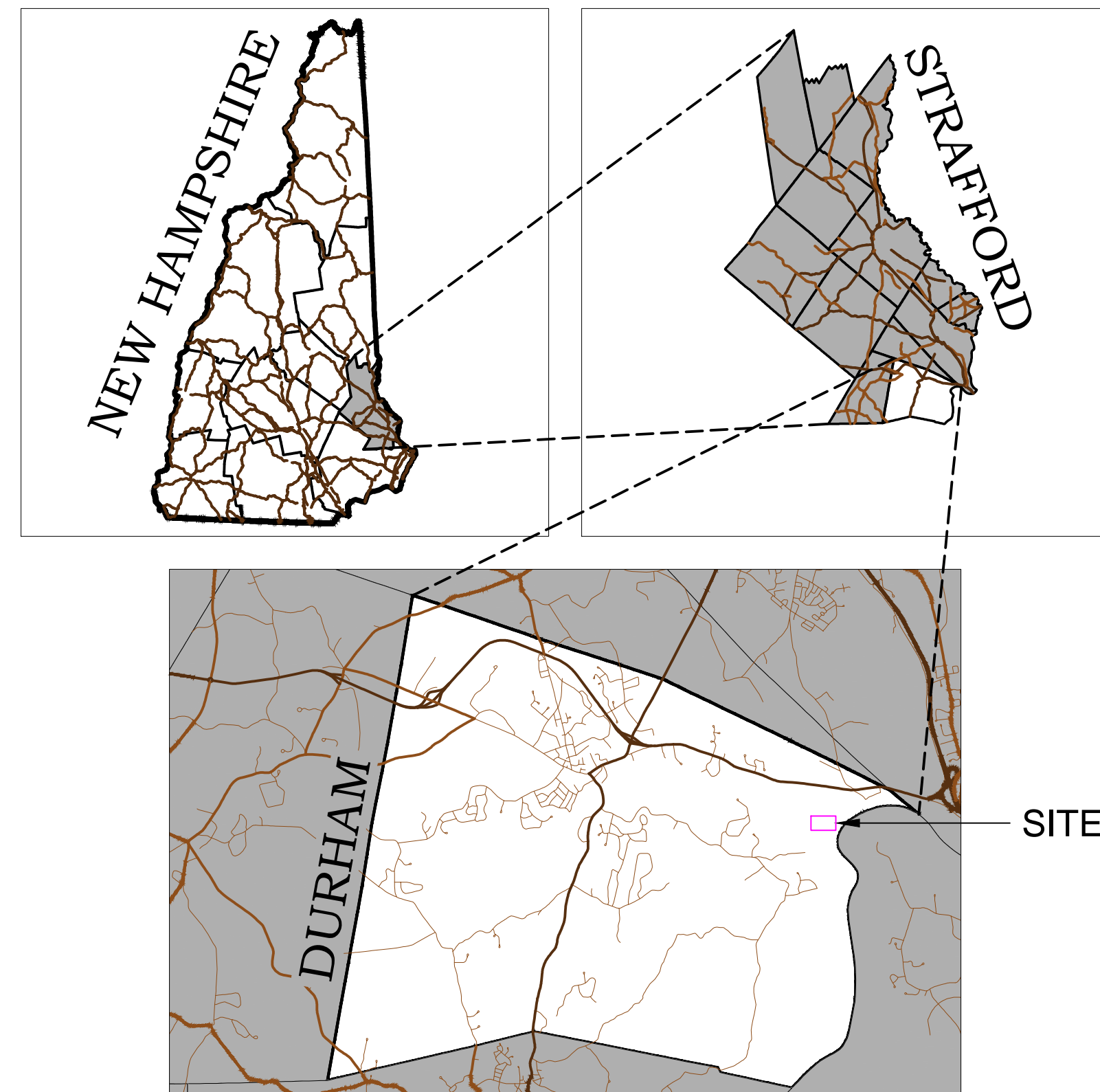


WAGON HILL FARM SHORELINE RESTORATION

100% DESIGN PLANS

WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NEW HAMPSHIRE

02 MAY 2019



VICINITY MAP
NOT TO SCALE



LOOKING SOUTH AT THE PROPOSED SITE LOCATION

LIST OF SHEETS

NO	SHEET ID	SHEET TITLE
1.	NOTES	CONCEPTUAL PROJECT NOTES
2.	LGND	SHEET SET LEGEND
3.	X-OVIEW	EXISTING SITE OVERVIEW
4.	P-OVIEW	RESTORATION PLAN OVERVIEW
5.	P-AERIAL	RESTORATION PLAN OVER AERIAL
6.	P-PLAN	DETAILED CONCEPTUAL PLAN
7.	P-GRAD	DETAILED GRADING PLAN
8.	P-AXS	PROPOSED STAGING & ACCESS
9.	P-XS1	CROSS SECTIONS 25 & 26
10.	P-XS2	CROSS SECTIONS 27 & 28
11.	P-XS3	CROSS SECTIONS 29 & 30
12.	P-PLANT	PLANTING PLAN
13.	D-TOE	PROPOSED MARSH TOE DETAILS
14.	D-AXS	ACCESS, STAGING, & UNLOADING DETAILS
15.	D-RAMP	GRANITE BLOCK WATER RAMP DETAIL

NOTES

1. THE EXISTING SURVEY WAS TIED IN TO GLOBAL COORDINATES USING GPS-ENABLED SURVEY GEAR IN AUGUST OF 2018;
2. THE DATUMS USED FOR REFERENCE ARE: VERTICAL TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), AND HORIZONTAL TO THE NH STATE PLANE DATUM (NH83), BOTH IN U.S. SURVEY FEET.
3. TIDAL WATER LEVELS WERE ORIGINALLY APPROXIMATED BY REFERENCING PUBLISHED NOAA TIDE ELEVATION PREDICTIONS AT GAGE 8421897 - DOVER POINT, NH. NOAA DOES NOT HAVE A PHYSICAL GAGE AT THIS LOCATION, ONLY PREDICTED VALUES.
4. TO SUPPLEMENT NOAA-PREDICTED TIDAL ELEVATIONS, A TRANSDUCER WAS PUT IN THE WATER OFF THE SHORE AT THE SITE FROM MID-FEBRUARY TO AUGUST 2017. A STAFF GAGE WAS INSTALLED IN EARLY JULY 2017, AND READINGS FROM THE STAFF GAGE ALONG WITH THE WATER ELEVATIONS FROM THE TRANSDUCER WERE USED TO ESTABLISH LOCAL ELEVATIONS FOR MEAN WATER LEVEL, MEAN HIGH TIDE, AND MEAN HIGH HIGH TIDE.
5. RESULTING FROM DATA OBTAINED FROM THE TRANSDUCER, MINOR ADJUSTMENTS TO THE 100% DESIGN PLANS (DATED 08 APRIL 2019) WERE NECESSARY, INCLUDING:
 - 5.1. RAISING THE TOE OF THE SOUTHWEST CUSP UP TO A CONSTANT ELEVATION OF 1.50 FT NAVD88
 - 5.2. REDEFINING THE ELEVATION LIMITS OF THE HABITAT ZONES
 - 5.3. RECALCULATING THE AREAS OF THE RESTORATION ZONES



GENERAL NOTES

1. UNLESS OTHERWISE STATED, THE GLOBAL DATUMS TO WHICH ALL ELEVATIONS ARE REFERENCED ARE:

1.1. HORIZONTAL: NAD83 – NEW HAMPSHIRE STATE PLANE, US SURVEY FEET

1.2. VERTICAL: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), US SURVEY FEET
2. TIDAL ELEVATIONS ARE SHOWN USING THE VALUES FROM A NOAA TIDE GAGE (GAGE 8423005 – ATLANTIC TERMINALS T14A, NH) LOCATED APPROXIMATELY 3.14 MILES DOWNSTREAM OF THE SITE, AT THE SPRAGUE OIL FACILITY ON THE OTHER SIDE OF THE GENERAL SULLIVAN BRIDGE. IN CONJUNCTION WITH THIS GAGE, READINGS TAKEN USING A PRESSURE TRANSDUCER PLACED IN THE BAY APPROXIMATELY 200 FEET OFFSHORE FROM THE SITE WAS COLLECTED, DURING WHICH TIME A STAFF GAGE WAS INSTALLED AT THE SITE, SURVEYED FROM KNOWN ELEVATIONS AT RANDOM INTERVALS. DATA FROM THESE TWO SOURCES HAS BEEN COLLECTED, COMPILED, AND PROCESSED, AND HAS PROVIDED MORE ACCURATE TIDAL ELEVATIONS. FROM THE TRANSDUCER, IT WAS FOUND THAT HIGH TIDE ELEVATIONS INCLUDE: HIGHEST OBSERVABLE TIDE (HOT) ~ 4.00’; MEAN HIGH HIGH WATER (MHHW) ~ 3.50’; MEAN HIGH WATER (MHW) ~ 3.30’.
3. THIS SHEET SET IS THE FINAL DESIGN FOR THE PROJECT. NO CHANGES TO THE DESIGN SHALL BE MADE WITHOUT FIRST CONTACTING PROJECT ENGINEERS AND MANAGERS, AND MAY ONLY BE DONE AFTER RECEIVING APPROVAL BY NHDES.
4. A STORMWATER SYSTEM IS TO BE CONSTRUCTED TO THE EAST OF THE SANDY BEACH ACCESS AREA AS PART OF A SEPARATE PROJECT FROM THIS SHORELINE RESTORATION. THE STORMWATER SYSTEM IS EXPECTED TO BE CONSTRUCTED IN THE SUMMER OF 2019. AN AS–BUILT SURVEY OF THE SYSTEM AND ANY DRAINAGE INFRASTRUCTURE SHALL BE COMPLETED, AND CONSIDERED FULLY IN THIS DESIGN.
5. THERE IS TO BE A GRANITE SLAB WATER ACCESS INSTALLED BY THE TOWN AS PART OF THIS PROJECT. THE APPROXIMATE LOCATION OF THE WATER ACCESS IS SHOWN ON THE PLANS.
6. EMERGENCY CONTACTS SHOULD BE NOTIFIED IMMEDIATELY SHOULD ANY ISSUES ARISE DURING CONSTRUCTION.
7. EMERGENCY CONTACTS FOR THIS PROJECT INCLUDE:

7.1. TOM BALLESTERO
PROJECT MANAGER AND ENGINEER
UNH DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
603–862–1405

7.2. DAVE BURDICK
PROJECT MANAGER AND BIOLOGIST
UNH DEPARTMENT OF NATURAL RESOURCES AND THE ENVIRONMENT
603–862–5129

7.3. MIKE LYNCH
PUBLIC WORKS DIRECTOR
TOWN OF DURHAM
603–868–5578
8. ADDITIONAL CONTACTS FOR THIS PROJECT INCLUDE:

8.1. JOEL BALLESTERO
PROJECT ENGINEER
UNH DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
970–556–7552

8.2. GREGG MOORE
PROJECT MANAGER AND BIOLOGIST
UNH DEPARTMENT OF NATURAL RESOURCES AND THE ENVIRONMENT
603–862–5138

8.3. KIRSTEN HOWARD
PROJECT REVIEW
NHDES COASTAL PROGRAM
603–559–0020

8.4. DAVE PRICE
PROJECT REVIEW AND PERMITTING
NHDES LAND RESOURCES MANAGEMENT
603–559–1514

8.5. STEFANIE GIALONGO
PROJECT REVIEW AND PERMITTING
NHDES WETLANDS BUREAU
603–559–1516

CONSTRUCTION NOTES

9. BEFORE PERFORMING ANY CONSTRUCTION, CONTACT DIGSAFE AT THE NUMBER PROVIDED TO THE RIGHT, OR ONLINE, TO ENSURE THE LOCATION OF ANY UNDERGROUND UTILITIES, IF THERE ARE ANY.
10. CONSTRUCTION ACCESS, STAGING, STOCKPILING, AND CONSTRUCTION SEQUENCE SHALL ALL BE DETERMINED BY THE CONTRACTOR – IN

- COORDINATION WITH THE TOWN, NH DES, US ACoE, AND THE PROJECT ENGINEERS – IN MANNERS THAT THE CONTRACTOR FEELS BEST SUITS THEIR ABILITIES, TIMELINE, AND CONSTRAINTS. PRIOR TO CONSTRUCTION, THESE SHOULD ALL BE WELL–DEFINED AND CLEARED BY ALL PERMITTING AND OTHERWISE INVOLVED PROJECT MEMBERS.
11. CONSTRUCTION WITHIN THE SHORELINE SHALL BE PERFORMED ‘IN THE DRY’ – DURING LOW TIDES – SUCH THAT NO WATER IS DISTURBED BY CONSTRUCTION ACTIVITIES.
12. NO EXISTING TIDAL MARSH OUTSIDE OF THE LIMITS SHOWN SHALL BE ALTERED OR HARMED IN ANY WAY DURING CONSTRUCTION.
13. DURING CONSTRUCTION, ANY ‘LIVE’ ROCK (ROCKS IN THE MUDFLATS THAT HAVE ALGAE OR OTHER GROWTH ON THEM) SHALL BE STOCKPILED APPROPRIATELY AND USED IN THE STONE TOE PROTECTION.
14. DUE TO THE FREQUENT AND HEAVY PUBLIC USE AT THE SITE (ESPECIALLY BY PEOPLE WITH PETS), WELL–DEFINED CONSTRUCTION LIMITS SHOULD BE CREATED USING HIGH–VISIBILITY ORANGE CONSTRUCTION FENCE AND SIGNAGE, ENSURING A BARRIER SURROUNDS THE SITE THAT MAKES IT INACCESSIBLE BY PETS. AT THE END OF EACH DAY THE SITE SHOULD BE FULLY SECURED SUCH THAT EVERY MEASURE POSSIBLE HAS BEEN TAKEN TO PREVENT ANY DANGER TO PEOPLE OR PETS.
15. AFTER COMPLETING CONSTRUCTION, ALL DISTURBED LANDS SHALL BE GROOMED TO ENSURE THE SITE IS LEFT APPEALING TO THE PUBLIC, AND THAT LITTLE TO NO EVIDENCE OF CONSTRUCTION ACTIVITIES IS LEFT BEHIND.
16. FROM THE PROPOSED GRADING, THERE IS AN ESTIMATED TOTAL CUT AT THE SITE OF 170.5 cy AND A REQUIRED TOTAL FILL OF 962.5 cy, MEANING THAT A TOTAL OF 792 cy OF FILL WILL BE REQUIRED. OF THIS FILL, AN ESTIMATED 437 cy WILL BE FOR TOPSOIL, AND 355 cy WILL BE THE REMAINING FILL.
17. THE THREE PLANTING ZONES THAT ARE PROPOSED FOR THE SITE INCLUDE THE TIDAL BUFFER ZONE, THE HIGH MARSH ZONE, AND THE LOW MARSH ZONE. IN GENERAL:

17.1. THE TIDAL BUFFER ZONE IS TO BE BETWEEN THE ELEVATIONS OF 7.0 ft AND 5.67 ft.

17.2. THE HIGH MARSH ZONE IS TO BE BETWEEN THE ELEVATIONS OF 5.67 ft AND 3.38 ft (JUST BELOW THE MEAN HIGH HIGH WATER, MHHW, AT 3.50).

