Innovation at Work: Integrating Uplands with Shorelines

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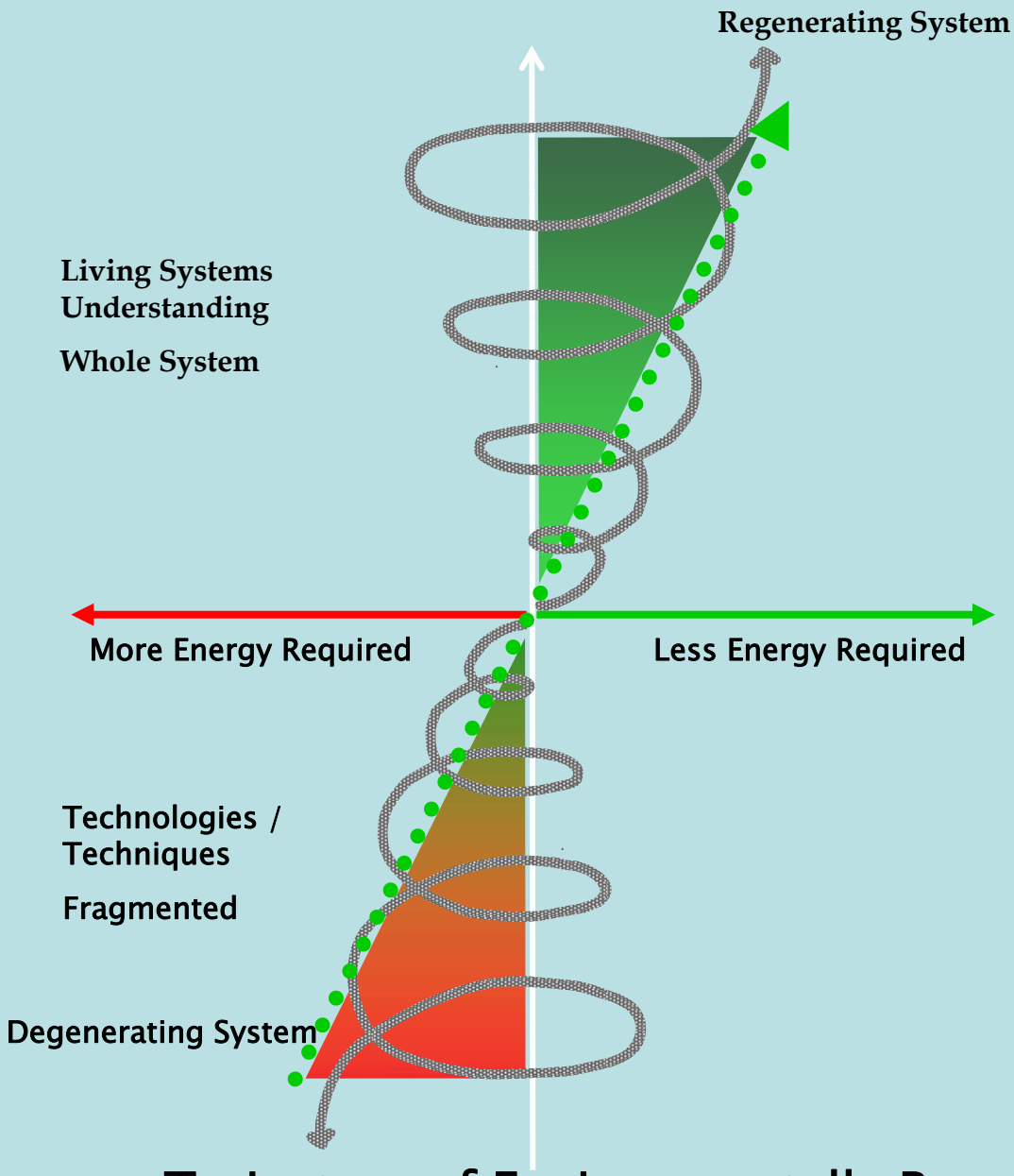


Regenerative
Humans (Hominids)
PARTICIPATING AS nature –
Co-evolution of the Whole System

Restorative

Sustainable
Neutral –
"100% less bad" (McDonough)

Green
Relative Improvement
(LEED, GB Tool, Green Globe, etc.)

Conventional Practice
"One step better than breaking the law" (Croxton)

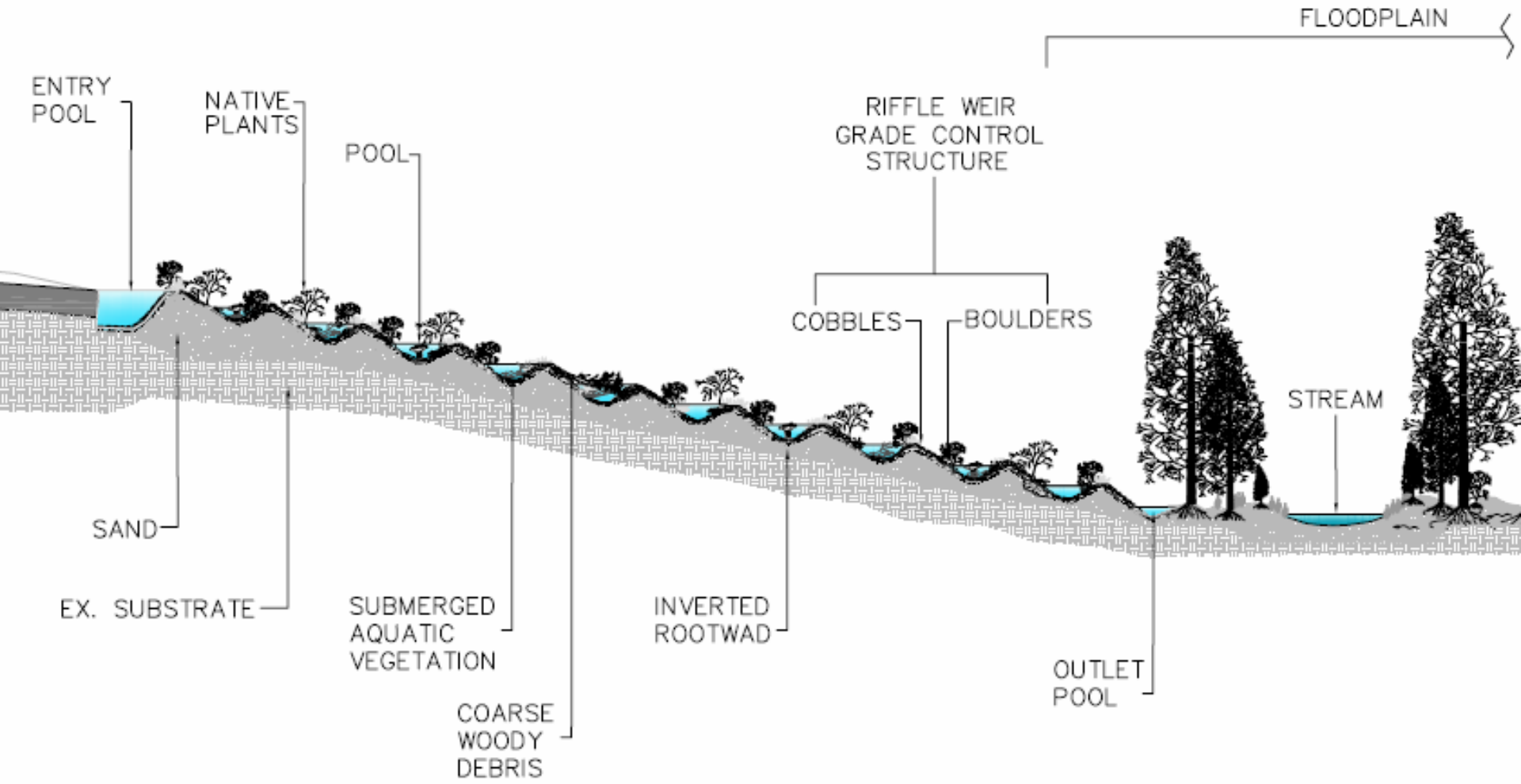
Trajectory of Environmentally Responsible Design

