Footbridge Reconstruction Workshop #2

Town of Boothbay Harbor, ME

July 12, 2018

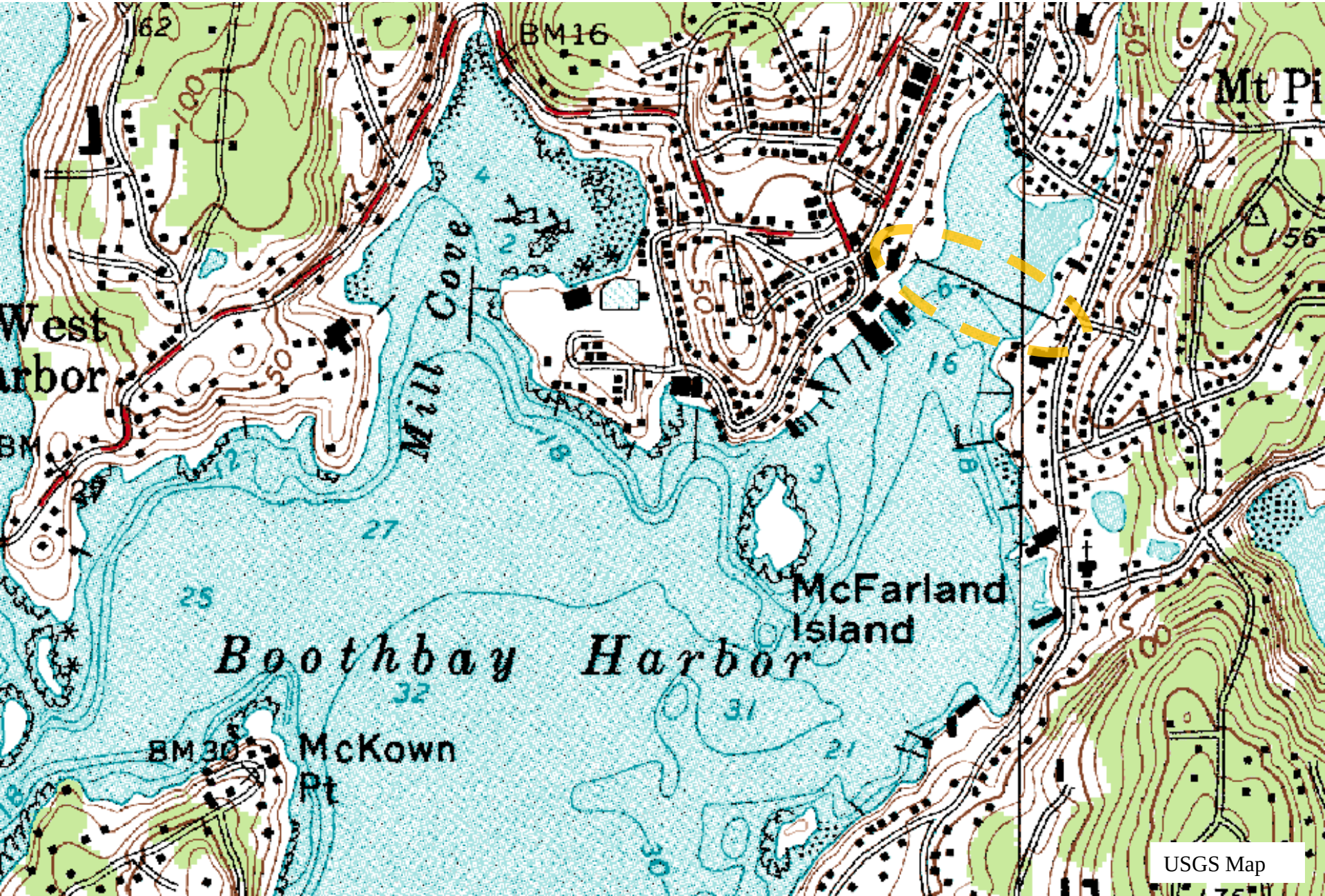
BAKER DESIGN CONSULTANTS
Civil, Marine, & Structural Engineering

tjd&a

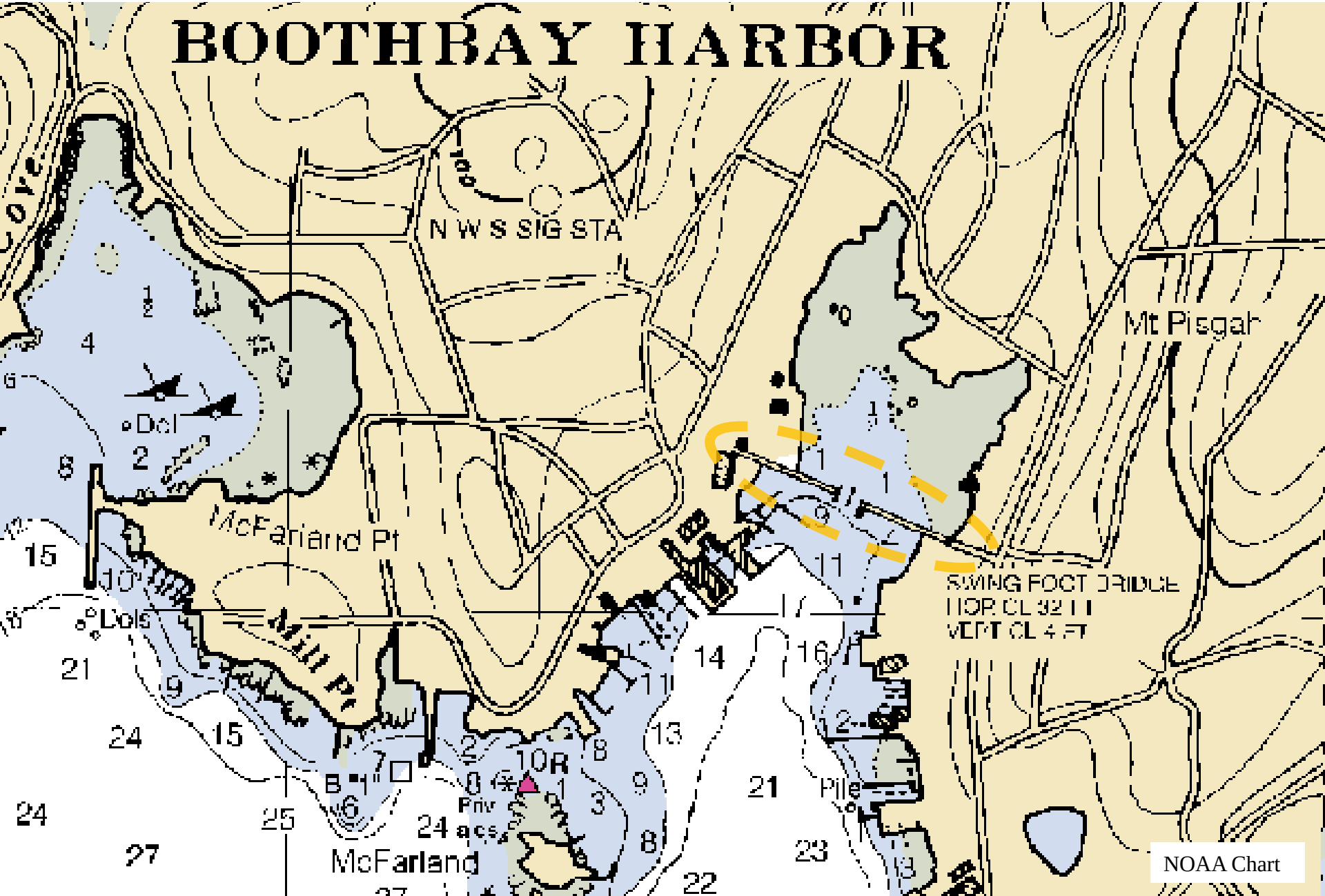
Presentation Outline

1. Project Location and Overview
2. Footbridge History
3. Existing Conditions
4. Project Purpose and Need
5. Reconstruction Options
   A. Key design parameters and input received to date
   B. Present Conceptual Designs
6. Next Steps
7. Feedback