17.3. THE LOW MARSH ZONE IS TO BE BETWEEN THE ELEVATIONS OF 3.38 ft (NEAR MHHW) AND 1.10 ft (JUST ABOVE MEAN TIDE).
18. THE TOTAL AREA WITHIN THE CONSTRUCTION LIMITS IS 27,578 sf. OF THAT, THERE IS 3,589 sf OF EXISTING TIDAL MARSH. OF THAT TIDAL MARSH, 2,319 sf ARE TO REMAIN UNALTERED, AND 1,178 sf ARE TO BE REBUILT, AS THEY ARE IN VERY POOR CONDITION.
19. IN TOTAL, THIS PROJECT PROPOSES TO CONSTRUCT 15,744 sf OF RESTORED LAND AREA, CONSISTING OF:

19.1. 6,857 sf OF LOW MARSH

19.2. 5,071 sf HIGH MARSH

19.3. 3,816 sf OF TIDAL BUFFER
20. THERE WILL BE AN ESTIMATED 171 cy OF CUT AT THE SITE AND 963 cy OF FILL. FROM OTHER PROJECTS, APPROXIMATELY 16% MORE VOLUME THAN CALCULATED SHOULD BE ADDED TO FILL TOTALS TO ACCOUNT FOR SETTLING. THIS RESULTS IN A NET TOTAL OF 42 cy OF LARGE STONE FOR THE MARSH SILL TOE PROTECTION, AND A TOTAL OF 791 cy OF IMPORTED MATERIAL MARSH FILL (ACCOUNTING FOR REDUCTIONS FROM STONE TOE VOLUME AND VEGETATED MAT VOLUME).
21. THE WOOD FENCE AT THE SITE WHICH BORDERS THE SANDY BEACH ACCESS IS TO BE EXTENDED ON BOTH SIDES 20 ft PAST THE TOE OF THE EXISTING MARSH, TO EITHER SIDE. THE N.H. PORT AUTHORITY AND THE U.S. COAST GUARD HAVE BOTH BEEN CONTACTED, AND HAVE NO OBJECTIONS TO EXTENDING THE FENCE, AS THE WATERWAY HERE IS NOT CONSIDERED NAVIGABLE. HOWEVER, IT IS CONSIDERED AN OBSTRUCTION WITHIN NAVIGABLE WATERS, AND THEREFORE MUST BE MAPPED BY NOAA AND THE COAST GUARD. AFTER CONSTRUCTION IS COMPLETE, THE FENCE SHALL BE SURVEYED FOR OR BY EITHER ENTITY, AND INCLUDED IN THEIR DATABASE(S).

EROSION AND SEDIMENT CONTROL NOTES

22. EROSION AND SEDIMENT CONTROL SHALL BE PLACED AT THE SITE BEFORE BEGINNING ANY CONSTRUCTION ACTIVITIES, AND SHOULD BE INSPECTED AT LEAST ONCE A WEEK, OR AFTER ANY STORM TOTALING 0.25” OF RAIN OR MORE. SHOULD ANY MAINTENANCE BE REQUIRED, IT SHALL BE PERFORMED BEFORE CONTINUING ANY CONSTRUCTION.
23. THE EXACT LOCATION OF REQUIRED EROSION MEASURES NECESSARY DURING CONSTRUCTION SHALL BE FULLY DETERMINED IN THE FIELD BY

- THE SITE ENGINEER, AND SHALL CONFORM TO NHDES STANDARDS, AND PLACED ON ALL SLOPES DRAINING AWAY FROM ANY CONSTRUCTION AREAS.
24. EROSION CONTROL SHALL BE REMOVED AND DISCARDED OF PROPERLY AFTER COMPLETING ALL CONSTRUCTION.

PLANTING NOTES

25. TREE POINT SCORES FOR EXISTING AND PROPOSED CONDITIONS MAY BE FOUND ON SHEET P–PLANT. IN AGREEMENT WITH NHDES, TREES ARE NOT APPROPRIATE TO THE PURPOSE OF THE PROJECT. AS SUCH, VEGETATION POINT SCORING ACCOUNTS FOR THE GROUND COVER AND SHRUBS WHICH ARE SPECIFIED IN THESE PLANS, TOTALING THEIR SCORES ABOVE THE MAXIMUM 10 POINTS THEY ARE TYPICALLY ALLOWED TO SCORE.
26. ALL RESTORED LANDS AND LAND CONTAINED WITHIN THE PROPOSED FENCE ARE TO BE LEFT UNMAINTAINED, IN A NATURAL STATE.
27. SOME TREES MAY BE PLANTED IN THE UPLAND ZONE AT THE SITE, BUT ARE NOT REQUIRED. TREES PLANTED IN THE UPLAND AREA MAY CONSIST OF, BUT ARE NOT LIMITED TO: AMERICAN BASSWOOD (*TILIA AMERICANA*), AMERICAN BEECH (*FAGUS GRANDIFOLIA*), BALSAM POPLAR (*POPULUS GRANDIDENTATA*), BLACK GUM (*NYSSA SYLVATICA*), EASTERN SYCAMORE (*PLANTANUS OCCIDENTALIS*), RED OAK (*QUERCUS RUBRA*), SHAGBARK HICKORY (*CARYA OVATA*), TULIPTREE (*LIRIODENDRON TULIPIFERA*), AND WHITE OAK (*QUERCUS ALBA*). OTHER SPECIES MAY BE SUBSTITUTED/SUPPLEMENTED, HOWEVER THEY MUST BE APPROVED BY THE ENGINEER BEFORE PURCHASING OR PLANTING.
28. ALL DISTURBED LANDS ABOVE THE MHHW ELEVATION SHALL BE SEEDED WITH A COASTAL SEED MIX, PERENNIAL RYE GRASS, OR GRASSES THAT BLEND IN WITH THE EXISTING LANDSCAPE.
29. PLANTING AND SEEDING ABOVE THE MHHW ELEVATION MAY COMMENCE IMMEDIATELY AFTER CONSTRUCTION EACH DAY. COVER THE SEEDED, ALTERED LANDS WITH STRAW TO A DEPTH OF 1 INCH, AND MAINTAIN THE AREA MOIST UNTIL GRASS HAS TAKEN ROOT, USUALLY WHEN THE GRASS IS 2 INCHES TALL.
30. PLANTING OF THE LOW MARSH ZONE IS TO BE DONE USING VEGETATION SHEETS (MATS) OF *SPARTINA ALTERNIFLORA*, RATHER THAN INDIVIDUAL PLANTS.
31. PLANTING OF THE HIGH MARSH ZONE IS TO BE DONE USING VEGETATION SHEETS (MATS) OF *SPARTINA PATENS*, RATHER THAN INDIVIDUAL SEED OR PLANTS. PLANT DIVERSITY IS TO BE INCREASED BY PLANTING *DISTICHLIS SPICATA*, *JUNCUS GERARDII* AND *LIMONIUM* BETWEEN MATS AT APPROPRIATE ELEVATIONS. PERIODS OF LOW HIGH TIDES AND/OR LOW RAINFALL FOR TWO WEEKS WILL NECESSITATE WATERING TWICE A WEEK FOR THE DROUGHT PERIOD.
32. PLANTING OF THE TIDAL BUFFER ZONE (ELEVATION ABOVE MHHW, SEE NOTES #27–29) IS TO BE DONE USING SEED AND PLANTS. DROUGHT PERIODS WILL NECESSITATE WATERING TWICE PER WEEK, AS SPECIFIED IN NOTE #31.
33. THE LOW MARSH ZONE SHALL CONSIST OF THE FOLLOWING:

33.1. CORDGRASS (*SPARTINA ALTERNIFLORA*) PLANTED AT A RATE OF ONE (1) MAT PER 1.65 SQUARE FEET.
34. THE HIGH MARSH ZONE SHALL CONSIST OF THE FOLLOWING:

34.1. SALT HAY (*SPARTINA PATENS*) PLANTED AT A RATE OF ONE (1) MAT PER 1.65 SQUARE FEET.

34.2. SPIKE GRASS (*DISTICHLIS SPICATA*), BLACK GRASS (*JUNCUS GERARDII*), AND SEA LAVENDER (*LIMONIUM SP.*) PLANTED AT RANDOM, IN A MIXED FASHION, AT A RATE OF ONE (1) PLANT PER 80 SQUARE FEET OF AREA (APPROXIMATELY 90 PLANTS TOTAL).
35. THE TIDAL BUFFER ZONE SHALL CONSIST OF THE FOLLOWING:



35.1. BAYBERRY (*MYRICA PENSYLVANICA*), SHADBUSH (*AMELANCHIER CANADENSIS*), SWITCHGRASS (*PANICUM VIRGATUM*), SWEET–FERN (*COMPTONIA PEREGRINA*), AND SWEET PEPPERBUSH (*CLETHRA ALNIFOLIA*) PLANTED AT RANDOM, IN A MIXED FASHION, AT A RATE OF ONE (1) PLANT PER 80 SQUARE FEET OF AREA (FOR APPROXIMATELY 50 PLANTS TOTAL).
36. THE VEGETATED PLANTING MATS OF CORDGRASS AND SALT HAY WILL BE ABOUT 2 INCHES IN DEPTH; GRADING OF EXCAVATED LAND AND FILL IN THE LOW AND HIGH MARSH ZONES SHOULD BE SET 2 INCHES BELOW THE FINISHED ELEVATION TO ACCOMMODATE PLANTING OF THE MATS.

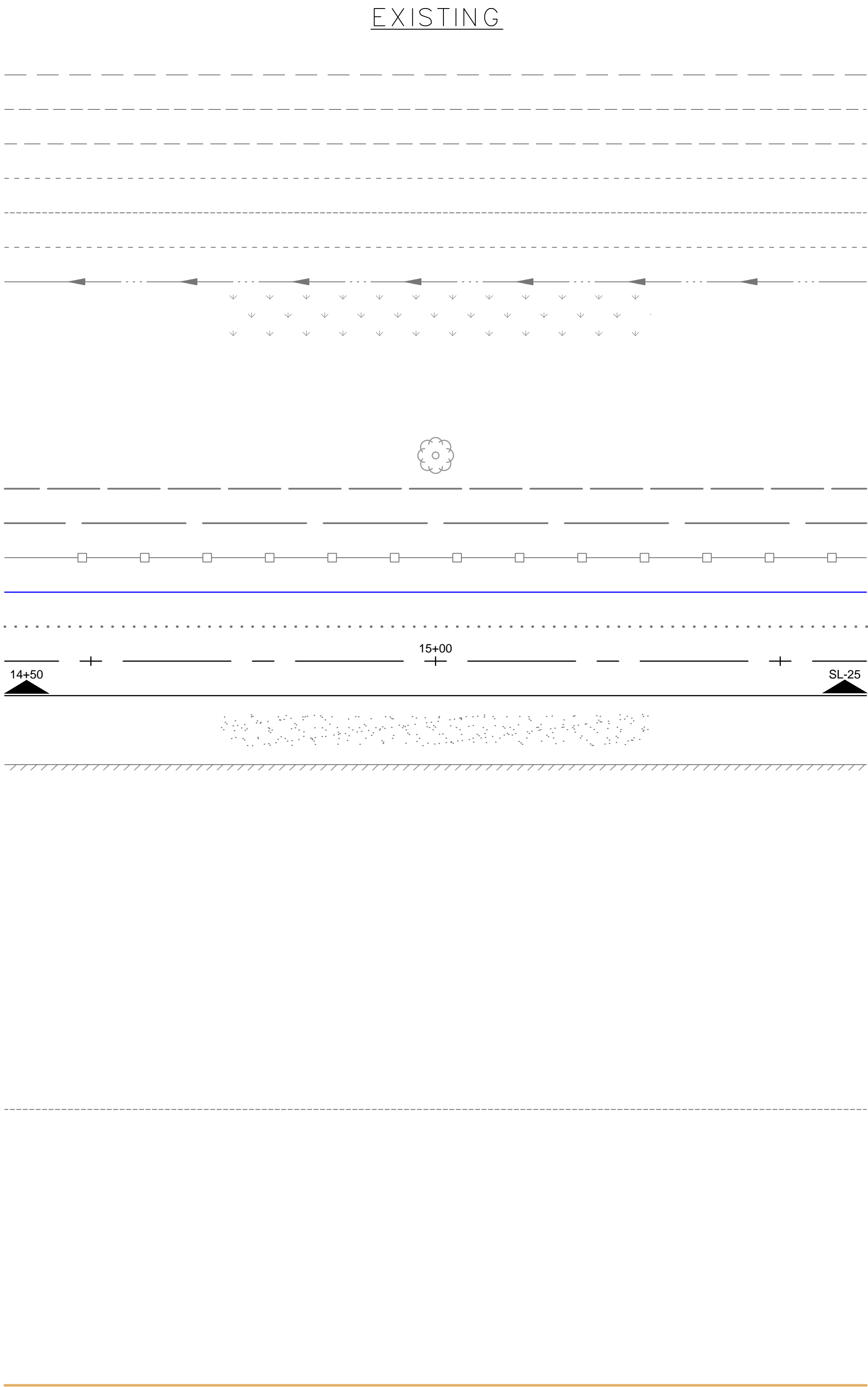
GENERAL CONSTRUCTION SEQUENCE

- **DETAILED CONSTRUCTION SEQUENCE SHALL BE PROVIDED BY THE CONTRACTOR, AS DETERMINED TO BEST FIT THEIR CONSTRUCTION PLANS AND METHODS, AND SHALL BE REVIEWED AND APPROVED BY ALL PERMITTING AGENCIES, AND ALL OTHER PROJECT PARTICIPANTS.
- A. SET UP, CLEARLY DELINEATE, AND SECURE A STAGING/STOCKPILING AREA AND GRAVEL ACCESS LANES, INSTALLING ANY AND ALL EROSION CONTROLS AND CONSTRUCTION FENCE IN THIS AREA.
- B. INSTALL ALL EROSION CONTROL MEASURES AND CONSTRUCTION FENCING AROUND CONSTRUCTION ZONE.
- C. REMOVE LARGE, UNDERCUT TREES ALONG HIGH BANK, REGRADE THE SLOPES, – STOCKPILING ANY MATERIAL TO BE REUSED – AND SEED OR PLANT RIPARIAN VEGETATION.
- D. DELIVER GRAVEL, STONE, AND FILL MATERIALS
- E. BEGIN CONSTRUCTING THE TIDAL MARSH BY FILLING FROM THE EXISTING LAND, SEAWARD TO THE LIMIT OF THE PROPOSED MARSH.
- F. AS FILL IS PLACED TO THE MARSH LIMIT, PLACE GEOTEXTILE, COIR PITH, AND THE APPROPRIATE TOE PROTECTION, AS DEFINED ON SHEET D–TOE.
- G. CONTINUE FILLING IN THIS MANNER, INSTALLING ANY BURIED STRUCTURES AND HABITAT BOULDERS AS NECESSARY UNTIL ACHIEVING THE FINAL BACKFILL SUBGRADE, AS SHOWN ON THE PLANS.
- H. PLANT AND SEED ALL DISTURBED AND CONSTRUCTED LANDS.
- I. REMOVE ALL EROSION CONTROL MEASURES, DECONSTRUCT STAGING AREA, AND RESTORE ANY AND ALL DISTURBED LANDS TO PREVIOUS CONDITIONS.

