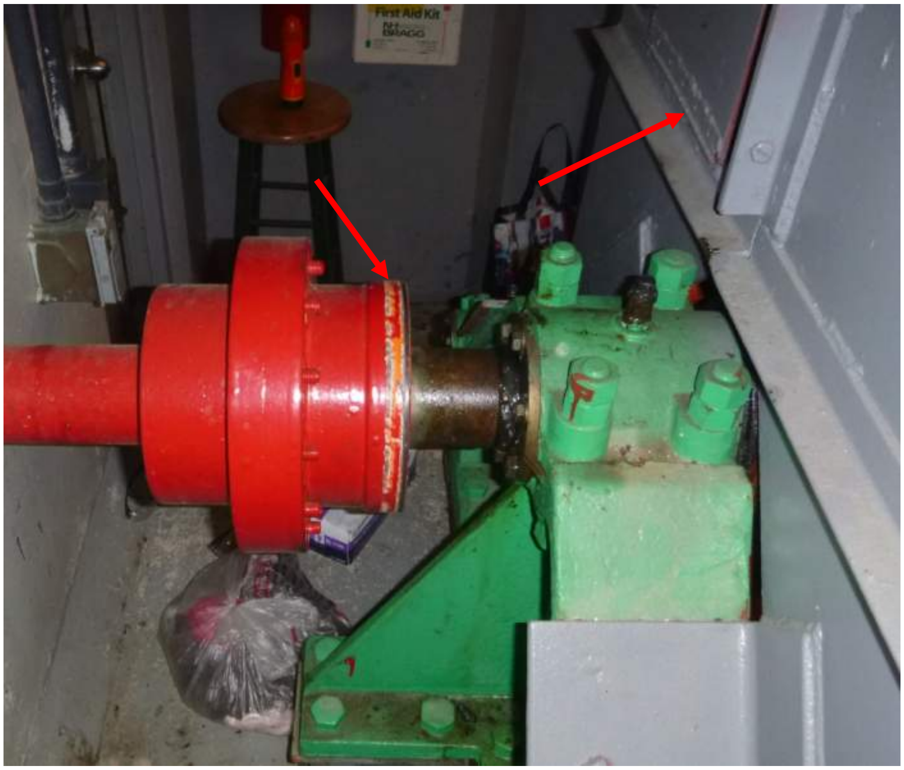


Photo M-03: The machinery coupling from the primary open gear set is scored from the maintenance hatch on the housing for the open gearing.

Photo M-04: The main pinion shaft coupling grease is leaking through the connecting shafts.

Photo M-05: The open gear housing and bearing fasteners are corroded with varying degrees of section loss.

Photo M-06: The auxiliary motor and brake exhibit moderate to severe corrosion and have not been operated in several years.

Photo M-07: The outside of the enclosed reducer is corroded and the mount is in poor condition.

Photo M-08: The auxiliary machinery coupling exhibits corrosion and section loss around the fasteners on the connection flanges.

Photo M-09: The bearings and mounts for the primary open gear set of the auxiliary machinery are severely corroded and may have seized with the shaft.

Photo M-10: The breather on the span lock reducer is clogged and covered with tape.

Photo M-11: The hand wheel shaft and limit switch are corroded and the limit switch lever arm has seized in place due to dirt and debris.

Photo M-12: The span lock machinery couplings exhibit corrosion and section loss on the flanges around the fasteners.

Photo M-13: The fasteners on the crank arm bearings are severely corroded with over 50% section loss.

Photo M-14: The lock bars are covered in old grease, dirt, and bird debris.

Photo M-15: The span drive instrumentation shaft is corroding and exhibits section loss.

Photo M-16: The pushrod for the span drive instrumentation is bent.

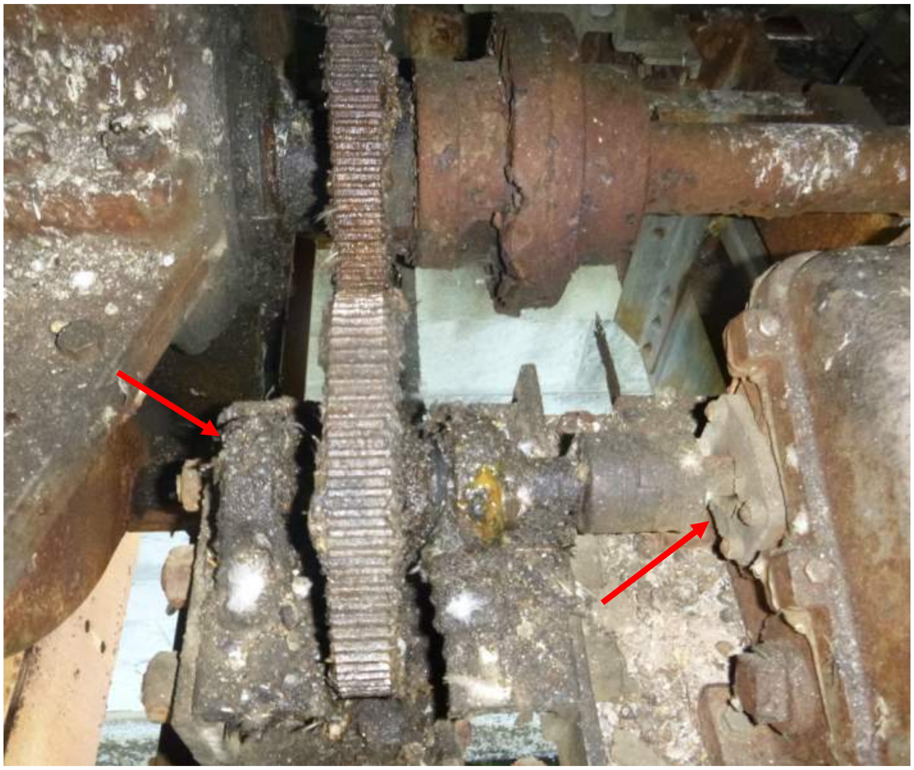


Photo M-17: The span drive instrumentation machinery is in poor condition.

Photo M-18: The live load shoe rivets exhibit severe corrosion and section loss.

APPENDIX C – ELECTRICAL CONDITION STATE DESCRIPTIONS

CHAPTER 3.6—ELEMENT 605 – MOVABLE BRIDGE DRIVE SYSTEM – ELECTRICAL

Description: The electrical components which provide or arrest motion to the span.

Classification: ADE

Units of Measurement: each

Quantity Calculation: Number of span drive systems for the entire bridge. For example, a single-leaf bascule would typically have a quantity of one; a double-leaf bascule would have a quantity of two.

Condition State Definitions

Defect	Condition State			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Operation (9000)	Bridge electrical drive system operates normally.	Bridge electrical drive system functions adequately with minor indications of issues such as slight motor overloading, speed or torque inconsistencies, or speed variation timing – items not requiring immediate repair or adjustment.	Bridge electrical drive system operating abnormally, either drawing very high current, overheating, operating too fast or too slowly, not changing speeds at appropriate times, or intermittently stopping.	Bridge electrical drive system is not functioning or functioning in such a way to cause severe overheating, tripping of overload devices, or potentially create a hazardous condition by either going too fast or not slowing down under consistent and reliable control.

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Defect	Condition State			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Accessibility and Labeling (9005)	All covers to electrical enclosures are properly secured in place. Arc fault labeling and working clearances conform to NFPA-70 (NEC) requirements. Electrical equipment and wiring identification labels are in place and legible.	All covers to electrical enclosures are in place, though some fasteners are missing. Not all arc fault labeling is in place. Some working clearances do not conform to NEC requirements. Some equipment or wiring identification labeling is either missing or is not legible.	All covers to electrical enclosures are in place, but many fasteners are missing. Few arc fault labels are in place. Many working clearances do not conform to NEC requirements. Many equipment or wiring identification labels are either missing or are not legible.	One or more covers to electrical enclosures are not in place. There are no arc fault labels on any enclosures. Most working clearances do not conform to NEC requirements. Most equipment or wiring identification labels are either missing or are not legible.
Support and Electrical Terminations (9006)	All electrical equipment is properly supported and all terminations are properly made, are clean, and appear tight.	Some electrical equipment supporting fasteners are loose or missing, but there is no danger of the equipment mounting(s) failing. Some electrical terminations are not clean or have mild corrosion.	Several electrical equipment mounting fasteners are missing and equipment mounting could potentially fail. Some electrical terminations are improperly made, are loose, are dirty, or appear to be overheating.	Electrical equipment supports have failed and electrical equipment is hanging from conduits, wires, or other non-structural elements not designed to support the equipment. Many electrical terminations are improperly made, are loose, are very dirty, have severe corrosion, or appear to be severely overheating.

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Defect	Condition State			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (Electrical) (9017)	No corrosion is present on electrical equipment.	Electric motors, enclosures, raceway, fasteners, or clamps exhibit minor corrosion.	Electric motors, enclosures, raceway, fasteners, or clamps exhibit moderate corrosion with minor section loss.	Electric motors, enclosures, raceway, fasteners, or clamps exhibit heavy corrosion with section loss and a perceived danger of component failure.
Damage (Electrical) (9018)	Electrical components are not damaged.	Electrical components have minor damage that does not affect the intended operation or mounting security of the equipment.	Electrical components have moderate damage that affects the intended operation or mounting security of the equipment, but does not appear to pose an immediate safety concern or risk of system failure.	Electrical components have significant damage that affects the intended operation or mounting security of the equipment such that operating the equipment poses a risk of injury to personnel or further damage to the equipment or structure.
Wear (Electrical) (9019)	Electrical components are not worn and electrical conductor insulation and motor insulation resistance values exceed the minimum values recommended by NETA.	Electrical components exhibit minimal wear that does not affect the intended operation of the equipment. The electrical conductor and motor insulation resistance values measure at the minimum values recommended by NETA.	Electrical components exhibit moderate wear that appears to be beginning to affect the intended operation of the equipment without creating an immediately dangerous condition to the public, bridge personnel, or the bridge. The electrical conductor and motor insulation resistance values measure 50 percent below the minimum values recommended by NETA.	Electrical components exhibit excessive wear that seriously affects the intended operation of the equipment. The electrical conductor and motor insulation resistance values measure less than 50 percent below the minimum values recommended by NETA.

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Defect	Condition State			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Functional Obsolescence (9008)	All electrical equipment is currently supported by the manufacturer and all replacement parts are readily available.	There are indications that some of the electrical equipment will soon be phased out by the manufacturer or the availability of parts may soon be a problem.	There are indications that some of the electrical equipment has been phased out by the manufacturer and the availability of parts has become a problem.	Most of the electrical equipment is not supported by the manufacturer and no parts are available.
Housekeeping (9004)	All electrical areas and equipment are clean and well organized.	Some of the electrical areas or equipment are dirty, unkempt, or disorganized. The levels of poor upkeep are not yet creating a serious hazard or potentially affecting the equipment's operation.	Many of the electrical areas or equipment are very disorganized or dirty. The levels of poor upkeep are beginning become a concern for fire or electrical shock hazards and may potentially affect the equipment's ability to dissipate heat or permit adequate servicing or inspection.	Most of the electrical areas or equipment are very disorganized or dirty. The levels of poor upkeep create fire or electrical shock hazards and likely affect the equipment's ability to dissipate heat. The electrical equipment cannot be properly accessed for servicing or inspection.

Element Commentary

Example components include:

- Electric motors
- Generators
- Auxiliary motors
- Motor brakes
- Machinery brakes

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APPENDIX D - MECHANICAL CONDITION STATE DESCRIPTION

CHAPTER 3.5—ELEMENT 604 – MOVABLE BRIDGE DRIVE SYSTEM – MECHANICAL

Description: The mechanical components which provide or arrest motion of the span.

Classification: ADE

Units of Measurement: each

Quantity Calculation: Number of main drive systems for the entire bridge. For example, a single-leaf bascule would have a quantity of one; a double-leaf bascule would have a quantity of two.

Condition State Definitions

Defect	Condition State			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Operation (9000)	Movable span operates smoothly. Major mechanical elements are properly adjusted.	Movable span operates with minor flaws, such as light vibration or noise. Equipment may be slightly out of adjustment. Filters or breathers may require replacement. None of the major mechanical elements require remedial action.	Movable span operates with significant flaws, including vibration, noise, or undesirable heating. Auxiliary operating systems may be nonfunctional. Equipment out of adjustment. Filters or breathers may be missing. Major mechanical elements may require short-term replacement or adjustment.	Movable span does not operate or operates in an erratic or uncontrolled manner. Various pieces of equipment may be significantly out of adjustment or nonfunctional. Required pieces of equipment may be missing. Major mechanical elements may require immediate replacement.
Lubrication (9001)	Lubricants are fresh, clean, and well-distributed. Oil levels are appropriate.	Lubricants exhibit minor contamination. Oil levels slightly low. Minor lubricant leaks may exist. Application of grease is excessive or barely adequate on major mechanical elements.	Lubricants exhibit moderate contamination. Oil levels low. Moderate lubricant leaks may exist. Application of grease is spotty and inadequate in places on major mechanical elements.	Lubricants exhibit heavy contamination. Oil levels extremely low. Heavy lubricant leaks may exist. Application of grease is inadequate in many places on major mechanical elements.

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Defect	Condition State			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Wear (Mechanical) (9002)	None.	Light wear present. Clearances related to major mechanical elements are within operational limits. No remedial action required.	Moderate wear present. Clearances related to major mechanical elements are near operational limits. Short-term replacement of components may be required.	Heavy wear present. Clearances related to major mechanical elements exceed operational limits. Immediate replacement of components may be required.
Damage (Mechanical) (9014)	None.	Minor damage noted such as pitting or scoring. Hoses may exhibit light abrasion. None of the major mechanical elements require remedial action.	Moderate damage such as pitting and scoring with plastic flow. Hoses may exhibit moderate abrasion. Major mechanical elements may require short-term replacement or adjustment.	Heavy damage present. Components may be cracked or broken. Overstress of components occurring. Hoses may exhibit heavy abrasion. Major mechanical elements may require immediate replacement.

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Defect	Condition State			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Alignment (Mechanical) (9003)	Components are aligned within manufacturer's recommended operational tolerances or code requirements. Components exhibit proper contact.	Certain components slightly outside of manufacturer's recommended operational tolerances or code requirements. No operational issues noted. None of the major mechanical elements require realignment.	Components outside of manufacturer's recommended operational tolerances or code requirements. Some shaft or coupling movement noted during operation. Components may exhibit improper contact. Major mechanical elements may require realignment.	Components well outside of manufacturer's recommended operational tolerances or code requirements. Significant shaft or coupling movement noted during operation. Unusual noises noted during operation. Overstress of components occurring. Components may exhibit extremely poor contact. Immediate replacement or realignment of major mechanical elements may be required.
Corrosion (Mechanical) (9015)	None.	Minor paint system failure and light corrosion present. None of the major mechanical elements require remedial action.	Spotty paint system failure and moderate corrosion present. Major mechanical elements may require short-term replacement.	Extensive paint system failure and heavy corrosion present. Immediate replacement of major mechanical elements may be required.

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Defect	Condition State 1	Condition State 2	Condition State 3	Condition State 4
	GOOD	FAIR	POOR	SEVERE
Connections (Mechanical) (9016)	Fasteners and keys are intact, tight, and without corrosion.	Fasteners or keys exhibit minor corrosion. Some fasteners related to major mechanical elements may be loose. No missing fasteners.	Fasteners or keys exhibit moderate corrosion. Fasteners or keys are loose. Some fasteners or keys related to major mechanical elements may be missing. Short-term repair of major mechanical elements may be required.	Fasteners or keys exhibit heavy corrosion. Many Fasteners or keys are loose. Fasteners or keys related to major mechanical elements are missing. Immediate repair of major mechanical elements may be required.
Housekeeping (9004)	The machinery access areas are clean, sanitary, and free of debris and trip or fall hazards. Machinery guards are intact.	The machinery access areas are generally safe, but may have minor debris or inconvenient access. There may be minor mechanical issues related to weather exposure.	The machinery access areas have safety issues. Machinery guards may be out of place. There may be significant issues related to weather exposure. Short-term repairs may be required.	The machinery access areas have significant safety issues such as: unsanitary waste, excessive guano, debris, or missing machinery guards. Alternatively, there are unsafe trip or fall hazards or machinery is inadequately protected from weather. Immediate repair may be required.

Element Commentary

The drive system can be separated into subsystems, as follows:

- Power
  - Electric Motors
  - Hydraulic Pumps
  - Generators
  - Auxiliary Motor
  - Manual Drive
- Power Transmission
  - Shafts
  - Couplings
  - Bearings

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Appendix G:
Condition Evaluation – Structural

Condition Assessment for the Hampton Harbor Bridge

15904 Seabrook-Hampton

Hampton Br. No. 235/025

HDR Engineering, Inc.

August 7, 2018

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

1.1 Introduction

HDR, Inc. (HDR) performed a Condition Assessment of the Hampton Harbor Bridge, New Hampshire Department of Transportation (NHDOT) Bridge No. 235/025, in August of 2018. The assessment results will be used to verify the conditions outlined in previous inspection reports and to produce an as-built load rating for analysis of current design loads on the existing cross-section and a proposed widened deck cross-section.

The following personnel performed the bridge assessment:

James Murphy	HDR/Project Manager
Nicholas Caron	HDR/Bridge Engineer
Kristofer Kretsch	HDR/Bridge Inspection Team Leader
Benjamin Sauter	HDR/Structural Intern
Peter Harrison	HDR/UAV Pilot
Adam Serock	HDR/UAV Spotter

Preliminary investigations show there are no critical structural issues that require immediate attention. There are a few items that should be addressed to prolong the life expectancy of the bridge which are detailed in Section 3 – Repair Recommendations.

1.2 Bridge Element Naming Conventions

For the purposes of this report the Hampton Harbor Bridge is assumed to span south to north with the inner Hampton Harbor to the west and outer Hampton Harbor and Atlantic Ocean to the east. The entire bridge is in Hampton with the town line passing just south of the south abutment. The spans are labeled as 1S - 6S from the bascule span toward the south abutment and 1N – 6N from the bascule span toward the north abutment. The piers are similarly numbered 1S – 6S south from the bascule span and 1N – 6N north of the bascule span.

There are two main girders on the bridge which will be referred to as the east and west girders. Floor beams span transversely between the east and west girder at intervals ranging from 16’-$7^1/_8$” to 19’-$9^5/_8$” along the length of the approach spans, and at 19’-4” intervals on the bascule span. Three stringers, which run parallel to and between the east and west girders, frame into the floor beams. Floor beams extend outboard of the east and west girders to support deck overhangs in line with the inboard floor beams. Additional support beams are positioned at the quarter points between the floor beams to provide additional support for the overhang. Fascia stringers frame into the ends of the exterior floor beams on both sides of the bridge.

2 FIELD OBSERVATIONS

2.1 Assessment Approach

A visual condition evaluation of the bridge structural members was conducted. The field assessment included the approach spans superstructure members, piers, and abutments. Spans 6S and 6N and piers 6S and 6N were inspected from the surrounding tidal flats. The remainder of the bridge was inspected utilizing Unmanned Aerial Vehicle (UAV) methods. Detailed measurements were not taken as a part of this scope. The following sections describe assessment findings that were found for various members of the approach spans and supporting substructures.

2.2 Item 58 – Overall Deck – Very Good Condition

2.2.1 Curbs and Sidewalk

The concrete curbs and sidewalk of the approach spans exhibit fine cracks and minor spalls. The sidewalk on the bascule span is beginning to lift and has metal grid exposed.

2.2.2 Exposed Concrete Deck

Fine cracks are present in the exposed deck. Fine cracks were also observed on the underside of the concrete deck and exhibited minor leaking with efflorescence. Staining is also visible on the overhangs, (see photos S-01 & S-02).

2.2.3 Open Steel Grid Deck

The grid deck system present on the bascule span is rusted, has cracked welds, and has evidence of plow damage, (see photos S-04).

2.2.4 Deck Joints

The deck joints are slightly worn and the glands at the abutment joints are tight and torn. Evidence of leaking through the joint is also present.

2.2.5 Bridge Rail

The bridge rails are substandard to modern code requirements. It is rusted and scraped along the entire length of the bridge. The bridge rail is also damaged at the southeast corner of the bridge.

2.2.6 Drainage

The bridge scuppers are rusted but otherwise functioning and free from debris.

2.2.7 Utilities

Light poles with luminaires are in generally good condition. Operation of the luminaires where not observable at the time of evaluation. The conduits attached to the west fascia of the bridge are in good condition, (see photo S-07).

2.3 Item 59 – Overall Superstructure – Poor Condition

2.3.1 Girders

The two main girders of the approach spans exhibit rusting and some section loss. See photo S-05 for typical approach girder condition. The bascule span girders are of a similar condition as the approach span girders, (see photo S-07). There is a vertical stiffener on the outboard face of the east girder in span 1N which is bent, (see photo S-08). Pack rust is visible most predominantly at cover plate sections, (see photo S-09). The bottom flange projection of the west girder at pier 4N appears to be bent in an upward direction, (see photo S-13).

2.3.2 Stringers

The steel stringers were observed to be rusted including sections of scaling and localizations of pack rust. See photo S-11 for typical stringer condition.

2.3.3 Floor Beams

The floor beams have failing paint and are typically rusted. Pitting was observed throughout the typical member with pack rust at the connection plates. See photo S-12 for typical floor beam condition.

2.3.4 Bracing

The cross bracing was observed to have failing paint, pitting, and pack rust, (see photo S-12). Some slight deformation of cross bracing members was also noted.

2.3.5 Bearings

Bearings located under deck joints exhibited deterioration of the steel components. A few anchor bolts nuts have corroded off the bolt. The expansion bearings at pier 4S are heavily rusted and the expansion bearings at pier 4N are severely corroded, potentially restricting the movement of the bearing, (see photo S-13 and see photo S-14). The remainder of the pier bearings appear to be in satisfactory condition, (see photo S-15). Abutment bearings are rusted with section loss of anchor bolt nuts, see photo S-16, and bearing retainer tabs, (see photo S-17).

2.3.6 Signage

“E-2” signs are present at either approach to the bridge. Signage signaling vehicular and pedestrian traffic of the lift span operation is present on both approaches to the lift span. Navigational aids are present below the bridge to direct boat traffic through the navigation channel and provides information for contacting the bridge operator.

2.4 Item 60 – Overall Substructure – Satisfactory Condition

2.4.1 Abutments

The abutments were in generally satisfactory condition. Light cracks with efflorescence and spalls exist, (See photos S-18 – S-20). The footing is exposed at the south abutment and large rip rap stone have been installed for future scour protection, (see photo S-21).

2.4.2 Piers

The piers and in satisfactory condition have some cracked cut granite stones and deteriorating mortar. (See photo S-22) The caps on piers 4S and 4N have cracks and spalls with exposed rebar. (See photo S-23) The rotation of pier 4N that was noted in previous inspection reports appears to have stabilized as no further movement was observed. It should be noted that repair plans dated 1957 addressed a repair to rotation of this pier, which was shown to be approximately 1’-4” out of plum in those plans. Rotation observed in the field appears to be significantly less than 1’-4”.

3 RECOMMENDATIONS

The following maintenance items are recommended to prolong the service life of the bridge.

3.1 Short Term

1. Review the bearing retaining tab at the northeast abutment bearing for replacement as the tab has completely corroded through.

3.2 Long Term

1. Repair the bridge railing at the southeast corner of the bridge.
2. Flush bridge joint glands to remove debris and promote proper drainage.
3. Replace corroded nuts at bearing assembly anchor bolts.
4. Continue to monitor Pier 4N for any further displacement to the north at semi-annual bridge inspections.

APPENDIX A – SELECT BRIDGE PLANS

APPENDIX B - STRUCTURE PHOTOS

Photo S-01: Typical approach span deck overhang condition.

Photo S-02: Typical approach span deck condition.

Photo S-03: Typical bascule span deck overhang condition.

Photo S-04: Typical bascule girder condition.

Photo S-05: Approach span typical condition.

Photo S-06: Approach span at bascule span typical condition.

Photo S-07: Bascule span typical girder condition.

Photo S-08: Bent stiffener plate in Span 1N on the outboard side of the east girder, north of the northern girder splice.

Photo S-09: Pack rust causing prying of cover plates over Pier 6S.

Photo S-10: General utility condition.

Photo S-11: Approach span stringer typical condition.

Photo S-12: Approach span floor beam and cross bracing typical condition.

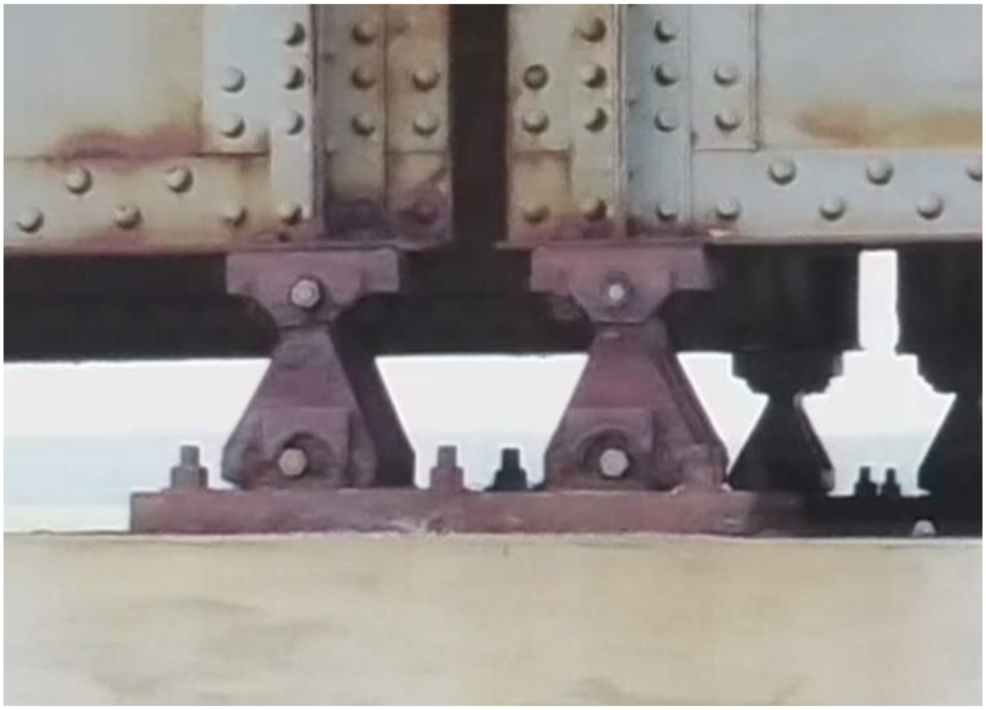


Photo S-13: Rusted bearings at Pier 4S.

Photo S-14: Severely corroded bearings a Pier 4N.

Photo S-15: Typical bearing conditions over piers without expansion joints.

Photo S-16: Typical condition of bearings at abutments.

Photo S-17: Typical condition of bearings at abutments.

Photo S-18: North Abutment elevation.

Photo S-19: Cracks and efflorescence at northeast wingwall.

Photo S-20: Cracks and efflorescence at southeast wingwall.

Photo S-21: Large riprap placed around south abutment.

Photo S-22: Typical pier condition with cracked granite stones and deteriorated mortar at the water line.

Photo S-23: Deteriorated pier cap at Pier 4N.

Appendix H:

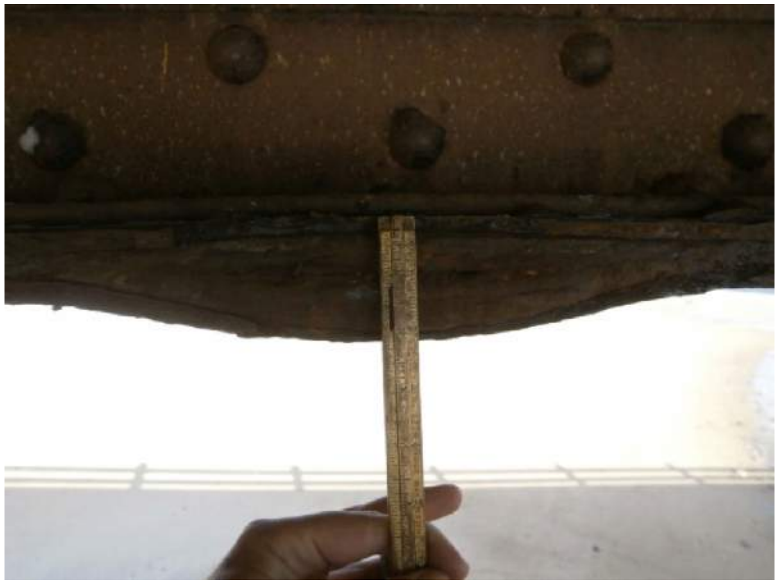
Available Inspection Reports Developed by Others

Bridge Dimensions.

Wednesday, July 18, 2018

PACK RUST IS 2.25" THICK AT GIRDER #1, SPAN #1. (RL)

C585 56



Wednesday, July 18, 2018

CROSS BRACING IS HOLED, HEAVY PACK RUST, SPAN #1. (RL)

C585 57

Wednesday, July 18, 2018

LATERAL BRACING IS HOLED AND HEAVY PACK RUST AT PIER #1. (RL)

C585 58

Wednesday, July 18, 2018

STONE FASCIA IS SPLIT AND FALLING OUT AT LIFT SPAN, EAST SIDE. (RL)

C585 59

Wednesday, July 18, 2018

REPAIRS TO LIFT MACHINERY. (RL)

C585 60

Wednesday, July 18, 2018

STEEL SIDEWALK PANS ARE HEAVILY RUSTED WITH ANCHORAGE RUSTED OFF. (RL)

C585 61

Wednesday, July 18, 2018

PIER 9 SPALLED REBAR EXPOSED. (RL)

C585 62

Terracon
Consulting Engineers & Scientists

TERRACON UNDERWATER SUBSTRUCTURE INSPECTION FORM

Date: **16 July 2015 – 31 July 15**
Work Order # **N1159086 - J1159086**
Structure ID # 074/117
Inspection performed for: (Client)
GPS COORDINATES: 42.896326 (lat), -70.816523 (long)
Name: **New Hampshire Dept. of Transportation**
County: Rockingham
Address: John O. Morton Bldg.
7 Hazen Drive, PO Box 483
Concord, New Hampshire
City: Hampton
Roadway / Hwy #: NH 1-A
Field Representative: Jeffrey E. Lorden
Waterway: Hampton River
Telephone: 603-419-9539 Cell
Assessment Team: Brad Walden, Casey Redden, Diver Jason Hickey E.I.

Previous Inspection Reports Available:
Yes X No
Date of Report: June/July 2010 Originator: Previous Consultant firm

Construction or As-Built Plans / Drawings Available:
Yes No X
Dates:

BRIDGE ACCESS

Boat: Pontoon ____ Jonboat X Barge: ____ Other: ____
Ramp Location: **N/A**
Ramp: Concrete: X Gravel: ____ Dirt: ____ Grade: **ok** Width: **ok** Depth: **ok**
Distance from Ramp to Bridge: **¼ mile** **Travel Time:** **2 minutes**
Ramp Fee: **$50 commercial, fee waved** **Lockage Required:** **Yes** ____ **No** **X**
Comments / Directions: 1 Ocean Blvd # 1, Hampton, NH 03842

Highly recommended to notify United States Coast Guard, local Police and NHDOT bridge house (603-271-6862. Bridge house can also be notified on Marine (VHF) Radio Channel 13.

BOAT TRAFFIC

	Heavy	Moderate	Light	N/A
Recreational:	X			
Fishing:	X			
Barge:				X

Comments:
Need two sets of dive flags, one on a buoy mount and the other on the boat. Place the buoy opposite of the dive boat.

WEATHER

Temperature	Fair	Cloudy	Ptly. Cldy	Windy	Rain
Range, 59° - 80°(F)			X		

WATER CONDITIONS

Temperature: **Range, 65°(F) - 70°(F)** Visibility: **5'**
Current: Heavy X Moderate ____ Light X None ____

BANK / SHORE

Grass ____ Rock X Gravel ____ Dirt/Mud ____ Other **Sand**

INSPECTION METHOD

Surface Supplied Air ____ Scuba **X** Wading ____ Other ____

BRIDGE TYPE

Continuous Plate Girder ____ Suspension ____ Steel Truss ____

Steel Beam **X** Wood Truss ____ Other ____

BRIDGE SUPPORT TYPE

Masonry **X** Closed Web ____ Open Web ____ Steel Piles

Reinforced Concrete **X** Timber Piles ____ Other **Granite, some concrete**

FOUNDATION TYPE

Pile w/ pile cap ____ Pile w/o pile cap ____ Pier founded on Rock ____ Or Soil ____

Caisson ____ Spread Footing ____ Other **Unknown**

CROSS SECTIONS

	5’	10’	25’	50’	100’
Upstream	X		X		
Downstream	X		X		

GPS DATA 42.896326 (lat), -70.816523 (long)

SOUNDINGS (Shallow Stream or Culvert)

Equipment Used: **Level Rod, Portable electronic depth sounder**

(See Attached Drawings)

SCOUR (see field notes for detailed description)

	Yes	No	
Scour pockets or troughs	**X**	**X**	
Footing or foundation element exposed		**X**	
Scour increased since last inspection		**X**	

Comments:

PIER / ELEMENT CONDITIONS (see field notes for detailed description)

Biological Growth	**Heavy**	Zebra Mussel Growth	**None**
Spalling	**None**	Honeycombing	**None Detected**
Scaling	**None detected**	Re-Steel Exposed	**No**
Delamination	**None detected**		
Vertical Cracks	Hairline **N/A**	Measurable	**None detected**
Horizontal Cracks	Hairline **N/A**	Measurable	**None detected**
Impact Damage	Minor **N0**	Major	**None detected**
Pier Faces not Inspected	List Piers **1, 2 and 3**		
Reason for not Inspecting	Out of water at low tide and inspected by NHDOT inspection teams		
Comments:			

BOTTOM CONDITIONS

Sand X | Cobbles ____ | Gravel ____
Clay ____ | Boulders X | Silt ____
Bedrock, type ____ | Clay ____

Debris:

Sticks ____ | Timbers ____ | Steel ____ | Tree Limbs ____
Construction Debris ____ | Waste Concrete ____ | Tree ____
Other: ____

Heavy debris located around element Yes ____ No X Elements ____

Photography / Video Documentation

Photographs Taken: Yes X No ____

1. Bridge Structure, looking west
2. Pier 1
3. Pier 2
4. Pier 3
5. Pier 4
6. Pier 5
7. Pier 6
8. Pier 7
9. Pier 8
10. Pier 9
11. Pier 10
12. Pier 11
13. Pier 12
14. Pier 10 – Overturning Views, It appears to be overturning to the northeast. Looking west.
15. Pier 10 – Overturning Views, It appears to be overturning to the northeast. Looking north.
16. Pier 10 – Overturning Views, It appears to be overturning to the northeast. Looking east.
17. Marine growth
18.
19.
20.
21.
22.
23.
24.

Video Documentation Taken: Yes ____ No X
Above Surface: Yes ____ No X
Below Surface: Yes ____ No X
Video Tape Identification ____

Substructure Rating 7
Channel and Channel Protection Rating 6

General Comments (Include any Unusual Conditions Encountered):

The bridge structure is rated as “Good (7) Condition”.

The waterway opening is adequate, the channel and channel protection is rated as Code 6.

Terracon
Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015 07/31/2015**

County: **Rockingham** State: **New Hampshire**

Description : **Bridge Field Notes**

Piers show similar characteristics.

NH 1-A is a multi-span bridge with a moveable single leafed bascule bridge. The vertical lift span is at piers 6 and 7, pier 7 serves as

1. Piers were covered with a heavy layer of marine growth (both hard and soft, i.e., algae and barnacles). Because the piers are heavily covered in marine growth the inspector is unable to see most of the pier structure.
2. The bottom material in the channel and around the piers consisted of sand, to sand with rip-rap.along the wing walls and cutoff wall.
3. No exposed footers, foundations or undermining noted.
4. Piers 1, 2 and 12 are inspected by the NHDOT during low tides.

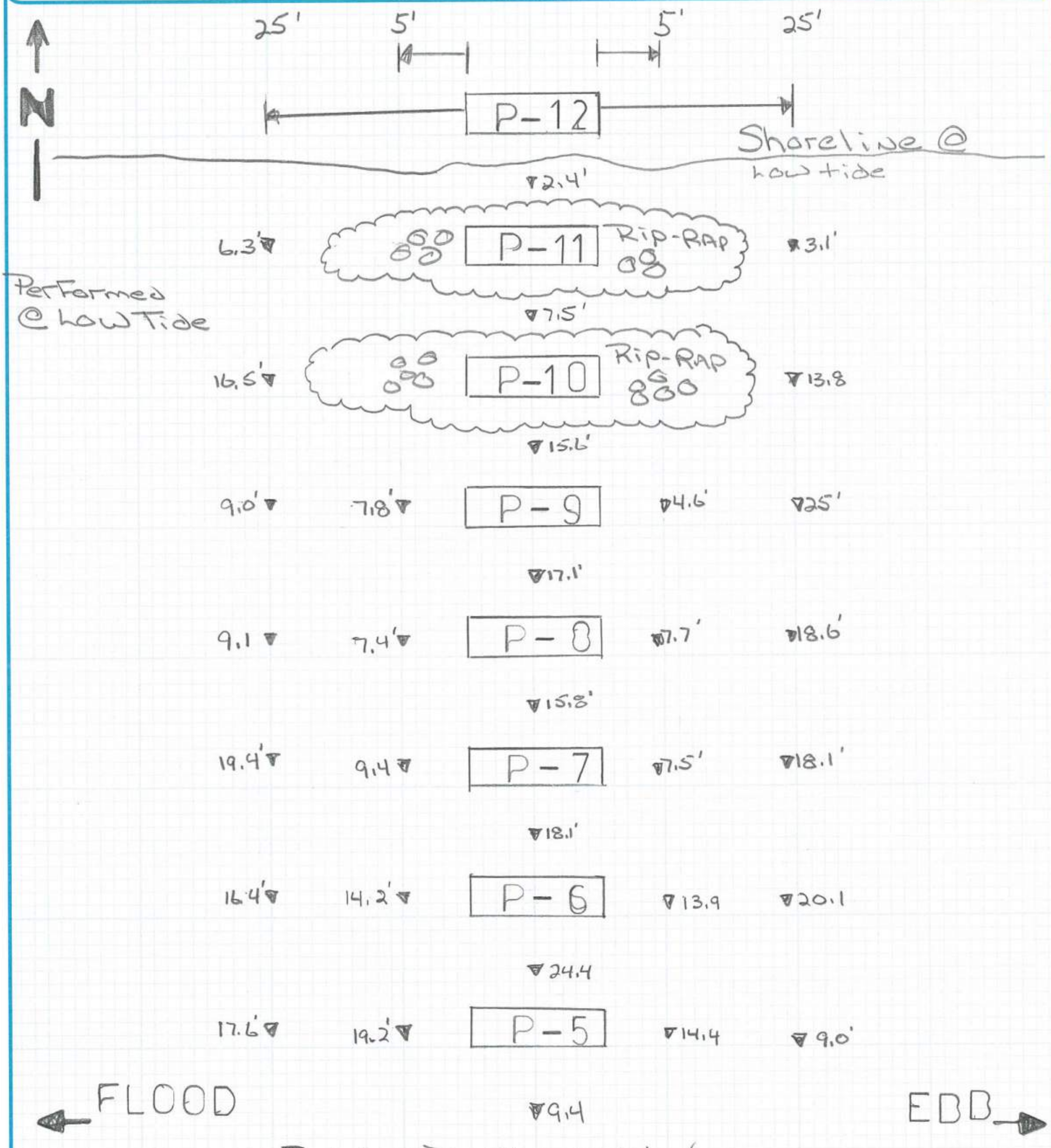
Bridge substructure is rated as "Good (7) Condition".

