Bustins Island Village Corporation
Established 1913

CUMBERLAND COUNTY
SOIL & WATER
CONSERVATION DISTRICT

Bustins Island Green Infrastructure Project Final Presentation

A Maine Coastal Community Grant
September 2019 – December 2021

Presented by:
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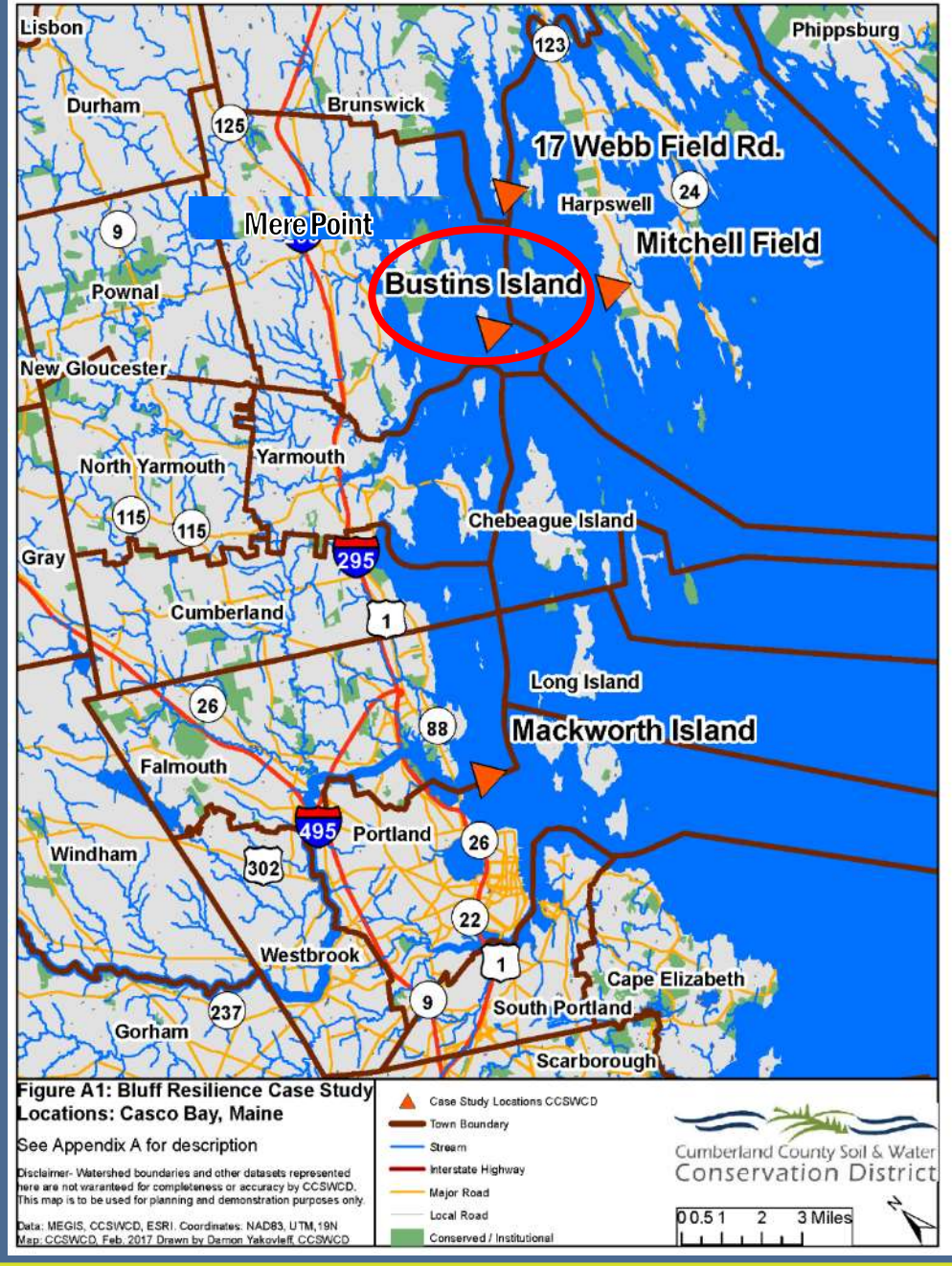
November, 2021

Bustins Island

- Off coast of Freeport
- Unbridged Island, seasonal community
- Efforts to assess and reduce bluff erosion since 2016



Building on Previous Work

- NOAA-funded project to study bluff erosion in Casco Bay
- On-island efforts to assess & experiment

INSTABILITY ASSESSMENT RATING DATA SHEET

Shoreline: ______ Rater(s): ______

Bluff/Tidal Marsh/Mud Flat/Low Bank ______ Date: ______

Photo(s): ______

Overall Bluff Condition Good Fair Poor

BLUFF ASSESSMENT

Category / Parameter / Measurement Method	Description of Bluff Condition: Good (1)	Fair (2)	Poor (3)	Rating (1/2/3)
1 Hydrology / Runoff / Ponding	[illegible]	[illegible]	[illegible]	
2 Hydrology / Runoff / Concentrated Flow	[illegible]	[illegible]	[illegible]	
3 Hydrology / Runoff / Land Use Change	[illegible]	[illegible]	[illegible]	
4 Hydrology / Runoff / Distance to Roads	[illegible]	[illegible]	[illegible]	
5 Hydrology / Runoff / Seepage	[illegible]	[illegible]	[illegible]	
6 Geomorphology / Riparian Vegetation	[illegible]	[illegible]	[illegible]	
7 Geomorphology / Sediment Supply	[illegible]	[illegible]	[illegible]	
8 Bank Slope	[illegible]	[illegible]	[illegible]	
9 Bank Height vs. High Tide Elevation	[illegible]	[illegible]	[illegible]	
10 Soil Properties: Particle Size / Stratification	[illegible]	[illegible]	[illegible]	
11 Density of Roots/ Bank Surface Protection/ % of Total Bank Height with Roots	[illegible]	[illegible]	[illegible]	
12 Biology / Landscape Connectivity	[illegible]	[illegible]	[illegible]	
[illegible]			Total Rating:	