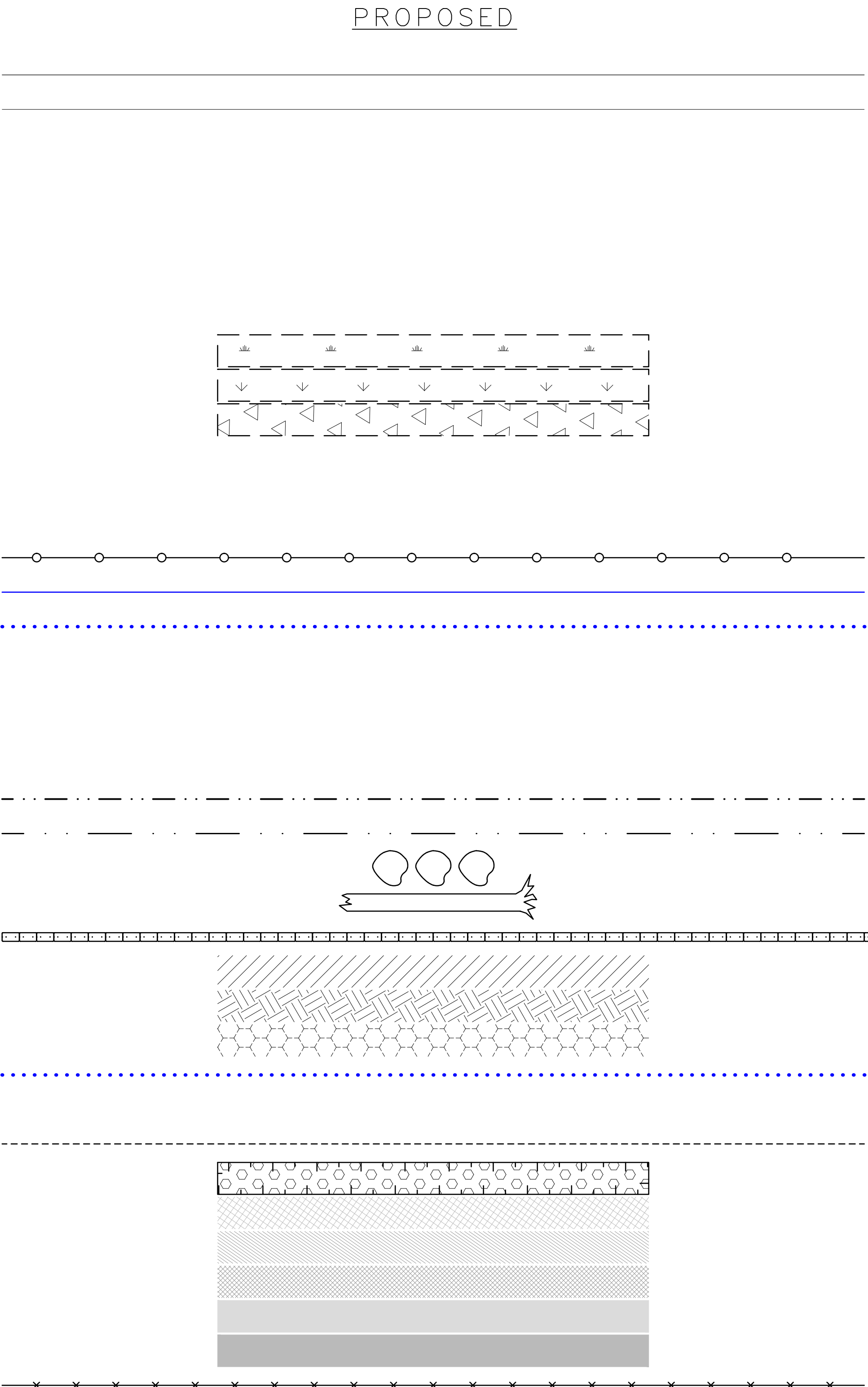
REVISIONS

- TIDAL ELEVATION RANGES, WHICH GOVERN THE ELEVATION LIMITS DEFINING THE THREE HABITAT ZONES, WERE INITIALLY ESTIMATED FROM SURVEYED SITE ELEVATIONS AND NEARBY NOAA GAGES. TO PROVIDE MORE ACCURATE AND SITE–SPECIFIC INFORMATION, A PRESSURE TRANSDUCER WAS INSTALLED IN THE WATER OFF THE SITE. THE DATA COLLECTED FROM THE TRANSDUCER HAS BEEN PROCESSED, CALIBRATED, AND CHECKED IN THE FIELD. THE TIDAL ELEVATIONS (IN FEET, NAVD88) SUGGESTED BY THE TRANSDUCER HAVE RESULTED IN THE FOLLOWING REVISIONS [*TIDAL DATUM – ELEVATION (FORMER ELEVATION)*]:
 - HIGHEST OBSERVABLE TIDE – 4.00 (3.75)
 - MEAN HIGH HIGH WATER – 3.50 (3.38)
 - MEAN HIGH WATER – 3.30 (3.01)
- THE DATA FROM THE PRESSURE TRANSDUCER HAS ALSO RESULTED IN THE FOLLOWING CHANGES TO THE ELEVATION LIMITS DEFINING THE THREE HABITAT ZONES [*HABITAT ZONE – LOW to HIGH ELEVATION (FORMER ELEVATIONS)*]:
 - LOW MARSH – 1.50 to 3.30 (1.10 to 3.40)
 - HIGH MARSH – 3.30 to 4.40 (3.40 to 5.80)
 - TIDAL BUFFER – 4.40 to 6.10 (5.80 to 7.00)
- DUE TO THE REVISED ELEVATION RANGE LIMITS LISTED ABOVE, APPROXIMATELY 963 SQUARE FEET OF THE SOUTHWEST CORNER OF THE PROPOSED MARSH LIES BELOW THE LOWER LIMIT OF THE LOW MARSH ZONE, PER THE GRADING SHOWN ON THE 100% DESIGN PLANS DATED 08 APRIL 2019. THIS MAY RESULT IN POOR CONDITIONS FOR THE SUCCESSFUL SURVIVAL OF *S. ALTERNIFLORA* IN THAT LOCATION, A REDUCTION IN THE AMOUNT OF RESTORED MARSH, AND COULD LEAD TO LONG–TERM INSTABILITY. TO REMEDY THIS, THE SEAWARD EDGE OF THE PROPOSED MARSH FROM STATIONS 16+00 TO 17+65 HAS BEEN RAISED TO AN ELEVATION OF 1.50, AND THE MARSH IN THAT AREA REGRADED ACCORDINGLY.
- THE UPDATED GRADING PROPOSED IN THIS PLAN SET RESULTS IN AN ADDITIONAL 26 CUBIC YARDS OF MARSH FILL TO BE PLACED, INCLUDING SETTLING, AND AN ESTIMATED ADDITIONAL 5 CUBIC YARDS OF STONE TOE PROTECTION. REQUIRED QUANTITIES FOR MARSH BACKFILL AND STONE TOE PROTECTION NOW TOTAL 381 (FORMERLY 355) AND 47 CUBIC YARDS FORMERLY 42), RESPECTIVELY
- ALSO RESULTING FROM BOTH THE UPDATED HABITAT ZONE ELEVATION RANGES AND THE PROPOSED GRADING PLAN, THE AMOUNT OF RESTORED AREA WITHIN EACH HABITAT ZONE HAS BEEN UPDATED. THE UPDATED AREAS (IN SQUARE FEET) ARE AS FOLLOWS [*HABITAT ZONE – RESTORED AREA (FORMER RESTORED AREA)*]:
 - LOW MARSH – 6,757 (6,857)
 - HIGH MARSH – 2,232 (5,071)
 - TIDAL BUFFER – 3,089 (3,816)
 - TOTAL – 12,078 (15,744)

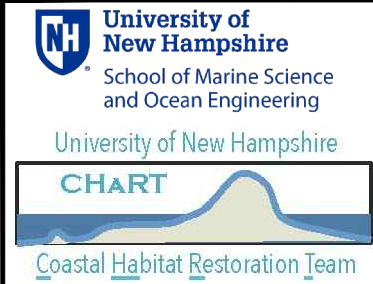
DESIGNED BY: JCB, TPB, DMB		DRAWN BY: JCB		CHECKED BY: TPB, DMB		DATE: 02 MAY 2019	
<div><div><div>University of New Hampshire</div><div>School of Marine Science and Ocean Engineering</div></div><div>University of New Hampshire</div><div>CHART</div><div>Coastal Habitat Restoration Team</div></div>							
NOTES: MINOR CHANGES TO SOUTHWEST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS		REVISION #:		DATE:			
		1		01 MAY 2019			
SHEET TITLE: PROJECT NOTES		SHEET SET:					
		100% DESIGN PLANS					
PROJECT NAME: WAGON HILL FARM SHORELINE RESTORATION							
PROJECT LOCATION: WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH							
SHEET ID: NOTES							
SHEET NUMBER: 01 OF 15							

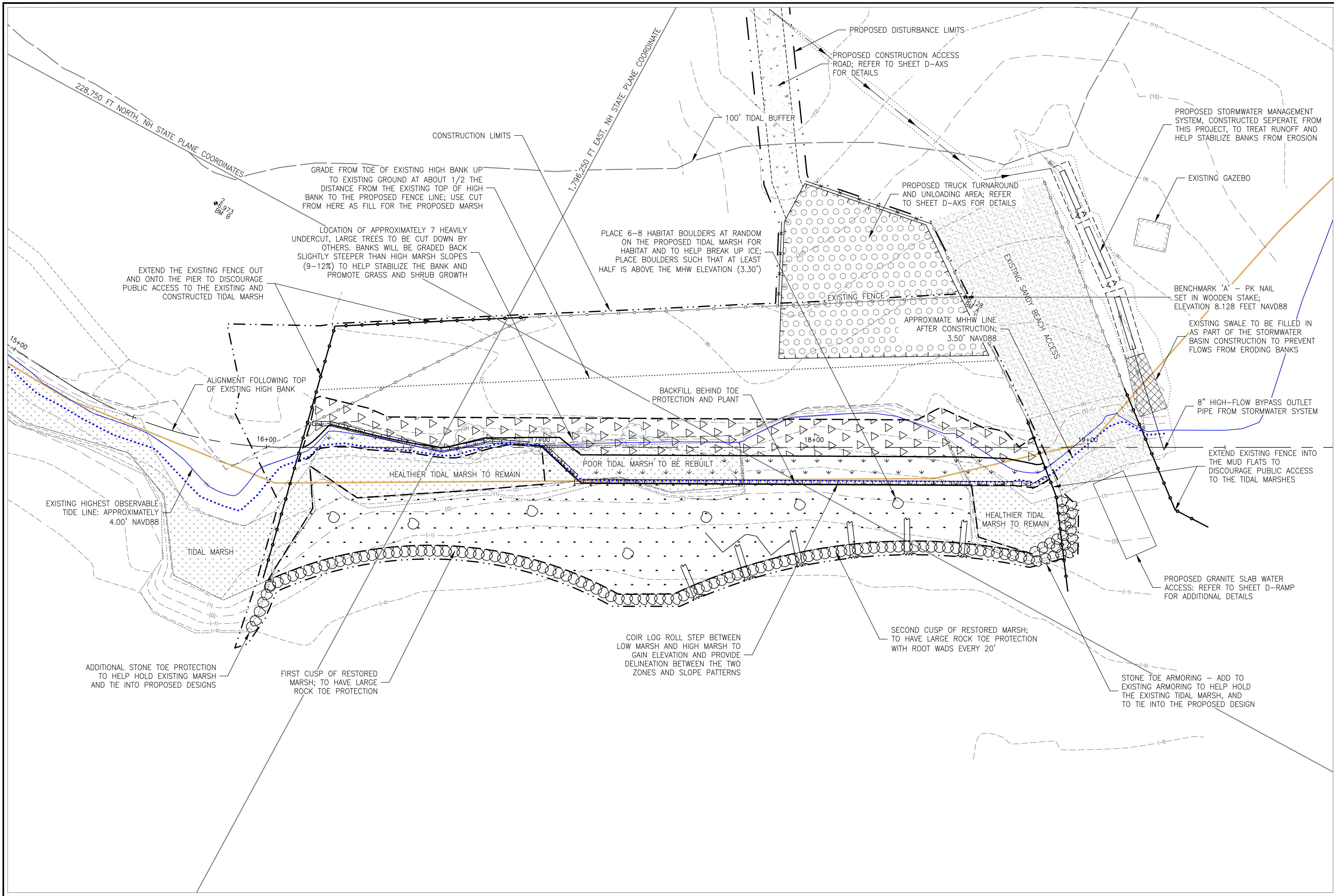


- FEATURE
- MINOR CONTOUR
 - MAJOR CONTOUR
 - TOP OF HIGH BANK
 - TOE OF HIGH BANK
 - TOP OF LOW BANK
 - TOE OF LOW BANK
 - SWALE
 - TIDAL MARSH
 - LOW MARSH ZONE
 - HIGH MARSH ZONE
 - TIDAL BUFFER ZONE
 - EXISTING SURVEYED TREE
 - REGULATORY – 100 ft TIDAL BUFFER
 - REGULATORY – 250 ft SHORELAND BUFFER
 - FENCE LINE
 - HIGHEST OBSERVABLE TIDE LINE
 - MEAN-HIGH HIGH WATER LINE
 - ALIGNMENT
 - CROSS SECTION
 - SANDY BEACH ACCESS
 - GAZEBO
 - CONSTRUCTION LIMITS
 - DISTURBANCE LIMITS
 - LARGE BOULDER OR STONE
 - ROOT WAD
 - COIR LOG ROLL
 - CROSS SECTION CUT
 - CROSS SECTION FILL
 - CROSS SECTION COIR PITH FILL
 - CROSS SECTION TIDAL WSEL
 - EXISTING GRAVEL ROAD
 - CONSTRUCTION ACCESS ROAD
 - STOCKPILING AND STAGING BOUNDARY
 - TEMPORARY IMPACTS WITHIN SHORELAND BUFFER
 - PERMANENT IMPACTS WITHIN SHORELAND BUFFER
 - TEMPORARY IMPACTS WITHIN TIDAL BUFFER
 - PERMANENT IMPACTS WITHIN TIDAL BUFFER
 - PERMANENT IMPACTS BELOW H.O.T. LINE
 - PROPERTY BOUNDARY FROM NHGRANIT
 - HI-VISIBILITY CONSTRUCTION FENCE



NOTE: SOME LINETYPES MAY APPEAR IN BOLD, AND SOME BLOCKS LARGER OR SMALLER ON SOME SHEETS TO HIGHLIGHT THE SELECTED FEATURES

DESIGNED BY: JCB, TPB, DMB	DRAWN BY: JCB	CHECKED BY: TPB, DMB	DATE: 02 MAY 2019				
				CHART			
				Coastal Habitat Restoration Team			
NOTES: MINOR CHANGES TO SOUTHWEST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS	DATE: 01 MAY 2019	REVISION #: 1	SHEET TITLE: SHEET SET LEGEND		SHEET ID: LGND		
			SHEET SET: 100% DESIGN PLANS		SHEET NUMBER: 02 OF 15		
			PROJECT NAME: WAGON HILL FARM SHORELINE RESTORATION		PROJECT LOCATION: WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH		



DESIGNED BY:
JCB, TPB, DMB

DRAWN BY:
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CHECKED BY:
TPB, DMB

DATE:
02 MAY 2019

University of
New Hampshire

School of Marine Science
and Ocean Engineering

University of New Hampshire

CHART

Coastal Habitat Restoration Team

NOTES:	MAJOR CHANGES TO SOUFWEST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS				
DATE:	01 MAY 2019				
REVISION #:	1				

SHEET TITLE:
RESTORATION PLAN OVERVIEW

SHEET SET:
100% DESIGN PLANS

PROJECT NAME:
WAGON HILL FARM SHORELINE RESTORATION

PROJECT LOCATION:
WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH

SCALE: 1" = 16'