The waterway opening is adequate, Channel and Channel Protection is rated as 6.

See attached drawings, sketches and photographs of the areas to better visualize the conditions at the time of the assessment.

PROJECT: Bridge #235/025, NH 1-A over Hampton River Page 1 of 13

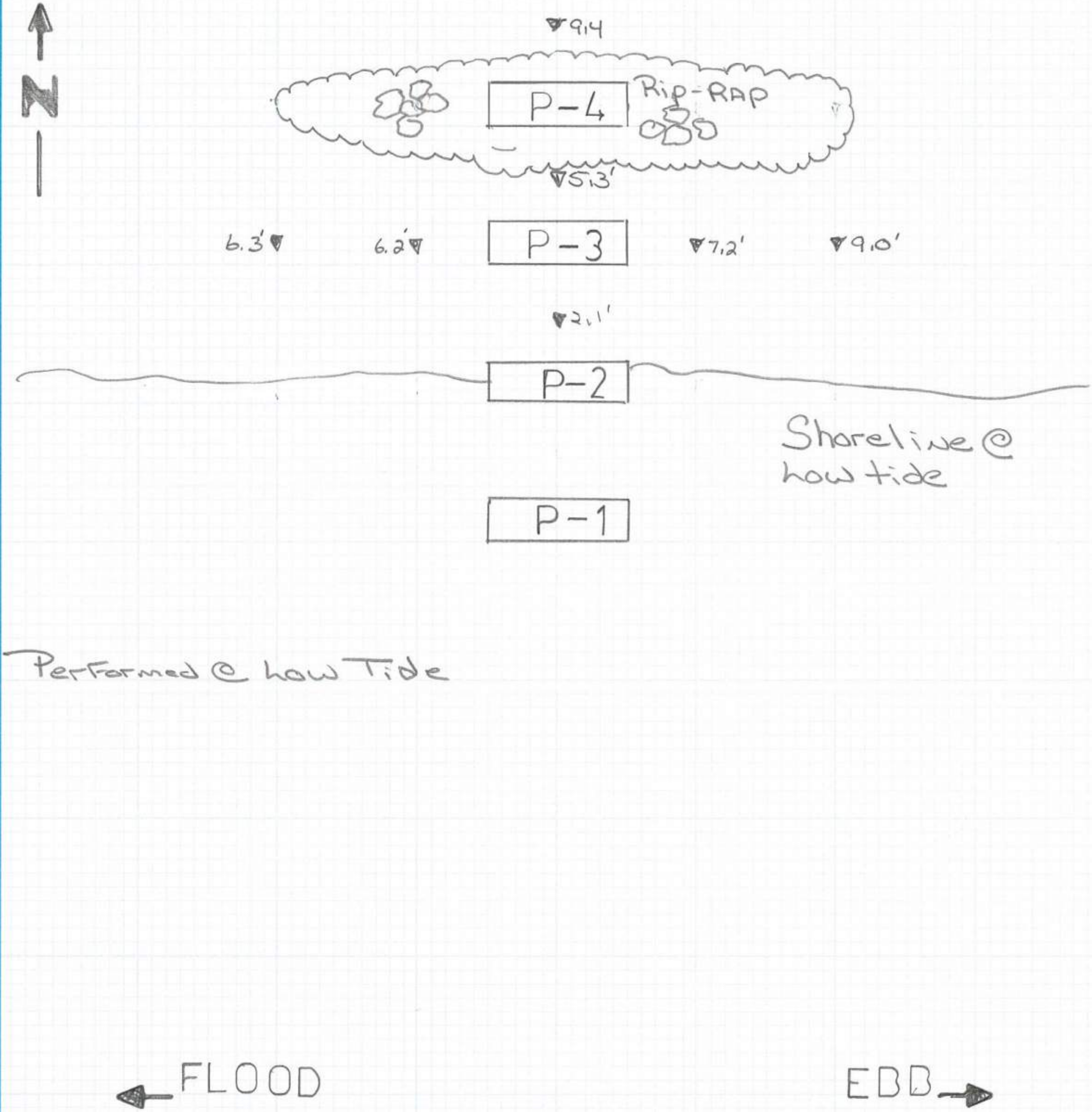
JOB NO. N1159086 Date 31 July 15 Comp. By BTW CHECKED BY: JTH



Terracon

PROJECT: Bridge # 235/025, NH 1-A over Hampton River Page 1A of 13

JOB NO. N1159086 Date 31 July Comp. By BTW CHECKED BY: JTH

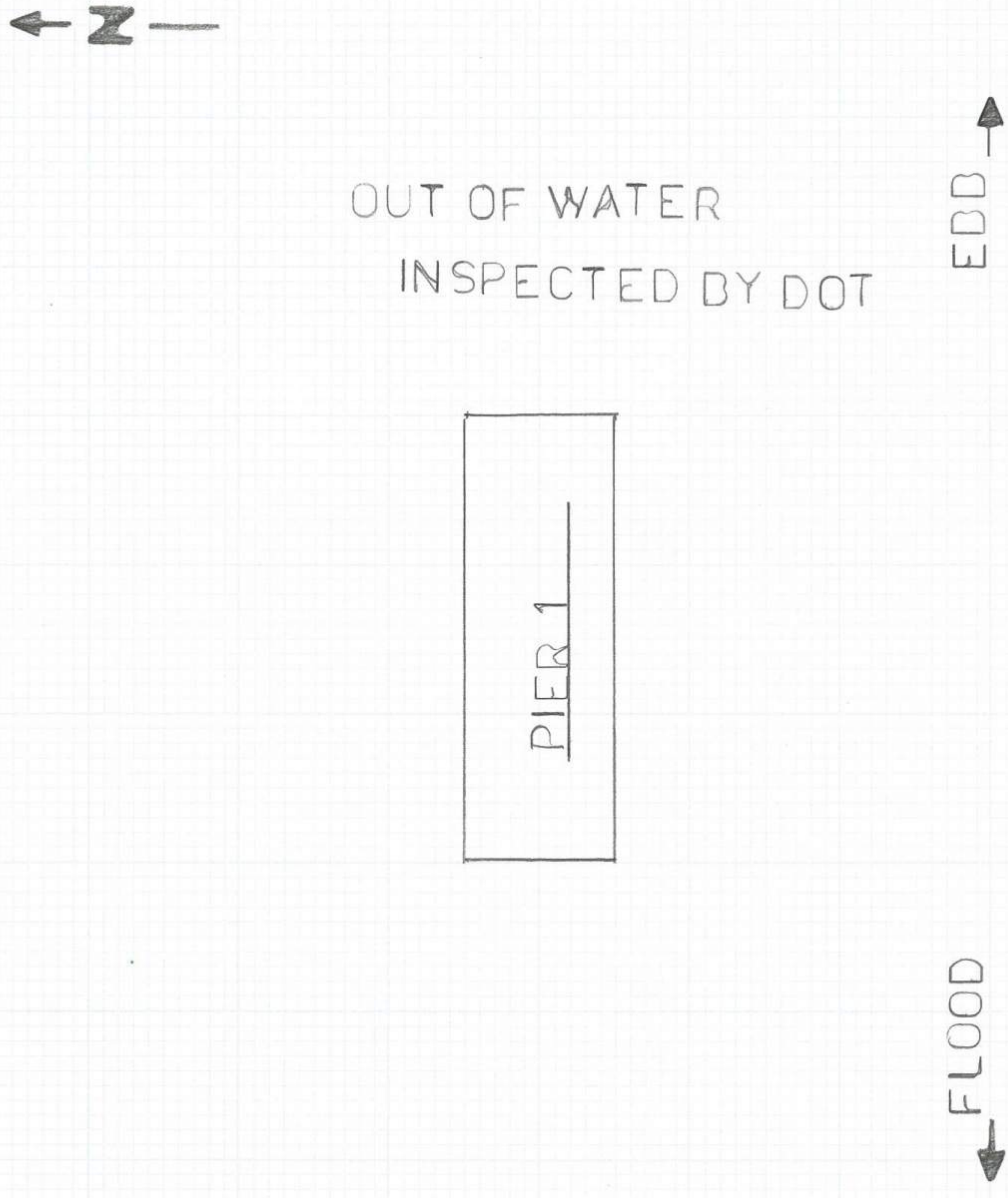


Form 112—5-93

Terracon

PROJECT: Bridge # 235/025, NH 1-A over Hampton River   Page 2 of 13

JOB NO. J2159086   Date 31 July 15   Comp. By BTW   CHECKED BY: JTH



Form 112—5-93

Terracon

PROJECT: Bridge # 235/025, NH 1-A over Hampton River Page 3 of 13

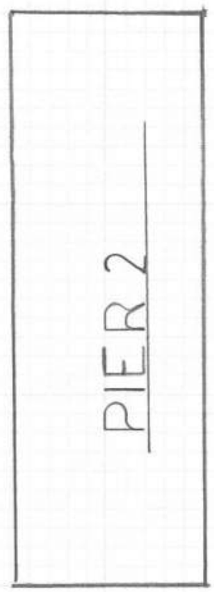
JOB NO. N1159086 Date 31 July Comp. By BRW CHECKED BY: JTH

← N —

EBB ↑

OUT OF WATER

INSPECTED BY DOT



FLOOD ↓

Form 112—5-93

Terracon

PROJECT: Bridge # 235/025, NH 1-A over Hampton River Page 4 of 13

JOB NO. N1159086 Date 16 July Comp. By BTW CHECKED BY: JTH

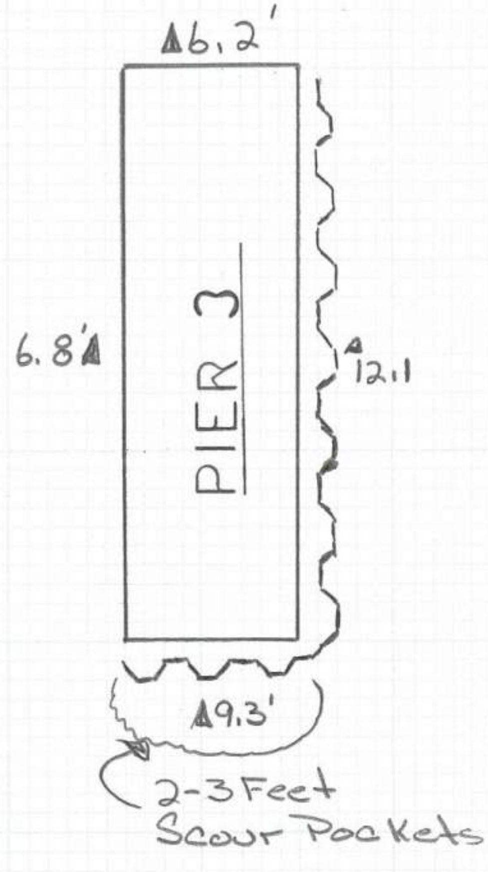
▲= Actual Depth of Water

= Sheet pile

← N —

Performed @ Low Tide

EBB ↑



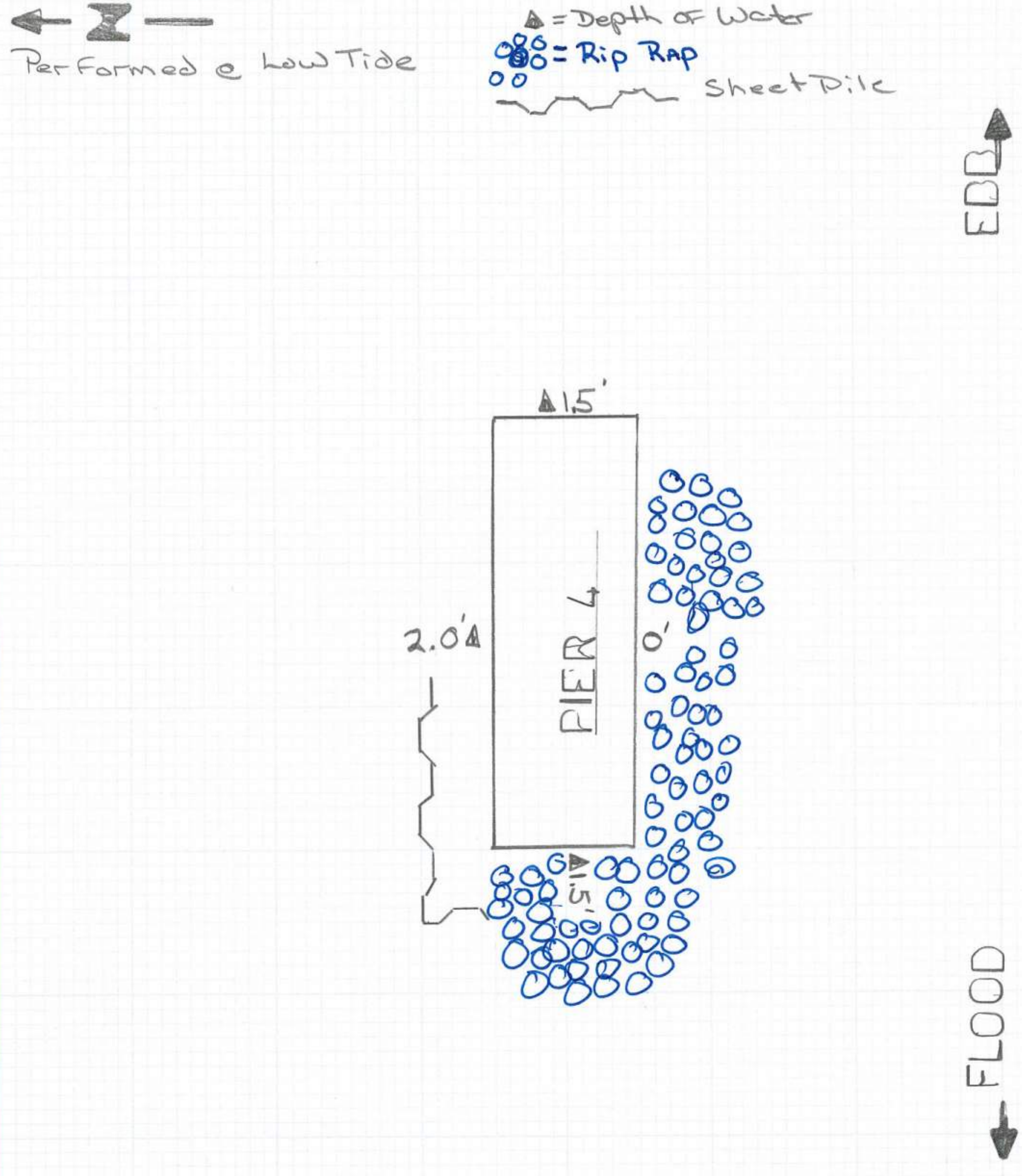
FLOOD ↓

Form 112—5-93

Terracon

PROJECT: Bridge # 235/025, NH 1-A over Hampton River Page 5 of 13

JOB NO. N1159086 Date 17 July 15 Comp. By BTW CHECKED BY: JTH

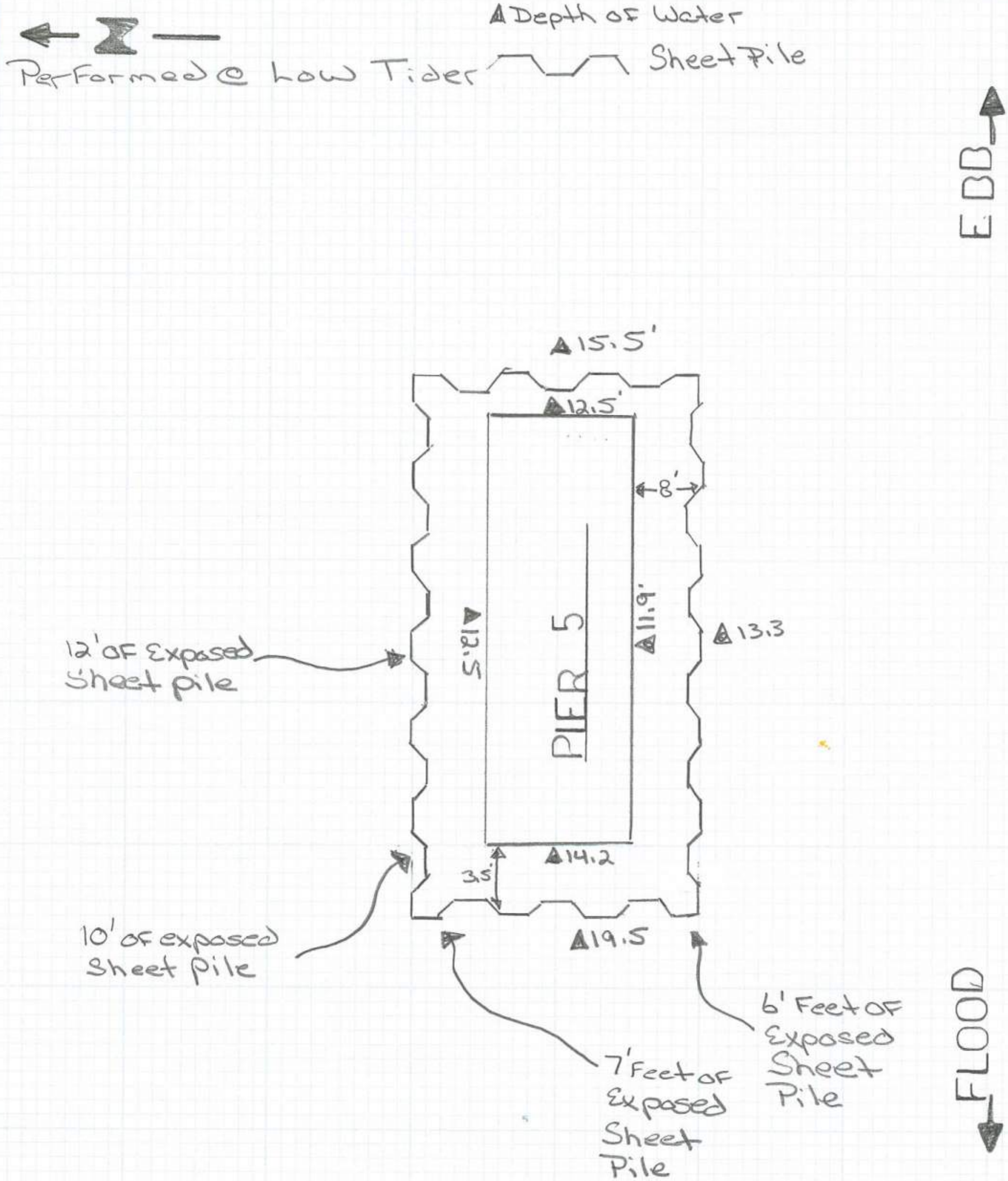


Form 112—5-93

Terracon

PROJECT: Bridge #235/025, NH 1-A over Hampton River   Page 6 of 13

JOB NO. N1159086   Date 17 July 15   Comp. By BTW   CHECKED BY: JTH



Form 112-5-93

Terracon

PROJECT: Bridge # 235/025, NH 1-A over Hampton River Page 7 of 13

JOB NO. N1159086 Date 31 July 15 Comp. By BTW CHECKED BY: JTH

N

▽ = Actual Depth of Water

Performed @ low tide

EBB

FLOOD

Form 112—5-93

Terracon

PROJECT: Bridge # 235/025, NH 1-A, over Hampton River Page 8 of 13

JOB NO. N1159086 Date 31 July 15 Comp. By BTW CHECKED BY: JTH

N

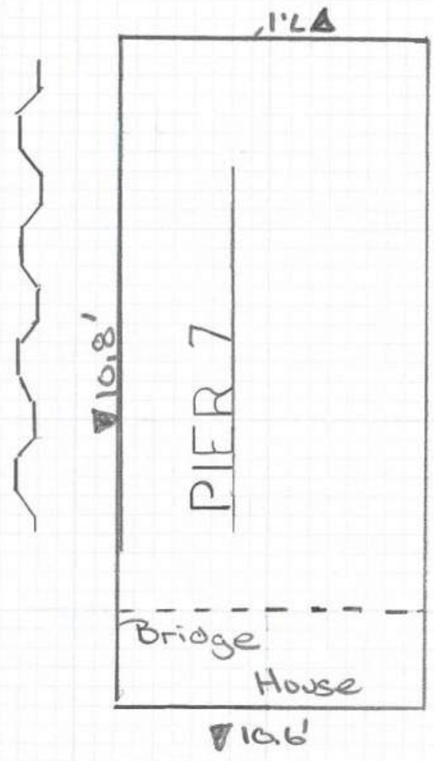
▼ = Actual Depth OF Water

= Sheet Pile

Performed @ low tide

Pier 7 serves as the Lift Pier For the single Leaf Bascule "Draw Bridge".

EBB



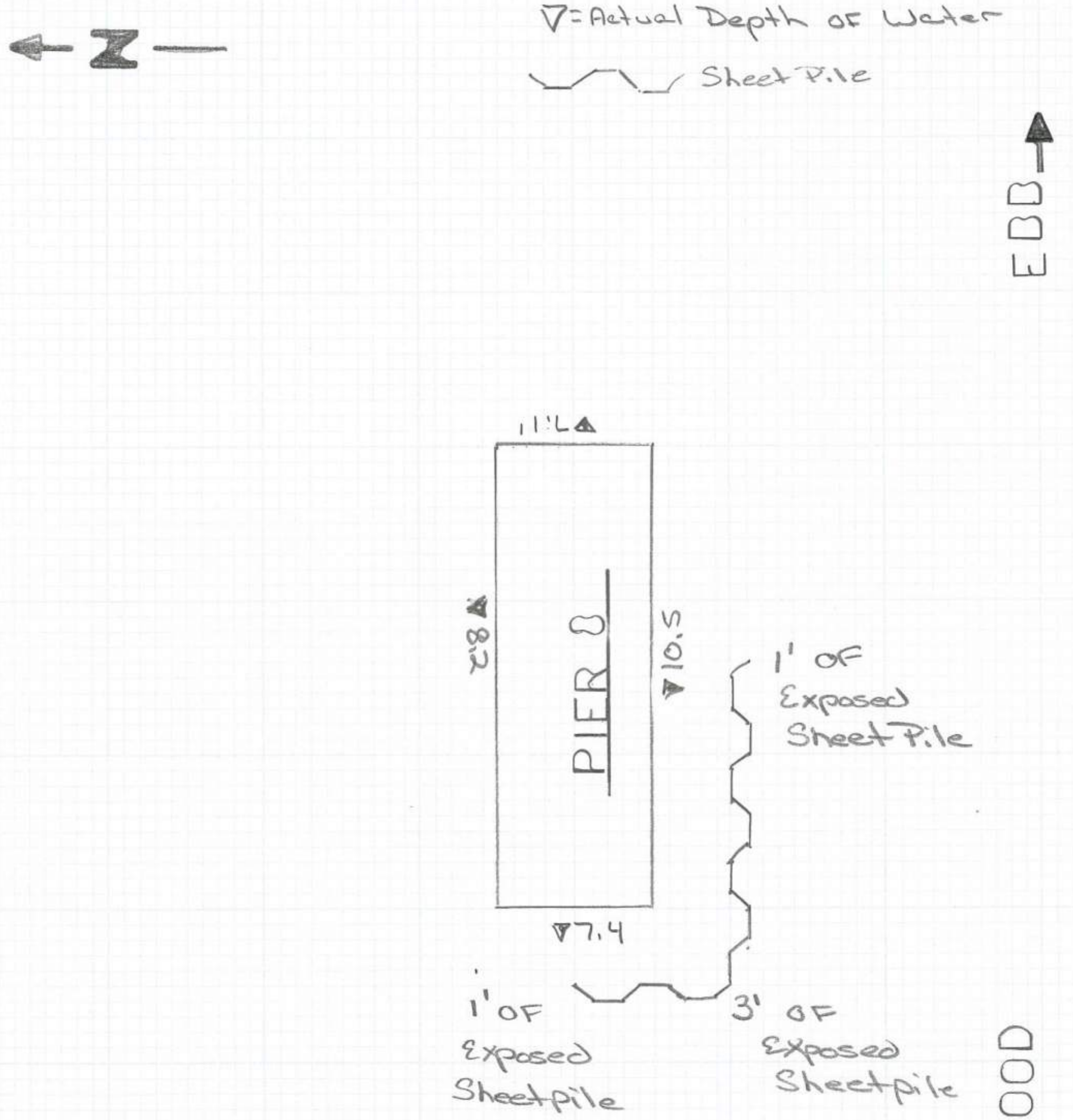
FLOOD

Form 112—5-93

Terracon

PROJECT: Bridge #235/025, NH-1-A over Hampton River Page 9 of 13

JOB NO. N1159086 Date 27 July 15 Comp. By BTW CHECKED BY: JTH

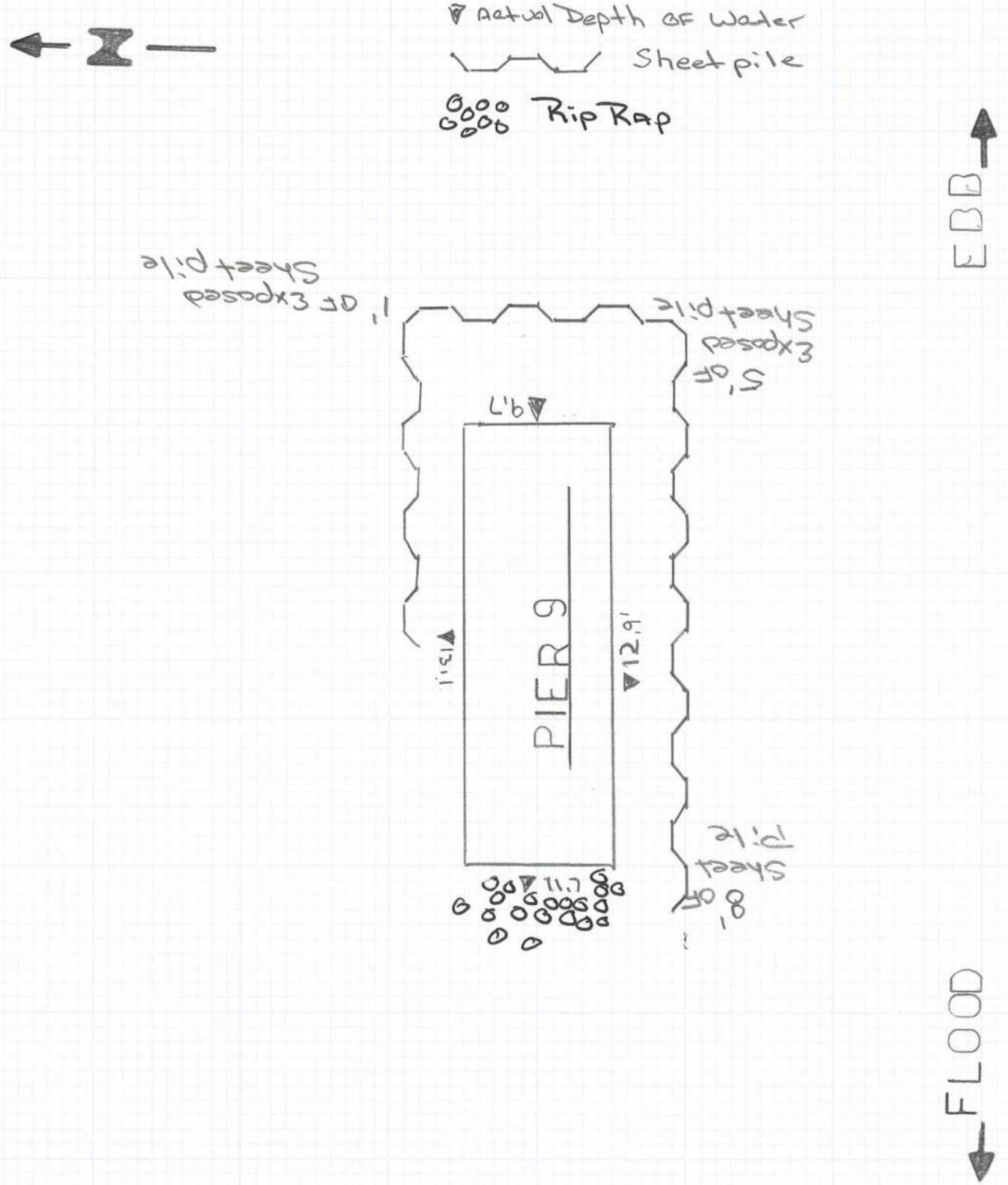


Form 112—5-93

Terracon

PROJECT: Bridge # 235/025, NH 1-A over Hampton River Page 10 of 13

JOB NO. N1159086 Date 27 July 15 Comp. By BTW CHECKED BY: JTH



Form 112—5-93

Terracon

PROJECT: Bridge # 235/025, NH-1A over Hampton River Page 11 of 13

JOB NO. N1159086 Date 20 July 15 Comp. By BTW CHECKED BY: JTH

N

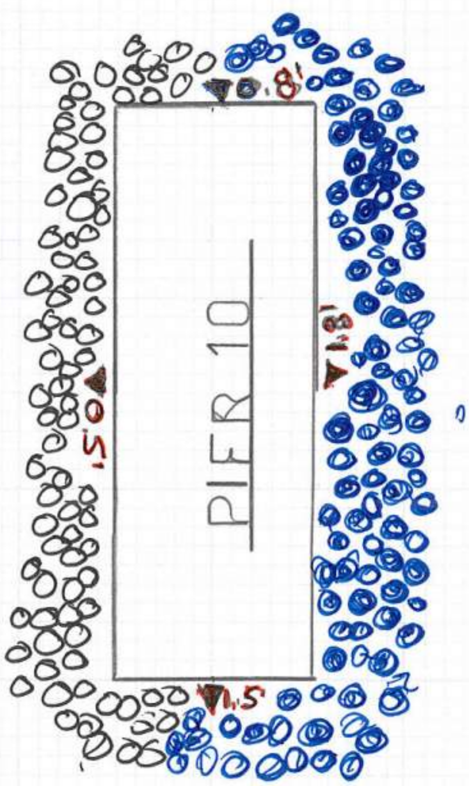
Performed @ low tide

▼= Actual Depth of Water

= Submerged Rip-Rap

= Rip-Rap

EBB



FLOOD

Form 112—5-93

Terracon

PROJECT: Bridge # 235/025, NH 1-A Over Hampton River Page 12 of 13

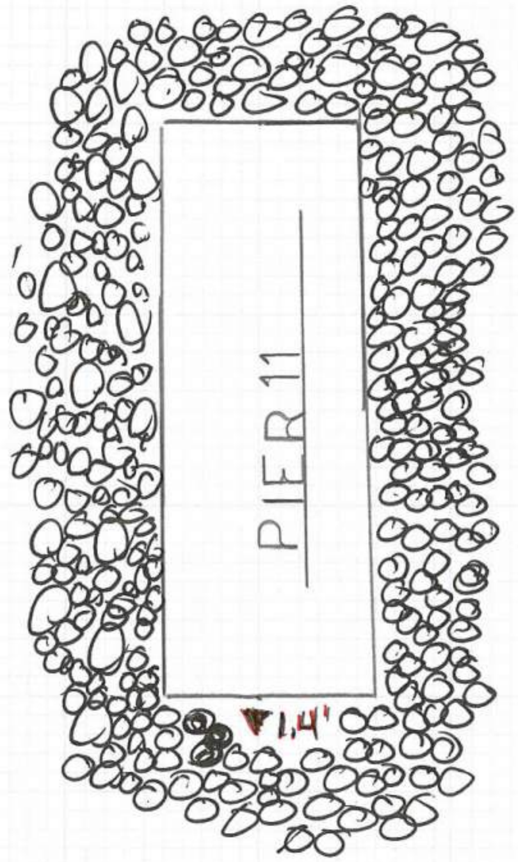
JOB NO. NH159086 Date 20 July 15 Comp. By BTW CHECKED BY: JFH

▼ = Actual Depth of Water

= Rip Rap

Performed @ low tide

EBB



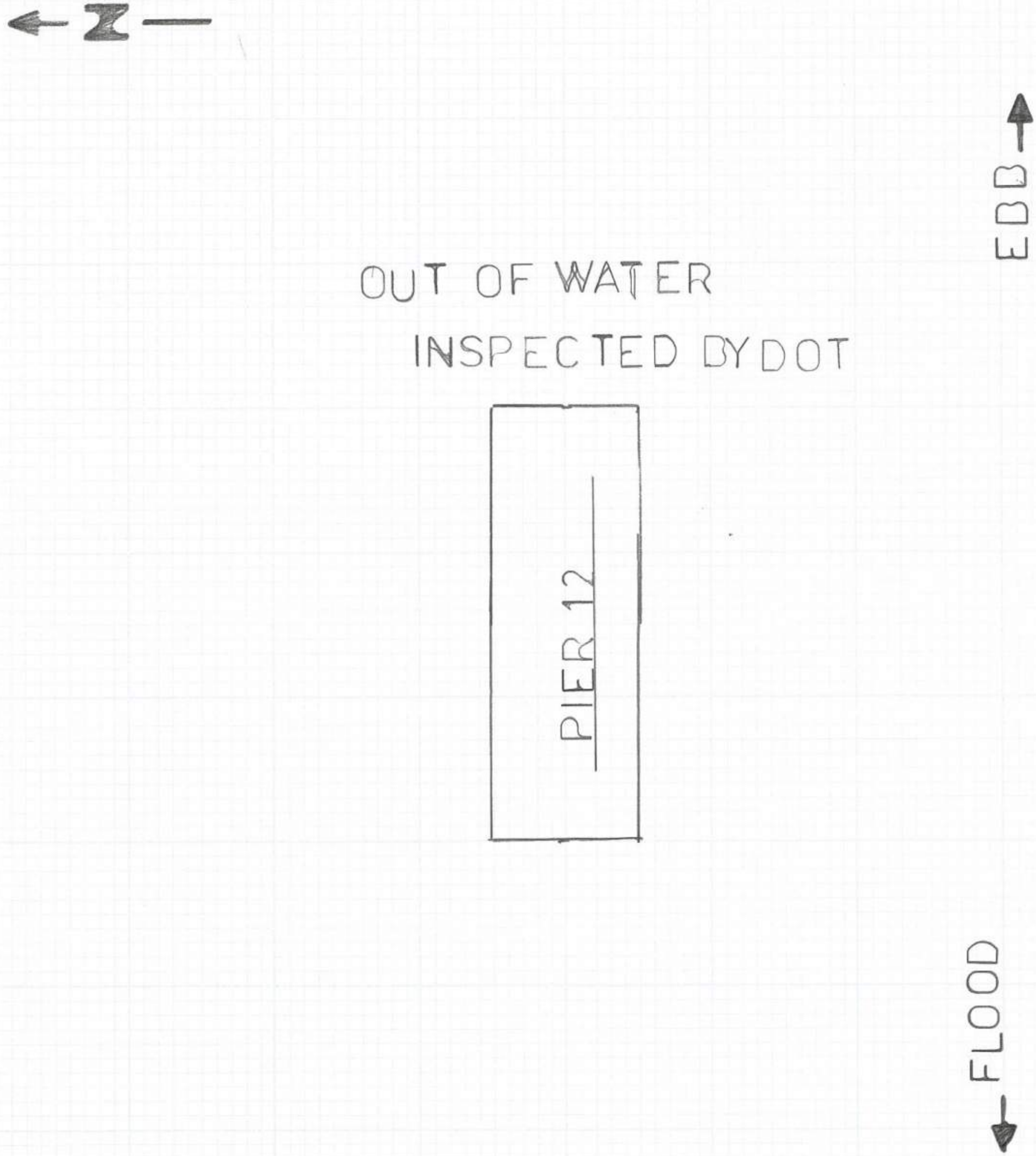
FLOOD

Form 112—5-93

Terracon

PROJECT: Bridge # 235/025, NH 1-A over Hampton River Page 13 of 13

JOB NO. N1159086 Date 20 July Comp. By BTW CHECKED BY: JTH



Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015** **07/31/2015**

County: **Rockingham** State: **New Hampshire**

Description : **Bridge Structure, looking west**

Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015**
07/31/2015

County: **Rockingham** State: **New Hampshire**

Description : **Pier 1**

Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015 07/31/2015**

County: **Rockingham** State: **New Hampshire**

Description : **Pier 2**

Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015** **07/31/2015**

County: **Rockingham** State: **New Hampshire**

Description : **Pier 3**

Photos
TERRACON

Terracon
Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015**
07/31/2015

County: **Rockingham** State: **New Hampshire**

Description : **Pier 4**

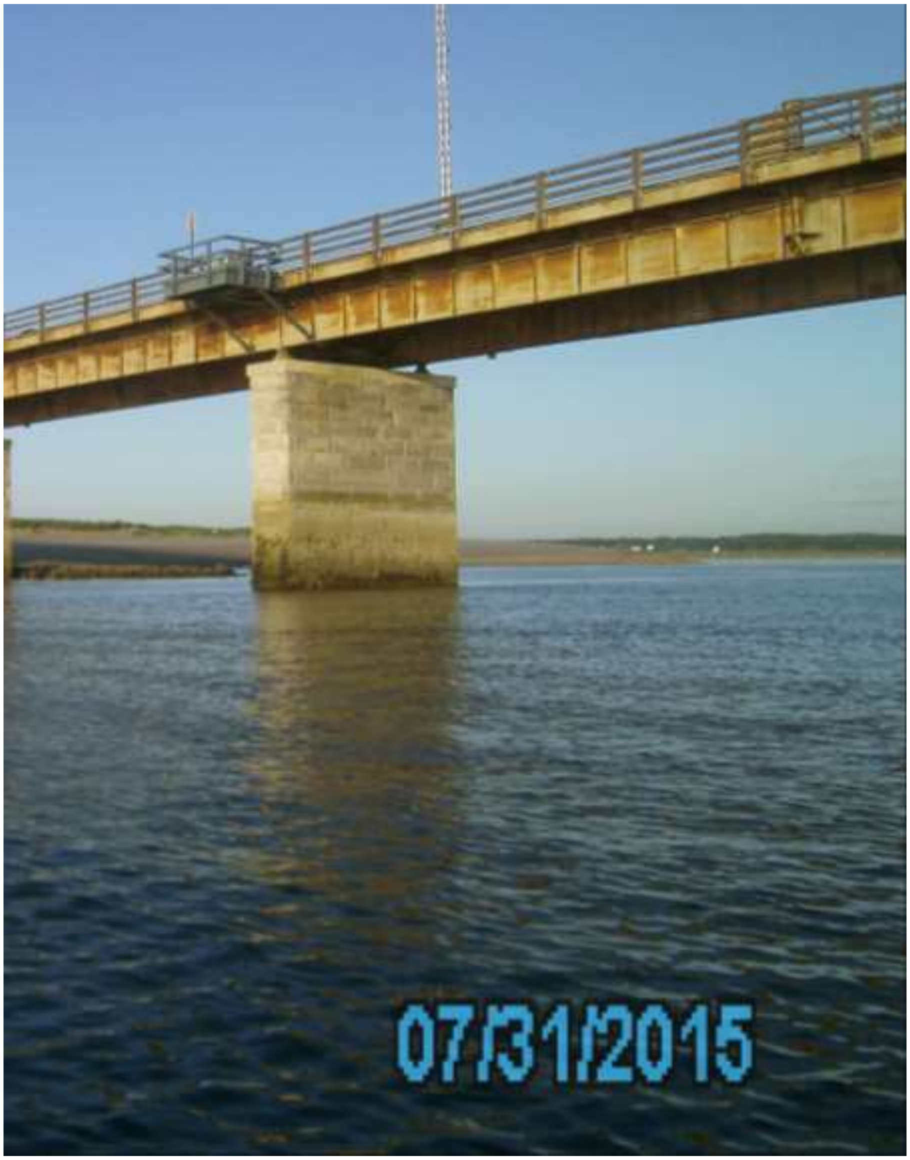
Photos
TERRACON

Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015**
07/31/2015

County: **Rockingham** State: **New Hampshire**

Description : **Pier 5**



Photos
TERRACON

Terracon
Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015 07/31/2015**

County: **Rockingham** State: **New Hampshire**

Description : **Pier 6**

Photos
TERRACON

Terracon
Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015**
07/31/2015

County: **Rockingham** State: **New Hampshire**

Description : **Pier 7**

Photos
TERRACON

Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015**
07/31/2015

County: **Rockingham** State: **New Hampshire**

Description : **Pier 8**

Terracon
Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015 07/31/2015**

County: **Rockingham** State: **New Hampshire**

Description : **Pier 9**

Terracon
Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015 07/31/2015**

County: **Rockingham** State: **New Hampshire**

Description : **Pier 10**

Photos
TERRACON

Terracon
Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015**
07/31/2015

County: **Rockingham** State: **New Hampshire**

Description : **Pier 11**

Photos
TERRACON

Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015** **07/31/2015**

County: **Rockingham** State: **New Hampshire**

Description : **Pier 12**

Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015**
07/31/2015

County: **Rockingham** State: **New Hampshire**

Description : **Pier 10 – Overturning Views, It appears to be overturning to the northeast. Looking west.**

Terracon
Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015 07/31/2015**

County: **Rockingham** State: **New Hampshire**

Description : **Pier 10 – Overturning Views, It appears to be overturning to the northeast. Looking north.**

Photos
TERRACON

Terracon
Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015 07/31/2015**

County: **Rockingham** State: **New Hampshire**

Description : **Pier 10 – Overturning Views, It appears to be overturning to the northeast. Looking east**

Consulting Engineers & Scientists

Structure ID #: **235/025, NH 1-A over Hampton River** Date: **07/16/2015**
07/31/2015

County: **Rockingham** State: **New Hampshire**

Description : **Marine growth**

Photos
TERRACON

Coating Condition Assessment of the Hampton Harbor Bridge

New Hampshire Department of Transportation
Bureau of Bridge Design

Prepared for:

New Hampshire Department of Transportation
Bureau of Bridge Design
John O. Morton Building
P.O. Box 483, 7 Hazen Drive
Concord, NH 03302-0483

Attn: Mr. David L. Scott, P.E.