1. Project Location and Overview



1. Project Location and Overview



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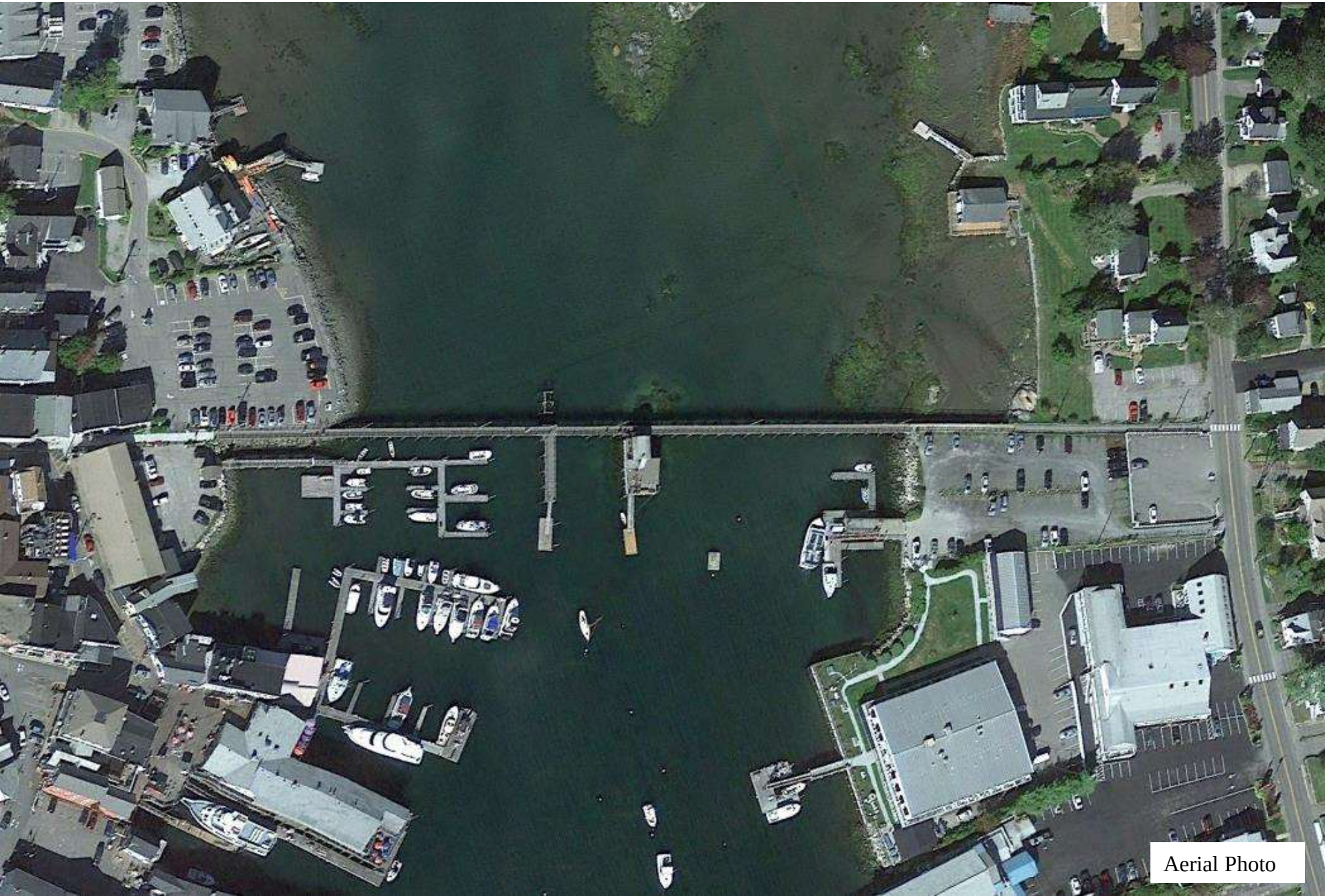


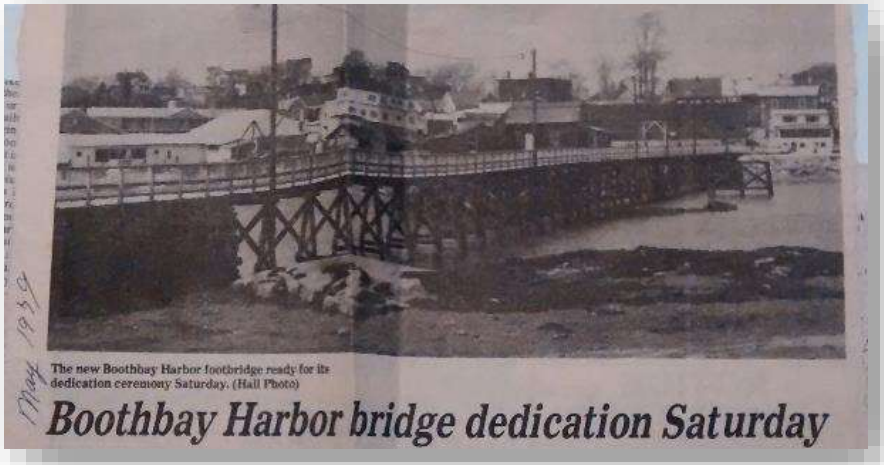
Aerial Photo

2. Footbridge History

- **1901** Original bridge constructed by Luther Maddocks at a cost of $1,500. Bridge originally had a hand-operated swing span to allow large vessels to reach head of harbor.
- **Winter 1917-1918** bridge damaged by icing and repaired
- **1928** bridge damaged by icing and repaired
- Originally 1,000-ft long, the bridge was at some point shortened by 300-ft by filling at ends. Parking Lots created at each end (currently Town Lot and Squirrel Island Lot)
- **1978-1979** Complete reconstruction of bridge completed by Mace Carter at a cost of $135,000.
- **2017** Pile bracing and swing span repair


Region Scenes Of The Past

EXACT DATE this photo was taken is not known, but it is believed to have been 1917, one of the years the harbor froze over. This picture was submitted for use in the Register by Mrs. Ethel Fowler of the Bridge House Studio in Boothbay Harbor.


The new Boothbay Harbor footbridge ready for its dedication ceremony Saturday. (Hall Photo)

Boothbay Harbor bridge dedication Saturday

3. Existing Conditions

3. Existing Conditions

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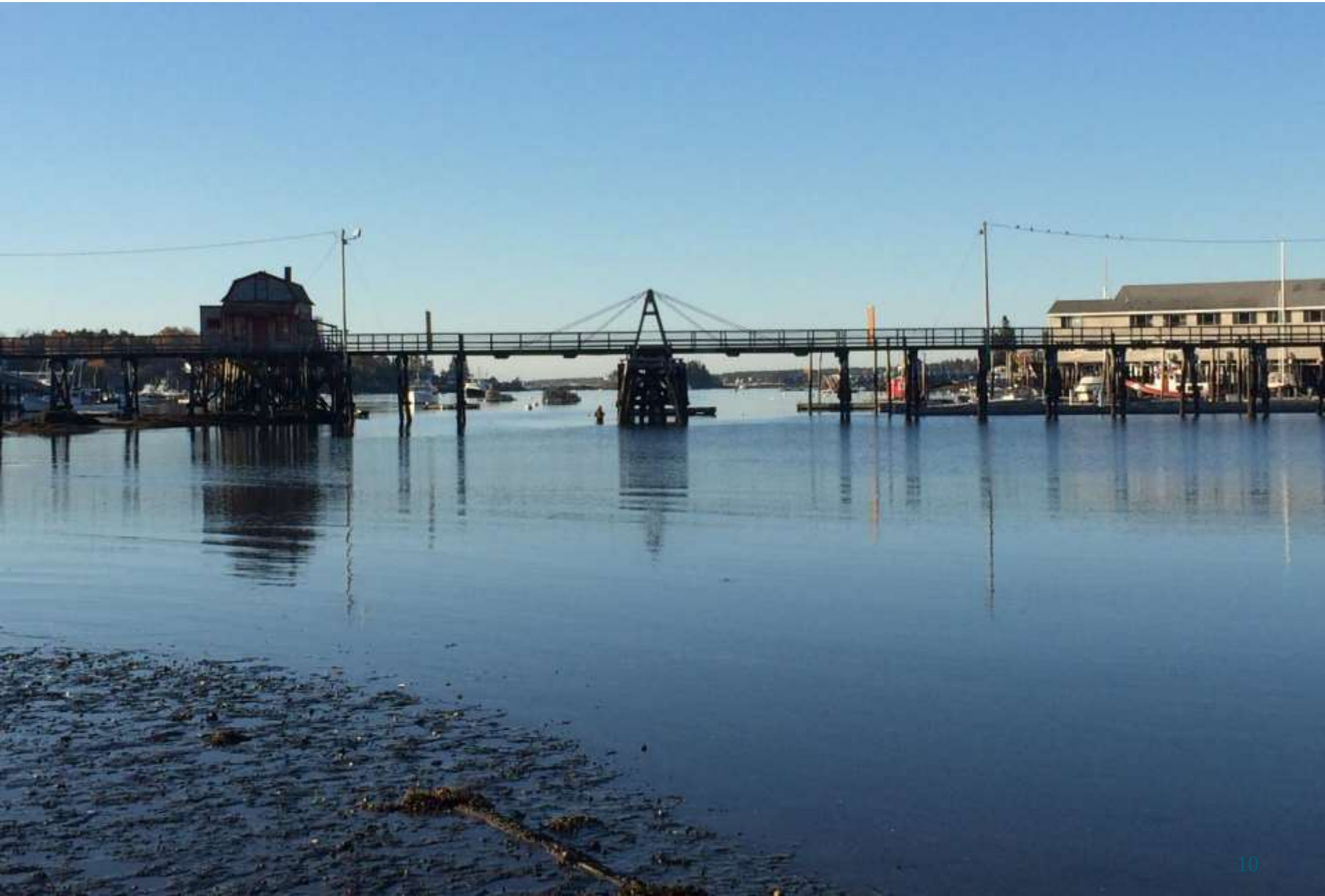

3. Existing Conditions

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4. Project Purpose and Need

- The Footbridge is an important piece of the Town of Boothbay Harbor's Infrastructure
  - Transportation
    - Access across harbor
    - Access to Town dock
    - Access to private property
  - Destination
    - Public access to the harbor for scenic viewing
  - Part of the character of Boothbay Harbor
- ***Why reconstruct the footbridge?***

