ALTUS ENGINEERING

Civil
Site Planning
Environmental
Engineering

133 Court Street
Portsmouth, NH
03801-4413

July 30, 2025

Peter Britz, Planning and Sustainability Director
City of Portsmouth Municipal Complex
1 Junkins Avenue
Portsmouth, New Hampshire 03801

Re: Application for Conditional Use Permit
Assessor's Map 207, Lot 13
60 Pleasant Point Drive
Altus Project No. 5138
LU 23-180

HARD COPY HAND DELIVERED
DIGITAL COPY UPLOADED TO VIEWPOINT

Dear Peter,

On behalf of Michelle and John Morris and 120-0 Wild Rose Lane, LLC, Altus Engineering and the Morris's design team respectfully submits a Conditional Use Permit Application for consideration at the August 13th Conservation Commission meeting and the August 21, 2025 Planning Board meeting.

The application is for shoreline stabilization work. The proposed improvements approved by NHDES revise and supersede the application package that was approved by the Planning Board on December 21, 2023.

Based on directives and suggestions by City Staff, we are utilizing the existing Land Use Application (LU 23-180). No changes to the building, access drive, or stormwater management elements are proposed from the previous approval. The application materials focus exclusively on the shoreline stabilization.

Enclosed for the Commission's and Planning Board's consideration, please find the following:

- Existing Conditions Survey by North Easterly Surveying, February 9, 2024
- Conditional Use Permit Plan (Altus) November 28, 2023
- Amended Site Plan (Altus) dated April 24, 2025
- Demolition Plan (Altus) November 28, 2023
- Wetlands Conditional Use Permit Checklist
- NHDES Wetlands Bureau Permit Approval dated November 4, 2024
- Matthew Cunningham Restoration Planting Plan, July 2, 2024
- TFM Conditional Use Permit Application materials
- Shoreline As-Built Sketch (Easterly) dated July 25, 2025

- July 30, 2025 letter and exhibits from HPGR, PA

The Morris' and the design team look forward to working with the City to resolve the technical issues and allow the John and Michelle to construct their new home. Please feel free to call or email me directly should you have any questions or need any additional information.

Sincerely,

ALTUS ENGINEERING, LLC

Enclosure

eCopy: Michelle and John Morris
R. Timothy Phoenix, Esq.
Roy Tilsey, Esq.
Jay Aube, TFM
Ben Auger, Auger Building Company
Portsmouth Conservation Commission

wde/5138.00 cup cvr ltr.docx

ZONING DATA PER CITY OF PORTSMOUTH ZONING ORDINANCE (LAST AMENDED DECEMBER 16, 2019):

ZONE: Single Residence B (SRB)

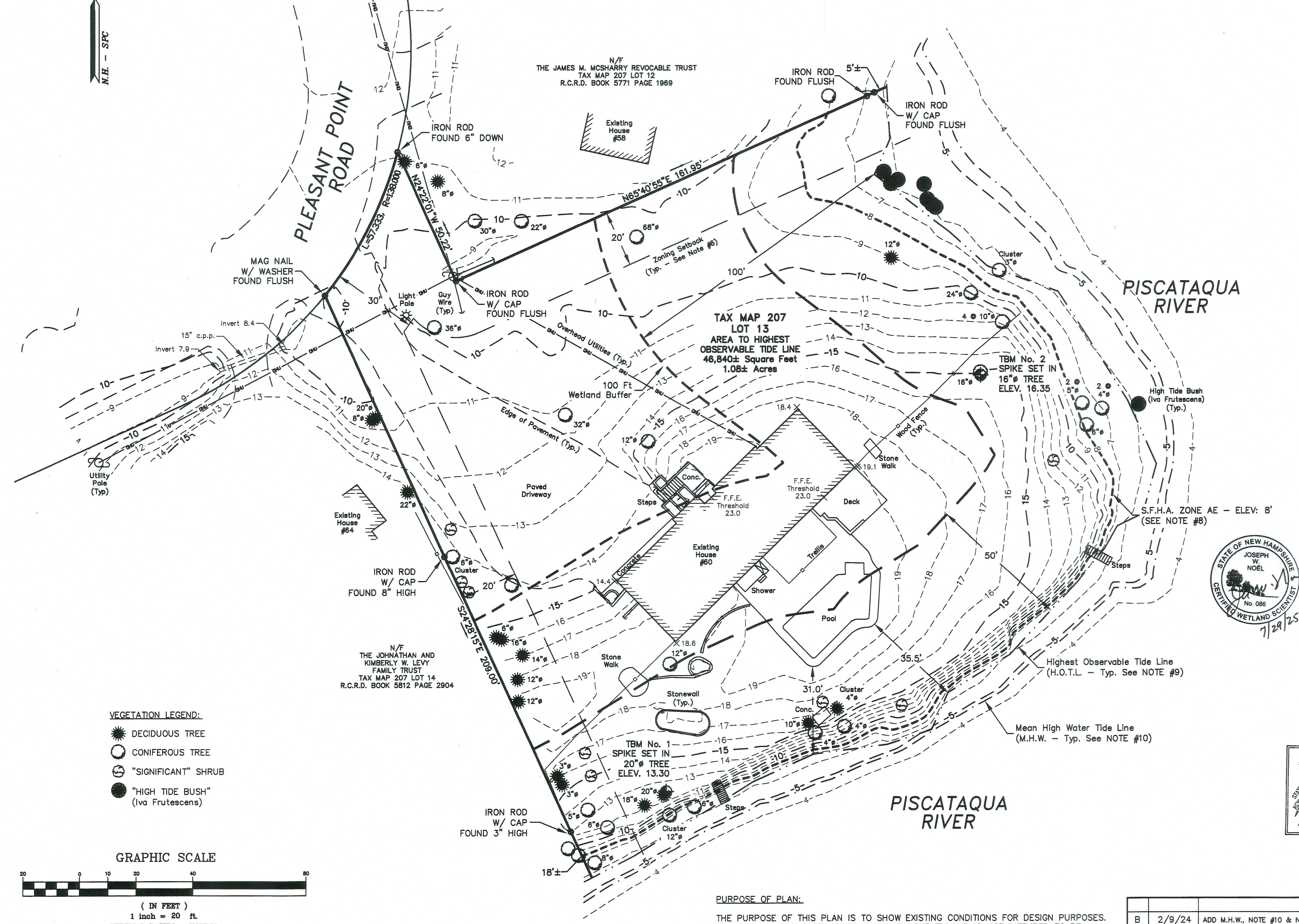
REQUIREMENTS:*
- MINIMUM LOT AREA: 15,000 Square Feet
- MINIMUM STREET FRONTAGE: 100 Ft
- MINIMUM LOT DEPTH: 100 Ft
- MINIMUM FRONT SETBACK: 30 Ft
- MINIMUM SIDE SETBACK: 20 Ft
- MINIMUM REAR SETBACK: 40 Ft
- MAXIMUM BUILDING HEIGHT: SLOPED ROOF: 35 Ft
- MAXIMUM BUILDING COVERAGE: 20%
- MINIMUM OPEN SPACE: 40%

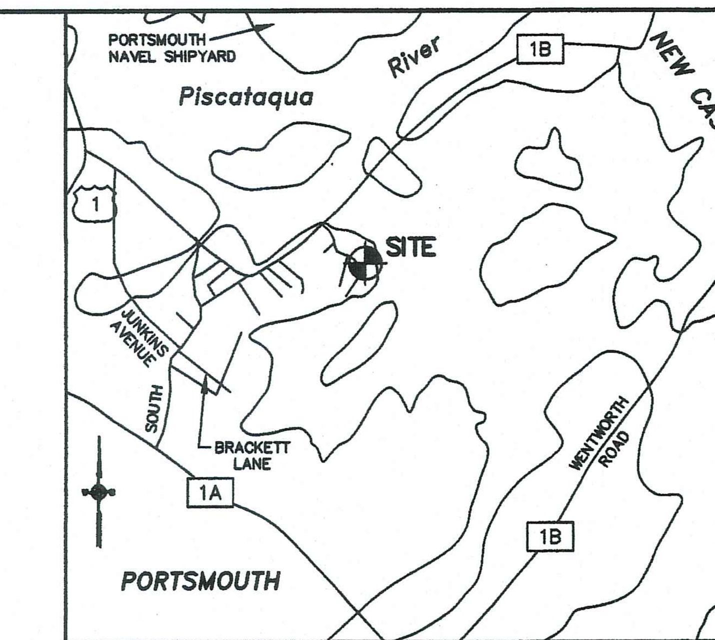
BUILDING COVERAGE CALCULATION:

TOTAL LOT AREA TO H.O.T.:	46,840± SQ. FT.
HOUSE:	2,621 SQ. FT.
BUILDING COVERAGE:	5.6%

OPEN SPACE CALCULATION:

TOTAL LOT AREA TO H.O.T.:	46,840± SQ. FT.
DRIVEWAY:	4,910± SQ. FT.
HOUSE:	2,621± SQ. FT.
PATIO/POOL:	1,707± SQ. FT.
DECK:	309± SQ. FT.
CONCRETE/MISC.:	182± SQ. FT.
STEPS:	172± SQ. FT.
RETAINING WALLS:	114± SQ. FT.
TOTAL COVERAGE:	10,015 SQ. FT.
OPEN SPACE:	36,825± SQ. FT. (78.6%)





LOCATION MAP
(not to scale)

PLAN REFERENCES:

1. "EXISTING CONDITIONS PLAN PLEASANT POINT DRIVE ASSESOR'S PARCEL 207–014 PORTSMOUTH, NEW HAMPSHIRE FOR OWNERS JOAN S. WALDRON KIMBERLY WALDRON LEVY", PREPARED BY JAMES VERRA AND ASSOCIATES, INC., DATED JULY 11, 2005.

2. "PLAN OF LOTS NEW CASTLE AVENUE PORTSMOUTH, N.H. FOR ROBERT A. MOEBUS & HENRY C. SIVIK", PREPARED BY JOHN W. DURGIN CIVIL ENGINEERS, DATED OCTOBER 1952, AND RECORDED AT THE R.C.R.D. AS PLAN No. 02160–B.

3. "LAND IN PORTSMOUTH, N.H. ROBERT A. MOEBUS TO HENRY C. SIVIK AND HENRY C. SIVIK TO ROBERT A. MOEBUS", PREPARED BY JOHN W. DURGIN CIVIL ENGINEERS, DATED JUNE 1951, REVISED DECEMBER 1953.

NOTES:

1. OWNERS OF RECORD:
   TAX MAP 207 LOT 13
   120–0 WILD ROSE, LLC
   R.C.R.D. BOOK 6174 PAGE 1450
   DATED OCTOBER 5, 2020

2. TOTAL EXISTING PARCEL AREA:
   TAX MAP 207 LOT 13
   1.08± Acres To H.O.T.L.

3. BASIS OF BEARING IS NEW HAMPSHIRE SPC. VERTICAL DATUM IS NGVD29.

4. APPROXIMATE ABUTTER'S LINES SHOWN HEREON ARE FOR REFERENCE PURPOSES ONLY AND SHALL NOT BE RELIED UPON AS BOUNDARY INFORMATION.

5. EASEMENTS OR OTHER UNWRITTEN RIGHTS MAY EXIST THAT ENCUMBER OR BENEFIT THE PROPERTY NOT SHOWN HEREON.

6. ZONING INFORMATION AND SETBACKS SHOWN HEREON ARE FOR REFERENCE PURPOSES. CONFIRM CURRENT ZONING REQUIREMENTS WITH THE CITY OF PORTSMOUTH PRIOR TO DESIGN OR CONSTRUCTION.

7. THE BOUNDARY SHOWN HEREON IS DETERMINED FROM WRITTEN RECORDS, FIELD EVIDENCE AND PAROL TESTIMONY RECOVERED AT THE TIME OF SURVEY AND MAY BE SUBJECT TO CHANGE IF OTHER EVIDENCE BECOMES AVAILABLE.

8. A PORTION OF THE LOCUS PARCEL FALLS WITHIN SPECIAL FLOOD HAZARD AREA AE, WITH A BASE FLOOD ELEVATION OF 8 FT. PER FEMA FIRM MAP No. 33015C0278F, REVISED JANUARY 29, 2021.

9. THE HIGHEST OBSERVABLE TIDE LINE (H.O.T.L.) OF THE PISCATAQUA RIVER, WHICH CORRESPONDS WITH THE COASTAL WETLAND BOUNDARY, WAS DELINEATED BY JOSEPH W. NOEL, NEW HAMPSHIRE CERTIFIED WETLAND SCIENTIST #086 ON DECEMBER 11, 2020. REFER TO LETTER/REPORT DATED DECEMBER 15, 2020 FOR MORE INFORMATION.
THE DELINEATION WAS CONDUCTED IN ACCORDANCE WITH THE U.S. ARMY CORPS OF ENGINEERS DOCUMENT "CORPS OF EINGINEERS WETLAND DELINEATION MANUAL", (1987), ALONG WITH THE REQUIRED "REGIONAL SUPPLEMENT TO THE CORPS OF ENGINEERS WETLAND DELINEATION MANUAL: NORTHCENTRAL AND NORTHEAST REGION", (VERSION 2, JANUARY 2021).

10. THE MEAN HIGH WATER TIDE LINE (M.H.W.) SHOWN HEREON IS BASED ON THE TIDAL ELEVATION PUBLISHED BY N.O.A.A. FOR TIDE STATION 8423898, FORT POINT NH. SAID TIDAL ELEVATION FOR M.H.W. IS 3.97' REFERENCED TO THE NAVD88 DATUM. THIS ELEVATION WAS CONVERTED TO THE NGVD29 DATUM THROUGH THE N.O.A.A. VERTCON DATUM SHIFT PROCESS, AND CORRESPONDS WITH A TIDAL ELEVATION OF 4.74' ON THE NGVD29 DATUM, WHICH IS USED HEREON.

11. THE EXISTING CONDITIONS SHOWN HEREON ARE REFLECTIVE OF FIELDWORK CONDUCTED IN JANUARY–APRIL OF 2021, WITH THE EXCEPTION OF THE MEAN HIGH WATER LINE WHICH WAS MAPPED IN FEBRUARY 2024. SINCE THE INITIAL EXISTING CONDITIONS SURVEY, A NEW DOCK HAS BEEN BUILT ON THE SUBJECT PARCEL WHICH IS NOT SHOWN HEREON.

STATE OF NEW HAMPSHIRE JOSEPH W. NOEL No. 086 CERTIFIED WETLAND SCIENTIST 7/29/25

STATE OF NEW HAMPSHIRE No. 829 PETER AGRODNIA LICENSED LAND SURVEYOR SIGNATURE 2/9/24

PURPOSE OF PLAN:

THE PURPOSE OF THIS PLAN IS TO SHOW EXISTING CONDITIONS FOR DESIGN PURPOSES. THIS PLAN IS NOT A STANDARD BOUNDARY SURVEY AND IS NOT INTENDED TO BE RECORDED, USED FOR CONVEYANCE, OR ANY OTHER TITLE PURPOSE.

REV.	DATE	STATUS	BY	CHKD	APPD.
B	2/9/24	ADD M.H.W., NOTE #10 & NOTE #11	J.D.S.	P.L.A.	P.L.A.
A	4/2/21	ADDED ADDITIONAL TREES & ABUTTER BUILDINGS	A.H.P.	P.L.A.	P.L.A.

EXISTING CONDITIONS PLAN

FOR PROPERTY AT

60 Pleasant Point Drive

Portsmouth, Rockingham County, New Hampshire

OWNED BY

120–0 Wild Rose Lane, LLC

c/o Altus Engineering, Att. Erik Saari, V.P.
133 Court Street, Portsmouth, New Hampshire 03801

North
W EASTERLY
SURVEYING

SURVEYORS IN N.H. & MAINE 1021 GOODWIN ROAD, UNIT #1
(207) 439-6333 ELIOT, MAINE 03903

SCALE:	PROJECT NO.	DATE:	SHEET:	DRAWN BY:	CHECKED BY:
1" = 20'	20770	02/04/21	1 OF 1	A.H.P.	P.L.A.

DRAWING No: 20770 EXISTING CONDITIONS
FIELD BOOK No: "Portsmouth #17"

Tax Map 207 Lot 13

PROPOSED PERVIOUS SURFACES:

50 – 100' PATIOS AT POOL:	820 SF
REAR PATIO:	480 SF
WALKS:	52 SF
GARAGE EXIT:	40 SF
TOTAL:	1,392 SF
100 – 250' DRIVE (PAVERS):	1,625 SF

PROPOSED IMPERVIOUS:

0 – 50' DOCK:	160 SF
GRANITE STAIRS	35 SF
WOOD STAIRS	50 SF
TOTAL:	245 SF
50 – 100' POOL:	800 SF
PATIOS/WALLS:	1,173 SF
RESIDENCE:	2,790 SF
CABANA	360 SF
TOTAL:	5,123 SF
TOTAL IMPERVIOUS PROPOSED: (IN THE 100-FOOT BUFFER)	5,368 SF

NOTE: PORTION OF ROOF GUTTERS TO BE CONNECTED TO SUBSURFACE STORMWATER MANAGEMENT AREA – TO BE DETERMINED

APPROVED BY THE PORTSMOUTH PLANNING BOARD

CHAIRMAN DATE

CONDITIONAL USE PERMIT NOTES

1. ZONING SECTION 10.1016 – CONDITIONAL USE PERMIT REQUIRED FOR EARTH DISTURBANCE IN THE 100' CITY WETLAND BUFFER.
2. PROJECT PARCEL: MAP 207 LOT 13, 46,840 S.F.± (1.08 ACRES±) TO HIGHEST OBSERVABLE TIDE LINE (HOTL).
3. WETLAND AREA ON LOT: 0 S.F. (0 ACRES)
4. 100' WETLAND BUFFER ANALYSIS (EXISTING CONDITIONS):
   LAWN/LANDSCAPING: ±22,553 S.F.
   BRUSH/TREES: ± 6,575 S.F.
   IMPERVIOUS: ± 5,399 S.F.
   TOTAL BUFFER: ±34,527 S.F. (±0.79 ACRES)

   100' WETLAND BUFFER ANALYSIS (PROPOSED CONDITIONS):
   LAWN/LANDSCAPING: ±16,662 S.F.
   BRUSH/TREES: ±11,105 S.F.
   PERVIOUS SURFACES: ±1,392 S.F.
   IMPERVIOUS: ±5,368 S.F.
   TOTAL BUFFER: ±34,527 S.F. (±0.79 ACRES)
5. AREA OF 100' WETLAND BUFFER IMPACT:
   ONSITE: ±31,300 S.F.
   OFFSITE: ± 20 S.F. (REPLACE PORTION OF STEPS BELOW HOTL)
   TOTAL: ±31,320 S.F. (±0.56 ACRES)
6. AREA OF TREE/BRUSH REMOVAL IN 100' WETLAND BUFFER:
   0–25': ± 0 S.F.
   25'–50': ± 0 S.F.
   50'–100': ±40 S.F. (REMOVE 1 TREE)
   TOTAL: ±40 S.F. (DOES NOT INCLUDE INVASIVES)
7. EXISTING IMPERVIOUS SURFACES IN 50-FOOT BUFFER: 868 S.F.
   PROPOSED IMPERVIOUS SURFACES IN 50-FOOT BUFFER: 245 S.F.
8. PROPOSED WETLAND IMPACT: 20 S.F. (REPLACE STAIRS)
9. WETLANDS (HOTL) WERE DELINEATED BY JOSEPH W. NOEL, NH CERTIFIED WETLANDS SCIENTIST #086, ON DECEMBER 11, 2020.
10. CONSTRUCTION ACTIVITIES SHALL BE MANAGED IN STRICT ACCORDANCE WITH NH RSA 430:53 AND AGR 3800 RELATIVE TO INVASIVE SPECIES. NO INVASIVE SPECIES SHALL BE INSTALLED ON THE PROJECT SITE FOR ANY REASON.
11. AREAS WHERE EXISTING INVASIVE SPECIES ARE TO BE REMOVED & ROOTS TREATED ARE NOT INCLUDED IN AREAS OF DISTURBANCE BECAUSE THERE IS NO DISTURBANCE TO THE EXISTING GRADES.

CONSERVATION COMMISSION RECOMMENDATIONS:

1. IN ACCORDANCE WITH SECTION 10.1018.40 OF THE ZONING ORDINANCE, APPLICANT SHALL INSTALL PERMANENT WETLAND BOUNDARY MARKERS ALONG THE 25' VEGETATIVE BUFFER DURING PROJECT CONSTRUCTION. THESE CAN BE PURCHASED THROUGH THE CITY OF PORTSMOUTH PLANNING AND SUSTAINABILITY DEPARTMENT.
2. APPLICANT SHALL PROVIDE MONTHLY INVASIVE MANAGEMENT AND PLANTING UPDATES TO THE PLANNING AND SUSTAINABILITY DEPARTMENT ONCE REMOVAL BEGINS AND UNTIL THE END OF THE RESTORATION PROCESS (SEE MANAGEMENT CALENDAR FOR TREATMENT AND PLANTING). THESE UPDATES SHALL BE A REPORT SUMMARIZING THE ACTIVITIES PERFORMED, THE SUCCESS RATES, ANY PROPOSED PLAN CHANGES, AND ANY UPCOMING ACTIVITIES INVOLVING THE 25' VEGETATIVE BUFFER ON SITE. IF PLANTS HAVE NOT ACHIEVED AN 80% SUCCESS RATE OR GREATER AFTER ONE YEAR, APPLICANTS WILL REPLANT AND REPORT BACK TO THE PLANNING AND SUSTAINABILITY DEPARTMENT ONE YEAR AFTER PLANTING IS COMPLETE AND EACH SUBSEQUENT YEAR UNTIL AN 80% PLANTING SUCCESS RATE HAS BEEN ACHIEVED.

WETLANDS IMPACT TABLE

DIRECT WETLANDS IMPACTS	= 20 SF (REPLACE STEPS)
100-FT WETLANDS BUFFER IMPACTS	= 31,300 SF
EXISTING IMPERVIOUS AREA IN 100-FT WETLANDS BUFFER	= 5,399 SF
PROPOSED IMPERVIOUS AREA IN 100-FT WETLANDS BUFFER	= 5,368 SF

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)

P5138

ALTUS ENGINEERING

133 Court Street Portsmouth, NH 03801
(603) 433-2335 www.altus-eng.com

STATE OF NEW HAMPSHIRE ERIC D. WEINRIEB No. 7634 LICENSED PROFESSIONAL ENGINEER

11/28/23

NOT FOR CONSTRUCTION

ISSUED FOR: CONSERVATION COMM. REVIEW

ISSUE DATE: NOVEMBER 28, 2023

REVISIONS

NO.	DESCRIPTION	BY	DATE
0	INITIAL SUBMISSION	EDW	10/27/23
1	ADD CON. COMM. REC.	EDW	11/28/23

DRAWN BY: RLH

APPROVED BY: EDW

DRAWING FILE: 5138SITE.dwg

SCALE:

(22"x34") 1" = 20'

(11"x17") 1" = 40'

OWNER:

120-0 WILD ROSE LANE, LLC
209 WATER STREET
NEWBURYPORT, MA 01950

APPLICANT:

120-0 WILD ROSE LANE, LLC
209 WATER STREET
NEWBURYPORT, MA 01950

PROJECT:

JOHN & MICHELLE MORRIS RESIDENCE

TAX MAP 207, LOT 13

60 PLEASANT POINT DRIVE
PORTSMOUTH, NH

TITLE:

CONDITIONAL USE PERMIT PLAN

SHEET NUMBER:

1 OF 1

CONSERVATION COMMISSION RECOMMENDATIONS:

1. IN ACCORDANCE WITH SECTION 10.1018.40 OF THE ZONING ORDINANCE, APPLICANT SHALL INSTALL PERMANENT WETLAND BOUNDARY MARKERS ALONG THE 25' VEGETATIVE BUFFER DURING PROJECT CONSTRUCTION. THESE CAN BE PURCHASED THROUGH THE CITY OF PORTSMOUTH PLANNING AND SUSTAINABILITY DEPARTMENT.
2. APPLICANT SHALL PROVIDE MONTHLY INVASIVE MANAGEMENT AND PLANTING UPDATES TO THE PLANNING AND SUSTAINABILITY DEPARTMENT ONCE REMOVAL BEGINS AND UNTIL THE END OF THE RESTORATION PROCESS (SEE MANAGEMENT CALENDAR FOR TREATMENT AND PLANTING). THESE UPDATES SHALL BE A REPORT SUMMARIZING THE ACTIVITIES PERFORMED, THE SUCCESS RATES, ANY PROPOSED PLAN CHANGES, AND ANY UPCOMING ACTIVITIES INVOLVING THE 25' VEGETATIVE BUFFER ON SITE. IF PLANTS HAVE NOT ACHIEVED AN 80% SUCCESS RATE OR GREATER AFTER ONE YEAR, APPLICANTS WILL REPLANT AND REPORT BACK TO THE PLANNING AND SUSTAINABILITY DEPARTMENT ONE YEAR AFTER PLANTING IS COMPLETE AND EACH SUBSEQUENT YEAR UNTIL AN 80% PLANTING SUCCESS RATE HAS BEEN ACHIEVED.

LEGEND

PROPERTY LINE
HIGHEST OBSERVABLE TIDE LINE
50' LIMITED CUT BUFFER
100' WETLAND / TIDAL BUFFER
EXISTING TREES TO REMAIN
HOUSE/DECK/POOL TO BE REPLACED

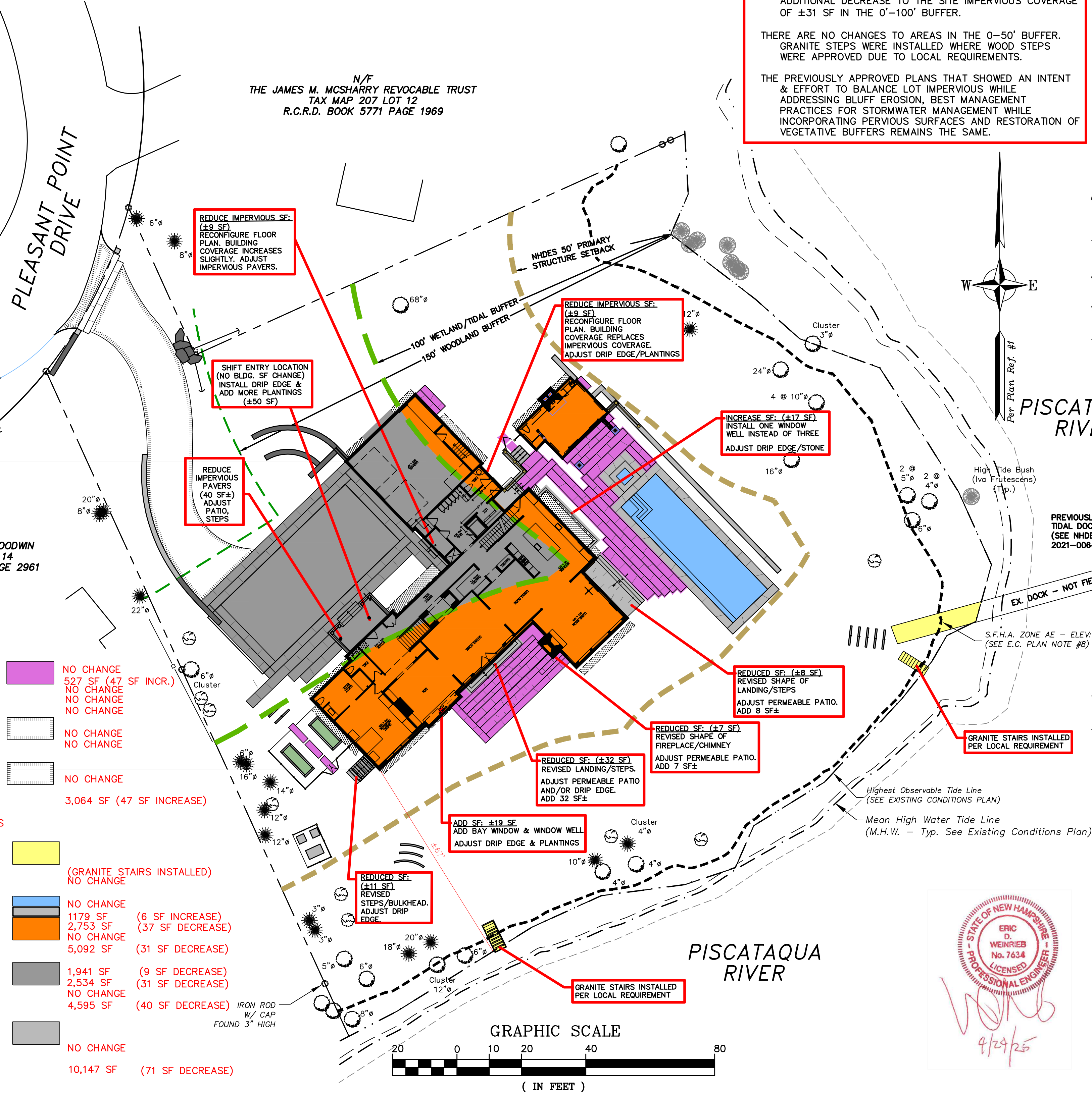
DESIGN REVISIONS

THE APPROVED BUILDING SETBACK DISTANCES TO THE RESOURCE REMAIN UNCHANGED.

PROPOSED MODIFICATIONS TO THE BUILDING FOOTPRINT RESULT IN AN ADDITIONAL DECREASE TO THE PROPOSED BUILDING COVERAGE OF ±37 SF IN THE 0 – 100' BUFFER AND AN ADDITIONAL DECREASE TO THE SITE IMPERVIOUS COVERAGE OF ±31 SF IN THE 0'–100' BUFFER.

THERE ARE NO CHANGES TO AREAS IN THE 0–50' BUFFER. GRANITE STEPS WERE INSTALLED WHERE WOOD STEPS WERE APPROVED DUE TO LOCAL REQUIREMENTS.

THE PREVIOUSLY APPROVED PLANS THAT SHOWED AN INTENT & EFFORT TO BALANCE LOT IMPERVIOUS WHILE ADDRESSING BLUFF EROSION, BEST MANAGEMENT PRACTICES FOR STORMWATER MANAGEMENT WHILE INCORPORATING PERVIOUS SURFACES AND RESTORATION OF VEGETATIVE BUFFERS REMAINS THE SAME.



PROPOSED PERVIOUS SURFACES:

50 – 100' PATIOS AT POOL:	820 SF	NO CHANGE	
REAR PATIO:	480 SF	527 SF (47 SF INCR.)	
WALKS:	52 SF	NO CHANGE	
GARAGE EXIT:	40 SF	NO CHANGE	
TOTAL:	1,392 SF	NO CHANGE	
100 – 150' DRIVE (PORTION):	155 SF	NO CHANGE	
TOTAL:	155 SF	NO CHANGE	
150 – 250' DRIVE (PORTION):	1,470 SF		
TOTAL:	1,470 SF	NO CHANGE	
TOTAL PERVIOUS PROPOSED:	~~2,965 SF~~ 3,017 SF SCRIVENER'S ERROR	3,064 SF (47 SF INCREASE)	

PROPOSED IMPERVIOUS:

0 – 50' DOCK:	160 SF		
GRANITE STAIRS	35 SF		
WOOD STAIRS	50 SF	(GRANITE STAIRS INSTALLED)	
TOTAL:	245 SF	NO CHANGE	
50 – 100' POOL:	800 SF	NO CHANGE	
PATIOS/WALLS/STEPS	1,173 SF	1179 SF	(6 SF INCREASE)
RESIDENCE:	2,790 SF	2,753 SF	(37 SF DECREASE)
CABANA	360 SF	NO CHANGE	
TOTAL:	5,123 SF	5,092 SF	(31 SF DECREASE)
100 – 150' RESIDENCE:	1,950 SF	1,941 SF	(9 SF DECREASE)
PAVEMENT/PATIOS/ENTRY:	2,565 SF	2,534 SF	(31 SF DECREASE)
WALLS	120 SF	NO CHANGE	
TOTAL:	4,635 SF	4,595 SF	(40 SF DECREASE)
150 – 250' PAVEMENT:	100 SF		
WALLS:	115 SF		
TOTAL:	215 SF	NO CHANGE	
TOTAL IMPERVIOUS PROPOSED:	10,218 SF	10,147 SF	(71 SF DECREASE)

SITE NOTES

1. DESIGN INTENT – THE EXISTING ANTIQUATED SINGLE FAMILY RESIDENCE WILL BE RAZED & REPLACED WITH A NEW SINGLE FAMILY RESIDENCE.
2. THE BASE PLAN USED HERE WAS DEVELOPED FROM "EXISTING CONDITIONS PLAN FOR PROPERTY AT 60 PLEASANT POINT DRIVE, PORTSMOUTH, NH", DATED FEB. 4, 2021 BY EASTERLY SURVEYING, INC.
3. PROJECT PARCEL: MAP 207 LOT 13, 46,840 S.F (1.08 ACRES) TO HIGHEST OBSERVABLE TIDE LINE (HOTL).
4. ZONE: SRB (SINGLE RESIDENCE B)
   OVERLAY: FLOOD PLAIN DISTRICT OVERLAY
5. DIMENSIONAL REQUIREMENTS:

		EXISTING	PROPOSED
LOT AREA:	15,000 SF	46,840 SF	46,840 SF
LOT FRONTAGE:	100'	57'+	57'+
LOT DEPTH:	100'	150'+	150'+
FRONT YARD:	30'	136'+	93'±
SIDE YARD:	10'	51'+	33'±
REAR YARD:	30'	57'+	67'±
MAX. BUILDING HEIGHT:	35' (SLOPED ROOF)	<35'	<35'
MAX. BUILDING COVERAGE:*	20%	6.3% (2,970 SF)	10.3% (4,810 SF) 10.8% (5,054 SF) [CABANA NOW INCL]
MIN. OPEN SPACE:	40%	78%	71%
WETLAND BUFFER:	100'	57'±(RESIDENCE)	67'± (RES.)
WETLAND LIMITED CUT:	50'	31'±(POOL)	52'± (POOL)
WETLAND NO–CUT:	25'	0' (STEPS/LAWN)	0' (STEPS)

* BUILDING COVERAGE CALCULATION IS BASED ON TOTAL LOT AREA TO HOTL: 46,840± S.F.

6. PORTIONS OF THE SITE ARE IN FLOOD HAZARD ZONE AE PER FLOOD INSURANCE RATE MAP (FIRM), ROCKINGHAM COUNTY, NEW HAMPSHIRE, MAP #33015C0278F JANUARY 29, 2021 (ELEVATION 8').
7. WETLANDS WERE DELINEATED BY JOSEPH W. NOEL, NH CERTIFIED WETLANDS SCIENTIST #086 ON DECEMBER 11, 2020.
8. AREA OF DISTURBANCE IS APPROXIMATELY 45,700 S.F. THEREFORE OVER 43,560 S.F., EPA NPDES PHASE II CONSTRUCTION GENERAL PERMIT IS REQUIRED.
9. AREA OF DISTURBANCE UNDER 50,000 S.F., NHDES ALTERATION OF TERRAIN PERMIT NOT REQUIRED.
10. THE ENTIRE PARCEL IS WITHIN THE 250' NHDES SHORELAND ZONE. NHDES SHORELAND PERMIT REQUIRED & WAS RECEIVED ON DECEMBER 28, 2023 (2023–03139).
11. PORTIONS OF THE SITE ARE IN THE 100' NHDES TIDAL BUFFER. NHDES WETLANDS PERMIT REQUIRED & RECEIVED ON 11/04/2024 (PERMIT #2023–03138).
12. ZONING SECTION 10.1016 – CONDITIONAL USE PERMIT REQUIRED FOR WORK IN THE CITY WETLAND BUFFER. APPROVAL WAS RECEIVED ON 12/21/2023 (PERMIT #LU–23–180).

0 – 100–FOOT BUFFER IMPERVIOUS SUMMARY:

DIST. TO HOTL	EXISTING	PROPOSED	(REDUCTION)/INCREASE
0 – 100'	5,399 SF	5,368 SF 5,337 SF	(31 SF) (62 SF)

THIS IS A BETTERMENT OF 31 SF FROM THE APPROVED DWGS.

IMPERVIOUS SUMMARY (ENTIRE LOT):

DIST. TO HOTL	EXISTING	PROPOSED	(REDUCTION)/INCREASE
0 – 50'	868 SF	245 SF	(623 SF) NO CHANGE
50 – 100'	4,531 SF	5,123 SF 5,092 SF	592 SF 561 SF
100 – 150'	3,005 SF	4,635 SF 4,595 SF	1,630 SF 1,590 SF
150 – 250'	2,020 SF	215 SF	(1,805 SF) NO CHANGE
TOTAL:	10,424 SF	10,218 SF 10,147 SF	(206 SF) (277 SF)

THIS IS A BETTERMENT OF 71 SF FROM THE APPROVED DWGS.

STATE OF NEW HAMPSHIRE – ERIC D. WEINRIEB No. 7634 – LICENSED – PROFESSIONAL ENGINEER
4/24/25

P5138

ALTUS ENGINEERING
133 Court Street
(603) 433-2335
Portsmouth, NH 03801
www.altus-eng.com

NOT FOR CONSTRUCTION

ISSUED FOR: DESIGN REVISIONS

ISSUE DATE: APRIL 24, 2025

REVISIONS

NO.	DESCRIPTION	BY	DATE
0	INITIAL SUBMISSION	EDW	10/27/23
1	NHDES SUBMISSION	EDW	11/28/23
2	PER NHDES COMMENTS	EDW	07/09/24
3	ARCHITECTURAL REVS. & SITE IMPERVIOUS ADJUSTMENTS	EDW	04/24/25

DRAWN BY: RLH
APPROVED BY: EDW
DRAWING FILE: 5138SITE–2025.DWG

SCALE:
(22"x34") 1" = 20'
(11"x17") 1" = 40'

OWNER:
120–0 WILD ROSE LANE, LLC
209 WATER STREET
NEWBURYPORT, MA 01950

APPLICANT:
120–0 WILD ROSE LANE, LLC
209 WATER STREET
NEWBURYPORT, MA 01950

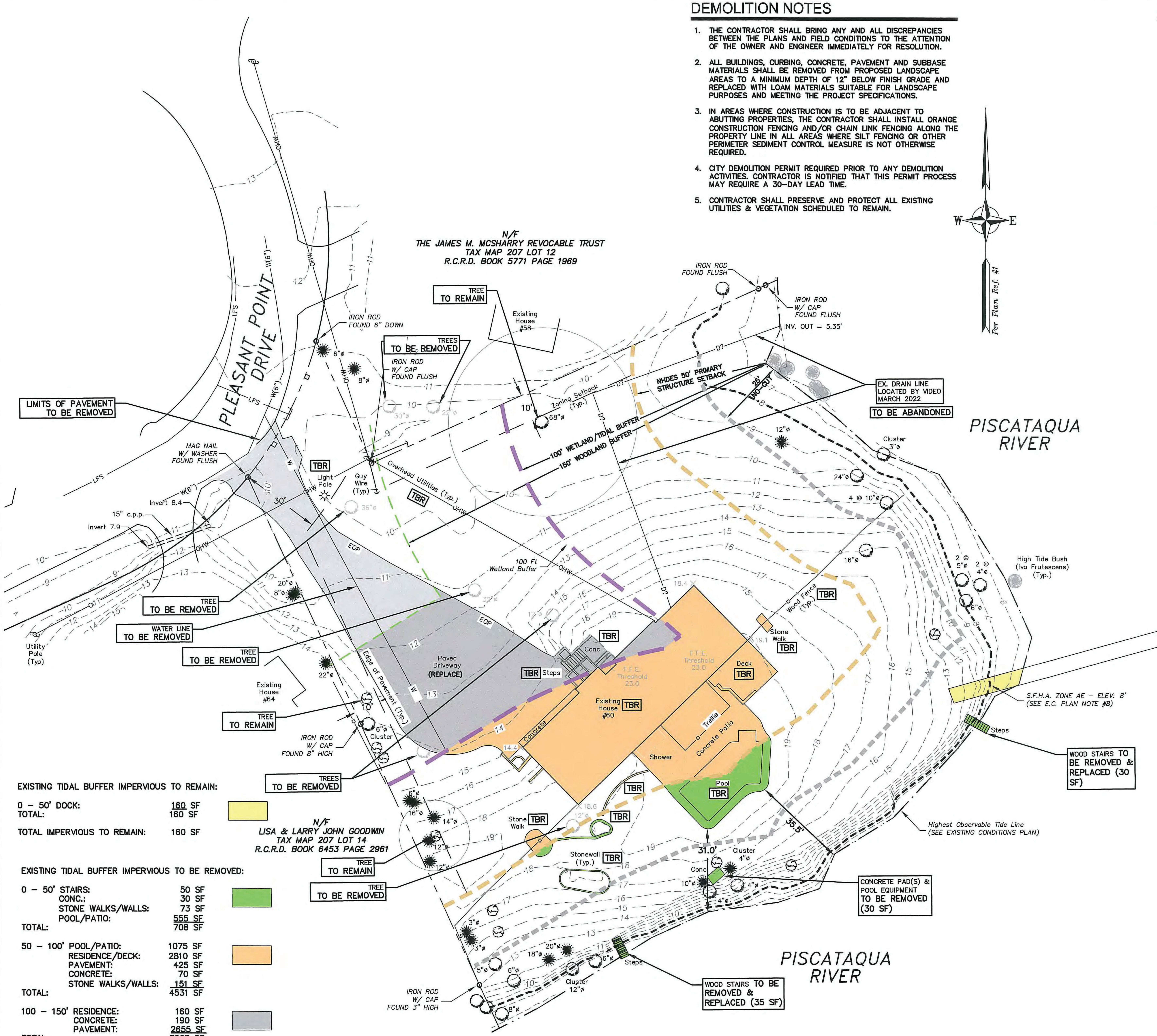
PROJECT:
JOHN & MICHELLE MORRIS RESIDENCE
TAX MAP 207, LOT 13
60 PLEASANT POINT DRIVE
PORTSMOUTH, NH

TITLE:
AMENDED SITE PLAN

SHEET NUMBER:
1 of 1

DEMOLITION NOTES

1. THE CONTRACTOR SHALL BRING ANY AND ALL DISCREPANCIES BETWEEN THE PLANS AND FIELD CONDITIONS TO THE ATTENTION OF THE OWNER AND ENGINEER IMMEDIATELY FOR RESOLUTION.
2. ALL BUILDINGS, CURBING, CONCRETE, PAVEMENT AND SUBBASE MATERIALS SHALL BE REMOVED FROM PROPOSED LANDSCAPE AREAS TO A MINIMUM DEPTH OF 12" BELOW FINISH GRADE AND REPLACED WITH LOAM MATERIALS SUITABLE FOR LANDSCAPE PURPOSES AND MEETING THE PROJECT SPECIFICATIONS.
3. IN AREAS WHERE CONSTRUCTION IS TO BE ADJACENT TO ABUTTING PROPERTIES, THE CONTRACTOR SHALL INSTALL ORANGE CONSTRUCTION FENCING AND/OR CHAIN LINK FENCING ALONG THE PROPERTY LINE IN ALL AREAS WHERE SILT FENCING OR OTHER PERIMETER SEDIMENT CONTROL MEASURE IS NOT OTHERWISE REQUIRED.
4. CITY DEMOLITION PERMIT REQUIRED PRIOR TO ANY DEMOLITION ACTIVITIES. CONTRACTOR IS NOTIFIED THAT THIS PERMIT PROCESS MAY REQUIRE A 30-DAY LEAD TIME.
5. CONTRACTOR SHALL PRESERVE AND PROTECT ALL EXISTING UTILITIES & VEGETATION SCHEDULED TO REMAIN.



EXISTING TIDAL BUFFER IMPERVIOUS TO REMAIN:

0 – 50' DOCK:	160 SF	
TOTAL:	160 SF	(yellow)
TOTAL IMPERVIOUS TO REMAIN:	160 SF	

EXISTING TIDAL BUFFER IMPERVIOUS TO BE REMOVED:

0 – 50'	STAIRS:	50 SF	(green)
	CONC.:	30 SF	
	STONE WALKS/WALLS:	73 SF	
	POOL/PATIO:	555 SF	
TOTAL:		708 SF	
50 – 100'	POOL/PATIO:	1075 SF	(orange)
	RESIDENCE/DECK:	2810 SF	
	PAVEMENT:	425 SF	
	CONCRETE:	70 SF	
	STONE WALKS/WALLS:	151 SF	
TOTAL:		4531 SF	
100 – 150'	RESIDENCE:	160 SF	(dark gray)
	CONCRETE:	190 SF	
	PAVEMENT:	2655 SF	
TOTAL:		3005 SF	
150 – 250'	PAVEMENT:	2020 SF	(light gray)
(INCLUDING OFF-SITE)			
TOTAL IMPERVIOUS REMOVED:		10,264 SF	

DEMOLITION NOTES - continued

6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE TIMELY NOTIFICATION OF ALL PARTIES, CORPORATIONS, COMPANIES, INDIVIDUALS AND STATE AND LOCAL AUTHORITIES OWNING AND/OR HAVING JURISDICTION OVER ANY UTILITIES RUNNING TO, THROUGH OR ACROSS AREAS TO BE DISTURBED BY DEMOLITION AND/OR CONSTRUCTION ACTIVITIES WHETHER OR NOT SAID UTILITIES ARE SUBJECT TO DEMOLITION, RELOCATION, MODIFICATION AND/OR CONSTRUCTION.
7. ALL UTILITY DISCONNECTIONS/DEMOLITIONS/RELOCATIONS SHALL BE COORDINATED BETWEEN THE CONTRACTOR, ALL APPROPRIATE UTILITY COMPANIES, PORTSMOUTH DPW AND ABUTTING PROPERTY OWNERS. UNLESS OTHERWISE SPECIFIED, THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL RELATED EXCAVATION, TRENCHING AND BACKFILLING.
8. WHERE SPECIFIED TO REMAIN, MANHOLE RIMS, CATCH BASIN GRATES, VALVE COVERS, HANDHOLES, ETC. SHALL BE ADJUSTED TO FINISH GRADE UNLESS OTHERWISE SPECIFIED.
9. SEE EROSION CONTROL PLANS FOR EROSION AND SEDIMENT CONTROL MEASURES THAT SHALL BE IN PLACE PRIOR TO DEMOLITION ACTIVITIES.
10. ALL MATERIALS SCHEDULED FOR DEMOLITION OR REMOVAL ON PRIVATE PROPERTY SHALL BECOME THE PROPERTY OF THE CONTRACTOR UNLESS OTHERWISE SPECIFIED.
11. ALL MATERIAL SCHEDULED TO BE REMOVED SHALL BE LEGALLY DISPOSED OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS/CODES.
12. WATER: PORTSMOUTH DPW WATER DIVISION, JIM TOW, (603) 427-1530.
13. SEWER: PORTSMOUTH DPW SEWER DIVISION, JIM TOW, (603) 427-1530.
14. TELECOMMUNICATIONS: CONSOLIDATED, JOE CONSIDINE, (603) 427-5525.
15. CABLE: COMCAST, MIKE COLLINS, (603) 679-5695, EXT. 1037.
16. ELECTRICAL: EVERSOURCE, MICHAEL BUSBY, (603) 332-4227, EXT. 5555334.
17. GAS: UNITIL, DAVID BEAULIEU, (603) 294-5144.
18. CONTRACTOR TO CONTACT PORTSMOUTH DPW A MINIMUM OF TWO WEEKS PRIOR TO ANY DEMOLITION TO COORDINATE ALL WORK CONCERNING DISCONNECTION/DEMOLITION OF ANY WATER AND SEWER LINE SERVICES.
19. ENTIRE PARCEL LIES WITHIN THE NHDES 250-FOOT SHORELAND PROTECTION AREA.
20. ALL WATER MAIN AND SANITARY SEWER SERVICE DISCONNECTIONS SHALL CONFORM TO PORTSMOUTH DPW STANDARDS.
21. NO BURNING SHALL BE PERMITTED PER LOCAL REGULATIONS.
22. HAZARDOUS MATERIALS ENCOUNTERED DURING DEMOLITION AND CONSTRUCTION ACTIVITIES SHALL BE ABATED IN STRICT ACCORDANCE WITH ALL APPLICABLE STATE AND LOCAL REGULATIONS.
23. AT NO TIME SHALL ANY UTILITY SERVICE OR VEHICULAR ACCESS TO ABUTTING PROPERTIES BE COMPLETELY INTERRUPTED UNLESS A FULL SHUTDOWN IS COORDINATED WITH ALL AFFECTED PARTIES AND UTILITY PROVIDER(S).
24. SHOULD GROUNDWATER BE ENCOUNTERED DURING EXCAVATION, APPROPRIATE BEST MANAGEMENT PRACTICES SHALL BE EMPLOYED TO ENSURE SEDIMENT LADEN WATER IS NOT DISCHARGED INTO THE CITY DRAINAGE SYSTEM. A DISCHARGE PERMIT SHALL BE OBTAINED PRIOR TO DISCHARGING GROUNDWATER.
25. EXISTING HOUSE IS SERVICED BY A PROPANE TANK. REMOVAL AND DISPOSAL OF EXISTING TANK & INSTALLATION OF NEW PROPANE TANK, IF DESIRED, SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE REGULATIONS.
26. THIS PLAN IS INTENDED TO PROVIDE MINIMUM GUIDELINES FOR THE DEMOLITION OF EXISTING SITE FEATURES. UNLESS OTHERWISE NOTED TO REMAIN, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL BUILDING, PAVEMENT, CONCRETE, CURBING, SIGNS, POLES, UTILITIES, FENCES, VEGETATION AND OTHER EXISTING FEATURES AS NECESSARY TO FULLY CONSTRUCT THE PROJECT.
27. EXISTING SEWER SERVICE LOCATION IS APPROXIMATE BASED ON REFERENCE PLAN. CONTRACTOR SHALL INVESTIGATE THE EXISTING BUILDING DISCHARGE AND PERFORM TEST PITS AND OTHER WORK AS NECESSARY TO LOCATE THE CONNECTION. THE NEW SERVICE SHALL BE CONNECTED PER UTILITY PLAN & IN ACCORDANCE WITH DPW STANDARDS.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)

P5138

ALTUS ENGINEERING

133 Court Street, Portsmouth, NH 03801
(603) 433-2335 www.altus-eng.com

STATE OF NEW HAMPSHIRE – ERIC D. WEINRIEB – No. 7634 – LICENSED PROFESSIONAL ENGINEER – 11/28/23

NOT FOR CONSTRUCTION

ISSUED FOR: NHDES APPROVAL

ISSUE DATE: NOVEMBER 28, 2023

REVISIONS

NO.	DESCRIPTION	BY	DATE
0	INITIAL SUBMISSION	EDW	10/27/23
1	NHDES SUBMISSION	EDW	11/28/23

DRAWN BY: RLH

APPROVED BY: EDW

DRAWING FILE: 5138SITE.dwg

SCALE: (22"x34") 1" = 20'; (11"x17") 1" = 40'

OWNER: 120-0 WILD ROSE LANE, LLC, 209 WATER STREET, NEWBURYPORT, MA 01950

APPLICANT: 120-0 WILD ROSE LANE, LLC, 209 WATER STREET, NEWBURYPORT, MA 01950

PROJECT: JOHN & MICHELLE MORRIS RESIDENCE, TAX MAP 207, LOT 13, 60 PLEASANT POINT DRIVE, PORTSMOUTH, NH

TITLE: DEMOLITION PLAN

SHEET NUMBER: C - 1

City of Portsmouth, New Hampshire

Wetland Conditional Use Permit Application Checklist

This wetland conditional use permit application checklist is a tool designed to assist the applicant in the planning process and for preparing the application for Conservation Commission and Planning Board review. The checklist is required to be uploaded as part of your wetland conditional use permit application to ensure a full and complete application is submitted to the Planning and Sustainability Department and to the online portal. A pre-application conference with a member of the Planning and Sustainability Department is encouraged as additional project information may be required depending on the size and scope of the project. The applicant is cautioned that this checklist is only a guide and is not intended to be a complete list of all wetland conditional use permit requirements. Please refer to Article 10 of the City of Portsmouth Zoning Ordinance for full details.

Applicant Responsibilities: Applicable fees are due upon application submittal to the Planning Board (no fees are required for Conservation Commission submission). The application will be reviewed by Planning and Sustainability Department staff to determine completeness. Incomplete applications which do not provide required information for the evaluation of the proposed site development shall not be provided review by the Conservation Commission or Planning Board.