Integrative Design Collaborative and Regenesis 2006 – Bill Reed, reed@integrativedesign.net

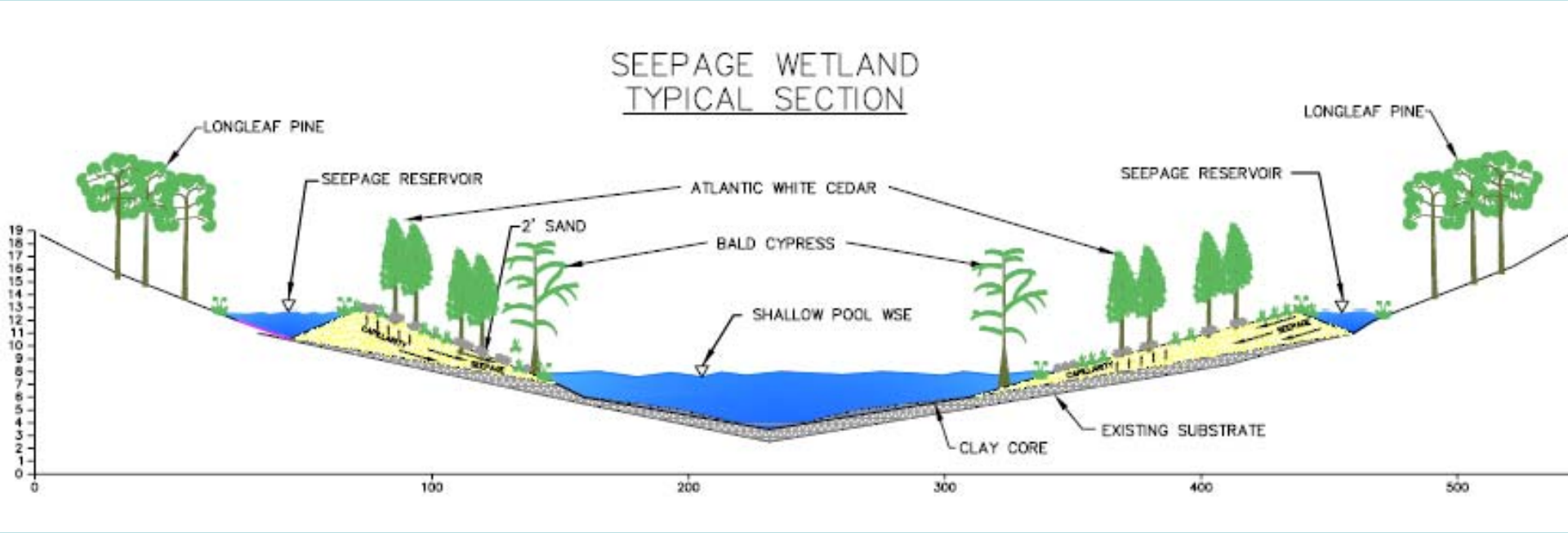
Stream and Wetlands Ecosystem Restoration Techniques

COASTAL PLAIN OUTFALL

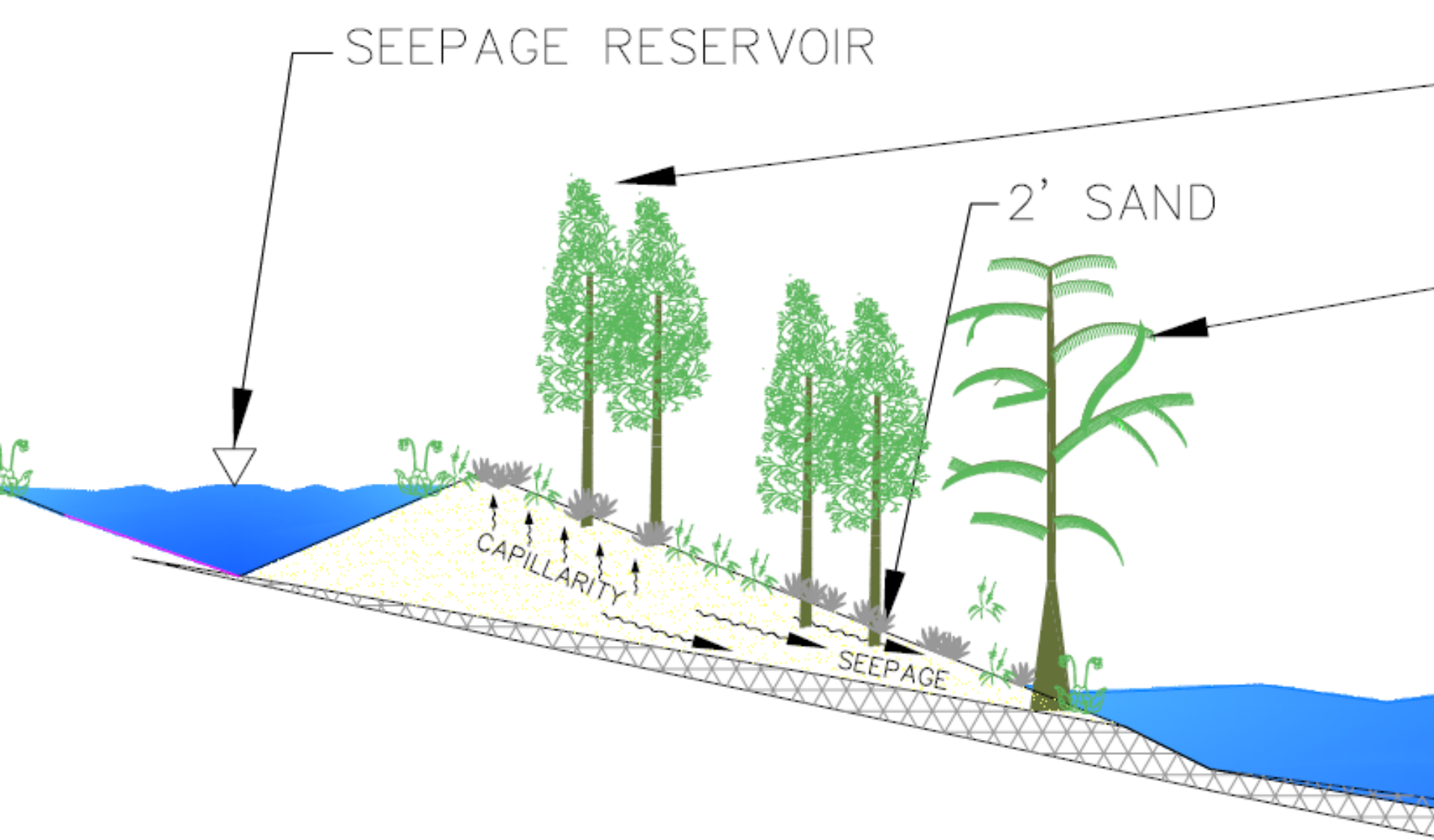
N.T.S.