SHEET ID:
P-OVIEW

SHEET NUMBER:
04 OF 15



DESIGNED BY:
JCB, TPB, DMB

DRAWN BY:
JCB

CHECKED BY:
TPB, DMB

DATE:
02 MAY 2019

University of
New Hampshire

School of Marine Science
and Ocean Engineering

University of New Hampshire

CHART

Coastal Habitat Restoration Team

REVISION #	DATE	NOTES
1	01 MAY 2019	MAJOR CHANGES TO SOUPINIST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS

SHEET TITLE:
RESTORATION PLAN OVER AERIAL

SHEET SET:
100% DESIGN PLANS

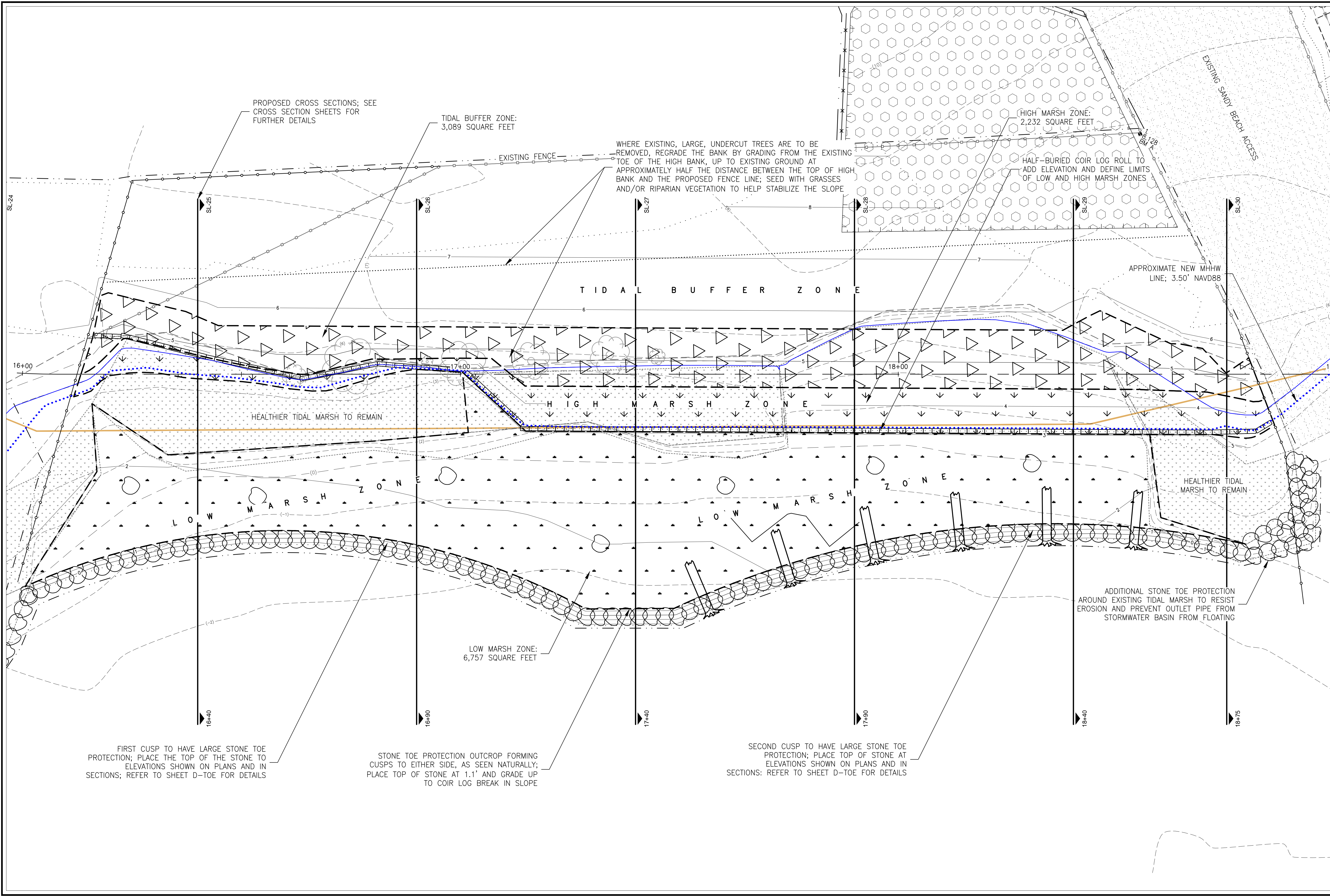
PROJECT NAME:
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PROJECT LOCATION:
WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH

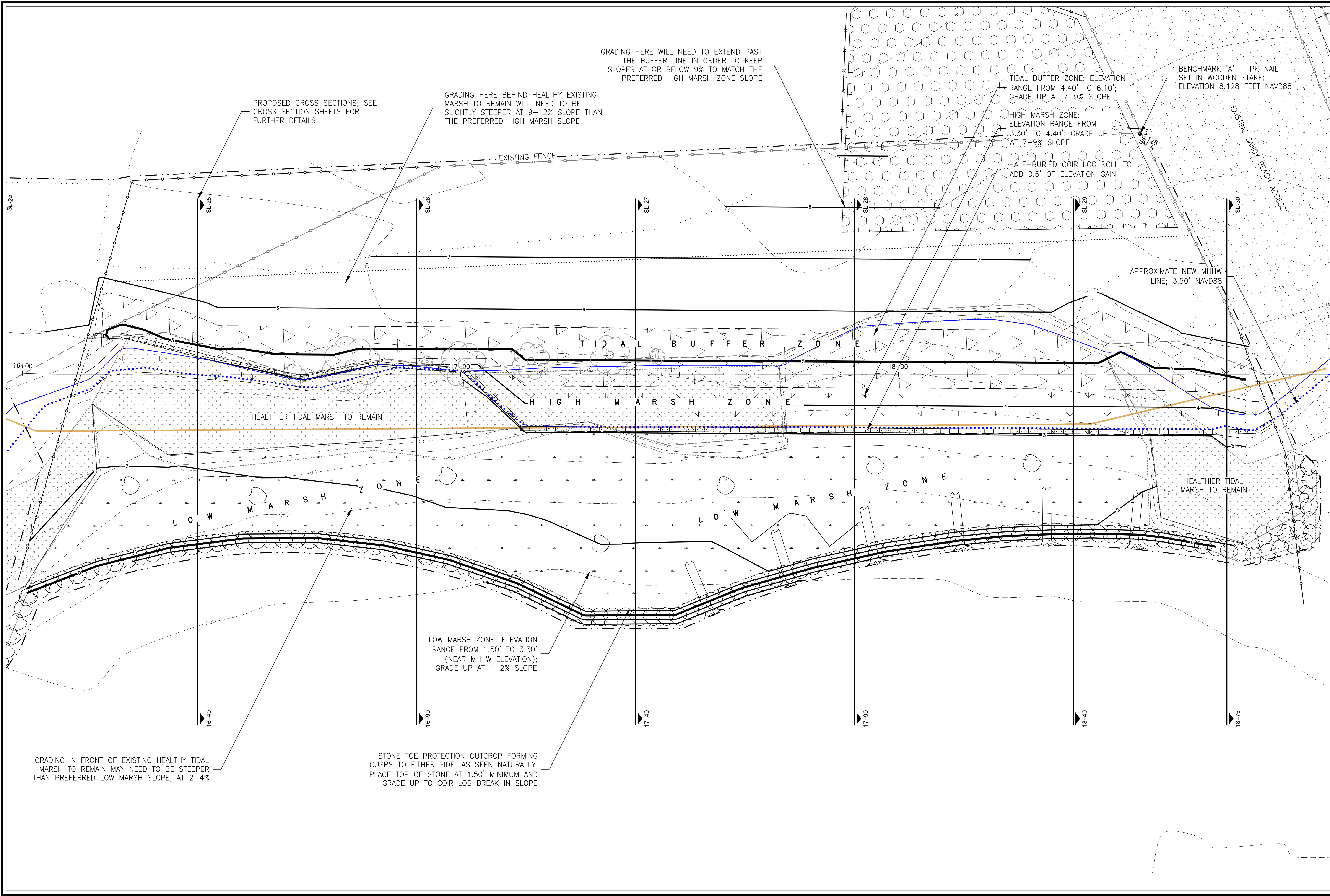
SCALE: 1" = 16'

SHEET ID:
P-AERIAL

SHEET NUMBER:
05 OF 15



DESIGNED BY: JCB, TPB, DMB	UNIVERSITY OF NEW HAMPSHIRE School of Marine Science and Ocean Engineering	DATE: 02 MAY 2019
DRAWN BY: JCB	CHART Coastal Habitat Restoration Team	
CHECKED BY: TPB, DMB		
NOTES:		
REVISION #:	DATE:	
1	01 MAY 2019	
MAJOR CHANGES TO SOUFWEST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS		
SHEET TITLE: DETAILED CONCEPTUAL PLAN		
SHEET SET: 100% DESIGN PLANS		
PROJECT NAME: WAGON HILL FARM SHORELINE RESTORATION		
PROJECT LOCATION: WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH		
SHEET ID: P-PLAN		
SHEET NUMBER: 06 OF 15		



DESIGNED BY:
JCB, TPB, DMB

DRAWN BY:
JCB

CHECKED BY:
TPB, DMB

DATE:
02 MAY 2019

University of
New Hampshire

School of Marine Science
and Ocean Engineering

University of New Hampshire

CHART

Coastal Habitat Restoration Team

NOTES:	MAJOR CHANGES TO SOFTENEST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS				
DATE:	01 MAY 2019				
REVISION #:	1				

SHEET TITLE:
DETAILED GRADING PLAN

SHEET SET:
100% DESIGN PLANS

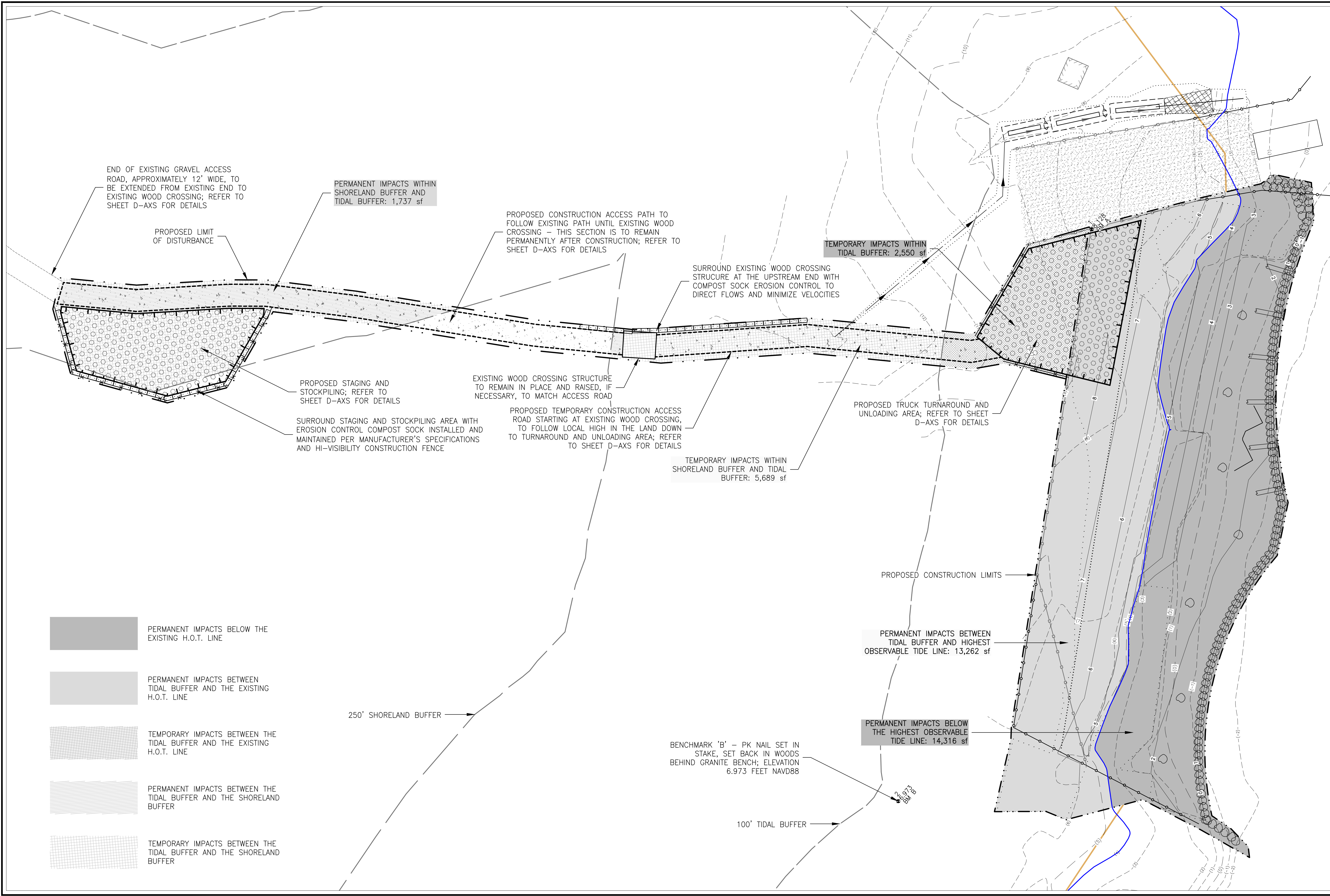
PROJECT NAME:
WAGON HILL FARM SHORELINE RESTORATION

PROJECT LOCATION:
WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH

SCALE: 1" = 10'

SHEET ID:
P-GRAD

SHEET NUMBER:
07 OF 15



DESIGNED BY:
JCB, TPB, DMB

DRAWN BY:
JCB

CHECKED BY:
TPB, DMB

DATE:
02 MAY 2019

University of New Hampshire

School of Marine Science and Ocean Engineering

University of New Hampshire

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Coastal Habitat Restoration Team