Name of Applicant: 120 Wild Rose Lane, LLC Date Submitted: 7-23-25

Application # (in City's online permitting): 23-180

Site Address: 60 Pleasant Point Drive Map: 207 Lot: 13

☑	Required Items for Submittal	Item Location (e.g. Page or Plan Sheet/Note #)
✔	Complete application form submitted via the City's web-based permitting program	filed on-line
✔	All application documents, plans, supporting documentation, this checklist and other materials uploaded to the application form in OpenGov in digital **Portable Document Format (PDF)**. One hard copy of all plans and materials shall be submitted to the Planning and Sustainability Department by the published deadline.	Hard copy submitted

☑	Required Items for Submittal	Item Location (e.g. Page/line or Plan Sheet/Note #)
✔	Basic property and wetland resource information. **(10.1017.21)**	Existing Conditions survey by Easterly, dated 2-9-24
✔	Additional information required for projects proposing greater than 250 square feet of permanent or temporary impacts. **(10.1017.22)**	Site Development Plans by TFM showing hybrid living shoreline stabilization
✔	Demonstrate impacts as they relate to the criteria for approval set forth in Section 10.1017.50 (or Section 10.1017.60 in the case of utility installation in a right-of-way). **(10.1017.23)**	Narrative by TFM
✔	Balance impervious surface impacts with removal and/or wetland buffer enhancement plan. **(10.1017.24)**	Site Development plans by TFM with supporting narrative

☑	Required Items for Submittal	Item Location (e.g. Page/line or Plan Sheet/Note #)
✔	Wetland buffer enhancement plan. **(10.1017.25)**	Site Development Plans by TFM
✔	Living shoreline strategy provided for tidal wetland and/or tidal buffer impacts. **(10.1017.26)**	Hybrid living shoreline design and narrative by TFM
✔	Stormwater management must be in accordance with Best Management Practices including but not limited to: *1. New Hampshire Stormwater Manual, NHDES, current version.* *2. Best Management Practices to Control Non-point Source Pollution: A Guide for Citizens and City Officials, NHDES, January 2004.* **(10.1018.10)**	Previous design work for home, driveway and yard part of 2023 plan set, no changes proposed. Driveway is outside 100-foot buffer
✔	Vegetated Buffer Strip slope of greater than or equal to 10%. **(10.1018.22)**	hybrid living shoreline includes vegetated buffer strips.
✔	Removal or cutting of vegetation, use of fertilizers, pesticides and herbicides. **(10.1018.23/10.1018.24/10.1018.25)**	Plan notes
✔	All new pavement within a wetland buffer shall be porous pavement. **(10.1018.31)**	Application involves only hybrid living shoreline, no pavement proposed in the buffer
✔	An application that proposes porous pavement in a wetland buffer shall include a pavement maintenance plan. **(10.1018.32)**	not applicable
✔	Permanent wetland boundary markers shall be shown on the plan submitted with an application for a conditional use permit and shall be installed during project construction. **(10.1018.40)**	previously installed
☑	**Requested Items for Submittal**	**Item Location (e.g. Page or Plan Sheet/Note #)**
✔	A narrative/letter addressed to the Conservation Commission Chair (if recommended to Planning Board then an additional narrative addressed to the Planning Board Chair at that time) describing the project and any proposed wetland and/or wetland buffer impacts. Please visit the WCUP instruction page for further application instructions.	Narrative by TFM included in submission materials
✔	If New Hampshire Department of Environmental Services (NHDES) Standard Dredge and Fill Permit is required for this work, please provide this permit application at the same time as your submission for a Wetland Conditional Use Permit.	Permit previously received. Copy of permit included in submission materials

Applicant's Signature: Eric D. Weinrieb PE **Date:** 7-30-25

E # 25003859 02/07/2025 03:02:50 PM
Book 6601 Page 2257 Page 1 of 4
Register of Deeds, Rockingham County

RECORDING 22.00
SURCHARGE 2.00

Wetlands Permit

Rockingham County

The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner

WETLANDS AND NON-SITE SPECIFIC PERMIT 2023-03138

NOTE CONDITIONS

PERMITTEE: **120-0 WILD ROSE LANE LLC**
209 WATER STREET
NEWBURYPORT MA 01950

PROJECT LOCATION: **60 PLEASANT POINT DRIVE, PORTSMOUTH**
Tax Map/Block/Lot(s): 207/no block/13

WATERBODY: **PISCATAQUA RIVER**

APPROVAL DATE: **NOVEMBER 04, 2024** **EXPIRATION DATE: NOVEMBER 04, 2029**

Based upon review of permit application 2023-03138 in accordance with RSA 482-A and RSA 485-A:17, the New Hampshire Department of Environmental Services (NHDES) hereby issues this Wetlands and Non-Site Specific Permit. To validate this Permit, signatures of the Permittee and the Principal Contractor are required.

PERMIT DESCRIPTION:
Impact a total of 31,300 square feet (SF) of previously developed upland tidal buffer zone to replace an existing single-family residence with a new single-family residence and associated improvements, including construction of a pool, pervious patios, replace two sets of existing wooden stairs over the bank, and construction of a living shoreline to stabilize an eroding tidal bank.

THIS PERMIT IS SUBJECT TO THE FOLLOWING PROJECT-SPECIFIC CONDITIONS:

1. All work shall be done in accordance with the approved plans dated November 28, 2023, and revised through July 9, 2024, by Altus Engineering, Inc., received by the NH Department of Environmental Services (NHDES) on July 12, 2024; the revised plan sheet titled "NHDES Wetlands & Shoreland Permit Application Plan" dated November 28, 2023, and revised through August 15, 2024, by Altus Engineering, Inc., received by the NHDES on August 29, 2024; and the revised plan sheet titled "Living Shoreline Plan" dated June 10, 2024, and revised through September 9, 2024, by TF Moran, Inc., received by the NHDES on September 10, 2024, in accordance with Env-Wt 307.16.
2. In accordance with Env-Wt 314.02(b) and (c), for projects in the coastal area, the permittee shall record any permit issued for any work in the tidal buffer zone at the Rockingham County Registry of Deeds. Any limitations or conditions in the permit so recorded shall run with the land beyond the expiration of the permit. The permittee shall provide the department with a copy of the permit stamped by the registry with the book and page and date of receipt.
3. In accordance with Env-Wt 609.10(b)(4), all work shall be done at low tide when the work area is fully exposed.
4. In accordance with Env-Wt 307.07, all development activities associated with any project shall be conducted in compliance with applicable requirements of RSA 483-B and Env-Wq 1400 during and after construction.
5. All pervious technologies used shall be installed and maintained to effectively absorb and infiltrate stormwater as required per RSA 483-B:6, II and Rule Env-Wq 1406.15(c) in order to ensure compliance with RSA 483-B:9, V(g).
6. No activity shall be conducted in such a way as to cause or contribute to any violation of surface water quality standards per Env-Wt 307.03(a).
7. All work including management of soil stockpiles, shall be conducted so as to minimize erosion, minimize sediment transfer to surface waters or wetlands, and minimize turbidity in surface waters and wetlands per Env-Wt 307.03(b).

8. In accordance with Env-Wt 307.03(g)(1), the person in charge of construction equipment shall inspect such equipment for leaking fuel, oil, and hydraulic fluid each day prior to entering surface waters or wetlands or operating in an area where such fluids could reach groundwater, surface waters, or wetlands.
9. In accordance with Env-Wt 307.03(g)(3) and (4), the person in charge of construction equipment shall maintain oil spill kits and diesel fuel spill kits, as applicable to the type(s) and amount(s) of oil and diesel fuel used, on site so as to be readily accessible at all times during construction; and train each equipment operator in the use of the spill kits.
10. In accordance with Env-Wt 307.03(g)(2), the person in charge of construction equipment shall repair any leaks prior to using the equipment in an area where such fluids could reach groundwater, surface waters, or wetlands.
11. In accordance with Env-Wt 307.03(h), equipment shall be staged and refueled outside of jurisdictional areas (unless allowed) and in accordance with Env-Wt 307.15.
12. In accordance with Env-Wt 307.03(c)(3), water quality control measures shall be installed prior to start of work and in accordance with the manufacturer's recommended specifications.
13. In accordance with Env-Wt 307.03(c)(1), water quality control measures shall be selected and implemented based on the size and nature of the project and the physical characteristics of the site, including slope, soil type, vegetative cover, and proximity to jurisdictional areas.
14. In accordance with Env-Wt 307.03(c)(2), water quality control measures shall be comprised of wildlife-friendly erosion control materials.
15. In accordance with Env-Wt 307.03(c)(5), water quality control measures shall be maintained so as to ensure continued effectiveness in minimizing erosion and retaining sediment on-site during and after construction.
16. In accordance with Env-Wt 307.03(c)(6), water quality control measures shall remain in place until all disturbed surfaces are stabilized to a condition in which soils on the site will not experience accelerated or unnatural erosion by achieving and maintaining a minimum of 85% vegetative cover using an erosion control seed mix, whether applied in a blanket or otherwise, that is certified by its manufacturer as not containing any invasive species; or placing and maintaining a minimum of 3 inches of non-erosive material such as stone.
17. In accordance with Env-Wt 307.03(c)(7), temporary water quality control methods shall be removed upon completion of work when compliance with Env-Wt 307.03(c)(6) is achieved.
18. In accordance with Env-Wt 307.05(e), to prevent the use of soil or seed stock containing nuisance or invasive species, the contractor responsible for work shall follow Best Management Practices for the Control of Invasive and Noxious Plant Species (Invasive Plant BMPs).
19. In accordance with Env-Wt 307.11(a), fill shall be clean sand, gravel, rock, or other material that meets the project's specifications for its use; and does not contain any material that could contaminate surface or groundwater or otherwise adversely affect the ecosystem in which it is used.
20. In accordance with Env-Wt 307.12(e), wetland soils from areas vegetated with purple loosestrife or other state-listed invasive plant species shall not be used in the area being restored.
21. In accordance with Env-Wt 307.12(d), mulch used within an area being restored shall be natural straw or equivalent non-toxic, non-seed-bearing organic material.
22. In accordance with Env-Wt 307.12(g), impact areas restored by seeding or plantings shall not be deemed successful if the area is invaded by nuisance species such as common reed or purple loosestrife during the first full growing season following the completion of construction; and a remediation plan shall be submitted to the department that proposes measures to be taken to eradicate nuisance species during this same period.
23. In accordance with Env-Wt 307.12(f), if any impact area that is stabilized with seeding or plantings does not have at least 75% successful establishment of wetlands vegetation after 2 growing seasons, the area shall be replanted or reseeded, as applicable.
24. In accordance with Env-Wt 307.03(e), all exposed soils and other fills shall be permanently stabilized within 3 days following final grading.
25. In accordance with Env-Wt 307.12(i), areas where permanent impacts are not authorized shall be restored to their pre-impact conditions and elevation by replacing the removed soil and vegetation in their pre-construction location and elevation such that post-construction soil layering and vegetation schemes are as close as practicable to pre-construction conditions.

26. Within 60 days of completion of construction, the applicant shall submit a post-construction monitoring report to the department prepared by a professional engineer, certified wetland scientist, or qualified professional, as applicable. The monitoring report shall include date(s) of inspections, photos showing the extent of jurisdictional impacts, areas of restoration, progress of any plantings, and contain narratives, exhibits, and photographs, as necessary to report the status of the project area and restored jurisdictional area in accordance with Env-Wt 514.05(h) and Env-Wt 301.18(c).

THIS PERMIT IS SUBJECT TO THE FOLLOWING GENERAL CONDITIONS:

1. Pursuant to RSA 482-A:12, a copy of this permit shall be posted in a secure manner in a prominent place at the site of the approved project.
2. In accordance with Env-Wt 313.01(a)(5), and as required by RSA 482-A:11, II, work shall not infringe on the property rights or unreasonably affect the value or enjoyment of property of abutting owners.
3. In accordance with Env-Wt 314.01, a standard permit shall be signed by the permittee, and the principal contractor who will build or install the project prior to start of construction, and will not be valid until signed.
4. In accordance with Env-Wt 314.03(a), the permittee shall notify the department in writing at least one week prior to commencing any work under this permit.
5. In accordance with Env-Wt 314.08(a), the permittee shall file a completed notice of completion of work and certificate of compliance with the department within 10 working days of completing the work authorized by this permit.
6. In accordance with Env-Wt 314.06, transfer of this permit to a new owner shall require notification to, and approval of, the NHDES.
7. The permit holder shall ensure that work is done in a way that protects water quality per Env-Wt 307.03; protects fisheries and breeding areas per Env-Wt 307.04; protects against invasive species per Env-Wt 307.05; meets dredging activity conditions in Env-Wt 307.10; and meets filling activity conditions in Env-Wt 307.11.
8. This project has been screened for potential impact to known occurrences of protected species and exemplary natural communities in the immediate area. Since many areas have never been surveyed, or only cursory surveys have been performed, unidentified sensitive species or communities may be present. This permit does not absolve the permittee from due diligence in regard to state, local or federal laws regarding such communities or species. This permit does not authorize in any way the take of threatened or endangered species, as defined by RSA 212-A:2, or of any protected species or exemplary natural communities, as defined in RSA 217-A:3.
9. In accordance with Env-Wt 307.06(a) through (c), no activity shall jeopardize the continued existence of a threatened or endangered species, a species proposed for listing as threatened or endangered, or a designated or proposed critical habitat under the Federal Endangered Species Act, 16 U.S.C. §1531 et seq.; State Endangered Species Conservation Act, RSA 212-A; or New Hampshire Native Plant Protection Act, RSA 217-A.
10. In accordance with Env-Wt 307.02, and in accordance with federal requirements, all work in areas under the jurisdiction of the U.S. Army Corps of Engineers (USACE) shall comply with all conditions of the applicable state general permit.

APPROVED:

Kristin L. Duclos
Wetlands Specialist, Wetlands Bureau
Land Resources Management, Water Division

THE SIGNATURES BELOW ARE REQUIRED TO VALIDATE THIS PERMIT (Env-Wt 314.01).

PERMITTEE SIGNATURE (required)
John G. Morris, Member
120-0 Wildrose Lane LLC

PRINCIPAL CONTRACTOR SIGNATURE (required)
BENJAMIN AUGER

RESTORATION PLANT LIST			QTY	SIZE
CODE	NATIVE SHRUBS			
	Scientific Name	Common Name		
RV	Rosa virginiana	Virginia Rose	120-190	#2 CONT.
PM	Prunus maritima	Beach Plum	75-100	#2 CONT.
MP	Myrica pensylvanica	Bayberry	165-190	#2 CONT.
VD	Viburnum dentatum	Arrowwood Viburnum	115-147	#2 CONT.
CP	Comptonia peregrina	Sweetfern	300-360	#2 CONT.
JV	Juniperus virginiana 'Grey Owl'	Grey Owl Juniper	83	#2 CONT.
	NATIVE GRASSES			
	Scientific Name	Common Name		
ES	Eragrostis spectabilis	Purple Love Grass	480-522	PLUG
JG	Juncus gerardii	Salt Meadow Rush	2,200-2,616	PLUG
SH	Sporobolus heterolepis	Prarie Dropseed	900-1,379	PLUG
BG	Bouteloua gracilis	Blue Gramma	750-957	PLUG
	NATIVE PERENNIALS			
	Scientific Name	Common Name		
AH	Amsonia hubrichtii	Blue Star	340-430	PLUG
BA	Baptisia australis	Blue False Indigo	225-300	PLUG
SN	Symphyotrichum novae-angliae	New England Aster	550-686	PLUG
LS	Liatris aspera	Blazing Star	320-450	PLUG
WF	Waldsteinia fragarioides	Barren Strawberry	75-120	PLUG

NOTES:

1. LANDSCAPE ARCHITECT TO SUBSTITUTE PLANTS WITH PLANTS OF COMPARABLE SIZE AND SPECIES AT TIME OF INSTALLATION.

2. INVASIVE SPECIES TO BE REMOVED. EXISTING NATIVE SPECIES TO BE PRESERVED AND PROTECTED. THE PROPOSED PLANT QUANTITIES ARE SUBJECT TO CHANGE DEPENDING ON THE AMOUNT OF EXISTING PLANT MATERIAL TO REMAIN AND FINAL AREA OF SLOPE. ALL QUANTITIES MUST BE FIELD VERIFIED PRIOR TO INSTALLATION.

3. SHRUBS TO BE PLANTED 2' O.C. PERENNIALS AND PLUGS TO BE PLANTED 15" O.C.

Morris Residence

60 Pleasant Point Drive
Portsmouth, NH

General Notes:

1. Existing conditions and topographic data are from a site plan of land dated 8 February 2021; prepared by Altus Engineering, INC., 133 Court Street, Portsmouth, NH 03801 - Tel: (603) 433.2335

2. Existing conditions supplemented from data collected by: Matthew Cunningham Landscape Design LLC, 411 Main Street, Stoneham, MA 02108 / 366 Fore Street, Portland, ME 04101 - Tel: (617) 905.2246

Planting Notes:

1. The contractor shall supply all plant material in quantities sufficient to complete the planting shown on all drawings.

2. All plant material shall conform to the guidelines established by "The American Standard for Nursery Stock" published by *The American Association of Nurserymen*, latest edition.

3. All plant material shall be warrantied for 1 year after substantial completion.

4. All plants shall be balled and burlap unless otherwise noted on the plant list/schedule.

5. All plants shall be approved by Landscape Designer prior to their installation at the site.

6. Contractor shall stake all plant locations in the field. Obtain approval of Landscape Designer before starting plant installations.

7. Plants to be transplanted shall be flagged and exact planting locations staked in the field.

8. All areas disturbed by construction shall be restored to a pre-construction state unless otherwise noted by landscape architect or plans.

MATTHEW J. CUNNINGHAM
LICENSED LANDSCAPE ARCHITECT
STATE OF NEW HAMPSHIRE
00161

MATTHEW CUNNINGHAM LANDSCAPE DESIGN LLC

matthew-cunningham.com

411 Main Street, Stoneham, MA 02180
366 Fore Street, Portland, ME 04101
617.905.2246 p | 617.321.4014 f

REVISIONS:

#:	DATE:	DESCRIPTION:

SCALE: 1"= 20'-0" DATE: 2 July 2024

0' 10' 20' 40'

SHEET TITLE:

RESTORATION PLANTING PLAN

SHEET NUMBER:

L0.3

NOT FOR CONSTRUCTION

City of Portsmouth Wetlands Conditional Use Permit Application

10.1017.20 Application Requirements

10.1017.21
The application shall be in a form prescribed by the Planning Board, and shall include the following information:

(1) Location and area of lot and proposed activities and uses;

The project is located at 60 Pleasant Point Drive - Tax Map: 207 Lot:13.

Lot Area

Total Lot Area: 1.08 Acres/ 46,840 square feet
Total Lot Area within 100-feet of the Tidal Wetland: 34,527 square feet

Proposed Activities

Retain 1,588 square feet of impact area within the upland 100-foot Tidal Wetland Buffer for the purpose of stabilizing an eroding shoreline that was severely damaged during the January 2024 storm events with a *Hybrid Living Shoreline* approach. Please see ***Exhibit-A*** which depicts the storm damage.

(2) Location and area of all jurisdictional areas (vernal pool, inland wetland, tidal wetland, river or stream) on the lot and within 250 feet of the lot;

The Existing Conditions Plan by North Easterly Surveying depicts the location of the Tidal Wetland and the associated 100-foot Tidal Wetland Buffer.

(3) Location and area of wetland buffers on the lot;

100-Foot Tidal Wetland Buffer Areas

25-foot Vegetated Buffer Strip: 10,496 SF
50-foot Limited Cut Area: 19,764 SF
100-foot Tidal Wetland Buffer: 34,527 SF

All relevant setbacks/buffers are depicted on the Altus Engineering Demolition Plan.

(4) Description of proposed construction, demolition, fill, excavation, or any other alteration of the wetland or wetland buffer;

Using a *Hybrid Stabilization approach*, the existing slope was regraded from a 1:1 slope to a 1.5:1 slope, large toe stones were set at the toe of slope, riprap was applied to the flattened bank, and a robust planting plan was implemented that includes a variety of native shoreline shrubs, grasses, and perennials. Ground running Juniper were intentionally selected so that, with time, they will mature and drape over the hard components of the *Hybrid Stabilization approach* and make it appear "greener." Despite the unseasonably dry conditions, the plants have established nicely with the assistance of an irrigation system. Greater than 50% of the Hybrid Living Shoreline constructed is comprised of native plantings. Over 1,000 native plantings were planted within the Hybrid Living Shoreline.

To increase the vegetative cover of what was constructed, to the greatest extent feasible, and in a manner that does not compromise the integrity of the structural design, some 18-minus stones will be hand removed so that planting pockets can be created, and additional ground running juniper bushes will be planted within these areas.

Moreover, the existing 18-minus riprap will be infilled with sand (washing it in to ensure all interstices of the riprap are filled) and then the surface will be planted with vegetation that grows in sandy environments including Bristly Gooseberry, Red raspberry, and Beach-Pea.

The Hybrid Living Shoreline Plan depicts the locations of all existing plantings and the locations of the proposed planting pockets as well as the areas of riprap that will be infilled with sand (vegetated riprap).

(5) Setbacks of proposed alterations from property lines, jurisdictional areas and wetland buffers;

All relevant setbacks/buffers are depicted on the Altus Engineering Demolition Plan.

(6) Location and area of wetland impact, new impervious surface, previously disturbed upland;

No direct wetland impacts have occurred – only the upland 100-foot Tidal Wetland Buffer was impacted. A net decrease in impervious area within the 100-foot Tidal Wetland Buffer is proposed. This will be achieved by constructing the new residential dwelling with a greater setback from public waters, and through the removal of the in-ground pool. The 100-foot Tidal Wetland Buffer impact area and the *Previously Disturbed Upland Area* are depicted on the Altus Conditional Use Permit Plan dated November 28, 2023, and the updated Amended Site Plan dated April 24, 2025.

(7) Location and description of existing trees to be removed, other landscaping, grade changes, fill extensions, rip rap, culverts, utilities;

The locations and species of all trees to be removed are depicted on the Demolition Plan. The proposed grade changes and the details relative to the riprap are depicted on the Hybrid Living

Shoreline Plan. A landscape plan, prepared by Matthew Cunningham Landscape Design, LLC, is also included with this application.

(8) Dimensions and uses of existing and proposed buildings and structures.

The Existing Conditions Survey Plan depicts all relevant buffers.

(9) Any other information necessary to describe the proposed construction or alteration.

The proposed *Hybrid Shoreline Stabilization Approach* utilized several resources, including but not limited to:

- National Oceanic Atmospheric Administration (NOAA), "Guidance for Considering the Use of Living Shorelines"
- City of Portsmouth, NH Vulnerability Assessment prepared by the Rockingham Planning Commission
- A *Coastal Vulnerability Assessment* prepared using the "NH Coastal Flood Risk Summary, Part II: Guidance for Using the Scientific Projections", generated by the NH Coastal Flood Risk Science and Technical Advisory Panel and as prescribed the NH Department of Environmental Services ("NHDES") Wetlands Bureau – ***Exhibit-B***
- Systems Approach to Geomorphic Engineering (SAGE) publication "Natural and Structural Measures for Shoreline Stabilization"
- Sea Level Affecting Marshes Model (SLAMM) for New Hampshire
- NH Wildlife Action Plan (WAP)
- Natural Resources Conservation Service (NRCS) Web Soil Survey
- Dr. Tom Ballestero, Professional Engineer, Coastal Geomorphologist, Associate Professor and Director of the University of New Hampshire Stormwater Center and member of the "Technical Team" associated with the development of the NH Living Shoreline Site Suitability Assessment – Technical Report ("L3SA").
- New Hampshire Living Shoreline Site Suitability Assessment - Technical Report
- Results of the Living Shoreline Site Suitability Mapping Tool for the project area – ***Exhibit-C***

* It is important to note that the *NH Living Shoreline Site Suitability Assessment – Technical Report* was intended to be a screening tool to serve a range of end users, including Conservation Commission Members, to facilitate conversations with landowners about appropriate stabilization actions for eroding shorelines.

10.1017.22
Where the proposed project will involve the temporary or permanent alteration of more than 250 sq. ft. of wetland and/or wetland buffer, the application shall provide information about the affected wetland and wetland buffer as follows:

(1) Up to 1,000 sq. ft. of alteration to the wetland: a wetland characterization that describes the type of wetland (e.g., emergent, scrub-shrub, forested), the percent of invasive species, and whether the wetland is seasonally flooded.

This project did not impact any wetlands.

(2) More than 1,000 sq. ft. of alteration to the wetland: a functions and values assessment equivalent to the model set forth in Appendix A of The Highway Methodology Workbook

Supplement – Wetland Functions and Values: A Descriptive Approach, NAEEP-360-1-30a, US Army Corps of Engineers, New England Division, September 1999, as amended.

This project did not impact any wetlands.

(3) More than 250 sq. ft. of alteration to the wetland buffer (regardless of the amount of alteration to the wetland): a description of the 100-foot buffer including vegetation type, the percent of the buffer with invasive species, and the percent of the buffer that is paved or developed.

Of the 46,840 square feet of property within the 100-foot Tidal Wetland Buffer, the vegetation consisted primarily of previously developed uplands/ maintained lawn area. The invasive species, Multiflora Rose (*Rosa multiflora*), Japanese Honey Suckle (*Lonicera japonica*), and Bittersweet (*Celastrus orbiculatus*) were present within roughly 30% of the vegetated portion of 100-foot Tidal Wetland Buffer area.

10.1017.24
Where feasible, the application shall include removal of impervious surfaces at least equal in area to the area of impervious surface impact. The intent of this provision is that the project will not result in a net loss of pervious surface within a jurisdictional wetland buffer. If it is not feasible to remove impervious surfaces from the wetland buffer at least equal in area to the area of new impervious surface impact, the application shall include a wetland buffer enhancement plan that describes how the wetland functions and values will be enhanced to offset the proposed impact.

This project will result in a 623 SF reduction in impervious area within the 50-foot Wetland Tidal Buffer with a total reduction of 62 SF in the 100-foot Tidal Wetland Buffer. Stormwater management techniques in the form of a permeable driveway and patio surfaces, stone drip edges along the face of the home, and enhanced landscaping with native plantings will act to treat and dissipate the runoff from the home and hardscape prior to discharge into the tidal resource area. An invasive species management plan will be implemented, and significant areas of the tidal wetland buffer will be replanted with native vegetation.

The NH Fish and Game Wildlife Action Plan (WAP) indicates the property is composed predominantly of **Developed or Barren Land** and **Developed Impervious**. Through the removal of the invasive species and robust planting plan with native species, this proposed Hybrid Living Shoreline significant increases the habitat value of the area. See ***Exhibit-D*** – NH Wildlife Action Plan.

Collectively, the proposed reduction in impervious area, stormwater management techniques, removal of invasive species, and the robust planting matrix of native vegetation will significantly enhance the functions and the overall ecological integrity of the neighboring aquatic resource.

10.1017.25
A wetland buffer enhancement plan shall be designed to enhance the functions of the jurisdictional wetland and/or wetland buffer on the lot, and to offset the impact of the proposed project.

(1) The wetland buffer enhancement plan shall include a combination of new plantings, invasive species removal, habitat creation areas, improved site hydrology, or protective easements provided offsite.

Collectively, the proposed reduction in impervious area, stormwater management techniques, removal of invasive species, and the robust planting matrix of native vegetation will significantly enhance the functions and the overall ecological integrity of the neighboring aquatic resource.

(2) Where the vegetated buffer strip contains grass or non-native plantings, or is otherwise not intact, the first priority of the wetland buffer enhancement plan shall be to include revegetation of the vegetated buffer strip with native, low-maintenance shrubs and other woody vegetation.

To the greatest extent *feasible*, the proposed hybrid shoreline stabilization approach has incorporated native plantings in the form of grasses, shrubs, and other perennials. A new innovative approach to making living shorelines greener called "vegetated riprap" will be implemented. This technique involves infilling the existing 18-minus riprap areas and the associated void space will with sand so it can be planted with vegetation that grows in sandy soils. Native Bristly Gooseberry, Red raspberry, and Beach-Pea will be planted in these areas.

10.1017.26
Where the proposed project involves a use, activity or alteration in a tidal wetland or tidal wetland buffer, the application shall include a living shoreline strategy to preserve the existing natural shoreline and/or encourage establishment of a living shoreline through restoration, as applicable. Said living shoreline strategy shall be implemented unless the Planning Board determines that it is not *feasible*.

Employing an entirely green, living shoreline strategy, one that uses vegetative, soft stabilization techniques alone, is not *feasible* in this area. The existing slopes are extremely steep and are composed of highly erodible Urban Land/ Canton complex soils – see ***Exhibit-E***. To construct an entirely soft/ green living shoreline in this area, the slopes would have to be dramatically reduced, significant levels of excavation would be required, and the property owners would lose a tremendous amount of level, usable area. ***Exhibit-F*** depicts the area of property that would be impacted by excavation to achieve a 10:1 and a 5:1 slope.

Through the NHDES Wetlands Bureau Permitting process, more particularly, the NHDES Wetlands Bureau Administrative Rules relative to the *Hierarchy of Tidal Shoreline Stabilization Methods* (Env-Wt 609.02), we demonstrated that this project warranted the use of hard stabilization methods and that doing so ***would not*** have an adverse effect on abutting properties. Please see the formal Responses to

NHDES Request for More Information ("RFMI") letters included with this application package as ***Exhibit-G***.

In summary, constructing an entirely green/ soft Living Shoreline in this area of NH's seacoast ***is not*** feasible. TFMoran's engineers and scientists used the best available scientific and engineering practices to design a Hybrid Living Shoreline that used a combination of techniques to stabilize this severely damaged shoreline - a method that incorporated native plantings to the greatest extent possible (more that 1,000 native plantings covering more than 50% of the bank.) Through our coordination with NHDES officials (through the NHDES permitting process), the DES Wetlands Permit was approved because DES found that:

A.) The Hybrid Living Shoreline is the Least Impacting Practical Alternative;
B.) Forces exist that render vegetative or soft stabilization methods, bioengineering, and natural design stabilization methods at the toe of slope physically impractical; and
C.) The Hybrid Living Shoreline will not have an adverse effect on abutting properties.

Third-party engineer, Dr. Tom Ballestero, an expert in coastal geomorphology, and a member of "Technical Team" that developed the *NH Living Shoreline Site Suitability Assessment Technical Report* (see ***Exhibt-I***) was retained to review TFMoran's Hybrid Living Shoreline design (see ***Exhibit-H***) and he confirmed that:

A.) Designing an entirely green/ soft living shoreline in this area of NH seacoast was infeasible; and
B.) The project, as designed, would not adversely affect abutting landowners.

The hybrid shoreline stabilization approach, as designed by TFMoran, Inc. professional engineers and scientists, as approved by NHDES, and reviewed by third-party engineer, Dr. Tom Ballestero, an expert in coastal geomorphology, strikes a wise balance between the protection of private property and natural resources.

* The *NH Living Shoreline Site Suitability Assessment – Technical Report* indicates this area of New Hampshire's coastal shoreline ***is not*** suitable for using soft/ green stabilization techniques alone.

<u>10.1018.10 Stormwater Management</u>

All construction activities and uses of buildings, structures, and land within wetlands and wetland buffers shall be carried out so as to minimize the volume and rate of stormwater runoff, the amount of erosion, and the export of sediment from the site. All such activities shall be conducted in accordance with Best Management Practices for stormwater management including but not limited to:

1. **New Hampshire Stormwater Manual, NHDES, current version.**

2. **Best Management Practices to Control Non-point Source Pollution: A Guide for Citizens and City Officials, NHDES, January 2004**

All activities were conducted in accordance with Best Management Practices for stormwater management. Adequate erosion and sedimentation control measures were installed prior to the commencement of construction, and they were monitored and maintained throughout the duration of the project. Erosion controls measures were removed when the site was deemed stable. Further, all construction equipment was inspected daily for leaks, and oil-spill kits were present on site for the duration of the project. Erosion control measures will be implemented during the riprap/ sand infusion phase of this project.

Section 10.1018.30 Porous Pavement in Wetland Buffer

10.1018.32
An application that proposes porous pavement in a wetland buffer shall include a pavement maintenance plan addressing erosion control, periodic removal of sediment and debris from the porous surfaces, snow management, and repairs.

N/A – all proposed permeable surfaces are beyond the limits of 100-foot Tidal Wetland Buffer.

10.1018.40 Wetland Boundary Markers

Permanent wetland boundary markers shall be shown on the plan submitted with an application for a conditional use permit and shall be installed during project construction.

Please see the Demolition Plan for wetland boundaries. Wetland boundary markers demarking the limits of the 25-foot vegetative buffer strip have been installed.

Criteria for Approval of a Conditional Use Permit 10.1017.50

(1) The land is reasonably suited to the use, activity or alteration.

The land is reasonably suited for the proposed use, activity or alteration. The property is predominantly developed upland area, and no impacts are proposed to wetlands or natural vegetated buffer areas. This property has exceptionally steep slopes with highly erodible soils immediately adjacent to the shoreline. The site is reasonably suited to undergo hybrid shoreline stabilization methods. It Is *not feasible* to use entirely soft/ green living shoreline stabilization techniques in this area.

(2) There is no alternative location outside the wetland buffer that is feasible and reasonable for the proposed use, activity or alteration.

The proposed use/ activity/ alteration must occur in this area of 100-foot Tidal Wetland Buffer because it is the area immediately adjacent to the tidal resource that experienced significant erosion during the January 2024 storm events.

(3) There will be no adverse impact on the wetland functional values of the site or surrounding properties.

This project proposes no direct impact to wetlands. A 62 SF reduction in impervious area within the 100-foot Wetland Tidal Buffer is proposed. Stormwater management techniques in the form of a pervious surfaces, stone drip edges along the face of the home, and enhanced landscaping with native plantings to treat and dissipate the runoff from the home and hardscape, will be capable of treating stormwater from the proposed residential dwelling before it enters the tidal resource. An invasive species management plan will be implemented, and significant areas of the tidal wetland buffer will be replanted with native vegetation.

Collectively, the proposed reduction in impervious area, stormwater management techniques, removal of invasive species, and the robust planting matrix of native vegetation will significantly enhance the functions and the overall ecological integrity of the neighboring aquatic resource.

This project was also designed in a manner that will not alter tidal energy in a manner that adversely impacts abutting properties.

(4) Alteration of the natural vegetative state or managed woodland will occur only to the extent necessary to achieve construction goals; and

Impacts are only proposed to those areas of the upland 100-foot Tidal Wetland Buffer that require stabilization.

Collectively, the proposed reduction in impervious area, stormwater management techniques, removal of invasive species, and the robust planting matrix of native vegetation will significantly enhance the functions and the overall ecological integrity of the neighboring aquatic resource.

(5) The proposal is the alternative with the least adverse impact to areas and environments under the jurisdiction of this Section.

Using a Hybrid Shoreline Stabilization approach in this instance is the alternative with the least adverse impact to the environment. Constructing an entirely green/ soft living shoreline would require far more excavation within the 100-foot Tidal Wetland Buffer and would also require the construction of vertical retaining walls to maintain the existing slopes adjacent to the proposed work area.

Collectively, the proposed reduction in impervious area, stormwater management techniques, removal of invasive species, and the robust planting matrix of native vegetation will significantly enhance the functions and the overall ecological integrity of the neighboring aquatic resource.

(6) Any area within the vegetated buffer strip will be returned to a natural state to the extent feasible.

To the greatest extent feasible, the 25-foot Vegetated Buffer Strip will be returned to a natural state. Invasive species were removed from this area and natural boulders were used for the toe stones. A robust planting plan was implemented that includes a variety of native shoreline shrubs, grasses, and perennials. Ground running Juniper were intentionally selected so that, with time, they will mature and drape over the hard components of the *Hybrid Stabilization approach* and make it appear "greener." Despite the unseasonably dry conditions, the plants have established nicely with the assistance of an irrigation system.

To increase the vegetative cover of what was constructed, to the greatest extent feasible, and in a manner that does not compromise the integrity of the structural design, some 18-minus stones will be hand removed so that planting pockets can be created, and additional juniper bushes will be planted within these areas.

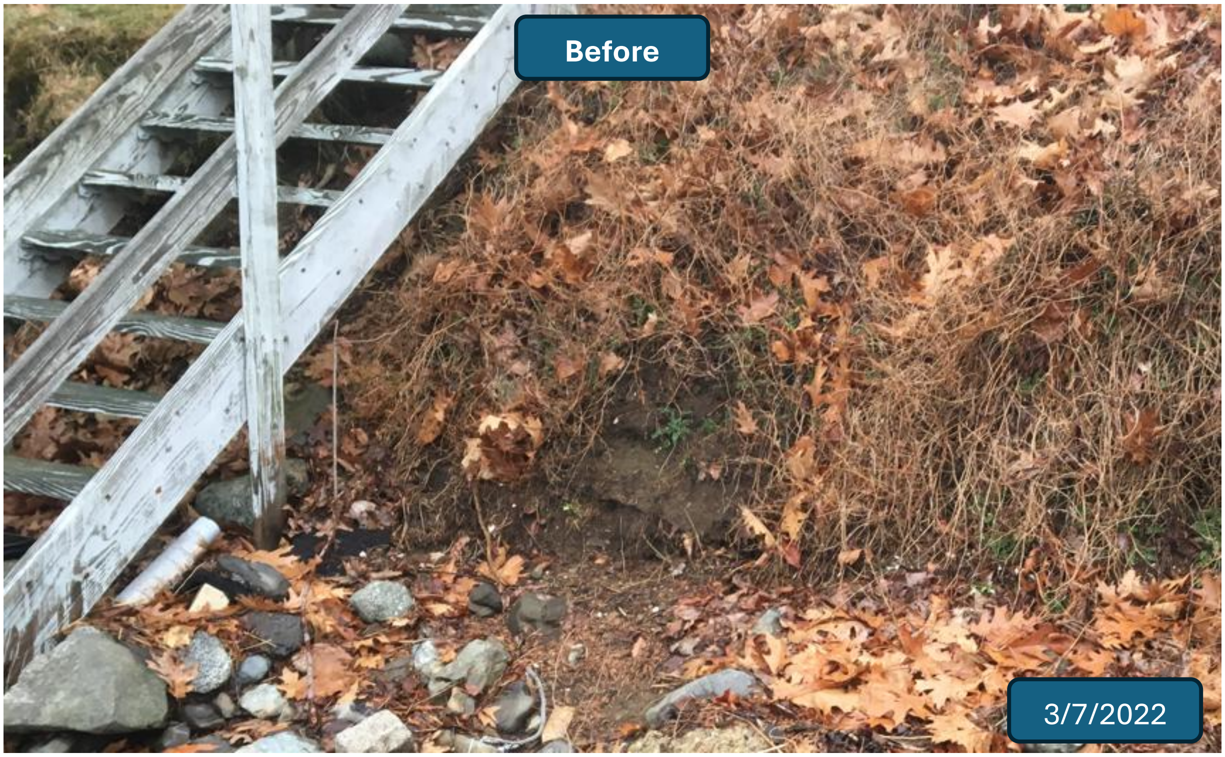
Moreover, the existing 18-minus riprap will be infilled with sand (washing it in to ensure all interstices of the riprap are filled) and then the surface will be planted with vegetation that grows in sandy environments including Bristly Gooseberry, Red raspberry, and Beach-Pea.

EXHIBIT A

Images of Storm Damage


Before
3/7/2022


After
2/25/2024


Before
3/7/2022


After
2/25/2024

Plants/ saplings with large root systems unable to prevent erosion. Evidence demonstrating a complete Living Shoreline is not feasible in this area.

EXHIBIT B

Projected Sea Level Rise
for the Project Area

Coastal Vulnerability Assessment
Highest Astronomical Tide Projections for Project Area

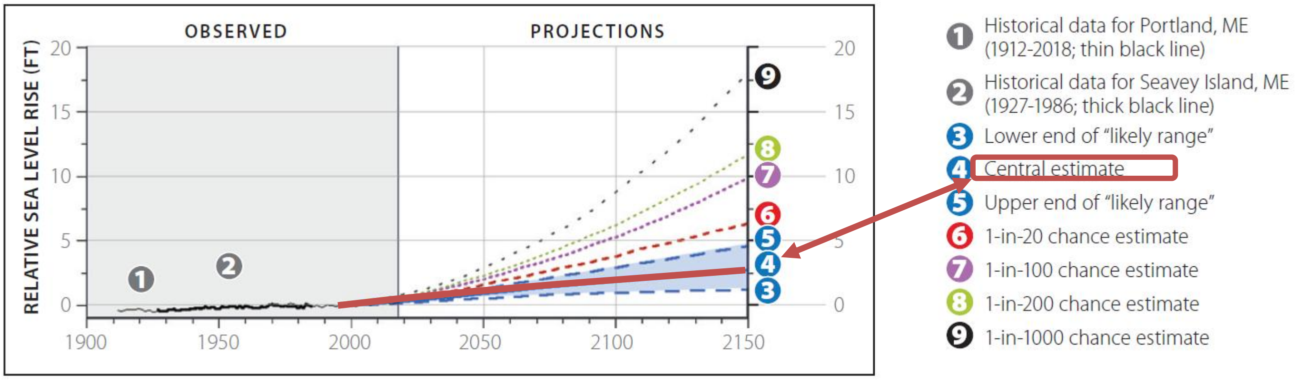


Figure 1: Greenhouse gas concentration scenario *Representative Concentration Pathway* RCP 4.5 used for RSLR estimates.

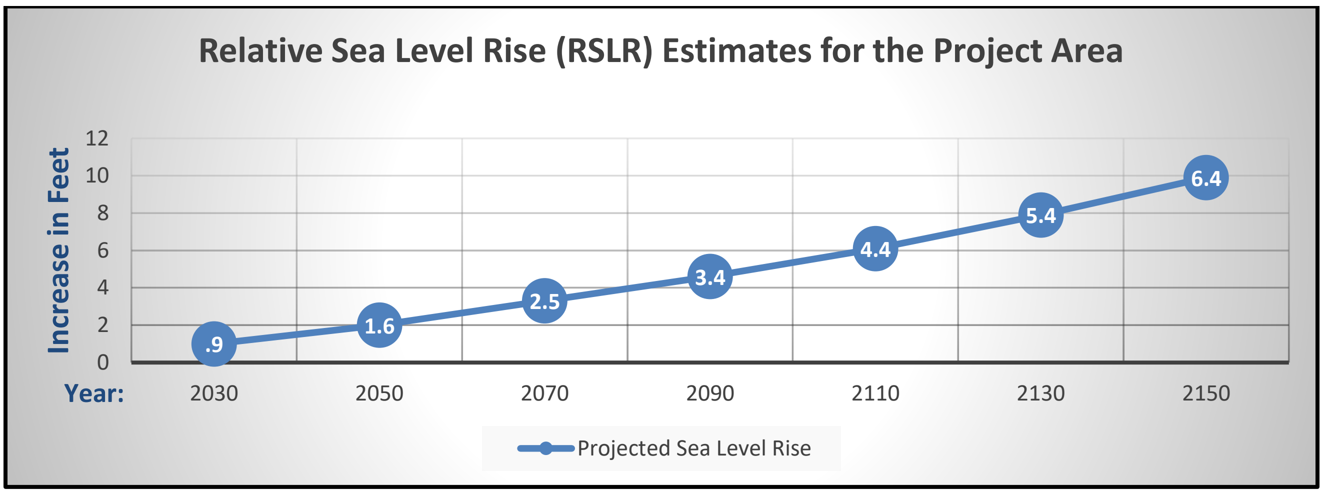


Figure 2: Incremental Relative Sea Level Rise for the project area based on Representative Concentration Pathway (RCP) 4.5 and a MEDIUM tolerance for flood risk.

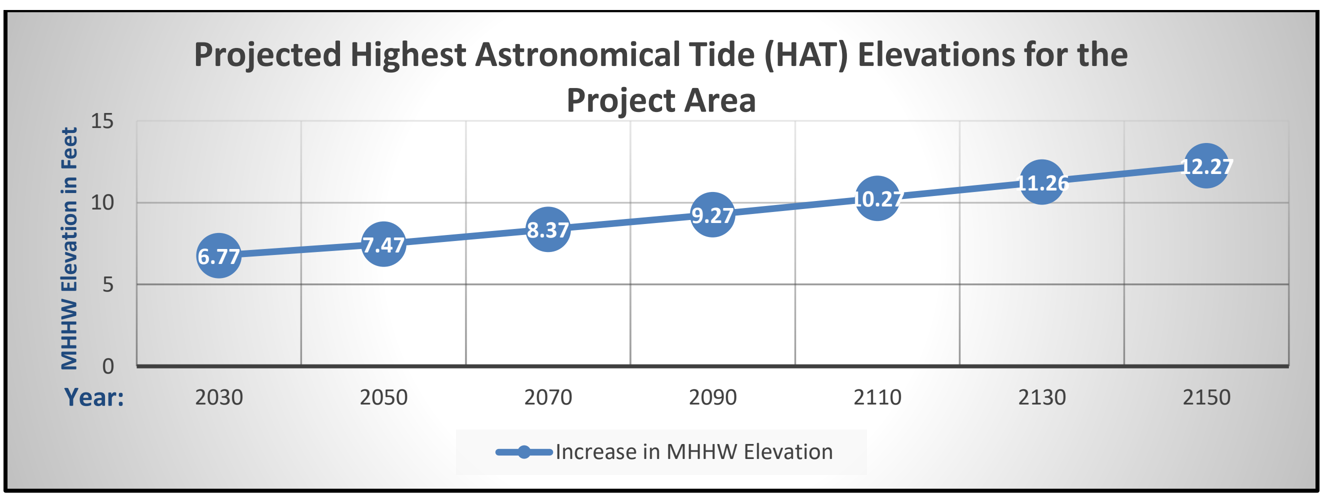


Figure 3: Incremental Relative Sea Level Rise for the project area based on Representative Concentration Pathway (RCP) 4.5, a MEDIUM Tolerance for flood risk, and the current Mean Highest Astronomical Tide (HAT) elevation of 5.87 feet determined by the National Oceanic and Atmospheric Association (NOAA) Seavey Island Tidal Station using NAVD 88 datum.

References

NHCFRSTAP (NH Coastal Flood Risk Science and Technical Advisory Panel). New Hampshire Coastal Flood Risk Summary, Part II: Guidance four Using Scientific Projections. Report Published by the University of New Hampshire, Durham. March, 2020.

NOAA (National Oceanic Atmospheric Association). NOAA Tides and Currents – Datums for Seavey Island, Maine – Site# 8419870. Site viewed on February 10, 2020. https://tidesandcurrents.noaa.gov/datums.html?datum=NAVD88&units=0&epoch=0&id=8419870&name=Seavey+Island&state=ME

RPC (Rockingham Planning Commission). Tides to Storms, Preparing for New Hampshire's Future Coast, City of Portsmouth Vulnerability Assessment. September, 2015.

SLRM (Sea Level Rise Mapping New Hampshire Open Coast, Piscataqua River, and Great Bay for the University of New Hampshire – Submitted by AECOM). December, 2013.

STAP (Science and Technical Advisory Panel, NH Coastal Risks and Hazards Commission). Sea-level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Project Future Trends). August, 2014.

EXHIBIT C

Results of the Living Shoreline Suitability Mapping Tool For the Project Area

Site Suitability for a Living Shoreline for the Project Area
Results from the NH Living Shoreline Suitability Assessment

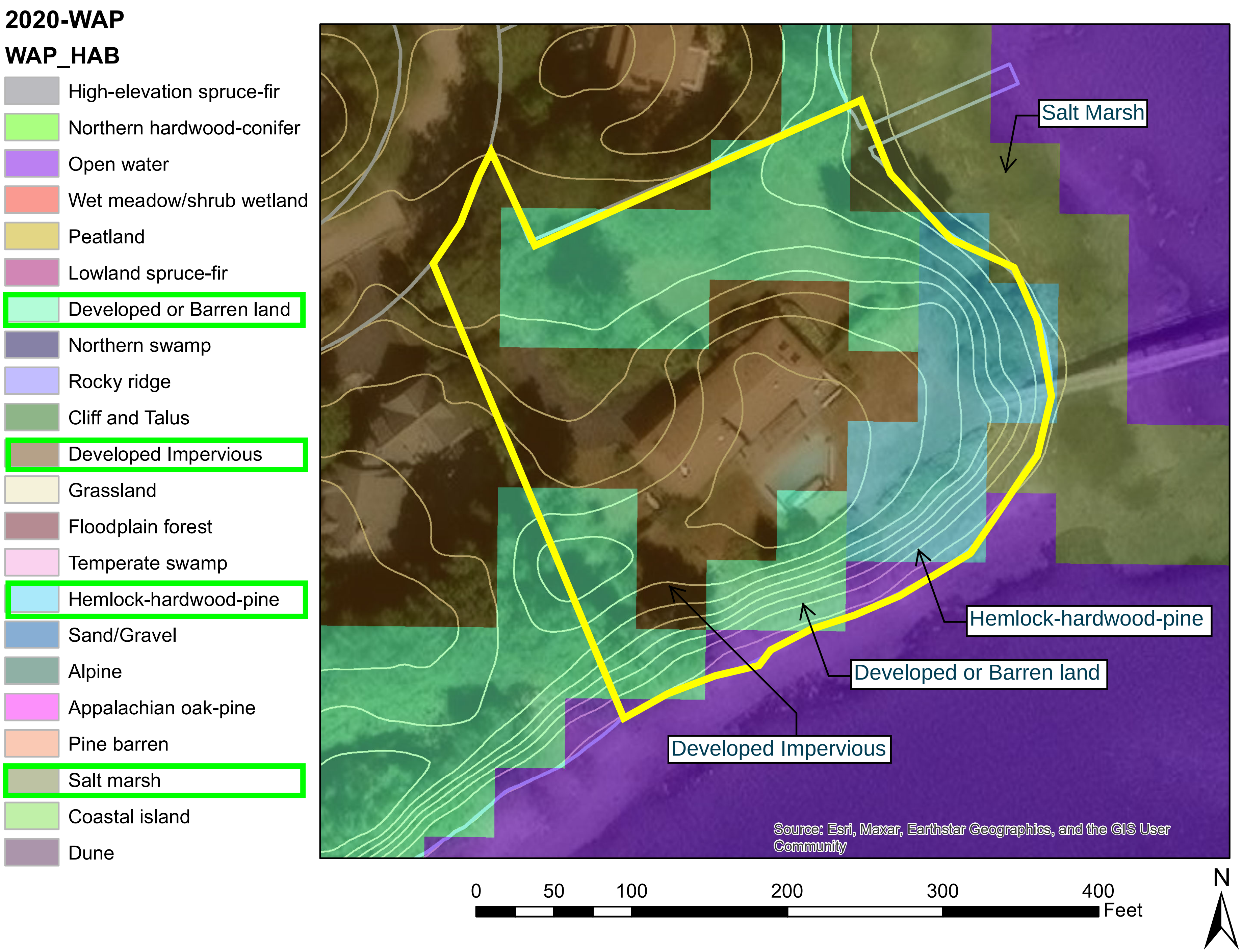
Legend for Interpreting the Biophysical Suitability Index Numbers

Suitability Index Number	Living Shoreline suitability	Structural components	Visualization
6	Highly suitable for living shorelines	None	
5	Suitable for living shorelines	None to Minimal	
4	Suitable for living shoreline hybrid solutions	Minimal	
3	Suitable for living shoreline hybrid solutions	Moderate	
2	May be suitable for living shorelines with hybrid components and/or significant. site modification	Significant	
1	May be suitable for living shorelines with very significant hybrid components and/or site modification	Very significant	

EXHIBIT D

NH Fish and Game
Wildlife Action Plan (WAP) Maps

NH Fish and Game Wildlife Action Plan (WAP)



NH Fish and Game Wildlife Corridors

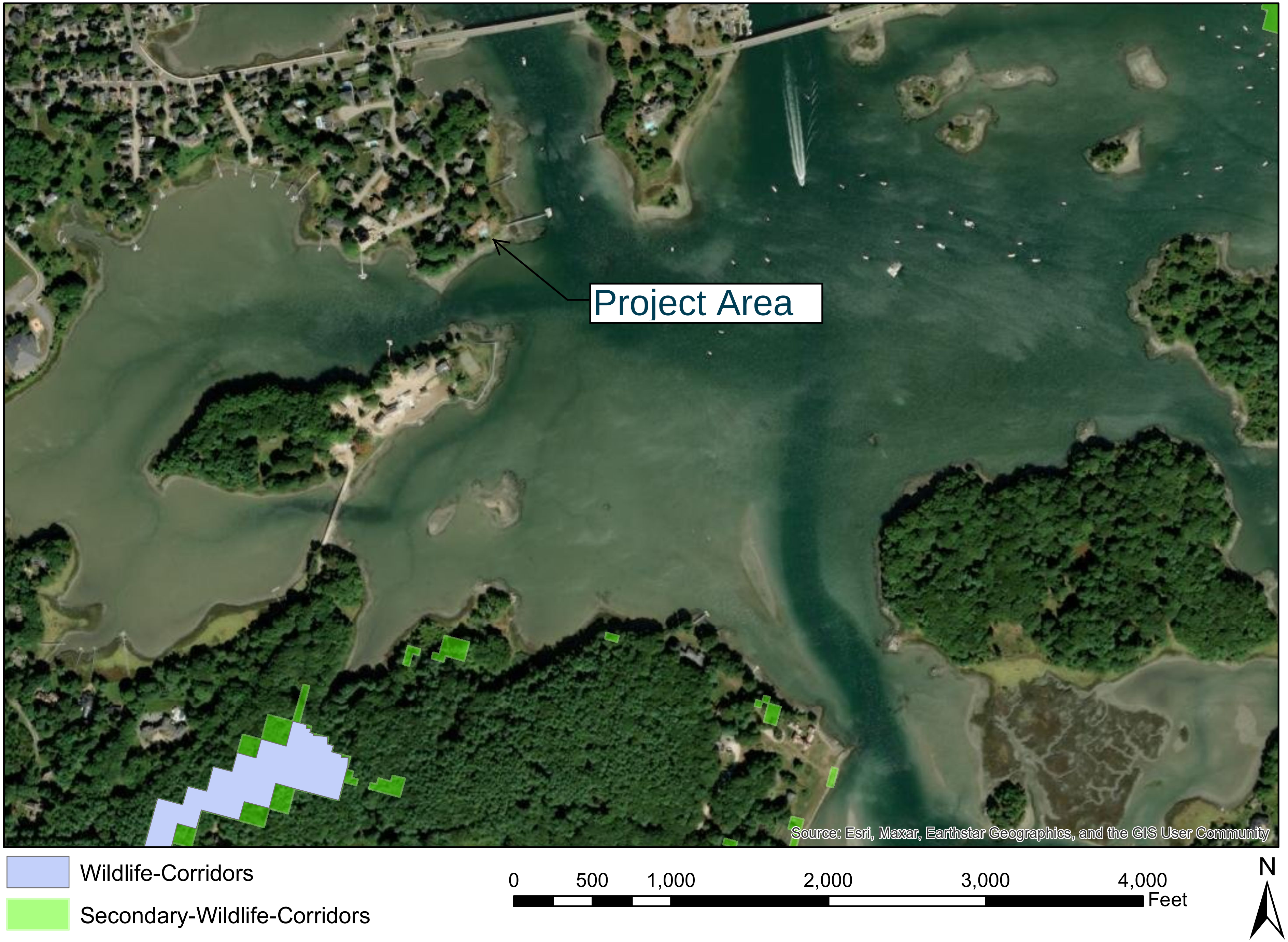


EXHIBIT E

U.S Department of Agriculture (USDA)– Natural Resources Conservation Service (NRCS) Web Soil Survey Results

Soil Map—Rockingham County, New Hampshire
(60 Pleasant Point Drive Soils)

Map Scale: 1:8,600 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 100, 200, 400, 600

Feet: 0, 400, 800, 1600, 2400

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Rockingham County, New Hampshire
Survey Area Data: Version 27, Sep 3, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 19, 2020—Sep 20, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
140B	Chatfield-Hollis-Canton complex, 0 to 8 percent slopes, rocky	10.9	3.8%
140C	Chatfield-Hollis-Canton complex, 8 to 15 percent slopes, rocky	8.1	2.8%
299	Udorthents, smoothed	0.9	0.3%
799	Urban land-Canton complex, 3 to 15 percent slopes	90.1	31.7%
W	Water	174.0	61.3%
Totals for Area of Interest		**283.9**	**100.0%**

EXHIBIT F

Plans Depicting the Amount of Excavation Required to Achieve 10:1 and 5:1 Slopes

P5138

ALTUS ENGINEERING

133 Court Street, Portsmouth, NH 03801
(603) 433-2335, www.altus-eng.com

STATE OF NEW HAMPSHIRE ERIC D. WEINRIEB No. 7634 LICENSED PROFESSIONAL ENGINEER

7/30/25

NOT FOR CONSTRUCTION

ISSUED FOR: CUP APPLN

ISSUE DATE: JULY 29, 2025

REVISIONS

NO.	DESCRIPTION	BY	DATE
	DISCUSSION	EDW	07/28/25

DRAWN BY: RLH

APPROVED BY: EDW

DRAWING FILE: 5138-WRKSHT-LIVING-SHOR

SCALE:
(22"x34") 1" = 20'
(11"x17") 1" = 40'

OWNER:
120-0 WILD ROSE LANE, LLC
209 WATER STREET
NEWBURYPORT, MA 01950

APPLICANT:
120-0 WILD ROSE LANE, LLC
209 WATER STREET
NEWBURYPORT, MA 01950

PROJECT:
JOHN & MICHELLE MORRIS RESIDENCE
TAX MAP 207, LOT 13
60 PLEASANT POINT DRIVE
PORTSMOUTH, NH

TITLE:
LIVING SHORELINE 5 TO 1 SLOPE WORKSHEET

SHEET NUMBER:
1 of 1

P5138

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PORTSMOUTH, NH

TITLE:
LIVING SHORELINE 10 TO 1 SLOPE WORKSHEET

SHEET NUMBER:
1 of 1

EXHIBIT G

Formal Responses to NHDES Request For More Information Letters

TFMoran's Response to NHDES Request for More Information (RFMI) letter dated February 2, 2024.