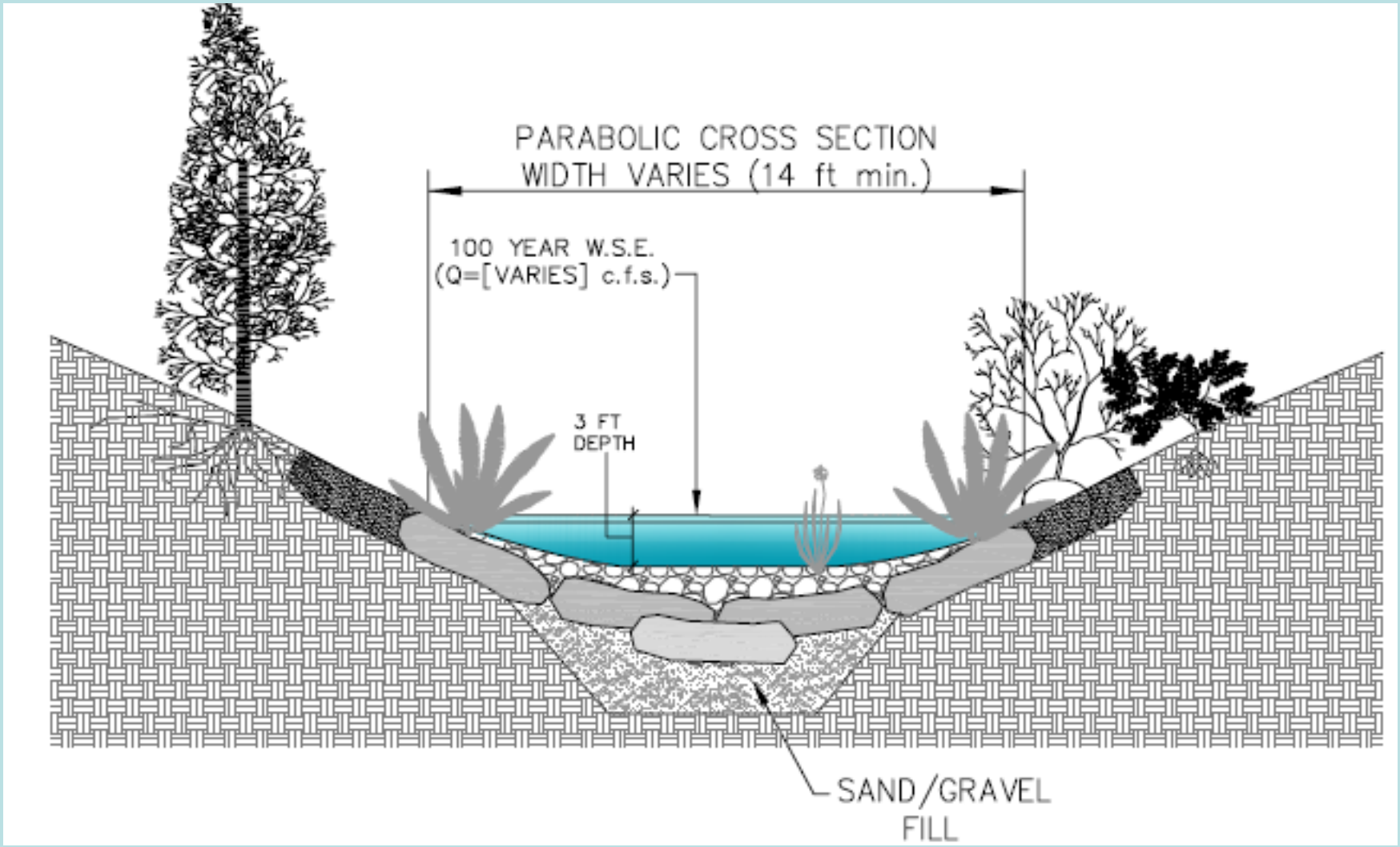

Stormwater outfalls

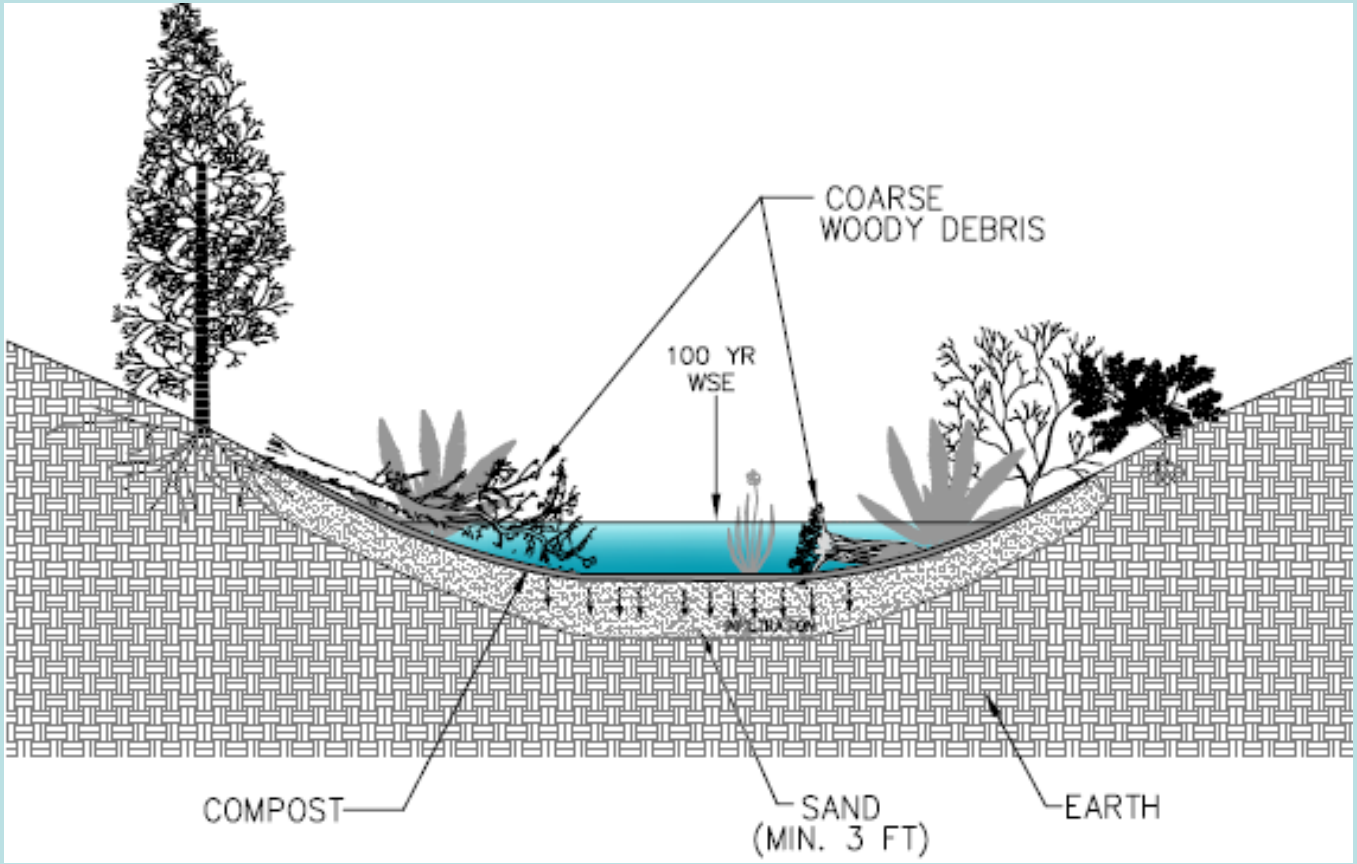

SEEPAGE WETLAND
TYPICAL SECTION
LONGLEAF PINE
SEEPAGE RESERVOIR
ATLANTIC WHITE CEDAR
2' SAND
BALD CYPRESS
SHALLOW POOL WSE
SEEPAGE RESERVOIR
LONGLEAF PINE
CLAY CORE
EXISTING SUBSTRATE
0
100
200
300
400
500


Denitrification and a host of other
TMDL-load reduction benefits



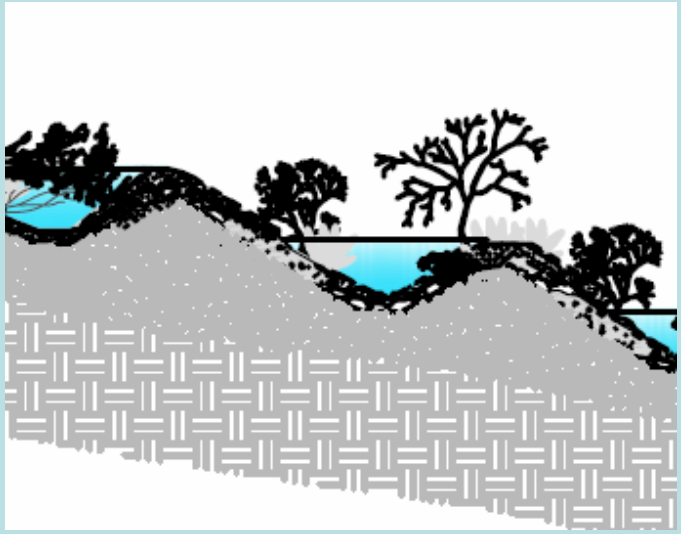
Capillarity from the seepage reservoir through the sand berm, and into the main channel


PARABOLIC CROSS SECTION