Cumberland County Soil & Water Conservation District

Coastal Planting Guide

Planting for Slope Stabilization on Maine's Coastal Bluffs

Coastal Bluffs—defined as "a steep shoreline slope formed in sediment (loose material such as clay, sand, and gravel) that has three feet or more of vertical elevation just above the high tide line" (Maine Geological Survey)—make up about 38% of Maine's coastline. Unstable bluffs can erode slowly or suddenly collapse, forming landslides. Some amount of bluff erosion is expected, and is beneficial to replenishment of beaches and other shoreline areas. However, because of significant risks to life and property, landowners and shoreline managers may wish to temper the speed of bluff erosion and reduce the risk of sudden collapse.

The stability of a coastal bluff is influenced by interactions with both the land and sea. This guide includes information for one of the most critical factors affecting bluff erosion rates and overall stability: vegetation. When selecting plant varieties for slope stabilization, there are many factors to be considered, including salt tolerance, soil depth, and water availability. This guide recommends native Maine plants that can be used to stabilize coastal shorelines and that have been determined to be suitable for restoration that uses a living, natural shoreline instead of armoring (such as with rip rap). Plant species are organized by whether they are classified as woody or herbaceous and whether they are recommended for shallow soil (<18") or deep soil (>18").

It should be noted, however, that not all bluff shorelines are suitable for living shorelines. Prior to planting a living shoreline, see the Suitability Table (**Table 1**), to determine if your site is suitable. If a shoreline is not a suitable option for stabilization, root wads (also known as toe wood), as shown in **Figure 1**, may be used as an alternative. Root wads can help protect and armor exposed soil, particularly

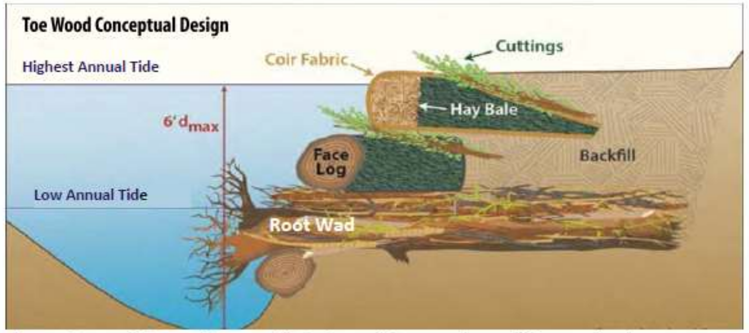


Figure 1. Root wads inserted into unstable banks can help protect bare soil from erosion. In areas not suitable for living shorelines, root wads can be an effective alternative.

Image adapted from: Bayou Preservation Association, http://www.preservingbuffalobayou.org/about-us/

09.2017

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CUMBERLAND COUNTY SOIL & WATER CONSERVATION DISTRICT

2019 Coastal Community Grant Project

- Funded by Maine Coastal Program
- Focus on managing upland runoff to reduce erosion rates on coastal bluffs
- Using low-cost, locally available methods suitable for islands
- Decentralized approach, "Low Impact Development" or LID