NHDES Wetlands Permit Application 2023-03138

Responses to questions relative to the construction of a *Living Shoreline*.

4. Please identify all known causes of erosion associated with this project and identify how each cause of erosion is being addressed as a part of the proposed bank stabilization project in accordance with Env-Wt 609.01(d).

Response: As a result of multiple coastal storm events that coincided with astronomically high tides over the last two years, the shoreline of this property experienced some erosion. These storm events produced significant levels of storm surge that undercut the bank of the shoreline in some locations. More specifically, when the storm surge, coupled with the high tides receded, by virtue of the hydrodynamics in this area, lateral movement of water along the toe of slope scoured and undercut the toe of slope.

Through the construction of a living shoreline designed with the use of the publication, "Guidance for Considering the Use of Living Shorelines," prepared by the National Oceanic Atmospheric Administration (NOAA), we're confident this property will be more resilient to future coastal storm events. The use of large toe stones, construction of a flatter 1.5:1 slope, and the implementation of robust native planting plan prepared by a NH Licensed Landscape Architect ensures this increased resiliency.

5. Please provide documentation demonstrating how the proposed technique or combination of techniques used as part of the proposed tidal shoreline stabilization project addresses the criteria listed in Env-Wt 609.02(b)(1) through (7), as required in accordance with Env-Wt 609.02(b).

Response: In accordance with NHDES Wetlands Bureau Administrative Rule Env-Wt 609.02, as indicated on the plans submitted with this permit application, the proposed Living Shoreline addresses each of the following:

Env-Wt 609.02(b)(1) – By way of the Functional Assessment submitted with this permit application, this project proposes no adverse impacts to the functions and values of the neighboring tidal resources. This project will enhance many of the resource's functions and values. Constructing a "Living Shoreline" is the prescribed method of attaining shoreline stabilization and resiliency against anticipated sea level rise by the NHDES Wetlands Bureau and the Piscataqua Region Estuaries Partnership (PREP).

Env-Wt 609.02(b)(2) – As a result of multiple coastal storm events that coincided with astronomically high tides over the last two years, the shoreline of this property experienced some erosion. These storm events produced significant levels of storm surge that undercut the bank of the shoreline in some locations. More specifically, when the storm surge, coupled with the high tides receded, by virtue of the hydrodynamics in this area, lateral movement of water along the toe of slope scoured and undercut the toe of slope.

Env-Wt 609.02(b)(3) – On areas of the shoreline, the lateral tidal forces associated with large storms events that produced storm surge have undercut and scoured the toe of slope. Left unabated, the shoreline will be exposed to future coastal storm events.

Env-Wt 609.02(b)(4) – The proposed Living Shoreline is within an area of NH's seacoast that does not experience *frequent* high tidal or wave action erosive forces. While some boat traffic occurs in the area during high tide, it is not significant enough to have a bearing on this project. The proposed geometry and orientation of living shoreline will not amplify the existing minimal tidal forces. The Living Shoreline Plan, bearing the stamp of Professional Engineer, Jack McTigue, demonstrates each of these factors have been considered during the design of this Living Shoreline. As demonstrated within the Coastal Vulnerability Assessment submitted with the permit application, the proposed Living Shoreline will be able to withstand future storm surge and extreme precipitation events.

Env-Wt 609.02(b)(5) – The proposed Living Shoreline is within an area that does not experience *frequent* high tidal action erosive forces. As demonstrated within the Coastal Vulnerability Assessment submitted with the permit application, the proposed Living Shoreline will allow the property to become significantly more resilient to anticipated sea level rise.

Env-Wt 609.02(b)(6) – We have utilized the Sea Level Affecting Marshes Model (SLAMM) GIS data layers available on NH GRANIT. Given the topography of the site, the property *does not* lend itself well to future salt marsh migration. The proposed living shoreline does propose a wide variety of upland, salt tolerant native species – see ***Figure 1*** below.

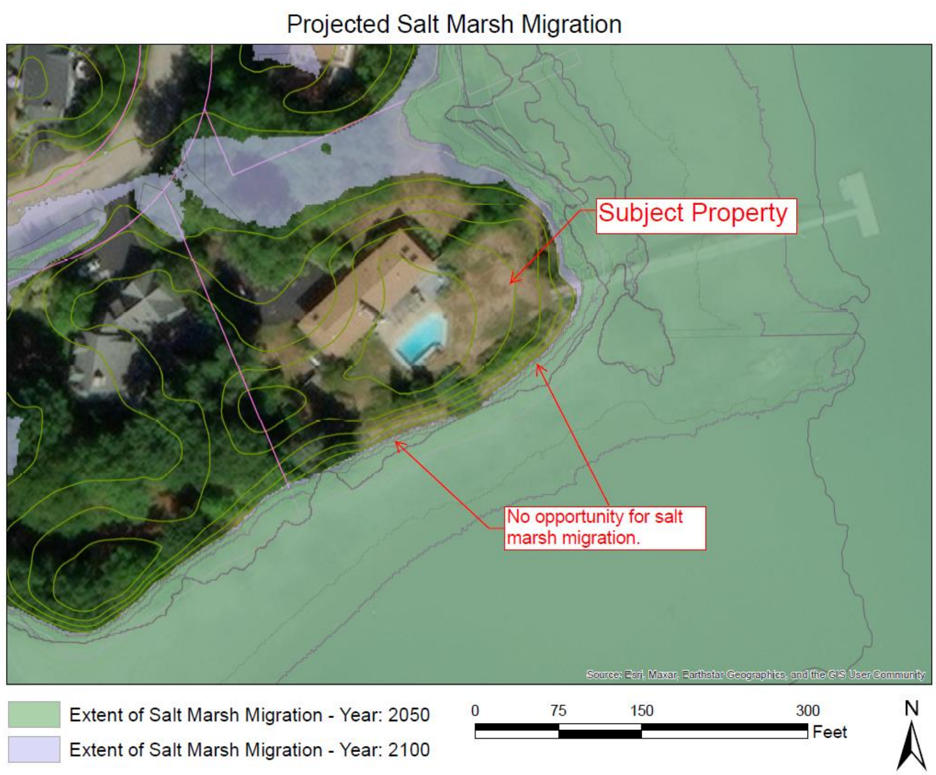

Figure 1- Sea Level Affecting Marshes Model (SLAMM).

Env-Wt 609.02(b)(7) – As demonstrated within the permit application and supporting materials, this project meets all the relevant Design Requirements of Env-Wt 514.04. Further, we have demonstrated how this project meets each provision of Env-Wt 514.04 below:

Env-Wt 514.04 (a) – Sheet flow naturally runs in the opposite direction and stormwater management techniques, including new pervious surfaces are proposed. The proposed regrading does not transfer any additional discharge towards the proposed Living Shoreline.

Env-Wt 514.04 (b) – To the maximum extent practicable, existing native trees and shrubs will be retained. Significant levels of invasive species will be removed as well.

Env-Wt 514.04 (c) – The bank is proposed to be regraded from a 1:1 slope to a flatter, 1.5:1 slope and a robust native planting plan is proposed.

Env-Wt 514.04 (d) – Impacts to adjacent properties and infrastructure have been avoided.

Env-Wt 514.04 (e) – Sound erosion and sediment control devices will be utilized, monitored, and adjusted as required throughout the duration of the project.

Env-Wt 514.04 (f) – Through our coordination with other relevant state and federal agencies, this project avoids and minimizes impacts to sensitive resources. The proposed Living Shoreline will result in an increase in the overall ecological integrity of the resource area.

Env-Wt 514.04 (g) – This is a coastal marine system, and therefore, this provision is not applicable.

Env-Wt 514.04 (h) – This is a coastal marine system, and therefore, this provision is not applicable.

Env-Wt 514.04 (i) – This is a coastal marine system, and therefore, this provision is not applicable.

6. Please revise the plans to show that the proposed living shoreline project will meet the all of the criteria listed in Env-Wt 609.05(b)(1) through (8), as required in accordance with Env-Wt 609.05(b), including but not limited to detailed plan views and cross sections of the existing slopes and proposed living shoreline treatments at representative stations along the length of the project; details regarding the proposed plantings; details regarding the methods for how all proposed bioengineered stabilization treatments will be securely anchored; etc.

Response: We referenced the "Guidance for Considering the Use of Living Shorelines" when designing this Living Shoreline. The existing and proposed shoreline is relatively uniform in shape, and therefore, a single cross section of proposed Living Shoreline will suffice. As demonstrated on the Living Shoreline Details Plan included with the permit application, the proposed Living Shoreline meets all the criteria of **Env-609.05(b)**, specifically:

Env-Wt 609.05(b)(1) – The proposed Living Shoreline uses native vegetation and limits the use of unnatural hardened structures.

Env-Wt 609.05(b)(2) – The proposed Living Shoreline mimics the natural landscape.

Env-Wt 609.05(b)(3) – This rule is not applicable as there are no beaches or dunes in this area.

Env-Wt 609.05(b)(4) – The proposed sill is at the lowest possible elevation.

Env-Wt 609.05(b)(5) – The proposed Living Shoreline maintains the shoreline's ability to absorb and mitigate storm impacts and adapt to the landward progression of the sea.

Env-Wt 609.05(b)(6) – The proposed Living Shoreline will not impact neighboring properties. The proposed living shoreline will connect to existing shorelines.

Env-Wt 609.05(b)(7) – The bank is being cut back from a 1:1 to a flatter, 1.5:1 slope and will be planted with native vegetation.

Env-Wt 609.05(b)(8) – The proposed Living Shoreline will enhance habitat for wildlife and aquatic species.

7. Please revise the plans to include a plan of all plantings proposed in the waterfront buffer, showing the proposed location(s) and Latin names and common names of proposed species in accordance with Env-Wt 610.04(f). Please note that this includes all plantings proposed as part of the living shoreline tidal bank stabilization project.

Response: A revised planting plan prepared by Licensed Landscape Architect, Matthew J. Cunningham, depicting the specifics of the proposed plantings is included with this response.

8. Please provide documentation that the proposed living shoreline design plan has been reviewed relative to delineations of wetlands and stamped by a certified wetland scientist in accordance with "Guidance for Considering the Use of Living Shorelines", NOAA (2015) as required in accordance with Env-Wt 609.05(a).

Response: We referenced the "Guidance for Considering the Use of Living Shorelines" when designing this Living Shoreline. As demonstrated on the Living Shoreline Details Plan included with the permit application, the proposed Living Shoreline is considered a "Green – Softer Technique" because only hard armor is proposed for sill materials for toe protection and greater resiliency for future, larger coastal storm events.

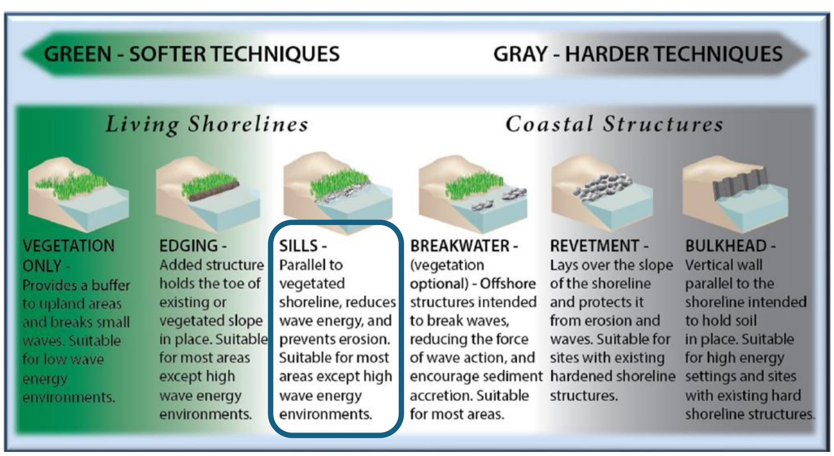

Figure 2 – Green, soft approach to constructing a Living Shoreline from the NOAA 2015 publication, "Guidance for Considering the Use of Living Shorelines."

NH Certified Wetland Scientist (CWS), Jay Aube and Professional Engineer (PE), Jack McTigue have stamped the plans.

Additional Supporting Information:

The following supporting information demonstrates how this project meets NHDES Wetland Bureau Administrative Rule Env-Wt 609.07 relative to the use of Hard-Scape or Rip-Rap in Tidal Shoreline Stabilization projects.

Env-Wt 609.07(a)(1)(a) – During storm events that coincide with astronomically high tides, the receding tide water produces lateral movements of water along the shoreline with a velocity that is too great to be treated with soft stabilization methods alone. Referencing the publication, "Guidance for Considering the Use of Living Shorelines," prepared by the National Oceanic Atmospheric Administration (NOAA), as prescribed by the NHDES Wetlands Bureau and the Piscataqua Region Estuaries Partnership (PREP), the professional engineers associated with this project have used a combination of soft and hard techniques to design this Living Shoreline.

Env-Wt 609.07(a)(1)(b) – The bulk of this Living Shoreline is proposed to be constructed with soft stabilization techniques. As result decreasing the slope to a flatter 1.5:1 slope and using angled stone, this project will have no adverse effect on neighboring properties.

Env-Wt 609.07(a)(2) – As evidenced by the plan prepared by professional engineers, the boulders and rip-rap are components used as a sill to stabilize the toe of slope and it is not the primary or dominant component of this Living Shoreline. This technique is outlined within the publication, "Guidance for Considering the Use of Living Shorelines," prepared by the National Oceanic Atmospheric Administration (NOAA).

Env-Wt 609.07(b)(1) – As evidenced by the photos below, TFMoran professional engineers have determined that soft stabilization techniques alone cannot adequately address this erosion. Using the methods outlined with the publication, "Guidance for Considering the Use of Living Shorelines," prepared by the National Oceanic Atmospheric Administration (NOAA), as prescribed by NHDES, hard armor is required to stabilize this shoreline and construct a sill at the toe of slope.

Photo 1 & 2 – Images depicting how the toe of slow has been undercut and compromised.

<u>Env-Wt 609.07</u>(b)(2) – During storm events that coincide in with astronomically high tides, the receding tide water produces lateral movements of water along the shoreline with a velocity that is too great to be treated with soft stabilization methods alone. Referencing the publication, "Guidance for Considering the Use of Living Shorelines," prepared by the National Oceanic Atmospheric Administration (NOAA), as prescribed by the NHDES Wetlands Bureau and the Piscataqua Region Estuaries Partnership (PREP), the professional engineers associated with this project have used a combination of soft and hard techniques to design this Living Shoreline.

<u>Env-Wt 609.07</u>(b)(3) – The professional engineers have determined the proposed rip-rap for toe protection will have no impact on neighboring properties. Adjusting the existing 1:1 slope to a flatter 1.5:1 slope and using minimal angled stone at the toe of slope ensures this Living Shoreline design will not accelerate tidal energy in a manner that adversely affects neighboring properties.

<u>Env-Wt 609.07</u>(b)(4) – The Living Shoreline Plan included with this RFMI response provides details relative to the sizes of all materials proposed for this Living Shoreline. Only a slight superficial layer of rip-rap is proposed above the toe stones equating to just 28 cubic yards distributed over 168-linear feet of proposed Living Shoreline.

<u>Env-Wt 609.07</u>(b)(5) – A cross section of the Living Shoreline is depicted on Living Shoreline Plan included with this response.

<u>Env-Wt 609.07</u>(b)(6) – Detailed plans were submitted with the original permit application that depict the relationship of the project to fixed points or reference, abutting properties, and features of the natural shoreline.

<u>Env-Wt 609.07</u>(c)(1) – The Living Shoreline Plan included with this response bears the stamp of NH Professional Engineer, Jack McTigue.

<u>Env-Wt 609.07</u>(c)(2) – The plans provided with the original permit application materials depict the proposed impact areas and the location of the Mean High Water (MHW) elevation. This Living Shoreline is proposed entirely within uplands and immediately adjacent to the Highest Astronomical Tide Line (HOTL).

Memo

Civil Engineers
Structural Engineers
Traffic Engineers
Land Surveyors
Landscape Architects
Scientists

To:	Kristin Duclos, DES Wetlands Permitting Specialist
From:	Jack McTigue, NH Professional Engineer, TFMoran, Inc.
CC:	Eben Lewis, DES Southeast Region Supervisor
Date:	August 28, 2024
Re:	Response to DES Request for More Information (RFMI) letter dated August 12, 2024 – DES Permit Application: 2023-03138

Dear Kristen,

In response to the NHDES Request for More Information (RFMI) letter dated August 12, 2024, we offer the following information to supplement the materials we provided to you on July 12, 2024. This information further demonstrates conformance with Env-Wt 609.07(b)(1)-(3).

Env-Wt 609.07 (b)(1)

The area of the existing bank/shoreline that was impacted during the January storm events is, on average, 2 to 2.5-feet above the Highest Astronomical Tide (HAT) elevation of 6.53-feet. These impacts are largely the result of significant levels of storm surge coinciding with astronomically high tides during coastal storm events. Given the former vegetated bank, essentially a natural "living shoreline", was unable to resist the erosive forces associated with these storm events, we elected to stabilize the shoreline with a hybrid approach as outlined within the NOAA publication, "Guidance for Considering the Use of Living Shorelines" as prescribed by NHDES Wetlands Bureau Administrative Rule Env-Wt 609.05. This hybrid design improves/flattens the steepest existing slopes, incorporates large toe stones, and applies a layer of riprap to those areas of the slope where vegetation alone, in the previous storm events, was ineffective at stabilizing the shoreline. This hybrid approach to shoreline stabilization includes a robust planting plan that incorporates common juniper plants that have demonstrated a high degree of resilience in past storm events.

It is our professional opinion that, in this instance, a hybrid approach is the most effective approach for shoreline stabilization because the heavier stones resist the scour caused by the transverse flow of the water, and the angular shape of the riprap provides energy dissipation which reduces the velocity of the transverse flows and waves.

Photo 1: Undercutting occurring to existing, formerly vegetated, shoreline.

The images below depict the undercutting of a bank, typical of scouring caused by horizontal flow of the water, not directional wave energy. Scouring is the direct removal of bank material at or below water level by the physical action of flowing water. In this instance, decreasing the steepest slopes and applying riprap will be an effective solution because it will slow the flow along the shoreline.

(c) Bank undercutting

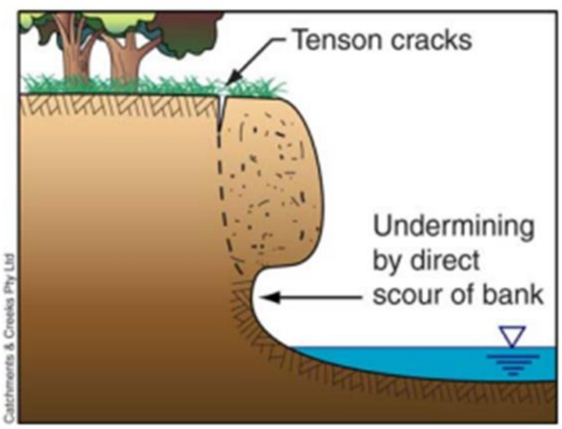

Figure 4 – Bank undercutting

Photo 4 – Bank undercutting (Qld)

Bank undercutting is the removal of material from the lower portion of a channel bank by 'bank scour'. This erosion results in the creation of an overhanging bank that usually fails in a more violent motion than occurs in 'bank slumping'. In effect, bank undercutting is a combination of bank scour within the lower bank, which ultimately causes upper bank slumping. The two actions may not occur simultaneously.

Reference 1: Saadon, Azlinda & Abdullah, Jazuri & Muhammad, Nur Shazwani & Ariffin, Junaidah. (2020). Development of riverbank erosion rate predictor for natural channels using NARX-QR Factorization model: a case study of Sg. Bernam, Selangor, Malaysia. Neural Computing and Applications. 1-11. 10.1007/s00521-020-04835-5.

Env-Wt 609.07 (b)(2)

As evidenced within photo 1 above, the scour was produced by a high energy environment and the existing vegetated shoreline alone was unable to resist the erosive forces associated with the tidal flows. During storm events, this high-energy environment cannot be stabilized by soft vegetative techniques alone.

Env-Wt 609.07 (b)(3)

The proposed riprap will be applied to the areas above highest astronomical tide elevation (HAT) that were impacted during the January storm events. During the majority of the yearly tidal cycles, tidal waters will not interface with the proposed riprap section of the living shoreline. The proposed riprap areas of the living shoreline will only interface with tidal waters that coincide with large storm events. As discussed above, the angled stone coupled with the improved/flattened steepest slopes dissipates energy so that the project also will not have adverse effects on the abutting properties. At the downstream terminal end of proposed riprap, we have keyed in the riprap at a 30-degrees angle to prevent scour on the neighboring property.

Respectfully,

Jack McTigue, PE, CPESC
Project Manager

EXHIBIT H

3rd Party Review of Hybrid Living Shoreline Design by Dr. Tom Ballestero

Shoreline modifications at 60 Pleasant Point Drive, Portsmouth, NH

Thomas P. Ballestero, PhD, PE, PG, PH, CGWP

Streamworks, PLLC

29 July 2025

The purpose of this memo is to review the shoreline modifications at 60 Pleasant Point Drive, Portsmouth, NH and to comment on two specific concerns:

- Will the shoreline modifications adversely impact abutting properties?
- What is the site's suitability for a completely green natural living shoreline and what type of site modifications would be required to achieve a completely green natural living shoreline?

The information available at the time of writing this memo includes:

- one design sheet (file entitled 'final-approved-plan-NHDES-wetland-permit.pdf, and entitled 'Living Shoreline Plan' (10 June 2024), identified as sheet-C-01
- one file entitled 'existing-conditions-plan.pdf' and entitled Existing Conditions Plan (4 February 2021) and identified as sheet C-01);
- photos dated November 23, 2020;
- photos taken February 25, 2024, and
- Google Earth images.

A site visit was conducted July 4, 2025.

The shoreline site is a portion of sheltered coastline along the Piscataqua River estuary. Lady Isle and Shapleigh Isle both act to minimize the fetch of part of the shoreline as well as shelter from wave action from the east and south. Newcastle, Blunts, and Leachs' islands further protect the site shoreline from direct wave impacts from the Atlantic Ocean. Bedrock outcrops are visible along the property and elsewhere to the north. There is existing salt marsh further north of the modified shoreline. The salt marsh forms the properties' east facing shoreline which is mostly north of the properties' dock. Some salt marsh exists south of this same dock and is grounded on a rock outcrop. There is a small island of salt marsh vegetation on the abutter's shoreline to the west, surrounded by gravel/cobble beach. From the plan sheet, notable elevations may be found in Table 1.

Table 1. Site Elevations (all in feet NAVD 88)

Descriptor	Elevation
Mean High Water	3.97
Mean High High Water	4.39
Highest Astronomical Tide	6.53
100-Year Base Flood Elevation	8.00

As is evident in Figures 1 and 2 (January 2025 and March 2025, respectively), there is a relic rock wall at almost the mean high water elevation. This relic rock wall is evident on Google Earth images back to 2003. Whether there was originally more to that structure is unknown, but previously shoreward of it was gravel/cobble beach for a few feet until it reached a near vertical, exposed, eroding bank. Before and after the shoreline modification there exists a gravel/cobble beach seaward of the relic rock wall. The relic rock wall is situated at approximately the mean high tide elevation. The wall continues to the west along the abutters shoreline (Figure 3). It can be seen here that along the abutters shoreline, the near vertical bank is a few feet shoreward of the relic rock wall. It is hypothesized that the Figure 3 shoreline geometry, shoreward of the relic rock wall, is similar to what existed at the subject property prior to the January 2024 storm, except for vegetation characteristics. Figure 4 is a picture of the property shoreline in 2020.   Because of its exposure to a larger fetch, the southern portion of the subject property witnesses more erosion than the shoreline to the north.

The January 2024 storm was reported to have caused significant erosion at the shoreline. Pictures (Figure 5, for example) reflect an erodible soil with a steep face. The shoreline modification was implemented in February 2025, as witnessed by the differences between Figures 1 and 2. The implemented shoreline modification used large toe stone (top elevation at highest observable tide) and a rip rap slope (1.5 H: 1V) to elevation 10 feet. Above that elevation, the slope continued to elevation 14.5 feet and was planted (Figure 6).

The northern terminus of the shoreline modification ends after the properties' dock (Figure 7) and about 90 feet from the northern property boundary. In the four months since project implementation, there does not appear to be evidence of an end effect (excessive deposition, erosion). There were few significant storms in this time period in which such effects might have been manifested. That said, the dock, the rock outcrop, and the relic rock wall act to stabilize hydraulic characteristics here (waves, currents) between before and after implementation. The geometry of the northern terminus (bending back into the shoreline) matches the general shoreline geometry. In addition, the tidal buffer (land elevation above mean high high water and generally extending in elevation to 3 to 4 feet higher) north of the shoreline modification is vegetated (Figure 7) further stabilizing this location against potential end effects.

The western terminus of the shoreline modification (Figure 8) is at the property boundary. A large maple tree is at this location and the relic rock wall continues in front of a mostly unprotected shoreline. There is no evidence of an end effect at this location, with the same caveats as the northern terminus of the shoreline modification. The shoreline modification bends shoreward at the end. There is gravel/cobble beach here (Figure 3) that extends westward. In addition, the width of the gravel/cobble beach increases moving westward. The property boundary here is about where the hydrodynamic shadowing effects of Lady Isle are noticeable, and a possible explanation for the widening beach when moving westward.

The opinion here is that on the north or west of the shoreline modification there are little apparent end effects to cause adverse effect on immediate property abutters. To the north, vegetation, the terminus geometry, the salt marsh, tidal buffer vegetation, bedrock outcrop, and the distance to the northern abutter, all act in concert to eliminate concerns of an adverse effect of the shoreline implementation of the northern abutter. To the west, Lady Isle, the end geometry, the maple tree, and the wider beach, all act in concert to minimize adverse effects to the western abutter.

To implement a complete living shoreline (no hard edge), first it must be recognized that vegetation with significant roots to hold soil only grows at the mean tide elevation and higher. The implemented shoreline modification was constructed above the highest astronomical tide elevation. Salt marsh vegetation grows generally between mean tide and mean high high tide elevations, and tidal buffer at higher elevation. The historic aerial imagery back to 2003 shows historic salt marsh vegetation about where it is today. The shoreline modifications do not appear to have removed salt marsh. Figure 9 is a drone image from October 2021 with salt marsh extent at that time. In the face of the extent and degree of erosion from the January 2024 storm (Figure 1), a living shoreline would need to have laid back the remaining shoreline slope from what it was. There is no specific criteria, however flatter is more stable, especially as soils get saturated. For a salt marsh, surface slope should be less than 5% (= 0.05, or 20 horizontal units to 1 vertical unit {20H:1V}). At higher elevations, the salt marsh transitions to tidal buffer vegetation. 3H:1V is about the steepest and 10H:1V is not uncommon for tidal buffer slope. The biggest disadvantage with living shorelines is that it takes time for vegetation and its roots to take hold. In the 2021 Existing Conditions Plan sheet, shoreline slopes at that time and along the location of the shoreline modification, ranged from 1.1H:1V to 2H:1V: much too steep for a living shoreline. In the middle of the shoreline modification, some unmodified shoreline exists.

Here there is a large juniper that survived (visible in Figures 1, 2, 4, and 5). This could serve as a template for such a living shoreline. The slope here is 2:1. However, a challenge at this site is that from elevation 16 feet to the elevation 19 feet, the land slope is 5H:1V to 6H:1V. This means that to implement the 3H:1V slope or flatter at the shoreline, there would need to be a vertical wall at the end of that slope to get to existing grade, or most of the higher elevations of the property would need to be excavated. Additionally, again from the 2021 Existing Conditions Plan sheet, the shoreline slope that starts at elevation 7 feet (note these elevations are in NGVD29) is a very steep bank of heights four to seven feet. It is extremely difficult with the tidal range and winter conditions at this site to have a soft edge with any more than 1 to 1.5 feet of near-vertical bank at the waters' edge. For all of these reasons a complete living shoreline at this site was infeasible. Creating a salt marsh at the shoreline modification would be a temporary solution because the marsh would not be able to migrate landward with sea level rise (due to the rapid increase in land elevation above MHHW). Given the starting elevation of the implemented shoreline modification (highest astronomical tide), tidal buffer vegetation would be successful shoreward. It should be noted that the 2019 New Hampshire Living Shoreline Site Suitability Assessment report and attendant mapping tool (https://nhdes.maps.arcgis.com/apps/webappviewer/index.html?id=157d2171163f439b9402ab7e93ac81fc), indicate that the location of the shoreline modification was suitable for a hybrid living shoreline (Figure 10), which is what was essentially constructed: a rock sill with plantings (tidal buffer) at a higher elevation. The selected shoreline modification addressed the bank height problem as well as accommodated steeper slopes. It is expected that in time, the plantings above the stone will grow and cover the stone sill much as the existing juniper does at the site today. To increase the vegetation coverage of what was constructed, one possibility is to infill the upper 18-inch minus stone with sand (washing it in to ensure all interstices are filled with sand) and plant dune vegetation (for example, Bristly gooseberry, Red raspberry, Beach heather, Beach-grass, Beach-pea, Little bluestem, Virginia wild rye).

Figure 1. Google Earth image dated January 2025

Figure 2. Google Earth image dated March 2025

Figure 3. Shoreline and relic rock wall extending to abutter to west (4 July 2025).

Figure 4. Property shoreline November 2020.

Figure 5. Post January 2024 shoreline erosion.

Figure 6. Modified shoreline at subject property (4 July 2025).

Figure 7. Northern terminus of shoreline modification (4 July 2025).

Figure 8. Western end of the shoreline modifications (4 July 2025).

Figure 9. Drone image from October 2021

Figure 10. Site suitability scoring

July 2025

THOMAS P. BALLESTERO
Hydrology and Water Resources Engineering

238 Gregg Hall — phone: (603) 862-1405
University of New Hampshire — fax: (603) 862-3957
Durham, NH 03824 — e-mail: tom.ballestero@unh.edu
Web site: https://ceps.unh.edu/person/thomas-ballestero

EDUCATION

Pennsylvania State University: B.S. in Civil Engineering, 1975
(Civil and Environmental Engineering)
Pennsylvania State University: M.S. in Civil Engineering, 1977
(Hydrology and Hydraulics)
Colorado State University: Ph.D. in Civil Engineering, 1981
(Hydrology & Water Resources)

REGISTRATION

Professional Engineering Licensure in NH, ME, VT, WY, NY, and PA
Registered Professional Hydrologist (AIH)
Certified Ground Water Professional (NGWA)
Licensed Professional Geologist, New Hampshire

TECHNICAL SOCIETIES

American Institute of Hydrology, Member
American Society of Civil Engineers, Life Member
American Water Resources Association, Member
National Society of Professional Engineers, Member

EXPERIENCE SUMMARY

2001-2020	Director, Stormwater Center, UNH
1989-present	Associate Professor of Civil Engineering, UNH
1993-1999	Chairman, Department of Civil Engineering, UNH
1986-1999	Director, New Hampshire Water Resources Research Center, UNH
1983-1988	Assistant Professor of Civil Engineering, UNH
1982-1983	Division Manager, Water Resources, Simons, Li and Associates, Inc.
1980-1981	Senior Hydrologist, Simons, Li and Associates, Inc.

PUBLICATIONS

Over 90 technical reports and papers on the topics of water resources planning, flood frequency analysis, hydrogeology, hydrology, contaminant fate and transport, solid waste management, stormwater management, stream restoration, living shorelines, liquefaction, oil spills, and reservoir operating procedures.

HONORS AND AWARDS

2024 FHWA 2024 Environmental Excellence Award for Successful Fish Passage Improvement Through Innovative Weir Construction on Bartlett Brook
2022 FHWA 2022 Environmental Excellence Award for Popham Beach, ME and Route 1A Newcastle Island, NH living shoreline designs
2016 ASCE/EWRI Water Visionary Award
2016 UNH Faculty/Staff Advisor of the Year
2015 New England Chapter American Public Works Association Meritorious Service Award
2015 Named by Presidential Board to US Stormwater Collaborative
2014 Best Paper Award: Journal of Transportation Engineering, Part A: Systems https://ascelibrary.org/doi/10.1061/JTEPBS.0000467
2011 US EPA Scientific Advisory Board for Hydraulic Fracturing Review Panel
2010 to present FEMA Scientific Resolution Panel on Flood Hazards
1998 τβπ Outstanding Teacher Award
1995-1997 Mr. and Mrs. Robert C. Davison Environmental Engineering Professorship
1992 University of New Hampshire Public Service Award
1992 Fulbright Scholar Award
1991 University of New Hampshire Outstanding Teaching Award
1991 Fulbright Scholar Award
1988 τβπ Outstanding Teacher Award
1986 American Express Partners of the Americas Outstanding Service Award

EXPERIENCE NARRATIVE

At the University of New Hampshire, Dr. Ballestero teaches Fluid Mechanics, Advanced Groundwater Topics, Hydrologic Monitoring, River Mechanics, Open Channel Flow, Engineering Hydrology, Coastal Engineering, Coastal Outfall Design, Stream Restoration, Advanced Stream Restoration Topics, Stormwater Management, and Design of Water Transmission Systems. His research interests are broadly in the field of applied water resources systems modeling and design as well as field monitoring of aquatic systems. Current research projects upon which he is working include: living shorelines, stream restoration; stormwater management; urbanization effects on runoff and water quality; stream crossing designs for aquatic organism passage, climate change characteristics of extreme floods; and instream flow. Past research endeavors included: movement, monitoring and biodegradation characteristics of organic contaminants in soils and ground water; innovative drilling and field techniques for characterization of contaminated sites and investigating environmentally sensitive locations; bedrock hydrogeology; hydraulic fracturing of bedrock formations; landfill leachate recirculation; artificial ground water recharge; land application of biosolids; simulation of historic salt water reductions to New Hampshire salt water marshes; evaluation of new drilling and ground water monitoring techniques; groundwater flow into coastal and estuarine systems; sediment transport and bridge scour; constructed wetlands from contaminated sediments; and composting of yard and agricultural solid wastes. Dr. Ballestero has taught courses in Concord, NH for personnel employed by the NH Department of Environmental Services that included: landfill design, introduction to ground water hydraulics and hydrology, and surface water hydrology. Dr. Ballestero has also lectured for the NH Technology Transfer Center on Stormwater Drainage and Design of Drainage Structures. He is active in international courses and education. He taught stormwater and groundwater short courses in Brazil, Panama, and Colombia, and taught graduate and undergraduate semester-long courses in Brazil and Puerto Rico. Dr. Ballestero is fluent in Portuguese and Spanish. In 2004 and 2005, at the request of the National Ground Water Association, Dr. Ballestero was invited to give three lectures on characterization and remediation of contaminated ground water in fractured rock. These lectures were given in New Orleans, Portland, and Houston. In 2006, again at the request of NGWA, this course was converted to an annual 2-day short course on site characterization in support of fractured rock remediation. The course was offered again in Denver in 2011.

International Efforts: Dr. Ballestero has been nationally and internationally involved in water resources projects including: groundwater development in northeast Brazil and Colombia, as well as the large Guaraní aquifer spanning Brazil, Uruguay, Paraguay, and Argentina; riverbank stabilization in Argentina; the effects of port construction in northeast Brazil; testimony before the U.S. Congress regarding ground water contamination; measurement and development of landfill gas emissions in Bermuda; monitoring of groundwater contamination in Colombia and South Korea; assessment of environmental hazards in northern Russia; contaminated bedrock remediation in Mexico; remediation of contaminated soil in Antarctica, estuarine monitoring in Puerto Rico; and an advisory/review capacity on the Boston Harbor clean-up program. In both 1991 and 1992 Dr. Ballestero was a Fulbright Scholar in Brazil where he taught ground water and surface water theory and modeling at two universities. His research focus there was ground water resources development, desertification, and water quality conditions of rivers. The Fulbright Awards also supported Dr. Ballestero's lectures at various universities and technical meetings throughout Brazil. In addition to his Fulbright experience, Dr. Ballestero has lectured on other occasions (1986, 1989, 1998, 2001, 2006, and 2018) at the Federal and State Universities in Fortaleza, Ceará, Brazil on topics of groundwater hydrology, computer simulation of hydrology and hydraulics, bedrock hydrogeology, stream restoration, and stochastic hydrology. At the Ceará State University he taught courses on environmental and water resources. He has also worked with the State of Ceará's technology agency (NUTEC) in hydrogeologic evaluation and development of ground water resources.

Dr. Ballestero taught stormwater management and design short courses in Panama for graduate students and practitioners. These courses were associated with the Technical University of Panama (UTP) and the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC).

Dr. Ballestero spent a sabbatical in Puerto Rico in 2000, at the request of the Puerto Rico Water Resources Research Center. With the Civil and Environmental Engineering Department at the University of Puerto Rico at Mayagüez, he taught two graduate courses: groundwater hydrology and water resources systems engineering. In addition, during this sabbatical he developed a monitoring plan for the Jobos Bay National Estuarine Research Reserve.

Groundwater: Dr. Ballestero has been involved with groundwater projects since 1980 (investigations, water supply, drainage, monitoring). He was one of the lead investigators of the Bedrock Bioremediation Center at UNH (1997-2004). In 1996, 1998, 2002, and 2003, Dr. Ballestero co-taught courses in Bogotá, Colombia on: design of ground water monitoring networks, ground water hydraulics, and ground water monitoring and sampling. The 2003 assignment was at the request of the Colombian geological agency, INGEOMINAS, to assist in the development and protection of bedrock groundwater resources in northern Colombia. In 1998, 2002, and 2003 he was an expert for the United Nations' International Atomic Energy Agency and was delegated to oversee ground water resources development: on the island of San

Andrés, Colombia; in the savanna north of Bogotá, Colombia; and for the Guaraní aquifer spanning Brazil, Uruguay, Paraguay, and Argentina. The 2002 assignment also included teaching in a two-week short course that incorporated one week of drilling, geophysics, sampling, and monitoring field demonstrations. Dr. Ballestero has a long consulting, academic, and research expertise in groundwater systems, and in 2010 the US Environmental Protection Agency (EPA) named him to its Science Advisory Board for the Hydraulic Fracturing Review. This panel provided independent peer review and advice to EPA regarding its study of the hydraulic fracturing method for the development of hard rock formations to provide unconventional gas for energy. At the present, he is the professional and technical lead for the University of New Hampshire chapter of Engineers Without Borders (EWB). EWB projects since 2000 primarily have focused on developing and/or improving water supplies in low income countries. Projects have been completed in: Malawi, Uganda, Thailand, Peru, and Niger. Very recently, Dr. Ballestero has been involved with groundwater projects that focus on perfluorinated compounds in groundwater.

Restoration of Impaired Aquatic Systems: Dr. Ballestero's original training and employment was in the area of surface water hydraulics and hydrology. His first private sector employment in the 1970's was with a firm that focused on river engineering: what is now called "stream restoration". Through the years he has continued to consult in this area. On a sabbatical year spanning 2005-2006, Dr. Ballestero performed stream and wetlands restoration projects with the US Fish & Wildlife Service Pennsylvania Field Office out of State College, PA. His duties included: engineering designs, collection of stream geomorphic data, and construction supervision. Representative projects included: dam removal, fish bypass channel designs for small dams; wetland design and construction; channel construction; sediment transport monitoring and modeling; and river hydraulic simulation. His projects were located across the Pennsylvania Commonwealth, one such project description of one of his designs may be found at https://www.wildlifeforeveryone.org/projects/coalTownship.php. During this time Dr. Ballestero also reviewed and commented on restoration projects that were submitted for regulatory permits to USFWS. This USFWS work effort continued when the USFWS extended to him a 5-year Intergovernmental Personnel Agreement. He spent June through December, 2007, June – August, 2008, and June – August 2009 with the USFWS. Also during this time, Dr. Ballestero taught in three seminars/short courses with the Pennsylvania State University Cooperative Extension on stormwater management and stream restoration. In 2013 he completed a US Army Corps of Engineers project in the restoration of Southampton Creek: an impaired urban stream near Philadelphia, PA. His current research lines in stream restoration include: statistical and geomorphic characteristics of large wood in streams; monitoring the movement of large particle (> 400 mm) sediment transport using passively induced transmitters; dam removal; urbanization consequences to streams; effects of stream crossings on aquatic organism passage (AOP), and fish frequencies related to wood. Dr. Ballestero was involved with modeling river hydraulics and floodplain studies since the mid-1970's. In 2010, the Federal Emergency Management Agency (FEMA) named Dr. Ballestero to its Scientific Resolution Panel (SRP). This panel is codified in the National Flood Insurance Act to perform independent reviews of the scientific and technical data used by FEMA to develop flood elevations for the National Flood Insurance Program's Flood Insurance Rate Maps. The objective of the SRP Process is to assist FEMA and communities in efficiently and impartially reviewing and resolving conflicting data presented to FEMA. In 2009, Dr. Ballestero was the lead technical author for the State of New Hampshire Stream Crossing Guidelines. He also developed a screening tool to assess the hydraulic, AOP, and geomorphic compatibility of culverts which the State of New Hampshire now use to assess all culverts in the state. More recently, in 2022-2023 Dr. Ballestero lead a team of biologists and NH agencies (NHDES, NHFG) and developed design and analytical guidelines for turtle crossings at road-wetland culverts. His stream restoration efforts have led to a related research line of living shorelines. Dr. Ballestero was a lead team member that designed and constructed the first coastal living shorelines in New Hampshire to arrest shoreline erosion. He has completed two other projects since and more are in the funding pipeline. Dr. Ballestero is actively involved with guidance documents and training with collaborators from: The Natures Conservancy, ASCE/COPRI, Piscataqua Region Estuaries Project, Northeast Region Ocean Council, NOAA, and NHDES.

Stormwater: Based upon his research during the 1990's on stormwater management systems, Dr. Ballestero was funded by NOAA to create the UNH Stormwater Center – UNHSC (http://www.unh.edu/unhsc/). The UNHSC has a nearly $1 million annual operating budget and studies the design, performance, maintenance, sustainability, and life cycle of all forms of stormwater management technologies. Dr. Ballestero served as the principal Investigator and Director of the UNHSC from its inception in 2002 through 2020. Dr. Ballestero had three staff working for the UNHSC, and numerous graduate and undergraduate students. At the present, he serves as the lead scientist for the UNHSC. The UNHSC developed some of the fundamental performance data for green stormwater infrastructure technologies as well as the design specifications for some of these technologies. EPA Region 1 used UNHSC field data to develop guidance for retrofitting green infrastructure into urban environments, and this is now built into regional MS4 permits. The UNHSC has designed, constructed, maintained, and/or monitored hundreds of stormwater systems, including: bioretention, detention/retention ponds, swales (grassed, rip rap, berm), sand filter, subsurface gravel wetland, subsurface gravel filters, tree filter, permeable pavements, and over two dozen manufactured systems. The UNHSC specifications for the subsurface gravel wetland, sectional media box filter, and porous asphalt are employed throughout the USA as have been included in numerous stormwater guidance documents. The UNHSC has designed unique stormwater systems for particularly challenging retrofit sites including infiltration systems, tree filters, and subsurface media filters.

Professional Engagement: Dr. Ballestero peer reviews articles submitted to the following journals: Journal of the American Water Resources Association, Journal of Energy Engineering (ASCE), Rivers, Groundwater (NGWA), Water Resources Research (AGU), Ground Water Monitoring and Remediation (NGWA), Journal of Environmental Engineering (ASCE), Journal of Irrigation and Drainage (ASCE), and Journal of Hydraulic Engineering (ASCE). He has also provided peer review of proposals and served on expert review panels for NSF, EPA, and USDA. He served for ten years on the Editorial Review Board for Ground Water Monitoring and Remediation, and six years as an Associate Editor for the Journal of the American Water Resources Association. Consulting work with which he is typically involved includes: hydraulic effects of flood plain encroachments; ground water resources delineation and development; ground water contamination; effects of mining on ground water; septic system failure mechanisms; design sediment and erosion control measures; design and analysis of stormwater management systems; valuation of ground water resources; dissolved oxygen modeling in rivers; design of coastal outfalls and harbor works; recirculation of landfill leachate; measurement of vapor fluxes from landfills; closure designs for solid waste dumps; hydrodynamic evaluation of coastal structures; and expert witness testimony.

Supervisory roles: Aside from these academic and research pursuits at UNH, from 1986 to 1999, Dr. Ballestero was the Director of the New Hampshire Water Resources Research Center. This position entailed: overseeing the annual research program, technology transfer, and water related publications. Annually the Center supported three to six research projects. The Center Director develops short- and long-term research objectives from the interactions and polling of water resources professionals throughout the State. The Director is also responsible for helping to develop federal water resources legislation by the U.S. Congress. Dr. Ballestero was formerly the Secretary of the National Institutes for Water Resources (NIWR) and the regional representative for the NIWR executive board.

Another administrative position held by Dr. Ballestero at UNH was as Chair of the Civil Engineering Department (1993 – 1999). At the time, the Department had 12 FTE faculty, 2 research faculty, and 3 full-time staff members. Also, the Department had 200 undergraduate and 50 graduate students. Department annual research expenditures exceeded $2 million. The Department housed the following research institutes: Technology Transfer Center, Environmental Research Group, and the New Hampshire Water Resources Research Center.

Prior to his employment at UNH, Dr. Ballestero was employed by Simons, Li, and Associates, Inc. His position there was Senior Hydrologist and Division Manager of the Water Resources Engineering Division. In this capacity, Dr. Ballestero was project manager for projects dealing with water resources development (ground water and surface water supplies), hydropower feasibility analyses, hydrologic analysis and simulation, evaluation of contaminant migration, water rights, and design and evaluation of water monitoring networks. Also, Dr. Ballestero was involved with proposals, corporate marketing, expert witness testimony and corporate management. Dr. Ballestero started and temporarily ran the company branch office in Cheyenne, WY.

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EXHIBIT I

NH Living Shoreline Site Suitability Assessment – Technical Report

New Hampshire Living Shoreline Site Suitability Assessment

Technical Report

April 2019

R-WD-19-19

New Hampshire Living Shoreline Site Suitability Assessment:
Technical Report

Prepared for:
The New Hampshire Department of Environmental Services Coastal Program

Prepared by:

Vidya Balasubramanayam,
NOAA Coastal Management Fellow,
Tridec Technologies, LLC

Kirsten Howard,
Coastal Resilience Coordinator,
New Hampshire Department of Environmental Services Coastal Program

Portsmouth Regional Office
Pease International Tradeport
222 International Drive, Suite 175
Portsmouth, NH 03801
(603) 559-1500 |www.des.nh.gov

Robert R. Scott, Commissioner
Clark Freise, Assistant Commissioner
Thomas O'Donovan, Water Division Director

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Project team

The project team provided valuable guidance throughout the course of this project. Project team members helped define the research questions, management goals and information needs addressed by the living shoreline site suitability assessment (L3SA). The project team met four times to review the progress of the L3SA and to make sure that it is relevant and useful for its end-users. Project team members also assisted by providing data and guidance in one-on-one meetings with the project leads.

Project team members include:

- Steve Couture, New Hampshire Department of Environmental Services Coastal Program
- Brianna Group, The Nature Conservancy New Hampshire
- Kirsten Howard, New Hampshire Department of Environmental Services Coastal Program
- Dr. Alix Laferriere, The Nature Conservancy New Hampshire
- Steve Miller, New Hampshire Fish and Game Department Great Bay National Estuarine Research Reserve
- Cory Riley, New Hampshire Fish and Game Department Great Bay National Estuarine Research Reserve

Technical team

The technical team provided extensive expertise related to technical aspects of L3SA development. Technical team members provided data sources, scored attributes, weighted factors and reviewed results.

The technical team for this project includes the following members:

- Dr. Tom Ballestero, UNH Stormwater Center
- Dr. David Burdick, Jackson Estuarine Laboratory
- Dr. Rick Chormann, New Hampshire Geological Survey
- Stefanie Giallongo, New Hampshire Department of Environmental Services Wetlands Bureau
- Kirsten Howard, New Hampshire Department of Environmental Services Coastal Program
- Kevin Lucey, New Hampshire Department of Environmental Services Coastal Program
- Ashley Norton, University of New Hampshire (UNH) Center for Coastal and Ocean Mapping; Delaware Department of Natural Resources and Environmental Control
- David Price, New Hampshire Department of Environmental Services Wetlands Bureau
- Pete Steckler, The Nature Conservancy New Hampshire

- Rachel Stevens, New Hampshire Fish and Game Department Great Bay National Estuarine Research Reserve
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- Amy Lamb, New Hampshire Natural Heritage Bureau
- Lindsey Lefebvre, U.S. Army Corps of Engineers
- Eben Lewis, New Hampshire Department of Environmental Services Wetlands Bureau
- Dr. Greg Moore, Jackson Estuarine Laboratory
- Lori Sommer, New Hampshire Department of Environmental Services Wetlands Bureau

Table of contents

List of figures

List of tables

List of equations

0.0 Executive summary

A recent inventory of New Hampshire's tidal shoreline protection structures showed that approximately 12% of the state's tidal shoreline is armored by some type of engineered erosion control structure (Blondin 2016). With rising seas and intensifying storm surges, erosion is expected to get worse and consequently, demand for shoreline stabilization is expected to increase (Field, Dayer and Elphick, 2017). However, traditional armored shoreline structures have been shown to impede salt marsh migration, negatively impact shoreline stability and habitat condition, and potentially fail during major storms if built poorly or not maintained (Gittman et al. 2014; Sutton-Grier, Work, and Bamford 2015; Smith et al. 2017; Thieler and Young 1991).

Recognizing the need to protect and enhance the resilience of coastal community shorelines, the New Hampshire Department of Environmental Services Coastal Program (NHCP) and its partners are advancing the practice of living shorelines as an erosion control strategy that works with nature. For the purposes of this report, a "living shoreline" means a management practice that provides erosion control benefits, protects, restores or enhances natural shoreline habitat, and maintains coastal processes through the strategic placement of plants, stone, sand fill and other structural organic materials, maintaining the continuity of the natural land-water interface while providing habitat value and protecting against coastal hazards (RSA 482-A; Env-Wt 600 DRAFT).

However, coastal New Hampshire does not have a long history of living shoreline implementation and evaluation and although permitting is shifting to favor living shorelines (RSA 482-A; Env-Wt 600 DRAFT), the process is untested (Woods Hole Group, 2017). Additionally, because of unique conditions in the Northeast including a short growing season, ice and nor'easters, and a large tidal range, living shoreline projects in the Northeast face additional challenges compared to those applied more extensively in the Gulf of Mexico and the Mid-Atlantic (Woods Hole Group, 2017).

The goal of the New Hampshire living shoreline site suitability assessment (L3SA) is to identify sites (at the finest resolution possible given data availability) that may be suitable for specific living shoreline approaches in order to address erosion issues along the New Hampshire tidal shoreline. Borrowing from geospatial living shoreline site suitability modelling approaches conducted in other states and regions (see Appendix II), the L3SA integrates hydrodynamic, geophysical, ecological and sociopolitical characteristics of the state's tidal shoreline and also attempts to incorporate characteristics unique to the Northeast such as a short growing season, effects of ice, nor'easters and a large tidal range (Woods Hole Group, 2017). The L3SA assigns a suitability index number (on a scale of 1 to 6) to each point along the shoreline spaced 10 feet apart; an index number of 6 indicates that the site is "highly suitable for living shorelines with no structural components," and an index number of 1 indicates that the site "may be suitable for living shorelines with very significant hybrid components and/or site modification."

Eighty-two percent of the New Hampshire tidal shoreline received biophysical suitability index numbers between 4 and 6, suggesting that the majority of the New Hampshire tidal shoreline may be suitable for no stabilization action, low impact management or nature-based stabilization. The results also suggest certain areas that may be suitable for hybrid shoreline stabilization approaches that may involve additional site modification, and identify currently armored segments where replacement or softening of armoring with nature-based components may be an option. The sociopolitical feasibility assessment provides additional context about each site that may influence project feasibility or approach.

The L3SA is intended to be a screening tool used for planning purposes only and sites of interest should be further evaluated with a site-specific survey. The L3SA results are intended to inform a range of end-users including New Hampshire Department of Environmental Services (NHDES) Wetlands permitters, municipal conservation commission members, other regulatory agency staff, NHCP technical assistance providers, grant managers, engineers, consultants, landscape architects, nonprofits, and owners of land/property along the New Hampshire tidal shoreline as they consider appropriate stabilization actions for eroding shorelines.

1.0 Introduction and background

Coastal shoreline erosion is primarily a natural process driven by geologic and hydrodynamic factors that provide a valuable sediment source for New Hampshire's beaches and salt marshes (Strafford Rockingham Regional Council 1978). Erosion can be exacerbated by human influences like nearshore development and recreation. In extreme circumstances erosion can threaten public and private property, emergency vehicle routes, and other coastal infrastructure (U.S. Global Change Research Program 2016). There is limited local historic data available to quantify short-term and long-term estuarine and outer coast shoreline change in New Hampshire. A study along the outer coast of northern New England found that although this region exhibits a long-term net shoreline change rate of 0.1m of accretion per year, 41% of transects showed 0.2m of erosion per year (Hapke et al. 2011). In 1978, the Strafford Rockingham Regional Council made an attempt to document local erosional hotspots and discussed major drivers of erosion along stretches of tidal shoreline. The assessment identified ice, decreased sedimentation from eelgrass loss and dams upstream, ebb currents and waves, and scouring due to tides as the primary drivers of estuarine erosion and pointed to longshore transport, erosion of unconsolidated glacial deposits, nor'easters, and storm surges as the primary drivers of erosion along the open coast.