Prepared by:

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(412) 788-1306 – fax
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Michael P. Reina, P.E.
Project Engineer

October 9, 2010

JDM/MPR:mr
JN300424
Hampton Harbor Bridge Report.doc

TABLE OF CONTENTS

NOTICE: This report represents the opinion of KTA-TATOR, INC. This report is issued in conformance with generally accepted industry practices. While customary precautions were taken to verify the information gathered and presented is accurate, complete and technically correct, this report is based on the information, data, time, materials, and/or samples afforded. This report should not be reproduced except in full.

INTRODUCTION

As authorized by a the New Hampshire Department of Transportation (NHDOT), KTA-Tator, Inc. (KTA) has completed a coating condition assessment of the Hampton Harbor Bridge located in Hampton, New Hampshire.

The purpose of this assessment was to determine the condition of the existing coatings on the structure in order to develop a maintenance painting strategy and an opinion of probable construction costs for the work. This report contains; the results of the field inspection and testing, laboratory analysis of field samples, a discussion of results, and an estimate of probable construction costs. Photographs depicting typical conditions found during the field investigation are included as part of this report.

Photograph 1 – View of Harbor Side Fascia and Bridge Rail

SUMMARY

The existing coating system on the Hampton Harbor Bridge is in poor condition. The existing coating system has deteriorated to the point that significant concentrations of spot rust and pinpoint rust are spread over virtually every member of the structure.

Due to the widespread nature of coating deterioration and rusting, it is obvious that the coating system is approaching the end of its useful service life. Therefore, the most practical, efficient, economical and preferred option is to totally remove and replace the existing coating system on the entire bridge.

The KTA laboratory analysis has found that the existing coating system contain concentrations of toxic metals, particularly lead. Lead concentration ranged from to 1,913 parts per million (PPM) to 13,488 PPM. The presence of these toxic metals in the existing paint film will necessitate the implementation of worker protection and environmental protection controls, in order to comply with federal, state and local regulations.

Details of the proposed coating repair option along with an opinion of probable construction costs for performing the coating rehabilitation work is presented in the Discussion section of this report.

Photograph 2 – Typical Coating Deterioration and Corrosion on Girder Bottom Flanges in Span 6N

BACKGROUND

The Hampton Harbor Bridge structure is owned and maintained by the NHDOT.

The thirteen-span steel structure carries New Hampshire Route 1A traffic over the Hampton River in the Town of Hampton, New Hampshire. The bridge consists of twelve - 94 foot long girder, floorbeam, and stringer spans (Spans 1-N through 6-N and 1-S through 6-S) and a 55 foot long single leaf bascule lift span. The lift span has a tower that is that is manned from April 1 to October 1 to accommodate waterway traffic. The bridge is supported by stone piers

The bridge has been repainted multiple times since construction in 1949, with the last repainting project taking place in 1985. In 1985 the bridge was blast cleaned in accordance with SSPC-SP 10, Near White Blast Cleaning and then coated with a two coat experimental paint system comprised of an inorganic zinc rich primer and a urethane topcoat. The experimental coating system did not provide the intended level of corrosion protection and after approximately 1 ½ years of service significant rusting was evident.

Photograph 3 – View of Pinpoint Rust on Ocean Side Girder Webs and Sidewalk Stringers

FIELD VISIT

A field visit to the Hampton Harbor Bridge was conducted by Michael P. Reina, P.E. of KTA on July 13, 2010. The bridge was accessed from the ground level at the abutments, by ladder at the concrete piers, and also by using existing ladders and platforms in the lift span. The tests and inspections performed, including the observations made during the investigation, are discussed herein.

The following methods, standards, and practices were used to evaluate the existing coating and underlying substrate conditions.

- **Visual** – A visual assessment of the coated surfaces was conducted to determine the type, extent, and location of coating breakdown and corrosion on the structure. Visual Standard SSPC VIS 2, "Standard Method for Evaluating Rusting on Painted Steel Surfaces," was used.

- **Coating Thickness** – Dry film thickness was determined using a Positector 6000. The Positector 6000 is a portable, battery operated, digital coating thickness gage that non-destructively measures non-magnetic coating thickness over ferrous substrates using a magnetic principle. Gage calibration was verified prior to and after use with the National Institute of Standards and Technology (NIST) thickness standards.

- **Number of Coats** – The number of coats present and the thickness of each were determined using a Tooke Gage Mark IV with a 2X cutting tip. This hand-held gage with a microscope (50X) destructively measures the thickness of each coat in multi-coat systems (up to 50 mils). Observation of a coating cross-section created with a cutting tip of known angle shows coating thickness in addition to intercoat contamination, voids, underlying rust, mill scale, and pinholes.

- **Adhesion** – Adhesion testing was conducted in accordance with ASTM D 3359, "Measuring Adhesion by Tape Test," Method A. This method involves cutting an "X" through the coating down to the substrate using a razor knife, followed by the application of pressure sensitive tape (Permacel 99). The tape is then rapidly removed from the X-cut and the adhesion is then rated according to the amount of coating removed using an ASTM rating scale. Typical ratings of 4A to 5A are considered by KTA to represent good adhesion, 2A to 3A represent fair adhesion, while 0A to 1A represent poor adhesion.

- **Paint Samples** – Samples were removed for further laboratory examination to determine if toxic metal concentrations are present in the existing coating films and to generically identify the coating type. A list of samples that were obtained during the field visit is included in the "Field Samples" section of this report.

- **Photographs** – Photographs of typical coating conditions were taken and are included as part of the report.

Visual Inspection

General

For purposes of the visual inspection, the bridge was broken down into simple component members (i.e., fascia girders, floorbeams, stringers, lateral bracing, sidewalk framing steel, and lift span steel). Overall, the visual coating condition was rated poor. The overall rate of coating deterioration (spot rust, pinpoint rust) was significant in all spans. There was graffiti on the concrete and steel around the abutment area. A summary of the typical coating condition on the various structural members of the bridge is presented below.

Girders

Coating deterioration on fascia girders ranged from approximately 20% to 50% of the surface area. Pitting and base metal deterioration was noted on some girders around road deck drain piping. In general, the higher rust concentrations were noted in spans over the water and on the ocean side fascia girder. The ocean side girder in Span 1 had an area of base metal loss adjacent to the road deck drain pipe.

Photograph 4 – Typical Condition of Interior Face of Girder Webs
Note Pinpoint Rust on Web and Stiffeners

Photograph 5 – Area of Pack Rust at Girder Bottom Flange

Photograph 6 – Corrosion and Metal Loss on Girder Bottom Flange in Span 6N

Floorbeams

Coating deterioration on floorbeams ranged from approximately 20% to 30% of the surface area. The higher concentrations of coating deterioration were located on the bottom flange faces of floorbeams.

Photograph 7 – Typical Pinpoint Rust on Floorbeams and Floorbeam Haunch

Photograph 8 – Corrosion on the Underside of the Bottom Flange of End Floorbeam

Photograph 9 – Upper Surface of Floorbeam Flange Depicted in Photograph 8

Stringers

Coating deterioration on stringers ranged from approximately 30% to 50% of the surface area. The higher concentrations of coating deterioration (with some rust pitting observed) were generally located on the bottom flange faces of the stringers.

Photograph 10 – Typical Rusting on Stringer Webs

Photograph 11 – Typical Coating Deterioration and Corrosion on Stringer Bottom Flanges

Lateral Bracing

Coating deterioration on the lateral bracing ranged from approximately 30% to 60% of the surface area. The bracing consisted of back-to-back angles. In many instances, pack rust formation in the crevice between the back-to-back angles and had caused distention of the steel along the braces.

Photograph 12 – Typical Rust on the Underside of the Lateral Bracing

Photograph 13 – Significant Pack Rust between Lateral Bracing Back-to-Back Angles

Sidewalk Framing Steel and Handrail

Coating deterioration on the sidewalk framing ranged from approximately 10% to 40% of the surface area. Rust pitting was evident in some surfaces. The ocean side handrail and the harbor side bridge rails were painted (brown color) over galvanized steel. The brown coating had chipped and eroded in some areas and the galvanized layer was visible. Rusting was visible on some welded splice areas and on end caps.

Photograph 14 – Typical Condition of Sidewalk Support Members

Photograph 15 – Typical Wear of the Topcoat on the Bridge Handrail

Lift Span

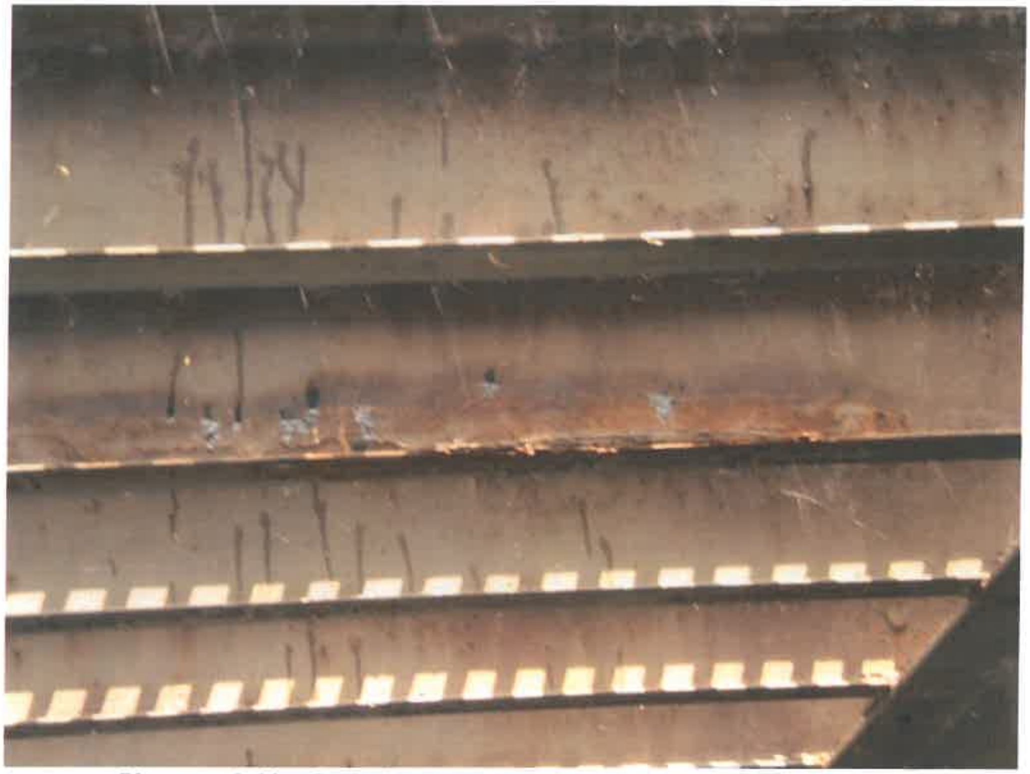
The coatings on the Lift Span steel were generally in better condition than other spans. Coating deterioration and rust on the Lift Span girders and floorbeams covered approximately 15% of the surface. On the girders and floorbeam there were areas of previous pitting corrosion (i.e. pits or areas of metal loss that were previously cleaned and repainted). The channel stringers supporting the open grid deck as well as the lateral bracing had a somewhat higher percentage of coating defects and rust (20%). Steel curbs on the lift span visible from the bridge deck also had a high percentage of rust totaling 20% of the curb area. Some of the lift assembly and equipment was covered with a layer of grease but the coatings appeared to be intact and protecting the surface. Housing around equipment appeared to have been more recently painted. Moving parts were designated with an orange colored finish and stationary parts were painted blue. The exterior of the painted steel counterweight had areas of corrosion totaling 10% of the surface. The interior of the counterweight could not be accessed during the field visit. The coatings on the new steel barrier gate platforms recently installed were in good condition.

Photograph 16 – General View of the Lift Span in the Raised Position

Photograph 17 – Pinpoint Rust on Lift Span Girder, Stringers, and Lateral Bracing

Photograph 18 – Somewhat Better Condition of Lift Span Girder and Fascia Members

Photograph 19 – Corrosion on Ocean Side Sidewalk Support and Deck Pans



Photograph 20 – Corrosion on Flange of Channel Stringers in Lift Span

Photograph 21 – Condition of Lateral Bracing and Stringers in Lift Span

Photograph 22 – Corrosion at Girder Top Flange

Photograph 23 – Heavy Corrosion Rivets in Lift Span

Photograph 24 – Typical Condition of Trunion Girder

Photograph 25 – Typical Coating Condition of Counterweight

Photograph 26 – Previous Pitting on the Lift Span Girder Web

Photograph 27 – Typical Condition of Steel Curbs in Lift Span

Dry Film Thickness

Total coating system dry film thickness measurements were taken on the existing coating system. The following table summarizes the range of the thicknesses obtained with a Positector 6000, magnetic-type dry film thickness gage:

Location	Minimum (mils)	Maximum (mils)	Average (mils)
Entire Bridge	5.5	11.2	7.8

The number of coats present on the structure was measured using a Tooke Gage. Measurements indicated that two coats of paint were present.

Adhesion

Adhesion testing was performed in accordance with ASTM D3359 Method A (X-cut). Adhesion ranged from 2A (fair) to 4A (good) with the most frequent rating being 3A (fair).

Substrate Examination

The substrate was examined at the sample acquisition areas and Tooke Gage reading areas. The substrate beneath the coating system had a roughened surface texture consistent with steel that had been abrasive blast cleaned.

FIELD SAMPLES

The following field samples were obtained during the KTA field visit:

KTA-1 – Total Paint System Scrapings, Pier 1, North Side Sway Brace

KTA-2 – Total Paint System Scrapings, North Abutment, Girder Ocean Side

KTA-3 – Total Paint System Scrapings, Span 9, Girder, Inlet Side

KTA-4 – Total Paint System Scrapings, Lift Span, Girder, Ocean Side

KTA-5 – Total Paint System Scrapings, Pedestrian Rail, North End

LABORATORY INVESTIGATION

The laboratory investigation consisted of visual and microscopic examination, atomic absorption spectroscopy and inductively coupled plasma spectroscopy. The test methods and results are described below.

Atomic Absorption Spectroscopy

Samples KTA-1, KTA-2, KTA-3, KTA-4 and KTA-5 were analyzed for total lead, cadmium and chromium in accordance with AOAC Method 974.02. Briefly, this method entails digesting samples in acid, filtering and analyzing by flame atomic absorption spectroscopy. Results of the testing can be found in the attached report (appended), specifically in the bold columns labeled "Lead (PPM)," "Chromium (PPM)," "Cadmium (PPM)," and "% by Wt."

In summary, lead concentrations ranged from 1,913 PPM to 13,448 PPM, cadmium concentrations ranged from below the test method detection limit of 30.4 PPM up to 108 PPM, and chromium concentrations ranged from 347 PPM to 3,374 PPM. All of the toxic metal concentrations on the high end of the range came from Sample KTA-5 which was taken from a section of pedestrian handrail on the north end of the bridge.

Inductively Coupled Plasma Spectroscopy

Samples KTA-1 through KTA-5 were combined and sent to Schneider Laboratories, Inc. in Richmond, Virginia, for hexavalent chromium analysis. The hexavalent chromium content is determined using inductively coupled plasma (ICP) spectroscopy. Results indicate a chromium concentration of 240 PPM. The laboratory report is provided in Appendix A.

DISCUSSION

The existing coating system on the Hampton Harbor Bridge is in poor condition. The existing coating system has deteriorated to the point that significant concentrations of spot rust and pinpoint rust are spread over virtually every member of the structure.

Due to the widespread nature of coating deterioration and rusting, it is obvious that the coating system is approaching the end of its useful service life. Therefore, the most practical, efficient, economical and preferred option is to totally remove and replace the existing coating system on the entire bridge.

The KTA laboratory analysis has found that the existing coating system contain concentrations of toxic metals, particularly lead. Lead concentration ranged from to 1,913 parts per million (PPM) to 13,488 PPM. The presence of these toxic metals in the existing paint film will necessitate the implementation of worker protection and environmental protection controls, in order to comply with federal, state and local regulations.

Total Coating Removal and Replacement

The initial pre-cleaning step prior to any surface preparation process is to remove any debris, dirt, grime, pigeon droppings, fungal growth etc. that have accumulated on the bridge. This can be accomplished by brushing, vacuuming, or pressure water cleaning. However, it must be recognized that any pre-cleaning procedure must carefully address worker and environmental protection issues related to the exposure to pigeon droppings (histoplasmosis) and control of the toxic metals (lead, cadmium, and chromium) in the existing coatings.

Surface Preparation of Spans 1-N through 6-N and 1-S through 6-S

The preferred maintenance strategy in these spans is to totally remove and replace the existing coatings on the structure by abrasive blast cleaning in accordance with SSPC-SP 10 "Near White Metal." Following blast cleaning, recoating can be performed with a three-coat, high performance coating system such as an organic zinc-rich primer, an epoxy intermediate coat, and a urethane finish. These coating systems have a proven history of performance on bridge structures throughout the country.

NHDOT participates in the Northeast Protective Coatings Committee (NEPCOAT) coatings evaluation program, which maintains a Qualified Products List (QPL). Coating systems are added to the list if they have been tested under AASHTO NTPEP (National Transportation Products Evaluation Program), and meet specific performance criteria established by NEPCOAT. NEPCOAT QPL List B contains several qualified organic zinc rich primer, epoxy intermediate coat and urethane finish coat paint system that could be applied. If desired, the a three coat moisture cured urethane coating system (MCU) that ~~which~~ includes a zinc-rich MCU primer could be substituted for the coating system listed above. The main advantage of the MCU system is that the painting system is somewhat more ? to adverse weather during application. An additional advantage of the MCU system is that most products are single component materials and therefore reduce the chance of coating failures due to improper mixing of the paint components.

The bridge railings, while experiencing some failure of the topcoat, are not experiencing corrosion and therefore are not in need of immediate attention. New steel at the traffic gate platforms are also in good condition and should be excluded from the coating rehabilitation work.

Surface Preparation of the Lift Span

The majority of the Lift Span steel, including the grid deck, should be prepared by abrasive blast cleaning as described above for the remainder of the bridge. The trunion box girder, gearboxes, and counterweight will require a different method of surface preparation. Because of the sensitive equipment and assemblies located at the trunion end of the Lift Span, extreme care must be taken when preparing those surfaces for painting. Because spent abrasive media and airborne particulate from abrasive blasting cleaning may harmful to this equipment, total coating removal by pressurized water jetting would be the recommended option. The total removal of existing coatings and rust by water jetting requires specialized equipment that utilizes water pressures up to 40,000 psi. When using pressurized water to prepare steel, it may be necessary to use rust inhibitive chemicals to retard premature rusting of the cleaned surfaces. SSPC-SP 12, Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating, (appended) provides detailed information on coating removal by water jetting including specific surface cleanliness wording that can be included in the project specification or special provision.

KTA can assist NHDOT in the development of these documents for this work as deemed necessary.

Prior to coating removal, it will be necessary to remove the layer of grease that is present on some surfaces. Grease removal can be accomplished by solvent cleaning, or, if the use of strong cleaning solvents is not desirable, through the use of other chemical degreasing products that are more environmentally friendly. In addition, steam cleaning may prove to be an effective method of grease removal. It may be found that a combination of the above methods is most effective. It is possible that some experimentation with removal methods will be necessary to determine the most effective method(s). In any event, SSPC-SP 1, Solvent Cleaning (appended), can be used as a guide in this cleaning process. The SP 1 standard is not limited to cleaning with solvent; chemical degreasers and steam cleaning methods are also addressed.

Toxic Metals in Existing Coatings

Laboratory testing of paint chip samples from the bridge verified the presence of toxic metals, particularly lead, in the coating. The presence of these toxic metals will necessitate that appropriate levels of controls (worker protection, environmental protection, hazardous waste disposal) are established when blast cleaning or other operations that may disturb the existing coatings are being conducted. The controls are necessary to address and comply with Federal, state and local regulatory requirements regarding the disposal of waste, worker protection, protection of the public, and environmental protection.

Chloride Remediation

It is imperative that residual chloride levels (salt contamination) be lowered to acceptable concentrations prior to coating. This is particularly necessary on bridge structures that span or are near saltwater. The level of salt contamination when applying organic coatings, such as those proposed for use, should be kept below 7 $\mu g/cm^2$. The specifications should require testing after blast cleaning has been performed and prior to painting. In many instances, chloride contamination can be reduced to acceptable levels by pressure water cleaning and/or abrasive blast cleaning with a combination of finely graded and coarser abrasive media. Chloride removal agents can also be added to the pressure washing water. Other options include abrasive blast cleaning the steel, and allowing it to rust over night followed by re-blast cleaning.

OPINION OF PROBABLE CONSTRUCTION COSTS

An opinion of probable construction costs for total removal and replacement of the existing coatings on the Hampton Harbor Bridge has been prepared. This analysis involved making various assumptions, based upon experience, as to how a contractor might staff and proceed with this type of work. Crew sizes, production rates, material and equipment requirements are evaluated, and man-days and project-days are calculated. From this project time estimate, costs associated with labor, materials, and equipment are factored in and the estimate is developed. Overhead and profit are added as a multiplier to the base estimate. For the purposes of this estimate, all labor was considered to be union painters and all equipment was calculated at rental rates. Production days were calculated from an estimated square footage of paintable steel surfaces and an allocated production rate. The requirements for environmental protection, worker health and safety, waste disposal, and containment are also included. Maintenance and protection of traffic is not included in the estimated costs. Finally, a variance multiplier is used on the final estimated cost to develop a range of anticipated bid prices. This multiplier allows for the variations in contractor bidding techniques, new technology, and scheduling of the work within the painting season. Using this method, the estimate for the proposed work is shown in the table below. The costs for coating work in the lift span were completed for three options:

? all?

- Option 1 – Lift Span in the Closed Position for the duration of the work. This option requires the restriction of all boat traffic. Vehicular traffic could be maintained using single lane closures and suitable covering of the grid deck in the lane open to traffic. The work in the counterweight and trunion areas would still require the work to be completed while the lift span is in the raised position. Therefore some interruption of vehicular traffic would be required.

- Option 2 – Work on the Lift Span would be completed while the span is in the closed position as in Option 1 with the exception that the span would have 5 scheduled openings per day. The containment and rigging would need to be secured and workers would exit the work area for each scheduled lift cycle.

- Option 3 – Work on the Lift Span would be completed with the span in the raised position for the duration of the work. This option requires that the bridge is closed to vehicular and pedestrian traffic during the work on the Lift Span. Boat traffic is maintained during the work.

Work Limits	Paintable Area	Cost Range*	Estimated Duration*
Spans 1-N to 6-N and 1-S to 6-S	105,200 ft²	$1,346,800 to $1,616,200	85 Production Days (4 Calendar Months)
Lift Span – Option 1	17,800 ft²	$255,100 to $270,100	12 Production Days (0.5 Calendar Months)
Lift Span – Option 2	17,800 ft²	$299,200 to $359,000	18 Production Days (0.8 Calendar Months)
Lift Span – Option 3	17,800 ft²	$274,100 to $329,000	15 Production Days (0.7 Calendar Months)
Trunion Area & Counterweight	2,000 ft²	$115,100 to $138,100	5 Production Days (0.2 Calendar Months)

*A detailed cost analysis and assumptions used is provided in Appendix B.

KTA-Tator, Inc.
115 Technology Drive
Pittsburgh, PA 15275

Lead in Paint Chips
EPA 7420/AOAC 974.02

412-788-1300
412-788-1306 FAX

Client: NHDOT
Job # 300424

	Sample #	Lab Sample #	Sample Wt.	AA Reading	Dil	V	Lead (PPM)	% by Wt.	QC % R
1	300424-1NHDOT	1	0.1821	2.6181	10	25	**3594**	**0.359**	
2	300424-2NHDOT	2	0.2035	2.3968	10	25	**2944**	**0.294**	
3	300424-3NHDOT	3	0.1755	2.7288	10	25	**3887**	**0.389**	
4	300424-4NHDOT	4	0.1763	13.4900	0	25	1913	0.191	
5	300424-5NHDOT	5	0.1865	10.0324	10	25	**13448**	**1.345**	
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
Dup									
Control A				2.6181	10	25			
Control B				2.8394	10	25			
Spike C				4.1674	10	25			
Spike D				4.4994	10	25			
Blank				0.1857	0	25			

Initial Calibration and Controls

Standard	PPM	ABS
0 PPM	0.000	-0.001
0.5 PPM	0.500	0.005
3 PPM	3.000	0.027
6 PPM	6.000	0.052
9 PPM	9.000	0.084
12 PPM	12.000	0.112
15 PPM	15.000	0.138
18 PPM	18.000	0.165

Correlation Co-Efficient: 0.9997
Detection Limit: 76.0

ICV (3 PPM)	2.776	0.024
ICB (0 PPM)	-0.360	-0.004
CCV (3 PPM)*	3.149	0.029
CCB (0 PPM)*	-0.245	-0.003
CCV (3 PPM)**	2.839	0.025
CCB (0 PPM)**	-0.259	-0.003

* After 1st 10 Samples
** After 2nd 10 Samples

Technician: MAS
Date: 7/29/10

Standards Batch #: 7/30/10

Controls: Acceptable Limits: 80% to 120%
Controls Verified JAG
Spikes: Acceptance Limits: 75% to 125%
Spikes Verified JAG
Calculation Verified JAG
Date 7/30/10

KTA-Tator, Inc.
115 Technology Drive
Pittsburgh, PA 15275

412-788-1300
412-788-1306 FAX

Chromium in Paint Chips
AOAC 974.02

Page 1 of 1

Client: **NHDOT**
Job # 300424

	Sample #	Lab Sample #	Sample Wt.	AA Reading	Dil	V	**Chromium (PPM)**	**% by Wt.**	QC % R
1	300424-1NHDOT	1	0.1821	3.7913	0	25	520	0.052	
2	300424-2NHDOT	2	0.2035	3.6420	0	25	447	0.045	
3	300424-3NHDOT	3	0.1755	3.3435	0	25	476	0.048	
4	300424-4NHDOT	4	0.1763	2.4478	0	25	347	0.035	
5	300424-5NHDOT	5	0.1865	2.5167	10	25	3374	0.337	
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
Quality Control									
Dup									
Control A									
Control B									
Spike C									
Spike D									
Blank									

Initial Calibration & Controls:

Standard	PPM	ABS
0 PPM	0.000	0.001
0.2 PPM	0.200	0.003
0.5 PPM	0.500	0.005
1.0 PPM	1.000	0.008
2.0 PPM	2.000	0.014

Correlation Co-Efficient: **0.9977**
Detection Limit: 30.4

ICV (1.0PPM)	1.498	0.011
ICB (0 PPM)	-0.081	0.001
CCV (1.0 PPM)*	1.040	0.016
CCB (0 PPM)*	-0.719	-0.006
CCV (1.0 PPM)**	0.967	0.007
CCB (0 PPM)**	0.450	0.004

* After 1st 10 Samples
** After 2nd 10 Samples

Techniciar MAS
Date: 7/29/10

Standards Batch # 7/30/10

Controls: Acceptable Limits: 80% to 120%
Controls Verified
Spikes: Acceptance Limits: 75% to 125%
Spikes Verified
Calculation Verified VDS
Date 8/2/2010

KTA-Tator, Inc.
115 Technology Drive
Pittsburgh, PA 15275

Cadmium in Paint Chips
AOAC 974.02

412-788-1300
412-788-1306 FAX

Client: NHDOT
Job # 300424

	Sample #	Lab Sample #	Sample Wt.	AA Reading	Dil	V	Cadmium (PPM)	% by Wt.	C % R
1	300424-1NHDOT	1	0.1821	0.0617	0	25	<30.4	<0.003	
2	300424-2NHDOT	2	0.2035	0.1268	0	25	<30.4	<0.003	
3	300424-3NHDOT	3	0.1755	0.2569	0	25	37	0.004	
4	300424-4NHDOT	4	0.1763	0.3826	0	25	54	0.005	
5	300424-5NHDOT	5	0.1865	0.8032	0	25	108	0.011	
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
Quality Control									
Dup									
Control A									
Control B									
Spike C									
Spike D									
Blank									

Initial Calibration & Controls:

Standard	PPM	ABS
0 PPM	0.000	-0.004
0.2 PPM	0.200	0.040
0.5 PPM	0.500	0.108
1.0 PPM	1.000	0.225
2.0 PPM	2.000	0.447

Correlation Co-Efficient: **1.0000**
Detection Limit: 30.4

ICV (1.0PPM)	1.044	0.232
ICB (0 PPM)	0.014	-0.001
CCV (1.0 PPM)*	1.024	0.232
CCB (0 PPM)*	0.005	-0.003
CCV (1.0 PPM)**	1.057	0.240
CCB (0 PPM)**	0.040	0.005

* After 1st 10 Samples
** After 2nd 10 Samples

Technician: MAS
Date: 7/29/10

Standard Batch # 7/30/2010

Controls: Acceptable Limits: 80% to 120%
Controls Verified
Spikes: Acceptance Limits: 75% to 125%
Spikes Verified
Calculation Verified
Date

SCHNEIDER LABORATORIES

INCORPORATED
2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • (FAX) 804-359-1475
Excellence in Service and Technology
AIHA/ELLAP 100527, NVLAP 101150-0, NYELAP/NELAC 11413, CAELAP 2078, NC 593, SC 93003

LABORATORY ANALYSIS REPORT

Hexavalent Chromium Analysis based on EPA 7196A Method
Using SLI M43

ACCOUNT #: 1861-10-2639
CLIENT: KTA-TATOR, Inc.
ADDRESS: 115 Technology Drive
Pittsburgh, PA 15275
PROJECT NAME: NHDOT
JOB LOCATION:
PROJECT NO.: 300424
PO NO.:

DATE RECEIVED: 8/5/2010
DATE ANALYZED: 8/11/2010
DATE REPORTED: 8/11/2010

Sample Type: PAINT

SLI Sample No.	Client Sample No.	Collection Date	Sample Description	Sample Wt (mg)	Total Chrom VI (µg)*	Chrom VI Conc (% by wt)	Chrom VI Conc PPM
30680325	NHDOT		NH Rte 1A/Hampton River	1,609	386.1	0.024	240

Sample weight below SLI SOP guidelines.

Analysis Run ID: 46236

Analyst: **Dara L. Fox**
Total Number of Pages in Report: 1
Results relate only to samples as received by the laboratory.

Marti H. Baird

Reviewed By **Marti H. Baird, Analyst**
Visit www.slabinc.com for current certifications.

*Minimum Reporting Limit: 1.0 µg. Quality control data is available from the laboratory upon request. *Data precision justifies 2 significant figures. Unusual sample conditions, if any, are described. All testing is performed in strict accordance with Schneider Laboratories, Inc. protocol.*

KTA Quality and Integrity Since 1949

KTA-TATOR, INC.
115 Technology Drive
Pittsburgh, PA 15275

INDEX NO. 1

SHEET NO. 1 OF 3

PROJECT NHDOT - HAMPTON HARBOR BRIDGE CALC. BY MPR DATE 9/14/10

SURFACE AREA TAKE-OFF JOB NO. 300424 CHK'D BY ____ DATE ____

BRIDGE GENERAL INFO:

TOTAL LENGTH = 1193 FT LIFTSPAN = 65'
WIDTH OUT/OUT = 35' NEW LIFTGATE PLATFORMS EXCLUDED
C/C GIRDERS = 24'
13 SPANS TOTAL

ABUT A TO PIER 1S & PIER 1N TO ABUT B. 12 @ 94' = 1128'

GIRDERS = (2)(1128')[(2)(80"/12) + (3)(14"/12)] = 37,976 SF

GIRDER STIFFENERS = (2)(2)(2)(5"/12)(80"/12)(1128'/5') = 5013 SF

FLOOR BEAMS = (12 SPANS)(5/SPAN)(24')(7.76 SF/FT) = 11,174 SF
W 27 x 98

FLOORBEAM HAUNCH = (60 EA)[(2 SIDES)(1/2)(4')(4.5') + (6.2"/12)(6')] = 1275 SF

INTERIOR STRINGERS = (3)(1128')(5.44 SF/FT) = 18,409 SF
W18 x 47

FASCIA STRINGERS = (2)(1128')(5.44 SF/FT) = 12,273 SF
W18 x 47

SIDEWALK BRACKETS B1 = (60)(5.2')(5.44 SF/FT) = 1697 SF
W18 x 47

SIDEWALK BRACKETS B2 = (60)(3.6')(5.44 SF/FT) = 1175 SF

SIDEWALK BRACKETS D1 = (60)(5.2)(5 SF/FT) = 1560 SF

SIDEWALK BRACKETS D2 = (60)(3.6')(5 SF/FT) = 1080 SF

SWAY FRAMES = (60)(50')(2.66 SF/FT) = 7980 SF
7F

BOTTOM LATERAL BRACING = TO BE REPLACED = 0 SF

BEARINGS = (2)(12)(25 SF EA) = 600 SF

SUBTOTAL = 100,212 SF
ADD 5% FOR MISC. CONNECTIONS, ETC.

ALL SPANS EXCEPT LIFTSPAN ≈ 105,200 SF

KTA-TATOR, INC.
115 Technology Drive
Pittsburgh, PA 15275

INDEX NO. 2

SHEET NO. 2 OF 3

PROJECT NHDOT - HAMPTON HARBOR BRIDGE CALC. BY MPR DATE 9/14/10

SURFACE AREA TAKE-OFF JOB NO. 300424 CHK'D BY ____ DATE ____

LIFT SPAN

GIRDERS = (2)(77')(16.83 SF/FT + 14"/12) = 2771 SF

GIRDER STIFF'S = (2)(2)(2)(5"/12)(80"/12)(77'/5) = 342 SF

INT. FLOORBEAMS W/ HAUNCHES = (3)(207.48 EA) = 622 SF

END FLBM (TRUNION SIDE) = (1)(24)[(2)(72"/12) + (4)(1.5')] = 288 SF

END FLBM STIFF = (1)(2)(2)(5"/12)(6')(5) = 50 SF

LONG. STRINGERS = (4)(65')(5.44 SF/FT) = 1414 SF

TRANVERSE STRINGERS SAY C12X30 = (15)(3)(30')(2.97 SF/FT) = 4010 SF

LAT. BRACING = (3)(2)(25')(2)(2 SF/FT) = 600 SF

SIDEWALK LAT. BRACING = (12)(7.8')(1)(2 SF/FT) = 187 SF

SIDEWALK BRACKETS = (2)(9)(5')(5.44 SF/FT) = 490 SF

GRID DECK (2" LONG. BARS @ 2", 1" TRANS BARS @ 2") = (2"/12)(2)(65')(30'x12"/2") + (1"/12)(2)(30')(65x12/2) = 5850 SF

BOTTOM OF SIDEWALK FILLED GRID DECK = (5')(65') = 325 SF

LIFT SPAN SUBTOTAL = 16,949 SF

ADD 5% MISC.

LIFT SPAN ≈ 17,800 SF

COUNTERWEIGHT & TRUNION - NO DWG'S DIMENSIONS ASSUMED

COUNTERWEIGHT EXTERIOR = (20')(12')(2) + (12')(4')(2) = 576 SF

CONTERWEIGHT INTERIOR = 576 SF + (3)(4')(12') = 720 SF

TRUNION GIRDER (BOX BEAM) EXT. = (2.5')(4)(19') = 190 SF

TRUNION GIRDER INT. = 190 SF + (2.5)(2.5)(2)(6) = 265 SF

MISC. HANDRAILS & PLATFORMS & LADDERS, ETC. = 200 SF

COUNTER WEIGHT & TRUNION ≈ 2000 SF

KTA-TATOR, INC.
115 Technology Drive
Pittsburgh, PA 15275

INDEX NO. 3

SHEET NO. 3 OF 3

PROJECT NHDOT - HAMPTON HARBOR BRIDGE CALC. BY MPR DATE 9/14/10

SURFACE AREA TAKE-OFF JOB NO. 300424 CHK'D BY ____ DATE ____

BRIDGE RAILINGS

RAILS = (1193')(5 RAILS)(5"/12)(4 SIDES) = 9942 SF
POSTS = (133)(2)(61)(3.45 SF/FT) = 5506 SF
BOTTOM RAIL = (1193')(1)(2"/12)(4 SIDES) = 795 SF

BRIDGE RAILS SUB TOTAL = 16,243 SF
ADD 5% MISC.