WIDTH VARIES (14 ft min.)
100 YEAR W.S.E.
(Q=[VARIES] c.f.s.)
3 FT
DEPTH
SAND/GRAVEL
FILL

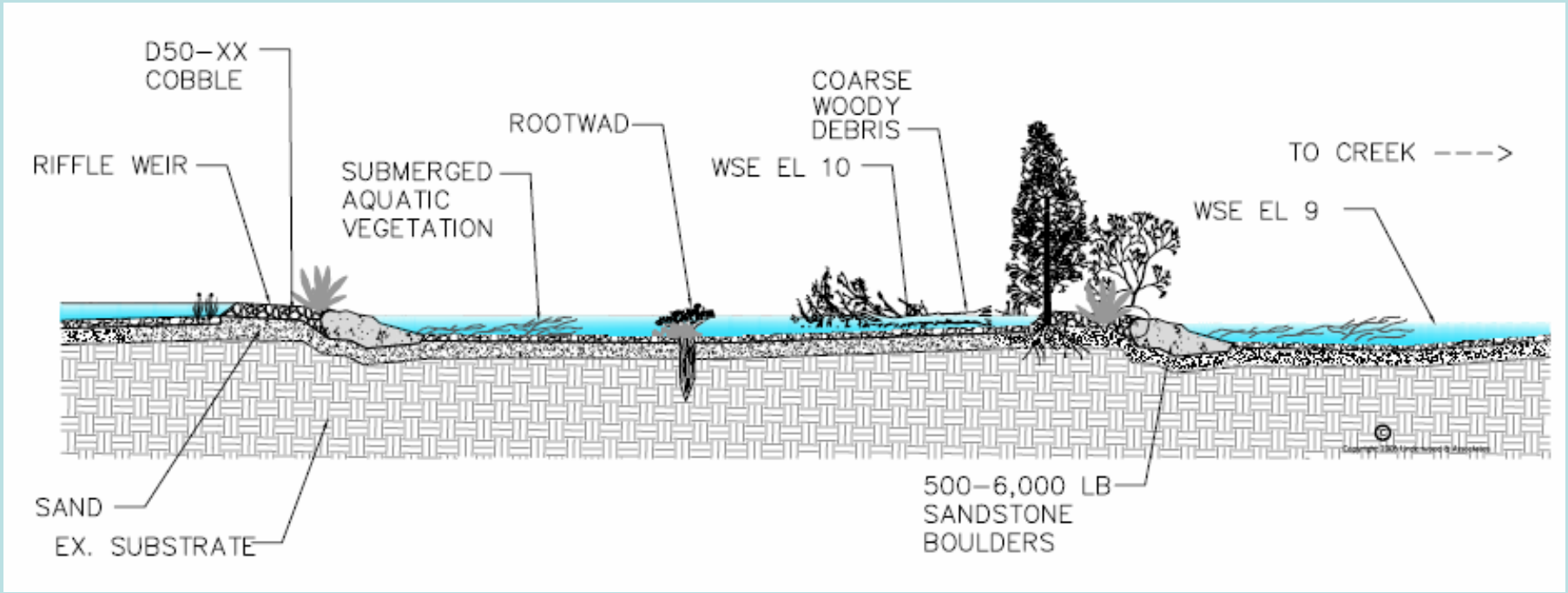

COARSE
WOODY DEBRIS
100 YR
WSE
COMPOST
SAND
(MIN. 3 FT)
EARTH


Weir construction –
Placement of footer boulders


Lining the pool with sand
& cobble



Profile views of weirs and shallow aquatic beds




Infiltration increases baseflow
and restores the natural geology


These systems are designed to mimic beaver dams


Shallow aquatic beds
separated by a weir

WHAT IS A LIVING SHORELINE?