In an attempt to better understand erosional trends in New Hampshire beaches, a 2017 study of beach volumetric change found that the large southern beaches including Hampton Beach and Seabrook Beach show net seaward movement or accretion; the smaller northern beaches including Plaice Cove, the southern portion of Bass Beach, Rye Beach show a net landward movement or erosion; and while North Beach, the northern portion of Bass Beach, Foss Beach and Wallis Sands showed mixed results of accretion and erosion, they showed net volumetric losses (Olson and Chormann 2017). The results of the 2017 study are being supplemented with data from volunteer-based beach and dune profiling efforts that began in early 2017. Although the beach profiling data record is still too short to explain long-term trends, pre- and post-storm data showed that most beaches and dunes eroded significantly after Winter Storm Riley in March 2018, and that recovery was occurring to varying degrees (Eberhardt et al. 2018). Long-term coastal beach erosion, as driven by sea-level rise and storms, is projected to continue, with one study indicating that the shoreline is likely to erode inland at rates of at least 3.3 feet (1 m) per year among 30% of sandy beaches along the U.S. Atlantic coast (Gutierrez et al. 2014). In order to estimate bank and marsh erosion rates along sheltered coastlines in New Hampshire (Norton 2017), an attempt was made to delineate the shoreline and conduct a point-based change analysis of the entire estuarine shoreline; however, because of data limitations, this approach was abandoned (Appendix III). Some insights about projected estuarine shoreline change can be gleaned from the Sea Level Affecting Marshes Model (SLAMM) results which suggest that with 6.6 feet of sea level rise by 2100, 240 out of 6,040 existing acres of salt marsh are likely to be lost in the next decade and by 2100, less than 300 acres of currently existing salt marshes may remain (New Hampshire Fish and Game Department 2014).

In addition to natural erosion, the effects of development and nutrient loading are placing significant stress on the Great Bay and Hampton-Seabrook estuaries, which are both showing declining trends in water quality and habitat extent (Piscataqua Region Estuaries Partnership 2017). Between the early 1900s and 2010, an estimated 431 acres of salt marsh area were lost in the Great Bay Estuary, and 614 acres were lost in the Hampton-Seabrook Estuary (Piscataqua Region Estuaries Partnership 2010). Loss of salt marsh results not only in loss of habitat, pollutant attenuation capacity and carbon storage (Davis et al. 2015; Gittman et al. 2016; Piehler and Smyth 2011), but also in more exposed shorelines vulnerable to erosion (New Hampshire Fish and Game Department 2015). These trends are likely to continue given that development in this region is expected to increase over subsequent decades (U.S. Environmental Protection Agency 2009).

A common coastal landowner response to land loss from both natural and human-caused erosion is to construct shoreline protection structures such as rip rap, seawalls and revetments. A recent inventory of New Hampshire’s tidal shoreline protection structures showed that approximately 12% of New Hampshire’s tidal shoreline is armored by some type of engineered structure (Blondin 2016). An analysis of NHDES Wetlands Bureau permit applications related to tidal shoreline stabilization suggests that demand for permits is increasing, with 157 permits issued in the 1980s compared to 564 permits issued in the 2000s (Blondin 2016a). With rising seas and intensifying storm surges, this increasing demand for traditional shoreline stabilization will likely continue (Field, Dayer, and Elphick 2017). However, traditional armored shoreline structures have been shown to impede salt marsh migration, negatively impact shoreline stability, habitat condition and other ecosystem services, and potentially fail during major storms if built poorly or not maintained (Thieler and Young 1991; Gittman et al. 2014; Sutton-Grier, Work, and Bamford 2015; Smith et al. 2017).

Living shoreline alternatives to traditional shoreline protection structures may reduce unintended consequences of controlling for erosion. Under appropriate conditions, living shoreline installations absorb wave energy (Manis, Garvis, Jachec and Walters 2014) which reduces scour, sediment resuspension and erosion (Polk and Eulie 2018) while supporting natural movement and distribution of sediments (Meyer, Townsend, and Thayer 1997) and providing habitat for native species as well as pollutant attenuation and improved carbon storage (Davis et al. 2015; Gittman et al. 2016; Piehler and Smyth 2011). For the purposes of the L3SA, a “living shoreline” means a management practice that provides erosion control benefits, protects, restores or enhances natural shoreline habitat, and maintains coastal processes through the strategic placement of plants, stone, sand fill and other structural organic materials, maintaining the continuity of the natural land-water interface while providing habitat value and protecting against coastal hazards (RSA 482-A; Env-Wt 600 DRAFT). Living shoreline projects consist of a wide range of specific approaches and range from regrading and replanting a bank to building a fringe salt marsh with a stabilizing sill to replenishing a beach or creating protective dunes (Woods Hole Group 2017).

Recognizing the need to protect and enhance the resilience of coastal community shorelines, the New Hampshire Department of Environmental Services Coastal Program (NHCP) and its partners are advancing the practice of living shorelines as an erosion control strategy that works with nature. Coastal New Hampshire does not have a long history of living shoreline implementation and evaluation and although permitting is shifting to favor living shorelines (RSA 482-A; Env-Wt 600 DRAFT), the process is untested (Woods Hole Group 2017). Additionally, because of unique conditions in the Northeast such as a short growing season, ice, nor’easters and a large tidal range, living shoreline projects in the Northeast face additional challenges compared to those applied more extensively in the Gulf of Mexico and the

Mid-Atlantic (Woods Hole Group 2017). However, New Hampshire has a longer history of successful nature-based bank stabilization in freshwater riverine ecosystems and guidance and lessons learned from those projects may prove useful for siting and designing living shorelines in New Hampshire's tidal regimes (Schiff, MacBroom, and Bonin 2007). One important step toward better understanding how living shoreline projects might work in New Hampshire is to identify the appropriate physical and social conditions and sites where projects could be successful, in order to inform landowners who may be considering stabilization projects and enable decision makers to approve suitable proposals.

1.1 The NH living shoreline site suitability assessment (L3SA)

The goal of the New Hampshire living shoreline site suitability assessment (L3SA) is to identify sites (at the finest resolution possible given data availability) that may be suitable for specific living shoreline approaches in order to address erosion issues along the New Hampshire tidal shoreline. Building on geospatial living shoreline site suitability modelling approaches conducted in other states and regions (see Appendix II), the L3SA integrates hydrodynamic, geophysical, ecological and sociopolitical characteristics of New Hampshire's tidal shoreline and also attempts to incorporate characteristics unique to the northeast such as a short growing season, effects of ice, nor'easters and a large tidal range (Woods Hole Group, 2017). The L3SA assigns a suitability index number on a scale of 1 to 6 to points along the shoreline spaced 10 feet apart; an index number of 6 indicates that the site is "highly suitable for living shorelines with no structural components," and an index number of 1 indicates that the site "may be suitable for living shorelines with very significant hybrid components and/or site modification."

The objective of the L3SA is to identify sites on the tidal shoreline that are:

- Suitable for employing soft stabilization living shorelines (eg., vegetative restoration).
- Suitable for employing hybrid stabilization living shorelines (eg., fringe marsh restoration with a structural sill).
- Best left alone (no action needed) either because they are stable systems or should be allowed to erode and provide a sediment source.
- Need to be significantly modified for a living shoreline approach and/or combined with more hybrid components.
- Currently armored but suitable for armor removal and replacement with a living shoreline.

The L3SA is intended to be a screening tool only and not a site assessment or prioritization tool. While it helps identify sites that could benefit from erosion control, it is not intended to be used for flood risk reduction/property protection purposes. It is not intended to be used to justify modifying the shoreline. An engineers' site assessment is always recommended before moving forward with a living shoreline strategy.

The L3SA is intended to be used in the following ways by the identified end-users:

- NHDES Wetlands Bureau permitters, municipal conservation commission members and other regulatory agency staff to evaluate proposed shoreline stabilization projects and to inform conversations with applicants about potential living shoreline approaches at specific sites.

- NHCP technical assistance providers and grant managers to decide where to allocate resources for shoreline stabilization.
- Engineers, consultants and landscape architects to inform conversations with prospective or active clients about suitable living shoreline options as specific sites.
- Public and conservation landowners such as The Nature Conservancy, New Hampshire (TNC NH), land trusts and other government agencies to understand suitable living shoreline approaches at eroding sites.
- Private property owners to learn about their site and identify potential living shoreline approaches at eroding sites.
- Researchers to acquire baseline site suitability data for monitoring and other research.

1.2 Study area and unit of analysis

The L3SA was conducted along the New Hampshire tidal shoreline including but not limited to tidally-influenced waters along the Atlantic Coast, Great Bay, the Piscataqua River, Portsmouth Harbor, the Squamscott River, the Bellamy River, the Lamprey River, the Oyster River, the Cocheco River, the Salmon-Falls River, the Winnicut River and intertidal marshes. The L3SA includes the 17 New Hampshire Coastal Zone communities: Dover, Durham, Greenland, Exeter, Hampton, Hampton Falls, Madbury, New Castle, Newfields, Newington, Newmarket, North Hampton, Portsmouth, Rollinsford, Rye, Seabrook and Stratham.

The analytical units of the L3SA are points spaced 10 feet apart along the Mean Higher High Water line derived from LiDAR (see Appendix IV). All relevant site suitability and feasibility data was aggregated to each MHHW point.

2.0 Methods/approach

2.1 Applicability of other living shoreline suitability studies to NH

Living shoreline site suitability assessments conducted in other geographic areas along the U.S. eastern seaboard and Gulf of Mexico (Appendix II) were reviewed. These assessments were developed using GIS-based site suitability models. The model developed for Maine's Casco Bay (Slovinsky et al. 2017 ongoing) proved most comparable and transferable to New Hampshire's shoreline conditions.

Most of the assessments' stated goals related to informing erosion control and shoreline stabilization projects. While the assessments conducted for Worcester County, Maryland (Berman and Rudnicky 2008) and Mobile Bay, Alabama (Boyd et al. 2016) used high-quality, field-verified erosion data, others, including the assessments in Long Island Sound, Connecticut (Zylberman et al. 2015), measured shoreline change using the Digital Shoreline Analysis System (DSAS), while Slovinsky et al. (2017) in Casco Bay, Maine and Mitsova et al. (2016) in Southeast Florida used erosion proxies such as fetch, boat wakes and wave heights. Since New Hampshire did not have erosion data for the estuarine shoreline, different options for erosion analysis were evaluated (Norton 2017) and attempted. Ultimately, the use of erosion proxies was deemed to be the most feasible approach given staff capacity and data availability for the New Hampshire shoreline (Appendix II).

The outputs varied across assessments: Slovinsky et al. (2017) in Casco Bay, Maine and Dobbs et al. (2016) in Sarasota County, Florida produced numerical outputs spanning a range of suitability numbers while other assessment outputs (Berman and Rudnicky 2008; Boyd et al. 2016; Zylberman et al. 2015) produced ranges of prescriptive strategies to address erosion. These output approaches informed New Hampshire's decision to produce numerical outputs linked but not explicitly tied to potential living shoreline strategies.

2.2 Conceptual models

In consultation with the project team and technical team and informed by the assessments conducted in other states, conceptual models were developed to inform the L3SA in New Hampshire. The conceptual biophysical suitability model (Figure 1) synthesized ecological, geophysical and hydrodynamic data inputs. The values of each input dataset were categorized and each category was assigned a score. Then, weights were assigned to indicate relative importance of data inputs to living shoreline suitability. A weighted overlay equation (see Section 2.3) was used to calculate the suitability index numbers which range from 1 to 6; with 1 representing possible suitability for hybrid living shoreline approaches with very significant structural components and/or site modification and 6 representing high suitability for living shoreline approaches with no structural components and no site modification.

The sociopolitical feasibility model (Figure 2) did not include numerical scoring or weighting due to the subjective and overlapping nature of some of the data inputs. However, datasets were compiled that represent some measures of likelihood of demand for stabilization, owner capacity/interest, vulnerability of a project to sea-level rise, regulatory considerations, and ecological values assigned by stakeholders to sites along the shoreline.

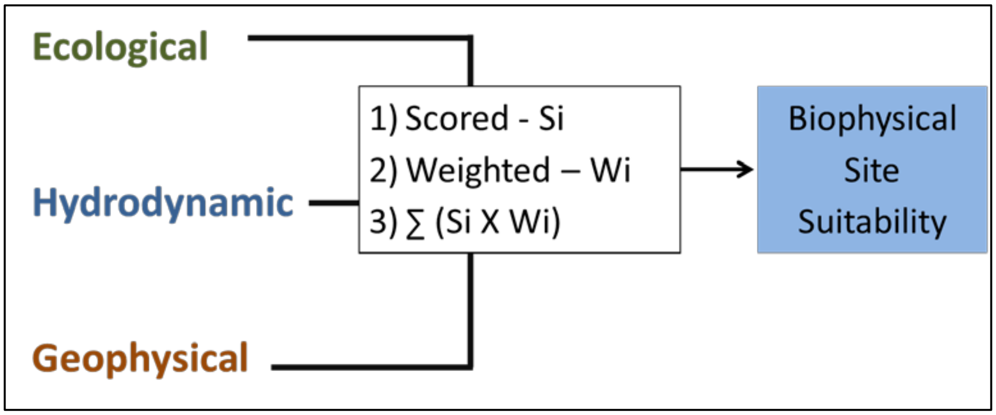


Figure 1. Conceptual model for living shoreline biophysical site suitability in New Hampshire

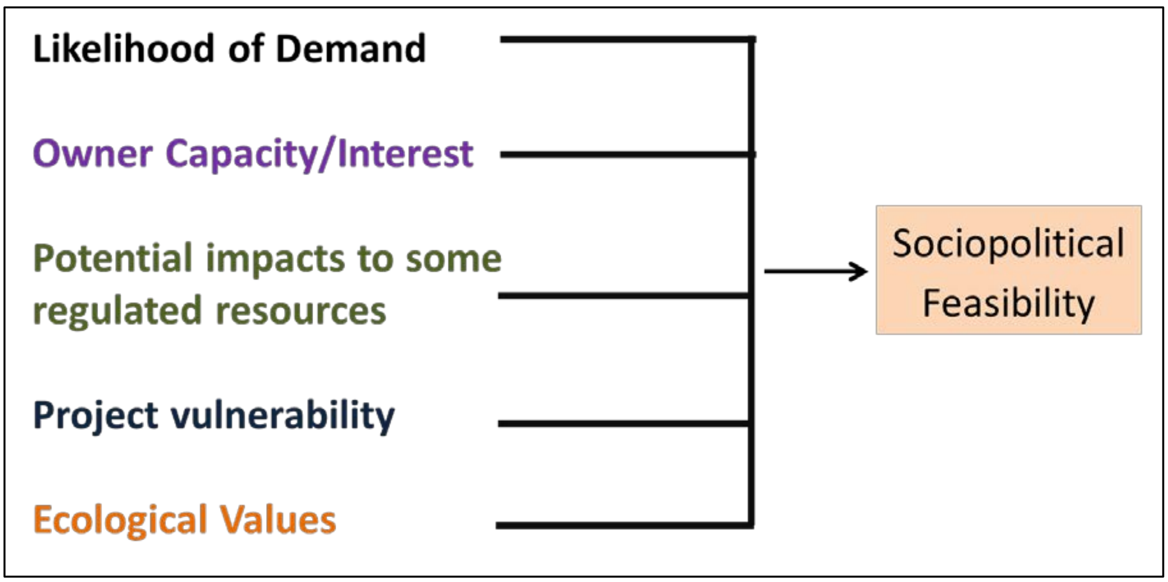


Figure 2. Conceptual model for living shoreline sociopolitical feasibility in New Hampshire

2.3 Biophysical suitability model

The analytical units of the biophysical suitability model are points spaced 10 feet apart (MHHW points). All input datasets were aggregated to these points based on rules specific to each dataset. The weighted overlay used in the biophysical suitability model was based on the following equation (Equation 1).

$$\mathbf{SI_i = (2A_i + 2B_i + C_i + D_i + E_i + F_i + G_i + 2H_i + 3I_i + 2J_i + K_i + 2L_i + 3M_i + 4N_i + O_i + 4P_i + 3Q_i) / (34 - X_i)}$$

Where:

i is MHHW point
SI is suitability index number
A is scored northeast fetch (proxy for storm effects)
B is scored northwest fetch (proxy for ice effects)
C is scored tidal crossing proximity (proxy for high velocity areas)
D is scored current velocity in terms of impacts on shoreline edge (proxy for scouring effects)
E is scored current velocity in terms of sediment transport (proxy for scouring effects)
F is scored distance from federal navigation channels (proxy for boat wakes which is in turn a proxy for erosion)
G is scored aspect (proxy for sunlight exposure)
H is scored distance from eelgrass beds (proxy for wave attenuation in sheltered coastlines)
I is scored landward shoretype
J is scored seaward shoretype
K is scored secondary seaward shoretype
L is scored future salt marsh potential
M is scored engineered shoreline structure presence
N is scored steep bank presence
O is scored beach erosion condition
P is scored seaward slope (proxy for wave energy)
Q is scored soils erodibility
X is the sum of weights for the input scores without data (sum weight when A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, or Q = 0)

Equation 1. Equation used to calculate living shoreline biophysical suitability index numbers for MHHW points in New Hampshire

2.4 Sociopolitical feasibility model

The base unit of the sociopolitical feasibility model was the MHHW line split into points spaced 10 feet apart. All input datasets were aggregated to these points based on rules specific to each dataset. Sociopolitical datasets were not assigned a numeric score or weight due to the subjective and overlapping nature of some of the data inputs.

2.5 Developing input datasets

2.5.1 Unit of analysis

The MHHW line was selected as the dataset to represent NH's tidal shoreline. This line was derived from 2011 6.5-foot LiDAR data and was generated by NH GRANIT in 2017 based on elevation zones that varied depending on the geography of the shoreline. Table 1 represents the different elevations used to generate the MHHW line in bays, rivers, oceans and embayments. The MHHW line was divided into 185,964 points spaced 10 feet apart from each other which form the analytical units for the L3SA. All datasets were aggregated to these points based on rules specific to each dataset (Appendix V).

Table 1. Elevations used to generate the MHHW line in bays, rivers, oceans and embayments (AECOM 2013)

Scenario	Zone			
	Bay	River	Ocean	Embayment
MHHW Elevation (NAVD88)	3.60	4.20	4.40	4.40

2.5.2 Erosion assessment

Since the focus of the L3SA is to address erosion issues, a priority data input included estimates of erosion or shoreline change along the tidal shoreline. However, while an assessment of historic beach shoreline change was completed in 2017 (Olson and Chormann 2017), New Hampshire lacked comprehensive geospatial erosion rates for the majority of the tidal shoreline. To inform the L3SA, a review was conducted of methods and feasibility for estimating marsh and bank erosion throughout the New Hampshire tidal shoreline (Norton 2017). The review recommended conducting a shoreline delineation and point-based change analysis of the entire estuarine shoreline. Appendix III describes the attempted delineation and point-based change analysis of the New Hampshire tidal shoreline and the justification for the decision to abandon this approach due to low quality of historic data in favor of the alternative recommendation to use erosion proxies.

2.5.3 Selecting and processing input datasets

L3SA input datasets represented ecological, hydrodynamic, geophysical and sociopolitical characteristics of the shoreline (Appendix IV). Datasets were selected based on their quality, resolution, comprehensiveness of their coverage of the tidal shoreline, date published, and expert input from the project and technical teams based on relevance to living shoreline site suitability.

Ecological datasets included habitat type, aspect (as a proxy for sun exposure), eelgrass extent (as a proxy for wave attenuation in sheltered coastlines), and the potential for favorable conditions for marsh migration. Hydrodynamic datasets included northwest fetch (as a proxy for ice shoving), northeast fetch (as a proxy for storm impacts), current velocities at both shoreline edge (as a proxy for scouring effects and likelihood of sediment resuspension), tidal crossings (as a proxy for high velocity water flow), and proximity to federal navigation channels (as a proxy for erosion risk from boat wakes). Geophysical datasets included presence of engineered shoreline stabilization structures, steep banks, seaward slope, soils erodibility and volumetric change in beaches. Dataset sources are listed in Appendix IV.

Sociopolitical datasets represented ecological values (using geospatial footprints of areas prioritized by conservation plans); owner interest/capacity (sites that were suggested for living shoreline projects by NHCP's partners, publicly owned sites and publicly accessible sites); potential impacts to certain regulated resources (historic eelgrass bed extent, shellfish bed extent, aquaculture site extents); likelihood of demand for stabilization (presence of trails and/or impervious cover, and a 2050 impervious cover buildout scenario); and project vulnerability (proximity of existing impervious cover to inundation extent of a 2-foot, sea-level rise scenario). The sociopolitical feasibility model did not include numerical scoring or weighting due to the subjective and overlapping nature of some of the data inputs. These datasets were thus treated separately from the biophysical model and represent feasibility not suitability. Dataset sources are listed in Appendix IV.

Some biophysical datasets (such as tidal crossings, current velocities, soils erodibility, shoreline structure inventory) and most of the sociopolitical datasets were already available for use in the L3SA. A few datasets were generated specifically for the L3SA (northeast fetch and northwest fetch) or processed further and re-interpreted (habitat type, steep banks, seaward slope, aspect, volumetric change in beaches) Information on how these datasets were generated and/or processed further can be found in Appendix IV.

2.5.4 Aggregating input datasets to the MHHW points

Each dataset was aggregated to the MHHW points based on rules specific to the dataset (Appendix V). For example, habitat types as delineated by the Environmental Sensitivity Index (NOAA Office of Response and Restoration 2016) were aggregated to their closest MHHW points through a Spatial Join (ArcToolbox, ESRI ArcGIS). Eelgrass beds were aggregated to the MHHW points by measuring the distance from each MHHW point to the closest eelgrass bed using the Near tool (ArcToolbox, ESRI). Most shoreline structures did not directly overlap with the MHHW points; consequently, the mode of aggregation for shoreline structures was to measure their distance to the closest MHHW point using the Near tool. Apart from Spatial Join and the Near tool, other GIS tools used for data aggregation included the Euclidean Distance tool and Extract Values to Points tool (for raster inputs). For more information on how each dataset was aggregated to the MHHW points, see Appendix V.

2.6 Scoring and weighting biophysical input datasets

The values of each input dataset were categorized based on living shoreline suitability thresholds informed by literature, other models reviewed, and expert input from the NH technical team (Miller 2015; Appendix II). For a given input dataset, each category was assigned a score ranging from 1 to 6 (Appendix VI) with 1 representing likelihood of suitability for hybrid living shoreline approaches with very significant structural components and/or site modifications and 6 representing high suitability for living shoreline approaches with no structural components. Sample Python and Visual Basic (VB) scripts for scoring are included in Appendix VIII.

Biophysical datasets were assigned weights based on their relative contribution to living shoreline site suitability as determined by the technical team and other stakeholder input sessions (Appendix VII). Input dataset weights are shown in Equation 1 and more details about the weighting methodology are available in Appendix VII. For sample Python and Visual Basic scripts used to assign weights, refer to Appendix VIII.

2.7 Suitability index with and without shoreline structures

The suitability index numbers were calculated using a weighted overlay equation that multiplies the score of each input dataset by the weight of its importance, sums the products, and then divides that sum by the sum of the weights for a final suitability index number between 1 and 6. A score of 0 for a particular input dataset at a specific MHHW point indicates no data available for that MHHW point and that data input is omitted from the suitability equation at that MHHW point. For each MHHW point, the “N18_No_datasets_missing” attribute sums the number of input datasets missing at a given point and further interpretation (“N18_Data_Quality”) enables the user to determine whether the MHHW point has adequate or minimal data (Appendix IX).

The model was run for two scenarios: suitability with shoreline structures and suitability without shoreline structures – the latter makes the simplistic assumption that no shoreline structures exist in order to inform users who may be interested in installing a living shoreline after removing a structure. Shoreline structures were assigned scores based on the type of structure (Appendix VI) and sites that are proximate to shoreline structures received lower suitability scores. The “Without Structures” scenario assumes a suitability score of 6 for the shoreline structure input at every MHHW point. The “Without Structures” scenario does not indicate the feasibility of removing the structure. VB scripts for the equations used to calculate the suitability index numbers for each of the two scenarios can be found in Appendix VIII.

2.8 Iteration and field check

Several changes were made to the model design based on feedback received in technical team and external stakeholder review meetings. Dataset input scores and weights were adjusted based on preliminary results for the Atlantic Coast and estuarine areas. Several stakeholders suggested including stormwater runoff and sub watershed drainage areas as data inputs, however, a suitable existing dataset did not exist to satisfy this recommendation. Experts also recommended replacing the tree canopy dataset which lacked accuracy with a calculated measure of aspect. The aspect dataset was developed and was used to replace tree canopy as a measure of exposure to sunlight.

A qualitative field check was conducted in January and February 2019. The goal of the field check was to understand whether or not the suitability index numbers represented on the ground conditions, so that the limitations of the L3SA could be clearly communicated to its end users. At 45 publicly accessible sites, GPS points were collected and photographs were taken of the entire shoreline profile (upland, shoreline, intertidal, tidal). Suitability index numbers were assigned to each site based on a visual site assessment. The suitability index numbers assigned to the photo were compared with the suitability index numbers generated by the model. Based on these visual observations and comparisons, the limitations of the L3SA were deduced and are described in detail in Section 4.0.

2.9 Quality assurance quality control

Each step of the GIS workflow was reviewed to correct any issues and identify inconsistencies. A review of the methods used to process and aggregate the datasets to the MHHW points resulted in several small adjustments to the data processing approaches. Fifty random MHHW points were chosen and the With and Without Structure Suitability Index numbers were recalculated for each point using an Excel-based workflow with identical results. Suitability Index numbers were determined to be calculated accurately.

2.10 Role of project team, technical team, and additional stakeholders

The project team defined the research questions, management goals and information needs of the L3SA. The project team met four times to review the progress of the L3SA and to ensure that it was relevant and useful for its target end-users.

The technical team provided expertise on data sources, scoring, weighting and reviewing draft results. The scores were developed based on interviews conducted individually with each technical team member in spring 2018. Technical team members were assigned datasets that aligned with their expertise, and were also given the opportunity to weigh in on scoring the other datasets. Where suggested scores differed among technical team members, discrepancies were recorded and a decision was made using literature and additional discussion. Weights for the model were assigned on the basis of the results of a sticky dot exercise conducted with technical team members in summer 2018. The sticky dot exercise was followed by a discussion to reflect on the results and resolve conflicts. “Draft weights” from the sticky dot exercise were employed for the first run of the model. Based on model results and further technical team review meetings, these weights were adjusted to ensure that the results closely aligned with on-the-ground conditions.

Following several iterations of the model run, two technical team meetings were conducted in fall 2018: one focused on the Atlantic Coast, and the other focused on the Great Bay and Hampton-Seabrook Estuaries. The goal of these meetings was to review the results and identify ways to improve the accuracy of the model. As a result of these meetings, some input datasets were added, replaced or removed; weights and scores were adjusted; and some of the results were re-framed. Two additional meetings were also convened: one with consultants/engineers, and a second with regulatory agency staff in order to understand what other information they needed in order to feel confident using this model.

3.0 Results

3.1 Interpreting the living shoreline site suitability index

The L3SA produced the following outputs:

I. The biophysical suitability model yielded a set of attributes and a suitability index number for a point on each 10-foot shoreline segment. The biophysical suitability model produced results for two scenarios:

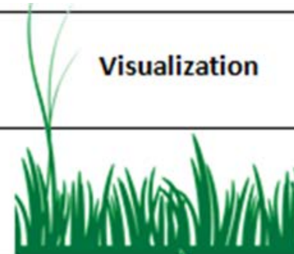
1) With Structures (existing condition): The site suitability results produced for this scenario should be used as a starting point for making decisions about living shoreline siting in areas under existing conditions, including areas proximate to armored shorelines.

2) Without Structures (hypothetical condition): The site suitability results produced for this scenario should be used as a starting point to evaluate whether a living shoreline approach might be an acceptable replacement for an existing engineered shoreline structure. It is important to note that no analysis was conducted to evaluate the feasibility of removing any existing shoreline structures, and further site-based assessment would be needed to understand if structure replacement is a feasible option (See Section 4.0 for more information about study uncertainty and limitations).

The suitability index numbers for the biophysical model range from 1 to 6. An index number 6 indicates that a site is highly suitable for living shorelines with no structural components. An index number 1 indicates that a site may be suitable for living shorelines with very significant hybrid components and/or site modification. Structural components could include materials such as rocks, coir logs, root wads, shells, and other biodegradable geotextile materials such as coir matting (NOAA 2015; Woods Hole Group 2017). Hybrid living shorelines could include a vegetated berm, a structural sill, an engineered core, or added habitat value to an existing hardened structure (NOAA 2015). Site modification could include limbing or cutting trees, grading a bank, and adding fill to create land-water continuity (Woods Hole Group, 2017). Certain types of site modifications are regulated by the NHDES Wetlands Bureau and Shoreland Bureau. Table 2 shows how to interpret the living shoreline suitability index numbers.

II. The sociopolitical feasibility assessment resulted in an attribute table that aggregated information on ecological values, owner capacity and interest, regulatory considerations, likelihood of demand for stabilization, and sea-level-rise vulnerability for a point along each 10-foot shoreline segment. No index numbers were produced for the sociopolitical feasibility assessment.

Table 2. Legend for interpreting the biophysical suitability index numbers.

Suitability Index Number	Living Shoreline suitability	Structural components	Visualization
6	Highly suitable for living shorelines	None	
5	Suitable for living shorelines	None to Minimal	
4	Suitable for living shoreline hybrid solutions	Minimal	
3	Suitable for living shoreline hybrid solutions	Moderate	
2	May be suitable for living shorelines with hybrid components and/or significant. site modification	Significant	
1	May be suitable for living shorelines with very significant hybrid components and/or site modification	Very significant	

3.2 Biophysical suitability results

In general, sheltered shorelines including those in Great Bay and the Hampton-Seabrook Estuary show suitability index numbers that are higher than suitability numbers for exposed, high energy shorelines along the Atlantic Coast. The lowest suitability index numbers occurred in developed areas along the Portsmouth section of the Piscataqua River and the Dover section of the Cocheco River. Figure 3 depicts biophysical suitability index numbers (With Structures scenario) across the study area.

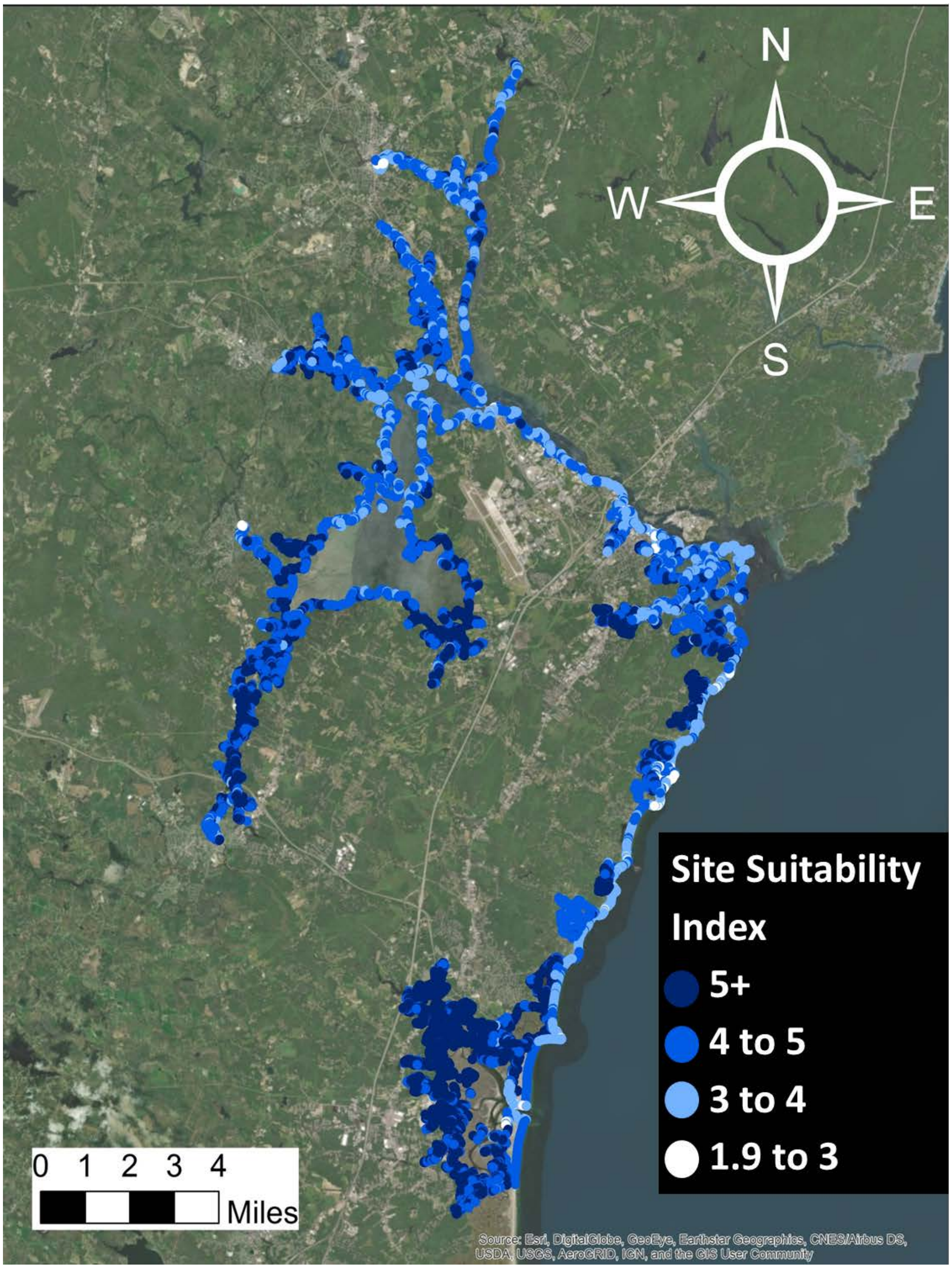


Figure 3. Geospatial distribution of suitability index numbers across New Hampshire tidal shoreline

3.2.1 With structures:

For the "With structures" scenario, the lowest suitability index number along the tidal shoreline is 1.9 and the highest suitability index number is 5.7. The sites with the lowest suitability index numbers are located along the armored sections of Rye Harbor State Park; however, the suitability index numbers for this area were calculated based on minimal data (8 datasets had missing values for this site; Section 2.7).

Figure 4. Example shoreline segment with suitability index numbers 3.4 - 3.6 | Hampton, NH

Figure 5. Example shoreline segment with suitability index numbers 4.5 - 4.8 | Rye, NH

The sites with the highest suitability index numbers include a small vegetated buffer strip along Great Bay near the Newington/Greenland town border, some shoreline segments along the Great Bay National Wildlife Refuge, marshes along Campbell Lane in New Castle, as well as sites along Meadow Pond in Hampton and along the back marshes of Hampton-Seabrook Estuary (Figure 3). More than 80% of the shoreline received a suitability index number greater than 4. Table 3 shows the distribution of index numbers for the "With structures" scenario by percentage of shoreline.

Figure 6. Example shoreline segment with suitability index numbers 2.7 - 3.2 | Dover, NH

Figure 7. Example shoreline segment with suitability index number of 5 | Newmarket, NH

3.2.2 Without structures:

For the "Without structures" scenario, the lowest suitability index number along the tidal shoreline is 2.6 and the highest suitability index number is 5.7. The highest and lowest index numbers were located at the same sites as the highest and lowest index numbers in the "With structures" scenario. The greatest difference in index number for a shoreline point between the two scenarios was 0.8. Table 3 shows the distribution of index numbers for the "Without structures" scenario by percentage of shoreline.

Table 3. Distribution of biophysical suitability index numbers along the New Hampshire tidal shoreline, as of March 2019

Suitability Index Number	With Structures (# MHHW points)	With Structures %	Without Structures (# MHHW points)	Without Structures %
5 to 6	73,810	39.7%	79,930	43.0%
4 to 5	79,732	42.9%	80,306	43.2%
3 to 4	30,252	16.3%	25,401	13.7%
2 to 3	2,121	1.1%	327	0.1%
Between 1-2	49	0%	0	0%
TOTAL	185,964	100%	185,964	100%

3.3 Sociopolitical feasibility results

The sociopolitical feasibility assessment produced an attribute table that aggregates information about likelihood of demand for stabilization, ecological values, owner capacity and interest, regulatory considerations, and sea-level-rise vulnerability for a point along each 10-foot shoreline segment. The attributes are not assigned scores, and therefore must be interpreted qualitatively. Table 4 shows the proportions of the shoreline that have a selection of characteristics that suggest higher feasibility for a living shoreline project.

Table 4. Selection of results from sociopolitical feasibility assessment, as of March 2019.

Feasibility Characteristic	Shoreline points (#)	% of shoreline
MHHW shoreline with two feet of SLR that will overlap with existing impervious cover, indicating upland development vulnerable to sea-level rise	13,587 out of 303,479 points*	4.5 %

>500 feet from eelgrass, shellfish, and aquaculture resources, indicating possibility of lower regulatory barriers	161,562 out of 185,964 points	86.9 %
Land under conservation/public ownership, indicating potential interest in living shoreline approach	70,187 out of 185,964 points	66.2%
Where >60% of the 100,000 sq ft area around the shoreline point is likely to be developed by 2050, indicating possible future desire for shoreline protection	5,418 out of 185,964 points	2.9%
High ecological value (identified in all 3: Wildlife Action Plan, Coastal Land Conservation Plan, and Water Resources Conservation Plan), indicating need to preserve the ecological functions of the site	85,378 out of 185,964 points	45.9%
Within 100 feet of a trail or impervious cover, indicating possible demand for shoreline protection	42,402 out of 185,964 points	22.8%
Publicly accessible, indicating possible accessibility for construction equipment	252 out of 185,964 points	0.01%

*The projected new 2050 MHHW shoreline with 2 feet of sea level rise has an additional number of points spaced 10 feet apart because of an increase in length of the exposed shoreline as the water encroaches landward. This increase in length is especially significant in bays and embayments.

3.4 Where to access the data and other materials

The biophysical suitability and the sociopolitical feasibility datasets can be downloaded via NH GRANIT and accessed via web on ArcGIS Online and on the NH Coastal Viewer. The attributes of each feature class can be interpreted using Appendices IX and X. If the feature class is converted into a shapefile, the name of the attribute will be truncated; however, the first three characters (Eg., N19, S19, W19) preceding the attribute name may be used to match the name of the truncated attribute on the shapefile to its corresponding interpretation in Appendices IX and X.

Upon request, NHCP will produce a property profile with tailored suitability results for a specific site. See Appendix XI for a sample property profile and information on who to contact if a property profile is desired.

4.0 Limitations and uncertainties

This section outlines the limitations and uncertainties of the L3SA, and identifies important considerations when applying the outputs of the L3SA to certain shoreline management decisions. Individuals who use the data understand that the NHDES, NHCP, and State of New Hampshire are not responsible for any inaccuracies or assumptions made with this dataset. It is recommended that the user read the metadata in its entirety before using the data (available through NH GRANIT). NHDES is not responsible for the use or interpretation of this information, or for any inaccuracies in the biophysical or sociopolitical assessments. All information is subject to verification. The information provided in the shapefile is not guaranteed to be complete. The data provided may be used in combination with other sources for decision making, but should not be used for enforcement decisions within NHDES or legal decisions that occur outside the purview of NHDES. This data should be used for planning, management and educational purposes only. Individuals who use this data also agree to use proper citation when displaying the data in other presentations or publications, or when using the data for other studies (see page ii for recommended citation).

The L3SA is intended to be a screening decision-support tool and does not replace an on-site assessment. The L3SA is not a comprehensive prioritization of living shoreline project sites – while it identifies areas that may be more suitable than others for living shoreline approaches, it is not an ordered hierarchy of site suitability from best to worst. The L3SA does not identify sites where living shorelines could be used to provide flood mitigation benefits – it focuses on potential for erosion control. The L3SA results should not be used to justify modifying the shoreline.

The L3SA used best available datasets that have varying resolutions and in some cases a lack of data coverage along the tidal shoreline. The proportional division employed to calculate the site suitability index numbers ensured points were not penalized for a lack of data inputs; however points lacking data inputs may reflect less accurate suitability results. A data quality attribute (N18_Data_Quality) was calculated for each point to show the count of data inputs missing (N18_No_datasets_missing) for each point as well as the percentage of weight values (N18_Percent_weights_missing) missing for each point (See Appendix IX).

4.1 Dataset limitations

The NHCP makes this data available with the understanding that the data is not guaranteed to be complete or accurate. Many of the datasets were developed by other agencies and information about data sources, resolutions, and other limitations is available directly from those data sources (listed in Appendix IV). Special caution should be exercised when considering the following attributes:

- **Habitat type (Landward shoretype/seaward shoretype):** Does not take into account small segments of marsh and other habitat features with <10 meter extents.

- **Future salt marsh**: identifies certain sites as a potential marsh migration area even though site verification shows that there is no marsh nearby or the site is too steep to allow for marsh migration. This limitation is likely due to the resolution and inaccuracies of National Wetlands Inventory (NWI) data which was used as an input for the SLAMM model.
- **Aspect (Sunlight Exposure):** Aspect is used as a proxy for sunlight exposure in the biophysical model, but aspect is only one of the determinants of the exposure of a site to sunlight. Other factors like tree canopy, man-made structures, etc. are not represented by this model, but should be taken into account for determining site suitability.
- **Fetch (NW and NE):** Fetch distances may be inaccurate in sheltered coastlines along the Atlantic Coast, especially within the Hampton-Seabrook Estuary.
- **Seaward slopes:** A variety of data sources and bathymetric contours were used to calculate the seaward slope. Information about the contour used is provided in the attribute table for each point (Appendix IX) and should be taken into consideration.
- **Suitability Index:** Index numbers do not fully account for interactions between the datasets and variability in resolution across datasets.

4.2 Using the L3SA at complex, vulnerable and armored sites

It is recommended that end-users of the L3SA consider several important limitations when determining site suitability for shoreline segments that have multiple habitat types, are vulnerable to sea level rise, or might involve installing new armoring and removing existing armoring:

4.2.1 Complex sites with multiple habitats and living shoreline approaches

Many sites have two or more shoreline types (i.e., a beach seaward of a dune or a salt marsh seaward of a bank). The model attempts to address this by identifying the landward shoretype and seaward shoretype. The model also detects the presence of a steep bank within 100 feet of the MHHW points. However, the suitability index output represents collective suitability at the site and does not provide independent suitability information based on shoretype. As a result, the end-user will have to explore the results and use additional information to understand whether the shoreline segment is suitable for a living shoreline approach at one or more of its shoretypes.

4.2.2 Sea-level rise, flooding and long-term planning

Living shoreline projects are typically intended to help control erosion and maintain intact or resilient habitats, but most often they will do little to alleviate flooding from sea-level rise and storms and in some cases may be vulnerable to sea-level rise and storms. A site might be more feasible for a living shoreline if conditions will allow salt marsh to migrate and persist over time at the site. A site may be less feasible for a living shoreline if sea-level rise is expected to inundate developed areas nearby. The model considers sea-level rise effects on a site through the marsh migration dataset (future salt marsh) in the biophysical model, and through the dataset representing impervious cover proximity to a 2-foot sea level rise extent in the sociopolitical model. Living shorelines and other stabilization projects should take into account sea-level rise on a site-by-site basis using best available guidance such as the ones developed by the New Hampshire Coastal Risk and Hazards Commission (2016).

4.2.3 Armoring

The model is not intended to provide justification for modifying the shoreline. A "low" suitability index number does not indicate that a site should be armored; it only indicates that more modification may be necessary (such as bank grading or filling) for a living shoreline project to be effective.

4.2.4 Removing Existing Armoring

The "Without Structures" scenario is intended to provide suitability information if the structures had never existed in the first place. It is important to note that no analysis was conducted to evaluate the feasibility of removing any existing shoreline structures, and further site-based assessment would be needed to understand if structure replacement is a feasible option, especially when property protection is of concern.

5.0 Discussion

According to the L3SA, 82% of the New Hampshire tidal shoreline received suitability index numbers between 4 and 6, suggesting that the vast majority of New Hampshire tidal shoreline may be suitable for no stabilization action, low-impact management, or nature-based stabilization. According to Blondin (2016a), 88% of New Hampshire tidal shoreline is currently not stabilized by an engineered shoreline protection structure, and given the undeveloped state of much of the New Hampshire tidal shoreline, the costs associated with engineered stabilization projects and permitting, relatively few landowners are actively pursuing tidal shoreline stabilization. Landowners interested in stabilizing their shorelines tend to choose riprap over living shorelines as their preferred approach because it is an approach traditionally used by contractors and it is perceived to be more effective and durable than living shorelines (Scyphers, Picou, and Powers 2014). However, given the likelihood that sea-level rise will exacerbate erosive trends, demand for shoreline stabilization is likely to increase as shoreline landowners grow increasingly concerned about visible and potentially hazardous erosion. By identifying the suitability of New Hampshire shorelines for nature-based stabilization, the L3SA presents important information for motivated landowners and decision-makers as they design and implement new stabilization projects or fortify existing structures. Successful pilot living shoreline projects, industry training and additional outreach to decision makers and landowners are needed to further advance living shorelines in coastal New Hampshire.

Any landowner considering managing shoreline erosion should first evaluate the option of doing nothing and/or moving at-risk assets away from the shoreline. Best available science suggests that sea-level rise will cause moderate to significant changes to shoreline composition and increase flood risk along the shoreline within the 21st Century and beyond (NH Coastal Risks and Hazards Commission 2016; New Hampshire Fish and Game Department 2014). In many cases, the most cost-effective and conservation-minded approach to dealing with erosion may be to allow the shoreline to erode, which can provide important sediments sources for salt marshes and beaches and enable salt marshes to migrate inland with sea-level rise. The sociopolitical feasibility analysis can provide some additional context about when the option of leaving a shoreline alone should be considered. Just over 45 percent of MHHW points are within areas designated as conservation priorities due to their ecological value (New Hampshire Fish and Game Department 2015; Zankel et al. 2006; Steckler et al. 2016). Depending on conservation management goals for these priority sites, leaving the shoreline alone or conducting low impact management may be a viable and effective option.

In low-lying areas, especially along the back marshes of the Hampton-Seabrook Estuary, MHHW points scored high in biophysical living shoreline suitability (greater than 4), but the sociopolitical feasibility analysis showed that some impervious surfaces immediately upland of the MHHW points will be inundated with 2 feet of sea-level rise which may occur as soon as 2050. Any shoreline stabilization (hard or soft) may temporarily address erosion but will not address the most pressing coastal hazard of high tide and storm-based flooding in these neighborhoods. In many cases these landowners also lack the option of moving assets upland away from erosion and flood risks due to small lot sizes. Some researchers have suggested neighborhood and landscape-scale concepts to address flooding and erosion in these areas such as back-barrier vegetated berms (Kirshen et al. 2018), but these options would likely be costly, face permitting obstacles and require significant multi-landowner coordination to mitigate any flooding without negatively influencing neighboring lots.

At shoreline segments that received high suitability numbers (4 to 6) and with motivated landowners, a variety of nature-based approaches may be feasible from low impact land management to a nature-based project with some hybrid components. A beach site might benefit from beach nourishment or a dune creation project while a low-energy mudflat or marsh site might benefit from natural marsh plantings with a coir sill, and an upland bank site might benefit from active understory enhancement and plantings.

At shoreline segments that received lower suitability numbers (1.7 to 4), are not currently armored, and have a motivated landowner, a potential living shoreline design could incorporate varying degrees of site modification and more hybrid components such as significant slope regrading and a rock sill. For sites with lower suitability numbers that are currently armored, a user could reference the site's biophysical suitability number using the "Without Structures" scenario. Depending on the landowner's goals, an appropriate expert could evaluate whether removing armoring and replacing with a living shoreline is a feasible option that might reduce scour and enhance ecological values. Alternatively, an increasing number of examples exist showcasing how to add functional habitats to engineered structures including adding breaks or openings in rip rap to maintain aquatic passage, incorporating marine-safe concrete or reef balls, fortifying seawalls with vegetated dunes, and maintaining wetlands and/or upland riparian buffers adjacent to existing structures (NOAA 2015).

In all cases, the appropriate shoreline management strategy can be informed by not just the biophysical suitability number, but will also depend on a variety of site-specific sociopolitical and biophysical factors such as landowner goals, soil and habitat type (i.e., exposed beach vs. sheltered intertidal), fetch, and seaward and shoreward slopes, among others. Details about some of these factors may be obtained from the L3SA attribute table for a shoreline site (Appendix IX and X) while other important information will need to be obtained from the landowner and a site visit. Some conceptual living shoreline designs for specific sites may be obtained from the Living Shorelines in New England: State of the Practice report (Woods Hole Group 2017).

6.0 Technical comments and reflections

This section identifies gaps and areas for future information development to improve our ability to determine living shoreline site suitability. This section summarizes reflections about how the model addresses erosion but not flooding, questions about site suitability approaches, and datasets that, if developed, would improve future iterations of the model.

6.1 Erosion versus flood protection

The L3SA attempts to identify sites that may be suitable for specific living shoreline approaches in order to address erosion issues along New Hampshire's tidal shoreline. "Erosion control" refers to the use of practices to contain soil particles and to prevent them from being displaced or washed down slopes by rainfall or run-off (RSA 482-A; Env-Wt 100 DRAFT). Living shorelines can be considered a set of structural erosion control practices (Woods Hole Group 2017). Flood mitigation refers to actions taken to reduce or eliminate risk to human life and property before a flood occurs and to foster resilience after a flood and can be structural (eg., flood proofing, elevation) or nonstructural (eg., planning and zoning, education for risk awareness, and insurance) (Cigler 2017). Erosion control might be effective for reducing the likelihood of flooding over the long-term because it preserves space and topographic relief to enable water storage; however, controlling erosion will not mitigate flooding in the short-term in most cases. The results of the L3SA should not be used to site living shoreline projects with the goal of reducing imminent flooding. Figure 4 developed by the U.S. Army Corps of Engineers: Engineer Research and Development Center (2018) explains the modes of flood risk management where erosion control is a strategy that is implemented at the site-specific scale (smaller areas) and only helps with reducing flood risk over time while flood mitigation strategies operate on a landscape scale (larger areas) and are more likely to reduce imminent flood risk (U.S. Army Corps of Engineers: Engineer Research and Development Center 2018).

The sociopolitical assessment informs the feasibility of siting a living shoreline project under sea-level rise conditions. The approach identifies areas where the "new shoreline" or MHHW line (given 2 feet of sea level rise by 2050) would inundate currently developed areas (based on impervious cover). At sites where the new shoreline inundates impervious cover by 2050, flooding is likely to be the priority concern of the property owner. While a living shoreline may be an effective strategy for maintaining land area at the site over the long-term, it is unlikely to be an effective approach for addressing flooding of developed areas. Other flood risk reduction strategies should be explored (Federal Emergency Management Agency 2018).

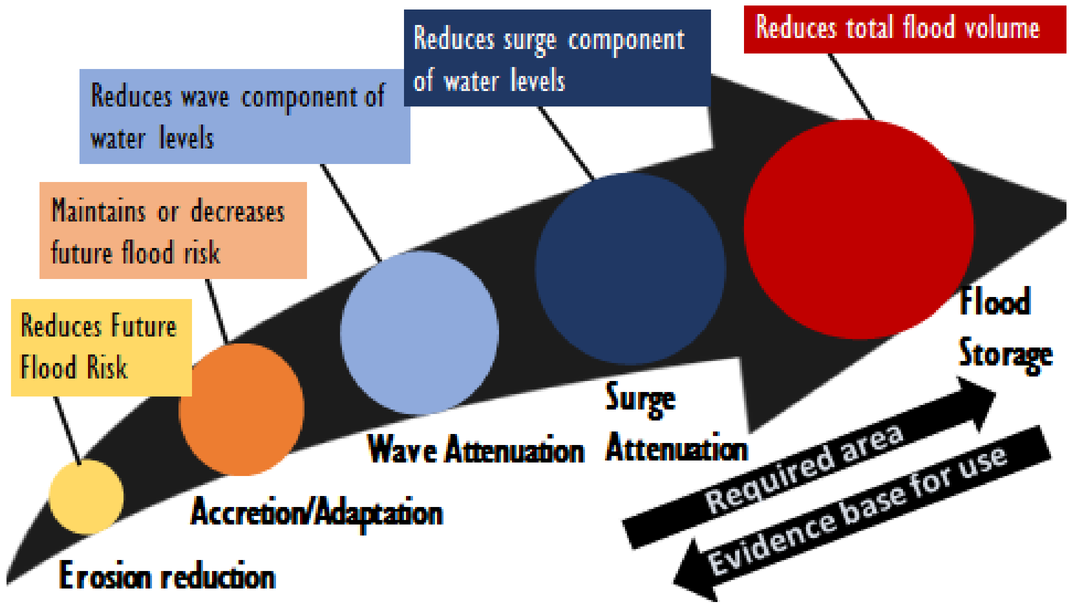


Figure 8. Modes of flood risk management: erosion reduction and flood mitigation (U.S. Army Corps of Engineers: Engineer Research and Development Center 2018)

6.2 Conceptual questions about suitability approaches

Several questions were considered throughout the development of the suitability model approach. In some cases, the literature did not sufficiently answer these questions for the New Hampshire shoreline, and expert opinion was taken into account in developing, scoring, and weighting the input datasets. Answers to the following questions would improve a future living shoreline site suitability model for New Hampshire:

- What factors significantly contribute to erosion along the New Hampshire shoreline? How do their effects vary along estuarine versus open coastlines?
- What are the shoreline change rates for the New Hampshire estuarine and open coastlines?
- What determines where ice is more likely to be formed, where ice is more likely to be shoved against the shoreline, and where ice needling effects are most likely to occur?
- Do eelgrass beds have a significant effect on wave attenuation in areas with a large tidal range? At what distance does their wave attenuation effect become significant?
- What factors should be used to determine the feasibility of removing an armored structure and replacing it with a living shoreline?
- What is the maximum distance from an engineered shoreline structure where erosional effects due to the presence of the structure can impact adjacent habitats?
- At what distance does erosion from boat wakes become significant?
- What factors should be used to determine when a shoreline is best left alone to erode?
- What factors influence landowners/shoreline property owners to protect their shoreline either through armoring or living shoreline stabilization?

- What combination of factors should be used to decide which living shoreline strategies suggested by the Living Shorelines in New England: State of the Practice report (Woods Hole Group 2017) are most applicable for a given site?

6.3 Data recommendations

The site suitability model should be updated as new data becomes available. During technical team meetings, a number of datasets were identified as important inputs for the living shoreline site suitability model; however, this project lacked capacity and resources to create some of these datasets. The following is a list of datasets to include in future iterations of the model:

Tree canopy: A high-resolution tree canopy dataset based on LiDAR point cloud interpretation would help identify shoreline segments that receive less sunlight thus inhibiting the growth of vegetation. This information could guide management decisions such as limbing shady tree branches.
Who to contact for generating this dataset: Fay Rubin and David Justice, NH GRANIT

Wave run-up: A geospatial dataset representing wave-run up would help identify structures that are likely to be overtopped and dunes that are eroding due to wave action. This information is integral for informing the design of a living shoreline project in open coastlines.
Who to contact for generating this dataset: Tom Lippmann, UNH Center for Coastal and Ocean Mapping.