REVISION #	DATE	NOTES
1	01 MAY 2019	MAJOR CHANGES TO SOFTENEST FOR FINISHED GRADE & ZONE RANGE ELEVATIONS

SHEET TITLE:
PROPOSED STAGING & ACCESS

SHEET SET:
100% DESIGN PLANS

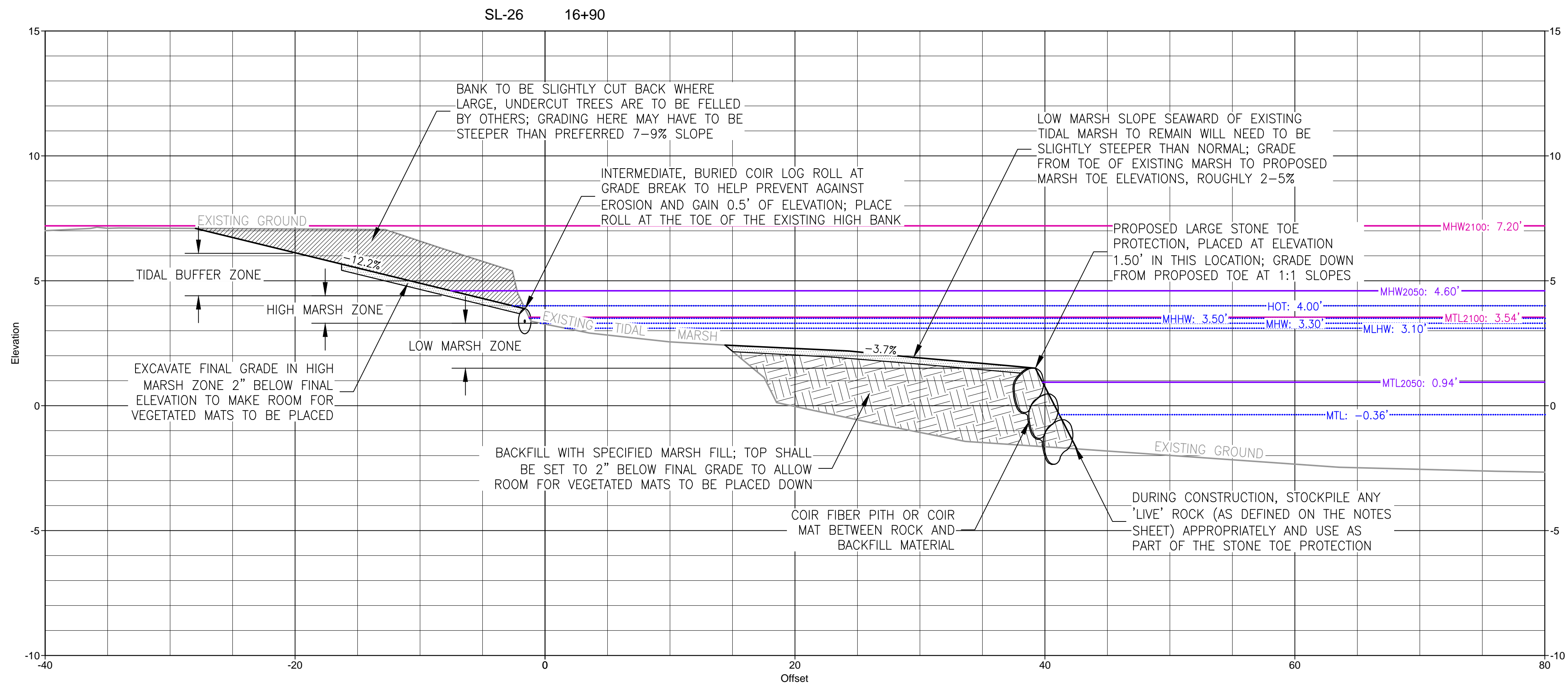
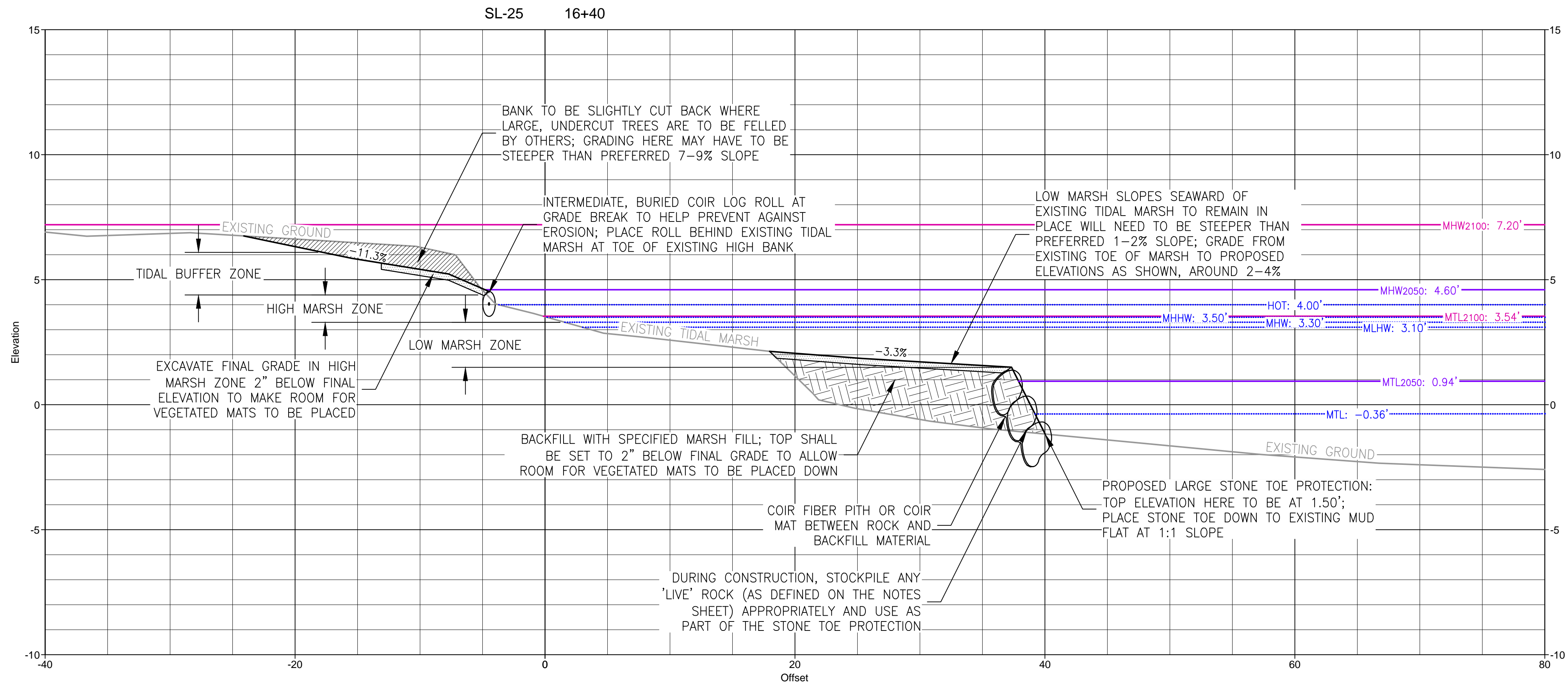
PROJECT NAME:
WAGON HILL FARM SHORELINE RESTORATION

PROJECT LOCATION:
WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH

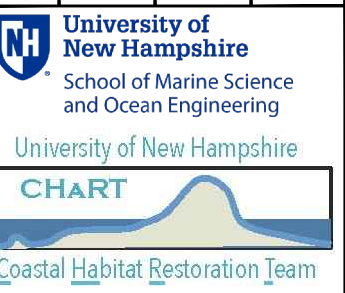
SCALE: 1" = 20'

SHEET ID:
P-AXS

SHEET NUMBER:
08 OF 15



DESIGNED BY: JCB, TPB, DMB
DRAWN BY: JCB
CHECKED BY: TPB, DMB
DATE: 02 MAY 2019

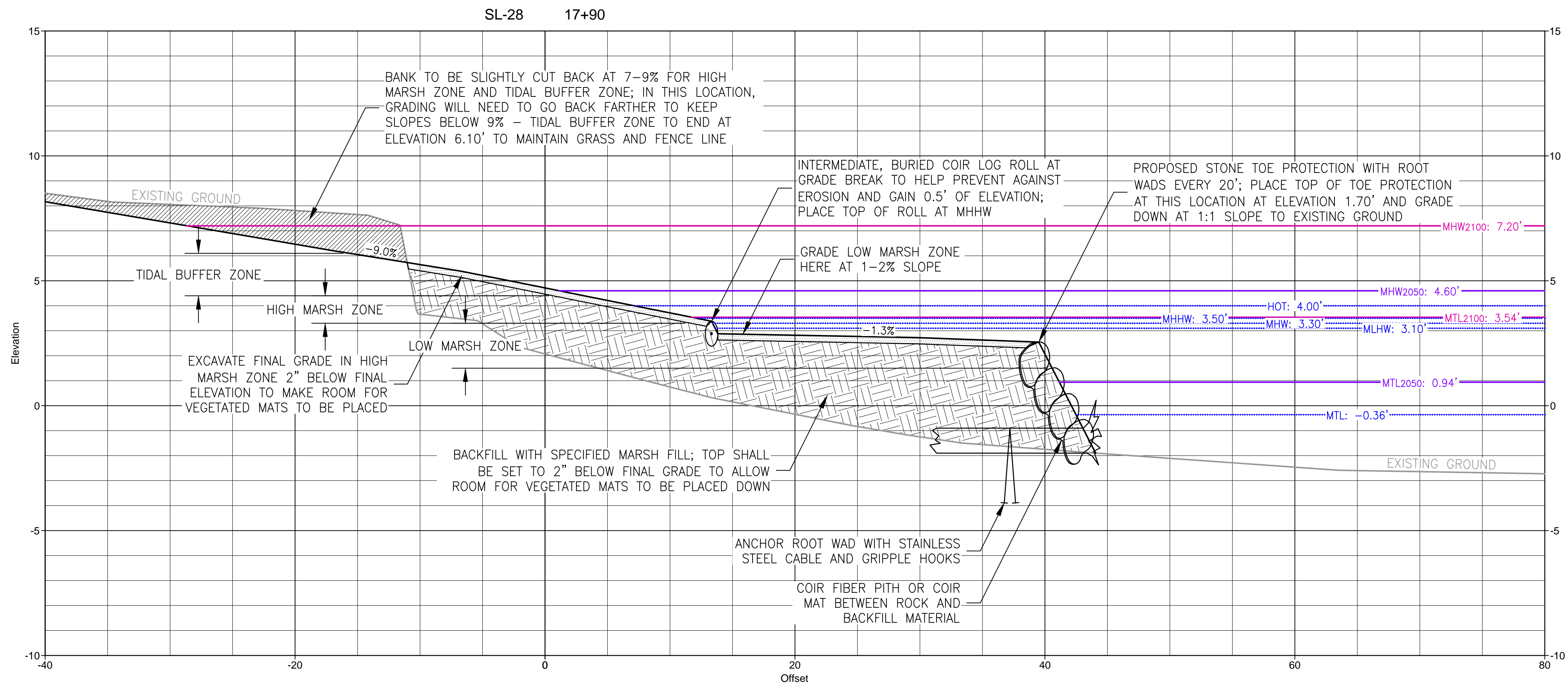
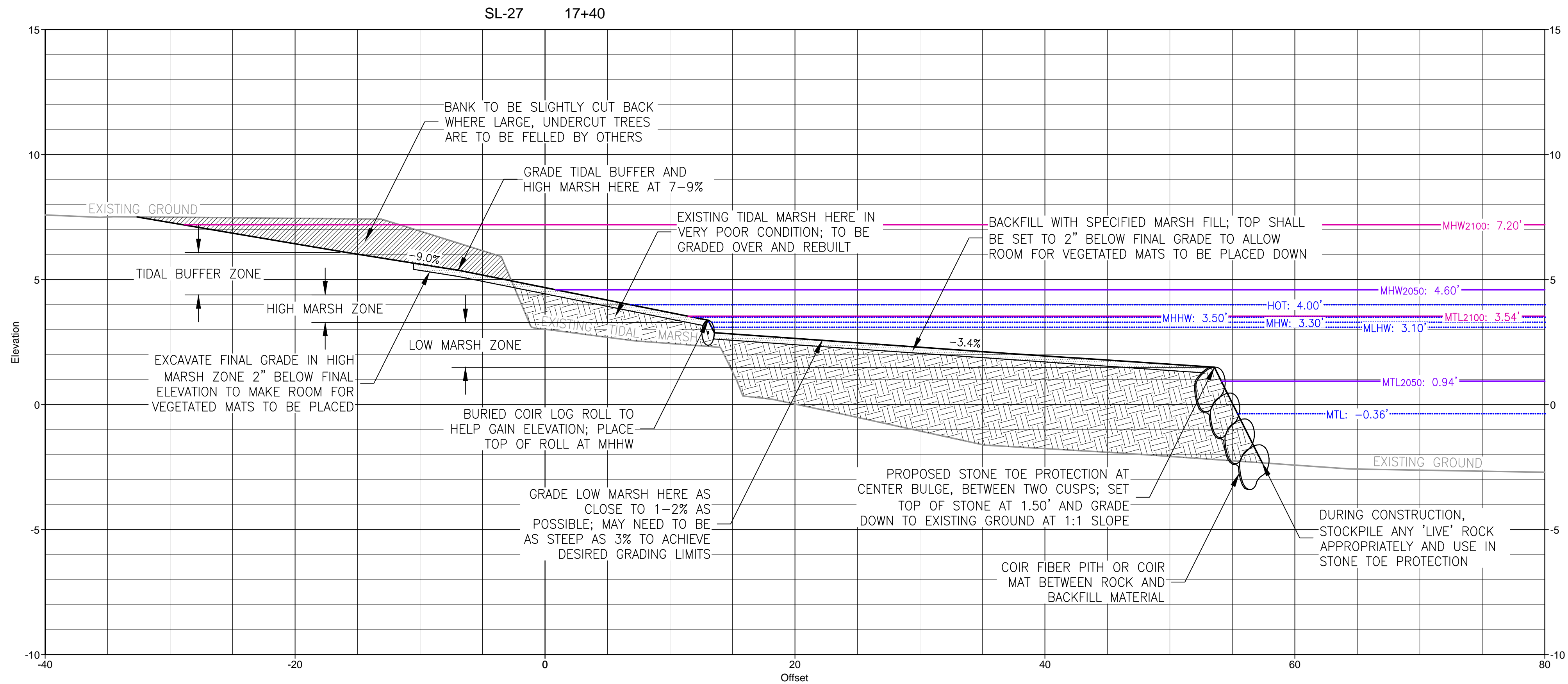


REVISION #	DATE	NOTES
1	01 MAY 2019	MAJOR CHANGES TO SOUTHWEST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS

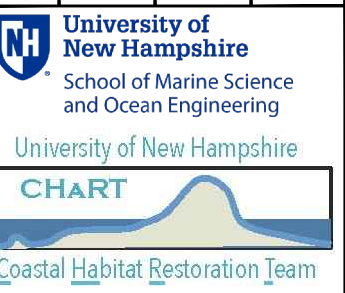
SHEET TITLE: CROSS SECTIONS 25 & 26
SHEET SET: 100% DESIGN PLANS
PROJECT NAME: WAGON HILL FARM SHORELINE RESTORATION
PROJECT LOCATION: WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH

2:1 VERTICAL EXAGGERATION
VERTICAL SCALE: 1" = 3'
HORIZONTAL SCALE: 1" = 6'