A design and construction approach that stabilizes shorelines which seeks to mimic natural shorelines through ecological engineering.

LIVING SHORELINE

- **Dynamic** – Seeks to replicate processes found in natural shorelines. Natural shorelines are not static They shift in response to the energies delivered to that particular location. They are designed to work with the energies in a given setting instead of armoring against them.
- **3 Dimensional** consisting of lagoons, shallow aquatic beds, Tidal marsh, Beach strand tidal ponds or pools, non-tidal wetlands and forests. Seeks to integrate tidal and nontidal as well as terrestrial ecosystems.
- **Natural** -uses natural materials native to the coastal plain including woody debris
- **Biologically Diverse** re-establishes a complex natural, aesthetically pleasing, self-sustaining coastal ecosystem.
  The plants established on these sites should mimic natural coastal communities. Not a monoculture of Spartina.
- **Integrates the adjacent landscape**. Shoreline Slope is set at less than 10% where possible so that waves are able to break on shoreline up to elevation 8. These projects Seek to incorporate adjacent sub-tidal, non-tidal and terrestrial landscapes.
- **Maximizes Riparian Habitat**
  Creates high value plant and wildlife habitat that is easily accessed by Bay organisms. Minimizes blockages and obstructions to wildlife.
  retains existing tree cover.
- **Direct sediment transport-**

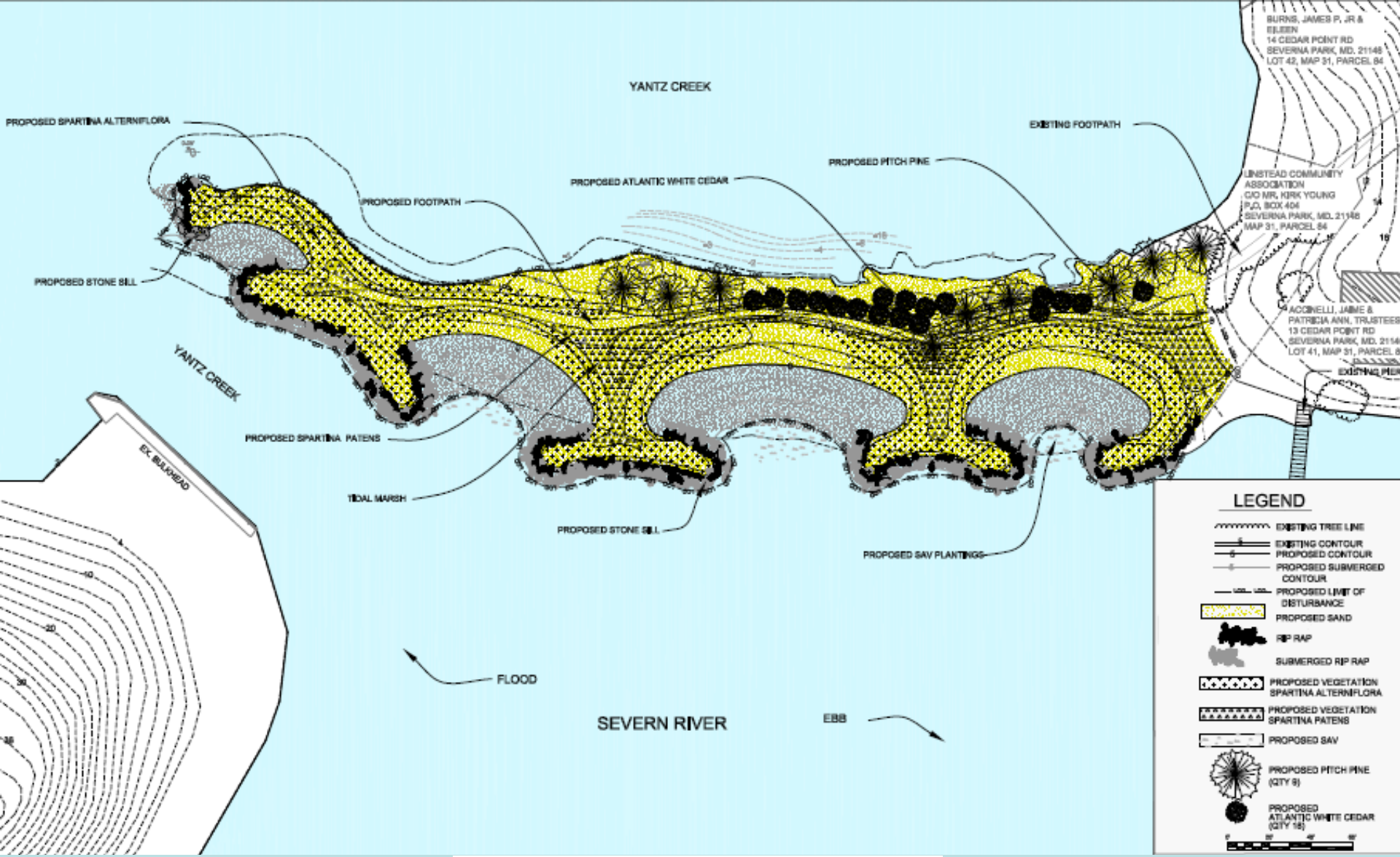
STATUS QUO

- **Static** - Designed to remain fixed in a position to armor against erosion
- **Linier** -Generally follow the existing MHW line with a band of rock sand and Spartina
- **Naturalistic -** Seeks to use natural material with a band rock sand and Spartina
- **Green –** incorporates tidal marsh plantings
- **Creates Planting Bed -** Constructed to create Spartina planting bed between MLW and + 3
- **Presents opportunity for riparian habitat** - Includes a window (often itself armored) to allow intertidal flooding into Spartina plantings.
- **Arrests Sediment Transport**