Wave refraction: Integrating results from a wave refraction model would help identify sites where longshore drift is likely to occur thus providing information about sediment transport and beach erosion. Currently, the model uses bathymetry as a proxy for wave energy; however, wave refraction data would provide better information about the strength and speed of a breaking wave.
Who to contact for generating this dataset: Tom Lippmann, UNH Center for Coastal and Ocean Mapping.

Shoreline change for estuaries: While the Digital Shoreline Analysis System (DSAS) quantifies shoreline change for open coastlines with a linear geometry, it does not provide reliable information on shoreline change in estuarine shorelines with a complex geometry. A robust methodology to digitize shoreline change in New Hampshire's estuaries (keeping in mind the limitations of historic aerial imagery resolution) needs to be developed to calculate shoreline change.
Who to contact for generating this dataset: Neil Olson and Rick Chormann, New Hampshire Geological Survey; Larry Ward, UNH Center for Coastal and Ocean Mapping; J.P. Walsh, University of Rhode Island Coastal Resources Center.

Sediment circulation/sediment cells: Delineating sediment cells could provide a better understanding of coastline erosion and the sediment budget of potential living shoreline sites. This could be especially helpful for prioritizing beach nourishment sites.

Who to contact for generating this dataset: Larry Ward, UNH Center for Coastal and Ocean Mapping; Tom Ballestero, UNH Stormwater Center.

Drainage features generated by stormwater runoff: Currently, the model represents shoreline erosion from the seaward side but not the landward side. This does not provide a comprehensive picture of erosion given the possibility of stormwater runoff originating upland and eroding coastal banks by forming gullies. The project leads initially attempted to include curve numbers generated using land cover and soil hydrologic groups as inputs (US Department of Agriculture and Natural Resources Conservation Service, 1986); however, this did not adequately capture stormwater runoff in urbanized areas, and was therefore removed from the model. A better approach would be to use the ArcGIS Hydrology toolset to generate flow accumulation streamlines for delineating drainage features that could form due to runoff. This would be useful for designing living shoreline projects in such a way that they will not be undermined.
Who to contact for generating this dataset: UNH Stormwater Center.

Boat wakes: Currently, the model uses proximity to federal navigation channels as a proxy for boat wake activity which in turn serves as a proxy for erosion. However, a better approach would be to use a hydrodynamic model for boat wakes. A review of data needs and information on a prototype boat wake model can be found here (Bilkovic et al. 2017).
Who to contact for generating this dataset: Donna Marie Bilkovic, Virginia Institute of Marine Sciences; Tom Lippmann, UNH Center for Coastal and Ocean Mapping.

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Appendix

I. Definitions

Biophysical Suitability: Biophysical suitability is the suitability of a site for a living shoreline based on the hydrodynamic, geophysical and ecological factors of the site. Biophysical suitability does not take into consideration social or political factors that influence the site.

Biophysical Suitability Model: The biophysical suitability model is the GIS-based model that predicts biophysical suitability of a site for a living shoreline based on the hydrodynamic, geophysical and ecological factors of the site.

Ecological factors: Ecological factors are those that represent or affect habitat conditions at a particular site.

Geophysical factors: Geophysical factors are those that represent or affect the geologic form of the landscape at a particular site.

Hydrodynamic factors: Hydrodynamic factors are those that represent or affect the movement of water at a particular site.

Living Shoreline: "Living shoreline" means a management practice that provides erosion control benefits, protects, restores or enhances natural shoreline habitat, and maintains coastal processes through the strategic placement of plants, stone, sand fill and other structural organic materials, maintaining the continuity of the natural land-water interface while providing habitat value and protecting against coastal hazards (RSA 482-A; Env-Wt 600 DRAFT). For more information, refer to the Living Shoreline in New England: State of the Practice report (Woods Hole Group, 2017).

NH Living Shoreline Site Suitability Assessment (L3SA): The NH L3SA is an effort to analyze site suitability and feasibility for living shorelines in tidal New Hampshire through a biophysical model, a sociopolitical feasibility assessment and a sea level rise vulnerability analysis.

Scoring the L3SA datasets: Scoring is a process where the values of each input dataset were categorized based on living shoreline suitability thresholds informed by literature, other models reviewed and expert input from the New Hampshire technical team. Each category was assigned a number (score) from 1 to 6 in order to normalize all the input datasets so that they can be compared on the same scale.

Shoreline Structures: These shoreline structures are built with the intention of minimizing the effects of ocean waves, currents, and sand movement in order to stabilize and protect the shoreline or provide calm water areas for boats. These structures are artificial and often made of concrete, rock or timber (Blondin, 2016). For more information, refer to the New Hampshire Shoreline Structure Inventory report (Blondin, 2016).

Site modification: Site modification indicates the degree to which the site needs to be altered in order to implement a living shoreline project. Site modification could include but is not restricted to bank grading, tree removal and limbing, and filling.

Sociopolitical Feasibility: Sociopolitical feasibility is a measure of how feasible living shoreline project implementation might be at a given site based on social and political conditions at the site.

Structural components: Materials besides plantings that contribute to added stability of a living shoreline such as rocks, coir logs, root wads, shells and other biodegradable geotextile materials such as coir matting (NOAA, 2015; Woods Hole Group, 2017).

Suitability Index Number: Suitability index number is a cumulative score representing the suitability of a site for a living shoreline approach. A suitability index number 6 indicates that a site is highly suitable for living shorelines with no site modification or structural components, while a suitability index number 1 indicates that a site may be suitable for living shorelines with very significant hybrid components and/or site modification.

Suitability Index: Suitability Index refers to the set of suitability index numbers (ranging from 1—6)

Weighting the L3SA datasets: Weighting is a process where numbers (weights) were assigned to each input dataset based on how important the dataset was for determining site suitability. Weights were informed by living shoreline suitability literature, other models reviewed and expert input from the New Hampshire technical team.

II. Review of L3SAs conducted in other areas: summary table

Table 5. Summary table reviewing assessments conducted in other study areas along the US eastern seaboard and Gulf of Mexico.

	Worcester County, Maryland (Berman and Rudnicky, Virginia Institute of Marine Sciences 2008)	Long Island Sound, Connecticut (Zylberman et al., University of CT, 2015)	Casco Bay, Maine- DRAFT (Slovinsky et al., Maine Geological Survey, 2017 ongoing)	Pamlico Sound, North Carolina (Carey et al., East Carolina University, 2013)	Mobile Bay, Alabama (Boyd et al., Geological Survey of Alabama and Mississippi State University, 2016)	Southeast Florida (Mitsova et al., Florida Atlantic University, 2016)	Sarasota County, Florida (Dobbs et al., University of Florida, 2016)
Goals	Preferred alternatives to erosion control.	Erosion control	Stabilization of bluffs, adaptability to open beaches, stabilization of developed land.	Focus on "what percent of shorelines is suitable for ___" as opposed to "where are the suitable sites"?	Improved restoration decisions for shoreline erosion protection.	Attenuate wave action, mitigate erosional forces, and reduce storm damage	increase the different forms of coastal protection used throughout Sarasota County, Florida
Questions it answers	Is LS an appropriate alternative to erosion control?	• Which sites are suitable? • How much of the shoreline is suitable?	What are some sites that already have natural shorelines or characteristics of natural shorelines which will then make it more likely to support living shorelines?	• How much of the shoreline is suitable for employing soft stabilization living shorelines techniques for shoreline stabilization? • How much of the shoreline is suitable for employing hybrid stabilization living shorelines techniques for shoreline stabilization?	How to maximize ecosystem services while performing erosion control?	(1) understanding of the shoreline properties (2) developing an algorithm for exposure as a determinant of the shoreline vulnerability to natural and man-made disturbances (3) understanding of feasibility and ease of implementation issues when all other favorable environmental factors are present (4) Assess the feasibility of the generic model to a range of shoreline types, including developed, undeveloped, and protected.	The GIS model identifies coastlines that are 1) most suitable for living shoreline treatment, 2) most suitable for a hybrid solution, or 3) not suitable for living shorelines
Scale	1:12,000	3 feet resolution	1 point represents a 100 ft.	Unclear but focuses on 145.68 kilometers of shoreline to represent the rest of the APES.	1:24,000 **Unit:** m	Unclear. (outputs were in the form of points spaced 100 m apart)	Unclear, raster cell size of all datasets = 10
Inputs	**Conditions suitable for soft stabilization** • Fetch: o low (0-1.0 mile) o moderate (1.0-5.0 miles) o high (> 5.0 miles) • Beach presence o Present o absent • Bank Condition: o high: observed erosion o low: no observed erosion o undercut: bank toe • Bathymetry: o 1m contour > 10m from shoreline • Marsh presence: o Present o absent **Conditions suitable for hybrid stabilization** • Fetch:	• Beach o Present o Absent • Marsh o Present within 25 feet of MHW o Absent within 25 feet of MHW • Bathymetry: o 1-m contour > 30m from the shoreline • Erosion: o Low (4 feet per year) o Moderate (2-4 feet per year) o High (>4 feet per year) • Fetch: o Low (0-1.0 miles) o Moderate (1.0-5.0 miles) o High (>5.0 miles)	• Shoreline was MHHW line (50 ft inland, 100 ft seaward) • Annualized Weighted Fetch o <=0.5miles (Very Low=8) o >0.5 and <=1 mile (Low=6) o >1 and <=3 miles (Moderate=2) o >3 and <=5 miles (High=1) o >5 miles (Very High=0) • Nearshore Bathymetry (10m contour, 30 ft resolution) o Shallower than 3 ft within 100 feet of MHW line (Shallow=6) o Deeper than 3 feet within 100ft of MHW line (Deep = 0) • Landward Shoreline Type o Wetlands, swamps, marshes, banks=6 o Beaches and scarps=5 o Sheltered hard shorelines, rip rap=3 o Expanded shorelines, rip rap=1 • Seaward Shoreline Type o Marshes and flats=6 o Beaches, dunes and flats=5 o Lower energy channels=3 o Higher energy channels=1 o Ledge or man-made lands=0	• Fetch • Boat traffic o within 1 mile • Bathymetry • Marsh (NC wetlands inventory) o within 10 ft of a pre-existing marsh • SAV o within 1000 ft of an SAV bed • Shoreline polyline created by USGS (fetch and bathy criteria not mentioned, probably same as VIMS or MD erosion potential?)	**New version** • Riparian Land Use/Land cover • Bathymetry – 1m contour o Deep (<10m of shoreline) o Shallow (>10m of shoreline) • Marsh o Marsh present o Marsh island o No • Bank height o 0-5ft o 5-30ft o >30ft o >60ft • Canal (yes or No) • SandSpit (Yes or No) • Forestshl o Yes if RiparianLU=Forested o Yes if wide tree fringe (>100 feet) • Erosion control structures	**Shoreline Properties** • Shoreline Type and Erodibility (ESI recategorized) o Natural and erodible o Unnatural and erodible o Armored but permeable (riprap etc) o Armored with wall/impermeable **Exposure** • Avg nearshore slope (10m from pt seaward: bathy; 10 m from point landward: DEM) o <5% (Very low=1) o 5-7% (Low=2) o 7-8% (Moderate=3) o 9-10% (High=4) o >10% (Very High =5) • Fetch o Very low: <0.25 mi o Low: 0.25-0.5 mi o Medium: 0.5mi-1.0 mi o High: 1-3mi	• Bathymetry (nearshore slope) o 0-3%= 3 (most suitable) o 3-6%= 2 o 6-10%= 1 o >10%=0 • Land Use o High intensity urban areas= 3 o Low intensity urban areas= 2 o Rural= 1 • Land Values (value of land per acre from US census bureau) o $ 0-75,000 =1 o $ 75,000-250,000=2 o 250,000-15,000,000= 3 • Population (people/acre) o 9-175= 3 o 3-9= 2 o 1-3=1 o 0-1= 0 • Sensitive Shorelines (ESI)

	o low (0-1 ml) – moderate (1-5ml) • Bank condition: o high: observed erosion o low: no observed erosion o undercut: bank toe erosion • Bathymetry: o Shallow (1m contour>10meter from shoreline) • Beach presence: o yes or no • Marsh presence: o yes (>15 feet deep) o no • Tree Canopy: o yes or no		• Average upland relief (within 50ft of MHW) o 0-5ft (=6) o 5-10 ft (=5) o 10-20ft (=3) o >20 ft (=1) • Average upland slope (within 50 ft of MHW) o 0-3% (=6) o 4-9% (=5) o 10-15% (=4) o 16-30% (=2) o >30% (=1) • Shoreline Aspect o Southeast to Southwest facing = 1; Oher aspects=0 • Habitat considerations (presence or absence of special mapped habitat types within 100 ft of MHW) o Eelgrass (=2) o Shellfish (=2) o Tidal wading and waterfowl (=2)		• Defended (Yes if structures present) • Exposure (Fetch) o Low (0-0.5 mile) o Moderate (0.5-2 mile) o High (>2 mile) • Roads/Permanent Structures (Obstacles that prevent bank grading) • Beach and Wide Beach o Yes or No • Tributary o Tidal creek if fetch >2 miles	o Unbounded • Wave height (m) o 0-20 percentile (1) o 20-40 percentile (2) o 40-60 percentile (3) o 60-80 percentile (4) o 80-100 percentile (5) • Boat wakes o No Wake zones (1) o Medium boat wake exposure (3) o High boat wake exposure (5) • Storm surge category 5 (later used category 3 data) o No storm surge (1) o No storm surge (2) o <2m (3) o 2-3m (4) o >3m (5) • Distance to inlet (proxy for tidal influence, overall circulation patterns, observed boat traffic) o No tidal influence (1) o Tidal influence <=3 miles (5) **Feasibility** • Presence of habitat (seagrass/ESI sensitive plant communities) o Presence of nearshore and upland habitat (1) o No habitat (5) • Land Use • Ownership	ESI assigned most sensitivity to shorelines with high wave energy, low biological productivity. o 3=Most sensitive o 2= less sensitive o 1=least sensitive • Shoreline Habitat (Land cover dataset) o Isolated freshwater marsh, marshes, salt marshes = 3 o All other land cover types capable of growing vegetation and near the shoreline =2 o Remaining and upland =0 • Tree Canopy (National Land cover database) o 0-33%=3 o 33-66%=2 o 66-100%=1 • Wave Energy o Bayou, lagoon, slough, tidal creek, and canal= low wave energy =3 o Inlet, pass, waterway, and basin = medium wave energy = 2 o Gulf, channel, and bay= highest wave energy = 1 o freshwater lakes and detention ponds = 0 • Shoreline (400m buffer of county boundary)
How it measures erosion	The MD Shoreline Inventory delineates the condition of the bank observed in the field. Bank condition is classified as high erosion (unstable), low erosion (stable), and undercutting (erosion at the bank toe).	DSAS Shoreline Change Analysis	Fetch In future: mapping 1.4m contour of beaches and comparing year to year to estimate shoreline change.	It doesn't directly incorporate erosion into suitability model.	Contracted with USGS to develop an erosion layer.	Exposure Index -avg exposure under wind and wave conditions -impact of category 3 hurricane	Erosion is not considered directly
Outputs	• Suitable for soft stabilization • Suitable for hybrid options o marsh planting or marsh toe revetment o marsh planting or sill o marsh toe revetment o riparian modifications o sill • Not suitable for LS	• Marsh enhancement o Low fetch o Low erosion o Shallow bathymetry o presence of marsh • Beach enhancement o Low fetch o Low erosion o Shallow bathymetry o presence of beach • marsh with structures o Moderate-high fetch	• 0-13 (likely highly unsuitable) • 14-20 (likely unsuitable) • 21-27 (Possibly suitable) • 28-35 (Likely suitable) 36-44 (Likely highly suitable) Maine looked at overall suitability and not necessarily different approaches (later examined using a decision making tool)	**Suitable/Unsuitable** • Southwest (225˚) Fetch Suitability for Soft Stabilization Living Shoreline. • Southwest (225˚) Fetch Suitability for Hybrid Stabilization Living Shoreline. • North-northeast (10˚) Fetch Suitability for Soft Stabilization Living Shoreline. • North-northeast (10˚) Fetch Suitability for Hybrid Stabilization Living Shoreline. • Nearshore Depth Suitability for Soft Stabilization Living Shoreline. • Nearshore Depth Suitability for Hybrid Stabilization Living Shoreline.	**Shoreline BMP** • No Action Needed • Maintain/Enhance/Create Marsh • Maintain Beach or Offshore Breakwaters • Plant Marsh With Sill • Revetment • Area of Special Concern **Upland BMP** • Area of Special Concern	**1) Specific strategies** • Soft, with vegetation and potentially sediment only • Hybrid, with harder features • Enhancement, with harder features and vegetation • Enhancement, with vegetation only • Hybrid, with harder features • Soft, with vegetation only	**0- Least Suitable** **1** **2** **3- Most Suitable**

		o Low-high erosion o Shallow bathymetry o Presence of marsh • Offshore breakwaters. o Moderate-high fetch o Low-high erosion o Shallow bathymetry o Presence of beach		• Boat Traffic Suitability for Living Shorelines. • Preexisting Marsh Suitability for Living Shoreline. • Submerged Aquatic Vegetation Suitability for Living Shoreline. **Suitability Score 1-6** • Unweighted Suitability Index for Soft Stabilization Living Shoreline. • Unweighted Suitability Index for Hybrid Stabilization Living Shoreline. **Suitability Score in 6 ranges (23-38; 38-47; 48-57; 58-71; 72-85; 86-100)** • Weighted Suitability Index for Soft Stabilization LS • Weighted Suitability Index for Hybrid Stabilization LS.	• Land Use Management • Maintain/Enhance/Restore Riparian Buffer • No action needed.	• None, water depth>3 ft, slope>1:10 **2) Exposure score overlaid on each shoreline type** Maps were symbolized with ESI shoreline types, and each type was assigned a shoreline stabilization strategy.	
Method (weighted or unweighted?)	• Datasets were queried for suitability. • 6 combinations yield suitability for soft stabilization. • 39 combinations yielded suitability for hybrid stabilization	Unweighted	Datasets were added to estimate cumulative suitability.	Unweighted and weighted	Start with shoreline shapefile, populate with attributes representing each input. Weighted overlay	Composite scoring with weights from expert elicitation	Unweighted and Weighted overlay: multiply value of each parameter by weight of its importance, sum results together
Suitability (binary or range?)	Based on combinations.	Binary	Range	Binary, suitability score, suitability range		Exposure index range→Sorted into high/medium/low→matched to specific strategies in the above table	
Model audience	Management level LSSSM is intended to advise regulatory or management action.	Coastal engineers, decision-makers, and waterfront property owners that considers shoreline armoring alternatives.					
Assumption	• Some action will occur to prevent erosion • Soft stabilization is always preferred over hard structural control				• All the shoreline is unstable.		• Does not consider shoreline protection structures, erosion history, sea level rise, and tidal ranges. • Assigning the value of "0" to areas of "No Data" largely impacted and perhaps skewed the results. • Land use and shoreline habitat cancelled each other out. • Streams and rivers should have received a classification of "3" not "0" based on lower wave energy. • As areas of "0" should represent segments that are entirely unsuitable, the ranges of the tree canopy should have been divided in to quarters instead of thirds.

III. Erosion assessment

Based on a recommendation from the review of methods to assess bank and marsh erosion conducted by NHCP staff (Norton, 2017), an attempt was made to delineate the shoreline for two erosion hotspots (Fox Point and Adam's Point) identified in the shoreline change assessment conducted by Strafford Rockingham Regional Council (1978). Historic and current aerial imagery was used to delineate the shoreline based on the wet/dry line in non-vegetated areas and the vegetated/non-vegetated line in marshy areas. However, shoreline delineation was inconsistent, the historic aerial imagery varied in resolution and lacked documentation of the imagery's tide stage, and shadows cast by tree canopy often obscured the location of the wet/dry line. Technical team members reviewed the preliminary product and agreed that the shoreline delineation approach lacked the rigor needed to create a consistent shoreline change comparison. The aerial imagery datasets reviewed are listed in Table 6.

Table 6. Aerial imagery reviewed including year, source and their corresponding resolutions

Year	Source	Resolution
1962	Complex Systems Research Center, University of New Hampshire	3-ft
1974	Complex Systems Research Center, University of New Hampshire	3-ft
1998	Complex Systems Research Center, University of New Hampshire	3.2-ft
2003	U.S. Department of Agriculture, Farm Services Agency, Aerial Photography Field Office	3.2-ft
2005	NH Department of Transportation	1-ft
2009	U.S. Department of Agriculture, Farm Services Agency, Aerial Photography Field Office	3.2-ft
2010/2011	NH Department of Transportation	1-ft

2013	Piscataqua Region Estuaries Partnership	1-ft
2015	U.S. Geological Survey	1-ft

IV. List of input datasets

Table 7. Input datasets used for the L3SA including name of dataset, reason for using, source, resolution, date updated, justification for using, and information on additional processing.

Name of dataset	Reason for using	Source	Date last updated	Resolution	Why this was chosen	Why others weren't used	Additional processing
				Unit of Analysis			
Shoreline (Mean Higher High Water)	Unit of analysis. All the datasets are aggregated to this point	AECOM/ GRANIT (LiDAR derived)	Derived from 2011 LiDAR, generated by NH GRANIT in 2017.	6.5-ft; for the suitability model, MHHW line was split into points 10 feet apart which serves as the resolution for the model.	Most objective and consistent delineation of the shoreline. It was also directly comparable to our sea level rise datasets since those datasets were also generated from the same LiDAR source.	Other shorelines such as the ESI shoreline were considered; however, the dataset we ultimately used was more region-specific. We also attempted to draw the shoreline using aerial imagery but the wet/dry line delineation was not objective.	All other datasets were aggregated to these points using a number of processing steps (see Appendix V).
				Ecological			
Landward Shoretype, Seaward Shoretype, Seaward Extra Information	To characterize habitat type	Environmental Sensitivity Index, NOAA Office of Response and Restoration	2016	The ESI maps features that are >=10m	We conducted an interview with Dr. Nancy Kinner, Director of the Coastal Response Research Center at UNH who expressed confidence in using the dataset as a qualitative shoretype indicator, and knew enough about the process to generate the dataset to confirm that it had been vetted by local data users. Also, ESI was unique because it differentiates between landward and seaward serotypes, and delineates vegetated banks as a distinct habitat type.	➢ SLAMM doesn't differentiate between landward shoretype, seaward shoretype, and does not have as many categories as ESI. ➢ The National Wetlands Inventory (NWI) 2017 dataset was not used because it was at too high a resolution for this analysis (1:24,000 and 1: 25,000).	➢ Deleted all attributes that pertained to man-made structures (in order to not replicate shoreline structure inventory). ➢ Replaced Landward Shoretype with "Dunes" where applicable because ESI does not delineate dunes. See Appendix V for more information.
Dunes (integrated into landward shoretype- see above row)	ESI does not capture dunes	Eberhardt, A. (University of New Hampshire), Burdick, D. (University of New Hampshire). Hampton-Seabrook Estuary Restoration Compendium. Sand dune habitat within the Hampton-Seabrook Estuary was delineated and digitized from 2003 Emerge aerial photography for NH (obtained from NH GRANIT) and 2005 aerial photography for MA obtained from MASS GIS). Data for NH were corrected by field survey.	2008 with 2018 update (a few other prominent dune features were digitized by NHCP staff for this model's purposes)	Not available	This was the only digitized dune shapefile available.	This was the only digitized dune shapefile available.	Further processing includes integration of dunes into Landward Shoretype (see above row)

Name of dataset	Reason for using	Source	Date last updated	Resolution	Why this was chosen	Why others weren't used	Additional processing
Aspect	Proxy for shade/identifying sunlit slopes	USGS LiDAR	2011	3-ft	Aspect was derived from the highest resolution most recently updated LiDAR available.	There are several LiDAR datasets out there; however, this dataset is the highest resolution out of all the rest. The following is a documentation of the other LiDAR datasets that were considered and their resolution. National Elevation Dataset - NH Extract - 2011- DEM – 30 ft National Elevation Dataset - NH Extract - 2011- Hillshade - 30 ft LiDAR - Coastal NH - 2011 - 2Meter DEM – 6 ft (resampled to 2.5 ft for the coast) LiDAR - Coastal NH - 2011 - Hillshade – 6 ft (resampled to 2.5 ft for the coast) DEM available for download on GRANIT – 100 ft Regional LiDAR DEM (Found through Image Services) – 2.5 ft but mosaic of many different sources. The coastal LiDAR component of that mosaic was 6ft so this was RULED OUT (see table here for the composition of this mosaic)	LiDAR was further processed to generate aspect using the "Aspect" tool in ArcToolbox, but the resulting Aspect dataset was not processed any further.
Marsh migration in 2050 under highest SLR (approx 2 ft SLR by 2050)	To identify future favorable environments for salt marsh	"SLAMM_Status" geodatabase: SLAMM analysis by New Hampshire Fish and Game	2015	2m horizontal, 15 cm vertical accuracy	We used 2050 as our time horizon keeping in mind average mortgage lifespan. This dataset was designed for identifying shoreline segments that could be preserved as-is, to allow marshes to migrate, because they already have connectivity. Areas that will get "squeezed" or inundated, could also be identified from the same geodatabase. (Note: "salt marsh persistent" actually means that a site could be suitable for a salt marsh in 2050 even if salt marsh is not currently present) Mention that this used NWI and not always correct everywhere. To do an accuracy check, confirm that ESI also identifies this as salt marsh.	The Restoration Opportunities layer would have been useful for identifying areas of potential future marsh migration *IF connectivity is restored.	
Eelgrass extent	Proxy for wave attenuation	UNH CCOM; Dr. Frederick Short (Research Professor of Natural Resources), UNH	2015	Information unavailable	The 2015 eelgrass extent was used since that was the most updated extent when the model was run.	The 2015 eelgrass extent could be replaced by the latest extent for the next model run.	

Name of dataset	Reason for using	Source	Date last updated	Resolution	Why this was chosen	Why others weren't used	Additional processing
					Hydrodynamic		
Tidal Crossings	To identify areas that might be scoured by high velocity flow of water	New Hampshire Coastal Program Tidal Crossing Assessment	2018	Varying resolutions	Most updated and QAQC'ed dataset.	An intersection of roads with NHD flowlines could have been used, but this dataset is the modified and ground verified version of the NHD-derived dataset.	
Current velocities (Maximum flood current at spring tide)	Proxy for ice formation and scour	Dr. Tom Lippmann (nearshore oceanographer at UNH CCOM)	2018	100-ft	This is the only dataset for current velocities in coastal NH.	There is a Gulf of Maine-wide current velocities dataset out there; however the resolution does not match the data needs of this model.	
Northwest Fetch (292 degree direction)	Proxy for ice shoving	USGS Fetch tool -Wind direction data from the Isles of Shoals buoy (National Buoy Data Center). -Shoreline shapefile from the ESI dataset (with an additional distance added to make up for discrepancy between MHHW points and ESI shoreline)	2017	10-ft	No other dataset that represents ice formation on a regional scale. The 292 degree direction was chosen because it was the predominant wind direction.	We used a 10ft resolution dataset because lack of processing speeds did not allow us to generate a higher res dataset.	The wind direction data and ESI shoreline shapefile were used as inputs for the USGS Fetch Tool. More information on how fetch was generated using these two inputs can be found here.
Northeast Fetch (90 degree direction)	Proxy for storms	USGS Fetch tool -Wind direction data was input as a default 90 degrees (without analysis) -Shoreline shapefile from the ESI dataset (with an additional distance added to make up for discrepancy between MHHW points and ESI shoreline)	2017	10-ft	The 90-degree direction was chosen although it was not the dominant wind direction. Although the 22-degree direction was the dominant wind direction, we felt that the exposure depicted by this direction did not match the actual damage by storms. Also, some of the technical team members pointed out that regardless of wind direction, most storm waves hit the coast from a perpendicular direction.	We used a 10ft resolution dataset because lack of processing speeds did not allow us to generate a higher resolution dataset. We didn't use storm surge data because they did not represent the *exposure* from wind-driven waves. Also, the storm surge data depicts flooding *extent* and not *exposure*.	The wind direction data and ESI shoreline shapefile were used as inputs for the USGS Fetch Tool. More information on how fetch was generated using these two inputs can be found here.
Likelihood of boat wake activity (Distance from federal navigation channels)	Proxy for erosion	Federal Navigation Channels from USACE	Information unavailable	3-ft	A number of other data sources were tested out but this presented the most objective, region-specific data source that fit the resolution of this model.	The recreational boater route density/water trails/recreational boater activities datasets from the Northeast Ocean Planning data portal did not match our resolution needs (~1000ft). Also takes into account non-motorized boat activity, which does not result in significant erosion. A buffer distance to access sites (data from NH Office of Energy and Planning, 2012) was also attempted but the technical team recommended a different approach because this would include non-motorized boat activity which in reality, doesn't contribute much to boat wakes.	

Name of dataset	Reason for using	Source	Date last updated	Resolution	Why this was chosen	Why others weren't used	Additional processing
					Geophysical		
Bathymetry (slope between MHHW points and the 0ft contour or the -1ft contour or the -2 ft contour depending on what data is available for each region)	Seaward slope	Great Bay - NHDES/UNH-CCOM-JHC	2015-2016	3-ft	There was no "one" comprehensive dataset for bathymetry. Different datasets were pieced together from different sources based on resolution, when it was updated, and the comprehensiveness of the coverage that it provided.	Woods Hole/USGS produced a 3-arc second DEM (~200ft) for the entire Gulf of Maine, however the resolution and coverage was not suitable for the model.	A number of steps were taken for further data processing in order to generate the seaward slope using contours. First, the contours were extracted from the raster DEMs using the "Raster to Contour" tool in ArcToolbox. Then, the slope was calculated using the rise over run equation. See Appendix V for more information.
		Little Bay - NHDES/UNH-CCOM-JHC	2013	3-ft			
		Hampton- Seabrook LiDAR Mosaic – compiled by Lippmann Lab (Kate von Krussentiern) using USACE and USGS data	USCACE: 2010, 2011, 2014; USGS:2011, 2014	All resampled to 32-ft			
		Piscataqua river -NOAA NGS LiDAR	2008	3-ft			
		Atlantic Coast – USACE	2010, 2014	6-ft (2010), 3-ft (2014)			
		AECOM/ GRANIT (LiDAR derived)	2016	6-ft (GRANIT resampled to 3-ft)			
Shoreline Structure Inventory	Treated as a negative influence on adjacent shoreline (within 50ft for GBE and SHE and within 100ft for Atl Coast) To evaluate potential for removal	NHDES Coastal Program	2015	1:1500	High resolution, ground-truthed digitized version of shoreline structures.	ESI documents shoreline structures but does not categorize them beyond "Sheltered/Exposed man-made structures" whereas the inventory identifies walls, revetments, rip rap, groins as distinct entities.	
Soils Erodibility	Measure of erosion	USDA NRCS	Unknown	100-ft, ~30m	This dataset evaluates soils erodibility on the basis of raindrop impact and runoff potential and is calculated using the Universal Soil Loss Equation (USLE). Data ranges from 0 -0.64 with 0.64 being more erodible.	One of many datasets to represent the cause of erosion. Other datasets, if better, could be incorporated into the model during its next scheduled run.	
Beach Volumetric Change	Measure of erosion	LiDAR beach erosion study (Olson and Chormann, 2017)	2017	3.3-ft	This is the only analysis that directly measures erosion/accretion in a beach setting.	This is the only analysis that directly measures erosion/accretion in a beach setting. Beach shoreline change could not be quantified using DSAS because of extensive hardening of shorelines.	The geospatial footprint to represent the results of this analysis was manually created. See Appendix V for more information.

Name of dataset	Reason for using	Source	Date last updated	Resolution	Why this was chosen	Why others weren't used	Additional processing
Bank slope	To identify steep banks (slope > 30 degrees) which would in turn help us understand degree of modification/grading that might be needed at the upland for a living shoreline project	USGS LiDAR	2011	3.3-ft	See "Aspect" and "Landward Shoretype".	See "Aspect" and "Landward Shoretype".	See Appendix V for more information on how this dataset was processed.
		ESI Banks delineation	2016	The ESI maps features that are >=10m			
				Sociopolitical			
Ecological Values	To acknowledge and take into consideration the ecological values that stakeholders assign to a site.	Wildlife Action Plan	2015	1:5000	These were the only plans that had geospatial footprints associated with them.	The conservation and public lands layers could have also been included, but it has been used separately in the sociopolitical feasibility assessment.	N/A
		Coastal Conservation Plan	2006				
		Water Resource Conservation plan	2016				
Suggested Living Shoreline Sites	To document sites where there is motivation for a living shoreline project	Solicited from partners/stakeholders	2018	N/A- manually placed dots	This is currently the easiest way we could document motivation.	This dataset could be added to through a more formal site solicitation process or by conducting a survey of landowners in the Seacoast.	N/A
Shoreline Access Sites	public education potential, construction accessibility	Compiled by New Hampshire Office of Energy and Planning, with input from New Hampshire Department of Fish and Game and the regional planning commissions of the state.	2012	1:24,000	Only dataset publicly available that documents shoreline access sites	Only dataset publicly available that documents shoreline access sites	N/A
Eelgrass extent 1996	to represent regulatory concern about not impacting current and historic eelgrass beds.	UNH CCOM; Dr. Frederick Short (Research Professor of Natural Resources), UNH	1996	Unknown	Represents largest eelgrass extent in history.	We wanted to use a dataset that represent greatest eelgrass coverage in case water quality improves in Great Bay. Some of the permitters said that they review projects based on largest historical extent even if those beds aren't currently present.	N/A
Shellfish beds	to represent regulatory concern about not impacting shellfish beds.	Shellfish field observation (NHDES),	2013	Unknown	These were the only datasets that we could find that map natural and restored shellfish beds.	These were the only datasets that we could find that map natural and restored shellfish beds. Some earlier versions exist for the restored beds, but we decided to use the most current version.	N/A
		UNH (Ray Grizzle), Shellfish restoration sites (TNC and UNH)	2017	Unknown			

Name of dataset	Reason for using	Source	Date last updated	Resolution	Why this was chosen	Why others weren't used	Additional processing
Aquaculture sites	to represent regulatory concern about not impacting aquaculture resources	NH Department of Environmental Services (NHDES)	5/13/2015	Unknown	This was the only dataset we could find that document licensed aquaculture sites.	This was the only dataset we could find that document licensed aquaculture sites.	N/A
Trails	To anticipate demand for stabilization	NH Office of Energy and Planning and NH Fish and Game Department	2016	Unknown	This was the only dataset we could find that maps NH's recreational trails.	This was the only dataset we could find that maps NH's recreational trails.	N/A
Conservation/Public Lands	To represent level of motivation/capacity/interest for living shoreline projects	The development of this data layer was initiated in the early 1990's as a collaboration between the Society for the Protection of NH Forests (SPNHF), the NH Office of Strategic Initiatives (OSI), and the Earth Systems Research Center at the University of New Hampshire (ESRC).	June 2018	1:24,000	Most comprehensive dataset identifying conservation and public lands.	Parcel data could have been used however this dataset was specifically developed for conservation purposes and uses parcel data as one of the inputs.	N/A
Impervious cover	To represent demand for stabilization and to understand project vulnerability.	Earth Systems Research Center, University of New Hampshire	2015	1:2,000 or greater (1 ft)	Highest resolution impervious cover dataset	This was the latest updated, highest resolution impervious cover dataset available	N/A
Buildout Scenarios for Impervious Cover under "Linear" development scenario by 2050	To represent demand for stabilization	Earth Systems Research Center, University of New Hampshire (Alexandra Thorn)	2017	100-ft	Currently, this was the most comprehensive buildout scenario dataset available. The planning commissions only had pieces of buildouts for some towns but didn't have anything comprehensive for the entire coast.	The Linear Scenario was selected over "Backyard" and "Community" because it assumed a medium value placed on ecosystem services and a population distribution in-between dispersed and concentrated, which the project team felt was most representative of seacoast NH.	N/A
Sea Level Rise 2050 High Emissions Scenario (2 feet)	To assess project vulnerability	AECOM/ GRANIT (LiDAR derived)	Derived from 2011 NH coastal LiDAR	6.5-ft; split into points 10-ft apart.	The 2050 time horizon matched the life span of the average homeowners' mortgage and most design life spans of projects.	This is the most region-specific SLR dataset available. We chose the 2050 high emissions scenario because the recent NCA4 suggested that sea level rise might be more than we expected.	Converted Raster to Vector and then generated points from the lines (See Appendix V)

V. Aggregation of datasets to MHHW points

Table 8. Methods used to aggregate L3SA input datasets to the MHHW points.

Dataset	Method of aggregation
	Ecological
Landward Shoretype, Seaward Shoretype, Seaward Extra Info	• Conducted a Spatial Join with the MHHW points as the Target Feature and the ESI lines as the Join feature, and selected "Closest" as the match option.
Dunes	• The "Near" tool was run to quantify the distance between the MHHW point (input feature) and its closest dune (near feature). • If a dune feature was present within a distance of 400 feet of the MHHW points (some features were added or removed manually based on the specific shoreline environment), the Landward Shoretype attribute was replaced with "Dune". • If a shoreline structure was present, the Landward Shoretype was re-classified as "None" and the shoreline structure dataset was given precedence.
Aspect	• Converted Aspect Raster to Points. • Conducted a Spatial Join with the MHHW points as the Target Feature and the Aspect points as the Join feature, selected "Closest" as the match option, and entered "3 feet" in "Search Radius".
Marsh migration in 2050 under highest SLR (approx 2-ft SLR by 2050)	• Conducted a Spatial Join with the MHHW points as the Target Feature and the salt marsh polygons as the Join feature, selected "Intersect" as the match option. • Used the attribute "STATUS 2M" to join.
Eelgrass proximity	• The "Near" tool was run to quantify the distance between the MHHW point (input feature) and its closest eelgrass bed (near feature).
	Hydrodynamic
Tidal Crossings	• Conducted a Spatial Join with the MHHW points as the Target Feature and the tidal crossing points as the Join feature, selected "Intersect" as the match option, and entered "50 feet" as the Search Radius.
Current velocities (Maximum flood current at spring tide)	• Conducted a Spatial Join with the MHHW points as the Target Feature and the current velocity points as the Join feature, selected "Closest" as

	the match option and "200 feet" as the Search Radius. • Manually went and set all the MHHW points beyond the coverage of the current velocities dataset to "Null" using the selection tool and field calculator.
Northwest Fetch (292 degree direction)	• Converted fetch raster to vector polygons (each polygon was 10 X 10 ft just like the raster grid). • Ran the "Near" tool to quantify the distance between the Fetch polygons (input feature) and nearest MHHW point (near feature). • Added the near distance to the fetch distance to get a new fetch. • Conducted a Spatial Join with the MHHW points as the Target Feature and the fetch polygons as the Join feature, selected "Closest" as the match option.
Northeast Fetch (90 degree direction)	• Converted fetch raster to vector polygons (each polygon was 10 X 10 ft just like the raster grid) • Ran the "Near" tool to quantify the distance between the Fetch polygon (input feature) and nearest MHHW point (near feature). • Added the near distance to the fetch distance to get a new fetch. • Conducted a Spatial Join with the MHHW points as the Target Feature and the fetch polygons as the Join feature, selected "Closest" as the match option.
Likelihood of boat wake activity (Distance from federal navigation channels)	• Ran the "Euclidean Distance" tool with Federal Navigation Channels as the Input feature. • Ran the "Extract Values to Points" tool with the MHHW points as the "Input Point Features" and the Euclidean Distance Raster as the "Input Raster".
Geophysical	
Seaward Slope	Ran the "Near" tool to quantify the distance between the MHHW point (input feature) and either the 0-ft bathymetric contours or the minus -1 foot bathymetric contour or the -2 foot bathymetric contour (near features). The Near Tool allowed all 3 contours to be entered in the "near features" section. Then, the elevation of the MHHW point was divided by the distance using a simple rise over run equation to get the slope. This value was then converted into degrees.

Shoreline Structure Inventory	Conducted a Spatial Join with the MHHW points as the Target Feature and the tidal crossing points as the Join feature, selected "Intersect" as the match option, and entered "100 feet" as the Search Radius for the Atlantic Coast and "50 feet" as the Search Radius for Great Bay Estuary.
Soils Erodibility	Conducted a Spatial Join with the MHHW points as the Target Feature and the slope points as the Join feature, selected "Closest" as the match option, and entered "10 feet" in "Search Radius".
Beach Volumetric Change	Using an aerial background layer, all the points along each beach was assigned their condition using a manual approach. This was because of the lack of a comprehensive beach shapefile to conduct a Spatial Overlay (the beaches delineated by the NWI did not cover all the beaches analyzed in the volumetric change assessment). • Hampton and Seabrook beaches showed gains in both the volumetric analysis and the DSAS analysis. (Accretion) • Plaice, Bass Beach 1, Rye Beach and Unnamed beach showed losses in both the volumetric analysis and the DSAS analysis. (Erosion) • North Beach, Bass Beach 2, Foss beach and Wallis Sands had mixed results, all showing total volumetric losses and a mix of accretion and erosion for some time period in the DSAS analysis. (Potentially stable)
Bank Slope	• Converted slope raster to slope points • Extracted slope points within 100 feet of the MHHW points. • Queried for all slopes greater than 30 degrees. • Extracted those points as a separate dataset. • Aggregated the points to the attribute table, aggregated each steep slope point to the closest MHHW point as long as they're within 100 feet of each other, also added an attribute specifying the distance. If > 100 foot, it comes out as null.
Sociopolitical	
Ecological Values	• Used Pete Steckler's One-Stop Dataset for Land Protection Transaction Grants' Screening. • Queried for each type, created a separate layer out of each type (for eg., separate layer for "Core Areas", separate layer for "Supporting Areas" (doing a single Spatial Join with just the

	OneStop dataset would not have been effective as this dataset has overlapping features). • Conducted a Spatial Join to join each layer to its intersecting MHHW point.
Suggested Living Shoreline Sites	Conducted a Spatial Join with the MHHW points as the Target Feature and the suggested points as the Join feature, selected "Closest" as the match option, and entered "730 feet" in "Search Radius" (based on a "Near" analysis keeping the suggested points as the Input feature and the MHHW points as the Target Feature and reviewing the near distances).
Shoreline Access Sites	Conducted a Spatial Join with the MHHW points as the Target Feature and the access sites as the Join feature, selected "Closest" as the match option, and entered "50 feet" in "Search Radius".
Eelgrass extent 1996	Ran the "Near" tool to quantify the distance between the MHHW point (input feature) and the closest eelgrass bed (near feature).
Shellfish beds	Ran the "Near" tool to quantify the distance between the MHHW point (input feature) and the closest shellfish bed feature (near feature).
Aquaculture sites	Conducted a Spatial Join with the MHHW points as the Target Feature and the access sites as the Join feature, selected "Closest" as the match option and "1000 feet" as the search distance.
Trails	Conducted a Spatial Join with the MHHW points as the Target Feature and the trails as the Join feature, selected "Closest" as the match option and "100 feet" as the search distance.
Conservation/Public Lands	Conducted a Spatial Join with the MHHW points as the Target Feature and Conservation/Public Lands as the Join feature, selected "Within a distance of" as the match option and "100 feet" as the search distance. Joins were conducted to match each code to its description using the accompanying Excel metadata spreadsheet for this dataset.
Impervious Cover	Clipped the Impervious Cover dataset to within a 1,000-foot buffer of the MHHW points (because of the large size of this dataset). Ran the "Near" tool to quantify the distance between the MHHW point (input feature) and the closest impervious cover feature (near feature) within 100 feet.
Buildout Scenarios	Used the "Extract Values to Points" tool with the MHHW points as the Input point feature and the

	Buildout raster as the Input Raster and checked the box for interpolation of values.
Sea Level Rise	• Used the 2-foot SLR polygon generated by GRANIT, used the “Dissolve” tool to combine all the polygons into one big polygon, broke the polygon up into lines using “Feature to Lines”, generated points along the lines using “Generate Points Along Lines” and setting the spacing to “10 feet”. • This became the “new shoreline in 2050 with 2 feet of sea-level rise.” • Conducted a spatial overlay using Select by Location where the Target Feature was the SLR point layer and the Source Layer was the impervious cover dataset. All the points from the SLR layer that intersected with the impervious cover dataset got assigned “Vulnerable” in the corresponding vulnerability attribute.

VI. Scores assigned to each dataset

Note: All scores were assigned based on technical team expert opinion and consultation with the literature.

Table 9. Scores assigned to datasets used in the biophysical model and justification for the scores assigned.

Name of dataset	Name of scoring attribute	Attribute values	Score (1-6)	Reasoning
		Ecological		
Landward Shoretype,	S1_Landward_Shoretype_Score	2A: Exposed, Wave-Cut Platforms (Bedrock/Mud/Clay)	2	Scored based on expert opinions. In general, pre-existing vegetation, sheltered areas, and habitat got higher suitability scores.
		3A: Fine to Medium Grained Sand Beaches	5	
		4: Coarse Grained Sand Beaches	4	
		5: Mixed Sand and Gravel Beaches	3	
		8A: Sheltered, Impermeable, Rocky Shores	2	
		9B: Vegetated Low Banks	5	
		10A: Salt and Brackish Water Marshes	6	
		10B: Freshwater Marshes	6	
		10C: Swamps	6	
		10D: Scrub and Shrub Wetlands	6	
		Dunes	6	
Seaward Shoretype,	S2_Seaward_Shoretype_Score	2A: Exposed, Wave-Cut Platforms (Bedrock/Mud/Clay)	2	
		3A: Fine to Medium Grained Sand Beaches	5	
		4: Coarse Grained Sand Beaches	4	
		5: Mixed Sand and Gravel Beaches	3	
		7: Exposed Tidal Flats	2	
		8A: Sheltered, Impermeable, Rocky Shores	2	
		8A: Sheltered Scarps (Bedrock/Mud/Clay)	4	
		9A: Sheltered Tidal Flats	5	
		9B: Vegetated Low Banks	5	

Seaward Extra Information	S3_Seaward_Extra_Info_Score	2A: Exposed, Wave-Cut Platforms (Bedrock/Mud/Clay)	2	
		3A: Fine to Medium Grained Sand Beaches	5	
		4: Coarse Grained Sand Beaches	4	
		5: Mixed Sand and Gravel Beaches	3	
		7: Exposed Tidal Flats	2	
		8A: Sheltered, Impermeable, Rocky Shores	2	
		9A: Sheltered Tidal Flats	5	
Aspect	S4_Aspect_SunExposure_Score	Flat (-1)	4.5 (More info)	Since Southern and Western faces tend to be warmer, the scores were set by incrementing the number gradually across the compass rosette. For instance, treating SSW as a maximum chance (using 3-6 with 6 being highest). Flat got a score of 4.5 because it's a neutral aspect.
		North (0-22.5)	3	
		Northeast (22.5-67.5)	3	
		East (67.5-112.5)	4	
		Southeast (112.5-157.5)	5	
		South (157.5-202.5)	6	
		Southwest (202.5-247.5)	6	
		West (247.5-292.5)	5	
		Northwest (292.5-337.5)	4	
		North (337.5-360)	3	
Marsh migration in 2050 under highest SLR (approx 2 foot SLR by 2050)	S6_Future_Salt_Marsh_Score	Salt Marsh lost	0.5	Salt marsh lost got 0.5 only so it doesn't get counted as a zero because zero is for no data. Areas where there is persistence or potential for marshes both got high suitability scores because we are equally interested in both areas.
		Salt Marsh persistent	6	
		Salt Marsh potential	6	
Eelgrass proximity	S5_Eelgrass_Proximity_Score	**0-1000 feet**	**2—5**	Used 1,000 feet as cut off because analysis proves that mean distance of eelgrass bed to shoreline is 1129 feet (0.1 mile). Also, Carey et al., (2013), used 1,000 feet in Pamlico Sound L3SA (Appendix II). For salt marshes in Great Bay, eelgrass is not so important for site suitability. In the Squamscott river, it may be more important for site suitability. Coves have potential for LS when eelgrass is present >1,000 feet got a score of 1 because wave attenuation benefits of eelgrass are not felt at this distance.
		Eelgrass in Great Bay	2	
		Eelgrass in Squamscott	4	
		Eelgrass in sheltered areas	5	
		>1000 feet	**1**	

Hydrodynamic					
Tidal Crossings	S12_Tidal_Crossing_Score	Present within 50 feet		3	Having a tidal crossing does not preclude the possibility of a living shoreline because the living shoreline project can be designed taking high velocity flow into account. The absence of a tidal crossing, does however, reduce the chance of scouring due to high velocity flow, and reduces the likelihood of long term erosion.
		Absent within 50 feet		6	
Current velocities (m/s) (Maximum flood current at spring tide)	S10_Current_Edge_Impact_Score	**m/s**	**ft/s**		Scoring based on 2 ft/s is the critical shear stress i.e., the sand transport capacity. At current velocities > 2 ft/s, sediment transport takes place.
		0.000000 - 0.057000	0 - 0.18700787	6	
		0.057001 - 0.176000	0.18700787 - 0.57742782	6	
		0.176001 - 0.362000	0.57742782 - 1.187664	6	
		0.362001 - 0.669000	1.187664 - 2.1948819	4	
		0.669001 - 1.119000	2.1948819 - 3.6712598	3	
		1.119001 - 1.912000	3.6712598 - 6.2729659	1	
	S11_CurrentSedimentImpact_Score	0.000000 - 0.057000	0 - 0.18700787	6	
		0.057001 - 0.176000	0.18700787 - 0.57742782	6	
		0.176001 - 0.362000	0.57742782 - 1.187664	5	
		0.362001 - 0.669000	1.187664 - 2.1948819	4	
		0.669001 - 1.119000	2.1948819 - 3.6712598	2	
		1.119001 - 1.912000	3.6712598 - 6.2729659	1	
Northwest Fetch (292 degree direction)	S8_NW_Fetch_Ice_Proxy_Score	0 - 0.01mi		6	Longer fetch = more ice shoved against the shoreline. Negative fetch got the lowest score (0.5) but not a 0 because 0= No Data.
		0.01- 0.18mi		5	
		0.18 - 0.56 mi		4	
		0.56- 0.94 mi		4	
		0.94 -3 mi		4	
		> 3 mi		4	
		Negative (unbounded)		0.5	

Northeast Fetch (90 degree direction)	S9_NE_Fetch_Storm_Proxy_Score	0 - 0.5 mi	6	Longer fetch= greater the impact from storm waves. Negative fetch got the lowest score (0.5) but not a 0 because 0= No Data.
		0.5 -1 mi	5	
		1 -2 mi	4	
		2 -3 mi	3	
		3 -5 mi	2	
		>5 mi	1	
		Negative (unbounded)	0.5	
Likelihood of boat wake activity (Distance from federal navigation channels in feet)	S13_BoatWakeErosionProxy_Score	0- 2677 ft	1	Further from federal navigation channels, more suitability because less likelihood of boat wake impacts. Scoring categories were generated using ArcGIS' Natural Jenks function.
		2678- 5342 feet	2	
		5343- 8006 feet	3	
		8007- 10671 feet	4	
		10672- 13336 feet	5	
		13337- 21119 feet	6	
Geophysical				
Seaward Slope	S17_Seaward_Slope_Score	28-49 degrees	1	"Steep" slopes were considered to be slopes greater than 28 degrees and hence these slopes got the lowest score indicating that more site modification (such as fill) might be needed before setting up a living shoreline. "Flat" slopes were those that were less than 3 degrees and they got the highest scores because these areas would not need much site modification, and in case of a marsh restoration project, migration would be easily facilitated if the slope was flat.
		18-28 degrees	2	
		12-18 degrees	3	
		7-12 degrees	4	
		3- 7 degrees	5	
		0- 3 degrees	6	
Shoreline Structure Inventory	S7_Shoreline_Structures_Score	Berm	4	Jetty/Groin got the lowest scores because they have the most negative influence on erosion and least habitat benefits. Walls got the second lowest scores because in some cases, walls can exist in conjunction with marshes/dunes but they still inhibit inland migration. Riprap/revetment got the third lowest score because they provide some, if sparse, habitat value. Berms got the next lowest because they are not as vertically obstructive as the other structures.
		Jetty/Groin	1	
		Riprap/revetment	3	
		Wall	2	

Soils Erodibility	S14_Soils_Erodibility_Score	0.05 - 0.15	2	Lower the erodibility, less suitable because it likely is bedrock. Higher erodibility values might also make it less suitable because of top soil loss. Thus, the mid-values got the highest scores.
		0.15 - 0.23	4	
		0.23 - 0.31	5	
		0.31 - 0.41	4	
		0.41 - 0.48	3	
		0.48 - 0.64	2	
Beach Volumetric Change	S16_Beach_Erosion_Score	Erosion	5	Based on the results of the Beach Volumetric Change report, each beach was considered as a unit. We used long term trends analyzed by the report to associate each beach with its overall condition. Eroding and Accreting beaches got scores of 5 because instability could warrant more site modification for a living shoreline project to be successfully. Potentially stable beaches got high scores because of the likelihood of a project to succeed if the sediment is in place. • Hampton and Seabrook beaches showed gains in both the volumetric analysis and the DSAS analysis. (Accretion) • Plaice, Bass Beach 1, Rye Beach and Unnamed beach showed losses in both the volumetric analysis and the DSAS analysis. (Erosion) • North Beach, Bass Beach 2, Foss beach and Wallis Sands had mixed results, all showing total volumetric losses and a mix of accretion and erosion for some time period in the DSAS analysis. (Potentially stable)
		Accretion	5	
		Potentially stable	6	
Bank slope (degrees)	S15_Steep_Bank_Slope_Score	0 –30 degrees	6	A slope greater than 30 degrees (1:2) indicates the presence of a steep bank which would require a high degree of site modification; hence these steep banks got a score of 1.
		> 30 degrees	1	
Sociopolitical				
Sociopolitical datasets were not scored and sociopolitical data is intended to be interpreted in a qualitative way.				

VII. Weights assigned to each dataset

Note: All weights were assigned based on technical team expert opinion and consultation with the literature.

Table 10. Weights assigned to datasets used in the biophysical model and justification for the weights assigned.