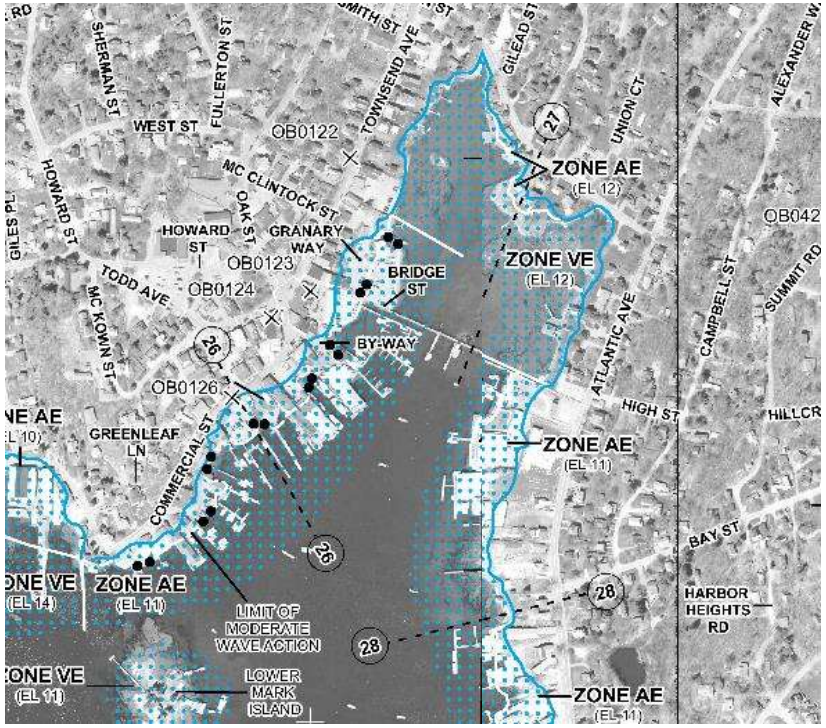
4. Project Purpose and Need

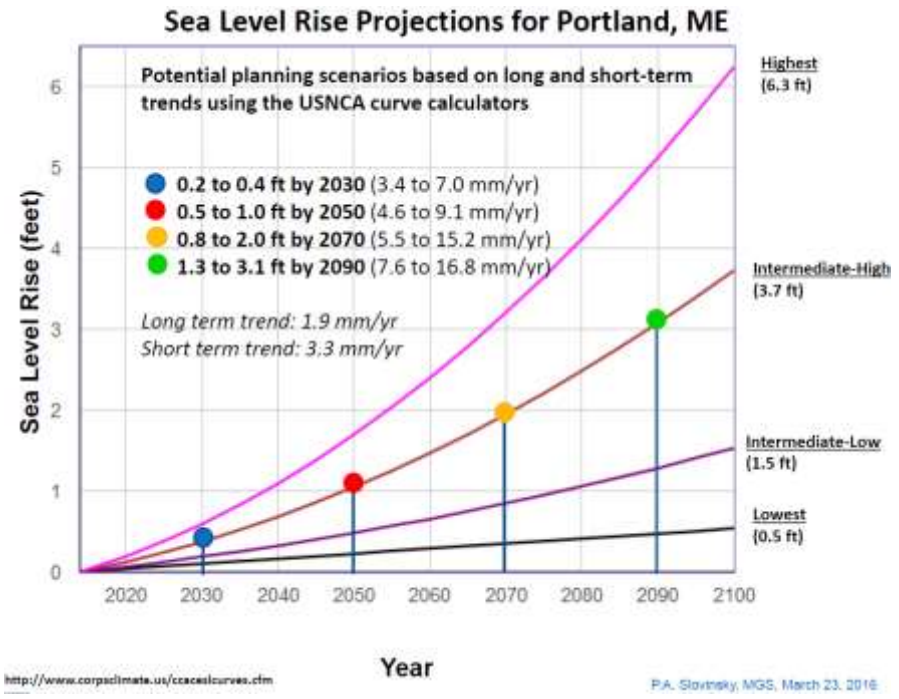
1. **Existing Structure built in 1978-1979**
   - Currently over 39 years old
   - This represents a significant portion of the expected service life of a timber structure in a coastal environment
   - *Investments should consider long-term economics and feasibility*
2. **Swing Span**
   - USCG classifies the Footbridge as a movable bridge
   - Not functional in recent history
   - Per USCG, Town is responsible for opening the bridge if need arises
   - *Operation of movable bridge should be restored or the Town should work with USCG to change the bridge classification*
3. **Structural Capacity**
   - Code requirement for pedestrian live load is 90-100 psf
   - Superstructure rated at 50 psf live load capacity
   - *The superstructure must be capable of supporting code-required live loading*

4. Project Purpose and Need

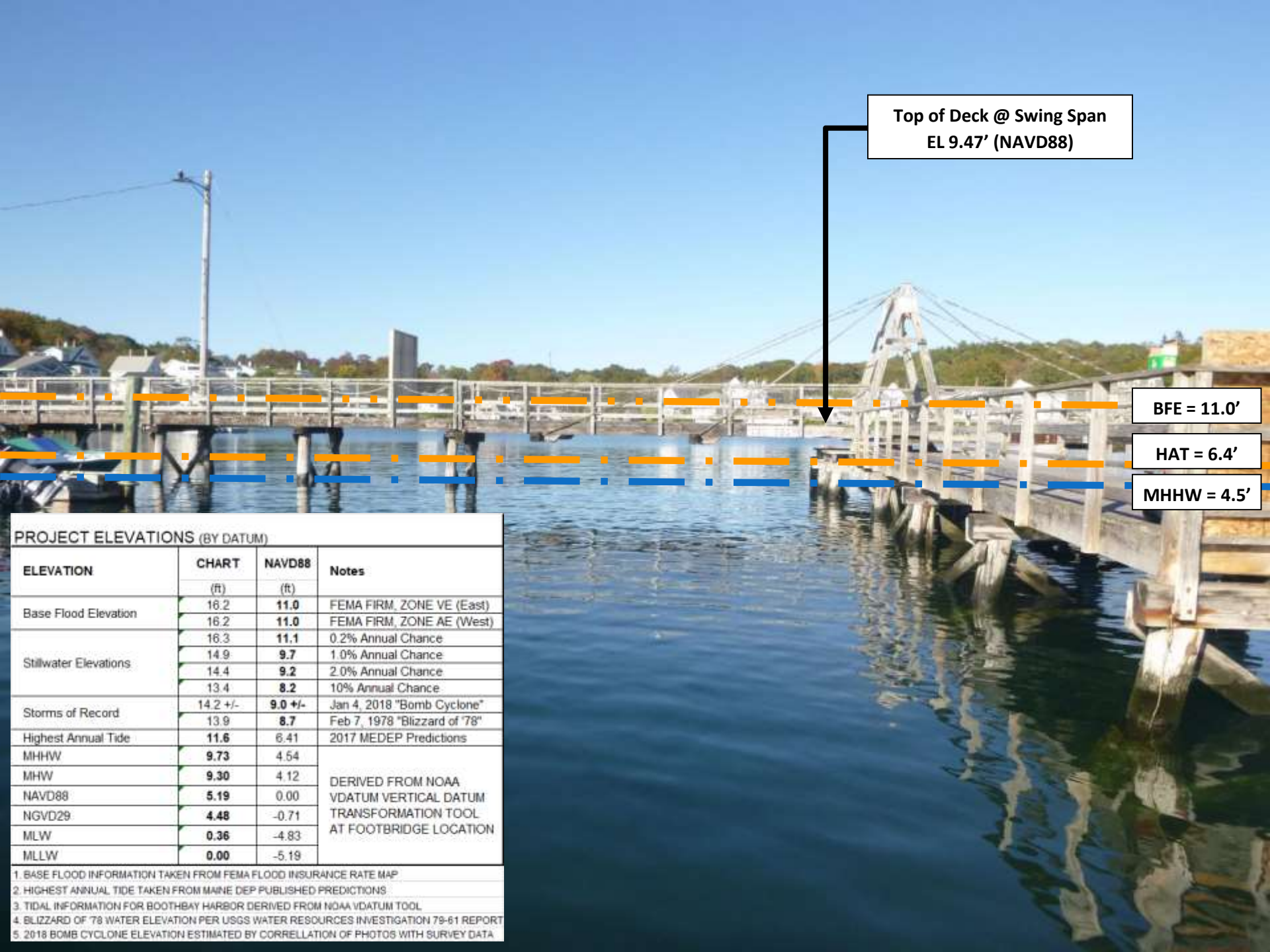
4. Flood Hazard Issues

- Structure is very low in relation to tidal and flood elevations
- Top of Deck ranges from **8.2**' NAVD88 to **9.5**' NAVD88
- Base Flood Elevation (BFE) = **11.0**' NAVD88
- Highest Annual Tide (HAT) = **6.4**' NAVD88 (Maine DEP 2017 Predictions)
- <u>These values do not account for Sea Level Rise</u>