Project Area
Bustins Island, Freeport

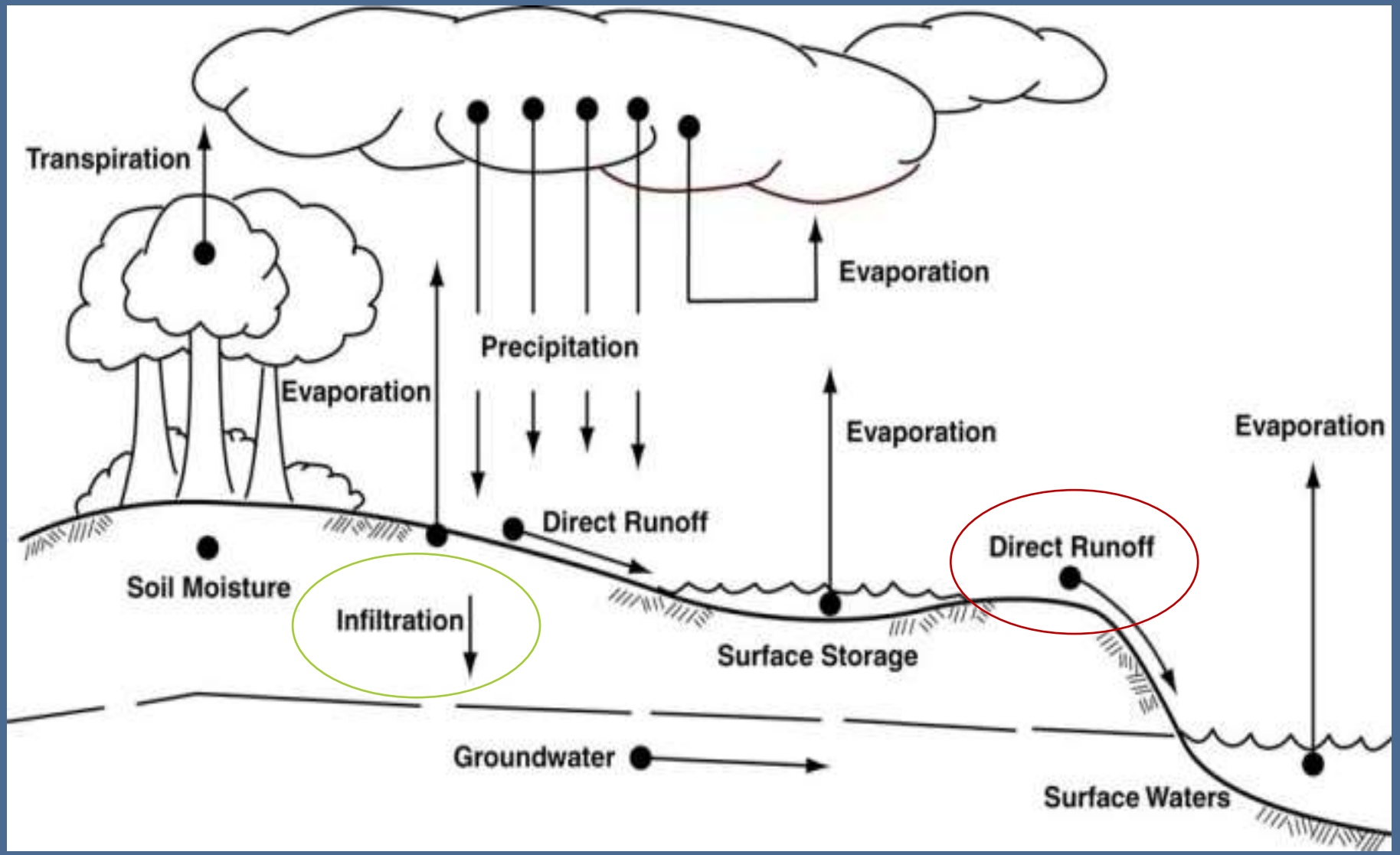
Bluff failure at location of arrow

Image source: CCSWCD

Project Goal:

To slow or capture stormwater runoff that now flows into the island's southeast sub-basin

The water cycle

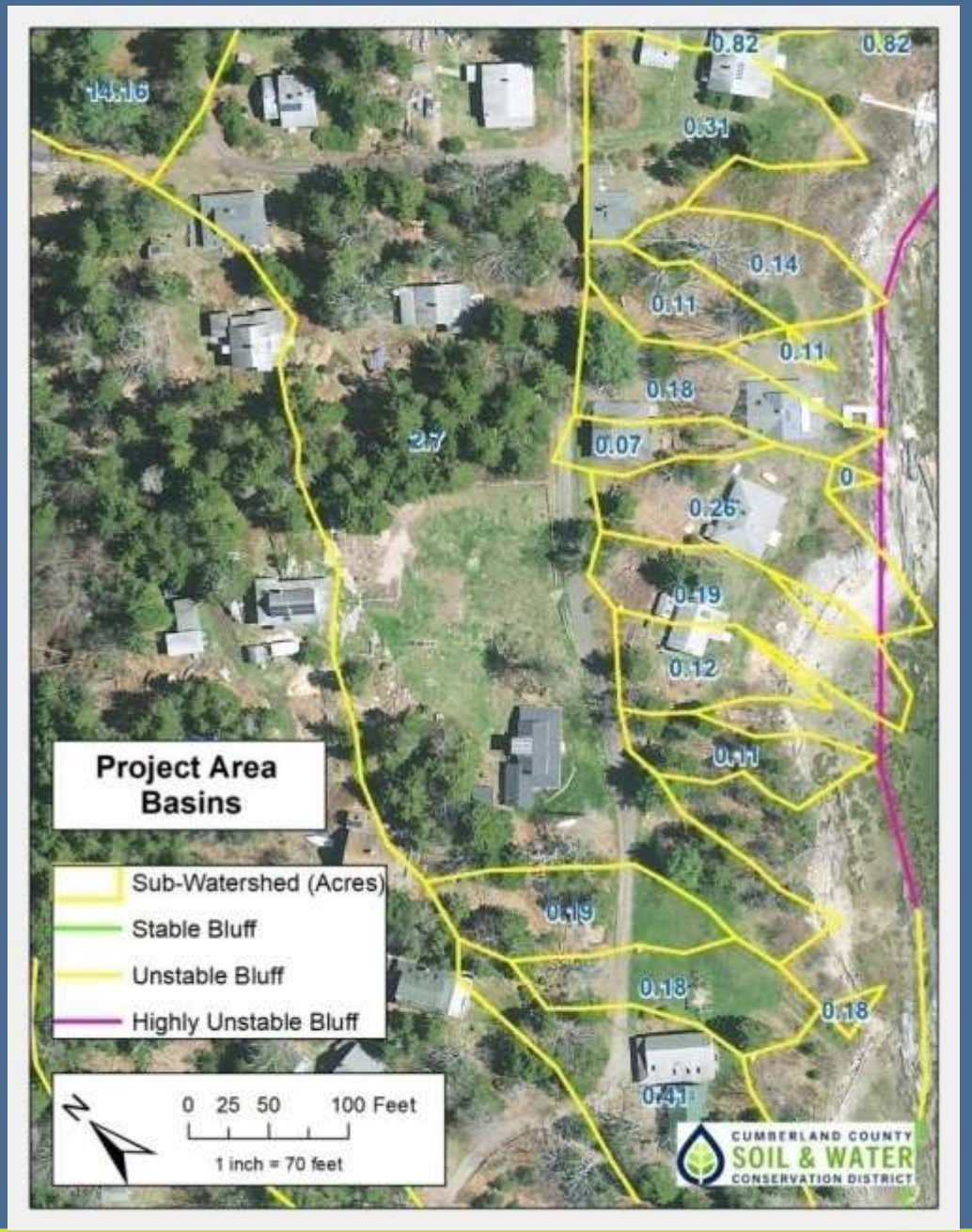


Project Method: Green Infrastructure

- Work with natural systems and materials to:
  - Recharge the aquifer
  - Protect coastal bluffs
  - Reduce road erosion
  - Restore habitats