Dataset	Name of weighting attribute	Weight	Justification for weight
	Ecological		
Landward Shoretype,	W1_Landward_Shoretype_Weight	3	Habitat type has a very high influence on site suitability. Pre-existing vegetation is an important determinant of suitability.
Seaward Shoretype,	W2_Seaward_Shoretype_Weight	2	
Seaward Extra Info	W3_Seaward_Extra_Info_Weight	1	
Aspect	W4_Aspect_SunExposure_Weight	1	Not all living shoreline strategies are vegetation dependent (such as beach nourishment), and aspect does not fully capture shading from trees.
Marsh migration in 2050 under highest SLR (approx 2 feet SLR by 2050)	W6_Future_Salt_Marsh_Weight	2	Future persistent salt marsh suggests high suitability for natural approaches in that area and any shoreline stabilization at the site should enable future migration.
Eelgrass proximity	W5_Eelgrass_Proximity_Weight	2	Wave attenuation benefits of eelgrass are limited due to the large tidal range.

Hydrodynamic			
Tidal Crossings	W12_Tidal_Crossing_Weight	1	The tidal crossing dataset does not specify tidal restrictions and the current velocity dataset also helps account for high velocity flow areas.
Current velocities (Maximum flood current at spring tide)	W10_Current_Edge_Impact_Weight	1	Although waves are generally considered to be the primary force impacting the design of coastal structures, currents also play an important role, particularly for living shorelines sites located near tidal inlets or along riverbanks. Currents have the capacity to uproot vegetation, scour the bank, and during storms can transport debris which increases the scour potential. In areas subject to freezing, currents can also transport blocks of ice, which similar to debris can scour the shoreline.
	W11_CurrentSedimentImpact_Weigh	1	
Northwest Fetch (292 degree direction)	W8_NW_Fetch_Ice_Proxy_Weight	2	Greater northwest fetch creates increased likelihood for ice to be shoved against the shoreline, contributing to erosion.

Northeast Fetch (90 degree direction)	W9_NE_Fetch_Storm_Proxy_Weight	2	Greater northeast fetch creates larger more powerful waves, lessening the likelihood of successful living shoreline establishment and stable sediment.
Likelihood of boat wake activity (Distance from federal navigation channels)	W13_BoatWakeErosionProxy_Weight	1	Boat wakes are only one of many indicators of wave energy/shoreline exposure and proximity to federal navigation channels is a coarse measure of boat wake impact.
	Geophysical		
Bathymetry (Seaward Slope)	W17_Seaward_Slope_Weight	4	Nearshore slope is an important determinant of wave energy and erosion.
Shoreline Structure Inventory	W7_Shoreline_Structures_Weight	3	Shoreline structures have significant implications for the feasibility of a living shoreline approach in a particular area. They indicate a likelihood that erosion has occurred at the site.
Soils Erodibility	W14_Soils_Erodibility_Weight	3	Soils erodibility is an indicator of erosion at a site.
Beach Volumetric Change	W16_Beach_Erosion_Weight	1	Beach volumetric change was scored on a beach unit scale, resulting in a coarse unit of analysis.
Bank slope (degrees)	W15_Steep_Bank_Slope_Weight	4	Steep banks negatively affect

			suitability and indicate a need for hybrid stabilization measures and site modification such as bank regrading and vegetation removal.
Sociopolitical			
Sociopolitical datasets were not weighted and sociopolitical data is intended to be interpreted in a qualitative way.			

VIII. Sample Visual Basic (VB) and Python Scripts

Python scripts for scoring (to be plugged into field calculator)

Sample script for numeric attributes (replace with name of dataset being scored):

Code Block:

```
def S4_Aspect_SunExposure_Score(N4_Aspect_SunExposure_Dgrs):
  if (N4_Aspect_SunExposure_Dgrs >=0) and
(N4_Aspect_SunExposure_Dgrs <= 22.5):
    return 3
  elif (N4_Aspect_SunExposure_Dgrs> 22.5) and
(N4_Aspect_SunExposure_Dgrs<= 67.5):
    return 3
  elif (N4_Aspect_SunExposure_Dgrs> 67.5) and
(N4_Aspect_SunExposure_Dgrs<= 112.5):
    return 4
  elif (N4_Aspect_SunExposure_Dgrs> 112.5) and
(N4_Aspect_SunExposure_Dgrs<= 157.5):
    return 5
  elif (N4_Aspect_SunExposure_Dgrs> 157.5) and
(N4_Aspect_SunExposure_Dgrs<= 202.5):
    return 6
  elif (N4_Aspect_SunExposure_Dgrs> 202.5) and
(N4_Aspect_SunExposure_Dgrs<= 247.5):
    return 6
  elif (N4_Aspect_SunExposure_Dgrs> 247.5) and
(N4_Aspect_SunExposure_Dgrs<= 292.5):
    return 5
  elif (N4_Aspect_SunExposure_Dgrs> 292.5) and
(N4_Aspect_SunExposure_Dgrs<= 337.5):
    return 4
  elif (N4_Aspect_SunExposure_Dgrs> 337.5) and
(N4_Aspect_SunExposure_Dgrs<= 360):
    return 3
  elif (N4_Aspect_SunExposure_Dgrs==-1):
    return 4.5
  else:
    return 0
```

Expression: S4_Aspect_SunExposure_Score (!N4_Aspect_SunExposure_Dgrs!)

A score of 0 implies that there is no data at that site.

Sample script for non-numeric attributes (replace with name of dataset being scored):

Code Block:

```
def S7_Shoreline_Structures_Score (N7_Shoreline_Structures):
  if (N7_Shoreline_Structures =='Rip Rap/Revetment'):
    return 3
  elif (N7_Shoreline_Structures =='Wall'):
    return 2
  elif (N7_Shoreline_Structures =='Jetty/Groin'):
    return 1
  elif (N7_Shoreline_Structures =='Berm'):
    return 4
  else:
    return 6
```

Expression: S7_Shoreline_Structures_Score (!N7_Shoreline_Structures!)

For Yes/No attributes like the shoreline structure inventory, areas with no structures get a score of 6 (highest suitability). Here, 0 is not part of the score assignment.

Python scripts for weighting (to be plugged into field calculator)

Replace with name of dataset being weighted:

Code Block:

```
def W4_Aspect_SunExposure_Weight (S4_Aspect_SunExposure_Score):
  if (S4_Aspect_SunExposure_Score >=1) and
(S4_Aspect_SunExposure_Score <= 6):
    return 1
  else:
    return 0
```

Expression: W4_Aspect_SunExposure_Weight (!S4_Aspect_SunExposure_Score!)

If an attribute has a score of 0, it means that there is no data, and so it is also assigned a weight of 0. In this case, this attribute is neither a part of the numerator nor the denominator.

VB script for calculating the suitability index (to be plugged into field calculator)

VB script for the "With structures" scenario:

(([S9_NE_Fetch_Storm_Proxy_Score] * 2) +
([S8_NW_Fetch_Ice_Proxy_Score] * 2) + ([S5_Eelgrass_Proximity_Score] * 2)
+ ([S1_Landward_Shoretype_Score]* 3) + ([S2_Seaward_Shoretype_Score]*
2) + ([S3_Seaward_Extra_Info_Score]* 1) +
([S7_Shoreline_Structures_Score] * 3) + ([S15_Steep_Bank_Slope_Score] *4)
+ ([S12_Tidal_Crossing_Score] *1) + ([S10_Current_Edge_Impact_Score]* 1)
+ ([S11_CurrentSedimentImpact_Score]* 1) +
([S13_BoatWakeErosionPrxy_Score]* 1) + ([S16_Beach_Erosion_Score] * 1)
+ ([S17_Seaward_Slope_Score] * 4) + ([S14_Soils_Erodibility_Score] * 3)+
([S6_Future_Salt_Marsh_Score] *2) + ([S4_Aspect_SunExposure_Score] *1))
/ ([W9_NE_Fetch_Storm_Proxy_Weight] +
[W8_NW_Fetch_Ice_Proxy_Weight] + [W5_Eelgrass_Proximity_Weight] +
[W1_Landward_Shoretype_Weight] + [W2_Seaward_Shoretype_Weight] +
[W3_Seaward_Extra_Info_Weight] + [W10_Current_Edge_Impact_Weight]
+ [W11_CurrentSedimentImpact_Weigh] +
[W13_BoatWakeErosionPrxy_Weight] + [W16_Beach_Erosion_Weight] +
[W17_Seaward_Slope_Weight] + [W14_Soils_Erodibility_Weight] +
[W6_Future_Salt_Marsh_Weight] + [W4_Aspect_SunExposure_Weight] +
[W15_Steep_Bank_Slope_Weight] + [W12_Tidal_Crossing_Weight] +
[W7_Shoreline_Structures_Weight])

VB script for the "Without structures" scenario:

(([S9_NE_Fetch_Storm_Proxy_Score] * 2) +
([S8_NW_Fetch_Ice_Proxy_Score] * 2) + ([S5_Eelgrass_Proximity_Score] * 2)
+ ([S1_Landward_Shoretype_Score]* 3) + ([S2_Seaward_Shoretype_Score]*
2) + ([S3_Seaward_Extra_Info_Score]* 1) + (6* 3) +
([S15_Steep_Bank_Slope_Score] *4) + ([S12_Tidal_Crossing_Score] *1) +
([S10_Current_Edge_Impact_Score]* 1) +
([S11_CurrentSedimentImpact_Score]* 1) +
([S13_BoatWakeErosionPrxy_Score]* 1) + ([S16_Beach_Erosion_Score] * 1)
+ ([S17_Seaward_Slope_Score] * 4) + ([S14_Soils_Erodibility_Score] * 3)+
([S6_Future_Salt_Marsh_Score] *2) + ([S4_Aspect_SunExposure_Score] *1))
/ ([W9_NE_Fetch_Storm_Proxy_Weight] +
[W8_NW_Fetch_Ice_Proxy_Weight] + [W5_Eelgrass_Proximity_Weight] +
[W1_Landward_Shoretype_Weight] + [W2_Seaward_Shoretype_Weight] +
[W3_Seaward_Extra_Info_Weight] + [W10_Current_Edge_Impact_Weight]
+ [W11_CurrentSedimentImpact_Weigh] +
[W13_BoatWakeErosionPrxy_Weight] + [W16_Beach_Erosion_Weight] +
[W17_Seaward_Slope_Weight] + [W14_Soils_Erodibility_Weight] +
[W6_Future_Salt_Marsh_Weight] + [W4_Aspect_SunExposure_Weight] +
[W15_Steep_Bank_Slope_Weight] + [W12_Tidal_Crossing_Weight] +
[W7_Shoreline_Structures_Weight])

Python script for counting the number of attributes with no data (to be plugged into field calculator)

Attribute Name: N18_No_datasets_missing

Expression: FieldCount(!S8_NW_Fetch_Ice_Proxy_Score!, !S10_Current_Edge_Impact_Score!, !S11_CurrentSedimentImpact_Score!, !S5_Eelgrass_Proximity_Score!, !S1_Landward_Shoretype_Score!, !S2_Seaward_Shoretype_Score!, !S3_Seaward_Extra_Info_Score!, !S13_BoatWakeErosionPrxy_Score!, !S16_Beach_Erosion_Score!, !S14_Soils_Erodibility_Score!, !S7_Shoreline_Structures_Score!, !S6_Future_Salt_Marsh_Score!, !S9_NE_Fetch_Storm_Proxy_Score!, !S4_Aspect_SunExposure_Score!, !S12_Tidal_Crossing_Score!, !S15_Steep_Bank_Slope_Score!, !S17_Seaward_Slope_Score!)

Code Block:

```
def FieldCount(S8_NW_Fetch_Ice_Proxy_Score,
S10_Current_Edge_Impact_Score, S11_CurrentSedimentImpact_Score,
S5_Eelgrass_Proximity_Score, S1_Landward_Shoretype_Score,
S2_Seaward_Shoretype_Score, S3_Seaward_Extra_Info_Score,
S13_BoatWakeErosionPrxy_Score, S16_Beach_Erosion_Score,
S14_Soils_Erodibility_Score, S7_Shoreline_Structures_Score,
S6_Future_Salt_Marsh_Score, S9_NE_Fetch_Storm_Proxy_Score,
S4_Aspect_SunExposure_Score, S12_Tidal_Crossing_Score,
S15_Steep_Bank_Slope_Score, S17_Seaward_Slope_Score):
 fields=[S8_NW_Fetch_Ice_Proxy_Score, S10_Current_Edge_Impact_Score,
S11_CurrentSedimentImpact_Score, S5_Eelgrass_Proximity_Score,
S1_Landward_Shoretype_Score, S2_Seaward_Shoretype_Score,
S3_Seaward_Extra_Info_Score, S13_BoatWakeErosionPrxy_Score,
S16_Beach_Erosion_Score, S14_Soils_Erodibility_Score,
S7_Shoreline_Structures_Score, S6_Future_Salt_Marsh_Score,
S9_NE_Fetch_Storm_Proxy_Score, S4_Aspect_SunExposure_Score,
S12_Tidal_Crossing_Score, S15_Steep_Bank_Slope_Score,
S17_Seaward_Slope_Score]
 return sum(f==0 for f in fields)
```

VB script for counting the % of weights missing (to be plugged into field calculator)

```
100 - ( (( [W9_NE_Fetch_Storm_Proxy_Weight] +
[W8_NW_Fetch_Ice_Proxy_Weight] + [W5_Eelgrass_Proximity_Weight] +
[W1_Landward_Shoretype_Weight] + [W2_Seaward_Shoretype_Weight] +
[W3_Seaward_Extra_Info_Weight] + [W10_Current_Edge_Impact_Weight]
+ [W11_CurrentSedimentImpact_Weigh] +
[W13_BoatWakeErosionPrxy_Weight] + [W16_Beach_Erosion_Weight] +
```

[W17_Seaward_Slope_Weight] + [W14_Soils_Erodibility_Weight] + [W6_Future_Salt_Marsh_Weight] + [W4_Aspect_SunExposure_Weight] + [W15_Steep_Bank_Slope_Weight] + [W12_Tidal_Crossing_Weight] + [W7_Shoreline_Structures_Weight])/ 34) * 100)

Python script for qualitatively assigning data quality (to be plugged into field calculator)

CodeBlock:

```
def N18_Data_Quality (N18_Percent_Weights_Missing):
   if (N18_Percent_Weights_Missing>=32):
      return "Minimal Data"
   else:
      return "Adequate Data"
```

Expression:

```
N18_Data_Quality ( !N18_Percent_Weights_Missing! )
```

IX. Biophysical suitability attribute table

Table 11. Details of attributes produced by the biophysical suitability model.

Attribute	Intention for using	Name	Range of Values	Units	Name of scoring attribute	Scoring range	Name of weighting attribute	Weight	Name of proximity attribute (Distance of MHHW points from attribute)
Landward Shoretype	Identification of banks, characterize habitat roughly landward of the MHHW points.	N1_Landward_Shoretype	10A: Salt and Brackish Water Marshes 10B: Freshwater Marshes 10C: Swamps 10D: Scrub and Shrub Wetlands 1A: Exposed, Rocky Shores 1B: Exposed, Solid Man-Made Structures 2A: Exposed, Wave-Cut Platforms (Bedrock/Mud/Clay);\ 3A: Fine to Medium Grained Sand Beaches; 4: Coarse Grained Sand Beaches 5: Mixed Sand and Gravel Beaches 6A: Gravel Beaches 6B: Riprap 8A: Sheltered, Impermeable, Rocky Shores 8B: Sheltered, Solid Man-Made Structures 8C: Sheltered Riprap 9B: Vegetated Low Banks	N/A (qualitative)	S1_Landward_Shoretype_Score	1-6	W1_Landward_Shoretype_Weight	3	D1_Dune_Distance (if applicable)
Seaward Shoretype	Identification of marshes/mudflats and other seaward shoreline types; characterize habitat roughly seaward of the MHHW points.	N2_Seaward_Shoretype	1A: Exposed, Rocky Shores; 1B: Exposed, Solid Man-Made Structures; 2A: Exposed, Wave-Cut Platforms (Bedrock/Mud/Clay); 3A: Fine to Medium Grained Sand Beaches; 4: Coarse Grained Sand Beaches; 5: Mixed Sand and Gravel Beaches; 6B: Riprap; 7: Exposed Tidal Flats; 8A: Sheltered Scarps (Bedrock/Mud/Clay); 8A: Sheltered, Impermeable, Rocky Shores; 8B: Sheltered, Solid Man-Made Structures; 8C: Sheltered Riprap; 9A: Sheltered Tidal Flats; 9B: Vegetated Low Banks	N/A (qualitative)	S2_Seaward_Shoretype_Score	1-6	W2_Seaward_Shoretype_Weight	2	N/A
Seaward Extra Info	Secondary (extra) seaward habitat information	N3_Seaward_Extra_Info	2A: Exposed, Wave-Cut Platforms (Bedrock/Mud/Clay); 3A: Fine to Medium Grained Sand Beaches; 4: Coarse Grained Sand Beaches; 5: Mixed Sand and Gravel Beaches; 7: Exposed Tidal Flats;	N/A (qualitative)	S3_Seaward_Extra_Info_Score	1-6	W3_Seaward_Extra_Info_Weight	1	

			8A: Sheltered, Impermeable, Rocky Shores; 9A: Sheltered Tidal Flats						
Aspect	Proxy for shade/identifying sunlit slopes	N4_Aspect_SunExposure_Dgrs	-1 – 360	degrees	S4_Aspect_SunExposure_Score	1-6	W4_Aspect_SunExposure_Weight	1	D4_Aspect_SunExposure_Dist
Eelgrass proximity	Proxy for wave attenuation	N5_EelgrassProximityWaveBenefit	22 – 69,378	feet	S5_Eelgrass_Proximity_Score	1-6	W5_Eelgrass_Proximity_Weight	2	Is itself a proximity attribute.
Marsh migration in 2050 under highest SLR (approx 2 feet of SLR by 2050)	To identify future favorable environments for salt marsh	N6_Future_SaltMarsh2050_2ftSLR	Persistent= means persistent in 2050 under 2 feet of sea level rise Potential Lost	N/A (qualitative)	S6_Future_Salt_Marsh_Score	0.5 or 6	W6_Future_Salt_Marsh_Weight	2	N/A
Shoreline Structures	Treated as a negative influence on adjacent shoreline (within 50 feet for GBE and SHE and within 100 feet for Atl Coast) To evaluate potential for removal	N7_Shoreline_Structures	Wall Riprap/Revetment Jetty/Groin Berm	N/A (qualitative)	S7_Shoreline_Structures_Score	1-4	W7_Shoreline_Structures_Weight	2	D7_Shoreline_Structure_Distance
NW Fetch	Proxy for ice shoving. Distance wind blows over open water before reaching the MHHW point.	N8_NW_Fetch_Ice_Proxy_ft	0 to unbounded (infinity)	feet	S8_NW_Fetch_Ice_Proxy_Score	1-6	W8_NW_Fetch_Ice_Proxy_Weight	2	N/A
		N8_NW_Fetch_Ice_Proxy_miles		miles					
NE Fetch	Proxy for storm impacts	N9_NE_Fetch_Storm_Proxy_ft	0 to unbounded (infinity)	feet	S9_NE_Fetch_Storm_Proxy_Score	1-6	W9_NE_Fetch_Storm_Proxy_Weight	2	N/A
		N9_ NE_Fetch_Storm_Proxy_miles		miles					

Currents	Proxy for scour	N10_11_Current_Scour_Proxy	0 – 1.19	m/s	S10_Current_Edge_Impact_Score	1-6	W10_Current_Edge_Impact_Weight	1	N/A
					S11_CurrentSedimentImpact_Score	1-6	W11_CurrentSedimentImpact_Weigh	1	
Tidal Crossing	Proxy for high velocity flows	N12_TidalCrossingVelocity_prxy	Yes within 50 feet/Null	N/A (qualitative)	S12_Tidal_Crossing_Score	3 or 6	W12_Tidal_Crossing_Weight	1	N/A
Proximity to federal navigable channels	Proxy for boat wakes which is in turn a proxy for erosion	N13_Boat_Wakes_Erosion_Proxy	0 – 21,119	Feet (qualitative)	S13_BoatWakeErosionProxy_Score	1-6	W13_BoatWakeErosionProxy_Weight	2	Is itself a proximity attribute.
Soils erodibility	Measure of erosion calculated via the Universal Soils Loss Equation (USLE) based on raindrop impact and runoff potential of soil types	N14_Soils_Erodibility	0 – 0.64	N/A (this is a ratio)	S14_Soils_Erodibility_Score	1-6	W14_Soils_Erodibility_Weight	3	N/A
Bank slope	To identify steep banks (slope > 30 degrees)	N15_Steep_Bank_Slope	30 – 61	degrees	S15_Steep_Bank_Slope_Score	1 or 6	W15_Steep_Bank_Slope_Weight	4	D15_Steep_Bank_Distance
Beach Volumetric Change	Qualitative measure of whether a beach unit is eroding, accreting, or stable.	N16_Beach_Erosion	Accretion Erosion Potentially Stable	Meters/ 3 years	S16_Beach_Erosion_Score	1-6	W16_Beach_Erosion_Weight	1	N/A
Bathymetry	Seaward slope	N17_Seaward_Slope_Rise_Over_Run	0 – 11, 11293	Feet	S17_Seaward_Slope_Score	1-6	W17_Seaward_Slope_Weight	4	D17_SeawardSlope_Dist_toContou
		N17_Seaward_Slope_Degrees	0 – 90	Degrees					

		N17_Seaward_Slope_Radians	0 – 1.57	Radians					
		N17_Seaward_Slope_Contour_Used	0-ft contour from Atlantic Coast/HSE mosaic -1-ft contour Lippmann -2 -ft contour Lippmann 0-ft contour GRANIT Coastal LiDAR	N/A (qualitative)					
		N17_MHHW_Contour_Elevation	3.6—Bay; 4.2—River; 4.4—Ocean/Embayment	feet					
Adequacy of data	To indicate where the site suitability index might be lower than it should be because of insufficient data	N18_No_datasets_missing	1—10	Number of datasets	N/A	N/A	N/A	N/A	N/A
		N18_Precent_Weights_Missing	2.9 – 55.8	%					
		N18_Data_Quality	Adequate Data (2.9 – 32%) Minimal Data (32 – 55.8%)	N/A (qualitative)					
Suitability Index	To suggest the degree of site modification for a soft stabilization approach	N19_Suitability_Index	1.9 – 5.7 6= Highly suitable for living shorelines 5= Suitable for living shorelines 4= Suitable for living shoreline hybrid solutions 3= Suitable for living shoreline hybrid solutions 2= May be suitable for living shorelines with hybrid components and/or significant. site modification 1= May be suitable for living shorelines with more hybrid components and/or sig. site modification	N/A (this is a ratio)	N/A	N/A	N/A	N/A	N/A
Suitability Without Structures	To understand how other factors contribute to site suitability if shoreline structures were absent	N20_SuitabilityIndex_WO_Struct	2.6 – 5.7 6= Highly suitable for living shorelines 5= Suitable for living shorelines 4= Suitable for living shoreline hybrid solutions 3= Suitable for living shoreline hybrid solutions 2= May be suitable for living shorelines with hybrid components and/or significant. site modification 1= May be suitable for living shorelines with more hybrid components and/or sig. site modification	N/A (this is a ratio)	N/A	N/A	N/A	N/A	N/A

X. Sociopolitical feasibility attribute table

Table 12. Details of attributes produced by the sociopolitical feasibility assessment.

Attribute	Intention for using	Name	Range of Values	Units	Name of proximity attribute (Distance of MHHW points from feature)
Ecological Values	To acknowledge and take into consideration the ecological values that stakeholders assign to a site.	N1_Coastal_Conservation_Plan	Core Areas, Landscape Areas (more info here)	N/A	N/A
		N2_Wildlife_Action_Plan	Tier 1 = Habitats of Highest Relative Rank by Ecological Condition in New Hampshire Tier 2 = Habitats of Highest Relative Rank by Ecological Condition in Biological Region (more info here)		
		N3_Water_Resources_Flood	"WR: Flood" or Null (areas across the watershed with high flood storage capacities that reduce flood risks to downstream infrastructure, and natural areas that will accommodate sea level rise and salt marsh migration)		
		N4_Water_Resources_Public_wate	"WR: PWS" or Null (lands that safeguard surface and groundwater resources for human consumption)		
		N5_Water_Resources_Water_Qlty	"WR: WQ" or Null (riparian buffers that intercept stormwater runoff and at the same time maintain natural cover adjacent to surface waters, and riparian wetlands that are highly efficient at treating pollutants already in surface waters) More info here		
Suggested Living Shoreline Sites	To document sites where there is motivation for a living shoreline project.	N6_Suggested_Location_Name N7_Suggested_Location_Desc	Includes name and description of each site.	N/A	N/A
Shoreline Access Sites	public education potential, construction accessibility	N8_Access_Facility N9_Access_Site_Owner N10_Access_Type	Includes name and access type.	N/A	N/A since access sites were not precisely geo-located.
Eelgrass extent 1996	to represent regulatory concern about not impacting current and historic eelgrass beds.	N11_Proximity_to_1996Eelgrass	0 – 68,616	ft	Is itself a proximity attribute
Shellfish beds	to represent regulatory concern about not impacting shellfish beds.	N12_Proximity_To_Shellfish	0 – 26,723	ft	Is itself a proximity attribute

Aquaculture sites	to represent regulatory concern about not impacting aquaculture resources	N13_Proximity_To_Aquaculture_Site N14_Aquaculture_Site_Name N15_ Aquaculture_Species	53 – 49,121	ft	Is itself a proximity attribute
Trails	To anticipate demand for stabilization	N16_Trail_Name N17_Trail_Property_Name	Includes names of trails.	N/A	D14_Distance_to_trail
Conservation/Public Lands	To represent level of motivation/capacity/interest for living shoreline projects	N18_ConsPub_Land_Name N19_ConsPub_Primary_Type N20_ConsPub_Protection_Term N21_ConsPub_Agency_Type N22_ConsPub_Program N23_ConsPub_Management_Status	For more information, refer metadata for this dataset here. Attributes for this data set are provided in 'Cons_Document.doc'. In addition, please also see 'AttributeCodes.xls' for a listing of codes for fields with defined domains. These documents are available as part of the dataset download.	N/A	N/A since boundaries were not precisely geo-located.
Impervious cover	To represent demand for stabilization and to understand project vulnerability.	N24_Distance_to_Impervious	-1 (no impervious surface within a 100 ft) to 100	ft	N/A
Buildout Scenarios for Impervious Cover under "Linear" development scenario by 2050	To represent demand for stabilization	N25_Percent_development_by_2050	0 – 97 (shows projected percentage of development by 2050 within 10000 sq feet.)	%	N/A
Biophysical Suitability Index	To provide information about biophysical conditions.	N26_Biophysical_Suitability_Index	1.9 – 5.7	N/A	N/A
		N27_Biophysical_Suitability_Index_WO_Struct	2.6 – 5.7		
Sea Level Rise 2050 High Emissions Scenario (2 feet)	To assess vulnerability of development to sea level rise.	Inundation_development_2ft_SLR	Inundated or Null	N/A	N/A

XI. Sample living shoreline suitability property profile

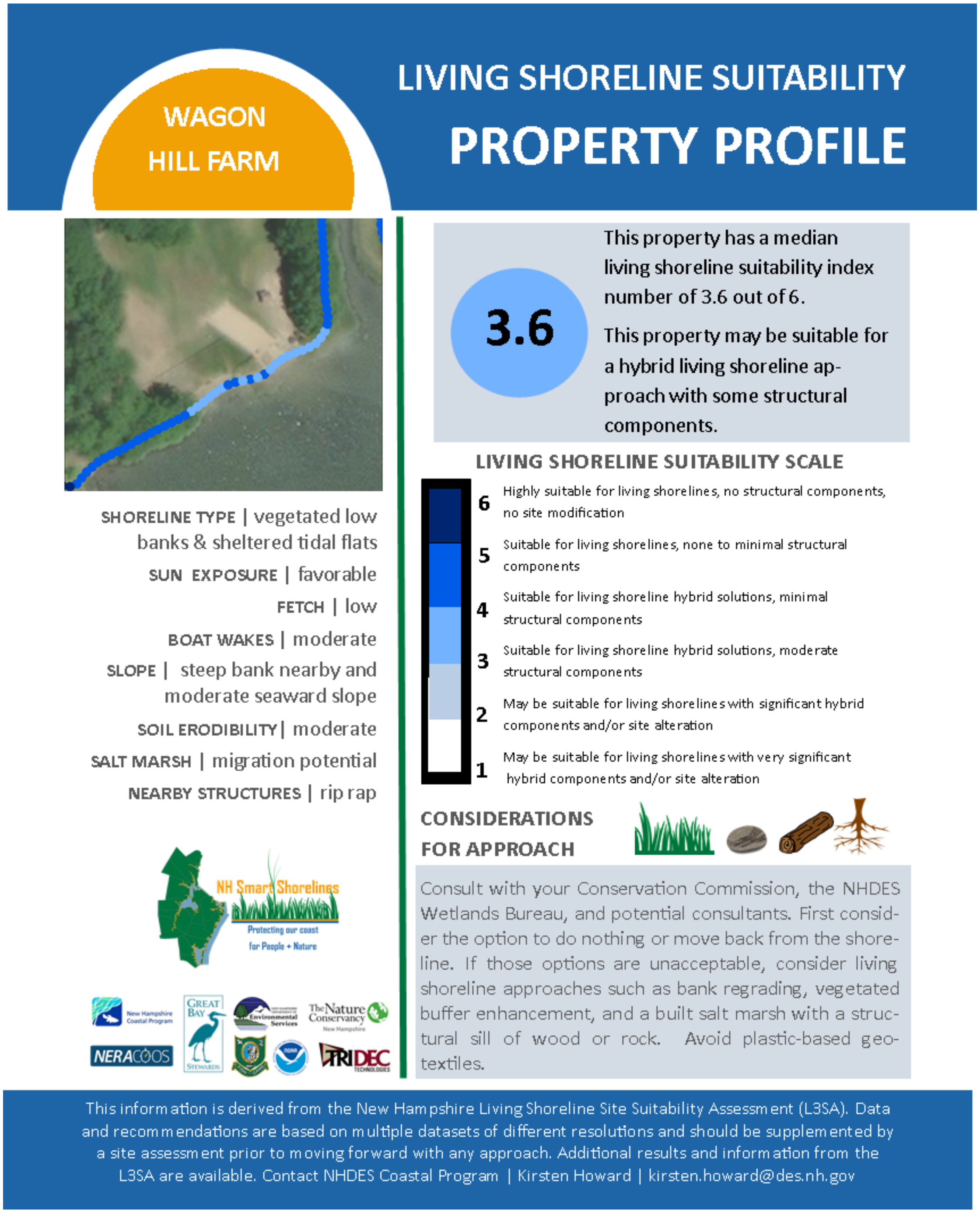
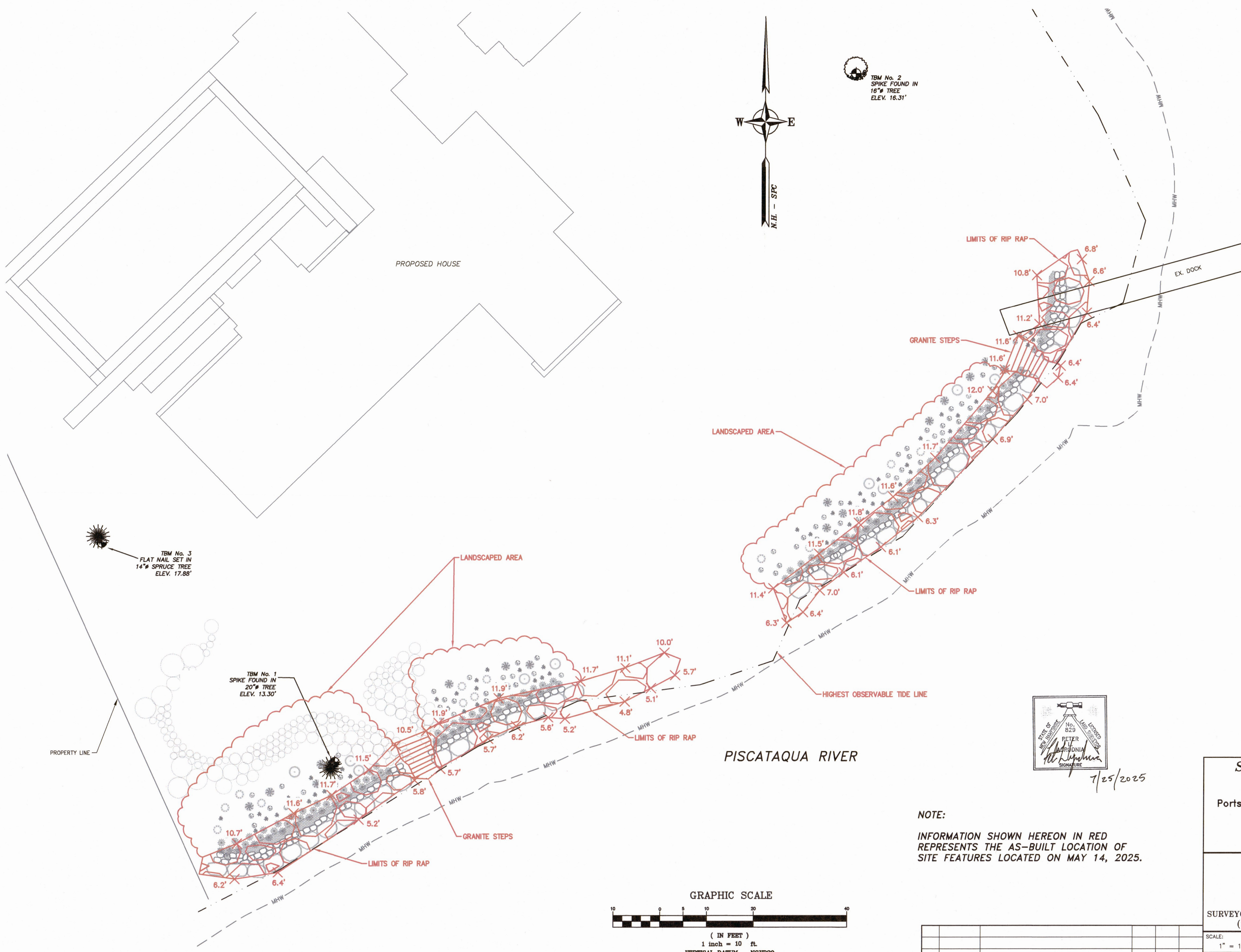


Figure 9. Sample property profile for Wagon Hill Farm, Durham, NH.

To get a tailored property profile for your site, contact:

Kirsten Howard
Coastal Resilience Coordinator,
New Hampshire Department of Environmental Services Coastal Program
222, International Drive, Suite 175, Portsmouth, NH 03801
Email: kirsten.howard@des.nh.gov | Phone: 603-559-0020



NOTE:

INFORMATION SHOWN HEREON IN RED REPRESENTS THE AS-BUILT LOCATION OF SITE FEATURES LOCATED ON MAY 14, 2025.

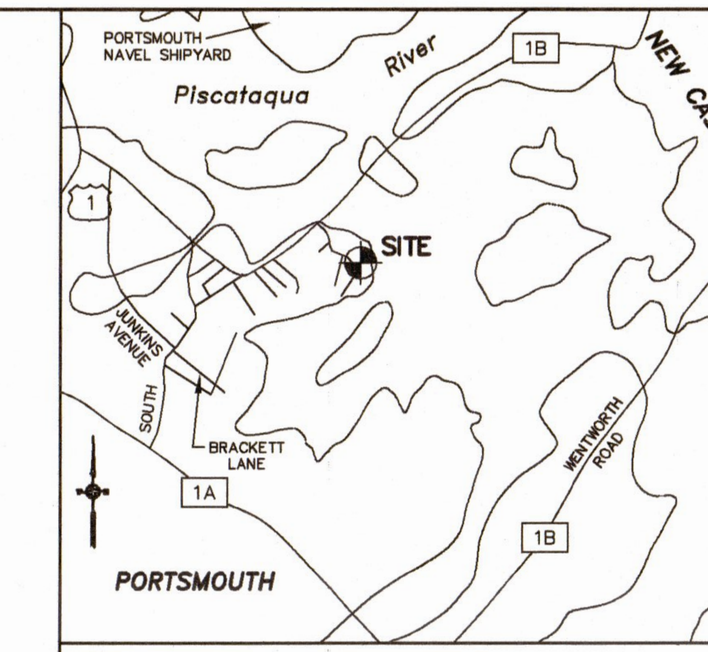
GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.
VERTICAL DATUM - NGVD29

STATE OF NEW HAMPSHIRE LICENSED LAND SURVEYOR No. 829 PETER AGRODNIA SIGNATURE

7/25/2025



LOCATION MAP
(not to scale)

SHORELINE AS-BUILT SKETCH

FOR PROPERTY AT

60 Pleasant Point Drive
Portsmouth, Rockingham County, New Hampshire

OWNED BY

120-0 Wild Rose Lane, LLC

c/o Altus Engineering, Att. Erik Saari, V.P.
133 Court Street, Portsmouth, New Hampshire 03801

North EASTERLY SURVEYING

SURVEYORS IN N.H. & MAINE 1021 GOODWIN ROAD, UNIT #1
(207) 439-6333 ELIOT, MAINE 03903

SCALE:	PROJECT NO.	DATE:	SHEET:	DRAWN BY:	CHECKED BY:
1" = 10'	24-297	07/25/25	1 OF 1	D.D.M.	P.L.A.

DRAWING No: 24-297 As-Built Shore
FIELD BOOK No: "Tidewater #20"

Tax Map 207 Lot 13

REV.	DATE	STATUS	BY	CHKD	APPD.

ALTUS ENGINEERING

Civil
Site Planning
Environmental
Engineering

133 Court Street
Portsmouth, NH
03801-4413

August 1, 2025

David Price, Southern Region, Coastal Wetlands Compliance Supervisor
NH Department of Environmental Services, Water Division
222 International Drive, Suite 175
Portsmouth, NH 03801

Re: **NHDES Wetlands Permit – File: 2023-03138**
60 Pleasant Point Drive
Portsmouth, NH

Transmitted via email to: david.price@des.nh.gov

Dear David:

Altus Engineering LLC (Altus) understands that the City of Portsmouth requested that you visit the subject property to view the Hybrid Living Shoreline constructed as permitted under NHDES Wetlands Bureau Permit 2023-03138.

On May 28, 2025 we understand you met on site with:

Kate Homet, City of Portsmouth
Shanti Wolph, City of Portsmouth
Andrew Wilson, Auger Building Company
Ben Auger, Auger Building Company

Following that meeting, Altus, working with TF Moran (TFM), filed a new Wetlands Conditional Use Permit Application (CUP) with the City of Portsmouth to address the City approved CUP modifications to the design required to secure the NHDES permit.

In working with the City of Portsmouth with respect to its Conditional Use Permitting process, we have recently obtained an As-Built Plan. While the vast majority of the Hybrid Living Shoreline was constructed as approved by NHDES, there are a few portions of the toe stones that slightly encroach over the Highest Observable Tide Line ("HOTL"). We are working with Riverside and Pickering Marine Contractors to remedy this subtle encroachment. During construction, an additional area of the eroded bank was discovered that also required stabilization, so and the Hybrid Living Shoreline was expanded laterally by up to 2.9-feet to address this area as well encompassing approximately 39 SF in this area. The enclosed as-built sketch by Easterly Surveying depicts the areas of the slight encroachment.

Working with Riverside and Pickering and TFM, Altus will submit a formal Wetland Permit Amendment Request to approve these minor amendments, to include retaining the additional Hybrid Living Shoreline components above the HOTL. Additionally, this amendment request will include new details relative to how we propose to vegetate portions of the hard armor. Essentially, using a new innovative approach, sand will be infilled into the riprap (washed in) and then planted with native plantings to give the shoreline a greener, more natural appearance.

Should you have any questions regarding this matter or require additional information, please do not hesitate to contact me directly at (603) 433-2335. Thank you for your consideration in this matter.

Respectfully submitted,

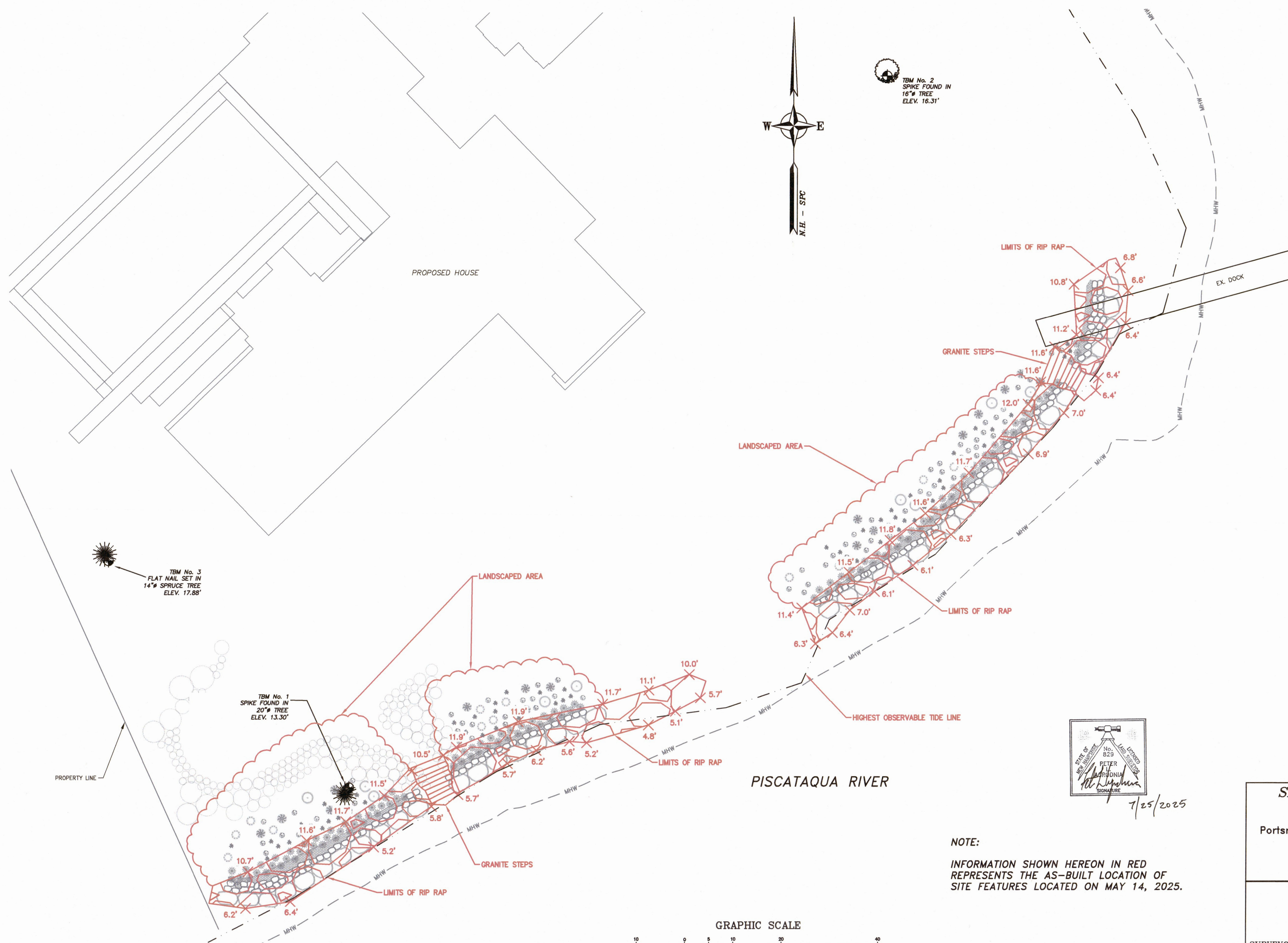
ALTUS ENGINEERING LLC

Eric Weinrieb, PE
President

Enclosure

eCopy: Michelle and John Morris
Ben Auger, ABC
Andrew Wilson, ABC
Jay Aube, TFM
City of Portsmouth (uploaded to viewpoint)
Tim Phoenix, Esq.
Roy Tilsey, Esq.

wde/5138.pb cvr ltr.docx



7/25/2025

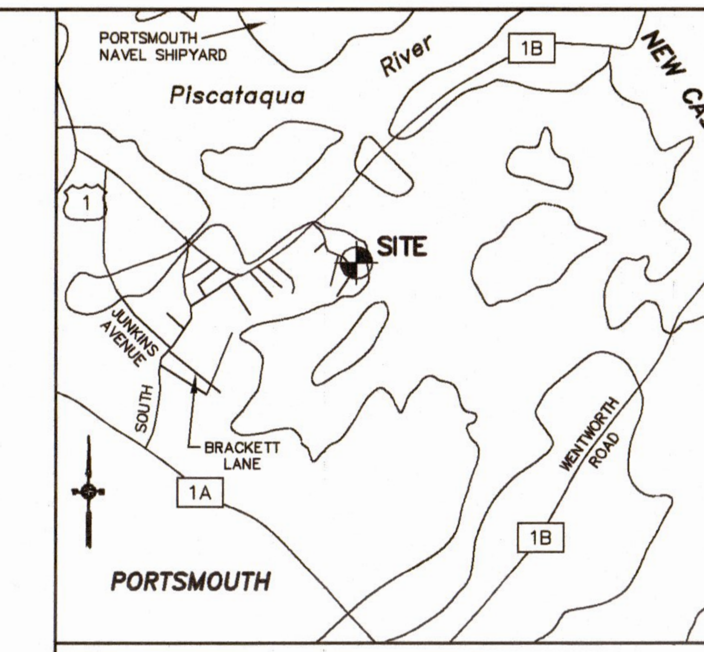
NOTE:

INFORMATION SHOWN HEREON IN RED REPRESENTS THE AS-BUILT LOCATION OF SITE FEATURES LOCATED ON MAY 14, 2025.

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.
VERTICAL DATUM - NGVD29



LOCATION MAP
(not to scale)

SHORELINE AS-BUILT SKETCH

FOR PROPERTY AT

60 Pleasant Point Drive
Portsmouth, Rockingham County, New Hampshire

OWNED BY

120-0 Wild Rose Lane, LLC
c/o Altus Engineering, Att. Erik Saari, V.P.
133 Court Street, Portsmouth, New Hampshire 03801

North
W EASTERLY
SURVEYING

SURVEYORS IN N.H. & MAINE 1021 GOODWIN ROAD, UNIT #1
(207) 439-6333 ELIOT, MAINE 03903

REV.	DATE	STATUS	BY	CHKD	APPD.

SCALE:	PROJECT NO.	DATE:	SHEET:	DRAWN BY:	CHECKED BY:
1" = 10'	24-297	07/25/25	1 OF 1	D.D.M.	P.L.A.

DRAWING No: 24-297 As-Built Shore
FIELD BOOK No: "Tidewater #20

Tax Map 207 Lot 13

ALTUS ENGINEERING

133 Court Street (603) 433-2335 Portsmouth, NH 03801 www.altus-eng.com

NOT FOR CONSTRUCTION

ISSUED FOR: CLIENT REVIEW

ISSUE DATE: AUGUST 6, 2025

REVISIONS

NO.	DESCRIPTION	BY	DATE
0	DISCUSSION	EDW	08/06/25

DRAWN BY: RLH

APPROVED BY: EDW

DRAWING FILE: 5138SITE-LIVING-SHORE

SCALE:
(22"x34") 1" = 20'
(11"x17") 1" = 40'

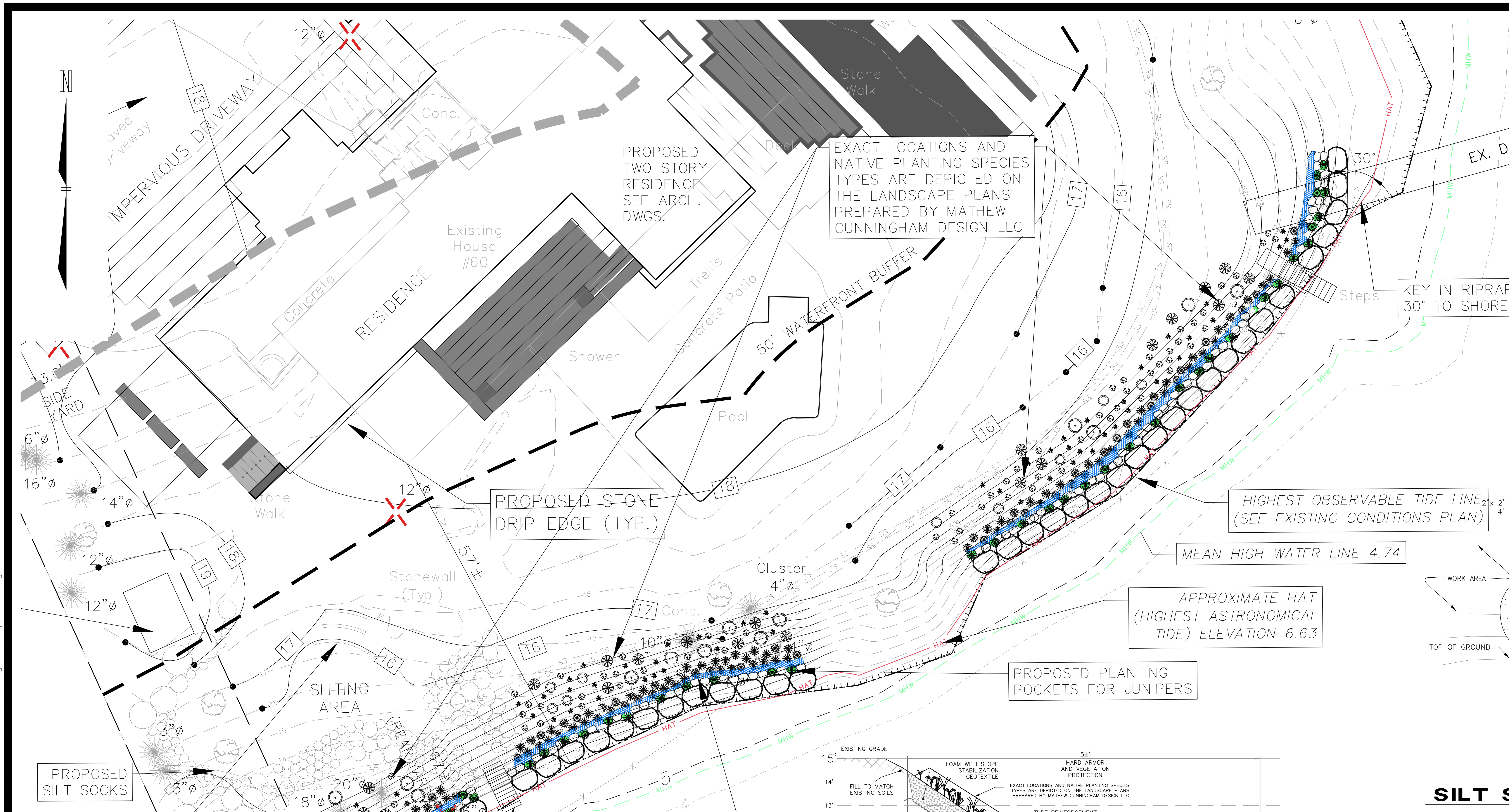
OWNER:
120-0 WILD ROSE LANE, LLC
209 WATER STREET
NEWBURYPORT, MA 01950

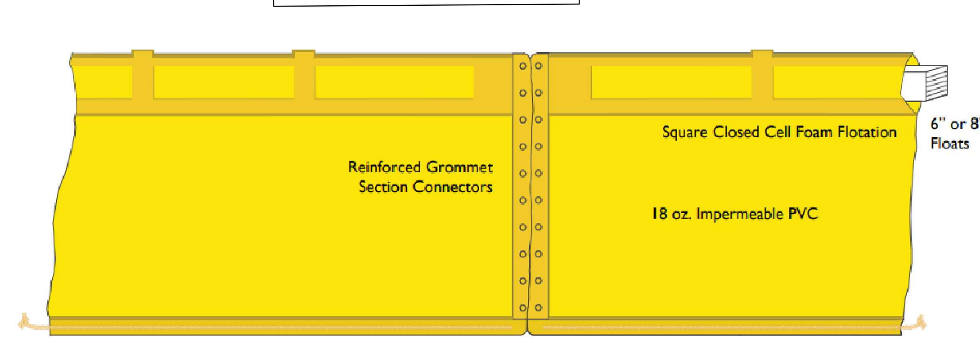
APPLICANT:
120-0 WILD ROSE LANE, LLC
209 WATER STREET
NEWBURYPORT, MA 01950

PROJECT:
JOHN & MICHELLE MORRIS RESIDENCE
TAX MAP 207, LOT 13
60 PLEASANT POINT DRIVE
PORTSMOUTH, NH

TITLE:
NATURAL SHORELINE ILLUSTRATION

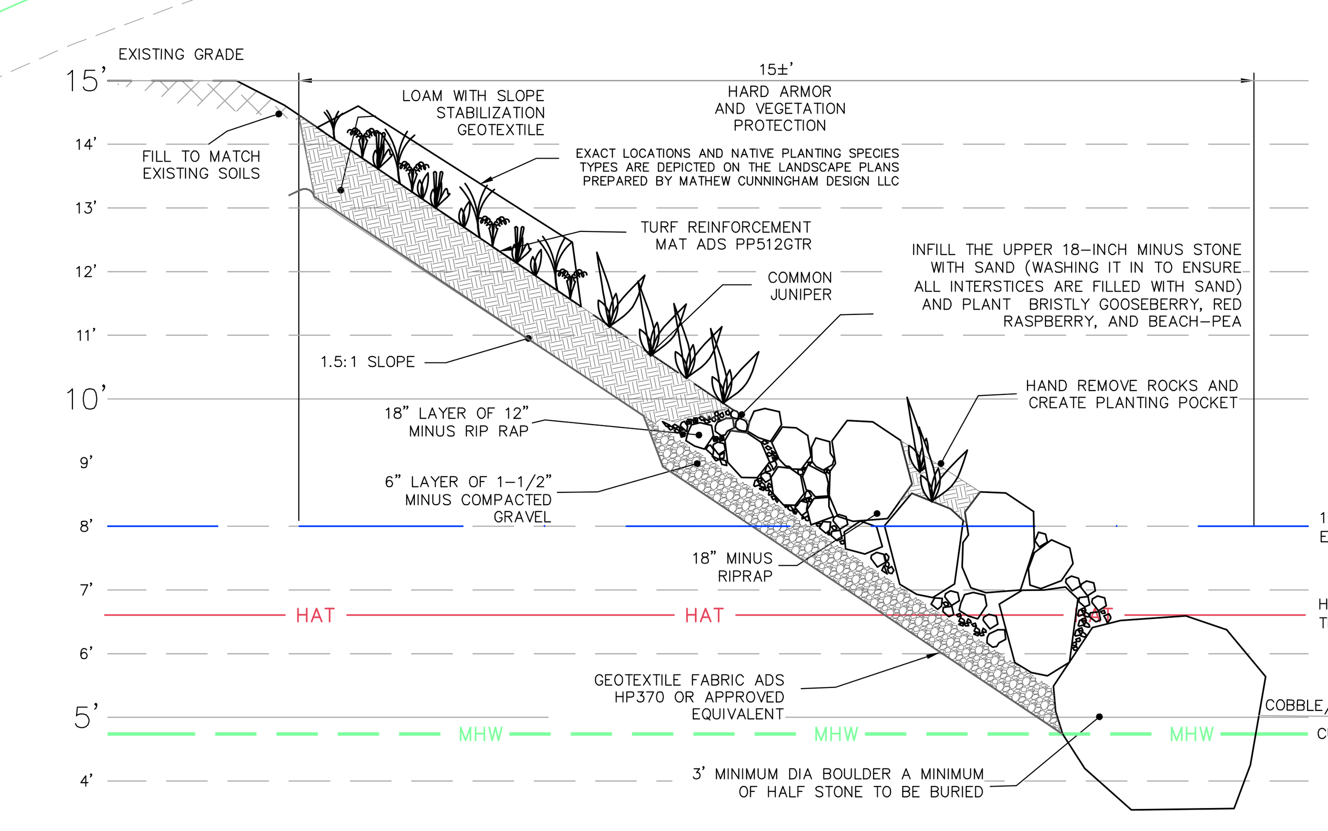
SHEET NUMBER:
1 OF 1





GEI WORKS	772-646-0597 www.GEIWorks.com info@geiworks.com
Type 1 DOT Turbidity Curtain	
Scale: Not to Scale	Date: 01/04/2018

Drawing is for illustrative purposes only. Not to scale.
Copyright © GEI Works 2018
Natural forces such as current, wind, waves, and location affect your product and may require engineering, additional anchoring, and customization.