BRIDGE RAILINGS ≃ 17,100 SF

BRIDGE TOTAL SURFACE ≃ 142,100 SF

Hampton Harbor Bridge

New Hampshire Department of Transportation
Bureau of Bridge Design

Given: Total Remove and Replace Existing Coating - All Steel (Hazardous Metals Present)

Assumptions : **Spans 1-N through 6-N and 1-S through 6-S** - All Steel Except Bridge Railings
Work from Barge Moored in Bay - Limited Traffic Restrictions
Abrasive Blast Clean per SSPC SP-10 and Apply 3 Coat MCU System
Crew Able to Work 10 Hours per Day 5 Days per Week (Avg. 1 Day Lost to Weather per Wk)

Total Surface Area =	105,200	sq ft
Longest Containment Length =	200	ft - (Two Spans)
No. of Spans =	12	
Platform Length =	200	ft
Platform Width =	40	ft
Required Platform Deck Area =	8,000	sq ft
Containment Draft Area =	400	sq ft
Cross Draft =	Yes	Yes or No
Hazardous Metals =	Yes	Yes or No
Recyclable Abrasive =	Yes	Yes or No

Assume Crew Size

Class	No.	Rate/hr	OT Rate
Foreman	1	$75	$112.50
Blaster/Painter	6	$65	$97.50
Laborer	3	$55	$82.50

Labor Cost per Day = $6,930 @ Hours / Day = 10

Labor

Mobilize =	6	Days
Platform =	3	Days
Rigging / Containment Moves =	25	Days
Solvent Cleaning =	0	Days
Power Wash =	0	Days
Blast/Prime =	28	Days
Full Intermediate Coat =	8	Days
Full Finish Coat =	8	Days
Cleanup, Demob, Punch List =	6	Days
Total Production Days =	85	Days
Calendar Months =	4.0	Months

Subtotal Labor = $589,107

Materials

	Rate	Unit	Cost
Full Prime =	$0.42	/sq ft	$44,184
Full Intermediate =	$0.26	/sq ft	$27,352
Full Finish =	$0.27	/sq ft	$28,404
Thinner =	$0.10	/sq ft	$10,520
Blast Media =	$1,000	/ton	$36,820

Subtotal Materials = $147,280

Equipment

Item	#Months	Qty	Rate	Cost
Blast Machine =	4	1	$15,000	$59,506
HEPA Filters for vac =	4	1	$260	$1,031
Dust Collector =	4	1	$6,800	$26,976
Duct =	NA	700	$25	$17,500
Hoses =	4	6	$940	$22,374
Nozzles =	4	6	$160	$3,808
Hoods =	NA	6	$250	$1,500
Lighting =	NA	6	$550	$3,300
Compressors =	4	2	$4,600	$36,497
Pumps =	4	2	$1,000	$7,934
Lines =	4	6	$250	$5,951
Guns =	NA	6	$300	$1,800
Generators =	4	3	$600	$7,141
Platform (Roof Decking and Cables) =	NA	8,000	$4	$32,000
Outriggers =	NA	25	$180	$4,500
Tarps =	NA	4800	$2	$9,600
Tarp Cables =	NA	250	$1	$250
Crane =	2.0	1	$4,800	$9,654
Cables & Picks / ft =	4	0	$1	$0
Pressure Washers =	4	0	$700	$0
Water Buffalos =	4	0	$3,000	$0
Work Barge =	4	1	$3,500	$13,885
Pick-up Trucks (w/ fuel) =	4	3	$1,000	$11,901
Large Trucks (w/Fuel) =	4	1	$1,200	$4,760
Hand Tools =	4	20	$10	$793
Power Tools =	4	9	$50	$1,785
Office Trailor =	4	2	$450	$3,570
Storage Trailor =	4	2	$375	$2,975

Subtotal Equipment = $290,992

Health and Safety

Item	# Months	Qty	Rate	Cost
Tyvek Suits =	4	20	$50	$3,967
Blood Leads =	NA	20	$100	$2,000
Worker Exposure Monitoring =	4	6	$30	$714
Worker Exposure Monitor Analysis =	4	6	$26	$619
Wash Trailor =	4	3	$450	$4,641
Waste Disposal =	NA	50	$300	$14,991
Safety Boat =	4	1	$500	$1,984

Subtotal Other Costs = $28,916

Engineering

Item	Hours	Qty	Rate	Cost
Drafting =	40	1	$65	$2,600
Engineering =	40	1	$125	$5,000
Administrative Submital Support =	20	1	$40	$800

Subtotal Engineering = $8,400

Total

Subtotal Job =	$1,064,696
Overhead (10%) =	$106,470
Subtotal with Overhead =	$1,171,165
Profit (15%) =	$175,675
Location Factor =	1.0
Total Cost =	**$1,346,840**
Cost / Sq ft =	$12.80

Expected Bid Range:	**$1,346,800**	**to**	**$1,616,200**
	$12.80	to	$15.36

SUMMARY PAGE ITEM#

Pay Items (Using High Side of Bid Range)	Price	Unit	
PAINTING EXISTING STRUCTURAL STEEL	$1,107,450	LS	68.5%
CONTAINMENT	$464,864	LS	28.8%
DISPOSAL OF BRIDGE WASTE	$22,756	LS	1.4%
WORKER HEALTH AND SAFETY	$21,138	LS	1.3%
MAINTENANCE & PROTECTION OF TRAFFIC	$0	LS	0.0%
Check Total	$1,616,200		

Hampton Harbor Bridge - Lift Span OPTION 1

New Hampshire Department of Transportation
Bureau of Bridge Design

Given: Total Remove and Replace Existing Coating - All Steel (Hazardous Metals Present)

Assumptions: **Lift Span** - All Steel Except Bridge Railings, Trunion Box Girder, Gearboxes, & Counterweight
Work from Barge Moored in Bay - Limited Traffic Restrictions - NO BOAT TRAFFIC
Abrasive Blast Clean per SSPC SP-10 and Apply 3 Coat MCU System
Crew Able to Work 10 Hours per Day 5 Days per Week (Avg. 1 Day Lost to Weather per Wk)

Total Surface Area =	17,800	sq ft
Longest Containment Length =	60	ft
No. of Spans =	1	
Platform Length =	65	ft
Platform Width =	40	ft
Required Platform Deck Area =	2,600	sq ft
Containment Draft Area =	400	sq ft
Cross Draft =	Yes	Yes or No
Hazardous Metals =	Yes	Yes or No
Recyclable Abrasive =	Yes	Yes or No

Assume Crew Size

Class	No.	Rate/hr	OT Rate
Foreman	1	$75	$112.50
Blaster/Painter	6	$65	$97.50
Laborer	3	$55	$82.50

Labor Cost per Day = $6,930 @ Hours / Day = 10

Labor

Mobilize =	0	Days
Platform =	1	Days
Rigging / Containment Moves =	2	Days
Solvent Cleaning =	0	Days
Power Wash =	0	Days
Blast/Prime =	5	Days
Full Intermediate Coat =	1	Days
Full Finish Coat =	1	Days
Cleanup, Demob, Punch List =	1	Days
Total Production Days =	12	Days
Calendar Months =	0.5	Months

Subtotal Labor = $80,807

Materials

	Rate	Unit	Cost
Full Prime =	$0.42	/sq ft	$7,476
Full Intermediate =	$0.26	/sq ft	$4,628
Full Finish =	$0.27	/sq ft	$4,806
Thinner =	$0.10	/sq ft	$1,780
Blast Media =	$1,000	/ton	$6,230

Subtotal Materials = $24,920

Equipment

Item	#Months	Qty	Rate	Cost
Blast Machine =	0.5	1	$15,000	$8,162
HEPA Filters for vac =	0.5	1	$260	$141
Dust Collector =	0.5	1	$6,800	$3,700
Duct =	NA	300	$25	$7,500
Hoses =	0.5	0	$940	$0
Nozzles =	0.5	6	$160	$522
Hoods =	NA	0	$250	$0
Lighting =	NA	0	$550	$0
Compressors =	0.5	2	$2,000	$2,177
Pumps =	0.5	0	$1,000	$0
Lines =	0.5	0	$250	$0
Guns =	NA	0	$300	$0
Generators =	0.5	3	$600	$979
Platform (Roof Decking and Cables) =	NA	2,600	$4	$10,400
Outriggers =	NA	9	$180	$1,620
Tarps =	NA	4300	$2	$8,600
Tarp Cables =	NA	140	$1	$140
Crane =	0.2	1	$4,800	$877
Cables & Picks / ft =	0.5	0	$1	$0
Pressure Washers =	0.5	0	$700	$0
Water Buffalos =	0.5	0	$3,000	$0
Work Barge =	0.5	1	$3,500	$1,905
Pick-up Trucks (w/ fuel) =	0.5	3	$1,000	$1,632
Large Trucks (w/Fuel) =	0.5	0	$1,200	$0
Hand Tools =	0.5	20	$10	$109
Power Tools =	0.5	9	$50	$245
Office Trailor =	0.5	0	$450	$0
Storage Trailor =	0.5	0	$375	$0

Subtotal Equipment = $48,710

Health and Safety

Item	# Months	Qty	Rate	Cost
Tyvek Suits =	0.5	10	$50	$272
Blood Leads =	NA	12	$100	$1,200
Worker Exposure Monitoring =	0.5	6	$30	$98
Worker Exposure Monitor Analysis =	0.5	6	$26	$85
Wash Trailor =	0.5	3	$450	$637
Waste Disposal (Tons) =	NA	8	$300	$2,537
Safety Boat =	0.5	1	$500	$272

Subtotal Other Costs = $5,100

Engineering

Item	Hours	Qty	Rate	Cost
Drafting =	40	1	$65	$2,600
Engineering =	80	1.5	$125	$15,000
Administrative Submital Support =	20	1	$40	$800

Subtotal Engineering = $18,400

Total

Subtotal Job =	$177,937
Overhead (10%) =	$17,794
Subtotal with Overhead =	$195,730
Profit (15%) =	$29,360
Location Factor =	1.0
Total Cost =	**$225,090**
Cost / Sq ft =	$12.65

Expected Bid Range:	**$225,100**	**to**	**$270,100**
	$12.65	to	$15.17

SUMMARY PAGE **ITEM#**

Pay Items (Using High Side of Bid Range)	Price	Unit	
PAINTING EXISTING STRUCTURAL STEEL	$151,657	LS	56.1%
CONTAINMENT	$110,709	LS	41.0%
DISPOSAL OF BRIDGE WASTE	$3,850	LS	1.4%
WORKER HEALTH AND SAFETY	$3,892	LS	1.4%
MAINTENANCE & PROTECTION OF TRAFFIC	$0	LS	0.0%
Check Total	$270,100		

Hampton Harbor Bridge - Lift Span OPTION 2
New Hampshire Department of Transportation
Bureau of Bridge Design

Given: Total Remove and Replace Existing Coating - All Steel (Hazardous Metals Present)

Assumptions: **Lift Span** - All Steel Except Bridge Railings, Trunion Box Girder, Gearboxes, & Counterweight
Work from Barge Moored in Bay - WORK WHILE CLOSED WITH 5 SCHEDULED OPENNINGS per Day
Abrasive Blast Clean per SSPC SP-10 and Apply 3 Coat MCU System
Crew Able to Work 10 Hours per Day 5 Days per Week (Avg. 1 Day Lost to Weather per Wk)

Total Surface Area =	17,800	sq ft
Longest Containment Length =	60	ft
No. of Spans =	1	
Platform Length =	65	ft
Platform Width =	40	ft
Required Platform Deck Area =	2,600	sq ft
Containment Draft Area =	400	sq ft
Cross Draft =	Yes	Yes or No
Hazardous Metals =	Yes	Yes or No
Recyclable Abrasive =	Yes	Yes or No

Assume Crew Size

Class	No.	Rate/hr	OT Rate
Foreman	1	$75	$112.50
Blaster/Painter	6	$65	$97.50
Laborer	3	$55	$82.50

Labor Cost per Day = $6,930 @ Hours / Day = 10

Labor

Mobilize =	0	Days
Platform =	2	Days
Rigging / Containment Moves =	3	Days
Solvent Cleaning =	0	Days
Power Wash =	0	Days
Blast/Prime =	7	Days
Full Intermediate Coat =	2	Days
Full Finish Coat =	2	Days
Cleanup, Demob, Punch List =	1	Days
Total Production Days =	18	Days
Calendar Months =	0.8	Months

Subtotal Labor = $122,869

Materials

	Rate	Unit	Cost
Full Prime =	$0.42	/sq ft	$7,476
Full Intermediate =	$0.26	/sq ft	$4,628
Full Finish =	$0.27	/sq ft	$4,806
Thinner =	$0.10	/sq ft	$1,780
Blast Media =	$1,000	/ton	$6,230

Subtotal Materials = $24,920

Equipment

Item	#Months	Qty	Rate	Cost
Blast Machine =	0.8	1	$15,000	$12,411
HEPA Filters for vac =	0.8	1	$260	$215
Dust Collector =	0.8	1	$6,800	$5,626
Duct =	NA	300	$25	$7,500
Hoses =	0.8	0	$940	$0
Nozzles =	0.8	6	$160	$794
Hoods =	NA	0	$250	$0
Lighting =	NA	0	$550	$0
Compressors =	0.8	2	$2,000	$3,310
Pumps =	0.8	0	$1,000	$0
Lines =	0.8	0	$250	$0
Guns =	NA	0	$300	$0
Generators =	0.8	3	$600	$1,489
Platform (Roof Decking and Cables) =	NA	2,600	$4	$10,400
Outriggers =	NA	9	$180	$1,620
Tarps =	NA	4300	$2	$8,600
Tarp Cables =	NA	140	$1	$140
Crane =	0.3	1	$4,800	$1,400
Cables & Picks / ft =	0.8	0	$1	$0
Pressure Washers =	0.8	0	$700	$0
Water Buffalos =	0.8	0	$3,000	$0
Work Barge =	0.8	1	$3,500	$2,896
Pick-up Trucks (w/ fuel) =	0.8	3	$1,000	$2,482
Large Trucks (w/Fuel) =	0.8	0	$1,200	$0
Hand Tools =	0.8	20	$10	$165
Power Tools =	0.8	9	$50	$372
Office Trailor =	0.8	0	$450	$0
Storage Trailor =	0.8	0	$375	$0

Subtotal Equipment = $59,422

Health and Safety

Item	# Months	Qty	Rate	Cost
Tyvek Suits =	0.8	10	$50	$414
Blood Leads =	NA	13	$100	$1,300
Worker Exposure Monitoring =	0.8	6	$30	$149
Worker Exposure Monitor Analysis =	0.8	6	$26	$129
Wash Trailor =	0.8	3	$450	$968
Waste Disposal (Tons) =	NA	8	$300	$2,537
Safety Boat =	0.8	1	$500	$414

Subtotal Other Costs = $5,910

Engineering

Item	Hours	Qty	Rate	Cost
Drafting =	40	1	$65	$2,600
Engineering =	80	2	$125	$20,000
Administrative Submital Support =	20	1	$40	$800

Subtotal Engineering = $23,400

Total

Subtotal Job =	$236,520
Overhead (10%) =	$23,652
Subtotal with Overhead =	$260,172
Profit (15%) =	$39,026
Location Factor =	1.0
Total Cost =	**$299,198**
Cost / Sq ft =	$16.81

Expected Bid Range:	**$299,200**	**to**	**$359,000**
	$16.81	to	$20.17

SUMMARY PAGE ITEM#

Pay Items (Using High Side of Bid Range)	Price	Unit	
PAINTING EXISTING STRUCTURAL STEEL	$208,382	LS	58.0%
CONTAINMENT	$141,685	LS	39.5%
DISPOSAL OF BRIDGE WASTE	$3,850	LS	1.1%
WORKER HEALTH AND SAFETY	$5,121	LS	1.4%
MAINTENANCE & PROTECTION OF TRAFFIC	$0	LS	0.0%
Check Total	$359,000		

Hampton Harbor Bridge - Lift Span OPTION 3
New Hampshire Department of Transportation
Bureau of Bridge Design

Given: Total Remove and Replace Existing Coating - All Steel (Hazardous Metals Present)

Assumptions: **Lift Span** - All Steel Except Bridge Railings, Trunion Box Girder, Gearboxes, & Counterweight
Work from Barge Moored in Bay - LIFT SPAN OPEN FOR WORK - NO VEHICULAR TRAFFIC
Abrasive Blast Clean per SSPC SP-10 and Apply 3 Coat MCU System
Crew Able to Work 10 Hours per Day 5 Days per Week (Avg. 1 Day Lost to Weather per Wk)

Total Surface Area =	17,800	sq ft
Longest Containment Length =	60	ft
No. of Spans =	1	
Platform Length =	65	ft
Platform Width =	40	ft
Required Platform Deck Area =	2,600	sq ft
Containment Draft Area =	400	sq ft
Cross Draft =	Yes	Yes or No
Hazardous Metals =	Yes	Yes or No
Recyclable Abrasive =	Yes	Yes or No

Assume Crew Size

Class	No.	Rate/hr	OT Rate
Foreman	1	$75	$112.50
Blaster/Painter	6	$65	$97.50
Laborer	3	$55	$82.50

Labor Cost per Day = $6,930 @ Hours / Day = 10

Labor

Mobilize =	0	Days
Platform =	2	Days
Rigging / Containment Moves =	3	Days
Solvent Cleaning =	0	Days
Power Wash =	0	Days
Blast/Prime =	6	Days
Full Intermediate Coat =	1	Days
Full Finish Coat =	1	Days
Cleanup, Demob, Punch List =	2	Days
Total Production Days =	15	Days
Calendar Months =	0.7	Months

Subtotal Labor = $107,207

Materials

	Rate	Unit	Cost
Full Prime =	$0.42	/sq ft	$7,476
Full Intermediate =	$0.26	/sq ft	$4,628
Full Finish =	$0.27	/sq ft	$4,806
Thinner =	$0.10	/sq ft	$1,780
Blast Media =	$1,000	/ton	$6,230

Subtotal Materials = $24,920

Equipment

Item	#Months	Qty	Rate	Cost
Blast Machine =	0.7	1	$15,000	$10,829
HEPA Filters for vac =	0.7	1	$260	$188
Dust Collector =	0.7	1	$6,800	$4,909
Duct =	NA	300	$25	$7,500
Hoses =	0.7	0	$940	$0
Nozzles =	0.7	6	$160	$693
Hoods =	NA	0	$250	$0
Lighting =	NA	0	$550	$0
Compressors =	0.7	2	$2,000	$2,888
Pumps =	0.7	0	$1,000	$0
Lines =	0.7	0	$250	$0
Guns =	NA	0	$300	$0
Generators =	0.7	3	$600	$1,299
Platform (Roof Decking and Cables) =	NA	2,600	$4	$10,400
Outriggers =	NA	9	$180	$1,620
Tarps =	NA	4300	$2	$8,600
Tarp Cables =	NA	140	$1	$140
Crane =	0.3	1	$4,800	$1,400
Cables & Picks / ft =	0.7	0	$1	$0
Pressure Washers =	0.7	0	$700	$0
Water Buffalos =	0.7	0	$3,000	$0
Work Barge =	0.7	1	$3,500	$2,527
Pick-up Trucks (w/ fuel) =	0.7	3	$1,000	$2,166
Large Trucks (w/Fuel) =	0.7	0	$1,200	$0
Hand Tools =	0.7	20	$10	$144
Power Tools =	0.7	9	$50	$325
Office Trailor =	0.7	0	$450	$0
Storage Trailor =	0.7	0	$375	$0

Subtotal Equipment = $55,628

Health and Safety

Item	# Months	Qty	Rate	Cost
Tyvek Suits =	0.7	10	$50	$361
Blood Leads =	NA	12	$100	$1,200
Worker Exposure Monitoring =	0.7	6	$30	$130
Worker Exposure Monitor Analysis =	0.7	6	$26	$113
Wash Trailor =	0.7	3	$450	$845
Waste Disposal (Tons) =	NA	8	$300	$2,537
Safety Boat =	0.7	1	$500	$361

Subtotal Other Costs = $5,546

Engineering

Item	Hours	Qty	Rate	Cost
Drafting =	40	1	$65	$2,600
Engineering =	80	2	$125	$20,000
Administrative Submital Support =	20	1	$40	$800

Subtotal Engineering = $23,400

Total

Subtotal Job =	$216,701
Overhead (10%) =	$21,670
Subtotal with Overhead =	$238,371
Profit (15%) =	$35,756
Location Factor =	1.0
Total Cost =	**$274,126**
Cost / Sq ft =	$15.40

Expected Bid Range:	**$274,100**	**to**	**$329,000**
	$15.40	to	$18.48

SUMMARY PAGE

ITEM#

Pay Items (Using High Side of Bid Range)	Price	Unit	
PAINTING EXISTING STRUCTURAL STEEL	$179,937	LS	54.7%
CONTAINMENT	$140,596	LS	42.7%
DISPOSAL OF BRIDGE WASTE	$3,850	LS	1.2%
WORKER HEALTH AND SAFETY	$4,568	LS	1.4%
MAINTENANCE & PROTECTION OF TRAFFIC	$0	LS	0.0%
Check Total	$329,000		

KTA-Tator, Inc.

Hampton Harbor Bridge
New Hampshire Department of Transportation

Lift Span & Adjacent Span - Trunion, Counterweight, Gearbox Equipment
SSPC SP-12WJ-1 ***Lift Span Must Be OPEN for This Work***
Assume Water Collection Required

Total Surface Area = 2,000 sq ft

Assume Crew Size — Hours / Day = 10

Class	No.	Rate	OT Rate
Foreman	1	$75	$112.50
Painter	6	$65	$97.50
Laborer	3	$55	$82.50

Labor per Day = $6,930

Labor

Mobilize =	0	Days
Containment / Rigging =	1	Days
Water Jetting / Prime Coat =	1	Days
Full Intermediate Coat =	1	Days
Full Finish Coat =	1	Days
Cleanup, Demob, Punch List =	1	Days
Total Production Days =	5	Days
Calendar Months =	0.2	Months

Labor = $34,650

Materials

Paint System

Primer	$0.420	$/sq ft
Intermediate	$0.260	$/sq ft
Finish	$0.270	$/sq ft

Prime =	$840
Intermediate =	$520
Finish =	$540
Thinner =	$190
Materials =	**$2,090**

Hampton Harbor Bridge
New Hampshire Department of Transportation

Lift Span & Adjacent Span - Trunion, Counterweight, Gearbox Equipment
SSPC SP-12WJ-1 ***Lift Span Must Be OPEN for This Work***

Equipment

Item	Qty	Rate	Cost
Water Jetting Units (40,000psi) / day	30.0	$500	$15,000
Water Buffalos / ea	3.0	$3,000	$9,000
Platform / SF	1200	$4	$4,800
Trucks & Fuel / mo	0.2	$2,200	$440
Tarps / sq ft	4800	$2	$9,600
Trucks & Fuel / ea	2.0	$1,000	$2,000
Hand Tools / ea	6.0	$65	$390
Storage Trailer / mo	0.0	$375	$0
Work Barge / mo	0.2	$3,500	$700
Lighting / mo	0.0	$500	$0

Equipment = $41,930

Other Costs

Item	Qty	Rate	Cost
Waste Disposal / ton	0.3	$300	$90
Worker Health& Safety / mo	0.2	$2,000	$400
Testing (h2o) / LS	0.2	$2,000	$400
Testing (soil) / LS	0.0	$2,000	$0
Waste Site Allow. / mo	0.2	$700	$140
Field Offices / mo	0.0	$2,000	$0
Ambient Air Monitoring / mo	0.0	$1,400	$0
Containment Design / LS	1.0	$5,000	$5,000

Other Costs = $6,030

Hampton Harbor Bridge

New Hampshire Department of Transportation

Lift Span & Adjacent Span - Trunion, Counterweight, Gearbox Equipment
SSPC SP-12WJ-1 ***Lift Span Must Be OPEN for This Work***

Water Jetting Water Collection & Disposal

Disposal =	$720
Tanker Truck & Driver =	$2,850
Pumps, Etc. =	$60
Subtotal Water Collection =	$3,630
Subtotal Job =	$88,330
Contingency (3%) =	$2,650
Overhead (10%) =	$9,098
Subtotal =	$100,078
Profit (15%) =	$15,012
Total Cost =	**$115,090**
Cost / Sq ft =	$57.54

Expected Bid Range:	**$115,100**	**to**	**$138,100**
	$57.55	to	$69.05

SSPC-SP 1
November 1, 1982
Editorial Revisions November 1, 2004

SSPC: The Society for Protective Coatings

SURFACE PREPARATION SPECIFICATION NO. 1

Solvent Cleaning

1. Scope

1.1 This specification covers the requirements for the solvent cleaning of steel surfaces.

2. Definition

2.1 Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from steel surfaces.

2.2 It is intended that solvent cleaning be used prior to the application of paint and in conjunction with surface preparation methods specified for the removal of rust, mill scale, or paint.

3. Surface Preparation Before and After Solvent Cleaning

3.1 Prior to solvent cleaning, remove foreign matter (other than grease and oil) by one or a combination of the following: brush with stiff fiber or wire brushes, abrade, scrape, or clean with solutions of appropriate cleaners, provided such cleaners are followed by a fresh water rinse.

3.2 After solvent cleaning, remove dirt, dust, and other contaminants from the surface prior to paint application. Acceptable methods include brushing, blow off with clean, dry air, or vacuum cleaning.

4. Methods of Solvent Cleaning

4.1 Remove heavy oil or grease first by scraper. Then remove the remaining oil or grease by any of the following methods:

4.1.1 Wipe or scrub the surface with rags or brushes wetted with solvent. Use clean solvent and clean rags or brushes for the final wiping.

4.1.2 Spray the surface with solvent. Use clean solvent for the final spraying.

4.1.3 Vapor degrease using stabilized chlorinated hydrocarbon solvents.

4.1.4 Immerse completely in a tank or tanks of solvent. For the last immersion, use solvent which does not contain detrimental amounts of contaminant.

4.1.5 Emulsion or alkaline cleaners may be used in place of the methods described. After treatment, wash the surface with fresh water or steam to remove detrimental residues.

4.1.6 Steam clean, using detergents or cleaners and follow by steam or fresh water wash to remove detrimental residues.

5. Inspection

6.1 All work and materials supplied under this standard shall be subject to timely inspection by the purchaser or his authorized representative. The contractor shall correct such work or replace such material as is found defective under this standard. In case of dispute the arbitration or settlement procedure established in the procurement documents, if any, shall be followed. If no arbitration or settlement procedure is established, then a procedure mutually agreeable to purchaser and contractor shall be used.

6.2 The procurement documents covering work or purchase should establish the responsibility for testing and for any required affidavit certifying full compliance with the standard.

6. Disclaimer

6.1 While every precaution is taken to ensure that all information furnished in SSPC standards and specifications is as accurate, complete, and useful as possible, SSPC cannot assume responsibility nor incur any obligation resulting from the use of any materials, coatings, or methods specified herein, or of the specification or standard itself.

6.2 This specification does not attempt to address problems concerning safety associated with its use. The user of this specification, as well as the user of all products or practices described herein, is responsible for instituting appropriate health and safety practices and for ensuring compliance with all governmental regulations.

7. Note

Notes are not requirements of this specification.

7.1 A Commentary Section is available and contains additional information and data relative to this specification. The Surface Preparation Commentary, SSPC-SP COM, is not part of this specification. The table below lists the subjects discussed relevant to solvent cleaning and the appropriate Commentary section.

Section Subject	SSPC-SP COM Section
Solvents and Cleaners	5.1.1 through 5.1.3
Steam Cleaning	5.1.4
Threshold Limit Values	5.1.5

Joint Surface Preparation Standard

SSPC-SP 12/NACE No. 5
Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating

This SSPC: The Society for Protective Coatings/NACE International (NACE) standard represents a consensus of those individual members who have reviewed this document, its scope, and provisions. It is intended to aid the manufacturer, the consumer, and the general public. Its acceptance does not in any respect preclude anyone, whether he has adopted the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not addressed in this standard. Nothing contained in this SSPC/NACE standard is to be construed as granting any right, by implication or otherwise, to manufacture, sell, or use in connection with any method, apparatus, or product covered by Letters Patent, or as indemnifying or protecting anyone against liability for infringement of Letters Patent. This standard represents current technology and should in no way be interpreted as a restriction on the use of better procedures or materials. Neither is this standard intended to apply in all cases relating to the subject. Unpredictable circumstances may negate the usefulness of this standard in specific instances. SSPC and NACE assume no responsibility for the interpretation or use of this standard by other parties and accept responsibility for only those official interpretations issued by SSPC or NACE in accordance with their governing procedures and policies which preclude the issuance of interpretations by individual volunteers.

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CAUTIONARY NOTICE: SSPC/NACE standards are subject to periodic review, and may be revised or withdrawn at any time without prior notice. The user is cautioned to obtain the latest edition. SSPC and NACE require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of initial publication.

Revised July 2002
Approved 1995

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Foreword

This joint standard describes the surface preparation technique known as waterjetting. This technique provides an alternative method of removing coating systems or other materials from metal surfaces, including lead-based paint systems, prior to the application of a protective coating or lining system. This standard is intended for use by coating or lining specifiers, applicators, inspectors, or others whose responsibility it may be to define a standard degree of surface cleanliness. Since publication of NACE Standard RP0172,[1] surface preparation using waterjetting equipment has found acceptance as a viable method.

Waterjetting can be effective in removing water-soluble surface contaminants that may not be removed by dry abrasive blasting alone, specifically, those contaminants found at the bottom of pits of severely corroded metallic substrates. Waterjetting also helps to remove surface grease and oil, rust, shot-creting spatter, and existing coatings and linings. Waterjetting is also used in areas where abrasive blasting is not a feasible method of surface preparation.

The use of a high-pressure water stream to strip existing coatings and clean the surface has advantages over open dry abrasive blasting with respect to worker respiratory exposure and work area air quality. Respiratory requirements for waterjetting may be less stringent than for other methods of surface preparation.

Waterjetting does not provide the primary anchor pattern on steel known to the coatings industry as "profile." The coatings industry uses waterjetting primarily for recoating or relining projects in which there is an adequate preexisting profile. Waterjetting has application in a broad spectrum of industries. It is used when high-performance coatings require extensive surface preparation and/or surface decontamination.

This standard was originally prepared by SSPC/NACE Joint Task Group TGD. It was technically revised in 2002 by Task Group 001 on Surface Preparation by High-Pressure Waterjetting. This Task Group is administered by Specific Technology Group (STG) 04 on Protective Coatings and Linings—Surface Preparation, and is sponsored by STG 02 on Protective Coatings and Linings—Atmospheric, and STG 03 on Protective Coatings and Linings—Immersion/Buried. This standard is issued by SSPC Group Committee C.2 on Surface Preparation, and by NACE International under the auspices of STG 04.

Joint Surface Preparation Standard

SSPC-SP 12/NACE No. 5
Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating

Contents

Section 1: General

1.1 This standard describes the use of waterjetting to achieve a defined degree of cleaning of surfaces prior to the application of a protective coating or lining system. These requirements include the end condition of the surface plus materials and procedures necessary to verify the end condition. This standard is limited in scope to the use of water only.

1.2 This standard is written primarily for applications in which the substrate is carbon steel. However, waterjetting can be used on nonferrous substrates such as bronze, aluminum, and other metals such as stainless steel. This standard does not address the cleaning of concrete. Cleaning of concrete is discussed in SSPC SP-13/NACE No. 6.[2]

1.3 Appendices A, B, and C give additional information on waterjetting equipment, production rates, procedures, and principles.

1.4 Visual Reference Photographs: SSPC-VIS 4/NACE VIS 7, "Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting,"[3] provides color photographs for the various grades of surface preparation as a function of the initial condition of the steel. The latest issue of the reference photographs should be used.

Section 2: Definitions

2.1 This section provides basic waterjetting definitions. Additional definitions relevant to waterjetting are contained in the WaterJet Technology Association's[(1)] "Recommended Practices for the Use of Manually Operated High-Pressure Waterjetting Equipment."[4]

2.1.1 **Waterjetting (WJ):** Use of standard jetting water discharged from a nozzle at pressures of 70 MPa (10,000 psig) or greater to prepare a surface for coating or inspection. Waterjetting uses a pressurized stream of water with a velocity that is greater than 340 m/s (1,100 ft/s) when exiting the orifice. Waterjetting does not produce an etch or profile of the magnitude currently recognized by the coatings industry. Rather, it exposes the original abrasive-blasted surface profile if one exists.

2.1.2 **Water Cleaning (WC):** Use of pressurized water discharged from a nozzle to remove unwanted matter from a surface.

2.1.3 **Standard Jetting Water:** Water of sufficient purity and quality that it does not impose additional contaminants on the surface being cleaned and does not contain sediments or other impurities that are destructive to the proper functioning of waterjetting equipment.

2.1.4 **Low-Pressure Water Cleaning (LP WC):** Water cleaning performed at pressures less than 34 MPa (5,000 psig). This is also called "power washing" or "pressure washing."

2.1.5 **High-Pressure Water Cleaning (HP WC):** Water cleaning performed at pressures from 34 to 70 MPa (5,000 to 10,000 psig).

2.1.6 **High-Pressure Waterjetting (HP WJ):** Waterjetting performed at pressures from 70 to 210 MPa (10,000 to 30,000 psig).

2.1.7 **Ultrahigh-Pressure Waterjetting (UHP WJ):** Waterjetting performed at pressures above 210 MPa (30,000 psig).

2.1.8 **Nonvisible Contamination (NV):** Nonvisible contamination is the presence of organic matter, such as very thin films of oil and grease, and/or soluble ionic materials such as chlorides, ferrous salts, and sulfates that remain on the substrate after cleaning.

2.1.9 **Visible Surface Cleanliness (VC):** Visible surface cleanliness is the visible condition of the substrate, when viewed without magnification, after cleaning.

Section 3: Surface Cleanliness Requirements

3.1 Table 1 lists four definitions of surface cleanliness in terms of visible contaminants. A surface shall be prepared to one of these four visual conditions prior to recoating.

3.1.1 As part of the surface preparation, deposits of oil, grease, and foreign matter must be removed by waterjetting, by water cleaning, by steam cleaning, by methods in accordance with SSPC-SP 1,[5] or by

[(1)] WaterJet Technology Association, 917 Locust Street, Suite 1100, St. Louis, MO 63101-1419.

another method agreed upon by the contracting parties.

3.1.2 NOTE: Direct correlation to existing dry media blasting standards is inaccurate or inappropriate when describing the capabilities of water cleaning and the visible results achieved by water cleaning.

3.1.3 The entire surface to be prepared for coating shall be subjected to the cleaning method.

3.1.4 For WJ-4 (see Table 1) any remaining mill scale, rust, coating, or foreign materials shall be tightly adherent. All of the underlying metal need not be exposed.

3.1.5 Photographs may be specified to supplement the written definition. In any dispute, the written standards shall take precedence over visual reference photographs or visual standards such as SSPC-VIS 4/NACE VIS 7.[3]

3.2 Table 2 lists definitions of flash rusted surfaces (See Section 4). When deemed necessary, a surface should be prepared to one of these flash rusted surface conditions prior to recoating.

3.3 The specifier shall use one of the visual surface preparation definitions (WJ-1 to WJ-4 in Table 1) and, when deemed necessary, one of the flash rust definitions.

3.3.1 The following is an example of a specification statement:

"All surfaces to be recoated shall be cleaned to SSPC-SP 12/NACE No. 5, WJ-2/L, Very Thorough or Substantial Cleaning, Light Flash Rusting."

3.4 Appendix A contains information on nonvisible surface contaminants. In addition to the requirements given in Paragraph 3.1, the specifier should consider whether a surface should be prepared not to exceed the maximum level of nonvisible surface contamination prior to recoating. A suggested specification statement for nonvisible contaminants is given in Appendix A.

Table 1: Visual Surface Preparation Definitions

Term	Description of Surface
WJ-1	**Clean to Bare Substrate:** A WJ-1 surface shall be cleaned to a finish which, when viewed without magnification, is free of all visible rust, dirt, previous coatings, mill scale, and foreign matter. Discoloration of the surface may be present.[A, B, C]
WJ-2	**Very Thorough or Substantial Cleaning:** A WJ-2 surface shall be cleaned to a matte (dull, mottled) finish which, when viewed without magnification, is free of all visible oil, grease, dirt, and rust except for randomly dispersed stains of rust, tightly adherent thin coatings, and other tightly adherent foreign matter. The staining or tightly adherent matter is limited to a maximum of 5% of the surface.[A, B, C]
WJ-3	**Thorough Cleaning:** A WJ-3 surface shall be cleaned to a matte (dull, mottled) finish which, when viewed without magnification, is free of all visible oil, grease, dirt, and rust except for randomly dispersed stains of rust, tightly adherent thin coatings, and other tightly adherent foreign matter. The staining or tightly adherent matter is limited to a maximum of 33% of the surface.[A, B, C]
WJ-4	**Light Cleaning:** A WJ-4 surface shall be cleaned to a finish which, when viewed without magnification, is free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose coating. Any residual material shall be tightly adherent.[C]

[A] Surfaces cleaned by LP WC, HP WC, HP WJ, or UHP WJ do not exhibit the hue of a dry abrasive blasted steel surface. After waterjetting, the matte finish color of clean steel surface immediately turns to a golden hue unless an inhibitor is used or environmental controls are employed.[6] On older steel surfaces that have areas of coating and areas that are coating-free, the matte finish color varies even though all visible surface material has been removed. Color variations in steel can range from light grey to dark brown/black.

Steel surfaces show variations in texture, shade, color, tone, pitting, flaking, and mill scale that should be considered during the cleaning process. Acceptable variations in appearance that do not affect surface cleanliness include variations caused by type of steel or other metals, original surface condition, thickness of the steel, weld metal, mill fabrication marks, heat treating, heat-affected zones, and differences in the initial abrasive blast cleaning or in the waterjet cleaning pattern.

The grey or brown-to-black discoloration seen on corroded and pitted steel after waterjetting cannot be removed by further waterjetting. A brown-black discoloration of ferric oxide may remain as a tightly adherent thin film on corroded and pitted steel and is not considered part of the percentage staining.

[B] Waterjetting at pressures in excess of 240 MPa (35,000 psig) is capable of removing tightly adherent mill scale, but production rates are not always cost effective.

[C] Mill scale, rust, and coating are considered tightly adherent if they cannot be removed by lifting with a dull putty knife. (See SSPC-SP 7/NACE No. 4.[7]).

Section 4: Flash Rusted Surface Requirements

4.1 Table 2 lists four definitions of flash rusted surface requirements. *Flash rust* or *water bloom* is a light oxidation of the steel that occurs as waterjetted carbon steel dries. With the exception of stainless steel surfaces, any steel surface may show flash rust within 0.5 to 2 hours, or longer depending on environmental conditions, after cleaning by water. Flash rust quickly changes the appearance. Flash rust may be reduced or eliminated by physical or chemical methods. The color of the flash rust may vary depending on the age and composition of the steel and the time-of-wetness of the substrate prior to drying. With time, the flash rust changes from a yellow-brown, well adherent, light rust to a red-brown, loosely adherent, heavy rust.

4.2 It is a common practice to remove heavy flash rust by low-pressure water cleaning. The visual appearance of steel that has heavily flash rusted after initial cleaning and is then recleaned by low-pressure water cleaning (up to 34 MPa [5,000 psig]) has a different appearance than the original light flash rusted steel depicted in SSPC-VIS 4/NACE VIS 7.