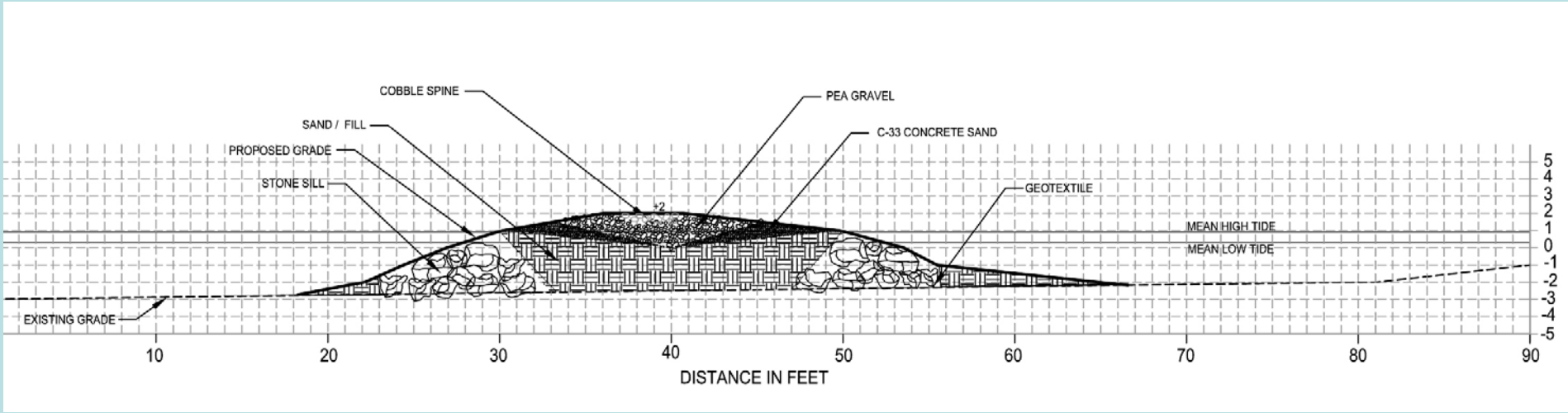
Habitat for Bay Organisms

Drevar Park

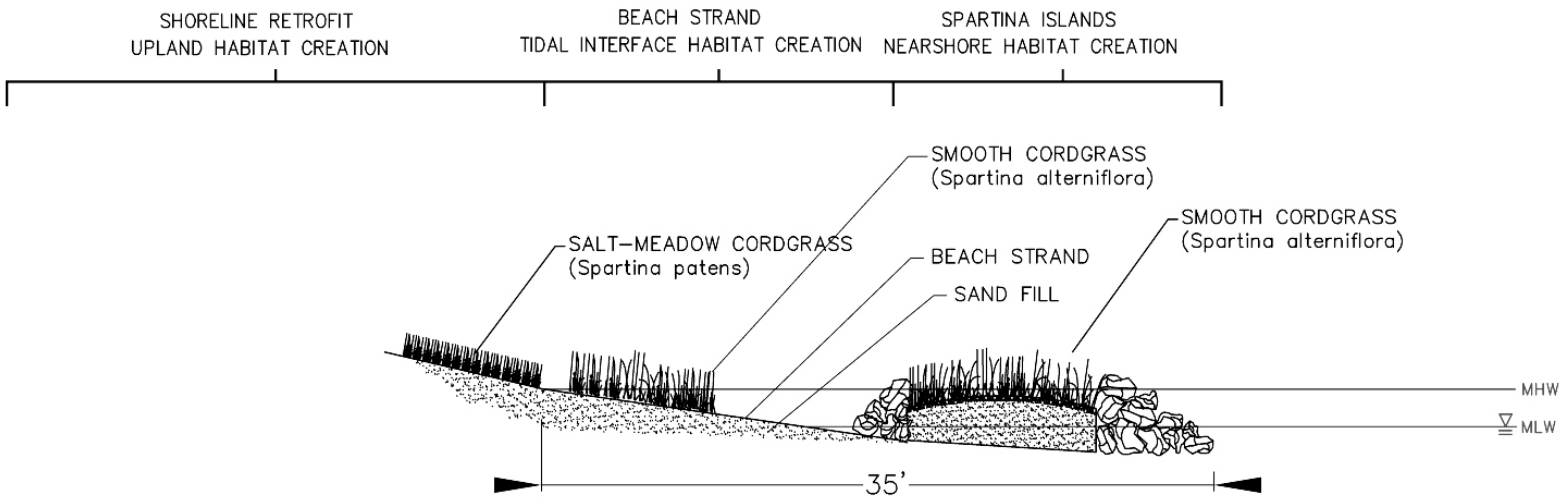
Linsted Living Shoreline



Concept Restoration Plan

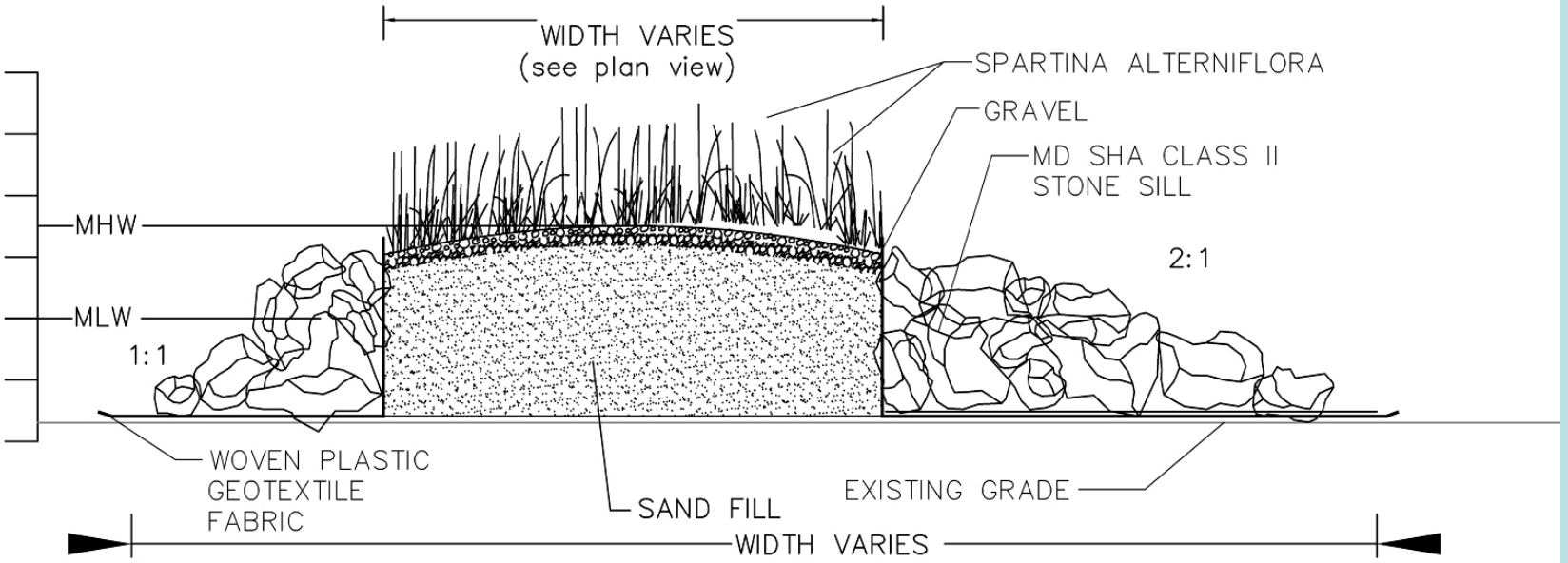

COBBLE SPINE
PEA GRAVEL
SAND / FILL
C-33 CONCRETE SAND
PROPOSED GRADE
STONE SILL
GEOTEXTILE
+2
MEAN HIGH TIDE
MEAN LOW TIDE
EXISTING GRADE
5
4
3
2
1
0
-1
-2
-3
-4
-5
10
20
30
40
50
60
70
80
90
DISTANCE IN FEET