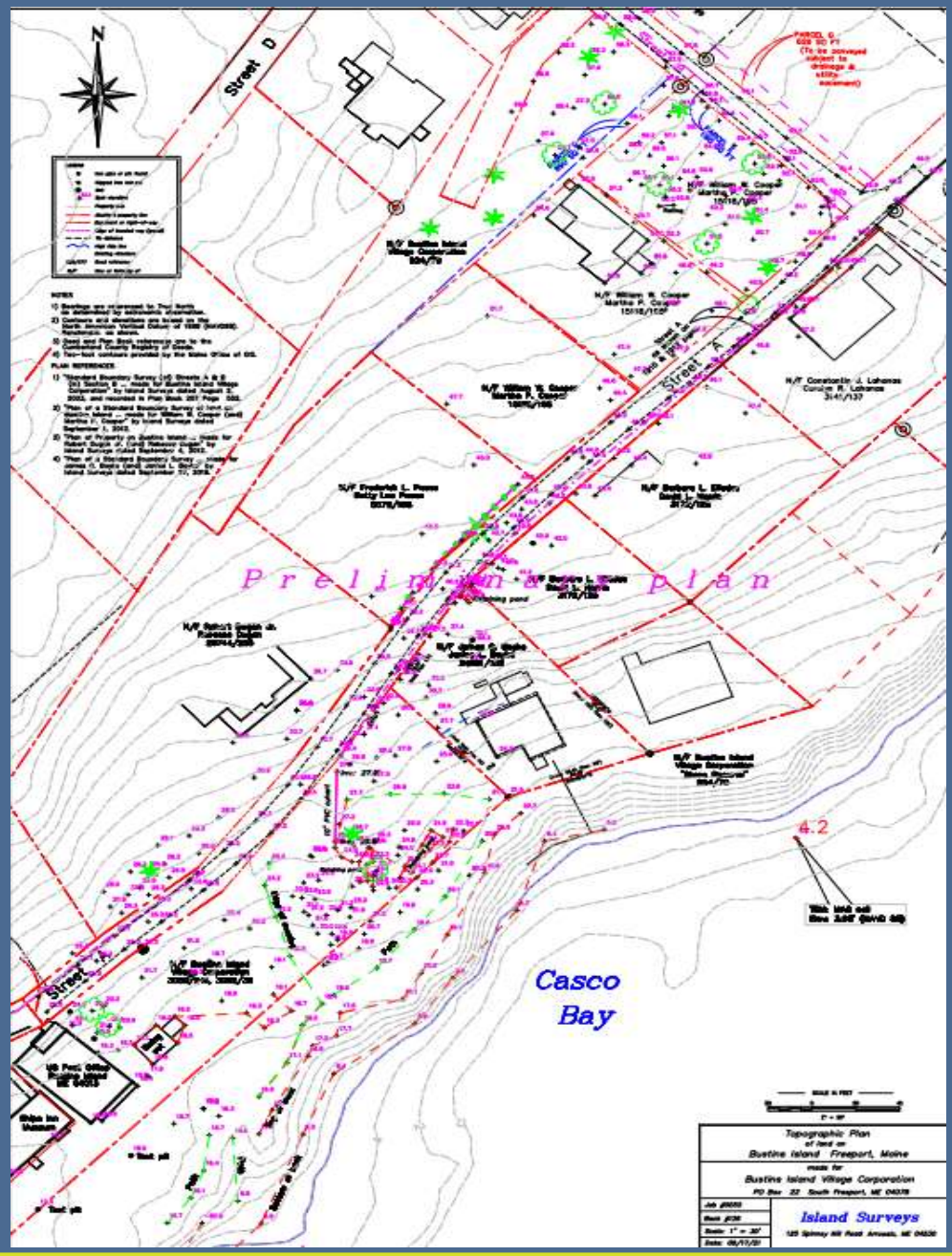
Potential for solutions

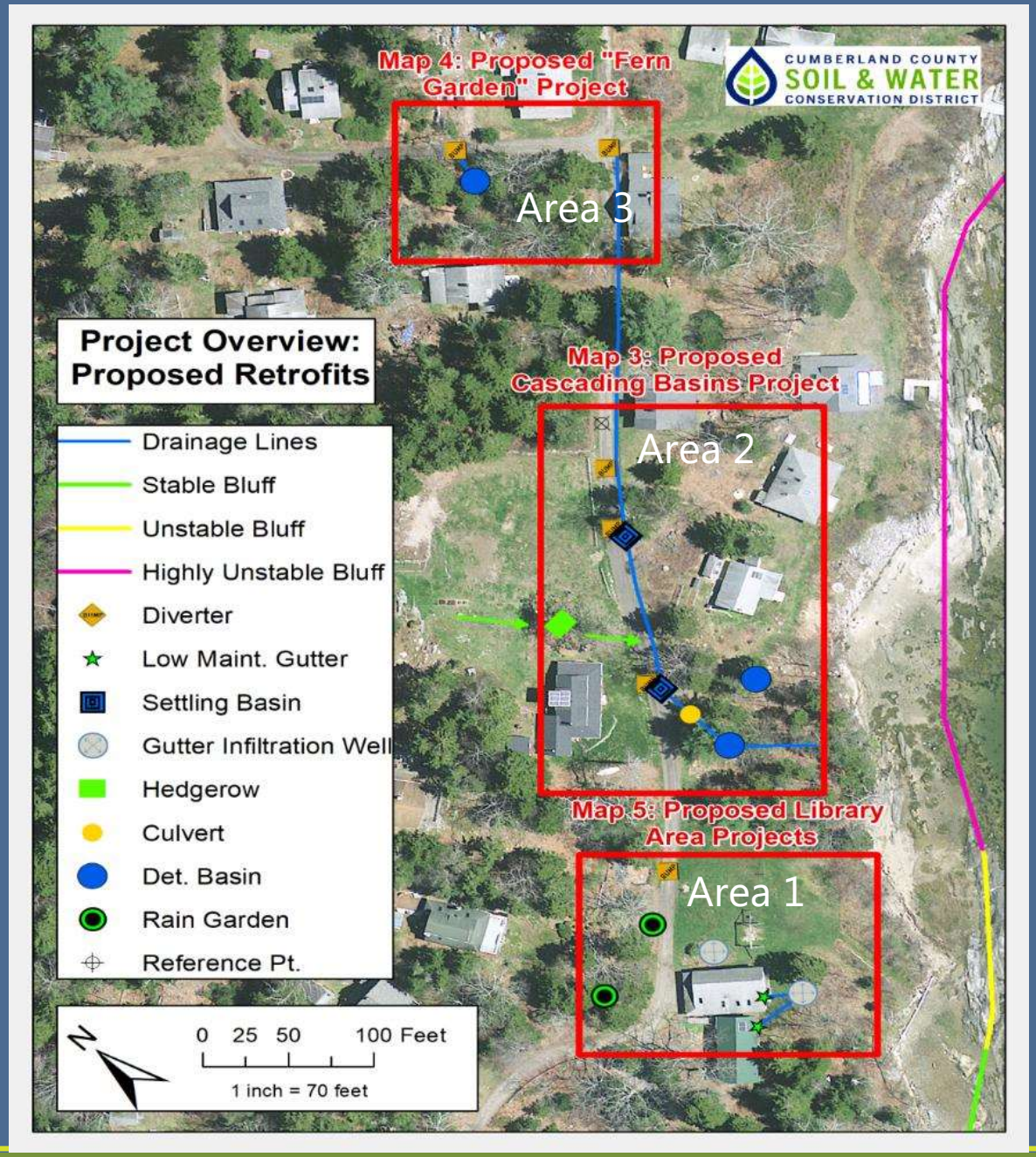
- Upland areas carrying stormwater runoff
- Sloping land to work with
- Natural basins w/good drainage
- Unbuilt areas w/ good drainage