TOE PROTECTION PROFILE
1"=2'

HYBRID LIVING SHORELINE DETAIL

HORIZONTAL SCALE 1"=10'

SITE DATA

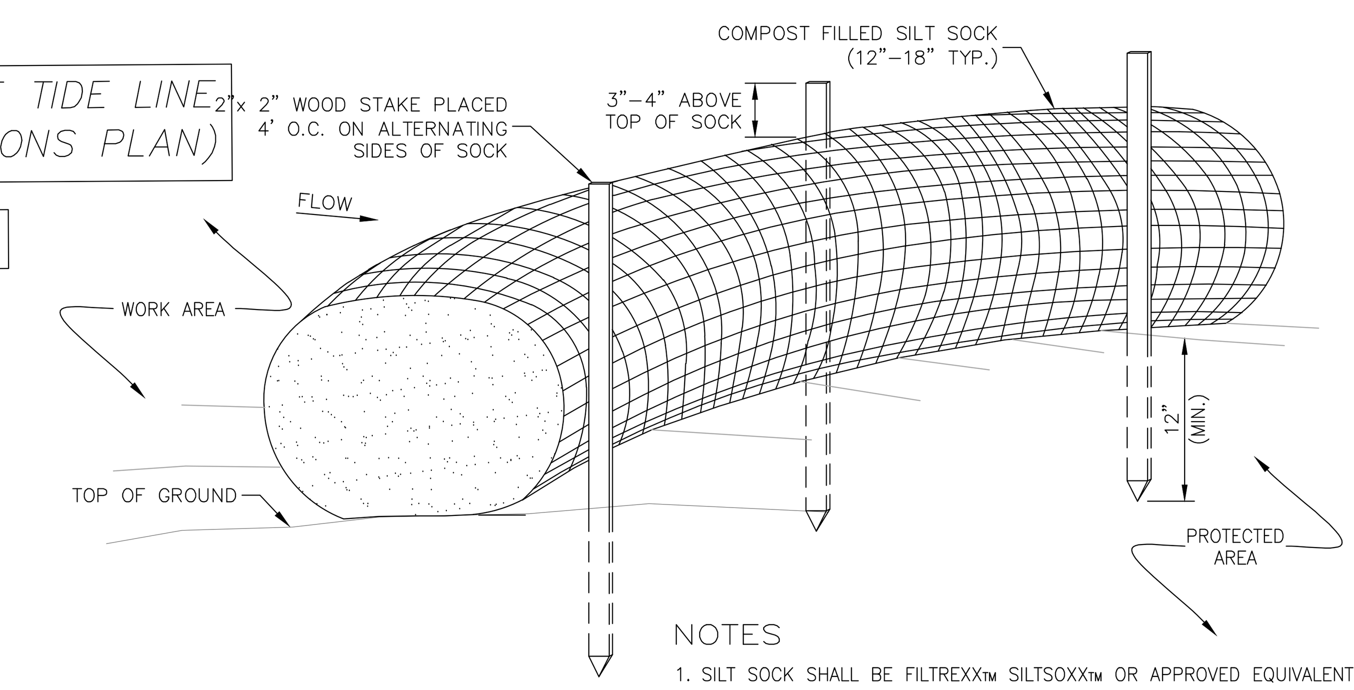
OWNER: OWNER OF RECORD OF MAP 207 LOT 13: 120-0 WILD ROSE LANE, LLC
DEED REFERENCE TO PARCEL IS BK #6174 PG #1450
AREA OF PARCEL = 50530± SF OR 1.16± ACRES

THE PURPOSE OF THIS PLAN IS TO DEPICT A SHORELINE STABILIZATION PROJECT THAT INCORPORATES BOTH HARD ARMOR AND VEGETATION ELEMENTS

WORK SEQUENCE NOTES

1. REMOVE ALL INVASIVE VEGETATION
2. LAY FILTER FABRIC
3. 2-3 TON TOE STONES
4. 16"-18" ARMOR STONE
5. 7"- 12" RIP RAP
6. CHINK WHERE NEEDED WITH SMALLER STONE
7. IMPLEMENT WEEP HOLES TO ALLOW DRAINAGE
8. INTEGRATE VEGETATION BEHIND RIP RAP WALL
9. SLOPE OF BANK IS 1.5:1
10. TO THE GREATEST EXTENT PRACTICABLE EXISTING TREES WILL REMAIN

LEGEND	
TURBIDITY CURTAIN	
SILT SOCKS	
EXISTING CONTOURS	
PROPOSED CONTOURS	
HOTL	
COMMON JUNIPER	
3' MINIMUM DIA BOULDERS	
18" MINUS RIPRAP	
12" MINUS RIPRAP	



NOTES

1. SILT SOCK SHALL BE FILTREXX™ SILTSOXX™ OR APPROVED EQUIVALENT.
2. SEE SPECIFICATIONS FOR SOCK SIZE AND COMPOST FILL REQUIREMENTS.
3. SILT SOCK SHALL BE INSPECTED PERIODICALLY AND AFTER ALL STORM EVENTS, AND REPAIR OR REPLACEMENT SHALL BE PERFORMED AS NEEDED.
4. COMPOST MATERIAL SHALL BE DISPERSED ON SITE, AS DETERMINED BY THE ENGINEER.

SILT SOCK

NOT TO SCALE

SITE DEVELOPMENT PLANS

TAX MAP 207 LOT 13

HYBRID LIVING SHORELINE PLAN

SHORELINE STABLIZATION

60 PLEASANT POINT DRIVE, PORTSMOUTH NH

OWNED AND PREPARED FOR

120-0 WILD ROSE LANE, LLC

1"=20' (11"X17")
SCALE: 1"=10' (22"X34") **JUNE 10, 2024**

REV	DATE	DESCRIPTION	DR	CK
2	7/29/2025	REVISE HYBRID LIVING SHORELINE	VPB	JRA
1	9/9/2024	REVISE RIPRAP TIES TO SHORE	JJM	JRA

TFM
Civil Engineers
Structural Engineers
Traffic Engineers
Land Surveyors
Landscape Architects
Scientists
48 Constitution Drive
Bedford, NH 03110
Phone (603) 472-4488
Fax (603) 472-9747
www.tfmoran.com

FILE	DR	VPB	FB	-	
47307.20	CK	JRA	CADFILE	LIVING-SHORELINE-PLAN	C-01

DIG SAFE
CONTACT DIG SAFE 72 BUSINESS HOURS PRIOR TO CONSTRUCTION

HOEFLE, PHOENIX, GORMLEY & ROBERTS, PLLC
ATTORNEYS AT LAW
127 Parrott Avenue | Portsmouth, NH, 03801
Telephone: 603.436.0666 | Facsimile: 603.431.0879 | www.hpgrlaw.com

July 30, 2025

Peter Britz, Planning and Sustainability Director
City of Portsmouth Municipal Complex
1 Junkins Avenue
Portsmouth, New Hampshire 03801

Re: 120-0 Wild Rose Lane LLC/John & Michelle Morris
Application for Conditional Use Permit
Assessor's Map 207, Lot 13
60 Pleasant Point Drive
LU-23-180

Dear Mr. Britz:

On behalf the above referenced property owner, 120-0 Wild Rose Lane, LLC, and its principals, John and Michelle Morris ("Morris"), please accept this letter, for distribution to the Planning Board and Conservation Commission, in support of Altus Engineering's ("Altus") 7/30/25 submission for Conditional Use Permit ("CUP") for shoreline stabilization. Its purpose is to submit background and context for a new CUP application/amendment required by the city.

I. EXHIBITS

1. . Photographs (See also Ballestero Report).
   - A) 1/15/24
   - B) 2/11/24
   - C) 2/20/24
   - D) 3/4/24
   - E) 3/10/24
2. DES Requests for more information ("RFMI")
   - A) 2/2/24
   - B) 8/12/24
   - C) 10/0/24 (not related to shoreline stabilization)

3A. 7/12/24 TFM Response to 2/2/24 DES RFMI.
3B. 8/28/24 TFM Response to 8/12/24 DES RFMI.
4. 11/4/24 DES Cover Letter and Approved Permit-copied to Portsmouth Conservation Commission.

5. January, 2025 Email exchanges.
   A) Pickering to City.
   B) Auger to City.
   C) City to Auger
6. 7/29/25 Thomas Ballestero Report/Resume.
7. 7/25/25 Memorandum-Riverside/Pickering Marine.
8. Portsmouth Hard Armor Photos.
   A) 30 Walden Street
   B) 500 Market Street
   C) Lady Isle
   D) 363 New Castle Avenue
   E) 379 New Castle Avenue

II. HISTORY

On or about December 27, 2023, the Portsmouth Planning Board issued a CUP for *inter alia* shoreline protection for the property at 60 Pleasant Point Rd. described as a soft "Living Shoreline", submitted by Altus as designed by Matthew Cunningham Landscape Architects, LLC (See LU-23-180). No expert engineer "stamp" signifying that the proposal would sufficiently protect the Morris property was provided.

On or about November 30, 2023, as required by state law, more particularly, RSA 482-A, an application for a Wetland Permit was submitted to the New Hampshire Department of Environmental Services ("DES") proposing the same impacts and protections applied for and approved under the 12/27/23 CUP.

In January 2024, the Morris property sustained significant damage to the shoreline during two (2) major coastal storm events that coincided with astronomically high tide events. (**Photos Exhibit 1**)

On February 2, 2024, DES reviewed the submission and issued a Request for More Information ("RFMI") followed by additional RFMI on 8/12/24 and 10/10/24. (**Exhibit 2**) Through the initial RFMI letter, DES requested, *inter alia*, identification of all known causes of erosion, the specifics relative to how the proposed Living Shoreline would be constructed, documentation that the proposed Living Shoreline was designed by a Certified Wetland Scientist "(CWS)" and a Professional Engineer ("PE") in accordance with the National Oceanic and Atmospheric Administration ("NOAA") publication, "Guidance for Considering the Use of Living Shorelines". (**Exhibit 2A**)

On or about May 29, 2024, Auger Building Company ("Auger"), retained the services of TFMoran, Inc. ("TFM") to assist Altus respond to the DES RFMI relative to the questions pertaining to the construction of a Living Shoreline. TFM Certified Wetland Scientist, Jay Aube, and Professional Engineer, Jack McTigue, answered all RFMI questions relative to the construction of a Living Shoreline. (**Exhibit 3A**) Having viewed the severe erosion from the January 2024 storm events (**See Exhibit 1**), and through the use of the guidance documents prescribed by the DES Wetlands Bureau, more particularly, DES Wetlands Bureau Administrative Rule Env-Wt 609.05 (a), as cited within the first DES RFMI letter, and by performing a Coastal Vulnerability Assessment to assess projected Relative Sea Level Rise (RSLR) on the project site, TFM determined that in this instance, using soft, green stabilization techniques, alone, (as proposed/permitted by the original City of Portsmouth CUP) was not reasonable or practical as they would not adequately protect the Morris property in the future. In order to adequately protect the Morris property TFM determined and proposed that a combination of techniques, more specifically a robust planting plan with native species, coupled with the implementation of hard armor in the form of large toe stones and riprap, was required in order to "stamp" a plan reasonably protective of the eroded/storm damaged section of the Morris shoreline. (*Id.*) This technique of shoreline stabilization, considered a "Hybrid Approach to Shoreline Stabilization," was conveyed to DES in a 7/12/24 formal responses to DES' RFMI letters prepared and submitted by Altus. (*Id.*)

On August 12, 2024, DES issued a second RFMI letter, (**Exhibit 2B**) in accordance with NHDES Wetlands Bureau Administrative Rule Ent-Wt 609.07, which is specifically related to the approval of "Tidal Shoreline Stabilization Using New Hard-Scape or Rip-Rap", requesting *inter alia* demonstration that:

a.) Factors exist that would render soft/ green stabilization methods physically impractical; and
b.) Abutting properties would not be adversely affected by the use of rip-rap;

On or about August 28, 2024, TFM prepared and submitted to DES a memo (**Exhibit 3B**) identifying several existing factors rendering the use of soft/green stabilization techniques alone as physically impractical, and how the use of rip-rap would not adversely affect abutting properties.

In summary, the Hybrid Living Shoreline plan, designed and stamped by TFM, includes hard armor (toe stones and riprap) at the toe of slope that extends up the bank, armoring approximately 50% of the bank, and a robust planting plan that covers the top half of the bank. It is to be noted that the Hybrid Living Shoreline design is along only approximately fifty percent (50%) of the length of the Morris shoreline that is most susceptible to storm damage. The remainer is in fact protected by the "soft" approach permitted by the original CUP (**See 7/30/25 CUP Application**).

On November 4, 2024, DES approved the "Hybrid Living Shoreline" proposed by TFM and issued a copy of its Letter of Approval and DES Wetland Permit to *inter alia* the Portsmouth Conservation Commission (**Exhibit 4**).

In January, 2025, prior to construction of the protective improvements, representatives from Riverside/Pickering Marine Contractors ("Riverside"), which was to build the State-approved shoreland features, and builder Auger, overseeing the site and responsible for non-shoreline-related lot improvements (including demolition of the aged existing dwelling structure and construction of a newly-designed home), each separately emailed a copy of the DES-approved Hybrid Living Shoreline Plan to the City of Portsmouth Building Department, advising of *inter alia* the riprap features and requesting next steps (**Exhibits 5A, B**). The city's 1/13/25 email response to Pickering and Auger, (**Exhibit 5C**) indicated that there was a review of the project with leadership from the City's Planning and Building Departments, did not require a building permit and authorizing, continuing the project, understood by Pickering and Auger to be authorizing construction of the shoreline protection pursuant to the DES approved and stamped "Hybrid Living Shoreline" "riprap" plan.

In the first quarter of 2025, shoreline protection was constructed pursuant to the DES-approved plan. On May 28, 2025, following construction, City of Portsmouth representatives (along with Auger representatives on behalf of Morris), inspected the site, also accompanied, at the City's request, by David Price of DES. Upon information and belief, Mr. Price, at the inspection on May 28, 2025, indicated that the shoreline protection as constructed was what DES wanted. Following inspection, the city issued a cease and desist letter prohibiting <u>all</u> sitework, opining that the shoreline protection as constructed was not permitted because it was different than the CUP plan approved by the Portsmouth Planning Board.

Following the cease and desist issuance Morris and their team met with City staff, and at staff suggestion, held a site walk and work session with the Portsmouth Conservation Commission. This CUP re-submission follows the cease and desist order. (requiring the alleged noncompliance to be addressed, which is the purpose hereof), said order respectfully considered as unnecessarily prohibiting any further construction related activities on the site, including demolition of the existing obsolete home and construction of a new home pending resolution of the issues, all to Morris's significant detriment, delay and cost.

On July 3, 2025, Auger, on behalf of Morris, retained the services of Dr. Thomas Ballestero, Professional Engineer, Coastal Geomorphologist, Associate Professor at the University of New Hampshire, and principal of Streamworks, PLLC, to provide independent third-party review of TFM's Hybrid Living Shoreline Design. Dr. Ballestero confirmed that:

a.) Factors existed that rendered the use of soft/ green stabilization methods, alone, physically infeasible; and
b.) The Hybrid Living Shoreline, as constructed, *did not* pose any adverse effect to abutting properties. (Ballestero Report/Resume, **Exhibit 6**)

The history of this matter notwithstanding, Morris relied upon their team, the City's perceived authorization and the DES Wetland Permit to construct the Hybrid Living Shoreline, and in turn, to continue with the project to build their new home. That is, the Morrises are entirely without fault with respect to all matters relating hereto, caught between differing approvals from the City and DES, while understanding from several experts (TFM, PICKERING, BALLESTERO, and DES) that the DES-approved Hybrid Living Shoreline is reasonable under the circumstances in order to provide proper protection of the Morris property. There is no support for the proposition that the Hybrid Living Shoreline, as designed and built, is in any way detrimental the environment and/or the functions and values of the adjacent aquatic resource, or is otherwise improper or unreasonable to achieve reasonable protection of the Morris property. To the contrary, and noting that invasive species will be removed, replaced with significant native plantings which will grow over and within the Hybrid Living Shoreline, it is the position of Morris' technical experts and Riverside that significant alteration of the Hybrid Living Shoreline at this juncture would require access from the water, more negatively impactful compared to leaving the existing improvements as constructed. (See Riverside Memo, **Exhibit 7**)

Despite the foregoing, Morris has explored and now offers a compromise to add plantings within the riprap to soften the "look" and function of the existing shoreline stabilization (**See LU-23-180 Altus 7/30/25 CUP submission**).

III. ANALYSIS AND CUP REQUEST

1. It cannot be overstated that the Morris shoreline stabilization is a "Hybrid Living Shoreline", approximately 50% full "Living Shoreline" as originally designed and approved via CUP. The other approximately 50% is a Hybrid Living Shoreline, with a toe stone and riprap base and complemented by a significant soft approach along the top half of the shoreline slope, with robust protective native plantings such as ground running juniper installed in consultation with and approval by DES, (now proposing to add plantings within the riprap) located in the areas along the Morris shoreline that were severely damaged/ eroded during the January 2024 storm events, thus in danger of future erosion/damage (**See Photos, Exhibit 1**). The Planning Board's recognition of these facts, coupled with the Morris technical experts and DES' determination that a green/soft Living Shoreline alone is not physically practical or reasonable in this location, leads to a conclusion, thus CUP approval by the Planning Board, that a complete living shoreline implementation is not feasible as it will not provide adequate protection.

2. It has been suggested that the in part hard-armor feature of the constructed Hybrid Living Shoreline approved and permitted by DES is essentially not found in the city of Portsmouth. Riverside, well experienced in shoreline stabilization projects throughout the seacoast, has identified several Portsmouth projects where "hard armor" protections have over the years been approved and installed: (**Exhibit 8**)

A. 30 Walden St.
B. 500 Market St.
C. Lady Isle
D. 363 New Castle Ave, Portsmouth
E. 379 New Castle Ave, Portsmouth

3. Before the Planning Board is review and approval of reasonable shoreline protection/ stabilization along the significantly eroded/storm damaged section of the Morris shoreline, in turn protecting private property landward of the Hybrid Living Shoreline, including construction of a new residential home and associated accessory structures and improvements. DES, which

has full time, day-to-day experience in and authority for shoreline stabilization projects along the entire New Hampshire coastline, is professionally most suited and experienced to review and approve the form of shoreline stabilization necessary for reasonable protection, given the location and individual circumstances of each application. Indeed, as the designer, TFM was required to "stamp" any plan, and thus stand behind its designed protection. It is the clear position of TFM, DES and Ballestero that a "softer/ greener" living shoreline in the subject area would not adequately protect the Morris shoreline, thus could not lead to a "stamped" plan as required by DES.

4. While a new or amended original "Hybrid Living Shoreline" CUP was not applied for prior to construction building the DES approved application , it is clear that the Morris team's representatives acted in good faith in pursuing DES approval after the Planning Board issued the original CUP, which included: issuance of RMFI and TFM responses; DES notice to the Conservation Commission via cover letter and the approved permit; separate submissions by Riverside and Auger of the DES approved plans to the Building Inspection Department referencing the intended riprap, seeking guidance on next steps, and proceeding with construction only upon receiving what was understood to be the City's authority to build the DES approved stabilization.

IV. <u>CONCLUSION</u>

The Hybrid Living Shoreline Plan approved by DES as constructed, as now amended to add plantings, provides reasonable and proper protection of the Morris shoreline and inland improvements and is neither an environmental nor neighboring property detriment. The plan originally approved via the existing CUP is: not designed or "stamped" by a certified wetland scientist or professional engineer; from an engineering standpoint, not feasible as it will not provide required protection of the Morris shoreline; is DES approved; and per Riverside will require significant and possibly destructive activity to remove. In short, the negative environmental and potential financial impact of removing the existing Hybrid Living Shoreline, coupled with the risk of future damages to/loss of additional property that could result from the implementation of a complete "soft/ green shoreline stabilization strategy" are unreasonably high.

For all the reasons herein stated, Morris respectfully requests that the Planning Board grant the pending request for CUP to allow the as-built "Hybrid Living Shoreline" designed by TFM and approved by DES, as amended to add plantings.

Respectfully submitted,

120-0 Wild Rose Lane LLC/
John and Michelle Morris
By its attorneys,
Hoefle, Phoenix, Gormley & Roberts

By: ______________________
R. Timothy Phoenix

cc: Clients
Altus Engineering
TF Moran
Auger Building Co.
Portsmouth Conservation Commission
Portsmouth Planning Dept.
Deputy City Attorney, Trevor McCourt, Esq.
Roy Tilsley, Esq.


1-15-24
EXHIBIT 1A


2-11-24
EXHIBIT 1B


2-20-24
EXHIBIT 1C

2-20-24

3-4-24

EXHIBIT 1D


3-4-24

3-10-24

EXHIBIT 1E

3-10-24

EXHIBIT 2A

The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner

February 02, 2024

120-0 WILD ROSE LANE LLC
209 WATER STREET
NEWBURYPORT MA 01950

Re: Request for More Information – Standard Dredge and Fill Wetlands Permit Application (RSA 482-A)
NHDES File Number: 2023-03138
Subject Property: 60 Pleasant Point Drive, Portsmouth, Tax Map #207, Lot #13

Dear Applicant:

On February 2, 2024, the New Hampshire Department of Environmental Services (NHDES) Wetlands Bureau reviewed the above-referenced Standard Dredge and Fill Wetlands Permit Application (Application). Pursuant to RSA 482-A:3, XIV(a)(2) and Rules Env-Wt 100 through 900, NHDES Wetlands Bureau determined the following additional information is required to complete its evaluation of the Application:

1. The Natural Heritage Bureau (NHB) Datacheck Report (NHB22-3247) submitted with this application expired on October 14, 2023. Please provide a new NHB Datacheck Report along with updated results and recommendations from NHB and documentation of coordination with NH Fish and Game Department (NHF&G) as applicable to determine how to avoid and minimize project-related impacts on the resource in accordance with Env-Wt 311.01(b) and Env-Wt 311.06(g).
2. The plans indicate that the proposed impacts will be taking place within 10 feet of the shared property lines with Portsmouth Tax Map #207, Lot #14, and Portsmouth Tax Map #207, Lot #12. Please either revise the plans to clearly show that the proposed impacts will be taking place at least 10 feet from all shared property lines as required in accordance with Env-Wt 307.13(b) or provide the written consent from all abutting property owners where impacts will occur within 10 feet of the shared property line as required in accordance with Env-Wt 307.13(d) as a part of the response to this letter.
3. Please revise the plan to show the location of tidal datum lines, specifically the mean high water tide line (MHW), depicted as a line with the associated elevation noted based on NAVD 88, as required in accordance with Env-Wt 603.07(b)(2).
4. Please identify all known causes of erosion associated with this project and identify how each cause of erosion is being addressed as a part of the proposed bank stabilization project in accordance with Env-Wt 609.01(d).
5. Please provide documentation demonstrating how the proposed technique or combination of techniques used as part of the proposed tidal shoreline stabilization project addresses the criteria listed in Env-Wt 609.02(b)(1) through (7), as required in accordance with Env-Wt 609.02(b).
6. Please revise the plans to show that the proposed living shoreline project will meet the all of the criteria listed in Env-Wt 609.05(b)(1) through (8), as required in accordance with Env-Wt 609.05(b), including but not limited to detailed plan views and cross sections of the existing slopes and proposed living shoreline treatments at representative stations along the length of the project; details regarding the proposed plantings; details regarding the methods for how all proposed bioengineered stabilization treatments will be securely anchored; etc.
7. Please revise the plans to include a plan of all plantings proposed in the waterfront buffer, showing the proposed location(s) and Latin names and common names of proposed species in accordance with Env-Wt 610.04(f). Please note that this includes all plantings proposed as part of the living shoreline tidal bank stabilization project.

8. Please provide documentation that the proposed living shoreline design plan has been reviewed relative to delineations of wetlands and stamped by a certified wetland scientist in accordance with "Guidance for Considering the Use of Living Shorelines", NOAA (2015) as required in accordance with Env-Wt 609.05(a).
9. Please revise the "NHDES Shoreland Permit Tree Count Plan" to include the names of the tree species identified in each waterfront buffer grid, using either the scientific names or common names in accordance with Env-Wt 610.06 and Env-Wq 1406.10(f).
10. Please revise the plans to show the proposed contours at 2-foot intervals measured from the highest observable tide line (HOTL) in accordance with Env-Wt 311.05(a)(17) and Env-Wt 610.04(a).
11. Please revise the plans to identify the specific wetland resource types and their locations on the property using the Cowardin classifications as required in accordance with Env-Wt 406.06(b) and Env-Wt 406.04.
12. Please revise the plans depicting wetland boundaries to include a note specifying the methods used to perform the wetland delineation in accordance with Env-Wt 311.05(b)(5).
13. The photographs provided are too dark and do not clearly show all the proposed impact areas. Please provide additional dated and labeled color photographs, mounted or printed no more than 2 per sheet on 8.5 inch by 11 inch sheets, that clearly depict all existing structures and all jurisdictional areas, including but not limited to portions of wetland, shoreline, or surface water where impacts have or are proposed to occur in accordance with Env-Wt 311.06(b)(1)(a) and Env-Wt 311.06(b)(2).
14. The tax map provided was not legible. Please provide a copy of a town tax map clearly showing the subject property, the location of the project on the property, and the location of properties of abutters with each lot labeled with the name and mailing address of the abutter in accordance with Env-Wt 311.06(a).
15. For the two sets of existing wooden stairs proposed to be replaced in-kind, please confirm whether the bottom of each stair structure lands on a beach above the mean high tide line and that no excavation is required to replace each set of wooden stairs in-kind pursuant to Env-Wt 610.02(d).

Please submit the required information as soon as practicable. Pursuant to RSA 482-A:3, XIV(a)(2), **the required information must be received by NHDES Wetlands Bureau within 60 days of the date of this request (no later than April 2, 2024), or the Application will be denied**. Should additional time be necessary to submit the required information, an extension of the 60-day time period may be requested. Requests for additional time must be received prior to the deadline in order to be approved. In accordance with applicable statutes and regulations, the applicant is also expected to provide copies of the required information to the municipal clerk and all other interested parties.

Pursuant to RSA 482-A:3, XIV(a)(3), NHDES Wetlands Bureau will approve or deny the Application within 30 days of receipt of all required information, or schedule a public hearing, if required by RSA 482-A or associated rules.

If you have any questions, please contact me at Kristin.Duclos@des.nh.gov or (603) 559-1516.

Sincerely,

Kristin L. Duclos
Wetlands Specialist, Wetlands Bureau
Land Resources Management, Water Division

cc: Portsmouth Municipal Clerk/Conservation Commission
Altus Engineering, Inc., c/o Eric Weinrieb

The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner

Sent Via Email

From: Duclos, Kristin
To: eweinrieb@altus-eng.com
Cc: jgmorris63@gmail.com; Richard Hackeman; Lewis, Eben
Subject: NHDES Wetland Application #2023-03138; 120-0 Wild Rose Lane LLC Residential Raze, Rebuild, & Tidal Bank Stabilization Project RFMI II
Date: Monday, August 12, 2024 2:28:00 PM

Hello Eric,

On August 9, 2024, the New Hampshire Department of Environmental Services (NHDES) Wetlands Bureau reviewed the applicant's response to NHDES' request for more information letter (RFMI) for Standard Dredge and Fill Wetlands Permit Application (Application) #2023-03138, received by the Department on July 12, 2024. Pursuant to RSA 482-A:3, XIV(a)(2) and Rules Env-Wt 100 through 1000, the NHDES Wetlands Bureau determined the following additional information is required to fully address the following outstanding items and complete its evaluation of the Application:

1. The response to item #1 of the request for more information (RFMI) dated February 2, 2024, is incomplete. In accordance with Env-Wt 311.06(g), please provide copies of the written follow-up communications such as additional memos or email communications with the Natural Heritage Bureau (NHB) regarding the exemplary natural communities and threatened plant species, and with the NH Fish and Game Department (NHF&G) regarding the threatened and endangered wildlife species located within the vicinity of the project as identified in the NHB DataCheck (NHB ID: NHB23-3415).
2. For the proposal to install new rip-rap to meet the approval requirements in Env-Wt 609.07(a), please provide supporting information to corroborate statements made in the "Responses to questions relative to the construction of a Living Shoreline" document prepared by TF Moran, Inc. as included in the RFMI response received by NHDES on July 12, 2024. This information is required in accordance with Env-Wt 609.07(b)(1)-(3).

Please submit the required information in order to address these outstanding items as soon as practicable. Pursuant to RSA 482-A:3, XIV(a)(2), the required information must be received by the NHDES Wetlands Bureau within 60 days of the date of this request for more information (no later than **October 11, 2024**), or the Application will be denied.

Should additional time be necessary to submit the required information, an extension of the 60-day time period may be requested. Requests for additional time must be received prior to the deadline in order to be approved. In accordance with applicable statutes and regulations, the applicant is also expected to provide copies of the required information to the municipal clerk and all other interested parties. Pursuant to RSA 482-A:3, XIV(a)(3), the NHDES Wetlands Bureau will approve or deny the Application within 30 days of receipt of all required information, or schedule a public hearing, if required by RSA 482-A or associated rules.

Thank you,
-Kristin Duclos

Kristin L. Duclos, Wetlands Specialist
Wetlands Bureau, Land Resources Management
Water Division, NH Department of Environmental Services
P.O. Box 95
Concord, NH 03302-0095
Phone: (603) 559-1516
Email: kristin.duclos@des.nh.gov

EXHIBIT 2C

The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner

Sent via Email

From: Duclos, Kristin
To: eweinrieb@altus-eng.com
Cc: DNCR: NHB Review; Richard Hackeman
Subject: NHDES Wetland Application #2023-03138; 120-0 Wild Rose Lane LLC Residential Raze, Rebuild, & Tidal Bank Stabilization Project RFMI III
Date: Thursday, October 10, 2024 3:47:00 PM

Hello Eric,

On October 10, 2024, the New Hampshire Department of Environmental Services (NHDES) Wetlands Bureau reviewed the applicant's response to NHDES' request for more information letter (RFMI) for Standard Dredge and Fill Wetlands Permit Application (Application) #2023-03138, received by the Department on August 29, 2024, and September 10, 2024. Pursuant to RSA 482-A:3, XIV(a)(2) and Rules Env-Wt 100 through 1000, the NHDES Wetlands Bureau determined the following additional information is required to fully address the following outstanding items and complete its evaluation of the Application:

1. NHDES correspondence with the Natural Heritage Bureau (NHB) indicates that final coordination with the NHB regarding the sensitive plant species located within the vicinity of the project as identified in the NHB DataCheck (NHB ID: NHB23-3415) has not been completed as the NHB has not received nor reviewed the results of the requested plant survey. In accordance with Env-Wt 311.06(g), please provide copies of the final written follow-up communications such as additional memos or email communications with the Natural Heritage Bureau (NHB) regarding the exemplary natural communities and threatened plant species located within the vicinity of the project indicating that coordination with the NHB has been completed for this project as required in accordance with Env-Wt 311.01(b).

Please submit the required information in order to address these outstanding items as soon as practicable. Pursuant to RSA 482-A:3, XIV(a)(2), the required information must be received by the NHDES Wetlands Bureau within 60 days of the date of this request for more information (no later than **December 9, 2024)**, or the Application will be denied.

Should additional time be necessary to submit the required information, an extension of the 60-day time period may be requested. Requests for additional time must be received prior to the deadline in order to be approved. In accordance with applicable statutes and regulations, the applicant is also expected to provide copies of the required information to the municipal clerk and all other interested parties. Pursuant to RSA 482-A:3, XIV(a)(3), the NHDES Wetlands Bureau will approve or deny the Application within 30 days of receipt of all required information, or schedule a public hearing, if required by RSA 482-A or associated rules.

Thank you,

-Kristin Duclos

Kristin L. Duclos, Wetlands Specialist
Wetlands Bureau, Land Resources Management
Water Division, NH Department of Environmental Services
P.O. Box 95
Concord, NH 03302-0095
Phone: (603) 559-1516
Email: kristin.duclos@des.nh.gov

EXHIBIT 3A

TFMoran's Response to NHDES Request for More Information (RFMI) letter dated February 2, 2024.

NHDES Wetlands Permit Application 2023-03138

Responses to questions relative to the construction of a *Living Shoreline*.

4. Please identify all known causes of erosion associated with this project and identify how each cause of erosion is being addressed as a part of the proposed bank stabilization project in accordance with Env-Wt 609.01(d).

Response: As a result of multiple coastal storm events that coincided with astronomically high tides over the last two years, the shoreline of this property experienced some erosion. These storm events produced significant levels of storm surge that undercut the bank of the shoreline in some locations. More specifically, when the storm surge, coupled with the high tides receded, by virtue of the hydrodynamics in this area, lateral movement of water along the toe of slope scoured and undercut the toe of slope.

Through the construction of a living shoreline designed with the use of the publication, "Guidance for Considering the Use of Living Shorelines," prepared by the National Oceanic Atmospheric Administration (NOAA), we're confident this property will be more resilient to future coastal storm events. The use of large toe stones, construction of a flatter 1.5:1 slope, and the implementation of robust native planting plan prepared by a NH Licensed Landscape Architect ensures this increased resiliency.

5. Please provide documentation demonstrating how the proposed technique or combination of techniques used as part of the proposed tidal shoreline stabilization project addresses the criteria listed in Env-Wt 609.02(b)(1) through (7), as required in accordance with Env-Wt 609.02(b).

Response: In accordance with NHDES Wetlands Bureau Administrative Rule Env-Wt 609.02, as indicated on the plans submitted with this permit application, the proposed Living Shoreline addresses each of the following:

Env-Wt 609.02(b)(1) – By way of the Functional Assessment submitted with this permit application, this project proposes no adverse impacts to the functions and values of the neighboring tidal resources. This project will enhance many of the resource's functions and values. Constructing a "Living Shoreline" is the prescribed method of attaining shoreline stabilization and resiliency against anticipated sea level rise by the NHDES Wetlands Bureau and the Piscataqua Region Estuaries Partnership (PREP).

Env-Wt 609.02(b)(2) – As a result of multiple coastal storm events that coincided with astronomically high tides over the last two years, the shoreline of this property experienced some erosion. These storm events produced significant levels of storm surge that undercut the bank of the shoreline in some locations. More specifically, when the storm surge, coupled with the high tides receded, by virtue of the hydrodynamics in this area, lateral movement of water along the toe of slope scoured and undercut the toe of slope.

Env-Wt 609.02(b)(3) – On areas of the shoreline, the lateral tidal forces associated with large storms events that produced storm surge have undercut and scoured the toe of slope. Left unabated, the shoreline will be exposed to future coastal storm events.

Env-Wt 609.02(b)(4) – The proposed Living Shoreline is within an area of NH's seacoast that does not experience *frequent* high tidal or wave action erosive forces. While some boat traffic occurs in the area during high tide, it is not significant enough to have a bearing on this project. The proposed geometry and orientation of living shoreline will not amplify the existing minimal tidal forces. The Living Shoreline Plan, bearing the stamp of Professional Engineer, Jack McTigue, demonstrates each of these factors have been considered during the design of this Living Shoreline. As demonstrated within the Coastal Vulnerability Assessment submitted with the permit application, the proposed Living Shoreline will be able to withstand future storm surge and extreme precipitation events.

Env-Wt 609.02(b)(5) – The proposed Living Shoreline is within an area that does not experience *frequent* high tidal action erosive forces. As demonstrated within the Coastal Vulnerability Assessment submitted with the permit application, the proposed Living Shoreline will allow the property to become significantly more resilient to anticipated sea level rise.

Env-Wt 609.02(b)(6) – We have utilized the Sea Level Affecting Marshes Model (SLAMM) GIS data layers available on NH GRANIT. Given the topography of the site, the property *does not* lend itself well to future salt marsh migration. The proposed living shoreline does propose a wide variety of upland, salt tolerant native species – see ***Figure 1*** below.

Figure 1- Sea Level Affecting Marshes Model (SLAMM).

Env-Wt 609.02(b)(7) – As demonstrated within the permit application and supporting materials, this project meets all the relevant Design Requirements of Env-Wt 514.04. Further, we have demonstrated how this project meets each provision of Env-Wt 514.04 below:

Env-Wt 514.04 (a) – Sheet flow naturally runs in the opposite direction and stormwater management techniques, including new pervious surfaces are proposed. The proposed regrading does not transfer any additional discharge towards the proposed Living Shoreline.

Env-Wt 514.04 (b) – To the maximum extent practicable, existing native trees and shrubs will be retained. Significant levels of invasive species will be removed as well.

Env-Wt 514.04 (c) – The bank is proposed to be regraded from a 1:1 slope to a flatter, 1.5:1 slope and a robust native planting plan is proposed.

Env-Wt 514.04 (d) – Impacts to adjacent properties and infrastructure have been avoided.

Env-Wt 514.04 (e) – Sound erosion and sediment control devices will be utilized, monitored, and adjusted as required throughout the duration of the project.

Env-Wt 514.04 (f) – Through our coordination with other relevant state and federal agencies, this project avoids and minimizes impacts to sensitive resources. The proposed Living Shoreline will result in an increase in the overall ecological integrity of the resource area.

Env-Wt 514.04 (g) – This is a coastal marine system, and therefore, this provision is not applicable.

Env-Wt 514.04 (h) – This is a coastal marine system, and therefore, this provision is not applicable.

Env-Wt 514.04 (i) – This is a coastal marine system, and therefore, this provision is not applicable.

6. Please revise the plans to show that the proposed living shoreline project will meet the all of the criteria listed in Env-Wt 609.05(b)(1) through (8), as required in accordance with Env-Wt 609.05(b), including but not limited to detailed plan views and cross sections of the existing slopes and proposed living shoreline treatments at representative stations along the length of the project; details regarding the proposed plantings; details regarding the methods for how all proposed bioengineered stabilization treatments will be securely anchored; etc.

Response: We referenced the "Guidance for Considering the Use of Living Shorelines" when designing this Living Shoreline. The existing and proposed shoreline is relatively uniform in shape, and therefore, a single cross section of proposed Living Shoreline will suffice. As demonstrated on the Living Shoreline Details Plan included with the permit application, the proposed Living Shoreline meets all the criteria of **Env-609.05(b)**, specifically:

Env-Wt 609.05(b)(1) – The proposed Living Shoreline uses native vegetation and limits the use of unnatural hardened structures.

Env-Wt 609.05(b)(2) – The proposed Living Shoreline mimics the natural landscape.

Env-Wt 609.05(b)(3) – This rule is not applicable as there are no beaches or dunes in this area.

Env-Wt 609.05(b)(4) – The proposed sill is at the lowest possible elevation.

Env-Wt 609.05(b)(5) – The proposed Living Shoreline maintains the shoreline's ability to absorb and mitigate storm impacts and adapt to the landward progression of the sea.

Env-Wt 609.05(b)(6) – The proposed Living Shoreline will not impact neighboring properties. The proposed living shoreline will connect to existing shorelines.

Env-Wt 609.05(b)(7) – The bank is being cut back from a 1:1 to a flatter, 1.5:1 slope and will be planted with native vegetation.

Env-Wt 609.05(b)(8) – The proposed Living Shoreline will enhance habitat for wildlife and aquatic species.

7. Please revise the plans to include a plan of all plantings proposed in the waterfront buffer, showing the proposed location(s) and Latin names and common names of proposed species in accordance with Env-Wt 610.04(f). Please note that this includes all plantings proposed as part of the living shoreline tidal bank stabilization project.

Response: A revised planting plan prepared by Licensed Landscape Architect, Matthew J. Cunningham, depicting the specifics of the proposed plantings is included with this response.

8. Please provide documentation that the proposed living shoreline design plan has been reviewed relative to delineations of wetlands and stamped by a certified wetland scientist in accordance with "Guidance for Considering the Use of Living Shorelines", NOAA (2015) as required in accordance with Env-Wt 609.05(a).

Response: We referenced the "Guidance for Considering the Use of Living Shorelines" when designing this Living Shoreline. As demonstrated on the Living Shoreline Details Plan included with the permit application, the proposed Living Shoreline is considered a "Green – Softer Technique" because only hard armor is proposed for sill materials for toe protection and greater resiliency for future, larger coastal storm events.

Figure 2 – Green, soft approach to constructing a Living Shoreline from the NOAA 2015 publication, "Guidance for Considering the Use of Living Shorelines."

NH Certified Wetland Scientist (CWS), Jay Aube and Professional Engineer (PE), Jack McTigue have stamped the plans.

Additional Supporting Information:

The following supporting information demonstrates how this project meets NHDES Wetland Bureau Administrative Rule Env-Wt 609.07 relative to the use of Hard-Scape or Rip-Rap in Tidal Shoreline Stabilization projects.

Env-Wt 609.07(a)(1)(a) – During storm events that coincide with astronomically high tides, the receding tide water produces lateral movements of water along the shoreline with a velocity that is too great to be treated with soft stabilization methods alone. Referencing the publication, "Guidance for Considering the Use of Living Shorelines," prepared by the National Oceanic Atmospheric Administration (NOAA), as prescribed by the NHDES Wetlands Bureau and the Piscataqua Region Estuaries Partnership (PREP), the professional engineers associated with this project have used a combination of soft and hard techniques to design this Living Shoreline.

Env-Wt 609.07(a)(1)(b) – The bulk of this Living Shoreline is proposed to be constructed with soft stabilization techniques. As result decreasing the slope to a flatter 1.5:1 slope and using angled stone, this project will have no adverse effect on neighboring properties.

Env-Wt 609.07(a)(2) – As evidenced by the plan prepared by professional engineers, the boulders and rip-rap are components used as a sill to stabilize the toe of slope and it is not the primary or dominant component of this Living Shoreline. This technique is outlined within the publication, "Guidance for Considering the Use of Living Shorelines," prepared by the National Oceanic Atmospheric Administration (NOAA).

Env-Wt 609.07(b)(1) – As evidenced by the photos below, TFMoran professional engineers have determined that soft stabilization techniques alone cannot adequately address this erosion. Using the methods outlined with the publication, "Guidance for Considering the Use of Living Shorelines," prepared by the National Oceanic Atmospheric Administration (NOAA), as prescribed by NHDES, hard armor is required to stabilize this shoreline and construct a sill at the toe of slope.

Photo 1 & 2 – Images depicting how the toe of slow has been undercut and compromised.

Env-Wt 609.07(b)(2) – During storm events that coincide in with astronomically high tides, the receding tide water produces lateral movements of water along the shoreline with a velocity that is too great to be treated with soft stabilization methods alone. Referencing the publication, "Guidance for Considering the Use of Living Shorelines," prepared by the National Oceanic Atmospheric Administration (NOAA), as prescribed by the NHDES Wetlands Bureau and the Piscataqua Region Estuaries Partnership (PREP), the professional engineers associated with this project have used a combination of soft and hard techniques to design this Living Shoreline.

Env-Wt 609.07(b)(3) – The professional engineers have determined the proposed rip-rap for toe protection will have no impact on neighboring properties. Adjusting the existing 1:1 slope to a flatter 1.5:1 slope and using minimal angled stone at the toe of slope ensures this Living Shoreline design will not accelerate tidal energy in a manner that adversely affects neighboring properties.

Env-Wt 609.07(b)(4) – The Living Shoreline Plan included with this RFMI response provides details relative to the sizes of all materials proposed for this Living Shoreline. Only a slight superficial layer of rip-rap is proposed above the toe stones equating to just 28 cubic yards distributed over 168-linear feet of proposed Living Shoreline.

Env-Wt 609.07(b)(5) – A cross section of the Living Shoreline is depicted on Living Shoreline Plan included with this response.

Env-Wt 609.07(b)(6) – Detailed plans were submitted with the original permit application that depict the relationship of the project to fixed points or reference, abutting properties, and features of the natural shoreline.

Env-Wt 609.07(c)(1) – The Living Shoreline Plan included with this response bears the stamp of NH Professional Engineer, Jack McTigue.

Env-Wt 609.07(c)(2) – The plans provided with the original permit application materials depict the proposed impact areas and the location of the Mean High Water (MHW) elevation. This Living Shoreline is proposed entirely within uplands and immediately adjacent to the Highest Astronomical Tide Line (HOTL).

Memo

TFM Since 1968
Civil Engineers
Structural Engineers
Traffic Engineers
Land Surveyors
Landscape Architects
Scientists

To:	Kristin Duclos, DES Wetlands Permitting Specialist
From:	Jack McTigue, NH Professional Engineer, TFMoran, Inc.
CC:	Eben Lewis, DES Southeast Region Supervisor
Date:	August 28, 2024
Re:	Response to DES Request for More Information (RFMI) letter dated August 12, 2024 – DES Permit Application: 2023-03138

Dear Kristen,

In response to the NHDES Request for More Information (RFMI) letter dated August 12, 2024, we offer the following information to supplement the materials we provided to you on July 12, 2024. This information further demonstrates conformance with Env-Wt 609.07(b)(1)-(3).

Env-Wt 609.07 (b)(1)

The area of the existing bank/shoreline that was impacted during the January storm events is, on average, 2 to 2.5-feet above the Highest Astronomical Tide (HAT) elevation of 6.53-feet. These impacts are largely the result of significant levels of storm surge coinciding with astronomically high tides during coastal storm events. Given the former vegetated bank, essentially a natural "living shoreline", was unable to resist the erosive forces associated with these storm events, we elected to stabilize the shoreline with a hybrid approach as outlined within the NOAA publication, "Guidance for Considering the Use of Living Shorelines" as prescribed by NHDES Wetlands Bureau Administrative Rule Env-Wt 609.05. This hybrid design improves/flattens the steepest existing slopes, incorporates large toe stones, and applies a layer of riprap to those areas of the slope where vegetation alone, in the previous storm events, was ineffective at stabilizing the shoreline. This hybrid approach to shoreline stabilization includes a robust planting plan that incorporates common juniper plants that have demonstrated a high degree of resilience in past storm events.

It is our professional opinion that, in this instance, a hybrid approach is the most effective approach for shoreline stabilization because the heavier stones resist the scour caused by the transverse flow of the water, and the angular shape of the riprap provides energy dissipation which reduces the velocity of the transverse flows and waves.

Photo 1: Undercutting occurring to existing, formerly vegetated, shoreline.

The images below depict the undercutting of a bank, typical of scouring caused by horizontal flow of the water, not directional wave energy. Scouring is the direct removal of bank material at or below water level by the physical action of flowing water. In this instance, decreasing the steepest slopes and applying riprap will be an effective solution because it will slow the flow along the shoreline.

(c) Bank undercutting

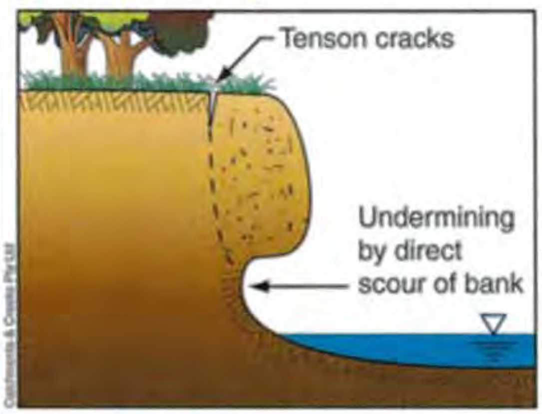


Figure 4 – Bank undercutting

Photo 4 – Bank undercutting (Qld)

Bank undercutting is the removal of material from the lower portion of a channel bank by 'bank scour'. This erosion results in the creation of an overhanging bank that usually fails in a more violent motion than occurs in 'bank slumping'. In effect, bank undercutting is a combination of bank scour within the lower bank, which ultimately causes upper bank slumping. The two actions may not occur simultaneously.

Reference 1: Saadon, Azlinda & Abdullah, Jazuri & Muhammad, Nur Shazwani & Ariffin, Junaidah. (2020). Development of riverbank erosion rate predictor for natural channels using NARX-QR Factorization model: a case study of Sg. Bernam, Selangor, Malaysia. Neural Computing and Applications. 1-11. 10.1007/s00521-020-04835-5.

Env-Wt 609.07 (b)(2)

As evidenced within photo 1 above, the scour was produced by a high energy environment and the existing vegetated shoreline alone was unable to resist the erosive forces associated with the tidal flows. During storm events, this high-energy environment cannot be stabilized by soft vegetative techniques alone.

Env-Wt 609.07 (b)(3)

The proposed riprap will be applied to the areas above highest astronomical tide elevation (HAT) that were impacted during the January storm events. During the majority of the yearly tidal cycles, tidal waters will not interface with the proposed riprap section of the living shoreline. The proposed riprap areas of the living shoreline will only interface with tidal waters that coincide with large storm events. As discussed above, the angled stone coupled with the improved/flattened steepest slopes dissipates energy so that the project also will not have adverse effects on the abutting properties. At the downstream terminal end of proposed riprap, we have keyed in the riprap at a 30-degrees angle to prevent scour on the neighboring property.

Respectfully,

Jack McTigue, PE, CPESC
Project Manager

EXHIBIT 4

The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner

November 04, 2024

120-0 WILD ROSE LANE LLC
209 WATER STREET
NEWBURYPORT MA 01950

Re: Approved Standard Dredge and Fill Wetlands Permit Application (RSA 482-A)
NHDES File Number: 2023-03138
Subject Property: 60 Pleasant Point Drive, Portsmouth, Tax Map #207, Lot #13

Dear Applicant:

On November 04, 2024, the New Hampshire Department of Environmental Services (NHDES) Wetlands Bureau approved the above-referenced Standard Dredge and Fill Wetlands Permit Application. Enclosed please find Wetlands Permit # 2023-03138 to Impact a total of 31,300 square feet (SF) of previously developed upland tidal buffer zone to replace an existing single-family residence with a new single-family residence and associated improvements, including construction of a pool, pervious patios, replace two sets of existing wooden stairs over the bank, and construction of a living shoreline to stabilize an eroding tidal bank.

This approval is based on the following findings:

1. This project is classified as a major project per Rule Env-Wt 610.17(a)(1), for any dredging, filling, or construction activity, or any combination thereof, that is proposed to occur within 100 feet of the Highest Observable Tide Line (HOTL), and that is proposed to alter any tidal shoreline bank, tidal flat, wetlands, surface water, or undeveloped uplands.
2. The impacts within the protected shoreland associated with this project are approved under NHDES Shoreland Permit #2024-03139.
3. Per Rule Env-Wt 311.01(b), the applicant coordinated with the NH Fish and Game Department (NHF&G) and the Natural Heritage Bureau (NHB) to determine how to avoid and minimize project-related impacts on rare or protected animal species and habitat, and on protected plants or exemplary natural communities.
4. On January 29, 2024, the Department received correspondence from the Portsmouth Conservation Commission dated January 3, 2024, stating that "[The Conservation Commission] recommends approval of the cited project."

In accordance with RSA 482-A:10, RSA 21-O:14, and Rules Ec-Wet 100-200, **any person aggrieved by this decision may file a Notice of Appeal directly with the NH Wetlands Council (Council) within 30 days of the decision date, November 04, 2024.** Every ground claiming the decision is unlawful or unreasonable must be fully set forth in the Notice of Appeal. Only the grounds set forth in the Notice of Appeal are considered by the Council. Information about the Council, including Council Rules, is available at https://www.nhec.nh.gov/wetlands-council/about. For appeal related issues, contact the Council Appeals Clerk at (603) 271-3650.

If you have any questions, please contact me at Kristin.Duclos@des.nh.gov or (603) 559-1516.

Sincerely,

Kristin L. Duclos
Wetlands Specialist, Wetlands Bureau
Land Resources Management, Water Division

Enclosure

Copied: Portsmouth Municipal Clerk/Conservation Commission
Altus Engineering, Inc. C/o Eric D. Weinrieb

The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner

WETLANDS AND NON-SITE SPECIFIC PERMIT 2023-03138

NOTE CONDITIONS

PERMITTEE:	**120-0 WILD ROSE LANE LLC** **209 WATER STREET** **NEWBURYPORT MA 01950**
PROJECT LOCATION:	**60 PLEASANT POINT DRIVE, PORTSMOUTH** **Tax Map/Block/Lot(s): 207/no block/13**
WATERBODY:	**PISCATAQUA RIVER**
APPROVAL DATE:	**NOVEMBER 04, 2024** **EXPIRATION DATE: NOVEMBER 04, 2029**

Based upon review of permit application 2023-03138 in accordance with RSA 482-A and RSA 485-A:17, the New Hampshire Department of Environmental Services (NHDES) hereby issues this Wetlands and Non-Site Specific Permit. To validate this Permit, signatures of the Permittee and the Principal Contractor are required.

PERMIT DESCRIPTION:
Impact a total of 31,300 square feet (SF) of previously developed upland tidal buffer zone to replace an existing single-family residence with a new single-family residence and associated improvements, including construction of a pool, pervious patios, replace two sets of existing wooden stairs over the bank, and construction of a living shoreline to stabilize an eroding tidal bank.