SHORELINE RESTORATION & HABITAT CREATION



DETAIL A-A
TYPICAL PLANTING PLAN

SHORELINE RESTORATION
& HABITAT CREATION

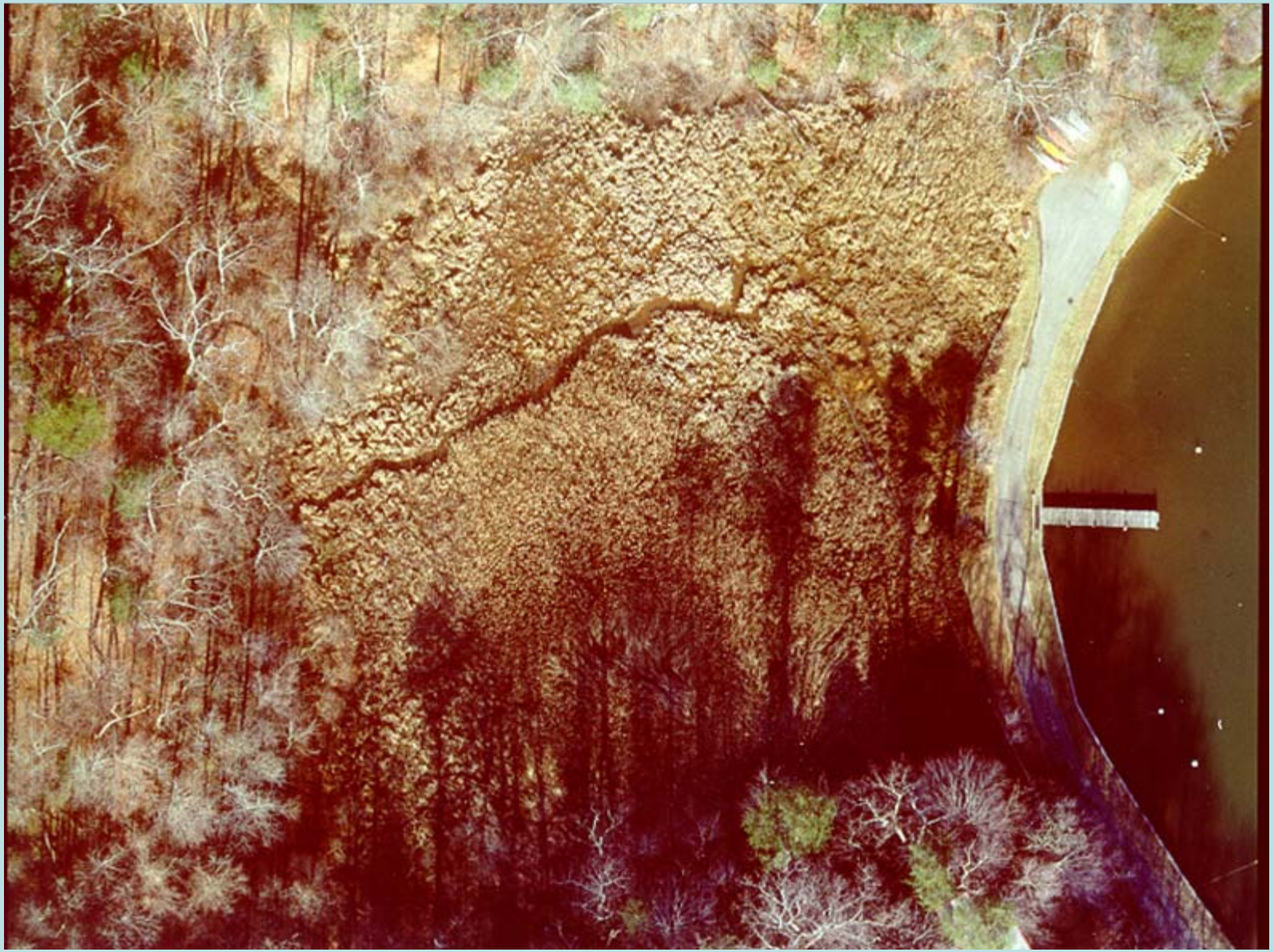


DETAIL A
TYPICAL HEADLAND BREAKWATER
CROSS SECTION

NOT TO SCALE

Stormwater management

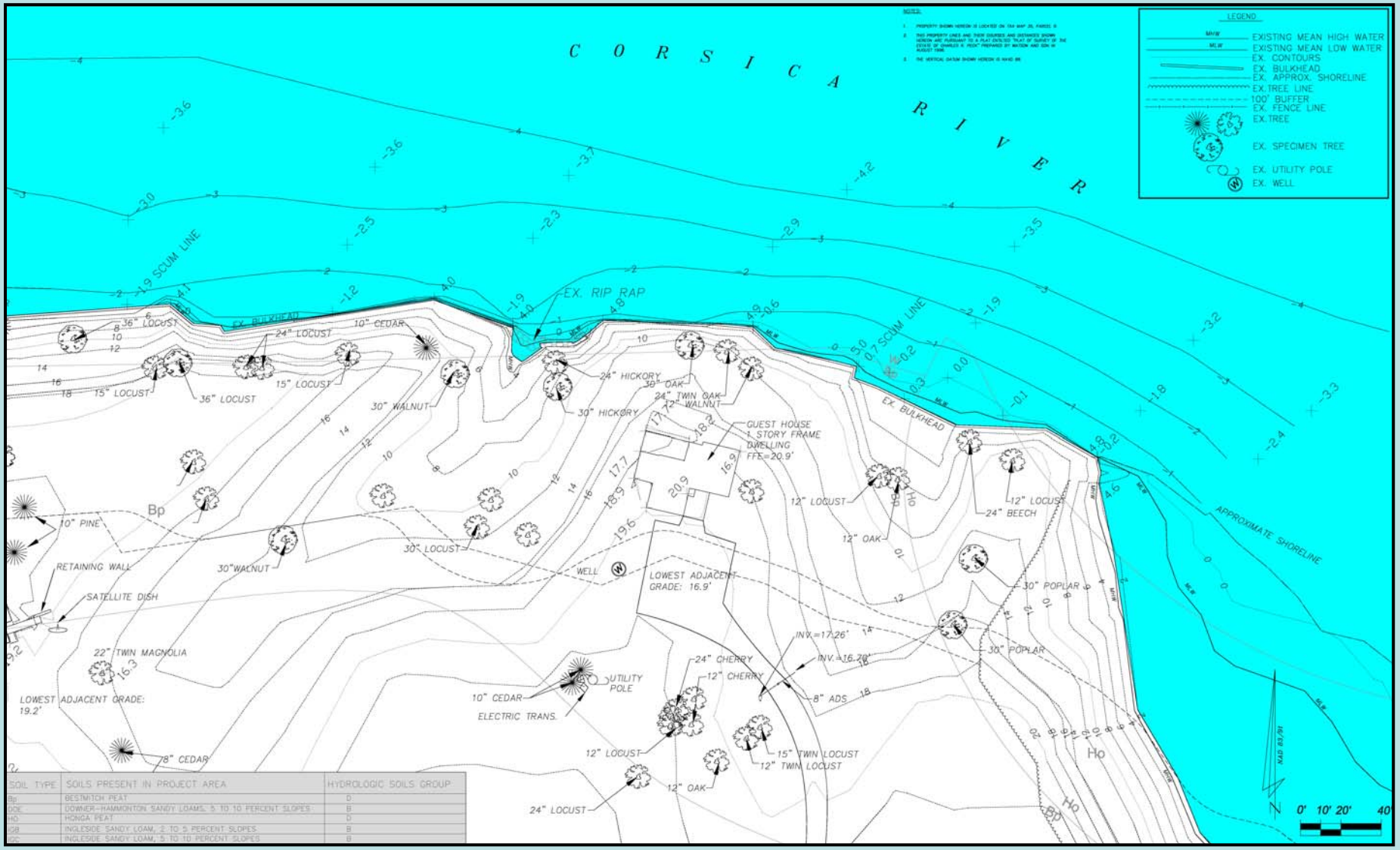
Hidden Pond



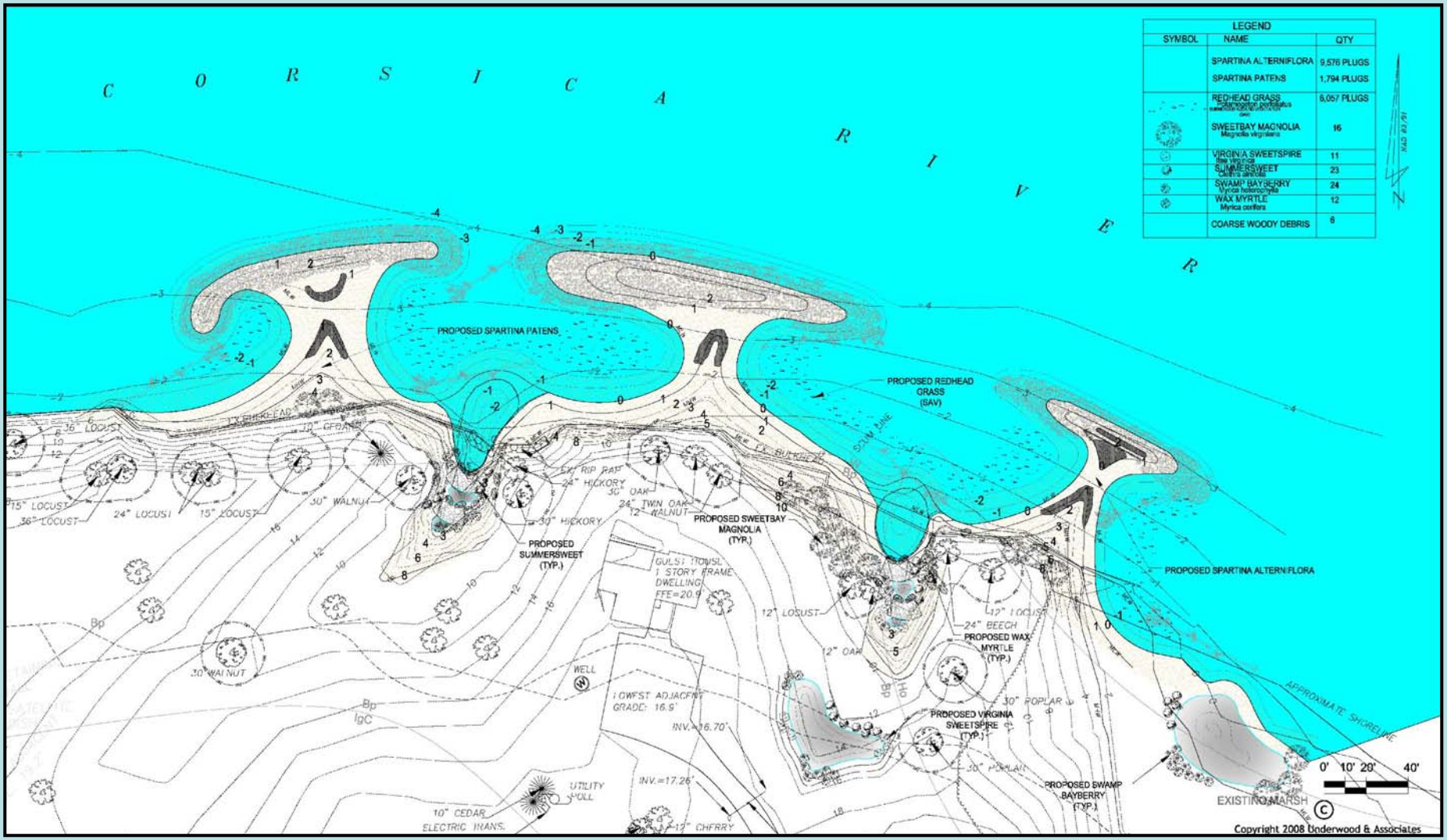

Fish passage & habitat
restoration

Windy Hill

The Evolution of Design



SOIL TYPE	SOILS PRESENT IN PROJECT AREA	HYDROLOGIC SOILS GROUP
Bp	BESTWITCH PEAT	D
DOE	DOWNER-HAMMONTON SANDY LOAMS, 5 TO 10 PERCENT SLOPES	B
HO	HONGA PEAT	D
IGB	INGLESIDE SANDY LOAM, 2 TO 5 PERCENT SLOPES	B
IGC	INGLESIDE SANDY LOAM, 5 TO 10 PERCENT SLOPES	B


LEGEND
SYMBOL
NAME
QTY
SPARTINA ALTERNIFLORA
9,576 PLUGS
SPARTINA PATENS
1,794 PLUGS
REDHEAD GRASS
6,057 PLUGS
SWEETBAY MAGNOLIA
Magnolia virginiana
16
VIRGINIA SWEETSPIRE
11
SUMMERSWEET
23
SWAMP BAYBERRY
Myrica heterophylla
24
WAX MYRTLE
Myrica cerifera