Sea Level Rise Projections from USACE per MGS 2016 Study



PROJECT ELEVATIONS (BY DATUM)

ELEVATION	CHART (ft)	NAVD88 (ft)	Notes
Base Flood Elevation	16.2	**11.0**	FEMA FIRM, ZONE VE (East)
	16.2	**11.0**	FEMA FIRM, ZONE AE (West)
Stillwater Elevations	16.3	**11.1**	0.2% Annual Chance
	14.9	**9.7**	1.0% Annual Chance
	14.4	**9.2**	2.0% Annual Chance
	13.4	**8.2**	10% Annual Chance
Storms of Record	14.2 +/-	**9.0 +/-**	Jan 4, 2018 "Bomb Cyclone"
	13.9	**8.7**	Feb 7, 1978 "Blizzard of '78"
Highest Annual Tide	**11.6**	6.41	2017 MEDEP Predictions
MHHW	**9.73**	4.54	DERIVED FROM NOAA VDATUM VERTICAL DATUM TRANSFORMATION TOOL AT FOOTBRIDGE LOCATION
MHW	**9.30**	4.12	
NAVD88	**5.19**	0.00	
NGVD29	**4.48**	-0.71	
MLW	**0.36**	-4.83	
MLLW	**0.00**	-5.19	

1. BASE FLOOD INFORMATION TAKEN FROM FEMA FLOOD INSURANCE RATE MAP
2. HIGHEST ANNUAL TIDE TAKEN FROM MAINE DEP PUBLISHED PREDICTIONS
3. TIDAL INFORMATION FOR BOOTHBAY HARBOR DERIVED FROM NOAA VDATUM TOOL
4. BLIZZARD OF '78 WATER ELEVATION PER USGS WATER RESOURCES INVESTIGATION 79-61 REPORT
5. 2018 BOMB CYCLONE ELEVATION ESTIMATED BY CORRELLATION OF PHOTOS WITH SURVEY DATA

February 11, 2016 High Tide
(Photo: LCPRC)

February 11, 2016 High Tide
(Photo: LCPRC)

November 16, 2016 High Tide (Photo: LCPRC)

November 16, 2016 High Tide (Photo: LCPRC)

January 4, 2018
(Photo: Tom Woodin)

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4. Project Purpose and Need

4. Flood Hazard Issues

- Structure is at significant risk of damage during flood events
- Opportunities: Elevate, Resist (Wet Floodproof), Combination
- Regulatory Requirements

Town of Boothbay Harbor
Flood plain Management Ordinance

§170-92 Development Standards

M. Bridges. New construction or substantial improvement of any bridge in Zones A, AE and VE shall be designed such that:

(1) When possible, the lowest horizontal member (excluding the pilings, or columns) is elevated to at least one foot above the base flood elevation; and

(2) A registered professional engineer shall certify that:

(a) The structural design and methods of construction shall meet the elevation requirements of this section and the floodway standards of § **170-92K**; and

(b) The foundation and superstructure attached thereto are designed to resist flotation, collapse and lateral movement due to the effects of wind and water loads acting simultaneously on all structural components. Water loading values used shall be those associated with the base flood.

O. Wharves, piers and docks. New construction or substantial improvement of wharves, piers, and docks are permitted in Zones A, AE, and VE, in and over water and seaward of the mean high tide, if the following requirements are met:

(1) Wharves, piers, and docks shall comply with all applicable local, state, and federal regulations; and

(2) For commercial wharves, piers, and docks, a registered professional engineer shall develop or review the structural design, specifications, and plans for the construction.

Full compliance with the Floodplain Management Ordinance requires the Top of Deck Elevation to be increased by **4.5'** at the Swing Span.

4. Project Purpose and Need

5. **Code Compliance Issues**
   - ADA (stairs to wharf, deck surface irregularities)
   - Handrails (insufficient structural capacity)
6. **Utilities**
   - Water, sewer, electric
   - Swing span mechanism subject to flooding

4. Project Purpose and Need

Conclusion:

The most feasible solution is a
<u>Replacement</u> of the existing footbridge

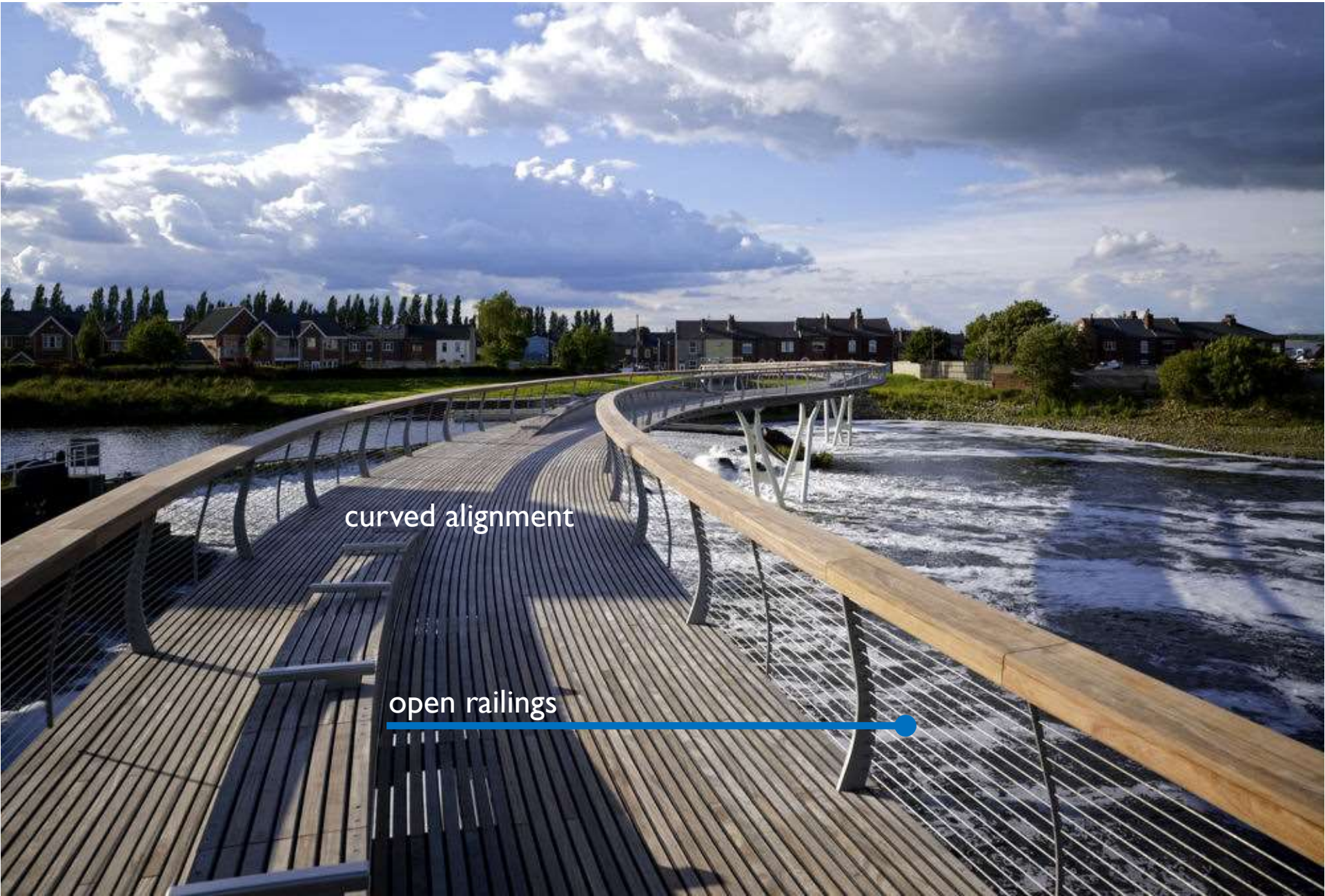
5. Reconstruction Options

- Design Parameters
  - General
    - Structural and Code Requirements
    - Uses and users
    - Navigational Needs
    - Historic Considerations
  - Geometric
    - Structure Location and Horizontal Alignment
    - Vertical Alignment/Elevation/Gradients
    - Width
  - Structure Type
    - Type and Materials
    - Inclusion of a movable span
  - Features
    - Lighting
    - Railings
    - Utilities
    - Aesthetics
    - Incorporation with Town dock and other adjacent facilities/improvements
    - Site improvements/overlooks/landings