John Woods' Topographical Survey

Contours & elevations at key points of Bustins Island's Southeast corner

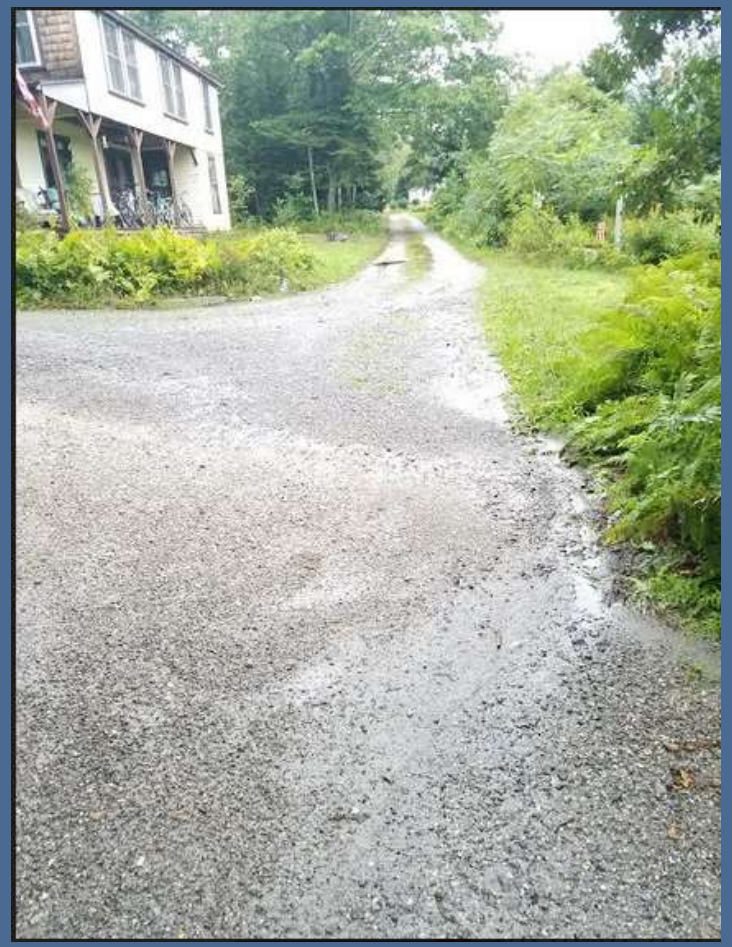




Proposed:

3 areas of focus to slow or capture stormwater now flowing into the island's southeast subbasin

Runoff from roads A & B merges at intersection near Rowe's, runs toward and over sloping hill, gaining momentum



Runoff from the hill crosses the road in front of Store Porch, runs down slope past side of library….

Runoff accumulates at lowest points: under swings, under and in back of buildings

WORK TO DATE:
Runoff is diverted by a berm in the road to a roadside basin, overflows into a ditch and culvert into…

WORK TO DATE:
Natural basins capture stormwater runoff before it reaches the playground and unstable bluffs

WORK TO DATE

With the elimination of runoff, the walking path has been rebuilt

WORK TO DATE

A reinforced outlet now directs runoff to a stable part of the bluff in a major rainstorm

WORK TO DATE:

An earthen diversion berm will force overflow runoff to a secure part of the embankment in a major rainstorm