SHEET ID: P-XS1
SHEET NUMBER: 09 OF 15



DESIGNED BY: JCB, TPB, DMB
DRAWN BY: JCB
CHECKED BY: TPB, DMB
DATE: 02 MAY 2019



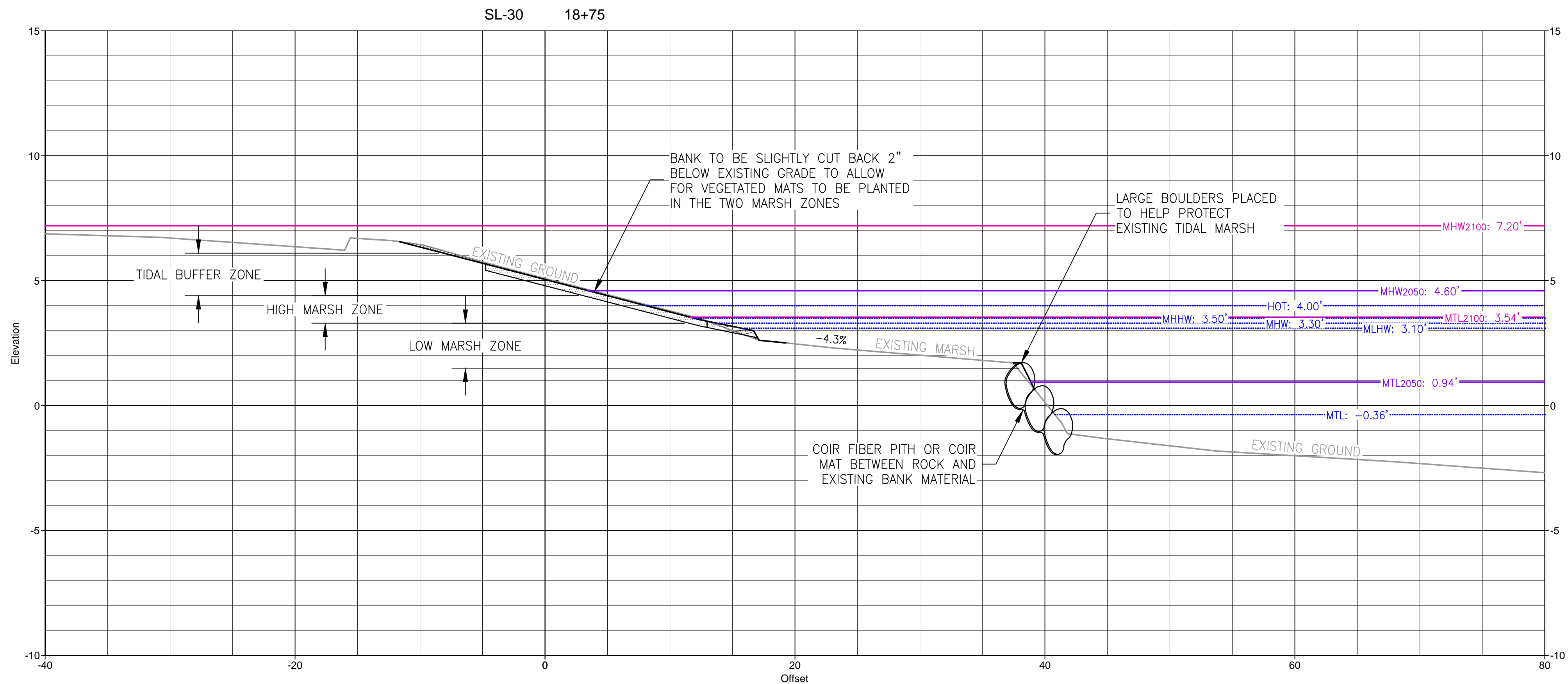
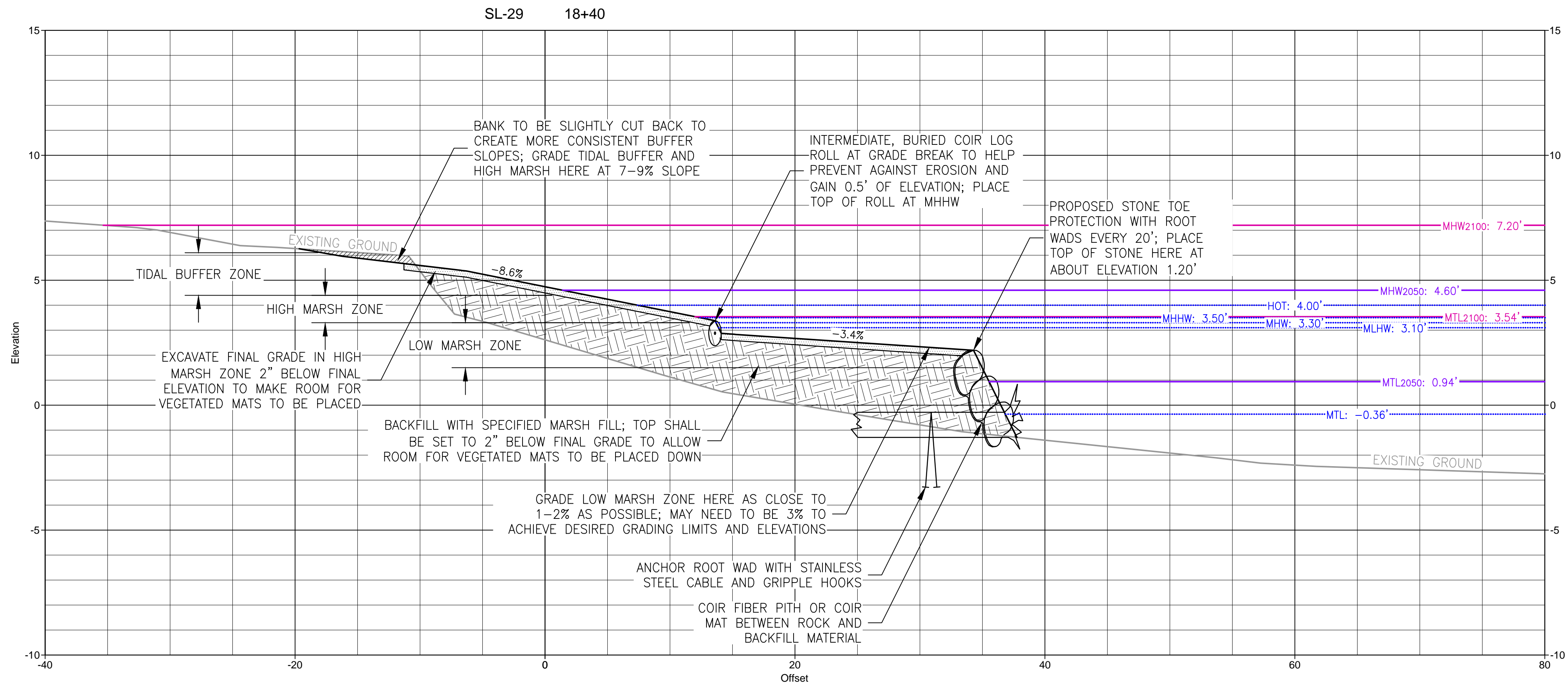
NOTES:	MAJOR CHANGES TO SOUTHWEST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS
DATE:	01 MAY 2019
REVISION #:	1

DATE:	01 MAY 2019
REVISION #:	1

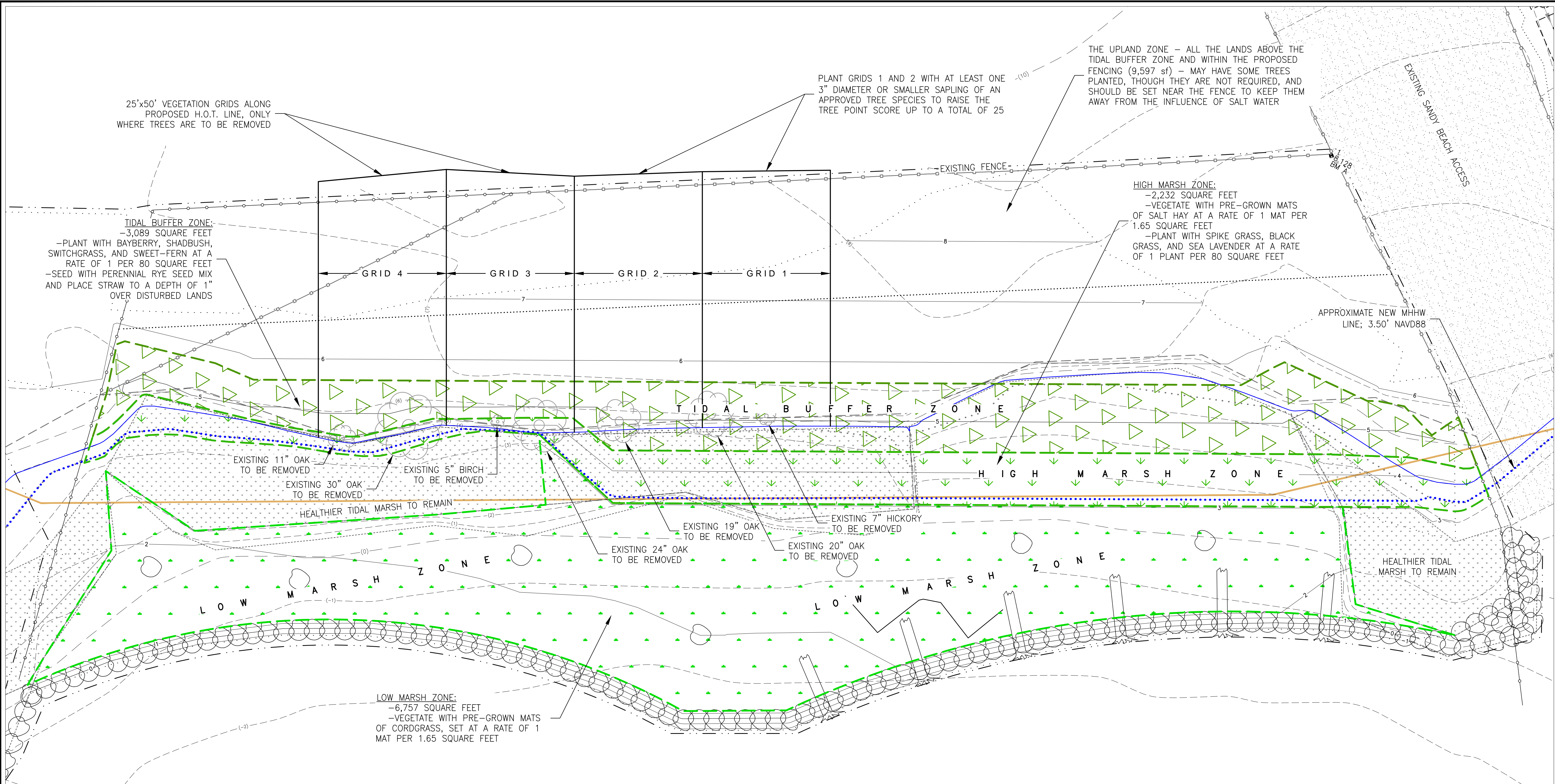
SHEET TITLE:	CROSS SECTIONS 27 & 28
SHEET SET:	100% DESIGN PLANS
PROJECT NAME:	WAGON HILL FARM SHORELINE RESTORATION
PROJECT LOCATION:	WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH

2:1 VERTICAL EXAGGERATION
VERTICAL SCALE: 1" = 3'
HORIZONTAL SCALE: 1" = 6'

SHEET ID: P-XS2
SHEET NUMBER: 10 OF 15

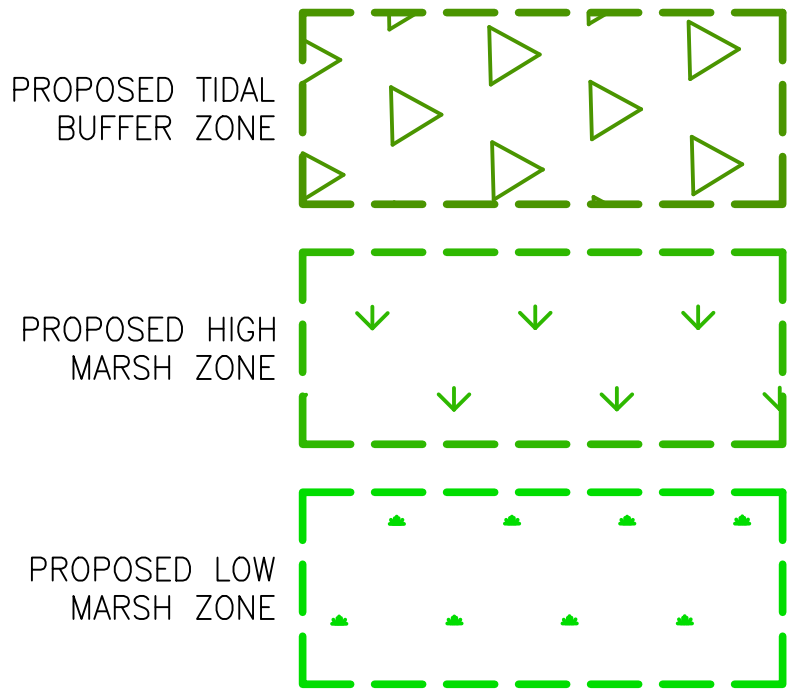


DESIGNED BY: JCB, TPB, DMB	CHECKED BY: JCB	DATE: 02 MAY 2019
UNIVERSITY OF NEW HAMPSHIRE SCHOOL OF MARINE SCIENCE AND OCEAN ENGINEERING CHART Coastal Habitat Restoration Team		
NOTES: MAJOR CHANGES TO SOFTENEST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS	DATE: 01 MAY 2019	REVISION #: 1
SHEET TITLE: CROSS SECTIONS 29 & 30		
SHEET SET: 100% DESIGN PLANS		
PROJECT NAME: WAGON HILL FARM SHORELINE RESTORATION		
PROJECT LOCATION: WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH		
2:1 VERTICAL EXAGGERATION VERTICAL SCALE: 1" = 3' HORIZONTAL SCALE: 1" = 6'		
SHEET ID: P-XS3		
SHEET NUMBER: 11 OF 15		



PLANT TYPE			EX GRID POINT SCORE				PRO GRID POINT SCORE			
PLANT TYPE	SIZE	SCORE	GRID 1	GRID 2	GRID 3	GRID 4	GRID 1	GRID 2	GRID 3	GRID 4
TREE	<3"	1					1	1		
TREE	>3", <=6"	5			5					
TREE	>6", <=12"	10	10			10				
TREE	>12"	15	15	15	15	15				
SHRUB*	4 sf	1					1	1	1	1
GROUND COVER*	50 sf	1					23	23	24	24
TOTAL*			25	15	20	25	25	25	25	25

*ACCORDING TO RSA 483-B:9 MINIMUM SHORELAND PROTECTION STANDARDS, EXISTING GRIDS ARE SCORED FOR TREES ONLY. PROPOSED CONDITIONS MAY ACCOUNT FOR SHRUBS/PLANTS AND GROUND COVER. SHRUBS/PLANTS AND GROUND COVER SHOULD ACCOUNT FOR AT LEAST 5 POINTS PER GRID, BUT NOT MORE THAN 10 POINTS PER GRID IN PROPOSED CONDITIONS. HOWEVER, IN AGREEMENT WITH NHDES, SHRUBS AND GROUND COVER ARE HEALTHIER FOR THE PURPOSE OF THIS RESTORATION PROJECT, AND THEREFORE MAY COUNT TOWARDS THE TOTAL POINT SCORE, AS SHOWN. GRID 3 DOES NOT QUITE REACH THE 25-POINT MINIMUM, HOWEVER THESE NUMBERS ARE BASED ON THE AMOUNT OF AREA WITHIN EACH GRID BY THE STATED PLANTING RATE. ACTUAL PLANTING RATES CAN BE ADJUSTED SUCH THAT MORE SHRUBS ARE PLANTED IN GRID 3 TO ACCOUNT FOR THE SHORTAGE SHOWN IN THE TABLE.