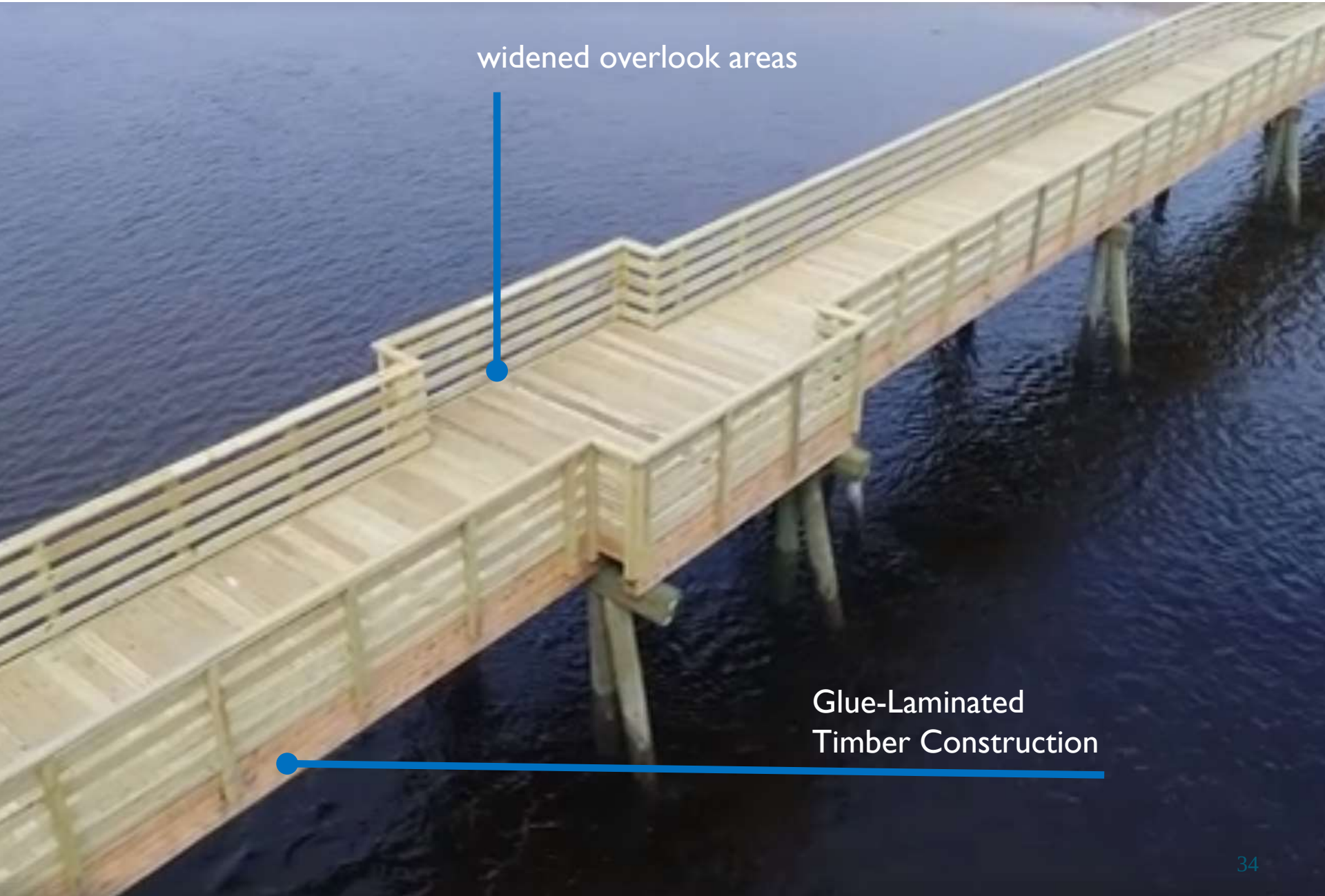
Design Precedents

Design Precedents

Design Precedents



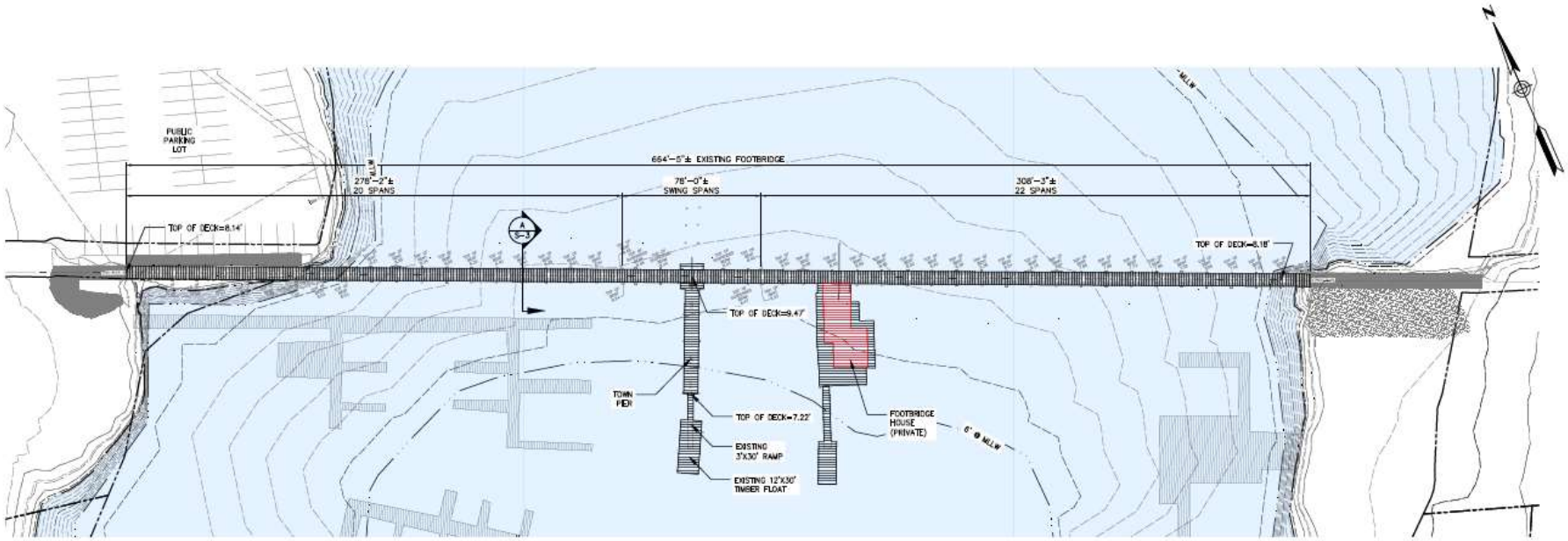
Design Precedents



Landings

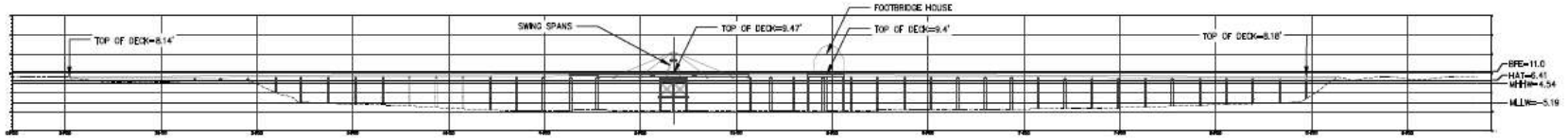

Access to water
Curved alignment
Improved
Landscape
feature

Existing Bridge



PLAN

0 15 30 45 90



PROFILE

0 15 30 45 90

LEGEND

- BUILDING
- PAVEMENT
- UTILITY POLE AND ANCHOR
- CONTOURS - MAJOR
- CONTOURS - MINOR
- PARCELS - MEGIS
- EXISTING BRIDGE AND PIERS

NOT FOR CONSTRUCTION

PRELIMINARY FOR REVIEW ONLY

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Civil, Marine, and Structural Engineering
7 Spruce Road • Freeport • Maine • 04032 • 207-865-1124 • info@bakerdesignconsultants.com