Conceptual Designs
&
Pilot Projects

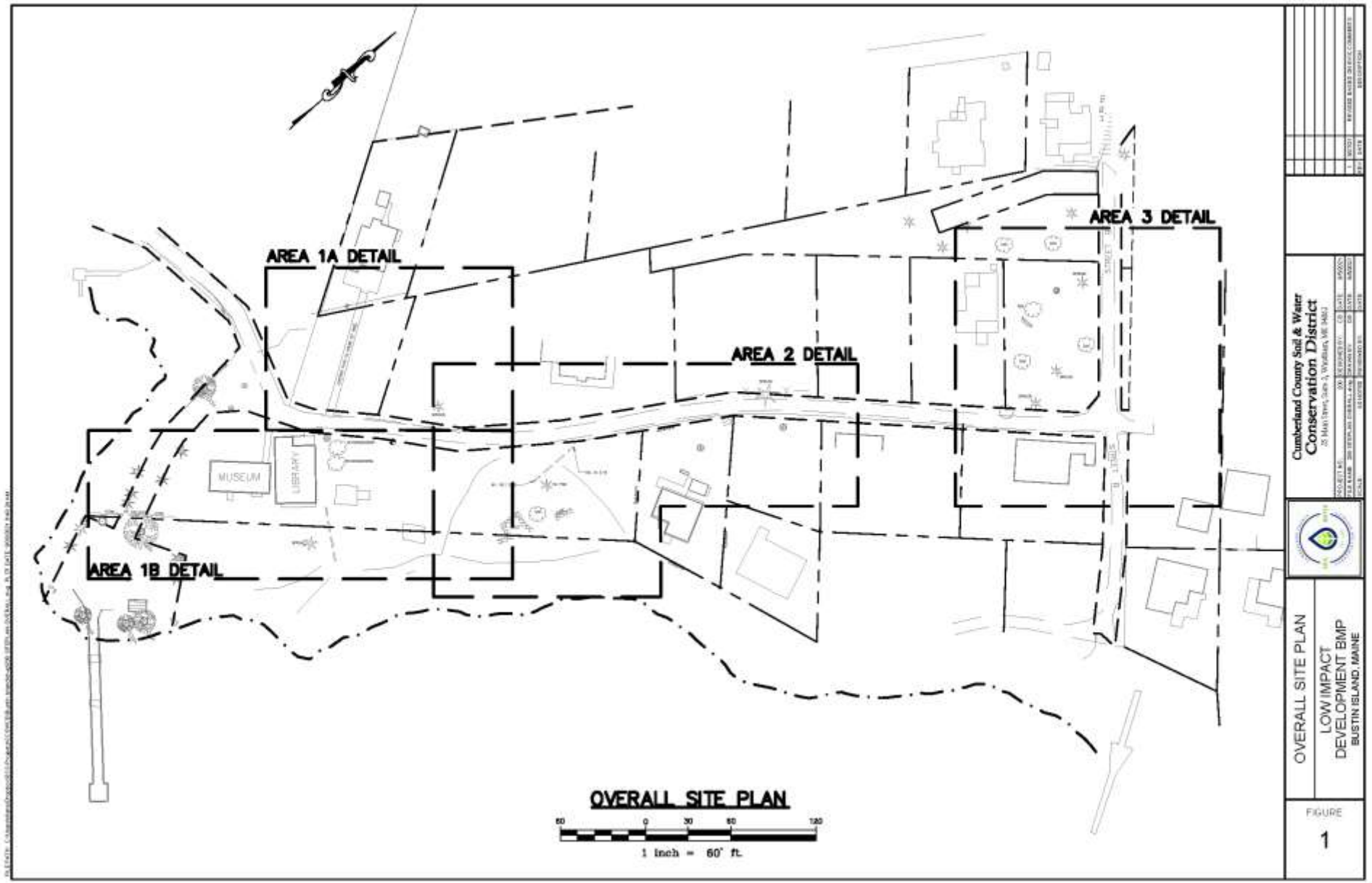
PLEASE NOTE:

CONCEPTS ARE FOR CONSIDERATION ONLY

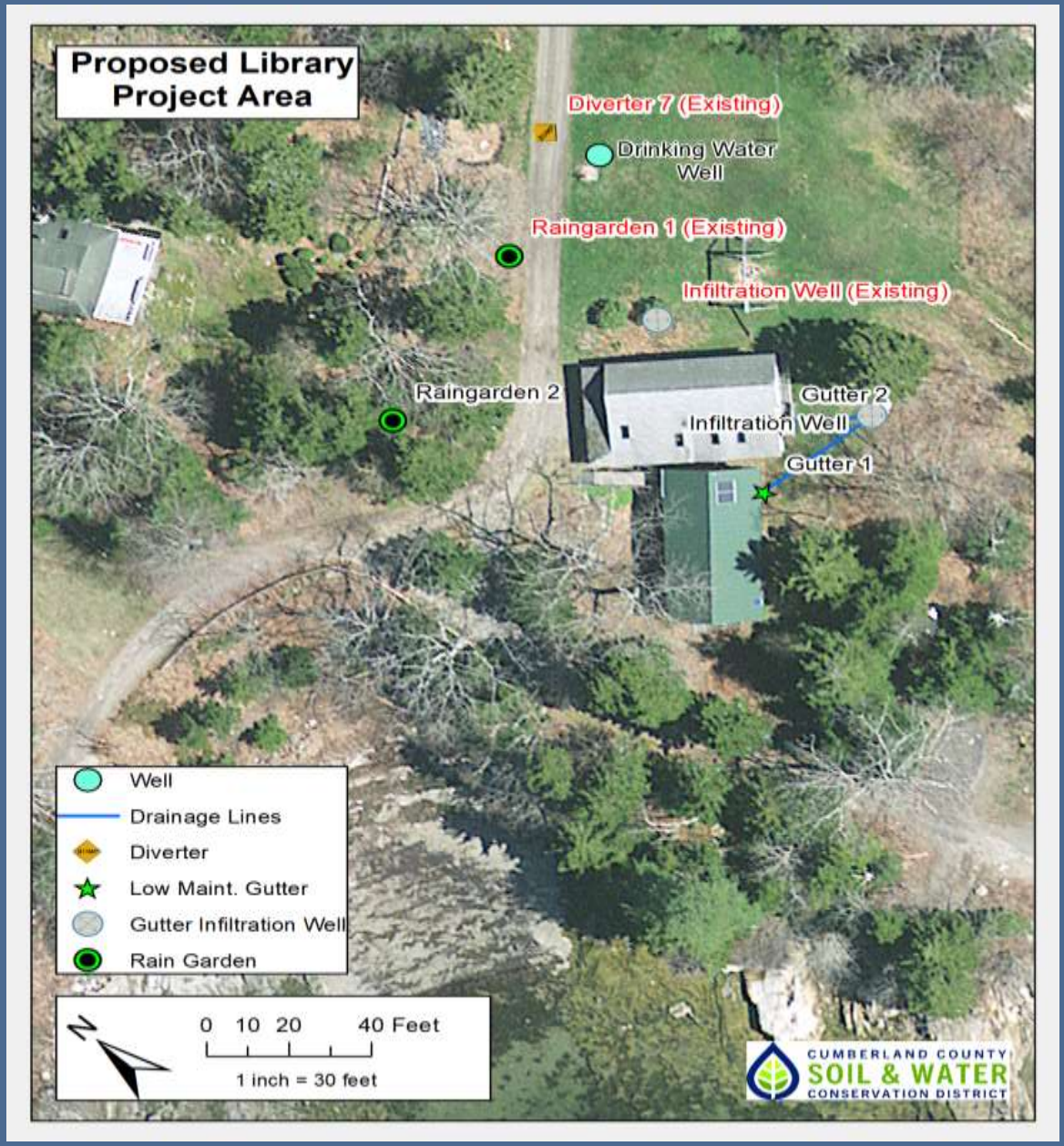
PENDING LANDOWNER/BIVC PERMISSIONS

Bustin islands: Green Infrastructure

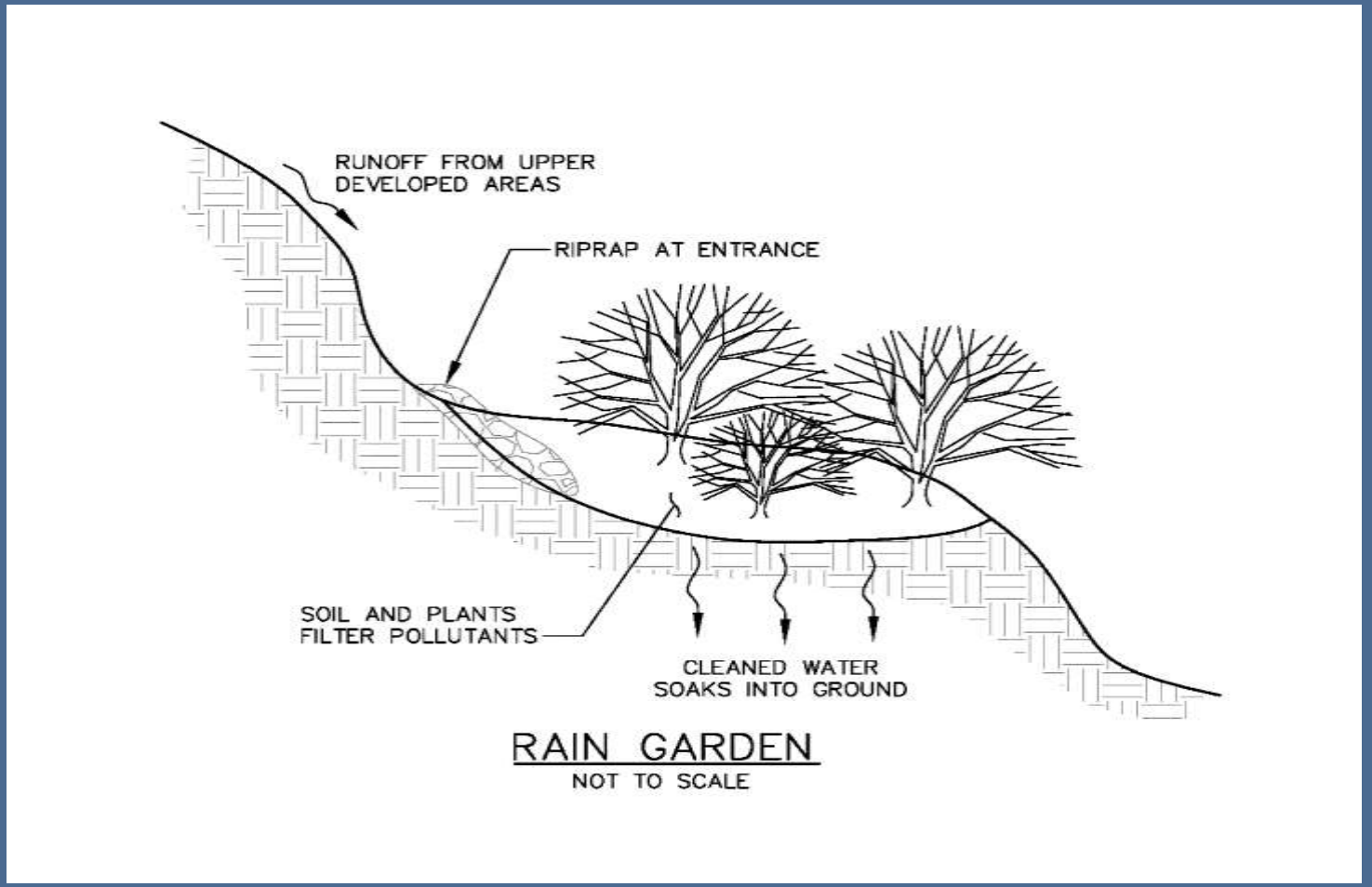
- The Four R's:
  - Recharge the aquifer
  - Reduce road erosion
  - Restore habitats
  - Redirect runoff from coastal bluffs