4.3 The coating manufacturer should be consulted to ascertain the tolerance of the candidate coatings to visual cleanliness, nonvisible contaminants, and the amount of flash rust commensurate with the in-service application. These conditions should be present at the time of recoating.

4.4 The following is an example of a specification statement concerning flash rust:

"At the time of the recoating, the amount of flash rust shall be no greater than moderate (M) as defined in SSPC-SP 12/NACE No. 5."

Table 2: Flash Rusted Surface Definitions

Term	Description of Surface
No Flash Rust	A steel surface which, when viewed without magnification, exhibits no visible flash rust.
Light (L)	A surface which, when viewed without magnification, exhibits small quantities of a yellow-brown rust layer through which the steel substrate may be observed. The rust or discoloration may be evenly distributed or present in patches, but it is tightly adherent and not easily removed by lightly wiping with a cloth.
Moderate (M)	A surface which, when viewed without magnification, exhibits a layer of yellow-brown rust that obscures the original steel surface. The rust layer may be evenly distributed or present in patches, but it is reasonably well adherent and leaves light marks on a cloth that is lightly wiped over the surface.
Heavy (H)	A surface which, when viewed without magnification, exhibits a layer of heavy red-brown rust that hides the initial surface condition completely. The rust may be evenly distributed or present in patches, but the rust is loosely adherent, easily comes off, and leaves significant marks on a cloth that is lightly wiped over the surface.

Section 5: Occupational and Environmental Requirements

5.1 Because waterjet cleaning is a hazardous operation, all work shall be conducted in compliance with all applicable occupational health and safety rules and environmental regulations.

Section 6: Cautionary Notes

6.1 Waterjetting can be destructive to nonmetallic surfaces. Soft wood, insulation, electric installations, and instrumentation must be protected from direct and indirect water streams.

6.2 Water used in waterjetting units must be clean and free of erosive silts or other contaminants that damage pump valves and/or leave deposits on the surface being cleaned. The cleaner the water, the longer the service life of the waterjetting equipment.

6.3 Any detergents or other types of cleaners used in conjunction with waterjetting shall be removed from surfaces prior to applying a coating.

6.4 Compatibility of the detergents with the special seals and high-alloy metals of the waterjetting equipment must be carefully investigated to ensure that WJ machines are not damaged.

6.5 If inhibitors are to be used with the standard jetting water, the manufacturer of the waterjetting equipment shall be consulted to ensure compatibility of inhibitors with the equipment.

6.6 The coatings manufacturer shall be consulted to ensure the compatibility of inhibitors with the coatings.

6.7 If effluent jetting water is captured for reuse in the jetting method, caution should be used to avoid introducing any removed contaminants back to the cleaned substrate. The effluent water should be treated to remove suspended particulate, hydrocarbons, chlorides, hazardous materials, or other by-products of the surface preparation procedures. The water should be placed in a clean water holding tank and tested to determine the content of possible contamination prior to reintroduction into the jetting stream. If detergents or degreasers are used prior to surface preparation, these waste streams should be segregated from the effluent jetting water to avoid contamination and possible equipment damage.

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3. SSPC-VIS 4/NACE VIS 7 (latest revision), "Guide and Reference Photographs for Steel Surfaces Prepared by Water-jetting" (Pittsburgh, PA: SSPC, and Houston, TX: NACE).

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5. SSPC-SP 1 (latest revision), "Solvent Cleaning" (Pittsburgh, PA: SSPC).

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(3) Federal Highway Administration (FHWA), 400 7th St. SW, Washington, DC 20590.
(4) ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

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NOTE: Appendices A, B, and C provide explanatory notes. They provide additional information on waterjetting.

Appendix A: Surface Cleanliness Conditions of Nonvisible Contaminants and Procedures for Extracting and Analyzing Soluble Salts

A1.1 For the purpose of this appendix, the list of non-visible contaminants is limited to water-soluble chlorides, iron-soluble salts, and sulfates. The contracting parties should be aware that other nonvisible contaminants may have an effect on the coating performance.[8] The specifier should determine whether, and to what condition, nonvisible chemical contaminants should be specified. Section 3 contains additional information on surface cleanliness conditions.

A1.2 The level of nonvisible contaminants that may remain on the surface is usually expressed as mass per unit area, for example, $\mu g/cm^2$ ($grains/in.^2$) or mg/m^2 ($grains/yd^2$) (1 $\mu g/cm^2$ = 10 mg/m^2 = 0.0001 $grains/in.^2$ = 0.13 $grains/yd^2$).

A1.3 Coatings manufacturers should be consulted for recommendations of maximum surface contamination allowed. The specification should read as follows:

"Immediately prior to the application of the coating, the surface shall not contain more than xx $\mu g/cm^2$ ($grains/in.^2$) of the specific contaminant (e.g., chloride) when tested with a specified method as agreed upon by contracting parties."

A1.4 The contracting parties shall agree on the test method or procedure to be used for determining the level of nonvisible contaminants.

Note: NACE and ISO committees are currently (2002) developing recommendations for the level of nonvisible contaminants that may be tolerated by different types of coatings in various services.

Table A1: Description of Nonvisible Surface Cleanliness Definitions[(A)] (NV)

Term	Description of Surface
NV-1	An NV-1 surface shall be free of detectable levels of soluble contaminants, as verified by field or laboratory analysis using reliable, reproducible test methods.
NV-2	An NV-2 surface shall have less than 7 $\mu g/cm^2$ (0.0007 $grains/in.^2$) of chloride contaminants, less than 10 $\mu g/cm^2$ (0.001 $grains/in.^2$) of soluble ferrous ion levels, or less than 17 $\mu g/cm^2$ (0.0017 $grains/in.^2$) of sulfate contaminants as verified by field or laboratory analysis using reliable, reproducible test methods.
NV-3	An NV-3 surface shall have less than 50 $\mu g/cm^2$ (0.005 $grains/in.^2$) of chloride or sulfate contaminants as verified by field or laboratory analysis using reliable, reproducible test methods.

[(A)] Additional information on suitable procedures for extracting and analyzing soluble salts is available in NACE Publication 6G186,[8] and SSPC-TU 4.[9]

A2.1 Procedure for Extracting Soluble Salts by Swabbing

The following procedures may be used to extract the soluble salts from the surface:

(a) SSPC Swabbing Method[9]
(b) Procedure described in ISO 8502-5, Section 5.1, "Washing of the Test Area"[10]
(c) Any suitable controlled washing procedures available and agreed to by the contracting parties. During the washing procedure, clean plastic or rubber gloves should be worn to ensure that the wash water is not accidentally contaminated.

A2.2 Procedure for Extracting Soluble Salts by Surface Cells

(a) Limpet Cell Method[11]
(b) Surface Conductivity Cell Method[9,11]
(c) Nonrigid Extraction Cell Method[9,11,12]

A2.3 Procedure for Field Analysis of Chloride Ions

The extract retrieved using the procedures in Paragraphs A2.1 and A2.2 may be analyzed using one of the following methods:

(a) Chloride Chemical Test Strips[9]
(b) Chloride Chemical Titration Kit[9]
(c) Ion Detection Tube Method[9,10]

The following laboratory method is available as a referee method:

(a) Specific Chloride Ion Electrode[9,11,13]

A2.4 Procedure for Field Analysis of Sulfate Ions

The extract retrieved using the procedures in Paragraphs A2.1 and A2.2 may be analyzed using one of the following methods:

(a) Turbidity Field Comparator Methods[9, 11]
(b) Turbidity Method[9,11]
(c) Standard Test Method for Sulfate Ion in Water[14]

A2.5 Procedure for Field Analysis of Soluble Iron Salts

The extract retrieved using the procedures in Paragraph A2.1 or A2.2 may be analyzed using one of the following methods:

(a) Ferrous Chemical Test Strips[9,11]
(b) Semiquantitative Test for Ferrous Ions[8]
(c) Field Colorimetric Comparator Methods

A2.5.1 Papers treated with potassium ferricyanide may be used for the qualitative field detection of ferrous ions.[8,9]

Appendix B: Waterjetting Equipment

B1.1 The commercial waterjet unit can be mounted on a skid, trailer, or truck; can be equipped with various prime movers (diesel, electric motor, etc.); and usually consists of a pump, hoses, and various tools. The tools can be hand-held or mounted on a robot (or traversing mechanism). Water is propelled through a single jet, a fan jet, or multiple rotating jets. Rotation is provided by small electric, air, or hydraulic motors, or by slightly inclined orifices in a multiple-orifice nozzle.

B1.2 The units operate at pressures up to 240 to 290 MPa (35,000 to 42,000 psig), using a hydraulic hose with a minimum bursting strength of 2.5 times the capability of its maximum-rated operating strength.

B1.3 A water flow rate of 4 to 53 L/min (1 to 14 gal/min) is typical.

B1.4 Pressure loss is a function of the flow rate of the water through the hose and the inside diameter of the hose. The manufacturer should be consulted for specific information on potential pressure loss for each type of equipment.

B1.5 Waterjets are produced by orifices, or tips, that can have different forms. The higher the pressure, the more limited is the choice of forms. Round jets are most commonly used, but orifices of other shapes are available. Tips can be designed to produce multiple jets of water that are normally rotated to achieve higher material removal rates. Interchangeable nozzle tips should be used to produce the desired streams. The manufacturer shall be consulted for specific recommendations.

B1.6 The distance from the nozzle to the work piece substrate (standoff distance) is critical for effective cleaning with any of the water methods. Excessive standoff does not produce the desired cleaning.

Appendix C: Principles of Waterjetting

SSPC-SP 12/NACE No. 5 is a performance specification, not a process specification. Appendix C is not intended to be used as an equipment specification.

C1 Commentary on Production Rates

C1.1 Operator skill and the condition of the steel surface affect waterjetting production rates.[15,16,17] Regardless of the surface conditions, production rates usually improve when:

(a) The operator gains additional experience with high- and ultrahigh-pressure waterjetting; or

(b) Mechanized, automated waterjetting equipment is used.

C1.1.1 New metal with tightly adhering mill scale requires the highest level of operator skill and concentration to produce a clean surface by waterjetting. Older, more corroded, or previously coated surfaces require an average level of skill and concentration to achieve desired results. This is the opposite of abrasive blasting, when poor surface conditions require the highest levels of operator skill and concentration.

C1.2 As a general rule, production and ease of removal increase as the waterjetting pressure increases.

C1.3 Cleanup time to remove waste material should be considered when determining the overall production rate.

C2 Commentary on Waterjetting Parameters

C2.1 The specifier should describe the final condition of the substrate. Depending on the initial condition of the area and materials to be cleaned, the method to achieve Visible Conditions WJ-1, WJ-2, WJ-3, or WJ-4 may be LP WC, HP WC, HP WJ, or UHP WJ. The method of water cleaning or waterjetting ultimately is based on the capabilities of the equipment and its components. Dwell time, transverse rate, pressure, flow, stand-off distances, the number of nozzles, and rotation speed all interact in determining what material will remain and what will be removed.

C2.2 There are two thoughts on increasing production rates during the removal of materials by pressurized water. First, determine the threshold pressure at which the material will just be removed. The user can then either increase the flow to achieve adequate production rates or increase the pressure by a factor no greater than three over the threshold pressure. These two methods do not necessarily yield the same result.[18]

C2.3 Details of the calculations in Table C1 are standard to the waterjetting industry and are beyond the scope of this standard.[19]

C2.4 Removal of degraded coating is coupled to thorough stressing of the remaining coating. The jet energy is the work done when the jet stream vertically impacts the coating surface. Energy is normally measured in kilojoules. The shear stress is developed against the vertical pit walls and larger fractures created on the eroded coating surface. This can, in gross terms, be thought of as a hydraulic load.

C2.5 Flexure stressing is induced by repetitive loading and unloading of the coatings systems by the jet streams as they pass over the surface. The rapid loading and unloading is vital to finding areas of low adherence and nonvisible adherence defects in the coating system.[19]

C2.6 Characteristics of typical pressurized water systems are included in Table C1.

Table C1: Typical Pressurized Water Systems

Pressure at Nozzle	70 MPa (10,000 psig)	140 MPa (20,000 psig)	280 MPa (40,000 psig)
Number of Tips	2	2	5
Diameter	1.0 mm (0.040 in.)	0.69 mm (0.027 in.)	0.28 mm (0.011 in.)
Flow	12.9 L/min (3.42 gpm)	8.3 L/min (2.2 gpm)	2.0 L/min (0.52 gpm)
Cross-Sectional Area	0.81 mm^2 (0.0013 $in.^2$)	0.37 mm^2 (0.00060 $in.^2$)	0.065 mm^2 (0.00010 $in.^2$)
Jet Velocity	360 m/s (1,180 ft/s)	520 m/s (1,700 ft/s)	730 m/s (2,400 ft/s)
Impact Force (per tip)	8.1 kg (18 lb)	7.7 kg (17 lb)	2.4 kg (5.3 lb)
Jet Energy	141 kJ (134 BTU)	189 kJ (179 BTU)	89 kJ (81 BTU)
Energy Intensity (energy/ cross-sectional area)	175 kJ/mm^2 (107,000 BTU/$in.^2$)	513 kJ/mm^2 (314,000 BTU/$in.^2$)	1,401 kJ/mm^2 (857,000 BTU/$in.^2$)

C2.7 In field terms, the 70-MPa (10,000-psig) jets may not significantly erode the coatings. Therefore, they are typically used for partial removal or for cleaning loose detrital material. The 140-MPa (20,000-psig) jets erode the coatings fairly rapidly and are typically used for partial removal. The 280-MPa (40,000-psig) jets erode and destroy coatings very fast and are typically used when most or all of the coating is to be removed (WJ-1 or WJ-2).

C2.8 Application judgment is employed by operators or users who make the decisions concerning which type of jetting water to use:

(a) HP WC (the water's flow rate is the predominant energy characteristic);

(b) HP WJ (pressure [i.e., the velocity of the water] and flow rate are equally important); or

(c) UHP WJ (the pressure [i.e., the velocity of the water] is the dominant energy characteristic).

C2.9 As water passes through the orifice, potential energy (pressure) is converted to kinetic energy. The energy increases linearly with the mass flow, but increases with the square of the velocity, as shown in Equation (C1).

$$\textit{Kinetic Energy} = \frac{1}{2}mv^2 \qquad \text{(C1)}$$

where

m = mass (derived from water volume)
v = velocity (derived from pressure)

In order to calculate the kinetic energy from flow rates and velocity, a time period must be selected. A time period of 10 milliseconds is used for Equation (C1).

C2.10 The threshold pressure(5) of a coating must also be determined. In general, the tougher or harder the coating (i.e., the more resistant to testing by a pocket knife), the higher the threshold pressure; the softer and more jelly-like the coating, the lower the threshold pressure.

C2.10.1 Once the threshold pressure is achieved or exceeded, the production rate increases dramatically. Therefore, waterjetting production rates are affected by two conditions:

(a) Erosion at pressures lower than the threshold pressure, and

(b) Waterjet cutting and erosion at pressures greater than the threshold pressure.

(5) *Threshold pressure* is defined as the minimum pressure required to penetrate the material.[20]

New Hampshire Department of Transportation

DRAFT
MECHANICAL AND ELECTRICAL SCOPING STUDY
FOR THE
NEIL R. UNDERWOOD BRIDGE
OVER THE HAMPTON RIVER

235/025

June 2010

PREPARED BY:

HDR Engineering, Inc.

695 Atlantic Avenue

Boston, MA 02111

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ELECTRICAL STUDY

1. EXECUTIVE SUMMARY

The Neil R. Underwood Memorial Bridge Main Movable Span Electrical facilities were inspected on April, 29th and 30th of 2010. The purpose of this inspection is to determine space and location of the new equipment, identify any conditions that may affect the future reliability of the bridge, and review the 2001 LBG/H&H report findings and provide recommendations.

The following personnel performed the electrical inspection:

Nidal Elderamneh	HDR/Electrical Engineer
Shadi Ammar	HDR/Electrical Engineer

The preliminary investigations show there should be sufficient room for the new equipment to be installed. Some of the equipment will require to be relocated, to meet current code requirement, such as the motor control center.

Also, a number of out of scope conditions were identified; some of them were mentioned in the 2001 LBG/H&H report, which may affect the future reliability of the bridge as detailed in section 5.2. of this report.

2. DESCRIPTION OF SYSTEMS

The Neil R. Underwood Memorial Bridge is single leaf two-girder bascule designed in 1946. The bridge carries route 1A traffic over the Hampton River between Hampton and Seabrook, New Hampshire. The bridge provides a 26-foot wide two-lane roadway and one 5-foot wide sidewalk on the east side of the bridge. The span has 40' of horizontal navigational clearance. Information is obtained from As-builts drawings by H&H dated Nov. of 1983 and a previous inspection report by H&H and LBG Inc dated Dec. of 2001.

The operator's house is located at the northwest corner of the bascule span. The upper level (first level) contains the control desk. The span level (second level) contains the main slate board motor control center (MCC), control relays, secondary resistors, two lighting panels, and the auxiliary drive controller. The third level contains the main motors and brakes. The forth level contains an emergency diesel generator, air compressor, and two lighting panels.

The span is operated via two 15 horse power (HP) wound rotor type motors under normal operation. The span speed is controlled by varying the resistance on the secondary of the main motors. The bridge operator controls all devices from the control house. The span stops automatically when it reaches nearly closed or nearly open positions. The operator then drives the bridge at a slower speed to fully open or fully closed positions. The bridge power is fed from a utility feeder at the north abutment. The submarine cables provide power and control to the span lock motors and instruments, span seated limit switches, far side gates, warning bell, and traffic light.

The bridge is also equipped with an auxiliary drive system located at the machinery level. For a detailed description of the auxiliary system please refer to the mechanical report.

3. INSPECTION APPROACH AND METHODOLOGY

A visual inspection of the bridge electrical and control systems components was conducted. All the accessible cabinets and enclosures were opened and inspected.

Tests consisting of insulation resistance and load current measurements were also conducted. Tests were performed to highlight areas that could be problematic towards the continued safe and reliable operation of the bridge as well as its effectiveness in supporting roadway, and marine traffic operations.

4. INSPECTION FINDINGS

4.1. MOTOR CONTROL CENTERS (MCC) AND CONTROL SYSTEM

The main slate board MCC is located at the span level (MCC room). It is enclosed in an enclosure. It houses the motor starters and the control relays for the bridge control system (see photo E-01). A number of the original components and wiring have been replaced over time (see photo E-02). The original devices and wiring looks deteriorated (see photo E-03). The MCC current location doesn't provide for code compliant working clearances (see photo E-04).

The MCC and Control cabinets are defined to be replaced as part of the project scope of work.

4.2. MAIN MOTORS

Both main motors are manufactured by General Electric (see photo E-05) and have the same ratings as follows:

Manufacturer: GE	Frame: 404Z	Duty Cycle: 30 Minutes
Type: MR	Model: 5MR1404CA1	Temp. Rise: 55 Deg. C.
Horsepower: 15 HP	Primary Voltage: 220/440V	Phase: 3 PH
FLC: 58/29 Amp	Full Load Speed: 690 RPM	Cycle: 60 Hz
Sec. Voltage: 145 V	Secondary Current: 49 Amp	

The inspection cover gaskets are deteriorated. The interior of the motor is dirty and has a lot of grease built up which indicates that the bearing seals may be deteriorated (see photo E-06 - E-09). The brushes however, are in satisfactory condition. See the mechanical report for more details on the physical condition of the motors. An insulation resistance test (IR) was performed on the main motors. The results are as follows:

	HDR April 2010	Weather Condition	LBG/H&H August 2001	Weather Condition
Motor 1 (stator)	>550 MΩ	55°F/Windy	25 MΩ	68°F/Foggy
Motor 2 (stator)	>550 MΩ	55°F/Windy	25 MΩ	68°F/Foggy
Motor 1 (rotor)	150 MΩ	55°F/Windy	20 MΩ	68°F/Foggy
Motor 2 (rotor)	145 MΩ	55°F/Windy	20 MΩ	68°F/Foggy

Tests were performed from the load side of the motor starters once and the second time from the load side of the local disconnect switches.

The IR tests were performed throughout the course of the inspection using a Fluke 1587. The meter's display range at 500 volt is up to 500 MΩ. Any test result above 500 MΩ will show as >550 MΩ. If it shows as >550 then it is a good insulation resistance.

A power quality (current and voltage) test was also performed during raising and lowering of the bridge. The results of the test were satisfactory. A voltage chart and a current chart are attached in appendix B that illustrates the results of the tests.

4.3. EMERGENCY DRIVE SYSTEM

The emergency drive motor and local disconnect switch are located in the machinery area (see photo E-09a). The motor and local disconnect switch exhibited signs of corrosion. An insulation resistance test was performed on the motor. The result of the test was a 20MΩ reading. The result of a previous IR test, performed by LBG and H&H during an in depth inspection dated August 2001, was 100 MΩ. The drop in the insulation resistance is a sign that the stator insulation may be deteriorated.

The emergency drive controller is attached to the side of the MCC (see photo E-09b). The controller contains relays, push buttons and indicating lights to control the emergency motor. The cabinet is in good condition. The cabinet will require relocation after the replacement of the existing MCC.

The current emergency drive system is not interlocked with the normal drive system. Which makes it not in compliance with ASHTOO LRFD 2007 2nd edition, paragraph 6.9.2.4.

4.4. BRAKES

The two brake motors are similar in type and ratings (see photo E-10). They are mounted to the shaft extension of the main motors. The name plate information is as follows:

Type: GE9516-463L

Catalog Number: 8020946-G3

Voltage: 208/220V

The current brakes are not equipped with local disconnect switches, which make the installation not in compliance with NEC 110.58.

The current system has motor brakes only, which does not meet current code requirements. See the mechanical report for more details with regard to the machinery brakes.

The brakes are defined to be replaced under the project scope of work.

4.5. CONTROL DESK

The control desk enclosure has peeling paint. The control desk top is defined to be replaced under the project scope of work. However, during the field visit, bridge personnel expressed their need to reduce the size of the control desk, if possible. A smaller control desk will provide more open area in the control room (see photo E-11).

The option of replacing the entire control desk is out of the project scope of work.

4.6. INDICATION AND MEASURING INSTRUMENTS

4.6.1. Height and Position Indication:

The rotary cam limit switch and the span position transmitter are located in the main motors room (see photo E-12). They are defined to be replaced under the project scope of work.

4.6.2. Span Seated Limit Switches:

The span fully seated plunger type limit switches located on the rest pier have both been disconnected. One lever roller type limit switch is installed to replace the two plunger switches (see photo E-13).

The switches are defined to be replaced under the project scope of work.

4.7. SPAN LOCKS

The span lock motor along with its local disconnect switch and the span lock rotary limit switch are all located at the span lock platform (see photo E-14 - E-16). They are all rusty and exhibited signs of corrosion.

The span lock motor insulation resistance (IR) tests and running current results were satisfactory.

IR: >550 MΩ

The running current was 9.5 Amp driving and 9.25 Amp pulling.

The span lock limit switches are defined to be replaced under the project scope of work; However, the span lock motor and local disconnect switch are not.

4.8. MISCELLANEOUS

4.8.1. Secondary Resistors:

The secondary resistors are suspended from the ceiling above the MCC (see photo E-17). The wiring is old and exhibited some degree of deterioration. The resistors are open type with out any safety guards.

The design work related to the replacement of the resistors and wiring was not part of the original scope of work.

4.8.2. Lighting Panels:

There are two lighting panels at the span level (MCC room). Both panels provide 120/240 Volts power to lights and other hotel loads. One panel is 3 phase with 40 Amps (See photo E-18). The other panel is single phase with 100 Amps. (See photo E-19).

There are two more lighting panels at the fourth level (EDG room). One is 120/208 volt, 3 phase, 50 Amp panel (See photo E-20) fed from the 240 volt-208 volt step down transformer (See photo E-21). This panel is used to provide power to the new barrier gates. The other panel is 120/240 volts, 1 phase (See photo E-22). This panel provides power to the air compressor. The two panels can't be combined since they are at different voltage levels. For other options to combine the two panels at the EDG room together see the recommendation section.

4.8.3. Traffic Light:

There are two traffic lights at each approach (see photo E-23). The conduit system to the traffic lights has been replaced at the south approach only, but not the others (see photo E-24 – E-25). The traffic light heads, masts and wiring are defined to be replaced under the project scope of work.

4.8.4. Lift Siren and Warning Bells:

The lift siren is located at the outside North wall of the operator room (See photo E-26). The lift siren and its wiring are defined to be replaced under the project scope of work.

There are two warning bells mounted at the traffic light masts one at each approach (see photo E-27). The warning bells along with their wiring back to the first termination point are defined to be replaced under the project scope of work.

4.8.5. Control Room Heater:

The control room heater will be replaced with a ceiling mounted heater under the project scope of work to increase the amount of space in the control room area.

5. RECOMMENDATIONS

5.1. WORK TO BE COMPLETED UNDER CURRENT SCOPE:

1. Motor control center and Control system
    a. Install new MCC.
    b. Install new relay based control system the control philosophy will match the existing.
    c. Relocate the emergency drive cabinet.

2. Main motors
    a. No change.

3. Emergency motor
    a. No change.

4. Brakes
    a. Install new thruster brakes in kind.

5. Control desk
    a. Install new control desk top.

6. Indication and measuring instruments
    a. Install new span position transmitter.
    b. Install new rotary cam limit switch.
    c. Install new heavy duty lever type span seated limit switches.

7. Span locks
    a. Install new span lock pulled/driven limit switches with lever arm.

8. Secondary resistors
    a. No change.

9. Lighting panels
    a. Install a new 120/240 volts lighting panel to combine the two lighting panels at the MCC room together.

b. Replace the 120/240 volts panel at the EDG room in kind.

10. Traffic lights
    a. Install new traffic light, masts, and wiring back to the first termination point.

11. Lift Siren and warning Bell
    a. Install new warning horn. The air horn shall consist of two remotely mounted stainless steel projectors and a compressor to be located inside the MCC room with a copper pipe extension to the projectors.
    b. Install new warning bells and wiring back to the first termination point.

12. Control room heater
    a. Replace the control room heater with a new ceiling mounted heater to be located over the stairs.

5.2. OUT OF SCOPE ITEMS FOR CONSIDERATION:

1. Main motors
   Even though replacing or rehabilitation of the main motors is not part of the current project scope of work, the overall main motors inspection results indicate that the motors should be considered for replacement/rehabilitation to ensure overall system reliability as follows:

   a. Install new 15hp motors: Installing new motors will provide the maximum life, however it is more expensive ($44,769.60) and may require major modification to the motor base plate and possible replacement of the concrete foundation underneath. See attached quote (Appendix E-C) from Stevens Drives and Controls Inc. for a rough price on new motor replacement.
   b. Rehabilitate the existing motors: This option will provide for system reliability at a lower cost ($3,580.00). See attached quote from Longo Electric (Appendix –C).

2. Emergency motor
   Even though replacing the emergency motor is not part of the current project scope of work, HDR recommends replacing the motor and the local disconnect switch due to the low IR results and the physical condition of both units as follows:

   a. Install new emergency motor: the new motor shall be equipped with an internal heater to minimize corrosion.
   b. Install new heavy duty stainless steel NEMA 4X disconnect switch.

   c. Interlock the emergency drive with the brake system to provide for additional safety feature in an even of a mechanical failure.

3. Brakes
   a. Install brakes local disconnect switch and reroute wiring.
   b. Install two new machinery brakes to meet current code requirements. See mechanical report for more details. The new brakes will require additional relays and interlocking in the control cabinet.

4. Control desk
   a. Install new control desk: the design will have provision for a smaller size control desk to allow for additional space.

5. Secondary resistors
   a. Install new secondary resistors: These new resistors will be equipped with a safety guard and have a smaller foot print.

6. Lighting panels
   a. Replace the barrier gate motors with new motors rated at 120/240 volts and combine the two panels at the EDG room together in one larger 120/240 volts panel.

7. Traffic lights
   a. Install new PVC RGS conduit system from the traffic lights back to the first box for both traffic lights at the North approach.

MECHANICAL STUDY

1. EXECUTIVE SUMMARY

A mechanical inspection of the Neil R. Underwood Memorial Bridge movable span was performed on April 29th and 30th of 2010 in support of an electrical rehabilitation project. During this work, a number of out of scope deficiencies were identified.

In general, the lubrication of all open gearing, bearings, couplings and trunnions is dry and contaminated. Poor lubrication of these components results in increased wear and reduced life. Continued poor lubrication of the trunnions will eventually result in seizing of the bearing surfaces and operational failure of the span.

Scattered areas of paint loss and corrosion are present on most mechanical components outside of the operators house. The corrosion on the emergency drive system was found to be more advanced than the main drive machinery. Some fasteners in this system have corroded substantially, reducing the reliability of the system. A failure of the emergency drive system during operation would leave the movable span without connection to emergency motor power and failsafe braking.

The operating machinery does not meet current code requirements for braking. Machinery brakes are not present. According to AASHTO LRFD 2007 2nd edition, paragraph 5.6.1, a set of two motor brakes and two machinery brakes are required. Machinery brakes should be located as close to the rack and pinion as possible.

The span lock reducer does have a breather top and is open for precipitation to enter. Water within the reducer will cause corrosion of the internal components and result in premature failure. Shaft seals are weeping lubrication.

A temporary steel center divider on the roadway has been added since the last inspection. It is unknown at the time of this report whether the span was balanced since this addition. Span motor current readings indicate that the required lifting power is approximately ten percent less than lowering. A change in span balance can significantly increase operating loads on machinery and reduce component life.

2. DESCRIPTION OF SYSTEMS

The bridge is a single leaf fixed-trunnion bascule bridge. The span carries north and south bound lanes of the US Route 1A highway over the Hampton River.

Under normal operation, the span operating machinery is driven by two 15 hp motors coupled to a primary open gear set on the west side of the span. Two motor brakes are connected to the motor auxiliary shafts. Power is then transmitted using a single main drive shaft through the west trunnion to a centrally located pinion under the span. This pinion drives a bull gear on a differential gear set. Power is then divided to each side to final open gear reductions. The output of these reductions then drives pinions each of which turn a curved rack mounted on the underside of the bascule girders, (See Figure 1).

During emergency operation, the span brakes are manually released and a hand lever operated jaw clutch is engaged at the differential gear set pinion to connect the emergency drive. The emergency drive, located on the east side of the span, is powered by a 3 hp motor with a motor mounted brake. The motor is coupled to an enclosed reducer which drives a two stage open gear set. The open gear set is coupled to a drive shaft which goes through the east trunnion and connects to the jaw clutch, (See Figure 1).

There are two locks which secure the movable span in the closed position, one at each bascule girder. The span locks are located on the south pier and accessed through a hatch in the northbound roadway deck. The span locks are driven by a 3 hp electric motor, which includes a motor mounted disk brake, connected to a Falk no. 7 ½ parallel shaft reducer. The reducer outputs are connected via shafting to a crank shaft and link arm. Each link arm then drives the accompanying lock bars through a guide in the fixed span and into a receiver on the movable span, (See Figure 2).

The movable span has two live load shoes, one located on each south corner to transfer the live load on the movable span to the rest piers. On each north corner of the movable span, live load is transmitted through the trunnions to bearings on the rest piers.

3. SCOPE OF WORK

The work to be completed in this project is defined in statewide bridge design agreement 14962, (See Appendix M-C). This document defines the electrical upgrades / repairs to the bridge and control panel.

4. INSPECTION APPROACH AND METHODOLOGY

A visual inspection of all movable span mechanical systems was performed. The goal of this inspection was the following:

- Document the condition of components scheduled for rehabilitation or upgrade under the scope of work.
- Visually inspect all mechanical components to identify those out of scope items that may effect the future reliability of the structure.
- Document nameplate and dimensional information of components and mounting surfaces required for the design work.

This inspection included the operating machinery, live load bearings, trunnions, span guides, and span locks. The scope of work indicates that this project is limited to a complete electrical rehabilitation and therefore detailed mechanical inspection measurements were not recorded. Covers which could be opened using simple hand tools were removed, but those which required the support of maintenance personnel were not.

5. INSPECTION FINDINGS

5.1. OPERATING MACHINERY

In general, the operating machinery is in good condition. With the exception of the emergency drive, most of the machinery is in need of only minor attention.

5.1.1. Motors, Brakes, and Mounting:

The span drive motors and motor brakes are mounted in the motor room. This room is located just below the switch board room in the operator house. There are two span drive induction motors with thruster released drum brakes on the motor auxiliary shafts, (See Photo M-01). The motor and brakes are mounted to a concrete pedestal using an assembly of structural steel angles. The steel mounting brackets for the motors and brakes have scattered areas of paint loss and light corrosion, (See Photo M-02). The motor brakes are identified for replacement under the project scope of work.

The motor cover plates were opened on the main span motors. The span drive motor interiors are contaminated with grease and oil which is leaking past the bearing seals, (See Photo M-03). During operation the motors had no unusual noise or visible vibration.

The following is the name plate information from the motor and motor brakes:

Span Motor

GE Model 5MR1404CA1,
15 HP, 55°C Rise in ½ Hr, Type MR,
690 RPM
Frame 404Z, 3 Phase,
220/440 Volts, 60 Hz,
No VE6815352

Motor Brake

type: GE9516-463L,
catalog no.: 8020946-G3,
208/220 volts, 60 Hz
brake wheel size: 8.00 inch diameter x 3.50 in width
160 Ft*lbs maximum torque

5.1.2. Open Gearing:

The primary open gear set is a single reduction located in the motor room. Each of the two motors is coupled to a pinion which drives a common bull gear. This bull gear is then coupled to a drive shaft. This gear set is covered by a heavy gauge steel cover with inspection covers. The gears are supported by plain bearings.

The overall condition of the primary open gear set is good. Lubrication appeared to be adequate and corrosion appeared minimal, (See Photo M-04).

The centrally located differential and secondary open gearing were mostly concealed by a heavy steel cover. Inspection windows in the cover provide a limited view of the gear teeth. The lubrication appears dry and contaminated, (See Photo M-05).

5.1.3. Shafts and Couplings:

Overall all span drive shafts and couplings are in good condition. The operating machinery shafts have scattered areas of paint loss and corrosion, (See Photo M-6).

5.1.4. Bearings:

Each open gear is supported by a set of plain bearings. The operating machinery bearings for the main drive appear in good condition. Some paint loss and light corrosion is present and the lubrication appears dry, (See Photo M-07).

5.1.5. Rack and Pinion:

The rack and pinions are used to drive the movable span about the trunnions. The final drive pinion and rack lubrication appears dry and contaminated, (See Photo M-08).

5.2. EMERGENCY DRIVE

5.2.1. Motors, Brake and Mounting:

The emergency drive motor, motor brake and pedestal have substantial paint loss and moderate corrosion, (See Photo M-09). The emergency drive front machinery support has substantial paint loss and moderate corrosion, (See Photo M-10).

The name plate information could not be read and the following is provided by the ‘as-built drawings”.

Motor with Motor Mounted Brake

Power: 3 HP
Full Load Speed: 1740 RPM
Motor Brake Torque: 10 LB-FT

5.2.2. Primary Reducer and Mounting:

The emergency drive primary reducer and machinery supports have paint loss and moderate corrosion, (See Photo M-11).

The name plate information could not be read and the following is provided by the ‘as-built drawings”.

Primary Reducer

Manufacture: Philadelphia Gear Company
Model: 2HL2
Reduction Ratio: 9.3:1
(Special) double reduction helical gearing

5.2.3. Open Gearing:

A hand wheel mounted to the open gearing is uncovered and is a safety hazard. The lubrication of the open gearing appeared dry and contaminated, (See Photo M-12).

5.2.4. Shafts and Couplings:

Power is output from the emergency drive open gearing through a gear coupling. The drive output coupling has substantial paint loss and light corrosion. Fasteners are corroded and the lubrication appears dry, (See Photo M-13).

5.2.5. Bearings

The emergency drive open gear pillow block bearings and fasteners have substantial paint loss and moderate corrosion. Pillow block bearing lubrication appears dry, (See Photo M-14).

Bearing block fasteners have near complete head loss due to corrosion. The pillow block bearing pedestals have substantial paint and moderate section loss, (See Photo M-15).

Secondary open gear plain bearings lubrication appears dry.

5.3. INSTRUMENT DRIVE:

The instrument drive is driven by a linkage which is mounted on the west trunnion. The linkage is connected to an arm which is mounted on the instrument drive shaft. The instrument drive shaft enters the machinery room and is coupled to a right angle gearbox. The rotary cam limit switch and span position transmitter are coupled to the right angle gearbox, (See Figure 3).

The instrument drive shaft has scattered paint loss and light corrosion, (See Photo M-16). The instrument drive is identified for replacement under the project scope of work. The instrument drive includes the rotary cam limit switch, the span position transmitter and right angle gearbox, (See Photo M-17).

Nameplate information for the electrical devices are as follows:

Rotary Cam Limit Switch

Manufacture: General Electric
Model: 1C9446, B420MA

Span Position Transmitter

Manufacture: Henschel Corporation
Model: Type 20, DR NO 10-1051-100
Volts 115, 60 Hz
Ratio 1:1

Instrument Drive Reducer

Manufacture: Ohio Gear
Right Angle Gearbox

Model: type 2330A, cat no. RA-3,
Ratio 3:1

5.4. SPAN LOCK MACHINERY

The span locks perform the function of ensuring that the movable span is fully seated on the live load bearings when the span is in the closed position. The span lock machinery is interlocked with the bridge controls to assure the span can not be opened when the lock bars are driven.

5.4.1. Span Lock Operators:

The span lock operators are an electric motor with motor mounted brake and a parallel shaft reducer. The span lock motor grease fittings appeared dry and the motor frame and has substantial paint loss and light corrosion, (See Photo M-18). The span drive reducer has scattered areas of paint loss and corrosion. The breather top is missing leaving the enclosure open for precipitation to enter. The oil seals are weeping, (See Photo M-19). During operation the motor and span lock reducer operated without unusual noise or visible vibration. The span lock bar engaged the receiver without interference or noticeable decrease in speed. Span lock limit switches and a span lock reducer emergency hand crank interlock switch will be replaced.

The name plate information could not be read and the following is provided by the 'as-built drawings".

Span Lock Motor

Manufacture: Westinghouse
Frame 215T
Power: 3 HP
Full Load Speed 900 Rpm
Voltage: 220 Volts
Cycle: 60 Hz
Phase: 3 PH
Full Load Current: 21 Amps

Span Lock Reducer

Falk Reducer
Size: 7 1/2
Power Rating: 5 HP
3 Stage
Ratio 212:1

5.4.2. Shafts and Couplings:

The span lock shafts and couplings have scattered areas of paint loss and light corrosion. The coupling lubrication appears dry, (See Photo M-20).

5.4.3. Lock Bars, Guides and Receivers:

The span lock bar is directly driven by the span lock operator and is supported by the lock bar guides as it passed through the structural steel of the fixed span. When the lock bar is driven, it engages a receiver on the movable span mounted on the structural steel. The span lock bar and receiver lubrication appeared dry, (See Photos M-21).

5.5. LIVE LOAD BEARINGS

Live load bearings are located in the corners of the span, at the south rest pier. They consist of an upper bearing half on the movable span and a lower bearing half mounted on the rest pier.