NO.	SUBMISSION	DATE	INT
4	PRELIMINARY REVIEW	4/27/18	DJB

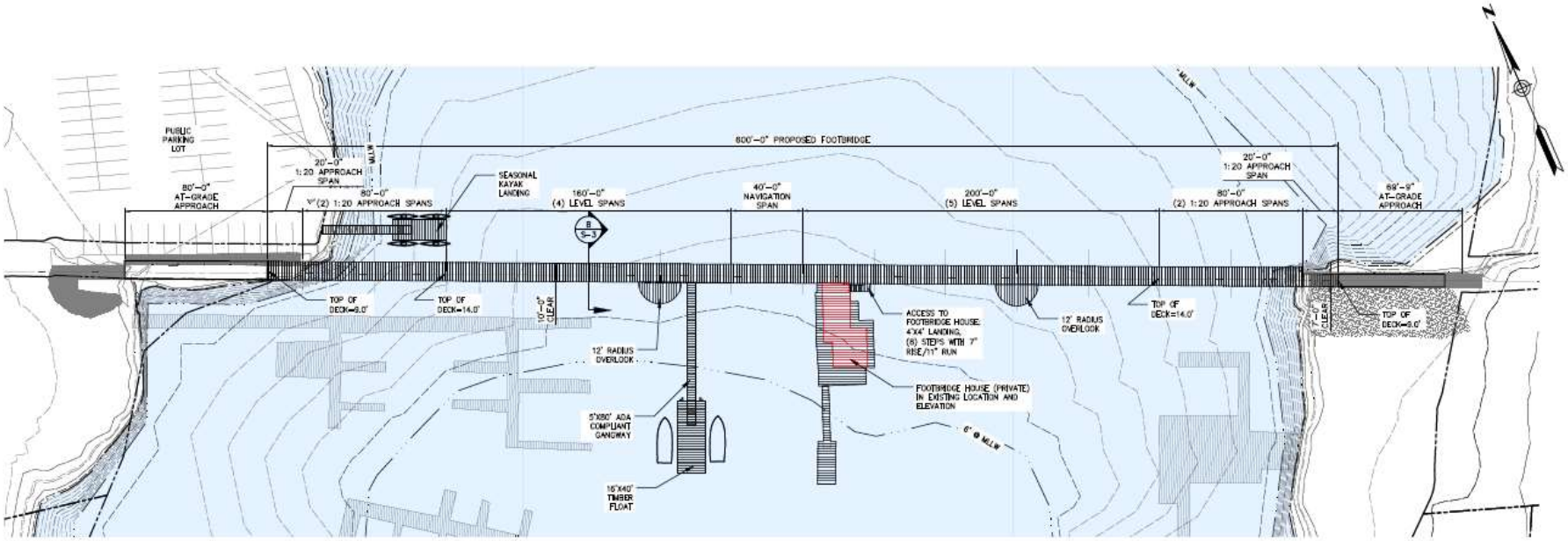
DESIGNED BY: DJB
DRAWN BY: DJB
CHECKED BY: BJB
SCALE: AS SHOWN

SHEET TITLE: BRIDGE PLAN & PROFILE EXISTING STRUCTURE

PROJECT: FOOTBRIDGE RECONSTRUCTION
TOWN OF SOUTHWEST HARBOR, MAINE

DATE: SEPT 2017
CONTRACT NO.: 16-80
SHEET NO.: S-1e
REV.: A

Concept Option 1



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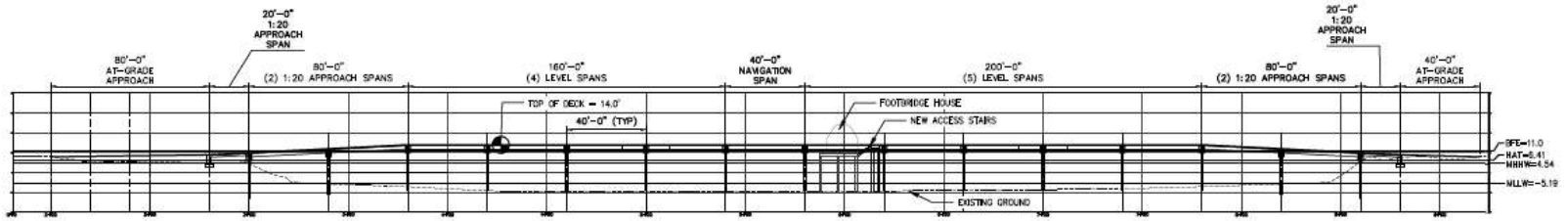

PROFILE

0 15 30 45 90

LEGEND

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SCALE: AS SHOWN

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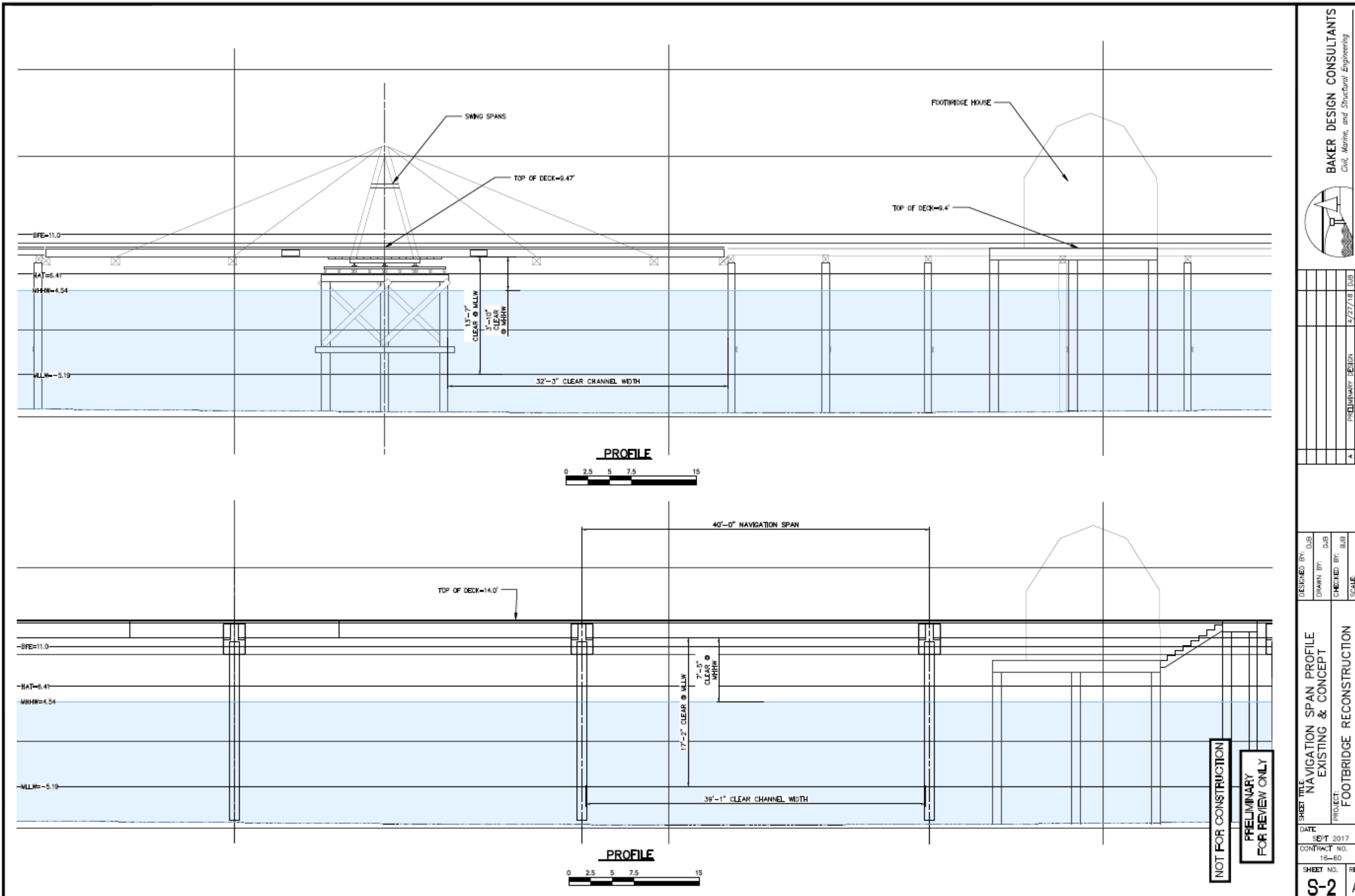
PROJECT: FOOTBRIDGE RECONSTRUCTION
TOWN OF SOUTHWEST HARBOR, MAINE

DATE: SEPT 2017
CONTRACT NO.: 16-60
SHEET NO.: S-1a
REV.: A


SWING SPANS
TOP OF DECK=9.47'
FOOTBRIDGE HOUSE
TOP OF DECK=9.4'
BFE=11.0
HAT=6.41
MHHW=4.54
MLLW=-5.19
13'-7" CLEAR @ MLLW
3'-10" CLEAR @ MHHW
32'-3" CLEAR CHANNEL WIDTH
PROFILE
0 2.5 5 7.5 15
40'-0" NAVIGATION SPAN
TOP OF DECK=14.0'
BFE=11.0
HAT=6.41
MHHW=4.54
MLLW=-5.19
7'-5" CLEAR @ MHHW
17'-2" CLEAR @ MLLW
39'-1" CLEAR CHANNEL WIDTH
PROFILE
0 2.5 5 7.5 15
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A PRELIMINARY DESIGN SUBMISSION 4/27/18 DJB
NO. DATE INT.
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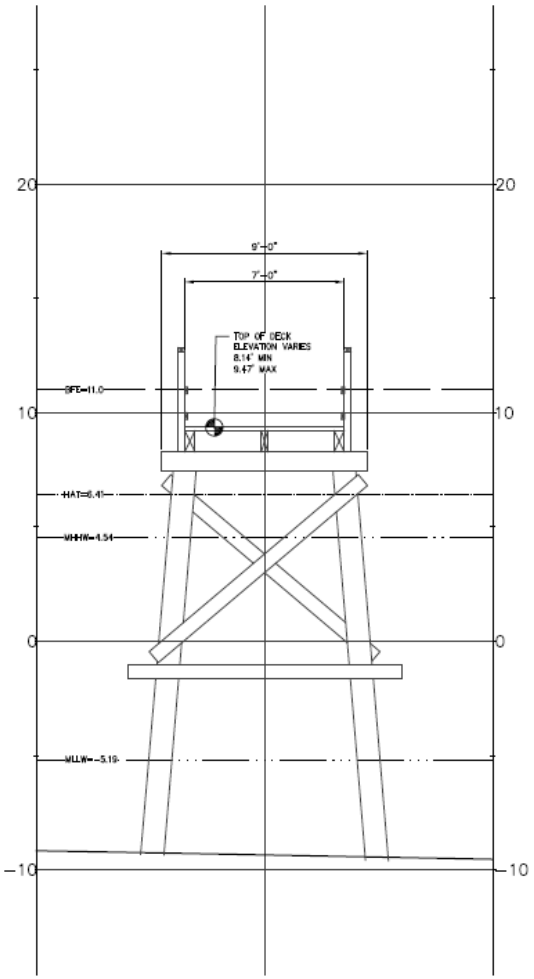
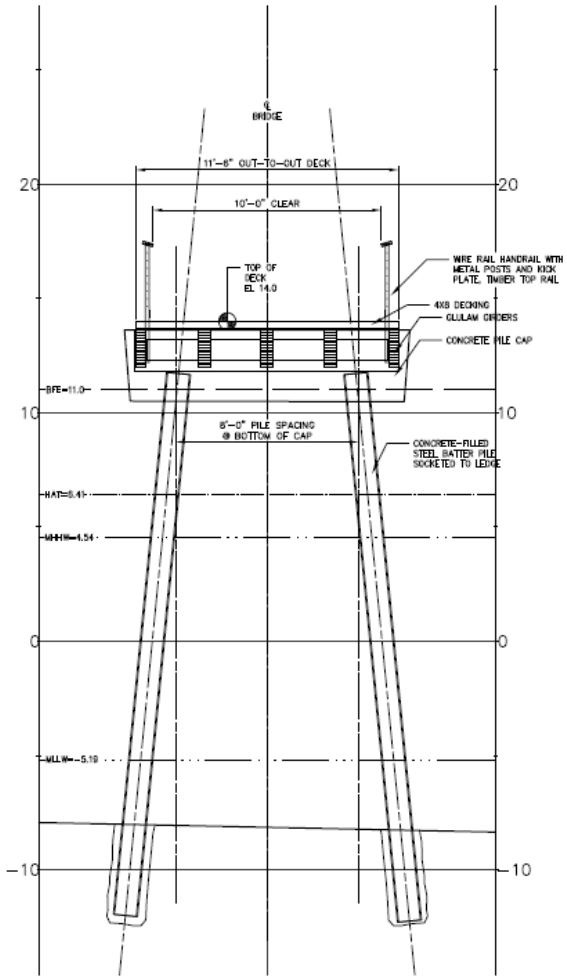
DRAWN BY: DJB
CHECKED BY: BJB
SCALE: AS SHOWN
SHEET TITLE: NAVIGATION SPAN PROFILE EXISTING & CONCEPT
PROJECT: FOOTBRIDGE RECONSTRUCTION
TOWN OF BOOTHBAY HARBOR, MAINE
DATE SEPT 2017
CONTRACT NO. 16-60
SHEET NO. S-2
REV. A