THIS PERMIT IS SUBJECT TO THE FOLLOWING PROJECT-SPECIFIC CONDITIONS:

1. All work shall be done in accordance with the approved plans dated November 28, 2023, and revised through July 9, 2024, by Altus Engineering, Inc., received by the NH Department of Environmental Services (NHDES) on July 12, 2024; the revised plan sheet titled "NHDES Wetlands & Shoreland Permit Application Plan" dated November 28, 2023, and revised through August 15, 2024, by Altus Engineering, Inc., received by the NHDES on August 29, 2024; and the revised plan sheet titled "Living Shoreline Plan" dated June 10, 2024, and revised through September 9, 2024, by TF Moran, Inc., received by the NHDES on September 10, 2024, in accordance with Env-Wt 307.16.
2. In accordance with Env-Wt 314.02(b) and (c), for projects in the coastal area, the permittee shall record any permit issued for any work in the tidal buffer zone at the Rockingham County Registry of Deeds. Any limitations or conditions in the permit so recorded shall run with the land beyond the expiration of the permit. The permittee shall provide the department with a copy of the permit stamped by the registry with the book and page and date of receipt.
3. In accordance with Env-Wt 609.10(b)(4), all work shall be done at low tide when the work area is fully exposed.
4. In accordance with Env-Wt 307.07, all development activities associated with any project shall be conducted in compliance with applicable requirements of RSA 483-B and Env-Wq 1400 during and after construction.
5. All pervious technologies used shall be installed and maintained to effectively absorb and infiltrate stormwater as required per RSA 483-B:6, II and Rule Env-Wq 1406.15(c) in order to ensure compliance with RSA 483-B:9, V(g).
6. No activity shall be conducted in such a way as to cause or contribute to any violation of surface water quality standards per Env-Wt 307.03(a).
7. All work including management of soil stockpiles, shall be conducted so as to minimize erosion, minimize sediment transfer to surface waters or wetlands, and minimize turbidity in surface waters and wetlands per Env-Wt 307.03(b).

8. In accordance with Env-Wt 307.03(g)(1), the person in charge of construction equipment shall inspect such equipment for leaking fuel, oil, and hydraulic fluid each day prior to entering surface waters or wetlands or operating in an area where such fluids could reach groundwater, surface waters, or wetlands.
9. In accordance with Env-Wt 307.03(g)(3) and (4), the person in charge of construction equipment shall maintain oil spill kits and diesel fuel spill kits, as applicable to the type(s) and amount(s) of oil and diesel fuel used, on site so as to be readily accessible at all times during construction; and train each equipment operator in the use of the spill kits.
10. In accordance with Env-Wt 307.03(g)(2), the person in charge of construction equipment shall repair any leaks prior to using the equipment in an area where such fluids could reach groundwater, surface waters, or wetlands.
11. In accordance with Env-Wt 307.03(h), equipment shall be staged and refueled outside of jurisdictional areas (unless allowed) and in accordance with Env-Wt 307.15.
12. In accordance with Env-Wt 307.03(c)(3), water quality control measures shall be installed prior to start of work and in accordance with the manufacturer's recommended specifications.
13. In accordance with Env-Wt 307.03(c)(1), water quality control measures shall be selected and implemented based on the size and nature of the project and the physical characteristics of the site, including slope, soil type, vegetative cover, and proximity to jurisdictional areas.
14. In accordance with Env-Wt 307.03(c)(2), water quality control measures shall be comprised of wildlife-friendly erosion control materials.
15. In accordance with Env-Wt 307.03(c)(5), water quality control measures shall be maintained so as to ensure continued effectiveness in minimizing erosion and retaining sediment on-site during and after construction.
16. In accordance with Env-Wt 307.03(c)(6), water quality control measures shall remain in place until all disturbed surfaces are stabilized to a condition in which soils on the site will not experience accelerated or unnatural erosion by achieving and maintaining a minimum of 85% vegetative cover using an erosion control seed mix, whether applied in a blanket or otherwise, that is certified by its manufacturer as not containing any invasive species; or placing and maintaining a minimum of 3 inches of non-erosive material such as stone.
17. In accordance with Env-Wt 307.03(c)(7), temporary water quality control methods shall be removed upon completion of work when compliance with Env-Wt 307.03(c)(6) is achieved.
18. In accordance with Env-Wt 307.05(e), to prevent the use of soil or seed stock containing nuisance or invasive species, the contractor responsible for work shall follow Best Management Practices for the Control of Invasive and Noxious Plant Species (Invasive Plant BMPs).
19. In accordance with Env-Wt 307.11(a), fill shall be clean sand, gravel, rock, or other material that meets the project's specifications for its use; and does not contain any material that could contaminate surface or groundwater or otherwise adversely affect the ecosystem in which it is used.
20. In accordance with Env-Wt 307.12(e), wetland soils from areas vegetated with purple loosestrife or other state-listed invasive plant species shall not be used in the area being restored.
21. In accordance with Env-Wt 307.12(d), mulch used within an area being restored shall be natural straw or equivalent non-toxic, non-seed-bearing organic material.
22. In accordance with Env-Wt 307.12(g), impact areas restored by seeding or plantings shall not be deemed successful if the area is invaded by nuisance species such as common reed or purple loosestrife during the first full growing season following the completion of construction; and a remediation plan shall be submitted to the department that proposes measures to be taken to eradicate nuisance species during this same period.
23. In accordance with Env-Wt 307.12(f), if any impact area that is stabilized with seeding or plantings does not have at least 75% successful establishment of wetlands vegetation after 2 growing seasons, the area shall be replanted or reseeded, as applicable.
24. In accordance with Env-Wt 307.03(e), all exposed soils and other fills shall be permanently stabilized within 3 days following final grading.
25. In accordance with Env-Wt 307.12(i), areas where permanent impacts are not authorized shall be restored to their pre-impact conditions and elevation by replacing the removed soil and vegetation in their pre-construction location and elevation such that post-construction soil layering and vegetation schemes are as close as practicable to pre-construction conditions.

26. Within 60 days of completion of construction, the applicant shall submit a post-construction monitoring report to the department prepared by a professional engineer, certified wetland scientist, or qualified professional, as applicable. The monitoring report shall include date(s) of inspections, photos showing the extent of jurisdictional impacts, areas of restoration, progress of any plantings, and contain narratives, exhibits, and photographs, as necessary to report the status of the project area and restored jurisdictional area in accordance with Env-Wt 514.05(h) and Env-Wt 301.18(c).

THIS PERMIT IS SUBJECT TO THE FOLLOWING GENERAL CONDITIONS:

1. Pursuant to RSA 482-A:12, a copy of this permit shall be posted in a secure manner in a prominent place at the site of the approved project.
2. In accordance with Env-Wt 313.01(a)(5), and as required by RSA 482-A:11, II, work shall not infringe on the property rights or unreasonably affect the value or enjoyment of property of abutting owners.
3. In accordance with Env-Wt 314.01, a standard permit shall be signed by the permittee, and the principal contractor who will build or install the project prior to start of construction, and will not be valid until signed.
4. In accordance with Env-Wt 314.03(a), the permittee shall notify the department in writing at least one week prior to commencing any work under this permit.
5. In accordance with Env-Wt 314.08(a), the permittee shall file a completed notice of completion of work and certificate of compliance with the department within 10 working days of completing the work authorized by this permit.
6. In accordance with Env-Wt 314.06, transfer of this permit to a new owner shall require notification to, and approval of, the NHDES.
7. The permit holder shall ensure that work is done in a way that protects water quality per Env-Wt 307.03; protects fisheries and breeding areas per Env-Wt 307.04; protects against invasive species per Env-Wt 307.05; meets dredging activity conditions in Env-Wt 307.10; and meets filling activity conditions in Env-Wt 307.11.
8. This project has been screened for potential impact to known occurrences of protected species and exemplary natural communities in the immediate area. Since many areas have never been surveyed, or only cursory surveys have been performed, unidentified sensitive species or communities may be present. This permit does not absolve the permittee from due diligence in regard to state, local or federal laws regarding such communities or species. This permit does not authorize in any way the take of threatened or endangered species, as defined by RSA 212-A:2, or of any protected species or exemplary natural communities, as defined in RSA 217-A:3.
9. In accordance with Env-Wt 307.06(a) through (c), no activity shall jeopardize the continued existence of a threatened or endangered species, a species proposed for listing as threatened or endangered, or a designated or proposed critical habitat under the Federal Endangered Species Act, 16 U.S.C. §1531 et seq.; State Endangered Species Conservation Act, RSA 212-A; or New Hampshire Native Plant Protection Act, RSA 217-A.
10. In accordance with Env-Wt 307.02, and in accordance with federal requirements, all work in areas under the jurisdiction of the U.S. Army Corps of Engineers (USACE) shall comply with all conditions of the applicable state general permit.

APPROVED:

Kristin L. Duclos
Wetlands Specialist, Wetlands Bureau
Land Resources Management, Water Division

THE SIGNATURES BELOW ARE REQUIRED TO VALIDATE THIS PERMIT (Env-Wt 314.01).

PERMITTEE SIGNATURE (required)

PRINCIPAL CONTRACTOR SIGNATURE (required)

EXHIBIT 5A

Morris, John

Subject: FW: 60 Pleasant Point Drive
Attachments: 47307-20_Shoreline_Plan.pdf

From: Kuerstin Fordham
Sent: Wednesday, January 8, 2025 3:11 PM
To: pjgarand@cityofportsmouth.com
Cc: Riverside Office <office@riversideandpickering.com>
Subject: 60 Pleasant Point Drive

Hi Paul!

I hope you enjoyed your holidays and Happy New Year! We will be performing a shoreline stabilization at the above noted address. Do you want us to file a permit for installing rip rap?

Let me know when you have a second.

Thanks for your help, Paul I look forward to hearing from you soon.

Best,

Kuerstin Fordham
Construction Administrator
Riverside & Pickering Marine Contractors
34 Patterson Lane
Newington, NH 03801
603-427-2824 ext. 1000 Office
866-571-7132 Fax
(A division of Riverside Marine Construction Inc)

Attachement to email

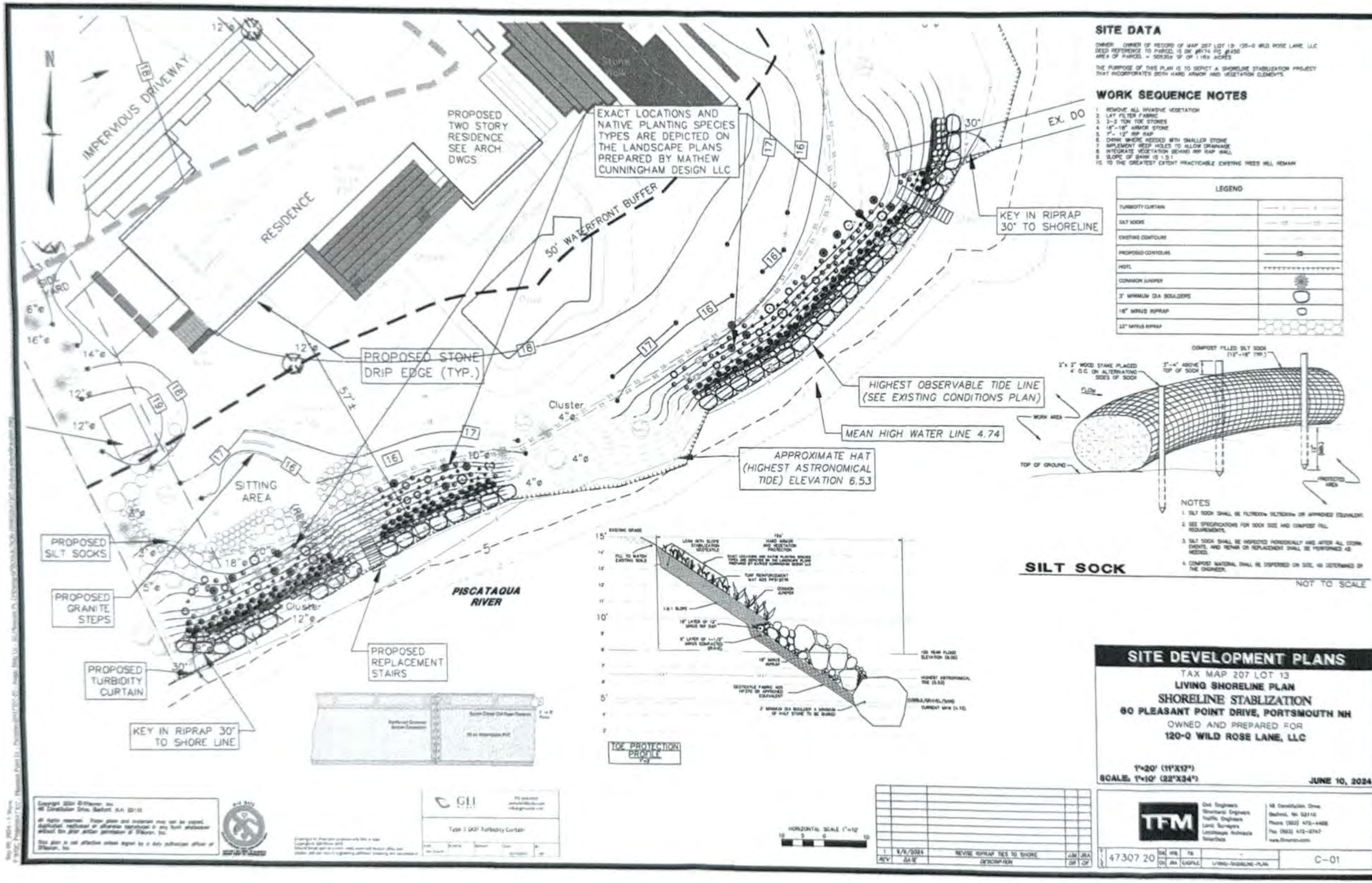


EXHIBIT 5B

Morris, John

Subject: FW: 60 Pleasant Point
Attachments: Morris final-approved-plan.pdf

Begin forwarded message:

From: Andrew Wilson <andrew@augerbuildingcompany.com>
Date: January 10, 2025 at 10:58:36 AM EST
To: "Shanti R. Wolph" <srwolph@cityofportsmouth.com>, "Paul J. Garand" <pjgarand@cityofportsmouth.com>
Cc: Ben Auger <ben@augerbuildingcompany.com>, Kuerstin Fordham <kuerstin@riversideandpickering.com>
Subject: Re: 60 Pleasant Point

Sorry, I forgot to attach the plan for you to review:

Andrew Wilson
Project Manager
Auger Building Company
255 Portsmouth Ave.
Greenland, NH 03840
andrew@augerbuildingcompany.com
Cell: 603-828-2499

On Jan 10, 2025, at 10:56 AM, Andrew Wilson <andrew@augerbuildingcompany.com> wrote:

Hi Paul and Shanti,
Paul, thanks for the call yesterday regarding the project over at 60 Pleasant Point Dr; I appreciate the feedback! As you both are aware, we are hoping to start work on the shoreline restoration project over there. Paul, you had mentioned that if we were planning on using stone for the stairs instead of replacing the existing wood stairs in kind, that we would not need a building permit. That kind of sparked a thought that I had, and I wanted to run it by you both. The owners were actually keen on using stone instead of wood for the stairs to the water. (There are two sets btw.) I just talked with our shoreline engineer, and he thought that the stone would be a better option from a resilience and aesthetic standpoint also. So given that:
1) are you good with us using stone instead of wood?
2) how do we move forward with the documentation/permitting process with you at the city so that we can start work on the shoreline resoration?
Thanks,

Plan Attached Auger email

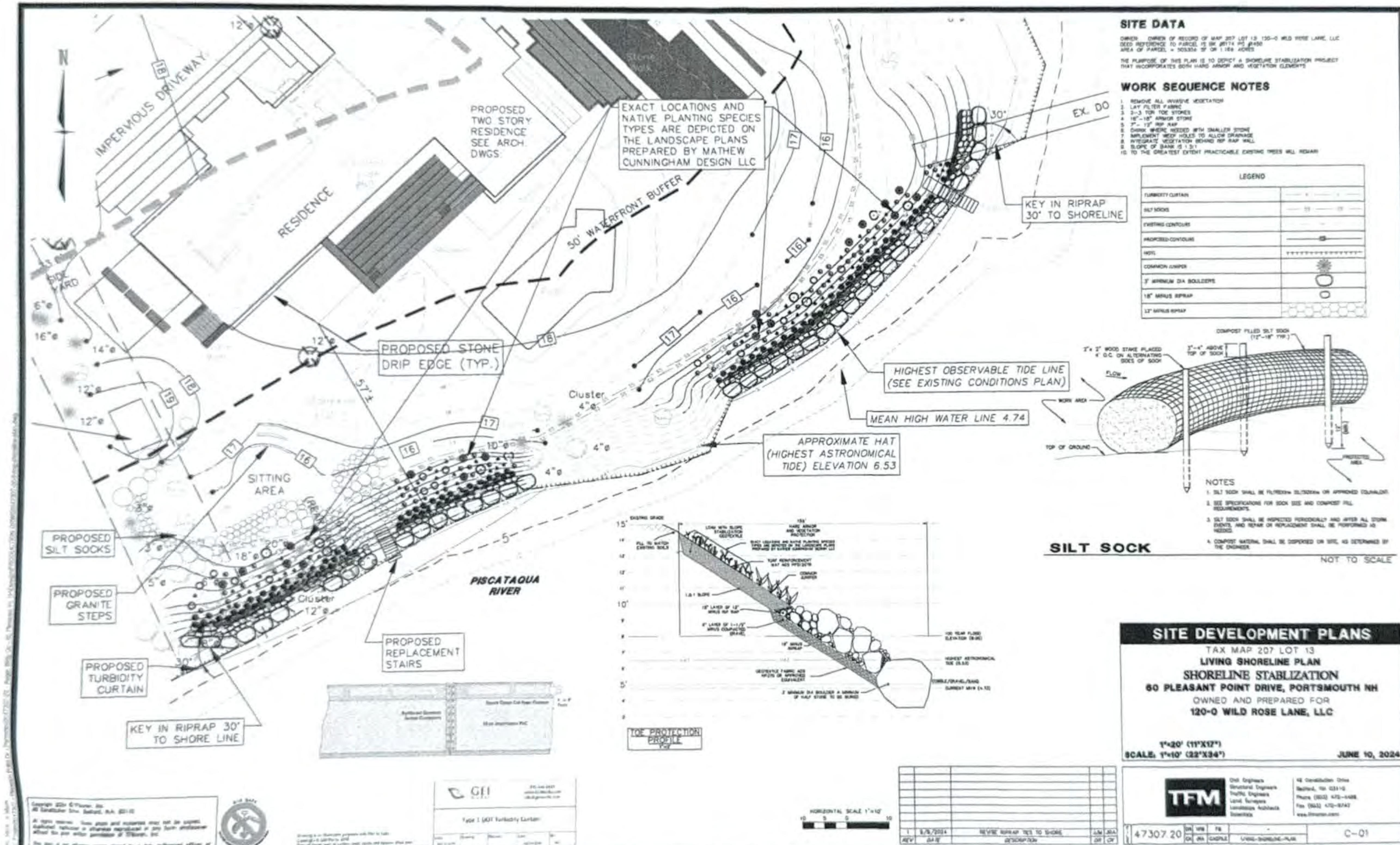


EXHIBIT 5C

Morris, John

To: Morris, John
Subject: RE: 60 Pleasant Point

-----Original Message-----
From: Paul J. Garand <pjgarand@cityofportsmouth.com>
Sent: Monday, January 13, 2025 8:19 AM
To: 'Andrew Wilson' <andrew@augerbuildingcompany.com>; Shanti R. Wolph <srwolph@cityofportsmouth.com>; Peter L. Britz <plbritz@cityofportsmouth.com>
Cc: Ben Auger <ben@augerbuildingcompany.com>; Kuerstin Fordham <kuerstin@riversideandpickering.com>
Subject: RE: 60 Pleasant Point

Good Morning Andrew,

I reviewed the project with Shanti and Peter Britz, Planner, determining that the project will be considered shoreline stabilization/landscaping and will not require a building permit. Please post the NHDES permits as required and continue.

Thank you,
Paul

Paul J. Garand
Building Inspector
City of Portsmouth
1 Junkins Avenue
Portsmouth, NH 03801
pjgarand@cityofportsmouth.com
Main Office 603-610-7243

City Hall Hours: Monday, 8:00 a.m. - 6:00 p.m.; Tuesday - Thursday, 8:00 a.m. - 4:30 p.m.; and Friday, 8:00 a.m. - 1:00 p.m.
(NOTE: If a holiday falls on a Monday, City Hall will be open until 6:00 p.m. on Tuesday)

-----Original Message-----
From: Andrew Wilson <andrew@augerbuildingcompany.com>
Sent: Friday, January 10, 2025 10:56 AM
To: Shanti R. Wolph <srwolph@cityofportsmouth.com>; Paul J. Garand <pjgarand@cityofportsmouth.com>
Cc: Ben Auger <ben@augerbuildingcompany.com>; Kuerstin Fordham <kuerstin@riversideandpickering.com>
Subject: 60 Pleasant Point

EXHIBIT 6

Shoreline modifications at 60 Pleasant Point Drive, Portsmouth, NH

Thomas P. Ballestero, PhD, PE, PG, PH, CGWP

Streamworks, PLLC

29 July 2025

The purpose of this memo is to review the shoreline modifications at 60 Pleasant Point Drive, Portsmouth, NH and to comment on two specific concerns:

- Will the shoreline modifications adversely impact abutting properties?
- What is the site's suitability for a completely green natural living shoreline and what type of site modifications would be required to achieve a completely green natural living shoreline?

The information available at the time of writing this memo includes:

- one design sheet (file entitled 'final-approved-plan-NHDES-wetland-permit.pdf, and entitled 'Living Shoreline Plan' (10 June 2024), identified as sheet-C-01
- one file entitled 'existing-conditions-plan.pdf' and entitled Existing Conditions Plan (4 February 2021) and identified as sheet C-01);
- photos dated November 23, 2020;
- photos taken February 25, 2024, and
- Google Earth images.

A site visit was conducted July 4, 2025.

The shoreline site is a portion of sheltered coastline along the Piscataqua River estuary. Lady Isle and Shapleigh Isle both act to minimize the fetch of part of the shoreline as well as shelter from wave action from the east and south. Newcastle, Blunts, and Leachs' islands further protect the site shoreline from direct wave impacts from the Atlantic Ocean. Bedrock outcrops are visible along the property and elsewhere to the north. There is existing salt marsh further north of the modified shoreline. The salt marsh forms the properties' east facing shoreline which is mostly north of the properties' dock. Some salt marsh exists south of this same dock and is grounded on a rock outcrop. There is a small island of salt marsh vegetation on the abutter's shoreline to the west, surrounded by gravel/cobble beach. From the plan sheet, notable elevations may be found in Table 1.

Table 1. Site Elevations (all in feet NAVD 88)

Descriptor	Elevation
Mean High Water	3.97
Mean High High Water	4.39
Highest Astronomical Tide	6.53
100-Year Base Flood Elevation	8.00

As is evident in Figures 1 and 2 (January 2025 and March 2025, respectively), there is a relic rock wall at almost the mean high water elevation. This relic rock wall is evident on Google Earth images back to 2003. Whether there was originally more to that structure is unknown, but previously shoreward of it was gravel/cobble beach for a few feet until it reached a near vertical, exposed, eroding bank. Before and after the shoreline modification there exists a gravel/cobble beach seaward of the relic rock wall. The relic rock wall is situated at approximately the mean high tide elevation. The wall continues to the west along the abutters shoreline (Figure 3). It can be seen here that along the abutters shoreline, the near vertical bank is a few feet shoreward of the relic rock wall. It is hypothesized that the Figure 3 shoreline geometry, shoreward of the relic rock wall, is similar to what existed at the subject property prior to the January 2024 storm, except for vegetation characteristics. Figure 4 is a picture of the property shoreline in 2020. Because of its exposure to a larger fetch, the southern portion of the subject property witnesses more erosion than the shoreline to the north.

The January 2024 storm was reported to have caused significant erosion at the shoreline. Pictures (Figure 5, for example) reflect an erodible soil with a steep face. The shoreline modification was implemented in February 2025, as witnessed by the differences between Figures 1 and 2. The implemented shoreline modification used large toe stone (top elevation at highest observable tide) and a rip rap slope (1.5 H: 1V) to elevation 10 feet. Above that elevation, the slope continued to elevation 14.5 feet and was planted (Figure 6).

The northern terminus of the shoreline modification ends after the properties' dock (Figure 7) and about 90 feet from the northern property boundary. In the four months since project implementation, there does not appear to be evidence of an end effect (excessive deposition, erosion). There were few significant storms in this time period in which such effects might have been manifested. That said, the dock, the rock outcrop, and the relic rock wall act to stabilize hydraulic characteristics here (waves, currents) between before and after implementation. The geometry of the northern terminus (bending back into the shoreline) matches the general shoreline geometry. In addition, the tidal buffer (land elevation above mean high high water and generally extending in elevation to 3 to 4 feet higher) north of the shoreline modification is vegetated (Figure 7) further stabilizing this location against potential end effects.

The western terminus of the shoreline modification (Figure 8) is at the property boundary. A large maple tree is at this location and the relic rock wall continues in front of a mostly unprotected shoreline. There is no evidence of an end effect at this location, with the same caveats as the northern terminus of the shoreline modification. The shoreline modification bends shoreward at the end. There is gravel/cobble beach here (Figure 3) that extends westward. In addition, the width of the gravel/cobble beach increases moving westward. The property boundary here is about where the hydrodynamic shadowing effects of Lady Isle are noticeable, and a possible explanation for the widening beach when moving westward.

The opinion here is that on the north or west of the shoreline modification there are little apparent end effects to cause adverse effect on immediate property abutters. To the north, vegetation, the terminus geometry, the salt marsh, tidal buffer vegetation, bedrock outcrop, and the distance to the northern abutter, all act in concert to eliminate concerns of an adverse effect of the shoreline implementation of the northern abutter. To the west, Lady Isle, the end geometry, the maple tree, and the wider beach, all act in concert to minimize adverse effects to the western abutter.

To implement a complete living shoreline (no hard edge), first it must be recognized that vegetation with significant roots to hold soil only grows at the mean tide elevation and higher. The implemented shoreline modification was constructed above the highest astronomical tide elevation. Salt marsh vegetation grows generally between mean tide and mean high high tide elevations, and tidal buffer at higher elevation. The historic aerial imagery back to 2003 shows historic salt marsh vegetation about where it is today. The shoreline modifications do not appear to have removed salt marsh. Figure 9 is a drone image from October 2021 with salt marsh extent at that time. In the face of the extent and degree of erosion from the January 2024 storm (Figure 1), a living shoreline would need to have laid back the remaining shoreline slope from what it was. There is no specific criteria, however flatter is more stable, especially as soils get saturated. For a salt marsh, surface slope should be less than 5% (= 0.05, or 20 horizontal units to 1 vertical unit {20H:1V}). At higher elevations, the salt marsh transitions to tidal buffer vegetation. 3H:1V is about the steepest and 10H:1V is not uncommon for tidal buffer slope. The biggest disadvantage with living shorelines is that it takes time for vegetation and its roots to take hold. In the 2021 Existing Conditions Plan sheet, shoreline slopes at that time and along the location of the shoreline modification, ranged from 1.1H:1V to 2H:1V: much too steep for a living shoreline. In the middle of the shoreline modification, some unmodified shoreline exists.

Here there is a large juniper that survived (visible in Figures 1, 2, 4, and 5). This could serve as a template for such a living shoreline. The slope here is 2:1. However, a challenge at this site is that from elevation 16 feet to the elevation 19 feet, the land slope is 5H:1V to 6H:1V. This means that to implement the 3H:1V slope or flatter at the shoreline, there would need to be a vertical wall at the end of that slope to get to existing grade, or most of the higher elevations of the property would need to be excavated. Additionally, again from the 2021 Existing Conditions Plan sheet, the shoreline slope that starts at elevation 7 feet (note these elevations are in NGVD29) is a very steep bank of heights four to seven feet. It is extremely difficult with the tidal range and winter conditions at this site to have a soft edge with any more than 1 to 1.5 feet of near-vertical bank at the waters' edge. For all of these reasons a complete living shoreline at this site was infeasible. Creating a salt marsh at the shoreline modification would be a temporary solution because the marsh would not be able to migrate landward with sea level rise (due to the rapid increase in land elevation above MHHW). Given the starting elevation of the implemented shoreline modification (highest astronomical tide), tidal buffer vegetation would be successful shoreward. It should be noted that the 2019 New Hampshire Living Shoreline Site Suitability Assessment report and attendant mapping tool (https://nhdes.maps.arcgis.com/apps/webappviewer/index.html?id=157d2171163f439b9402ab7e93ac81fc), indicate that the location of the shoreline modification was suitable for a hybrid living shoreline (Figure 10), which is what was essentially constructed: a rock sill with plantings (tidal buffer) at a higher elevation. The selected shoreline modification addressed the bank height problem as well as accommodated steeper slopes. It is expected that in time, the plantings above the stone will grow and cover the stone sill much as the existing juniper does at the site today. To increase the vegetation coverage of what was constructed, one possibility is to infill the upper 18-inch minus stone with sand (washing it in to ensure all interstices are filled with sand) and plant dune vegetation (for example, Bristly gooseberry, Red raspberry, Beach heather, Beach-grass, Beach-pea, Little bluestem, Virginia wild rye).

Figure 1. Google Earth image dated January 2025

Figure 2. Google Earth image dated March 2025

Figure 3. Shoreline and relic rock wall extending to abutter to west (4 July 2025).

Figure 4. Property shoreline November 2020.

Figure 5. Post January 2024 shoreline erosion.

Figure 6. Modified shoreline at subject property (4 July 2025).

Figure 7. Northern terminus of shoreline modification (4 July 2025).

Figure 8. Western end of the shoreline modifications (4 July 2025).

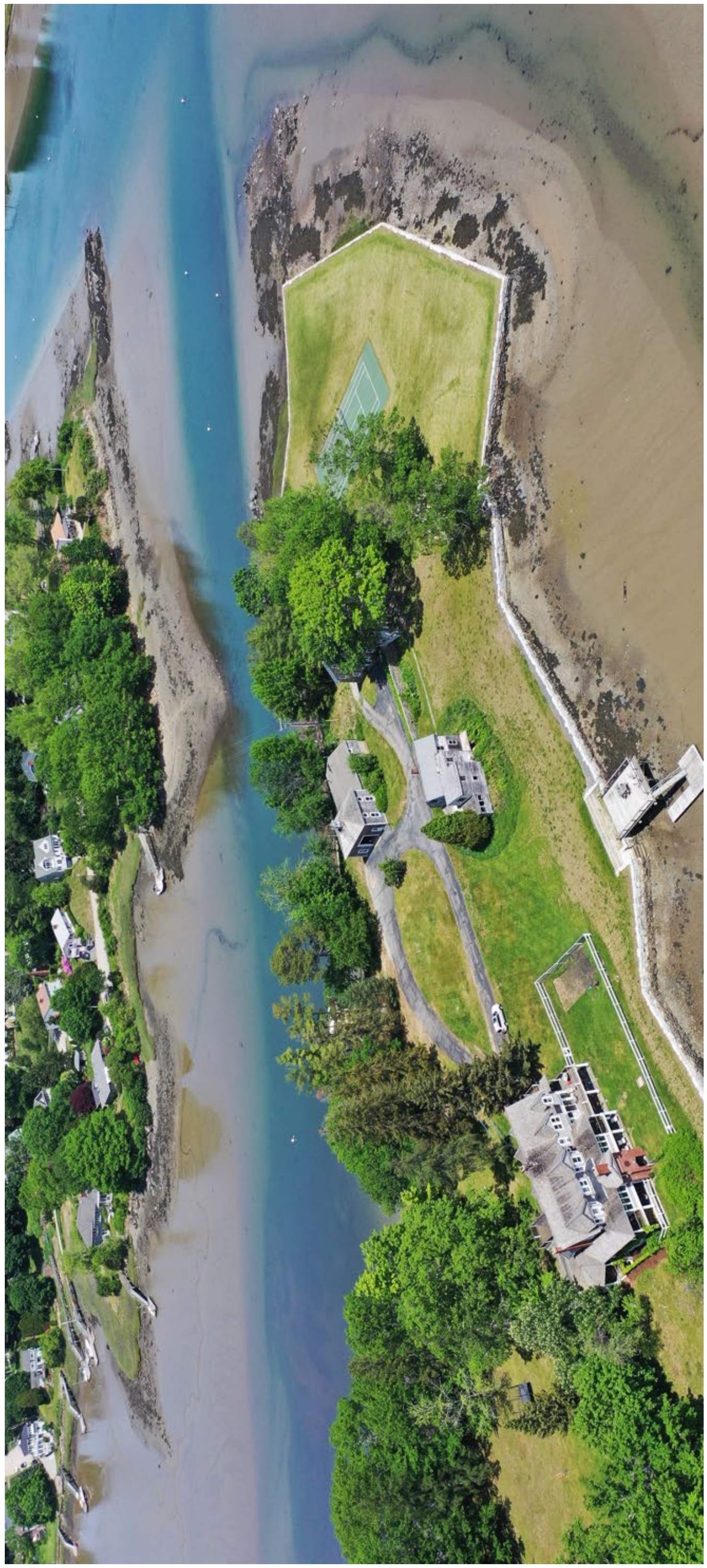


Figure 9. Drone image from October 2021

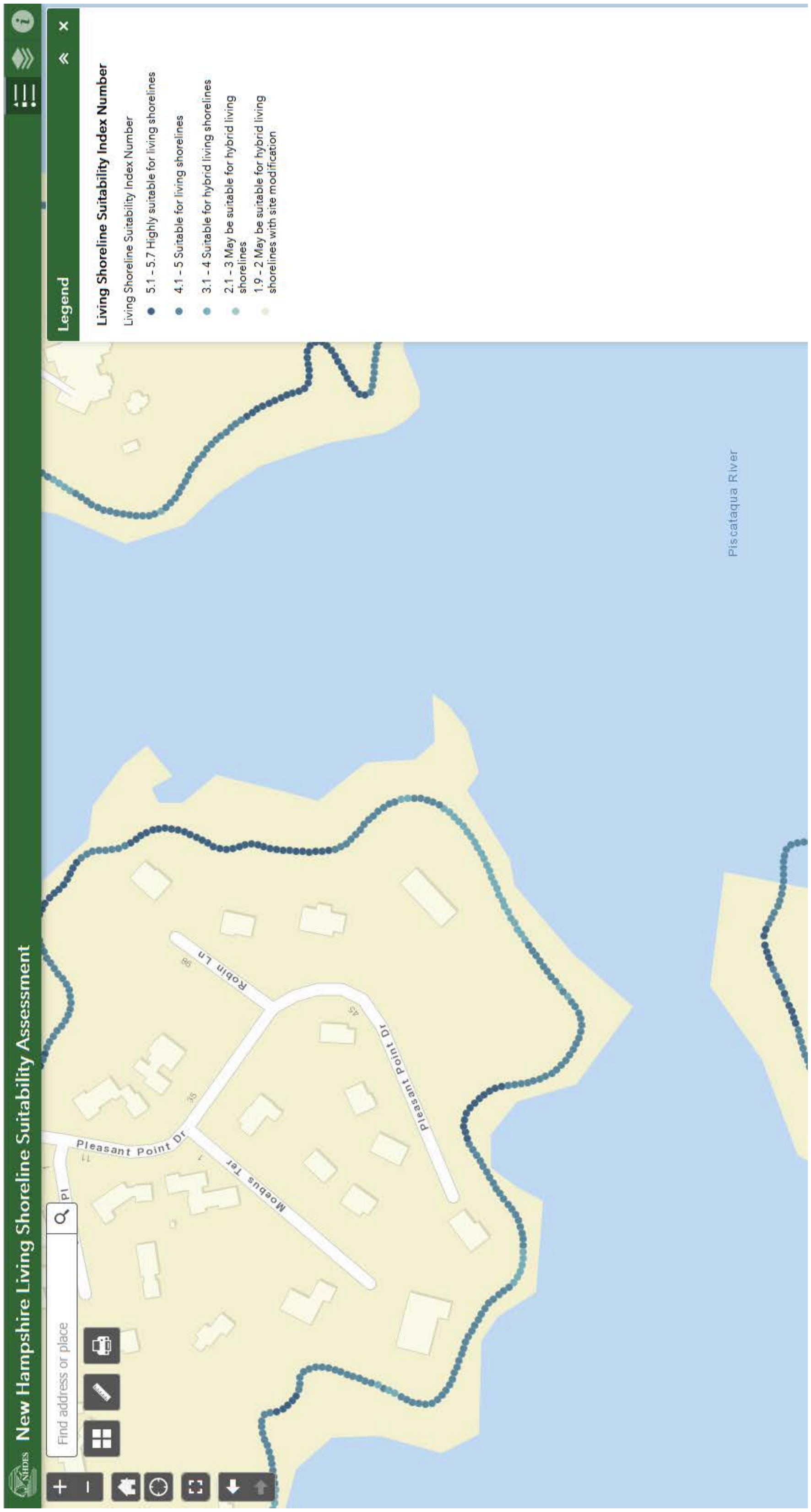


Figure 10. Site suitability scoring

July 2025

THOMAS P. BALLESTERO
Hydrology and Water Resources Engineering

238 Gregg Hall
University of New Hampshire
Durham, NH 03824

phone: (603) 862-1405
fax: (603) 862-3957
e-mail: tom.ballestero@unh.edu

Web site: https://ceps.unh.edu/person/thomas-ballestero

EDUCATION

Pennsylvania State University: B.S. in Civil Engineering, 1975 (Civil and Environmental Engineering)

Pennsylvania State University: M.S. in Civil Engineering, 1977 (Hydrology and Hydraulics)

Colorado State University: Ph.D. in Civil Engineering, 1981 (Hydrology & Water Resources)

REGISTRATION

Professional Engineering Licensure in NH, ME, VT, WY, NY, and PA
Registered Professional Hydrologist (AIH)
Certified Ground Water Professional (NGWA)
Licensed Professional Geologist, New Hampshire

TECHNICAL SOCIETIES

American Institute of Hydrology, Member
American Society of Civil Engineers, Life Member
American Water Resources Association, Member
National Society of Professional Engineers, Member

EXPERIENCE SUMMARY

2001-2020	Director, Stormwater Center, UNH
1989-present	Associate Professor of Civil Engineering, UNH
1993-1999	Chairman, Department of Civil Engineering, UNH
1986-1999	Director, New Hampshire Water Resources Research Center, UNH
1983-1988	Assistant Professor of Civil Engineering, UNH
1982-1983	Division Manager, Water Resources, Simons, Li and Associates, Inc.
1980-1981	Senior Hydrologist, Simons, Li and Associates, Inc.

PUBLICATIONS

Over 90 technical reports and papers on the topics of water resources planning, flood frequency analysis, hydrogeology, hydrology, contaminant fate and transport, solid waste management, stormwater management, stream restoration, living shorelines, liquefaction, oil spills, and reservoir operating procedures.

HONORS AND AWARDS

2024 FHWA 2024 Environmental Excellence Award for Successful Fish Passage Improvement Through Innovative Weir Construction on Bartlett Brook
2022 FHWA 2022 Environmental Excellence Award for Popham Beach, ME and Route 1A Newcastle Island, NH living shoreline designs
2016 ASCE/EWRI Water Visionary Award
2016 UNH Faculty/Staff Advisor of the Year
2015 New England Chapter American Public Works Association Meritorious Service Award
2015 Named by Presidential Board to US Stormwater Collaborative
2014 Best Paper Award: Journal of Transportation Engineering, Part A: Systems https://ascelibrary.org/doi/10.1061/JTEPBS.0000467
2011 US EPA Scientific Advisory Board for Hydraulic Fracturing Review Panel
2010 to present FEMA Scientific Resolution Panel on Flood Hazards
1998 τβπ Outstanding Teacher Award
1995-1997 Mr. and Mrs. Robert C. Davison Environmental Engineering Professorship
1992 University of New Hampshire Public Service Award
1992 Fulbright Scholar Award
1991 University of New Hampshire Outstanding Teaching Award
1991 Fulbright Scholar Award
1988 τβπ Outstanding Teacher Award
1986 American Express Partners of the Americas Outstanding Service Award

EXPERIENCE NARRATIVE

At the University of New Hampshire, Dr. Ballestero teaches Fluid Mechanics, Advanced Groundwater Topics, Hydrologic Monitoring, River Mechanics, Open Channel Flow, Engineering Hydrology, Coastal Engineering, Coastal Outfall Design, Stream Restoration, Advanced Stream Restoration Topics, Stormwater Management, and Design of Water Transmission Systems. His research interests are broadly in the field of applied water resources systems modeling and design as well as field monitoring of aquatic systems. Current research projects upon which he is working include: living shorelines, stream restoration; stormwater management; urbanization effects on runoff and water quality; stream crossing designs for aquatic organism passage, climate change characteristics of extreme floods; and instream flow. Past research endeavors included: movement, monitoring and biodegradation characteristics of organic contaminants in soils and ground water; innovative drilling and field techniques for characterization of contaminated sites and investigating environmentally sensitive locations; bedrock hydrogeology; hydraulic fracturing of bedrock formations; landfill leachate recirculation; artificial ground water recharge; land application of biosolids; simulation of historic salt water reductions to New Hampshire salt water marshes; evaluation of new drilling and ground water monitoring techniques; groundwater flow into coastal and estuarine systems; sediment transport and bridge scour; constructed wetlands from contaminated sediments; and composting of yard and agricultural solid wastes. Dr. Ballestero has taught courses in Concord, NH for personnel employed by the NH Department of Environmental Services that included: landfill design, introduction to ground water hydraulics and hydrology, and surface water hydrology. Dr. Ballestero has also lectured for the NH Technology Transfer Center on Stormwater Drainage and Design of Drainage Structures. He is active in international courses and education. He taught stormwater and groundwater short courses in Brazil, Panama, and Colombia, and taught graduate and undergraduate semester-long courses in Brazil and Puerto Rico. Dr. Ballestero is fluent in Portuguese and Spanish. In 2004 and 2005, at the request of the National Ground Water Association, Dr. Ballestero was invited to give three lectures on characterization and remediation of contaminated ground water in fractured rock. These lectures were given in New Orleans, Portland, and Houston. In 2006, again at the request of NGWA, this course was converted to an annual 2-day short course on site characterization in support of fractured rock remediation. The course was offered again in Denver in 2011.

International Efforts: Dr. Ballestero has been nationally and internationally involved in water resources projects including: groundwater development in northeast Brazil and Colombia, as well as the large Guaraní aquifer spanning Brazil, Uruguay, Paraguay, and Argentina; riverbank stabilization in Argentina; the effects of port construction in northeast Brazil; testimony before the U.S. Congress regarding ground water contamination; measurement and development of landfill gas emissions in Bermuda; monitoring of groundwater contamination in Colombia and South Korea; assessment of environmental hazards in northern Russia; contaminated bedrock remediation in Mexico; remediation of contaminated soil in Antarctica, estuarine monitoring in Puerto Rico; and an advisory/review capacity on the Boston Harbor clean-up program. In both 1991 and 1992 Dr. Ballestero was a Fulbright Scholar in Brazil where he taught ground water and surface water theory and modeling at two universities. His research focus there was ground water resources development, desertification, and water quality conditions of rivers. The Fulbright Awards also supported Dr. Ballestero's lectures at various universities and technical meetings throughout Brazil. In addition to his Fulbright experience, Dr. Ballestero has lectured on other occasions (1986, 1989, 1998, 2001, 2006, and 2018) at the Federal and State Universities in Fortaleza, Ceará, Brazil on topics of groundwater hydrology, computer simulation of hydrology and hydraulics, bedrock hydrogeology, stream restoration, and stochastic hydrology. At the Ceará State University he taught courses on environmental and water resources. He has also worked with the State of Ceará's technology agency (NUTEC) in hydrogeologic evaluation and development of ground water resources.

Dr. Ballestero taught stormwater management and design short courses in Panama for graduate students and practitioners. These courses were associated with the Technical University of Panama (UTP) and the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC).

Dr. Ballestero spent a sabbatical in Puerto Rico in 2000, at the request of the Puerto Rico Water Resources Research Center. With the Civil and Environmental Engineering Department at the University of Puerto Rico at Mayagüez, he taught two graduate courses: groundwater hydrology and water resources systems engineering. In addition, during this sabbatical he developed a monitoring plan for the Jobos Bay National Estuarine Research Reserve.

Groundwater: Dr. Ballestero has been involved with groundwater projects since 1980 (investigations, water supply, drainage, monitoring). He was one of the lead investigators of the Bedrock Bioremediation Center at UNH (1997-2004). In 1996, 1998, 2002, and 2003, Dr. Ballestero co-taught courses in Bogotá, Colombia on: design of ground water monitoring networks, ground water hydraulics, and ground water monitoring and sampling. The 2003 assignment was at the request of the Colombian geological agency, INGEOMINAS, to assist in the development and protection of bedrock groundwater resources in northern Colombia. In 1998, 2002, and 2003 he was an expert for the United Nations' International Atomic Energy Agency and was delegated to oversee ground water resources development: on the island of San

Andrés, Colombia; in the savanna north of Bogotá, Colombia; and for the Guaraní aquifer spanning Brazil, Uruguay, Paraguay, and Argentina. The 2002 assignment also included teaching in a two-week short course that incorporated one week of drilling, geophysics, sampling, and monitoring field demonstrations. Dr. Ballestero has a long consulting, academic, and research expertise in groundwater systems, and in 2010 the US Environmental Protection Agency (EPA) named him to its Science Advisory Board for the Hydraulic Fracturing Review. This panel provided independent peer review and advice to EPA regarding its study of the hydraulic fracturing method for the development of hard rock formations to provide unconventional gas for energy. At the present, he is the professional and technical lead for the University of New Hampshire chapter of Engineers Without Borders (EWB). EWB projects since 2000 primarily have focused on developing and/or improving water supplies in low income countries. Projects have been completed in: Malawi, Uganda, Thailand, Peru, and Niger. Very recently, Dr. Ballestero has been involved with groundwater projects that focus on perfluorinated compounds in groundwater.

Restoration of Impaired Aquatic Systems: Dr. Ballestero's original training and employment was in the area of surface water hydraulics and hydrology. His first private sector employment in the 1970's was with a firm that focused on river engineering: what is now called "stream restoration". Through the years he has continued to consult in this area. On a sabbatical year spanning 2005-2006, Dr. Ballestero performed stream and wetlands restoration projects with the US Fish & Wildlife Service Pennsylvania Field Office out of State College, PA. His duties included: engineering designs, collection of stream geomorphic data, and construction supervision. Representative projects included: dam removal, fish bypass channel designs for small dams; wetland design and construction; channel construction; sediment transport monitoring and modeling; and river hydraulic simulation. His projects were located across the Pennsylvania Commonwealth, one such project description of one of his designs may be found at https://www.wildlifeforeveryone.org/projects/coalTownship.php. During this time Dr. Ballestero also reviewed and commented on restoration projects that were submitted for regulatory permits to USFWS. This USFWS work effort continued when the USFWS extended to him a 5-year Intergovernmental Personnel Agreement. He spent June through December, 2007, June – August, 2008, and June – August 2009 with the USFWS. Also during this time, Dr. Ballestero taught in three seminars/short courses with the Pennsylvania State University Cooperative Extension on stormwater management and stream restoration. In 2013 he completed a US Army Corps of Engineers project in the restoration of Southampton Creek: an impaired urban stream near Philadelphia, PA. His current research lines in stream restoration include: statistical and geomorphic characteristics of large wood in streams; monitoring the movement of large particle (> 400 mm) sediment transport using passively induced transmitters; dam removal; urbanization consequences to streams; effects of stream crossings on aquatic organism passage (AOP), and fish frequencies related to wood. Dr. Ballestero was involved with modeling river hydraulics and floodplain studies since the mid-1970's. In 2010, the Federal Emergency Management Agency (FEMA) named Dr. Ballestero to its Scientific Resolution Panel (SRP). This panel is codified in the National Flood Insurance Act to perform independent reviews of the scientific and technical data used by FEMA to develop flood elevations for the National Flood Insurance Program's Flood Insurance Rate Maps. The objective of the SRP Process is to assist FEMA and communities in efficiently and impartially reviewing and resolving conflicting data presented to FEMA. In 2009, Dr. Ballestero was the lead technical author for the State of New Hampshire Stream Crossing Guidelines. He also developed a screening tool to assess the hydraulic, AOP, and geomorphic compatibility of culverts which the State of New Hampshire now use to assess all culverts in the state. More recently, in 2022-2023 Dr. Ballestero lead a team of biologists and NH agencies (NHDES, NHFG) and developed design and analytical guidelines for turtle crossings at road-wetland culverts. His stream restoration efforts have led to a related research line of living shorelines. Dr. Ballestero was a lead team member that designed and constructed the first coastal living shorelines in New Hampshire to arrest shoreline erosion. He has completed two other projects since and more are in the funding pipeline. Dr. Ballestero is actively involved with guidance documents and training with collaborators from: The Natures Conservancy, ASCE/COPRI, Piscataqua Region Estuaries Project, Northeast Region Ocean Council, NOAA, and NHDES.

Stormwater: Based upon his research during the 1990's on stormwater management systems, Dr. Ballestero was funded by NOAA to create the UNH Stormwater Center – UNHSC (http://www.unh.edu/unhsc/). The UNHSC has a nearly $1 million annual operating budget and studies the design, performance, maintenance, sustainability, and life cycle of all forms of stormwater management technologies. Dr. Ballestero served as the principal Investigator and Director of the UNHSC from its inception in 2002 through 2020. Dr. Ballestero had three staff working for the UNHSC, and numerous graduate and undergraduate students. At the present, he serves as the lead scientist for the UNHSC. The UNHSC developed some of the fundamental performance data for green stormwater infrastructure technologies as well as the design specifications for some of these technologies. EPA Region 1 used UNHSC field data to develop guidance for retrofitting green infrastructure into urban environments, and this is now built into regional MS4 permits. The UNHSC has designed, constructed, maintained, and/or monitored hundreds of stormwater systems, including: bioretention, detention/retention ponds, swales (grassed, rip rap, berm), sand filter, subsurface gravel wetland, subsurface gravel filters, tree filter, permeable pavements, and over two dozen manufactured systems. The UNHSC specifications for the subsurface gravel wetland, sectional media box filter, and porous asphalt are employed throughout the USA as have been included in numerous stormwater guidance documents. The UNHSC has designed unique stormwater systems for particularly challenging retrofit sites including infiltration systems, tree filters, and subsurface media filters.

Professional Engagement: Dr. Ballestero peer reviews articles submitted to the following journals: Journal of the American Water Resources Association, Journal of Energy Engineering (ASCE), Rivers, Groundwater (NGWA), Water Resources Research (AGU), Ground Water Monitoring and Remediation (NGWA), Journal of Environmental Engineering (ASCE), Journal of Irrigation and Drainage (ASCE), and Journal of Hydraulic Engineering (ASCE). He has also provided peer review of proposals and served on expert review panels for NSF, EPA, and USDA. He served for ten years on the Editorial Review Board for Ground Water Monitoring and Remediation, and six years as an Associate Editor for the Journal of the American Water Resources Association. Consulting work with which he is typically involved includes: hydraulic effects of flood plain encroachments; ground water resources delineation and development; ground water contamination; effects of mining on ground water; septic system failure mechanisms; design sediment and erosion control measures; design and analysis of stormwater management systems; valuation of ground water resources; dissolved oxygen modeling in rivers; design of coastal outfalls and harbor works; recirculation of landfill leachate; measurement of vapor fluxes from landfills; closure designs for solid waste dumps; hydrodynamic evaluation of coastal structures; and expert witness testimony.

Supervisory roles: Aside from these academic and research pursuits at UNH, from 1986 to 1999, Dr. Ballestero was the Director of the New Hampshire Water Resources Research Center. This position entailed: overseeing the annual research program, technology transfer, and water related publications. Annually the Center supported three to six research projects. The Center Director develops short- and long-term research objectives from the interactions and polling of water resources professionals throughout the State. The Director is also responsible for helping to develop federal water resources legislation by the U.S. Congress. Dr. Ballestero was formerly the Secretary of the National Institutes for Water Resources (NIWR) and the regional representative for the NIWR executive board.

Another administrative position held by Dr. Ballestero at UNH was as Chair of the Civil Engineering Department (1993 – 1999). At the time, the Department had 12 FTE faculty, 2 research faculty, and 3 full-time staff members. Also, the Department had 200 undergraduate and 50 graduate students. Department annual research expenditures exceeded $2 million. The Department housed the following research institutes: Technology Transfer Center, Environmental Research Group, and the New Hampshire Water Resources Research Center.

Prior to his employment at UNH, Dr. Ballestero was employed by Simons, Li, and Associates, Inc. His position there was Senior Hydrologist and Division Manager of the Water Resources Engineering Division. In this capacity, Dr. Ballestero was project manager for projects dealing with water resources development (ground water and surface water supplies), hydropower feasibility analyses, hydrologic analysis and simulation, evaluation of contaminant migration, water rights, and design and evaluation of water monitoring networks. Also, Dr. Ballestero was involved with proposals, corporate marketing, expert witness testimony and corporate management. Dr. Ballestero started and temporarily ran the company branch office in Cheyenne, WY.

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EXHIBIT 7

RIVERSIDE & PICKERING

MARINE CONTRACTORS

July 25,2025

Re: Rock Removal 60 Pleasant Point Drive Portsmouth, NH

The steps below would be required to remove a large amount of rip rap from the completed shoreline stabilization at the above noted address.

1) Bring equipment in by barge and spud down.
2) Offload equipment at the bottom of the riprap onto the resource. The barge will remain on site so we can load the rock being removed and take it away.
3) Work cannot be completed from the top as there are plantings installed for the green stabilization portion of hybrid stabilization.
4) Equipment required: John Deere 345 GLC TCAC excavator with a weight of 78,000lbs, 4 CY Wheel Loader JD 644K with a weight of 41,118lbs, and a Trac Bobcat with a weight of 7,744 lbs.
5) Equipment would need to be used below the HOTL in the resource. The overall impact of the equipment is 662 square feet moving impact to the resource.

Respectfully submitted,

By: Kuerstin Fordham

Kuerstin Fordham
Project Manager
Riverside & Pickering Marine Contractors
kuerstin@riversideandpickering.com
603-427-2824 ext. 1000

Google Maps 30 Walden St

EXHIBIT 8A

Imagery ©2025 Airbus, Maxar Technologies, Map data ©2025 50 ft

Google Maps 500 Market St

EXHIBIT 8B

Imagery ©2025 Airbus, Maxar Technologies, Map data ©2025 50 ft

Google Maps

EXHIBIT 8C

Imagery ©2025 Airbus, Maxar Technologies, Map data ©2025 100 ft

Google Maps

363 New Castle Ave

EXHIBIT 8D

Imagery ©2025 Airbus, Map data ©2025 20 ft

EXHIBIT 8E

Google Maps 379 New Castle Ave

Imagery ©2025 Airbus, Maxar Technologies, Map data ©2025 50 ft