Both live load bearings appeared to be fully seated in the closed position. There was no visible sign of movement (bounce) under the load of traffic.

The span seated limit switch is mounted near the live load bearings. The live load bearings were found to have some scattered areas of paint failure and corrosion, with no visible, significant wear, (See Photo M-22). Span seated limit switches, mounted adjacent to the live load bearings, will be replaced.

5.6. TRUNNIONS

Trunnions are located on the north pier and support the movable span. Lubrication for the trunnions appears dry, (See Photo M-23). During span operation no notable noise or vibration was generated from the trunnions. The lubrication fittings are difficult to access. Since the movable span rotates about the fixed trunnion shafts, proper lubrication is very important to prevent binding.

5.7. SPAN BALANCE

The span balance of the main movable span was not directly tested during the operation of the span. It was noted that a temporary steel center divider has been added to the movable span since the previous inspection, (See Photo M-24). Span motor current readings indicate that the required lifting power was as much as ten percent less than lowering. Wind was significant during the testing.

6. ALTERNATIVES

A number of options were considered for each deficiency noted. One choice for each item would be to do nothing. Since this course of action would cause continued deterioration and shortened life, it is not recommended.

The span motors can be replaced with new motors. New motors would provide the maximum life at an increased cost. Since the existing motors are in sound condition, rebuilding was determined to the most cost effective solution. Please see electrical section of this report for further information regarding the span motors.

The emergency drive system is a composition of small off the shelf components and fabricated parts. The off the shelf components, such as pillow block bearings, reducers, motors and couplings can not be or are not cost effective to be refurbished. The open gearing, shafts, machinery supports and machinery guards are fabricated assemblies. Although these items can be fabricated new, the restoration would be most cost effective.

Another option would be to redesign the entire emergency drive reduction to utilize a single enclosed reducer. This solution may be more cost effective overall and would provide the added benefit of weatherproofing the system. This approach would increase the life, decrease corrosion and decrease maintenance.

The open gearing and supporting plain bearings have very little running hours and it is likely that there is little to no wear present. It is likely that simple cleaning and lubrication will restore these items. The shafting and machinery supports will require sand blasting, steel repair and painting. The addition of a safety guard on the hand wheel could be included in this repair.

The span lock reducer can also be replaced with a new gear box. The existing gear box is currently operational and is in good running condition. Rehabilitation of the gearbox would include inspection of the gearbox interior, cleaning, painting and seal replacement. These repairs are relatively minor and would be the low in cost compared to a new replacement gearbox.

7. RECOMMENDATIONS

7.1. WORK TO BE COMPLETED UNDER CURRENT SCOPE:

1. Thruster Brake Replacement
    a. Remove existing obsolete brakes
    b. Clean and paint mounting brackets
    c. Mount new brake wheels on motor auxiliary shafts
    d. Mount new thruster brakes and align using stainless steel shims
    e. Adjust brakes

2. Instrument Drive Replacement
    a. Modify, clean and paint mounting brackets
    b. Replace instrument drive reducer
    c. Replace span position transmitter
    d. Replace rotary cam limit switch
    e. Replace instrument drive couplings
    f. Replace or restore instrument drive shafting, linkages, support bearings and mounting.
    g. Align instrument drive components using stainless steel shims

3. Span Lock Limit Switch
    a. Modify, clean and paint mounting brackets
    b. Replace limit switch and linkages

4. Span Seated Limit Switch
    a. Modify, clean and paint mounting brackets
    b. Replace span seated limit switches with heavy duty equipment

7.2. MAINTENANCE ITEMS:

1. Clean and lubricate all couplings and open gearing

2. Grease trunnions

3. Service span lock reducer
    a. Install new breather
    b. Change oil

4. Clean and paint main span drive and span lock machinery
    c. Couplings
    d. Shafts
    e. Machinery covers

7.3. ADDITIONAL OUT OF SCOPE WORK FOR CONSIDERATION:

1. Restore span drive reducer
    a. Clean and inspect gearbox interior
    b. Replace oil seals and breather
    c. Clean and paint gearbox exterior

2. Replace or rebuild span drive motors
    a. Rebuilding would include bearings, seals and electrical components as required. Replacement may include alterations to existing mounting.
    b. Replace output couplings

3. Evaluate replacement or restoration of emergency drive system based on the cost, benefits and feasibility.
    a. Replace emergency system to utilize a single enclosed reducer in place of current open gearing
    b. OR Restore emergency drive machinery
        i. Replace emergency drive motor and motor mounted brake
        ii. Replace motor coupling

iii. Replace or rebuild enclosed reducer. Rebuilding would include the cleaning, inspection, painting and replacement of all bearings and seals
iv. Replace front mounting base
v. Replace pillow block bearings
vi. Replace output coupling
vii. Install cover over hand wheel with interlock for OSHA compliance
viii. Clean and lubricate open gearing
ix. Paint emergency drive machinery

4. Trunnion lubrication
   a. Clean and purge trunnion lubrication passages with pressurized hot mineral spirit flush
   b. Install grease lines to trunnion grease passages to assure proper lubrication

5. Evaluate addition of two machinery brakes based on the cost, benefits and feasibility.
   a. Install machinery supports
   b. Replace existing open gearing shafts with extended shaft for brake wheel
   c. Mount new brakes on new machinery support pedestal

6. Adjust span balance
   a. Test span balance (strain gauge testing)
   b. Add or remove counterweight blocks as required

APPENDIX E-A
ELECTRICAL PHOTOS

Photo E-01, Top-front portion of the MCC.

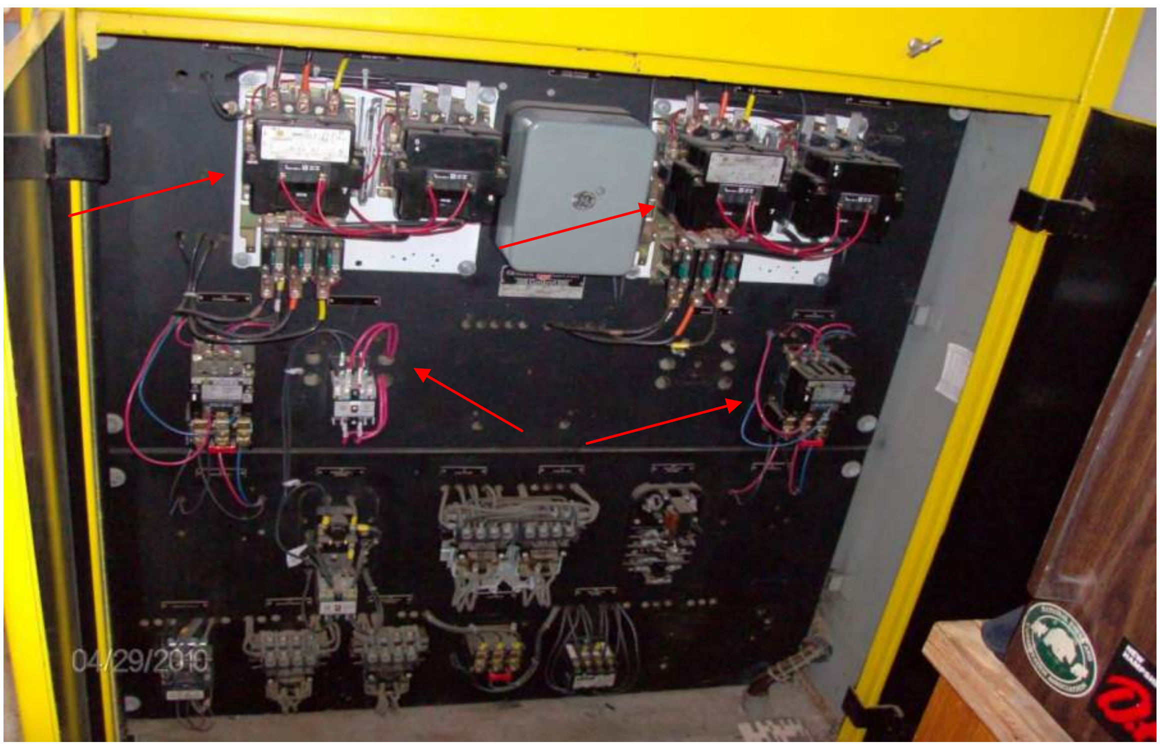


Photo E-02, Bottom portion of the MCC showing some components have been replaced.

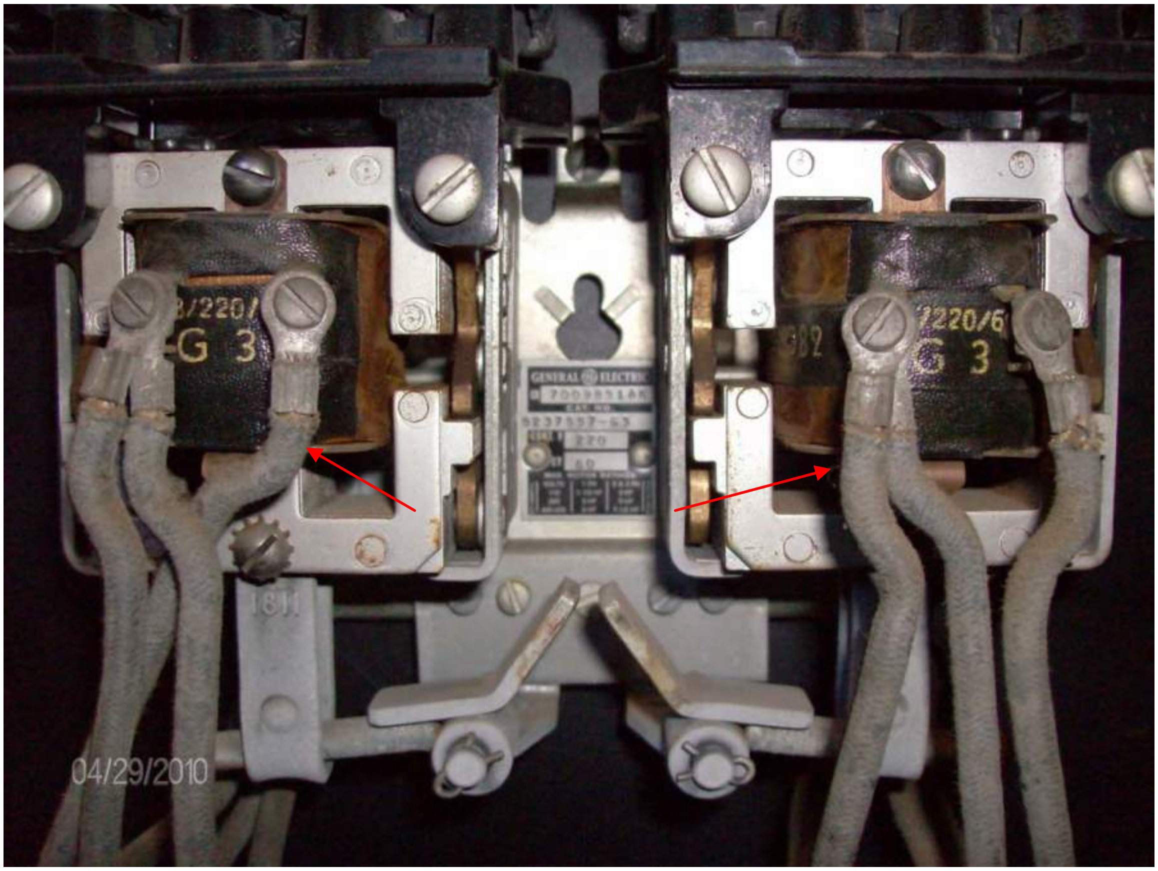


Photo E-03, Full voltage reversing contactor inside the MCC showing deteriorated wiring.

Photo E-04, The rear side of the MCC distance from the wall is less than the NEC requirement for working clearances.

Photo E-05, Main motors.

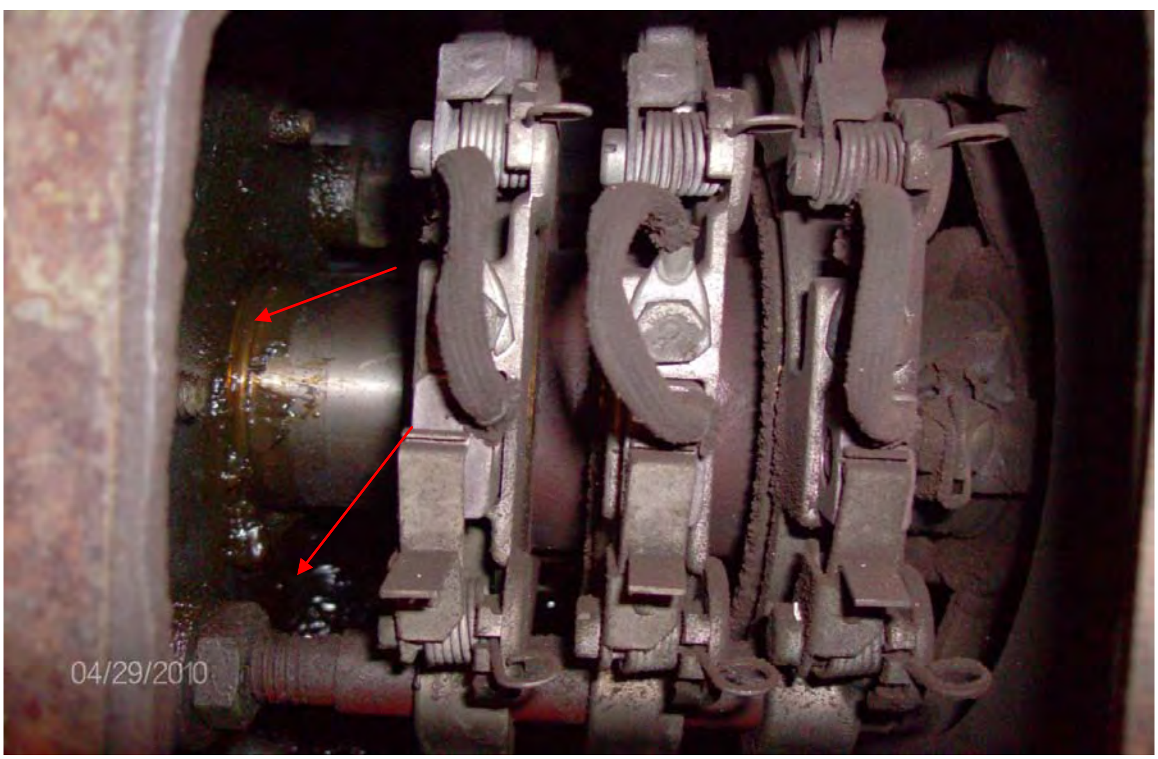


Photo E-06, Main motor interior showing grease build up.

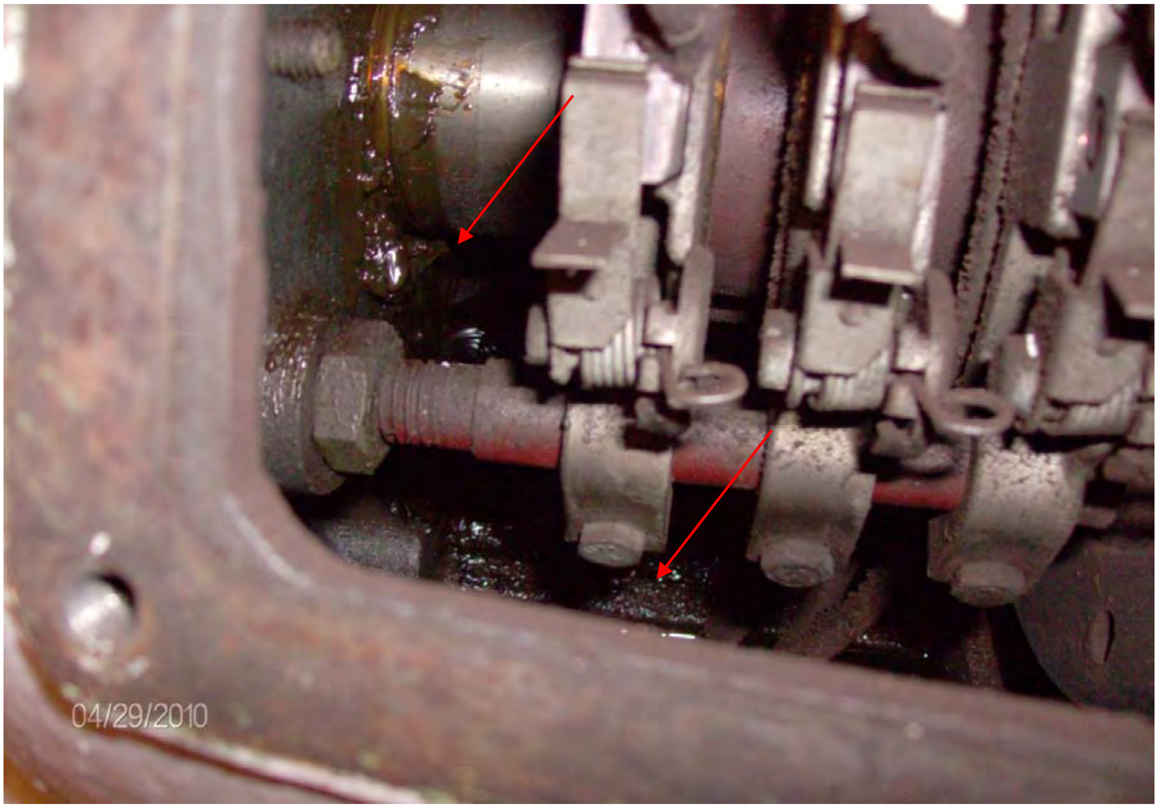


Photo E-07, Main motor interior showing grease build up.

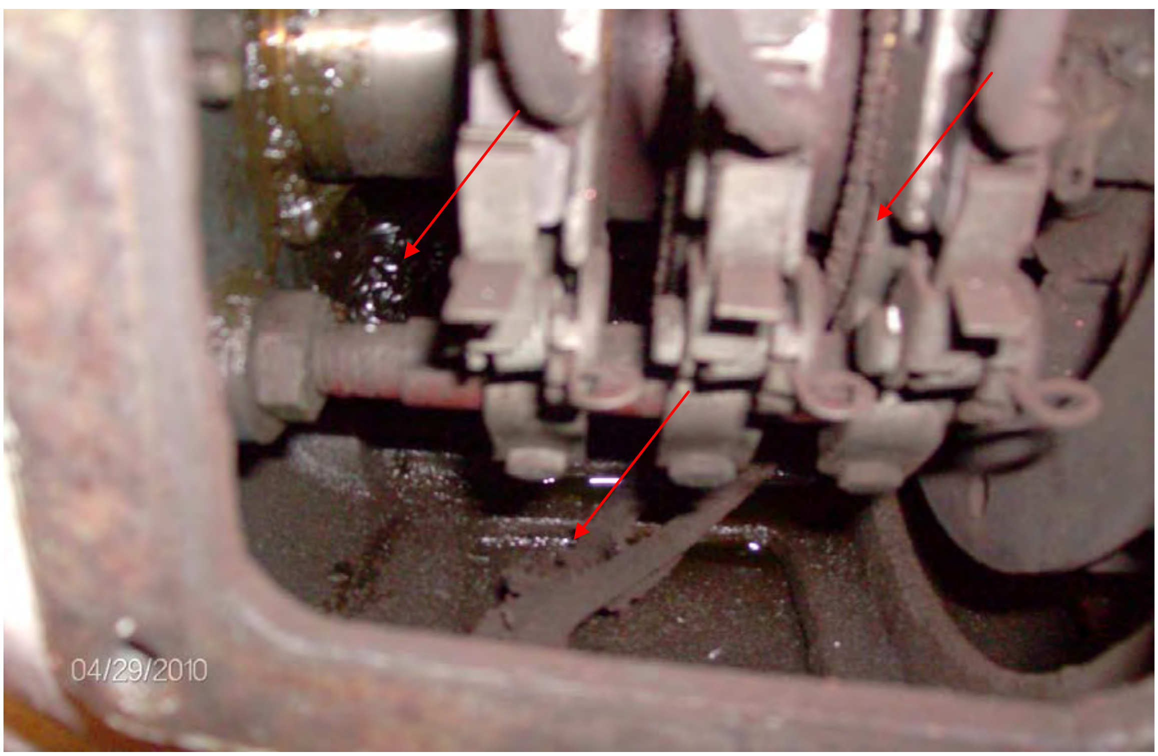


Photo E-08, Main motor interior showing grease and dirt build up.

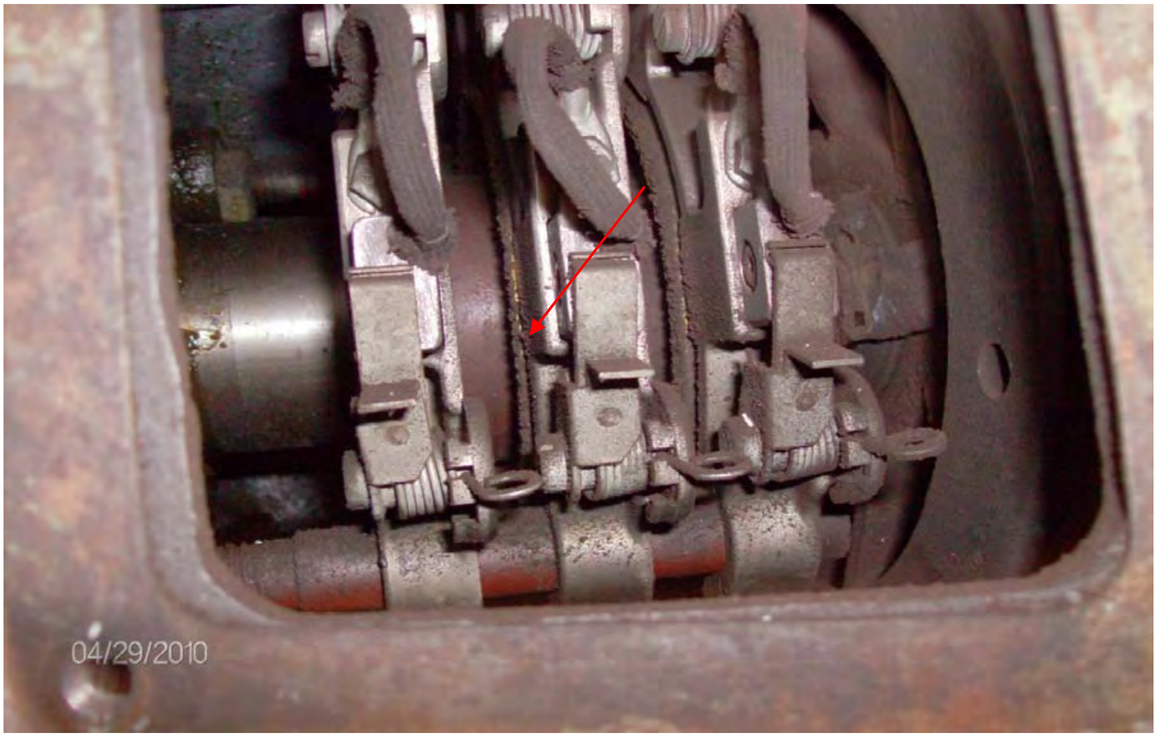


Photo E-09, Main motor interior showing dirt build up.

Photo E-09a, Emergency motor exhibited corrosion.

Photo E-09b, Emergency drive controller.

Photo E-10, This picture shows the Brakes.

Photo E-11, This picture shows the control desk. The control desk occupies a good portion of the control room.

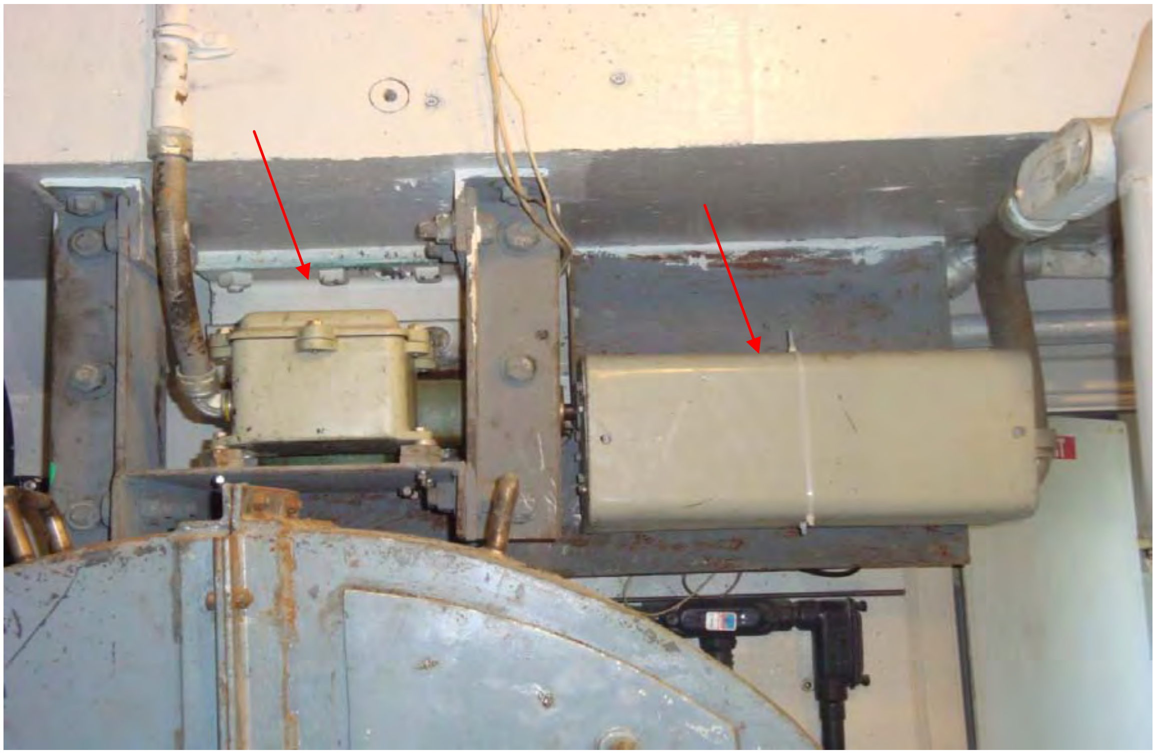


Photo E-12, Location of rotary cam limit switch & height transmitter.

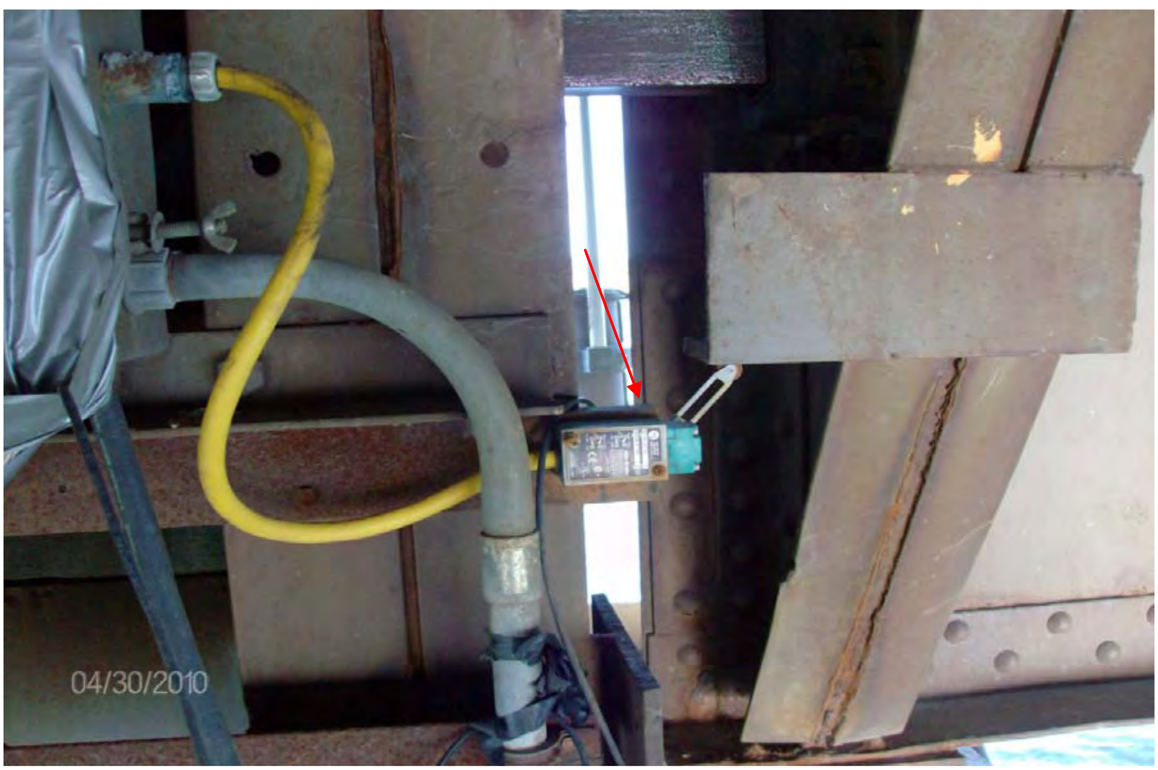


Photo E-13, Span seated lever arm limit switch (only one is used for seating indication).

Photo E-14, Span lock motor signs of corrosions.

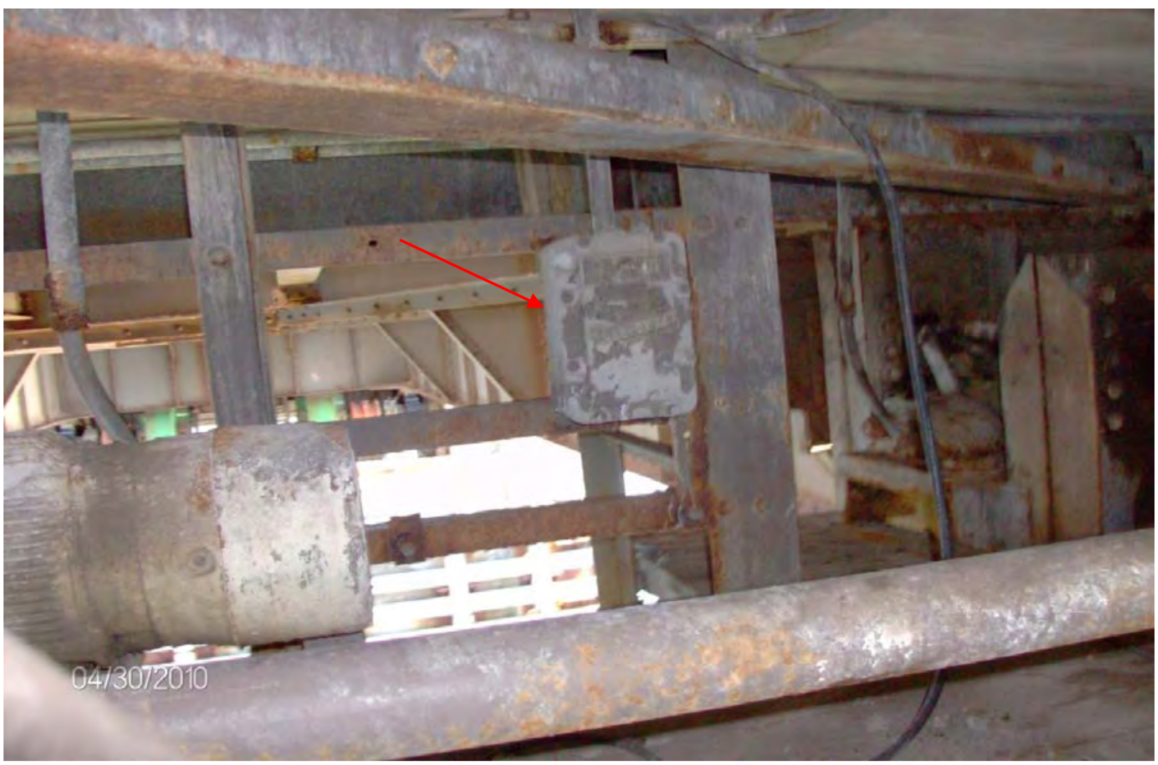


Photo E-15, Span lock motor local disconnect switch.

Photo E-16, Span lock position switch signs of corrosion.

Photo E-17, Main motors secondary resistors.

Photo E-18, 120/240 volts, 40 amp lighting panel.

Photo E-19, 120/240 volts, 100 amp lighting panel.

Photo E-20, 120/208 volts, 50 amp barrier gates lighting panel.

Photo E-21, 120/240-120/208 volts, step down transformer for barrier gates lighting panel.

Photo E-22, 120/240 volts, lighting panel for air compressor and other EDG room receptacles.

Photo E-23, Showing one of the south approach traffic lights.

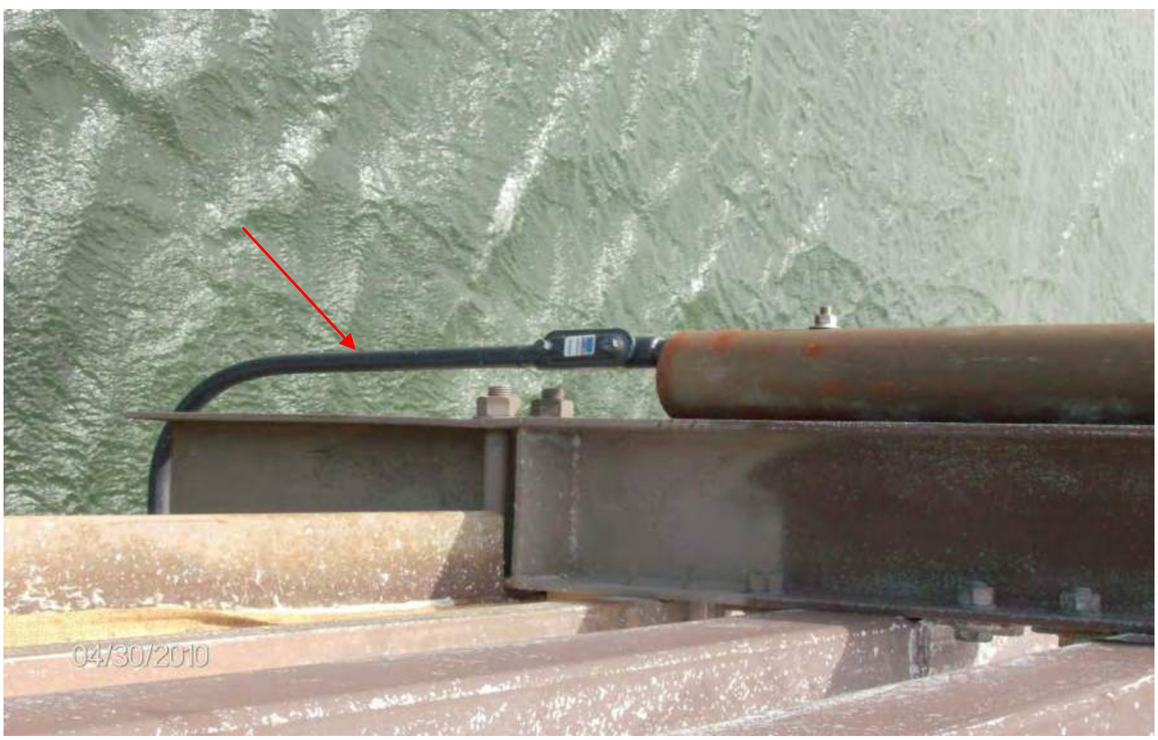


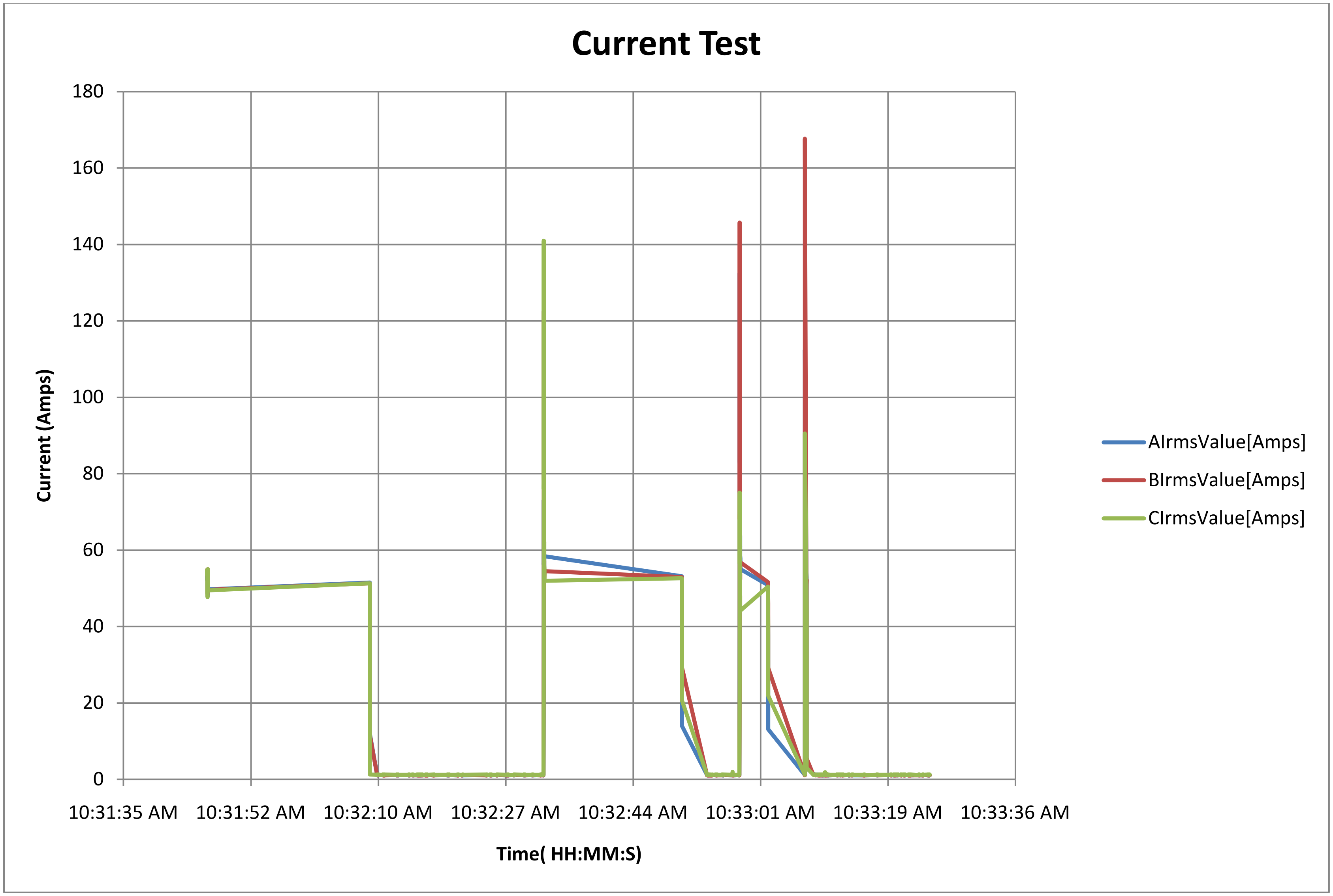
Photo E-24, Showing the new conduit system at the south approach traffic lights.