DESIGNED BY:
JCB, TPB, DMB

DRAWN BY:
JCB

CHECKED BY:
TPB, DMB

DATE:
02 MAY 2019

University of
New Hampshire

School of Marine Science
and Ocean Engineering

University of New Hampshire

CHART

Coastal Habitat Restoration Team

NOTES:

MAJOR CHANGES TO SOFTWIST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS

DATE:
01 MAY 2019

REVISION #:
1

SHEET TITLE:
PLANTING PLAN

SHEET SET:
100% DESIGN PLANS

PROJECT NAME:
WAGON HILL FARM SHORELINE RESTORATION

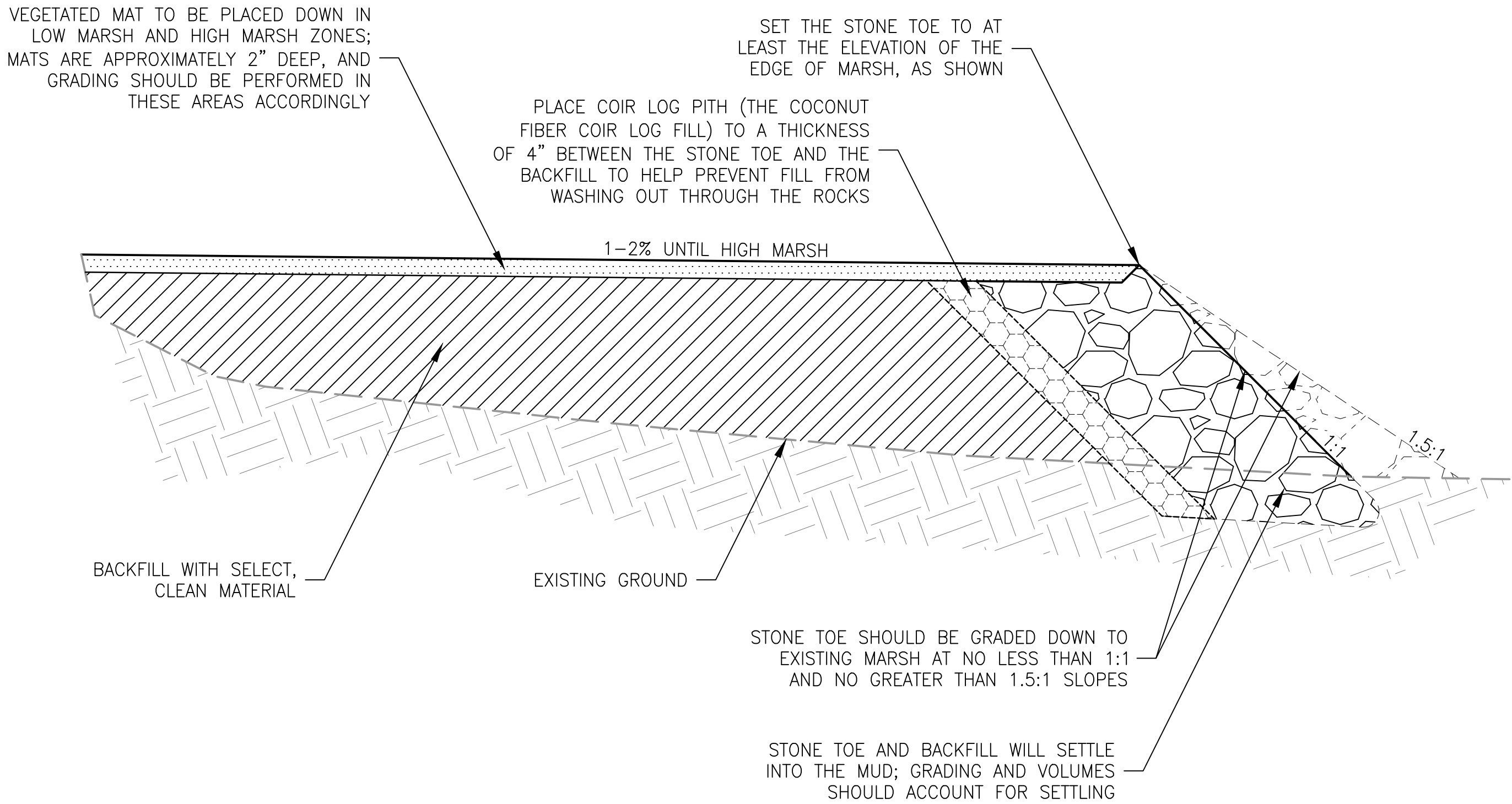
PROJECT LOCATION:
WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH

SCALE: 1" = 10'

SHEET ID:
P-PLANT

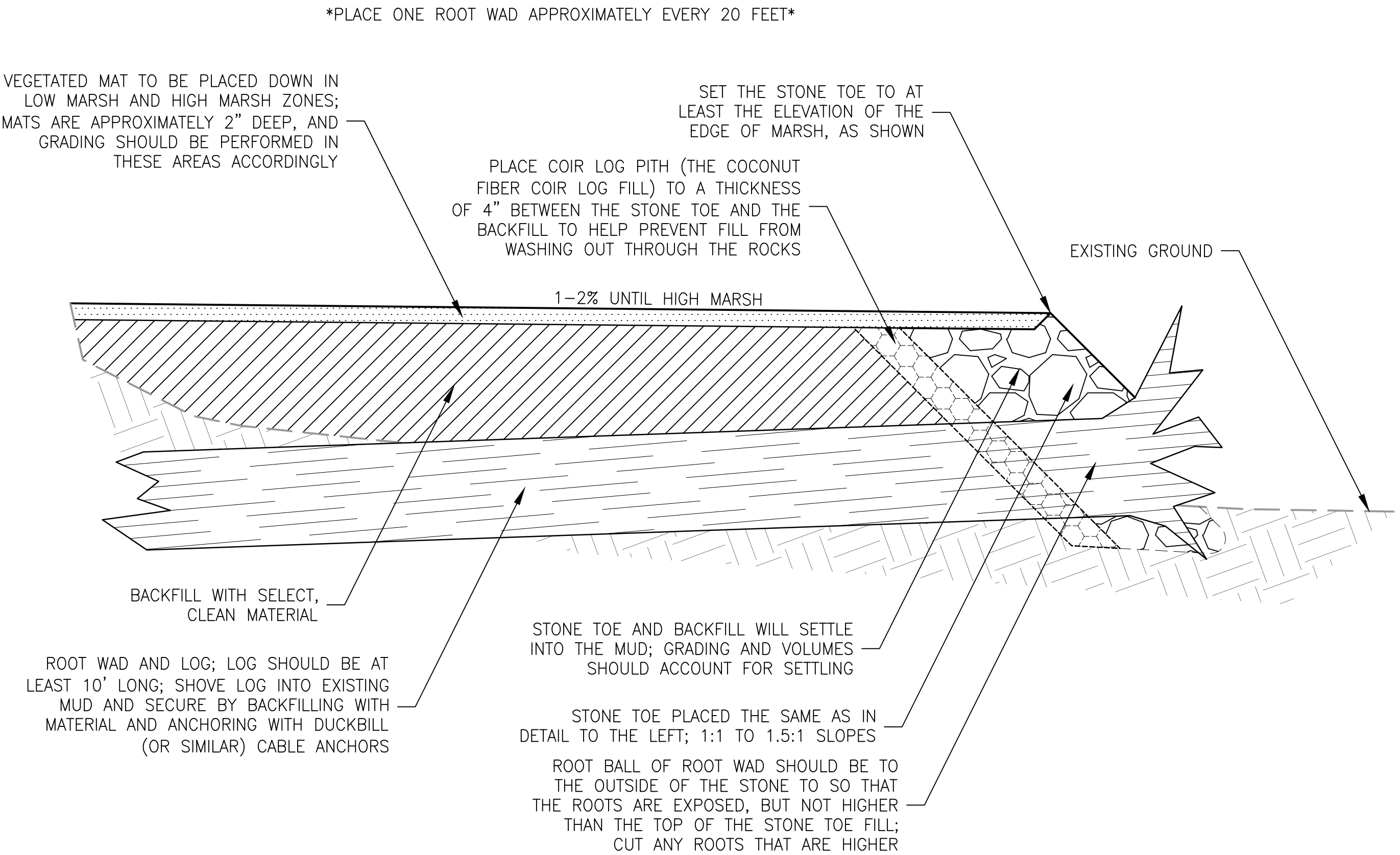
SHEET NUMBER:
12 OF 15

LARGE STONE TOE PROTECTION
STATIONS 16+00 TO 17+50

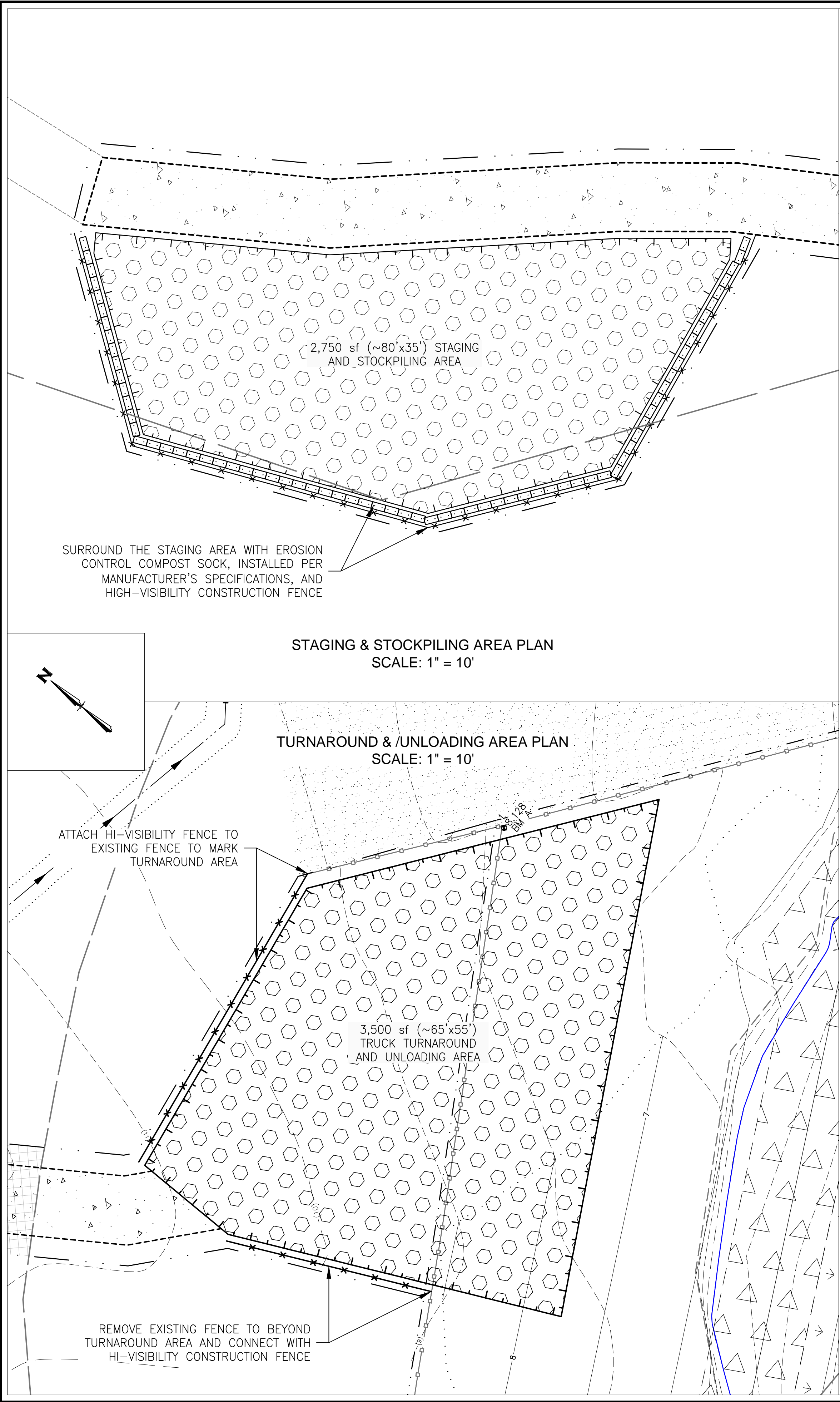


*STONE TOE ROCK SHOULD PREFERABLY CONSIST OF ANGULAR ROCK, FROM 1.0' TO 3.0' IN SIZE, WITH LESS MATERIAL OUTSIDE THAT RANGE, ULTIMATELY HAVING A COEFFICIENT OF UNIFORMITY (D60/D10) FROM 2 TO 8.

LARGE STONE AND ROOT WAD TOE PROTECTION
STATIONS 17+50 TO 18+50



DESIGNED BY: JCB, TPB, DMB	UNIVERSITY OF New Hampshire School of Marine Science and Ocean Engineering	DATE: 02 MAY 2019
DRAWN BY: JCB	CHECKED BY: TPB, DMB	
CHART Coastal Habitat Restoration Team		
NOTES: MAJOR CHANGES TO SOUTHWEST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS		
REVISION #:	DATE:	
1	01 MAY 2019	
SHEET TITLE: PROPOSED MARSH TOE DETAILS		
SHEET SET: 100% DESIGN PLANS		
PROJECT NAME: WAGON HILL FARM SHORELINE RESTORATION		
PROJECT LOCATION: WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH		
SCALE: NTS 0 5 10 15		
SHEET ID: D-TOE		
SHEET NUMBER: 13 OF 15		



NOTE:
THIS DETAIL APPLIES TO THE ACCESS ROAD TO BE BUILT FOR THE PROJECT. THE SECTION OF THIS ROAD BEGINNING WHERE THE EXISTING GRAVEL ROAD ENDS, TO THE EXISTING WOODEN CROSSING IS TO REMAIN AFTER PROJECT COMPLETION. THE SECTION BEGINNING AT THE WOODEN CROSSING AND ENDING AT THE TURNAROUND AREA IS TEMPORARY, AND SHALL BE REMOVED, BACKFILLED WITH LOAM, SEEDED, AND MULCHED, AFTER THE PROJECT HAS BEEN COMPLETED.

BACKFILL SHALL BE PLACED DOWN FLAT, THOUGH SLOPING WHERE NECESSARY, AND MAY HAVE A CROWN IN THE MIDDLE WHERE IT FOLLOWS THE EXISTING HIGH IN THE LAND

PLACE NON-WOVEN GEOTEXTILE BELOW CRUSHED STONE BACKFILL

THE EXISTING GROUND SHALL BE EXCAVATED ONLY TO A DEPTH TO REMOVE THE TOPSOIL

PLACE EROSION CONTROL COMPOST SOCK (AND CHECK DAMS, IF NECESSARY) AT THE DOWNSTREAM SIDE OF THE ACCESS ROAD; INSTALL AND MAINTAIN PER MANUFACTURER'S SPECIFICATIONS

ACCESS ROAD SHALL BE 10' WIDE AT THE TOP, AND SHALL BE PERMANENT FROM THE END OF THE EXISTING GRAVEL PATH, TO THE NORTH END OF THE EXISTING WOOD CROSSING, AND TEMPORARY FROM THE CROSSING DOWN TO THE TURNAROUND AREA

BACKFILL WITH 1" CRUSHED STONE,

TEMPORARY AND PERMANENT ACCESS ROAD SECTION
SCALE: 1" = 1'

NOTE:
THIS DETAIL APPLIES TO BOTH THE STAGING & STOCKPILING AREA AND THE TURNAROUND & UNLOADING AREA. BOTH AREAS ARE TEMPORARY, AND SHALL BE REMOVED AFTER CONSTRUCTION HAS BEEN COMPLETED, BACKFILLED WITH LOAM, SEEDED, AND MULCHED.