12
COARSE WOODY DEBRIS
6
CORSICA RIVER
PROPOSED SPARTINA PATENS
PROPOSED REDHEAD GRASS (SAV)
PROPOSED SWEETBAY MAGNOLIA (TYP.)
PROPOSED SUMMERSWEET (TYP.)
PROPOSED SPARTINA ALTERNIFLORA
PROPOSED WAX MYRTLE (TYP.)
PROPOSED VIRGINIA SWEETSPIRE (TYP.)
PROPOSED SWAMP BAYBERRY (TYP.)
APPROXIMATE SHORELINE
EXISTING MARSH
GULST HOUSE 1 STORY FRAME DWELLING FFE=20.9
LOWEST ADJACENT GRADE: 16.9'
INV.=16.70'
INV.=17.26'
WELL
UTILITY POLL
10" CEDAR
ELECTRIC MANS.
12" CHERRY
36" LOCUST
24" LOCUST
15" LOCUST
30" WALNUT
30" HICKORY
24" HICKORY
30" OAK
24" TWIN OAK
12" WALNUT
12" LOCUST
24" BEECH
2" OAK
30" POPLAR
EX. RIP RAP
EX. BULKHEAD
SWIM LINE
0' 10' 20' 40'
NAD 83 (91)
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Atlantic White Cedar

Native Species Planting


Restoration of reconnected
floodplain wetlands


Water lilies


Coarse, woody debris placed throughout the system

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