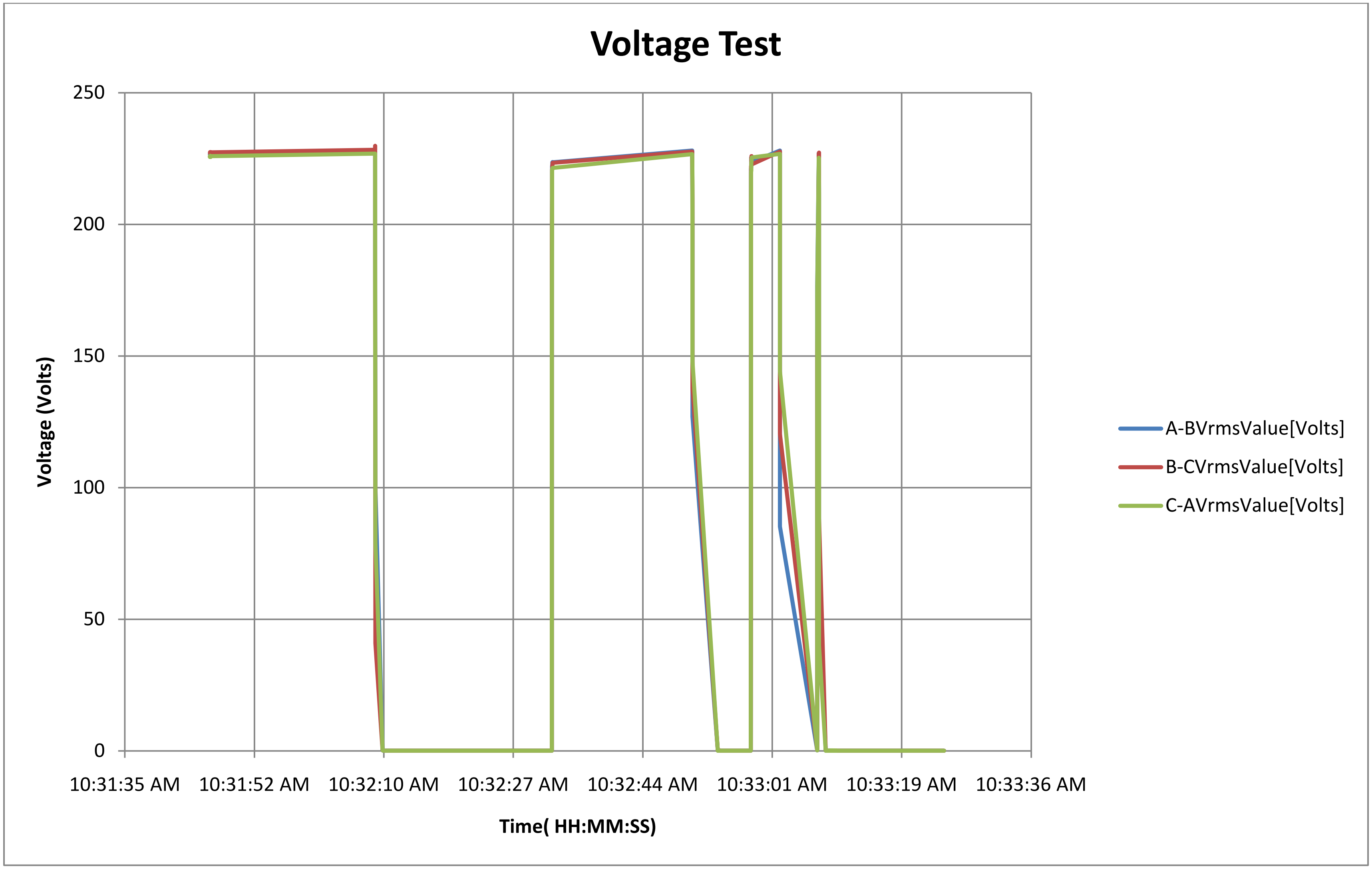
Photo E-25, Showing the old conduit system at the north approach traffic lights.

Photo E-26, Lift siren.

Photo E-27, Warning bell.

APPENDIX E-B
VOLTAGE AND CURRENT GRAPHS


Current Test
Current (Amps)
180
160
140
120
100
80
60
40
20
0
10:31:35 AM
10:31:52 AM
10:32:10 AM
10:32:27 AM
10:32:44 AM
10:33:01 AM
10:33:19 AM
10:33:36 AM
Time(HH:MM:S)
AIrmsValue[Amps]
BIrmsValue[Amps]
CIrmsValue[Amps]



Voltage Test
250
200
150
100
50
0
Voltage (Volts)
10:31:35 AM
10:31:52 AM
10:32:10 AM
10:32:27 AM
10:32:44 AM
10:33:01 AM
10:33:19 AM
10:33:36 AM
Time(HH:MM:SS)
A-BVrmsValue[Volts]
B-CVrmsValue[Volts]
C-AVrmsValue[Volts]

APPENDIX E-C
QUOTATIONS

www.stevensdrives.com

STEVENS DRIVES & CONTROLS, INC.
450 Hamburg Tpke.
Pompton Lakes, NJ 07442
Tel: (973) 831-9573
Fax: (973) 831-9576

Reuland Electric Motor quote

Date: 5/20/2010
Company: HDR
Attn: Nidal

Quote: A5AS0520H
Job: Hampton, NH
Tel: 973-474-5043

QTY	Description	Net Price	Total Net
1	Reuland Electric, 3HP, 900 RPM, design D lock motor, marine duty per IEEE-45, 215 frame, TENV, 30' duty, 230/3/60, hand crank. Rear mounted 25 lb-ft disc brake, class H insulation, waterproof, marine duty.	$6,642.00	$6,642.00
2	Reuland Electric Wound rotor motor, 15HP, 720RPM, 30' duty, 230/3/60, 326U frame, TENV, class H insulation, space heater marine duty. Secondary: approx. 145V, 54 amps	$22,384.80	$44,769.60

Thank You for the opportunity to do business with you.

QUOTE IS VALID FOR 30 DAYS. IN THE EVENT OF A PRICE INCREASE, PRODUCTS NOT ON ORDER FOR IMMEDIATE SHIPMENT ARE SUBJECT TO A PRICE INCREASE. SUBJECT TO STANDARD MANUFACTURERS TERMS AND CONDITIONS.

STEVENS DRIVES & CONTROLS, INC.
450 Hamburg Tpke.
Pompton Lakes, NJ 07442
Tel: (973) 831-9573
Fax: (973) 831-9576

www.stevensdrives.com

Quote

TO: Nidal	**FROM:** Al Sartorius
COMPANY: HDR	**DATE:** 5/20/10
PHONE NUMBER:	**TOTAL NO. OF PAGES INCLUDING COVER:** 1/1
FAX NUMBER:	**QUOTE NUMBER:** A5AS0520M
E-MAIL ADRESS:	**RE:** Hampton Bridge Resistors

As per your request for quotation, we are pleased to submit the following proposal:

Motor Control Resistor, Three phase, convection cooled
15HP, 145V secondary, 54A secondary, 4step/5speed
150% starting torque
R1-R2: 0.57 ohms, 19A
R2-R3: 0.21 ohms, 24.5A
R3-R4: 0.155 ohms, 27A
R4-R5: 0.10 ohms, 30A
Total of 1.035 ohms ±10% @ 20°C per phase
Mounted in mill galvanized finish indoor enclosure with
open bottom entry/exit
Approximate dimensions: 29" W x 18" D x 22" H

$1,272.00 net each

Notes: F.O.B. Mfg. Facility, freight not included. Del: 3-4 weeks

Thank You for the opportunity to do business with you.

QUOTE IS VALID FOR 30 DAYS. IN THE EVENT OF A PRICE INCREASE, PRODUCTS NOT ON ORDER FOR IMMEDIATE SHIPMENT ARE SUBJECT TO A PRICE INCREASE. SUBJECT TO STANDARD MANUFACTURERS TERMS AND CONDITIONS.

1625 Pennsylvania Ave.
Linden, NJ 07036
PH 908-925-2900
FX 908-925-9427
wznowlin@elongo.com

LONGO
Electrical – Mechanical, Inc.
Quote

FAX: D&R ENGINEERING

To:	NIDAL EUDERAMNEH	**From:**	WALTER NOWLIN
Fax:	973-474-5055	**Pages:**	1
Phone:	973-474-5043	**Date:**	05-20-10
RE:	15HP GE WOUND ROTOR MOTOR	**CC:**	
			TERMS CASH

☐ **Urgent** ☐ **For Review** ☐ **Please Comment** **Please Reply** ☐ **Please Recycle**

QUOTE #

INITIAL INSPECTION, ANALYSIS AND TESTING; DISMANTLE 15HP GE WOUND ROTOR MOTOR, PROBE MEGGER AND DROP TEST FIELDS; DUCTER AND MEGGER TEST ROTOR & RINGS,MICROMETER CHECK AND RECORD ALL CRITICAL FITS AND CLEARANCES OF MOTOR, AND ALL INTERNAL PARTS,STEAM CLEAN AND BAKE OUT STATOR & ROTOR AND RETEST,GLASS BEAD BLAST ALL NECESSARY PARTS, EPOXY COAT ALL INTERNAL PARTS, TURN & UNDERCUT SLIP RINGS, SUPPLY NEW BRUSHES, SEAT BRUSHES, SET TENSION, SUPPLY NEW SEALS & BEARINGS, CHECK NEUTRAL SETTING,FINAL ASSEMBLY, TEST RUN AND PANIT. **ESTIMATED RECONDITION COST $3,580.00 NON-REPAIR EVALUATION CHARGE $490.00**

NOTE: ABOVE QUOTE IS AN ESTIMATED ONLY, PRICE DOES NOT INCLUDE ANY MACHINE WORK OR COST FOR PARTS, WILL ADVISE ANY EXTRA COST AFTER A FULL SHOP EVALUATION.

This quote excludes any applicable sales taxes. If this contract requires the contractor or equipment supplier to pay sales tax, the amount of this tax will be added to the above prices. This proposal is valid for thirty days and is subject to prior to scheduling. Payment terms are net ten (10) days from receipt of invoice. All environmental related issues or items are the customer's responsibility. This proposal is subject to our standard terms and conditions in accordance with the enclosed form number CSFJJL990527. *If this proposal is based on a functional replacement motor, by acceptance of this proposal (or order placement) Buyer assumes all responsibility for electrical and mechanical modification that might be required including mounting and electrical connection. If drawings were supplied with this proposal, Buyer assumes all responsibility for review for suitability for its intended purpose prior to order placement. Please do not hesitate to call your Field Sales Representative regarding any questions or concerns. Your Longo team thanks you for this opportunity to present our quotation and looks forward to receiving your most valued order. **Order in excess of $500.00 which is paid by credit card, will be subject to a 2.5% processing fee.** Longo Industries thanks you for the opportunity to offer our quotation and looks forward to receiving your most valued order

Sincerely

Walter Nowlin

APPENDIX M-A
MECHANICAL PHOTOS

Photo M-01, General Electric 8 inch thruster brakes mounted on auxiliary side of 15 HP main span drive induction motors. View of motor room looking east.

Photo M-02, The steel mounting brackets for the motors and brakes have scattered areas of paint loss and light corrosion. View of motor room looking north.

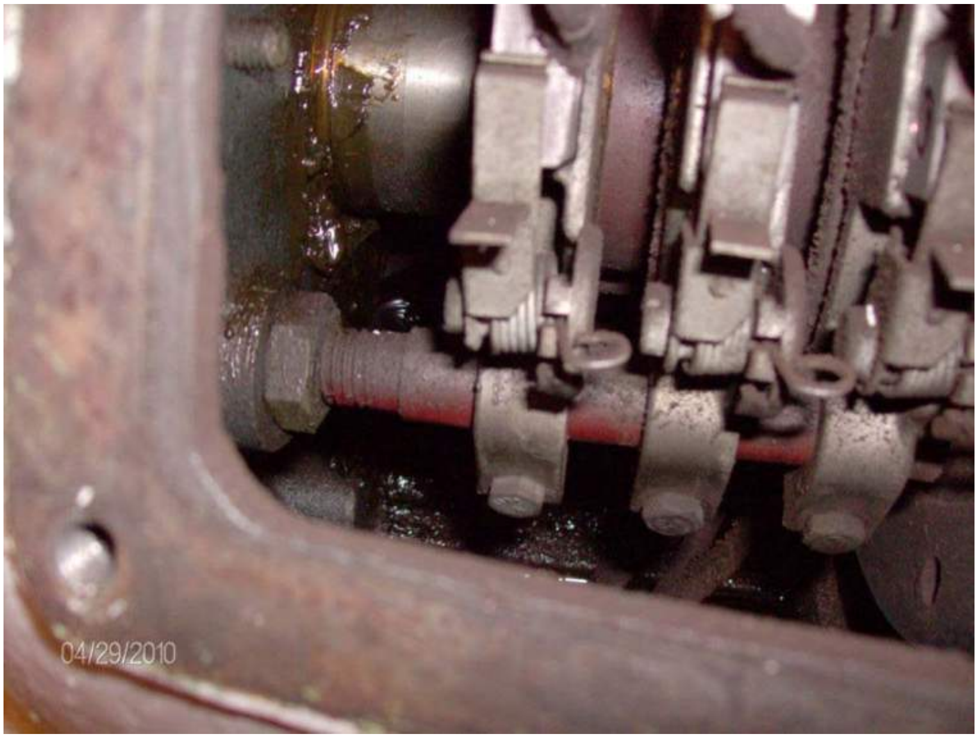


Photo M-03, The span drive motor interiors are contaminated with grease and oil which is leaking past the bearing seals.

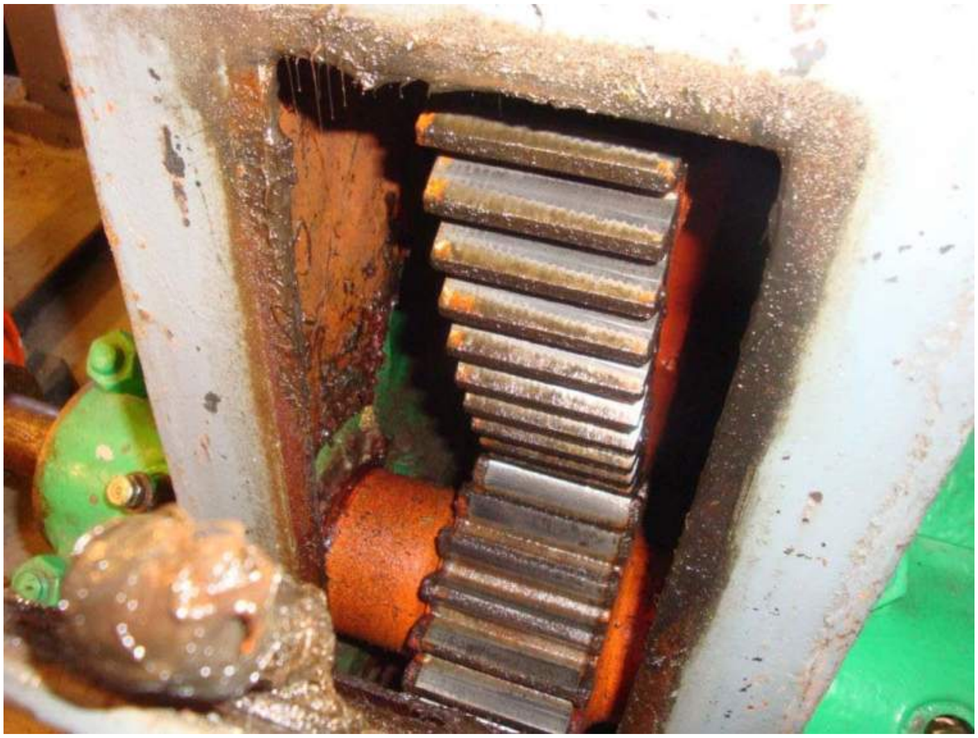


Photo M-04, The overall condition of the primary open gear set is good. Lubrication appeared to be adequate and corrosion appeared minimal due to the interior location.

Photo M-05, The centrally located differential and secondary open gearing were concealed by a heavy steel cover. Inspection windows provide a limited view of the gear teeth. The lubrication appears dry and contaminated.

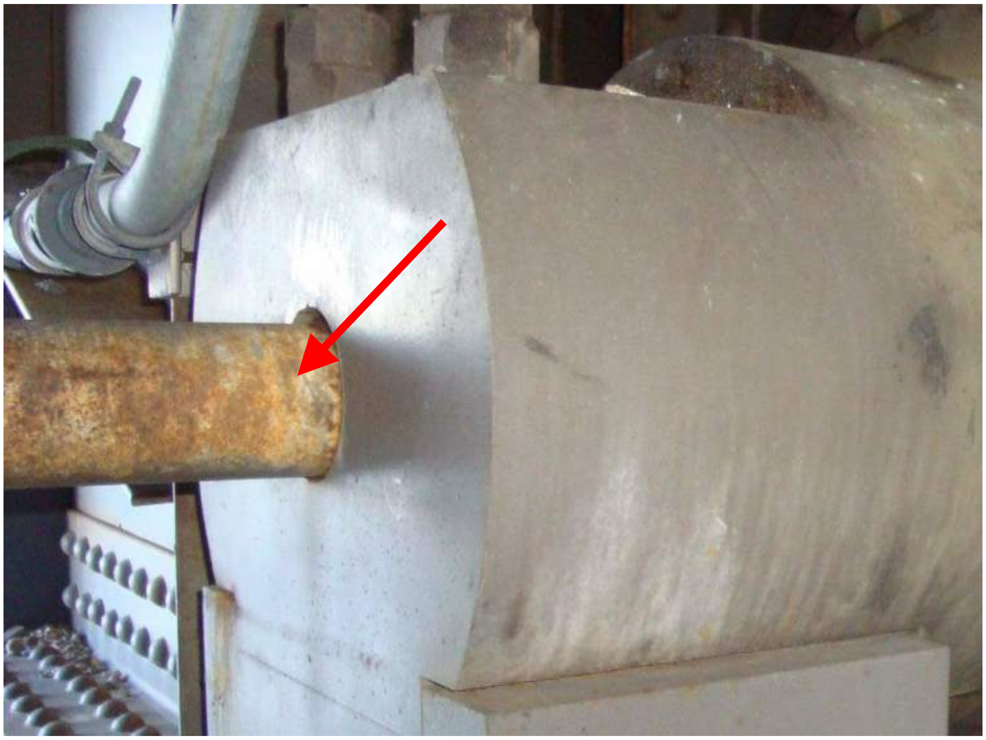


Photo M-06, The operating machinery shafts have scattered areas of paint loss and corrosion.

Photo M-07, The operating machinery bearings for the main drive appear in good condition. Some paint loss and corrosion is present and the lubrication appears dry.

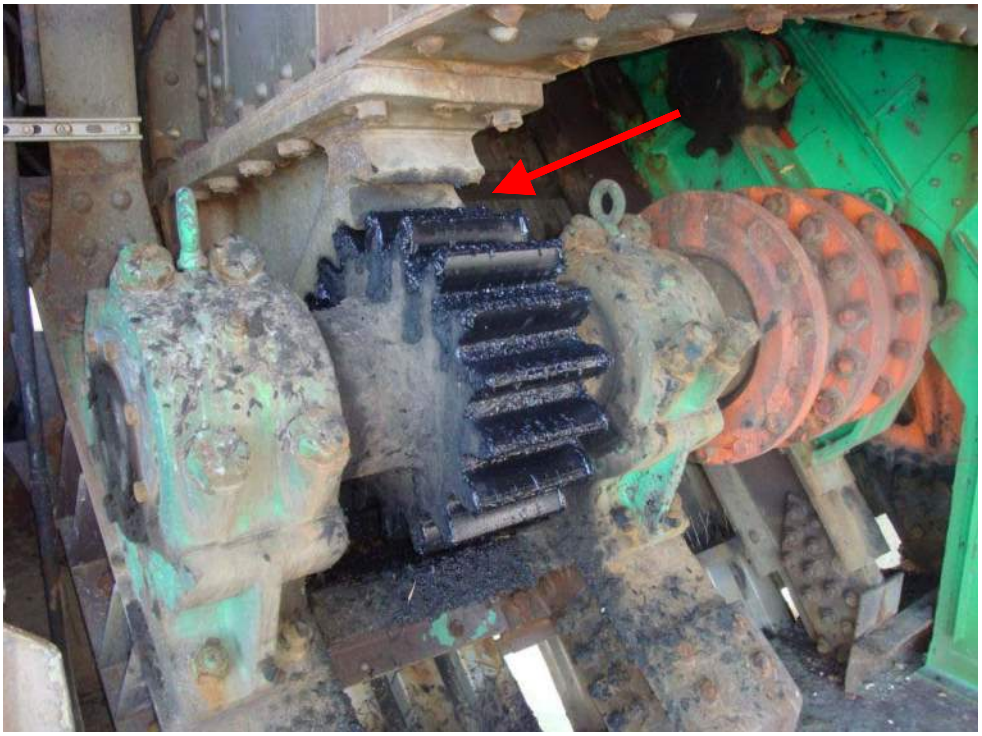


Photo M-08, The final drive pinion and rack lubrication appeared dry and contaminated.

Photo M-09, The emergency drive motor, motor brake and pedestal have substantial paint loss and corrosion.

Photo M-10, The emergency drive front machinery support has paint loss and light corrosion.

Photo M-11, Emergency drive primary reducer and machinery supports have paint loss and moderate corrosion.

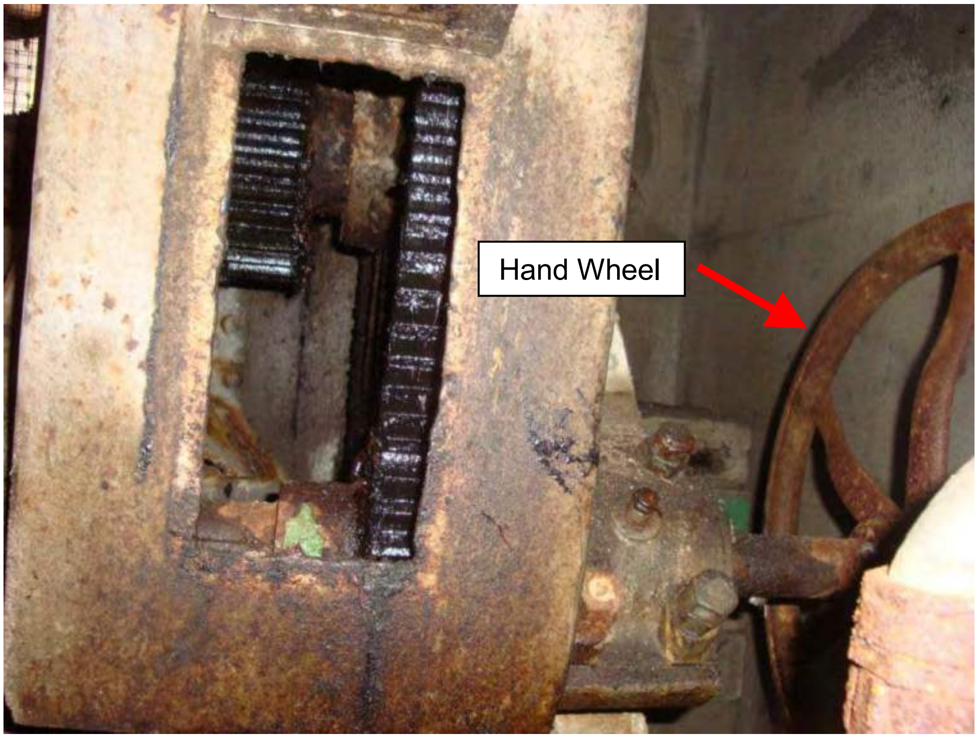


Photo M-12, A hand wheel mounted to the open gearing is uncovered and is a safety hazard. The lubrication of the open gearing appeared dry and contaminated.

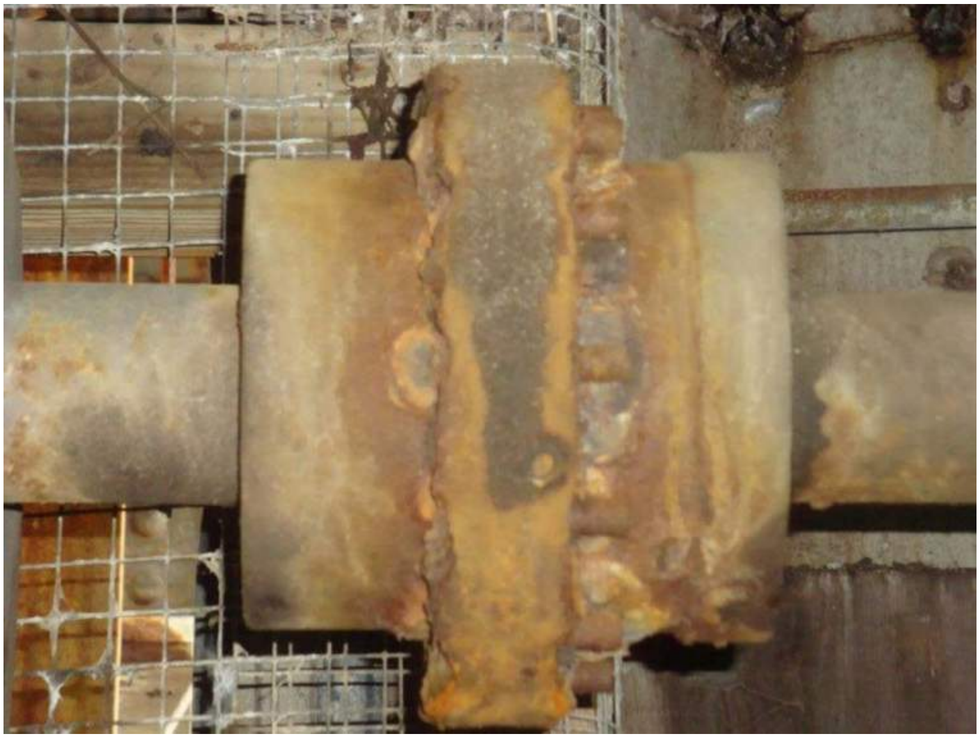


Photo M-13, The emergency drive output coupling has complete paint loss and corrosion. Fasteners are corroded and the lubrication appears dry.

Photo M-14, The emergency drive open gear pillow block bearings and fasteners have complete paint loss and corrosion. Pillow block bearing lubrication appears dry.

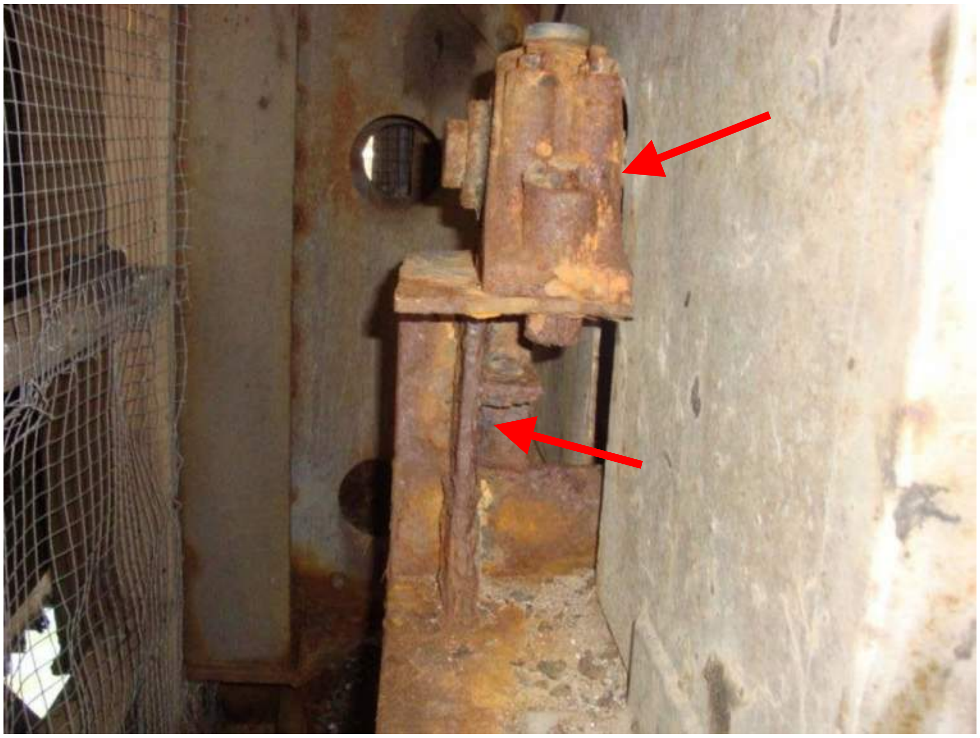


Photo M-15, Bearing block fasteners have near complete head loss due to corrosion. The pillow block bearing pedestals have complete paint loss and sectional loss.

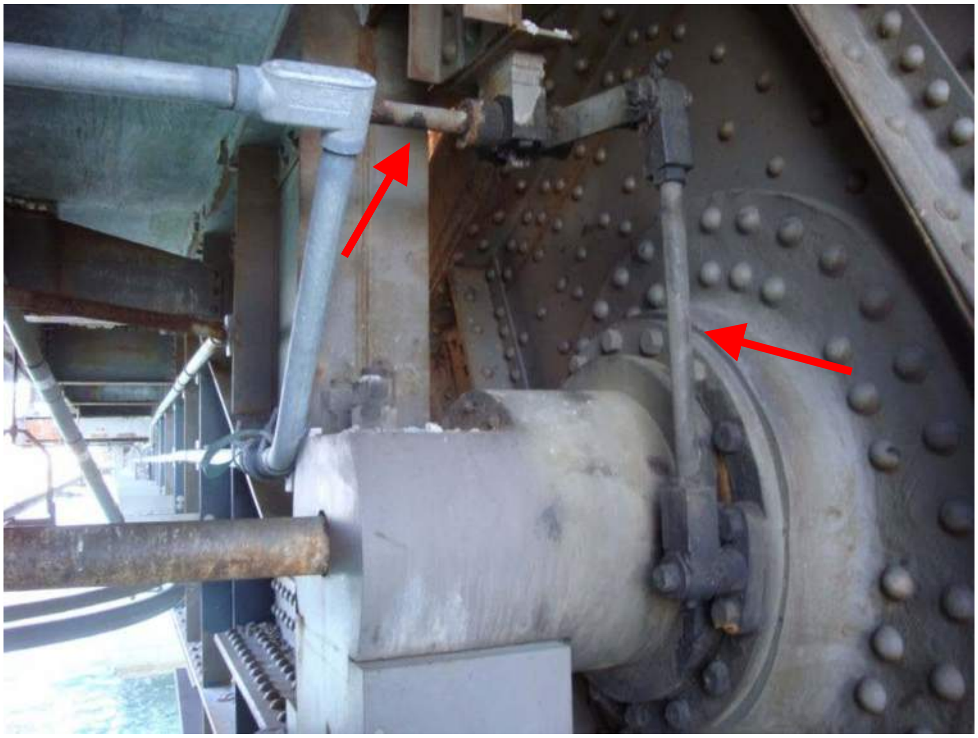


Photo M-16, The instrument drive shaft has scattered paint loss and light corrosion.

Photo M-17, General Electric rotary cam limit switch and Henschel Corp position transmitter.

Photo M-18, The span lock motor grease fittings appeared dry and the motor frame and had complete paint loss and light corrosion.

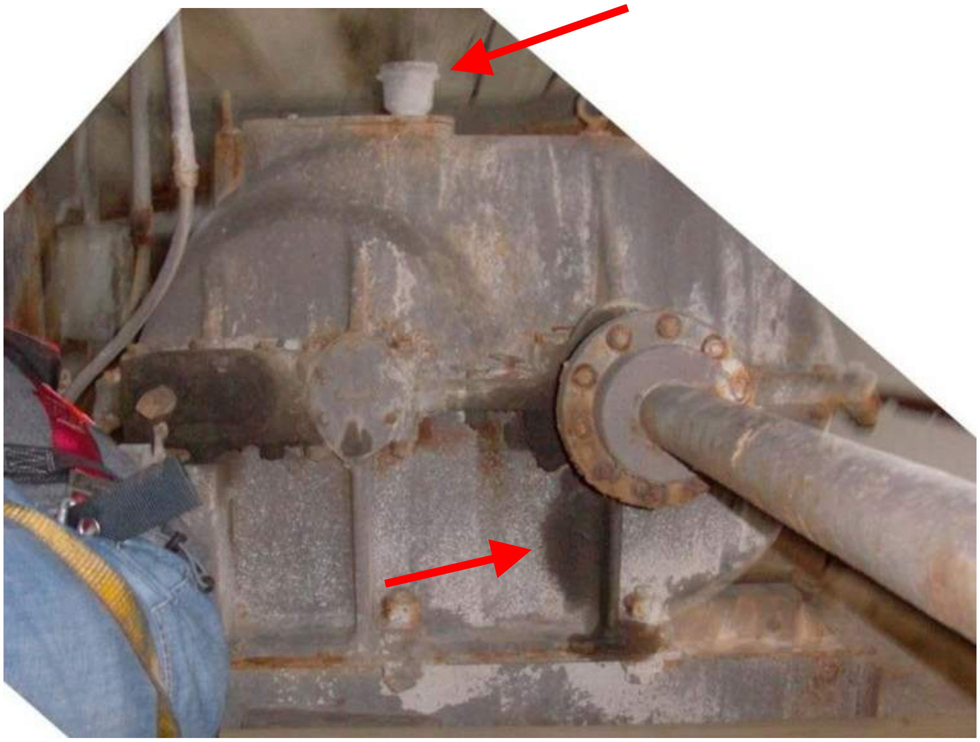


Photo M-19, The span drive reducer has scattered areas of paint loss and corrosion. The breather top is missing, leaving the enclosure open for precipitation to enter. The oil seals are weeping.

Photo M-20, The span lock shafts and couplings have scattered areas of paint loss and corrosion. The coupling lubrication appears dry.

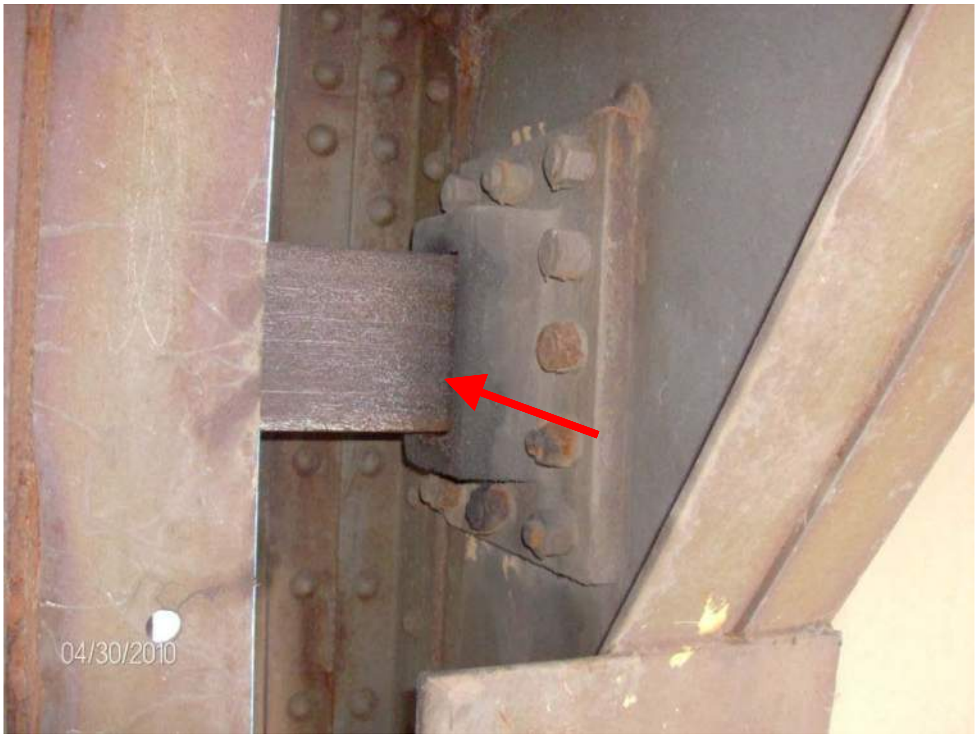


Photo M-21, The span lock bar and receiver lubrication appeared dry.

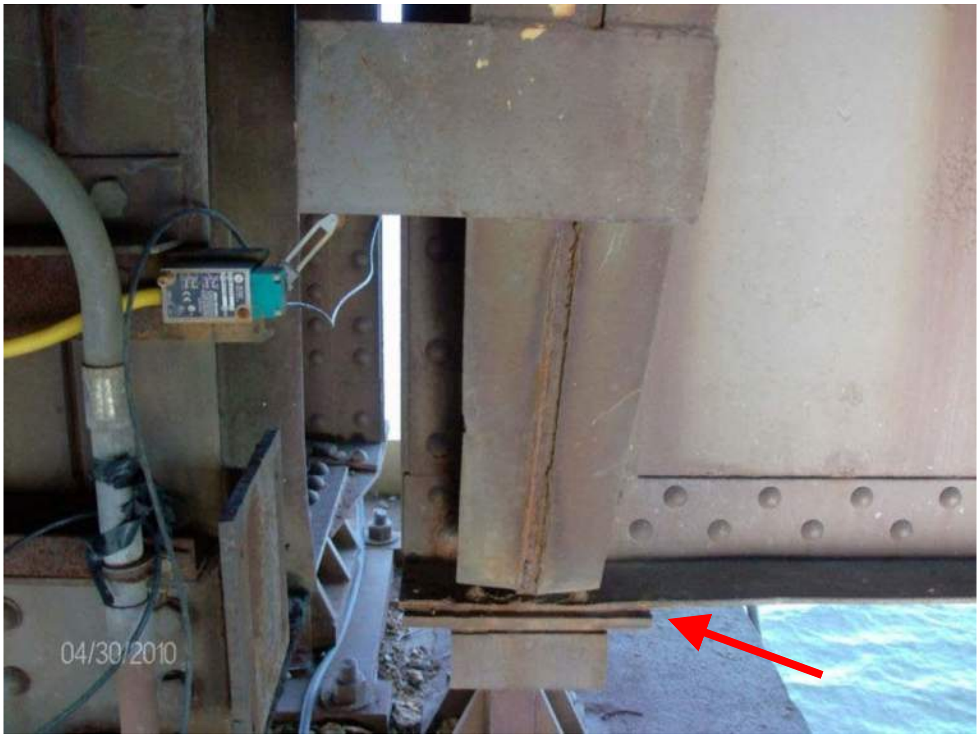


Photo M-22, The live load bearings were found to have some scattered areas of paint failure and corrosion, with no visible, significant wear. Please note the span seated limit switch which is being replaced as part of the electrical scope of work.