EXISTING BRIDGE SECTION



PROPOSED BRIDGE SECTION

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SHEET TITLE: TYPICAL BRIDGE SECTIONS

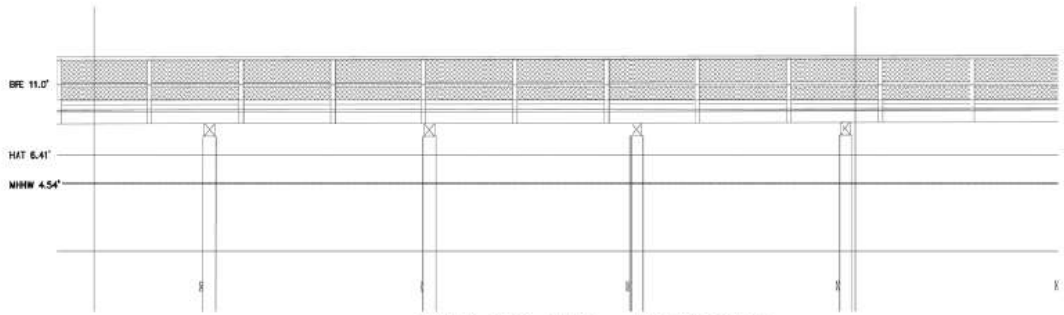
PROJECT: FOOTBRIDGE RECONSTRUCTION
TOWN OF BOOTHBAY HARBOR, MAINE

DATE: SEPT 2017

CONTRACT NO. 16-50

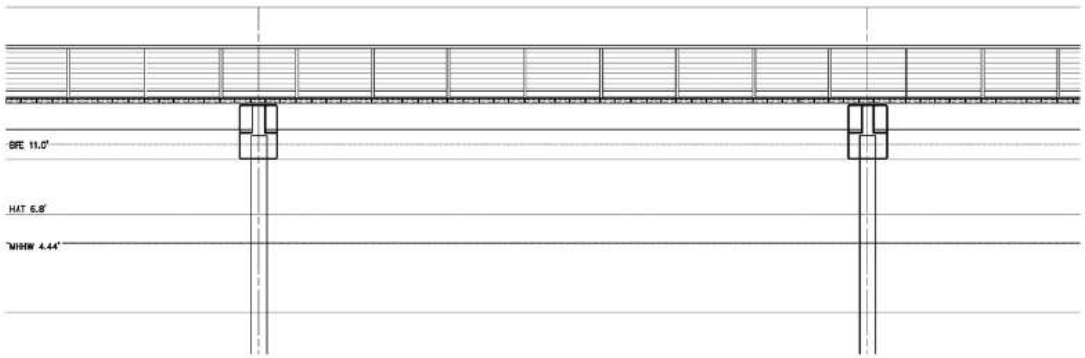
SHEET NO. S-3

REV. A



TYPICAL SPAN DETAIL – EXISTING BRIDGE

0 3 6 9 12 24



TYPICAL SPAN DETAIL

0 3 6 9 12 24

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SHEET TITLE: TYPICAL BRIDGE ELEVATIONS

PROJECT: FOOTBRIDGE RECONSTRUCTION
TOWN OF SOUTHWEST HARBOR, MAINE

DATE: SEPT 2017

CONTRACT NO.: 16-6C

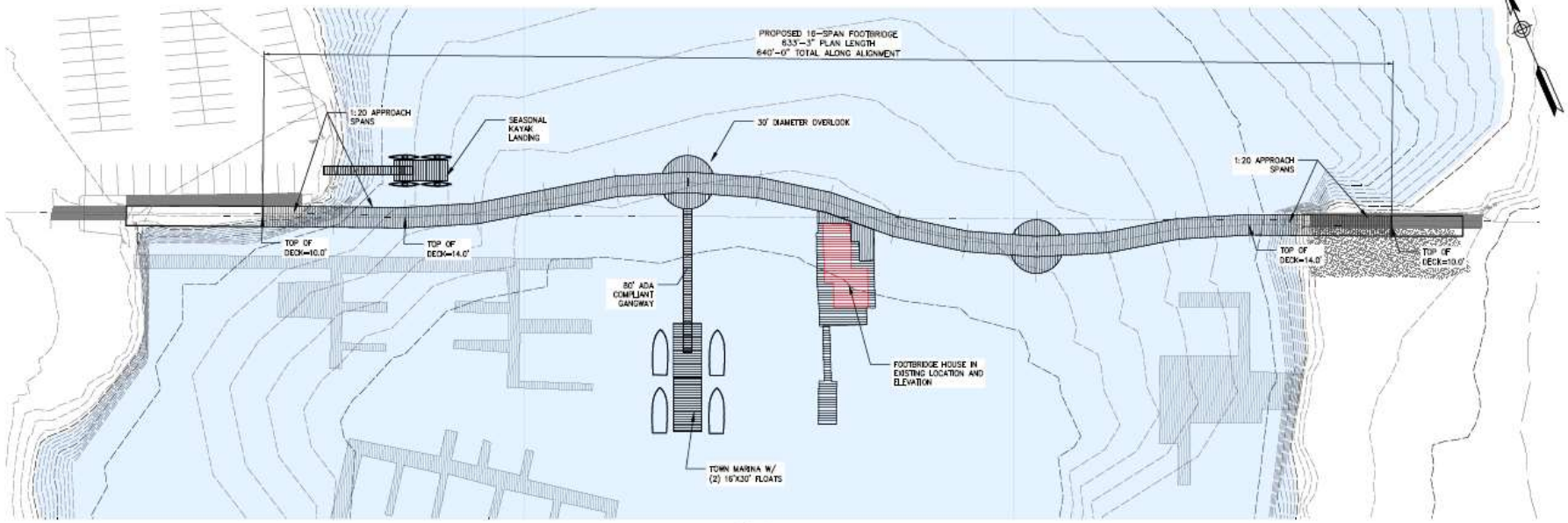
SHEET NO.: S-4

REV.: A


Existing


Concept Option 1

Concept Option 2



PLAN

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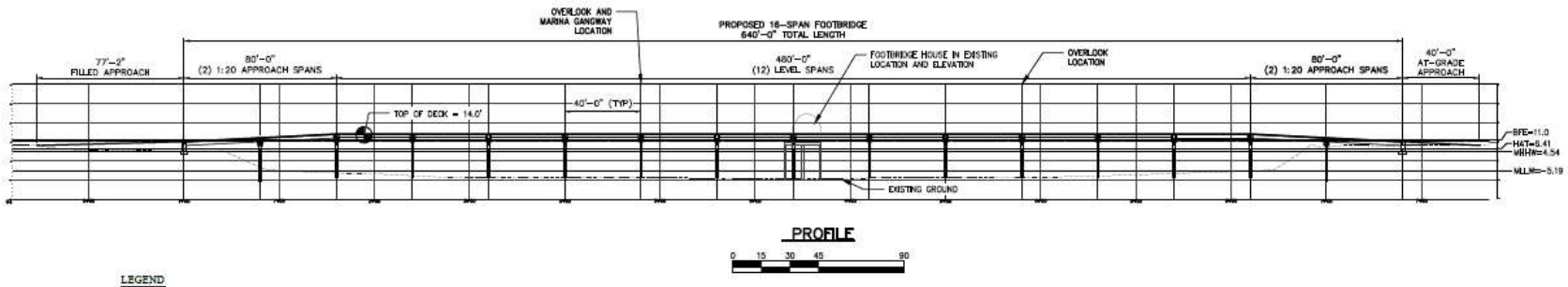