STAGING AND TURNAROUND AREAS SECTION
SCALE: 1" = 1'

ACCESS ROAD AND TURNAROUND AREA TO MATCH EXISTING TOPOGRAPHY

PLACE NON-WOVEN GEOTEXTILE BELOW ENTIRE AREA

PLACE HIGH-VISIBILITY CONSTRUCTION FENCE SURROUNDING AREA

PLACE EROSION CONTROL COMPOST SOCK (AND CHECK DAMS, IF NECESSARY) AT THE DOWNSTREAM SIDE OF THE TURNAROUND AREA; INSTALL AND MAINTAIN PER MANUFACTURER'S SPECIFICATIONS

~6" DEPTH OF 4" ANGULAR, CRUSHED ROCK OVER ENTIRE AREA

DESIGNED BY:
JCB, TPB, DMB

DRAWN BY:
JCB

CHECKED BY:
TPB, DMB

DATE:
02 MAY 2019

University of New Hampshire
School of Marine Science and Ocean Engineering

University of New Hampshire
CHART
Coastal Habitat Restoration Team

NOTES:	MAJOR CHANGES TO SOUPFINEST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS				
REVISION #:	1				
DATE:	01 MAY 2019				

SHEET TITLE:
ACCESS, STAGING, & UNLOADING DETAILS

SHEET SET:
100% DESIGN PLANS

PROJECT NAME:
WAGON HILL FARM SHORELINE RESTORATION

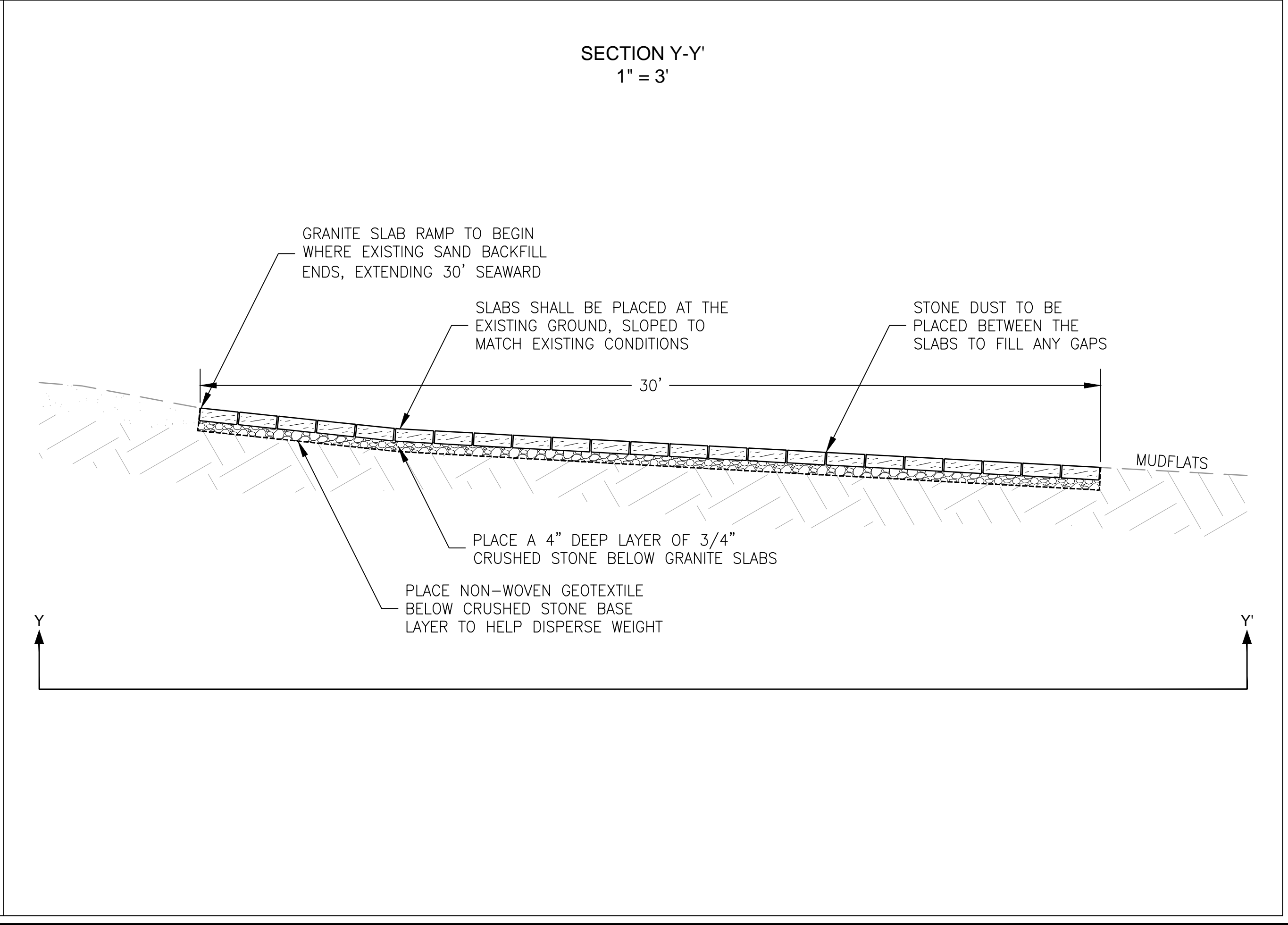
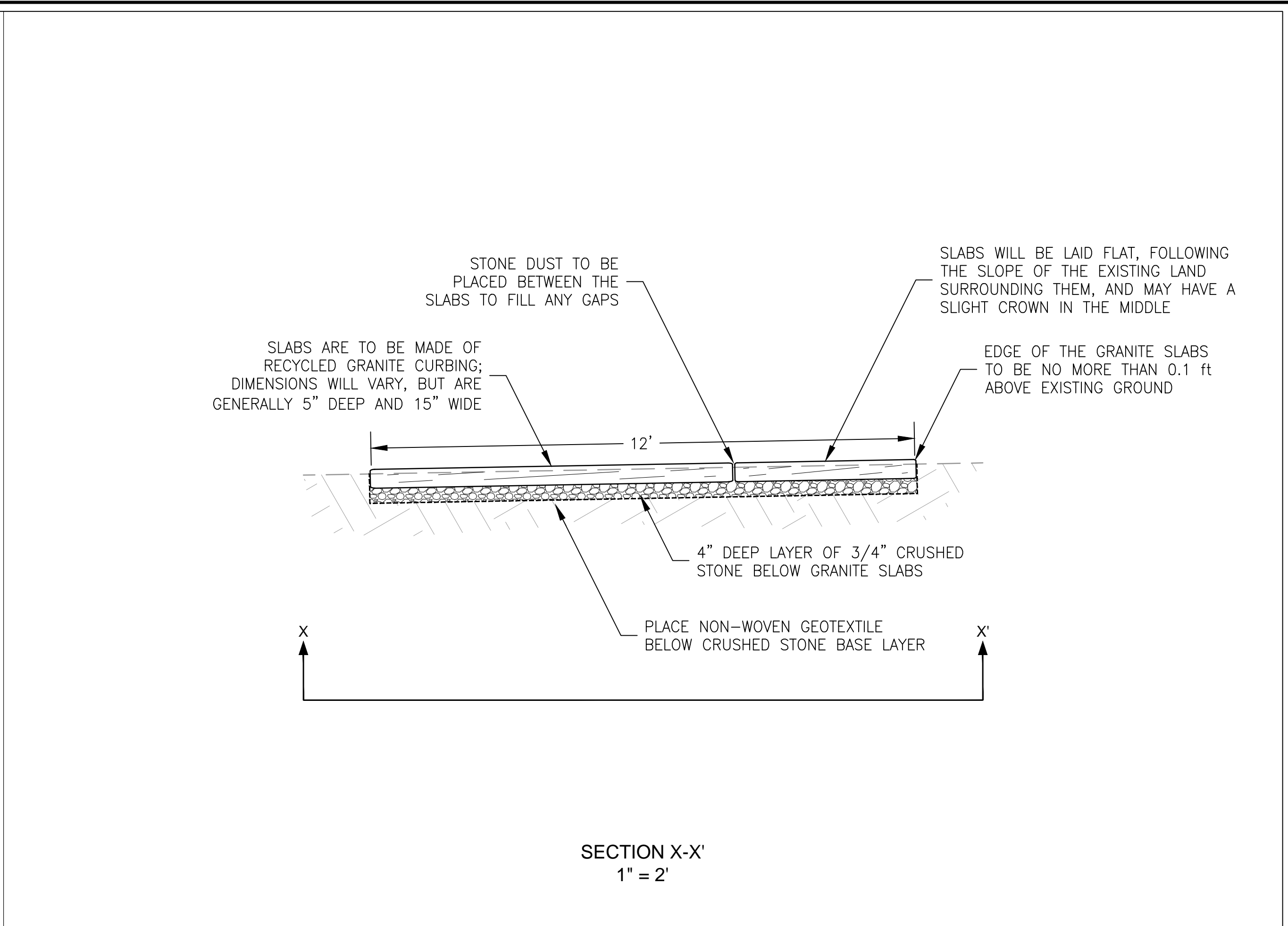
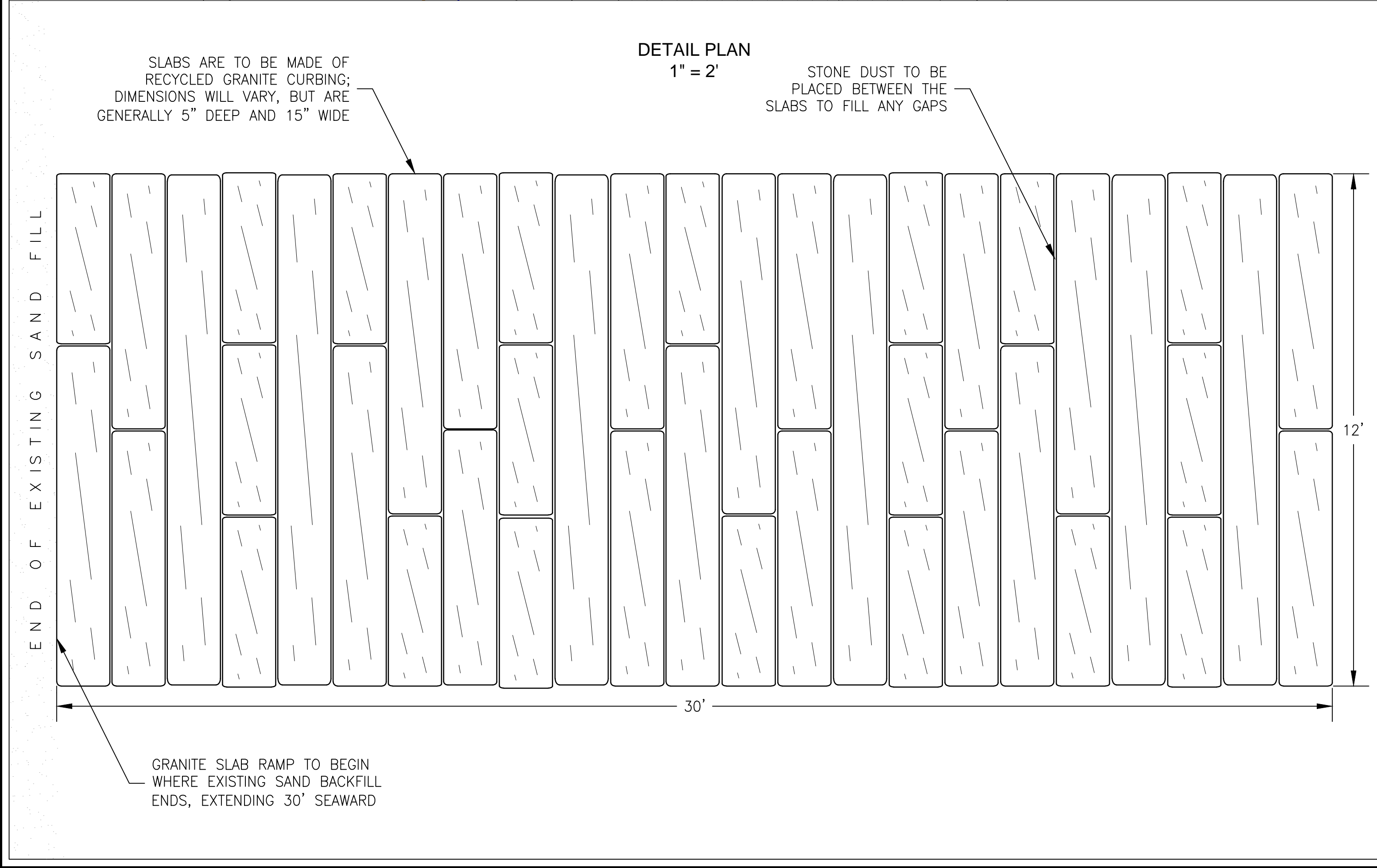
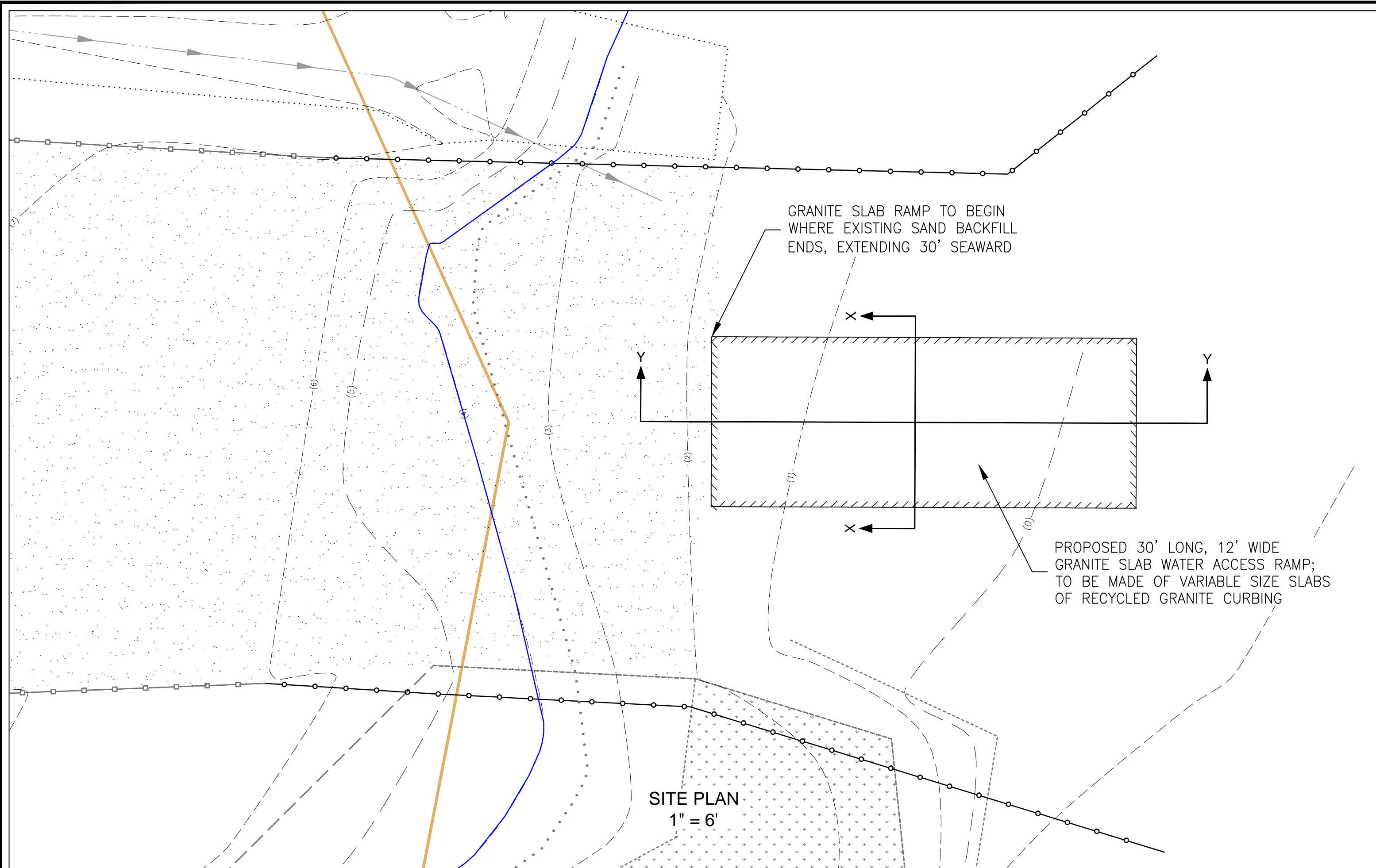
PROJECT LOCATION:
WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH

SCALE: VARIABLE

0 0.5' 1' 1.5'

SHEET ID:
D-AXS

SHEET NUMBER:
14 OF 15



DESIGNED BY: JCB, TPB, DMB	UNIVERSITY OF NEW HAMPSHIRE School of Marine Science and Ocean Engineering	DATE: 02 MAY 2019
DRAWN BY: JCB	CHART Coastal Habitat Restoration Team	
CHECKED BY: TPB, DMB		
NOTES: MAJOR CHANGES TO SOFTWEIST TOE FINISHED GRADE & ZONE RANGE ELEVATIONS		
REVISION #:	DATE:	
1	01 MAY 2019	
SHEET TITLE: GRANITE BLOCK WATER RAMP DETAIL		
SHEET SET: 100% DESIGN PLANS		
PROJECT NAME: WAGON HILL FARM SHORELINE RESTORATION		
PROJECT LOCATION: WAGON HILL FARM ON THE GREAT BAY IN DURHAM, NH		
SCALE: VARIABLE 0 0.5' 1' 1.5'		
SHEET ID: D-RAMP		
SHEET NUMBER: 15 OF 15		