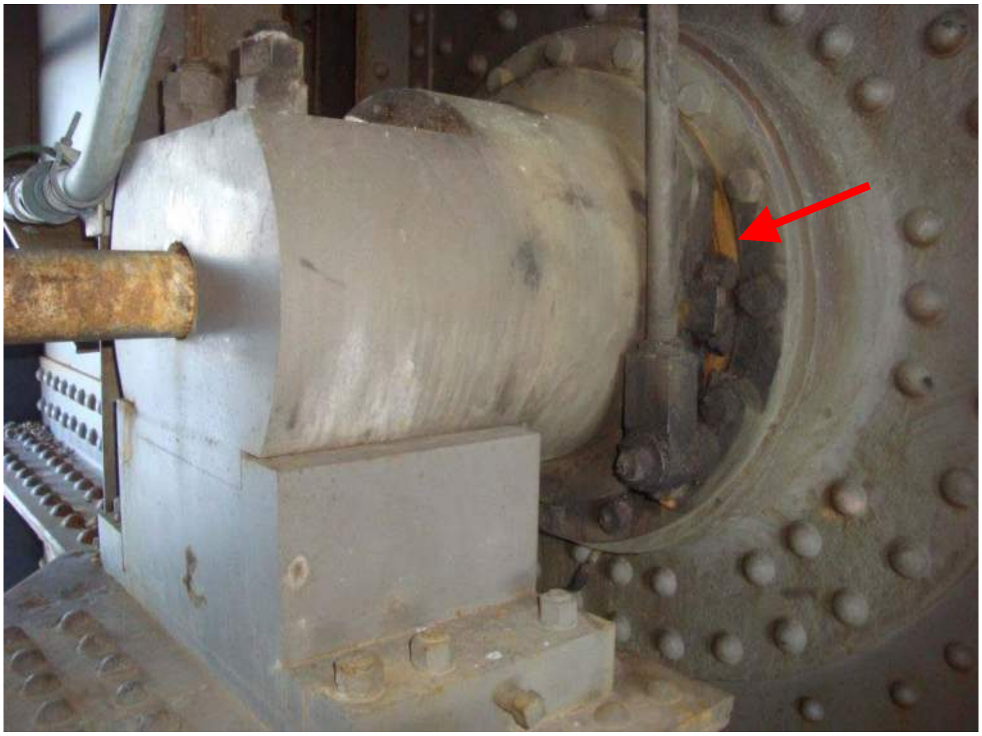


Photo M-23, Lubrication for the trunnions appears dry.


Photo M-24, A steel center divider has been added to the movable span since the previous inspection.

APPENDIX M-B
MACHINERY LAYOUT

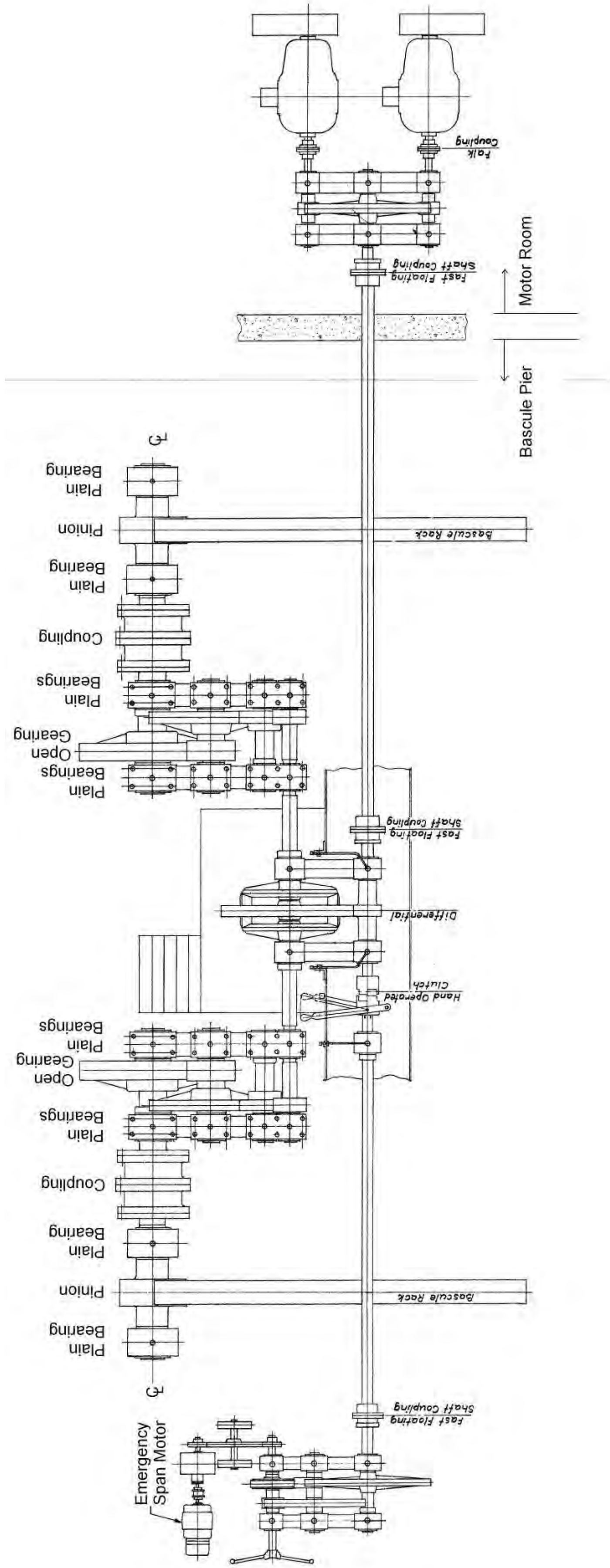


Figure 1, Operating Machinery

M-B-1

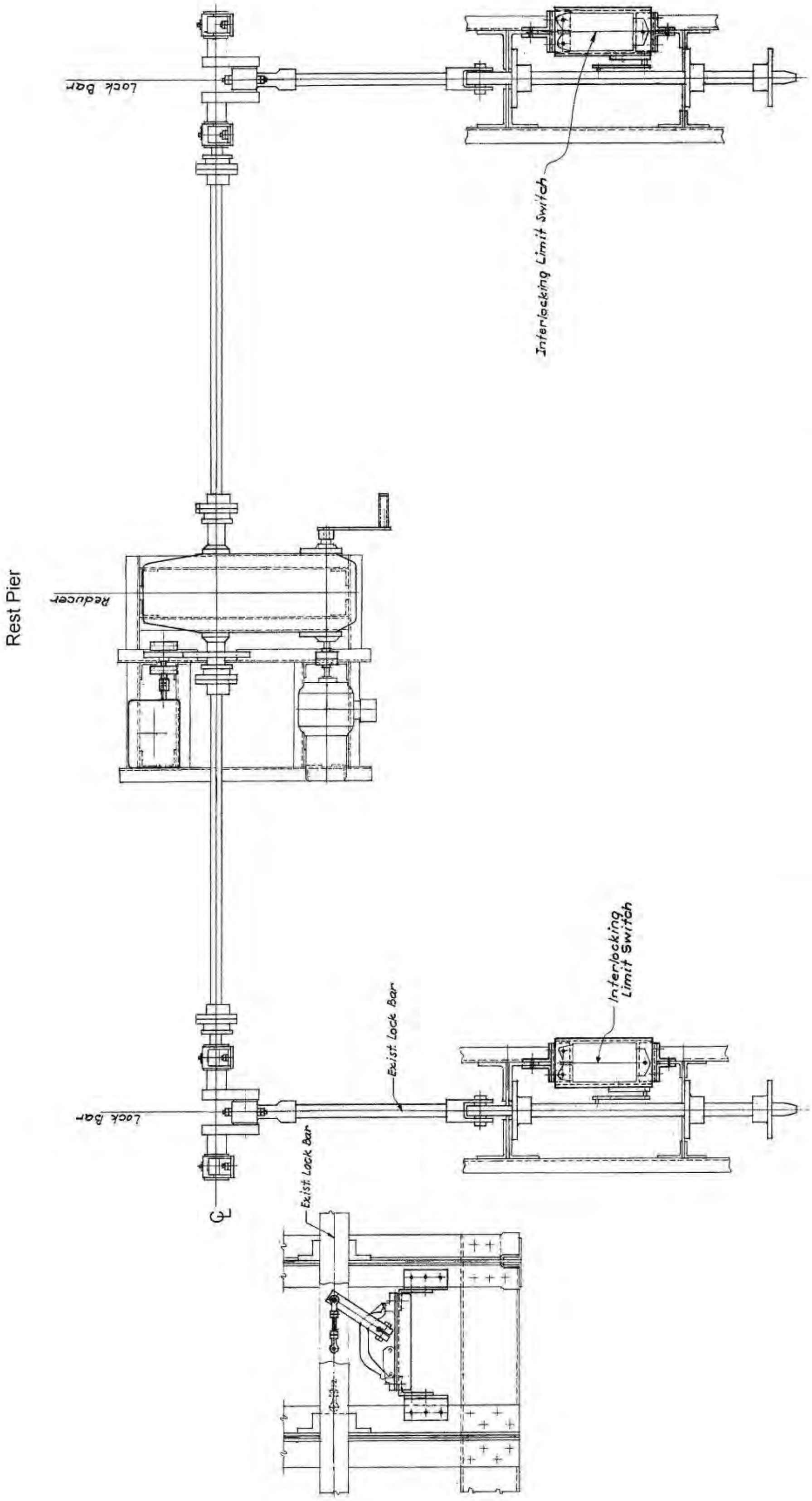


Figure 2, Span Lock Machinery

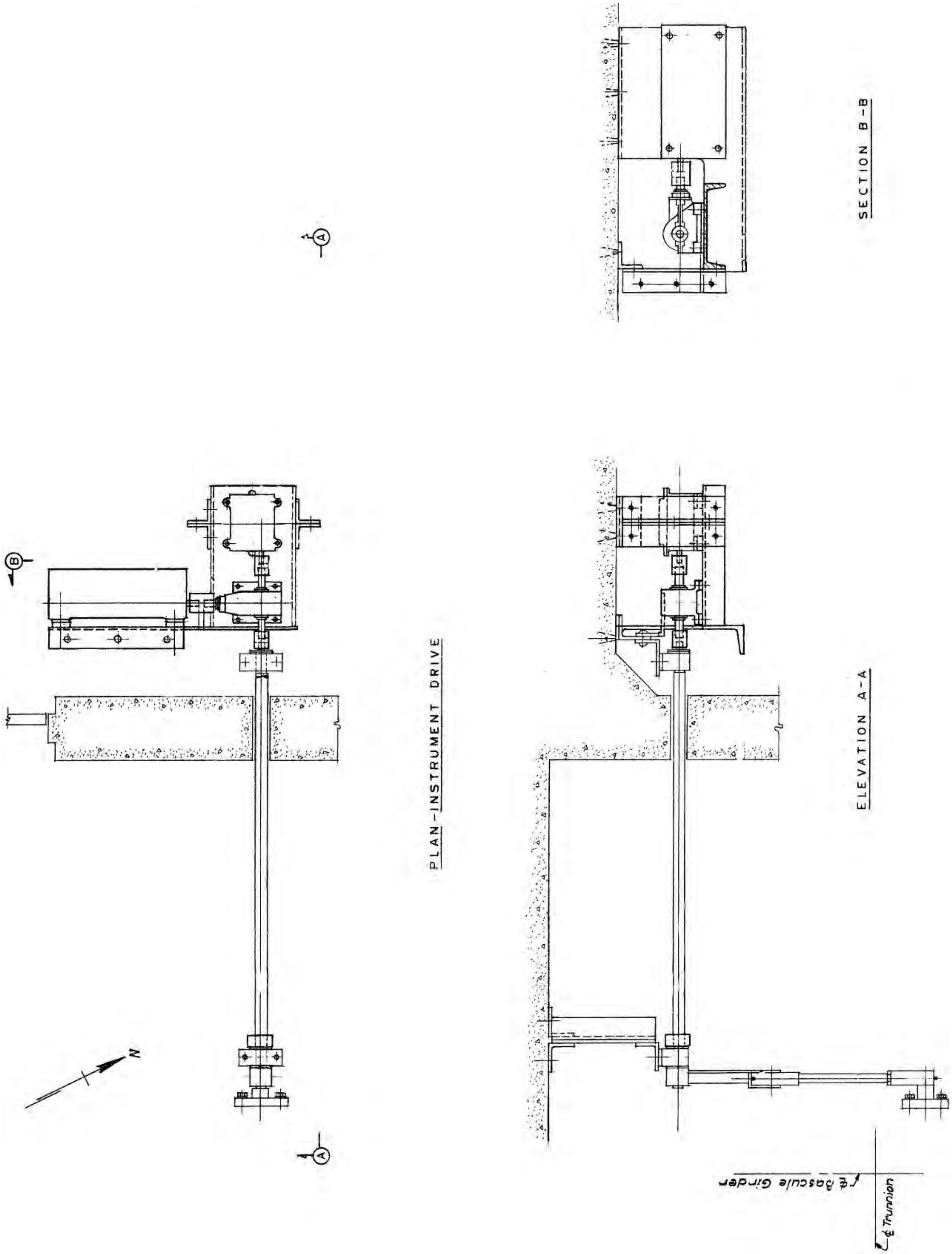


Figure 3, Instrument Drive Machinery

APPENDIX M-C
PROJECT SCOPE

Statewide Bridge Design Agreement 14962

Hampton – NH 1A Bridge over Hampton River

Electrical Upgrades/Repairs to Bridge Control Panel

Submitted by: HDR Engineering, Inc.
February 8, 2010

Hampton – NH 1A Bridge over Hampton River Scope of Work
Electrical Upgrades/Repairs to Bridge Control Panel
New Hampshire Department of Transportation

The goal of the project is to replace the existing slate board contactors with a Motor Control Center (MCC), relay cabinet, upgrade the control desk, replace warning bells, warning siren and traffic signals for the referenced structure. This will complete the electrical rehabilitation of this single leaf trunnion bascule bridge as all of the wiring and exterior devices were completed during prior contract work. In addition, obsolete span instruments and brakes will require replacement. No other mechanical work will be performed. The end product of this design work will be M&E contract drawings to allow NHDOT to contract the rehabilitation of the bridge electrical system. The existing motor drive wound rotor type will be reused. The motor speed will be controlled utilizing contactors and stepping resistors. In addition, a relay based bridge control system will be utilized.

Scope of Work:

1) Perform site survey to determine space and location for the new equipment.
2) Install a new MCC/bridge instrumentation.
3) Replace the control desk Top (The base will remain as will the control layout) with bridge controls consistent with existing bridge operation.
4) Replace the obsolete thruster brakes with new brakes.
5) Replace the span position (rotary cam LS, selsyn, etc.) with new equipment.
6) Replace the span seated limit switches with GE lever type switches.
7) Replace the span lock (pulled/driven) limit switches with GE lever type switches.
8) Identify asbestos items required for remediation (drum controller and brake shoes).
9) Prepare M&E construction documents, including special provisions.
10) Replace Warning bells and wiring, Lift Siren and wiring, and existing traffic signal heads, masts and wiring.
11) Review the conduit and wiring system on the lower bascule span platform, and provide recommendations on replacement.
12) Replace the floor mounted heater in the control room with a ceiling mounted heater.
13) Review the 2001 LBG/H&H Report and provide recommendations on additional equipment repairs.

During the site survey of the existing bridge equipment any conditions observed that could affect the future reliability of the structure will be identified as observed. Based upon this survey, the electrical design team will review the practical alternatives keeping in mind: system reliability, maintenance feasibility, operator capabilities, construction costs, project phasing and schedule. In addition any NEC and AASHTO code compliance issues will be identified and discussed (typically safety interlocks, and electrical equipment clearances). Based upon the field information obtained and mechanical and electrical calculations, HDR will provide NHDOT with an alternatives letter and detailed design criteria for review. This letter will identify all the issues our team identifies associated with the completion of the bridge electrical rehabilitation. HDR will visit NHDOT to review and discuss this letter and finalize the rehabilitation scope. Once the scope is finalized, we will determine the level of effort necessary to proceed to construction documents.

HDR will develop electrical and mechanical plans for the work as defined in the design criteria and scope documents. Plans will be prepared in accordance with NHDOT Cad standards. Specifications will be prepared in Microsoft Word format. Construction cost estimates will be prepared using an excel spread sheet. At the conclusion of the project HDR will submit to NHDOT all design documents including comments responses, calculations, plans, specification and construction cost estimates as a final package.

Deliverables:

1) Field inspection/design criteria/alternatives letter
2) Construction Documents (plans and specifications)
3) All calculations
4) Response to comments
5) Construction cost estimate

Assumptions:

1) It is our understanding that electronic plans are not available for the electrical system work performed in the past 7 years.
2) Existing electrical system plans including the existing relay schematics are available.
3) HDR does not intend to redraw original electrical plans.
4) NHDOT to provide cad standards and sample specifications.
5) HDR has assumed that a relay based control system will be utilized.
6) The existing standby generator is adequately sized, is in good working order and is adequate to operate the existing wound rotor motors
7) The submarine cable is in good condition and has sufficient conductors of the size and type required.
8) Work to be performed on a schedule to be negotiated with NH DOT after the final design criteria and scope of work has been determined.
9) The new bridge controls will replicate the existing system and will be upgraded as practical to meet current AASHTO and electrical code requirements. Where current code requirements can not be met, HDR will provide NHDOT with documentation discussing the reasons. NHDOT will have the final decision regarding code exceptions.
10) HDR is preparing the M&E contract documents only, bid tables, standard specifications, mpt, etc. by others.

11) Work associated with the Licensed Asbestos Abatement Contractor is not included in this scope of services and fee estimate. This work will be covered under the New Hampshire Department Bureau of Environmental and Occupational Health, Statewide Contract, only the items to be removed will be defined.

Construction Phase Services:

We have prepared a construction support section in the spreadsheet to address RFI's, Catalog cut reviews, Shop drawing reviews, Schematic reviews, participation in periodic conference calls on the project, one electrical shop test, addressing comments or questions during the bidding phase and attending 3 field meetings. These are outlined below and in the fee estimate:

Assumptions:

Response to RFI's – Assumed 10

Catalog cut reviews – Assume 20

Schematic drawing reviews – Assumed 12

Mechanical shop drawings – Assumed 4 drawings

Construction conference calls – Assumed 4 calls

Electrical shop test – Assumed 1 trip in New England

Bid Assistance and answer questions – Assumed 16 man-hours

Attend 3 Field meetings at Pre Construction, one interim meeting and I trip at start up.

These estimates are based on our recent experience with other projects in construction. These estimates can be adjusted as desired by the Department. We have included additional expenses into the fee estimate to perform this work.

Additional Scope Items, Maintenance Department:

Additional Scope Items that have been requested by maintenance have also been included in the revised fee estimate. A line item for each has been added for clarity:

- Relocation of the control cabinet:

Work to be performed includes the investigation of various alternatives and configurations for the relocation of the MCC/Control Panel Board. The fee estimate is based on the control desk (in the upper floor) will remain in the location it exists today. Work to be performed includes the evaluation of whether we can consolidate the electrical panel boards in the room into a new panel of sufficient size to clean up the final installation.

- Replace existing windows and screening/Repointing

  Work includes a one (1) day trip to the bridge for an architect and a one (1) plan sheet with call-outs and specifications. New windows will provide better visibility and possible energy savings. The granite blocks will be specified to be repointed as part of the control house rehabilitation.

- Conduit and wiring recommendations

  Work includes reviewing existing wiring and conduit for compatibility with the components being replaced. An additional drawing is anticipated.

- Control House heater relocation

  Work includes installation of a new heater over the stairway and removal of the existing heater on the floor.

- Control wiring and plans in Bascule pier

  Work includes examination of the wiring within the bascule pier for repairs. Two additional drawings anticipated to define work to the contractor.

- Traffic signal head and mast replacement

  Work includes installation of new traffic signal lights and wiring. These details will be shown on a sheet with the warning bell device details.

- Warning Bell Replacement

  Work includes replacement of the warning bells on the bridge.

- Siren replacement

  Work includes replacement of the siren on the bridge.

- Review of previous reports to determine if additional work should be performed as part of this rehabilitation.

  Work includes reviewing the previous documents and the conditions monitored in the field and providing recommendations to the Department. No additional work is anticipated or included into the drawing preparation package.

Appendix I:
Load Rating Summaries
(38’ Superstructure Replacement)

East Approach Girder Rating Summary

	Inventory	Operating	Loc (ft)
Shear			
Span 1	0.29	0.37	0.00
Span 2	0.50	0.65	94.00
Span 3	0.29	0.37	94.00
Moment			
Span 1	0.16	0.21	94.00
Span 2	0.15	0.19	94.00
Span 3	0.15	0.19	0.00
Flange Stress (Svc II)			
Span 1	0.54	0.70	94.00
Span 2	0.53	0.68	94.00
Span 3	0.53	0.68	0.00
Summary	0.15	0.19	

West Approach Girder Rating Summary

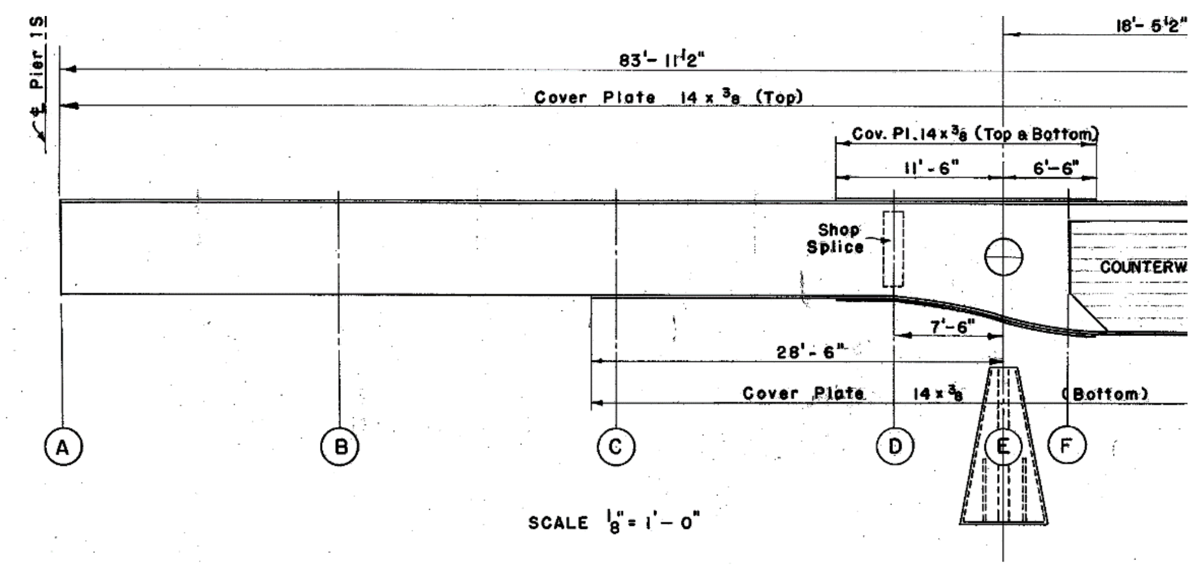
	Inventory	Operating	Loc (ft)
Shear			
Span 1	0.61	0.79	0.00
Span 2	0.95	1.23	94.00
Span 3	0.61	0.80	94.00
Moment			
Span 1	0.52	0.68	94.00
Span 2	0.51	0.66	94.00
Span 3	0.51	0.66	0.00
Flange Stress (Svc II)			
Span 1	1.05	1.36	94.00
Span 2	1.02	1.33	47.00
Span 3	1.04	1.35	0.00
Summary	0.51	0.66	

East Bascule Girder Rating Summary

	Inventory	Operating	Loc (ft) *
Shear	< 0.0	< 0.0	Section E
Moment	< 0.0	< 0.0	Section D
Summary	0.00	0.00	Multiple

West Bascule Girder Rating Summary

	Inventory	Operating	Loc (ft) *
Shear	< 0.0	< 0.0	Section E
Moment	< 0.0	< 0.0	Section D
Summary	0.00	0.00	Multiple



* See above graphic for section locations

APPENDIX J:

Pedestrian and Bicycle Turning Counts

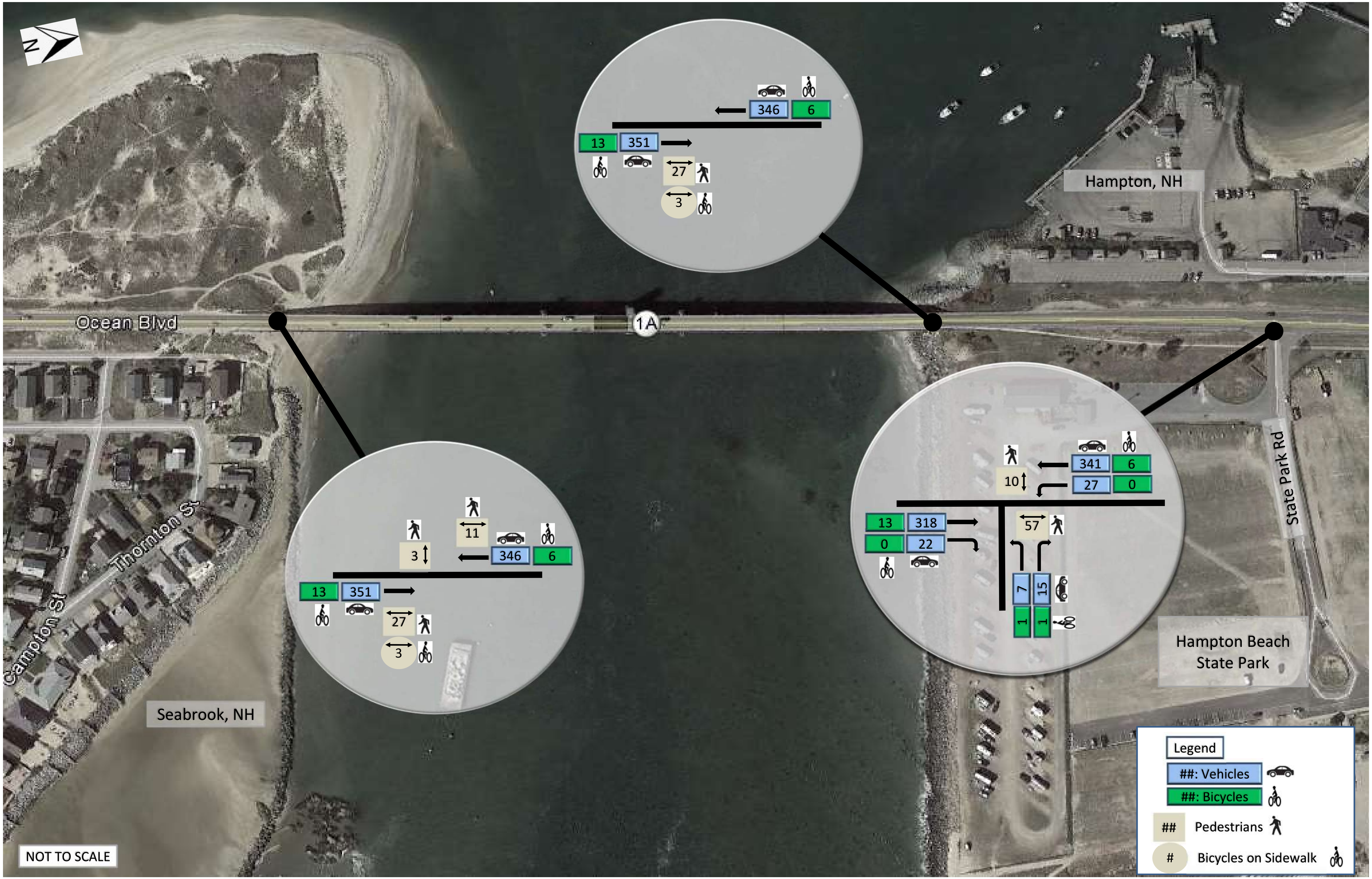


Figure 1
Seabrook-Hampton, NH
8/10/2018

2018 Existing Weekday Morning (6:00 AM-10:00 AM)
Turning Movement Counts

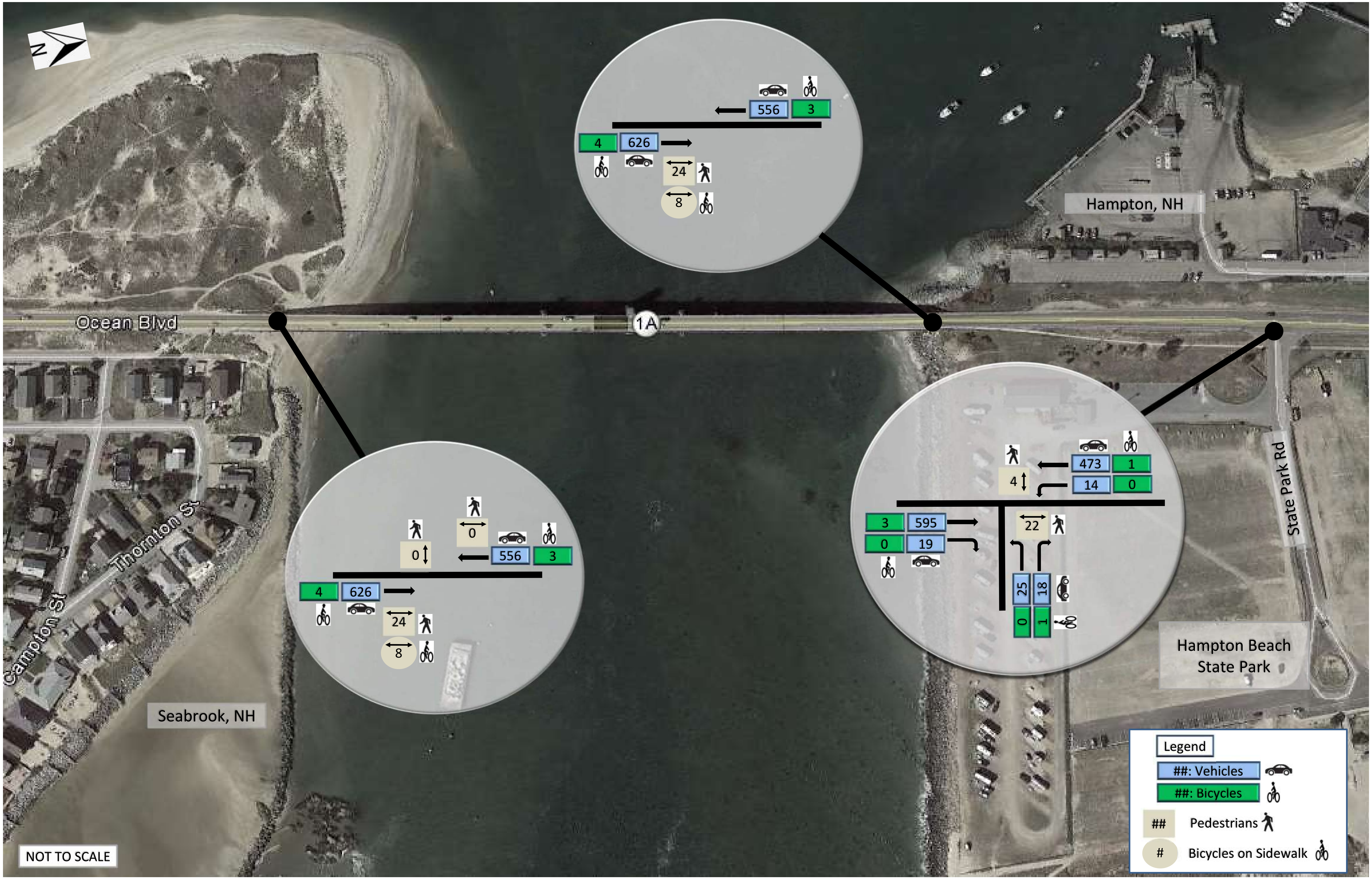


Figure 2
Seabrook-Hampton, NH
8/10/2018

2018 Existing Weekday Afternoon (3:00 PM-7:00 PM)
Turning Movement Counts

Figure 3
Seabrook-Hampton, NH
8/10/2018

2018 Existing Weekend Morning (6:15 AM-10:00 AM)
Turning Movement Counts

HDR

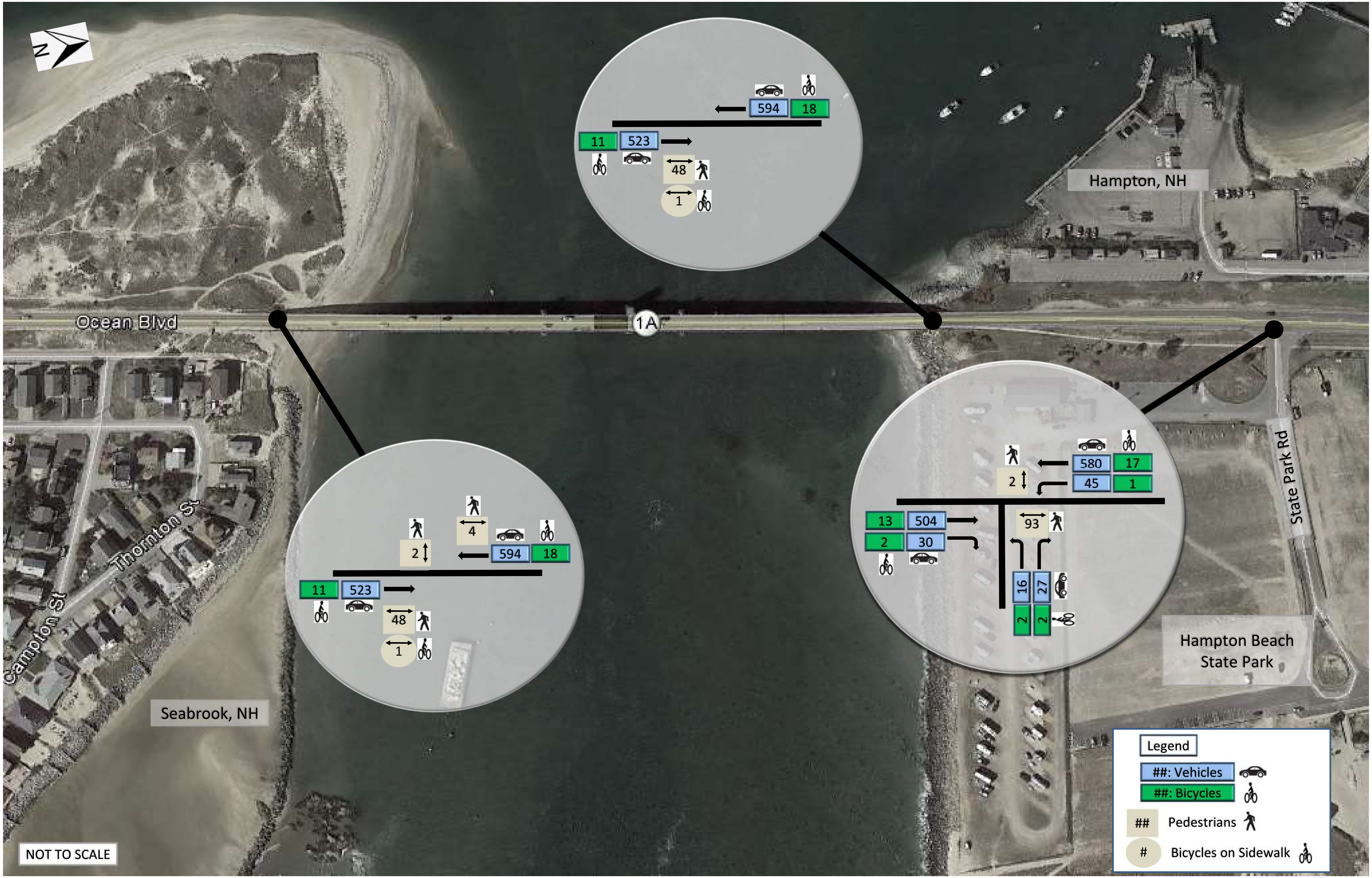


Figure 4

Seabrook-Hampton, NH

8/10/2018

2018 Existing Weekend Mid-Day (10:00 AM-2:00 PM)

Turning Movement Counts

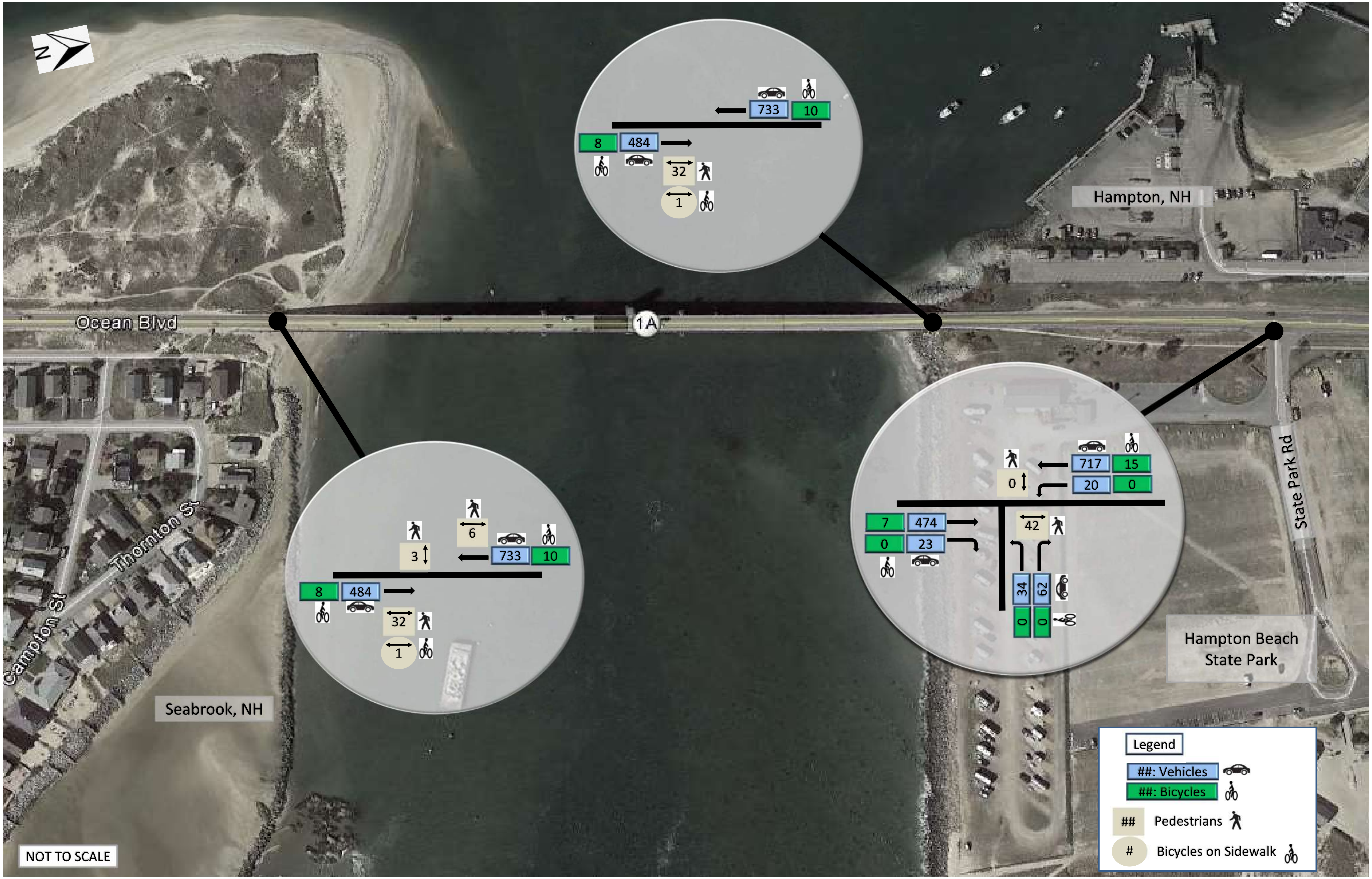


Figure 5
Seabrook-Hampton, NH
8/10/2018

2018 Existing Weekend Afternoon (2:00 PM-5:00 PM)
Turning Movement Counts