PROFILE

0 15 30 45 90

LEGEND

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4	REVIEW	5/14/18	DJB

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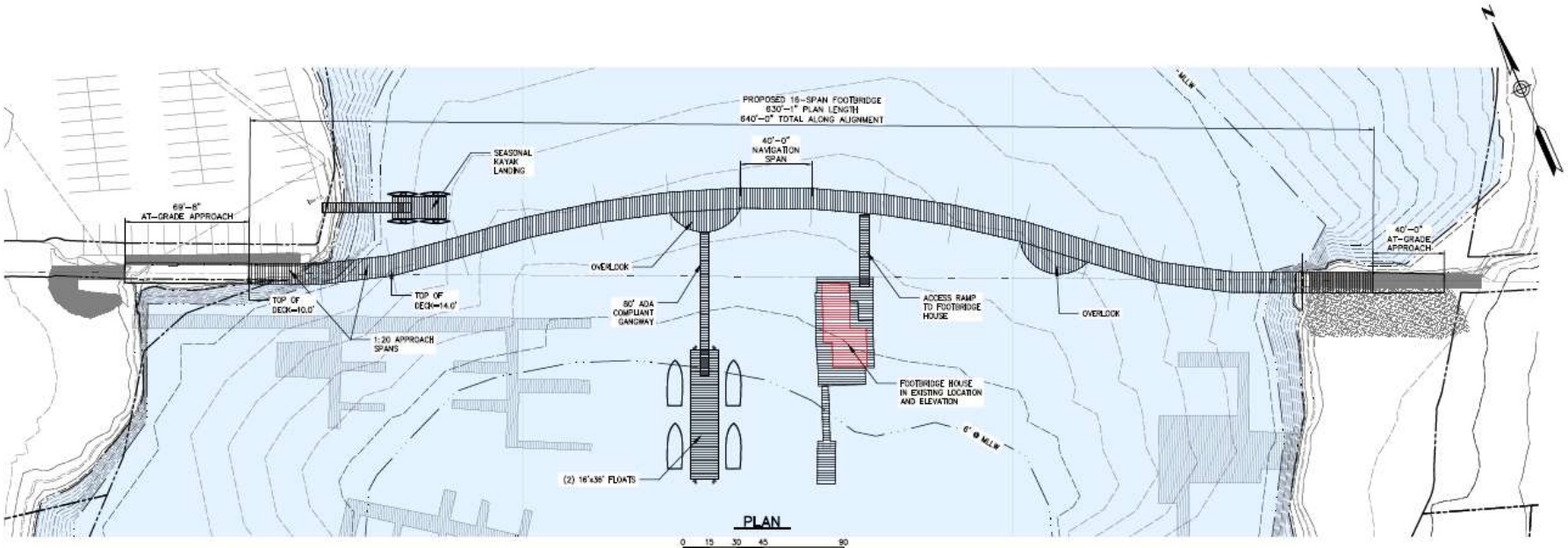
PROJECT: FOOTBRIDGE RECONSTRUCTION
TOWN OF SOUTHWEST HARBOR, MAINE

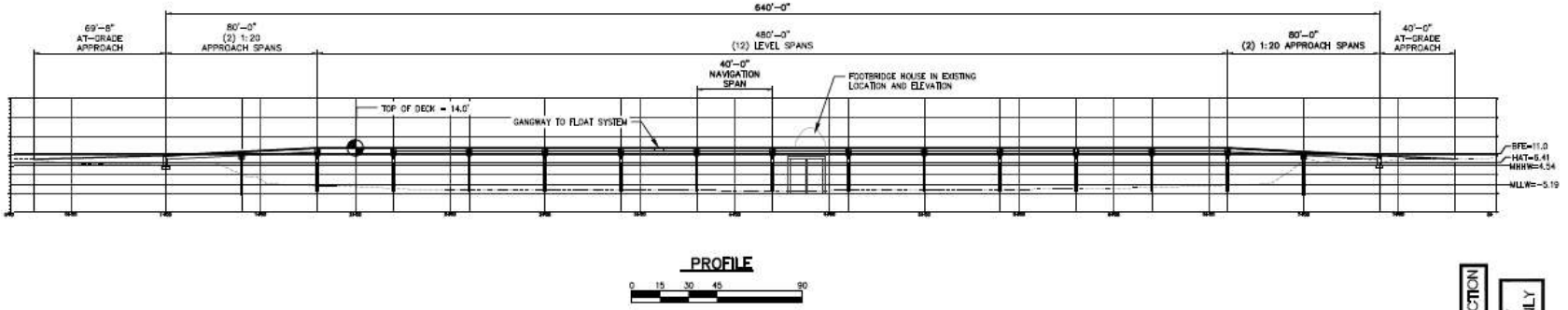
DATE: SEPT 2017
CONTRACT NO.: 16-60
SHEET NO.: S-1c
REV.: A

Existing

Concept Option 2

Concept Option 3





LEGEND

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NO.	SUBMISSION	DATE	INT
4	PRELIMINARY REVIEW	5/21/18	DJB

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SCALE: AS SHOWN

SHEET TITLE: BRIDGE PLAN & PROFILE ALTERNATIVE D
PROJECT: FOOTBRIDGE RECONSTRUCTION
TOWN OF SOUTHERN HARBOR, MAINE

DATE: SEPT 2017
CONTRACT NO. 16-60
SHEET NO. S-1d
REV. A


Existing


Concept Option 3

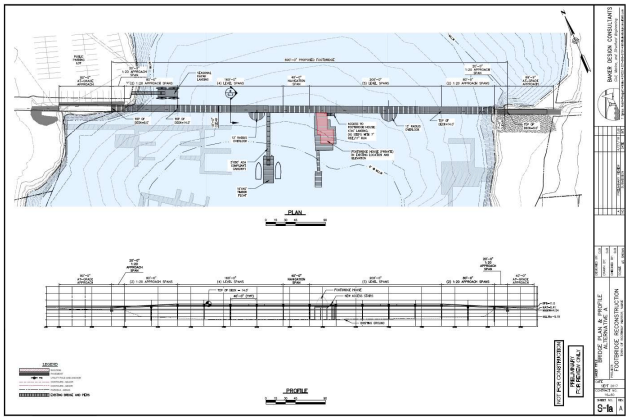
6. Timeline and Next Steps

- Workshop #2
  - Present preliminary design concepts
  - Gather input on preferred concept and design details
- Prepare Preliminary Design Report
- Permitting and Final Design pending acceptance of Preliminary Design
- Maine DOT funding for a portion of the project is programmed for 2020
- Additional funding pending

7. Feedback

- Some key items to consider:
  - Preferred concept
  - Navigation span requirements
  - Bridge aesthetics and material preferences
  - Overlook and Town Dock design
  - Any other items we should be aware of

Concept Option 1



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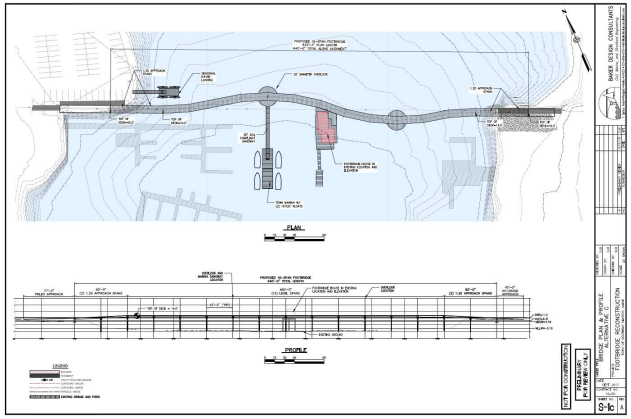
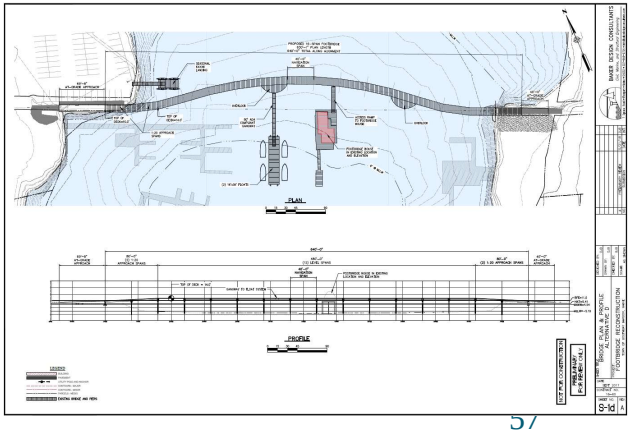


Concept Option 3



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Town of Boothbay Harbor, Maine

July 12, 2018

Questions, contact:

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