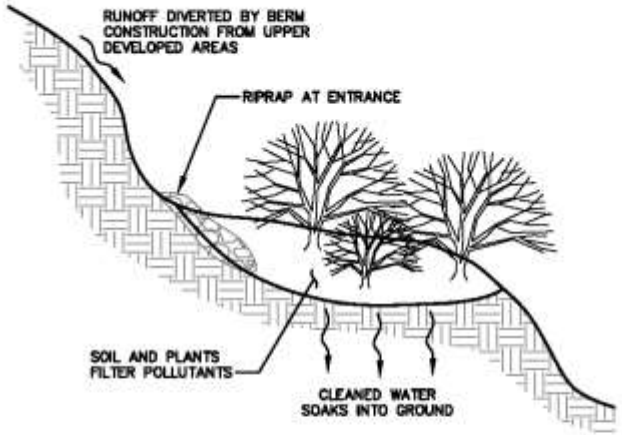

AREA 1A DETAIL
AREA 2 DETAIL
AREA 3 DETAIL
AREA 1B DETAIL
MUSEUM
LIBRARY
OVERALL SITE PLAN
1 inch = 60' ft.
Cumberland County Soil & Water Conservation District
OVERALL SITE PLAN
LOW IMPACT DEVELOPMENT BMP
BUSTIN ISLAND, MAINE
FIGURE
1

Area 1 Proposed Solution: Reduce runoff from hill across from post office and from building roof

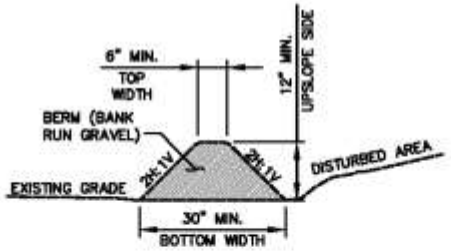


Pilot Project: Capture runoff from hill in rain garden – Plan to add additional gardens

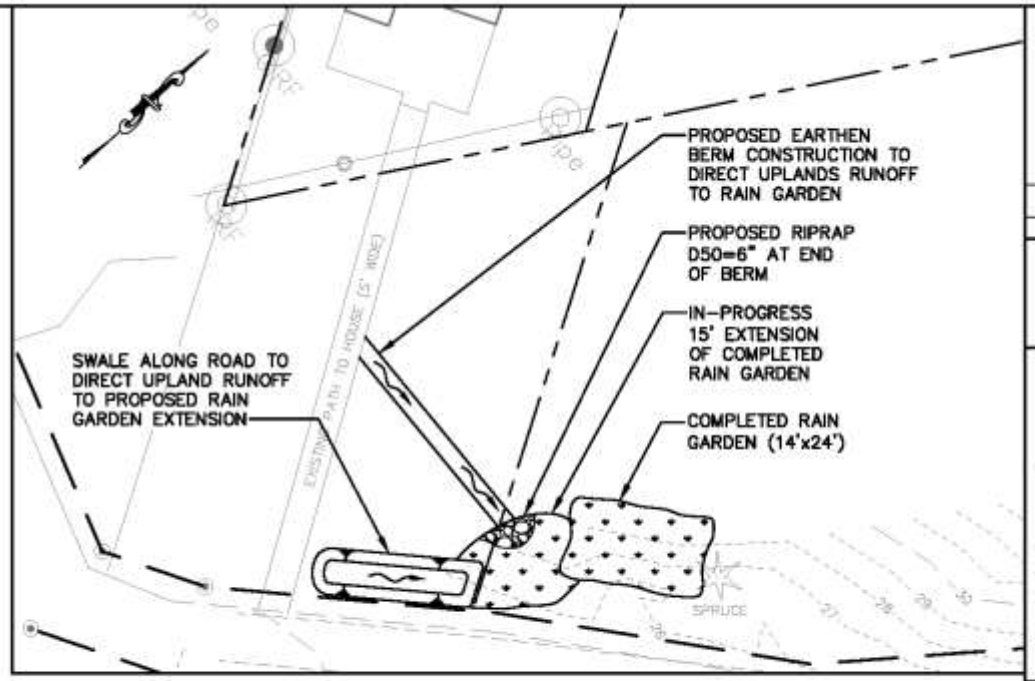




RAIN GARDEN
NOT TO SCALE



EARTHEN BERM/SWALE DETAIL
NOT TO SCALE



SITE PLAN

20 0 10 20 40

1 inch = 20' ft.

NOTES:
1) BEARINGS ARE REFERENCED TO TRUE NORTH AS DETERMINED BY ASTRONOMIC OBSERVATION.
2) CONTOURS AND ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). BENCHMARKS: AS SHOWN.
3) DEED AND PLAN BOOK REFERENCES ARE TO THE CUMBERLAND COUNTY REGISTRY OF DEEDS.
4) TWO-FOOT CONTOURS PROVIDED BY THE MAINE OFFICE OF GIS.

PLAN REFERENCES:
1) "STANDARD BOUNDARY SURVEY (OF) STREETS A & B (IN) SECTION B ... MADE FOR BUSTINS ISLAND VILLAGE CORPORATION" BY ISLAND SURVEYS DATED AUGUST 2, 2003, AND RECORDED IN PLAN BOOK 207 PAGE 552.
2) "PLAN OF A STANDARD BOUNDARY SURVEY OF LAND ON BUSTINS ISLAND ... MADE FOR WILLIAM W. COOPER (AND) MARTHA P. COOPER" BY ISLAND SURVEYS DATED SEPTEMBER 1, 2012.
3) "PLAN OF PROPERTY ON BUSTINS ISLAND...MADE FOR ROBERT DUGAN JR. (AND) REBECCA DUGAN" BY ISLAND SURVEYS DATED SEPTEMBER 4, 2012.
4) "PLAN OF A STANDARD BOUNDARY SURVEY ... MADE FOR JAMES G. BOYKO (AND) JANICE L. BOYKO" BY ISLAND SURVEYS DATED SEPTEMBER 27, 2019.

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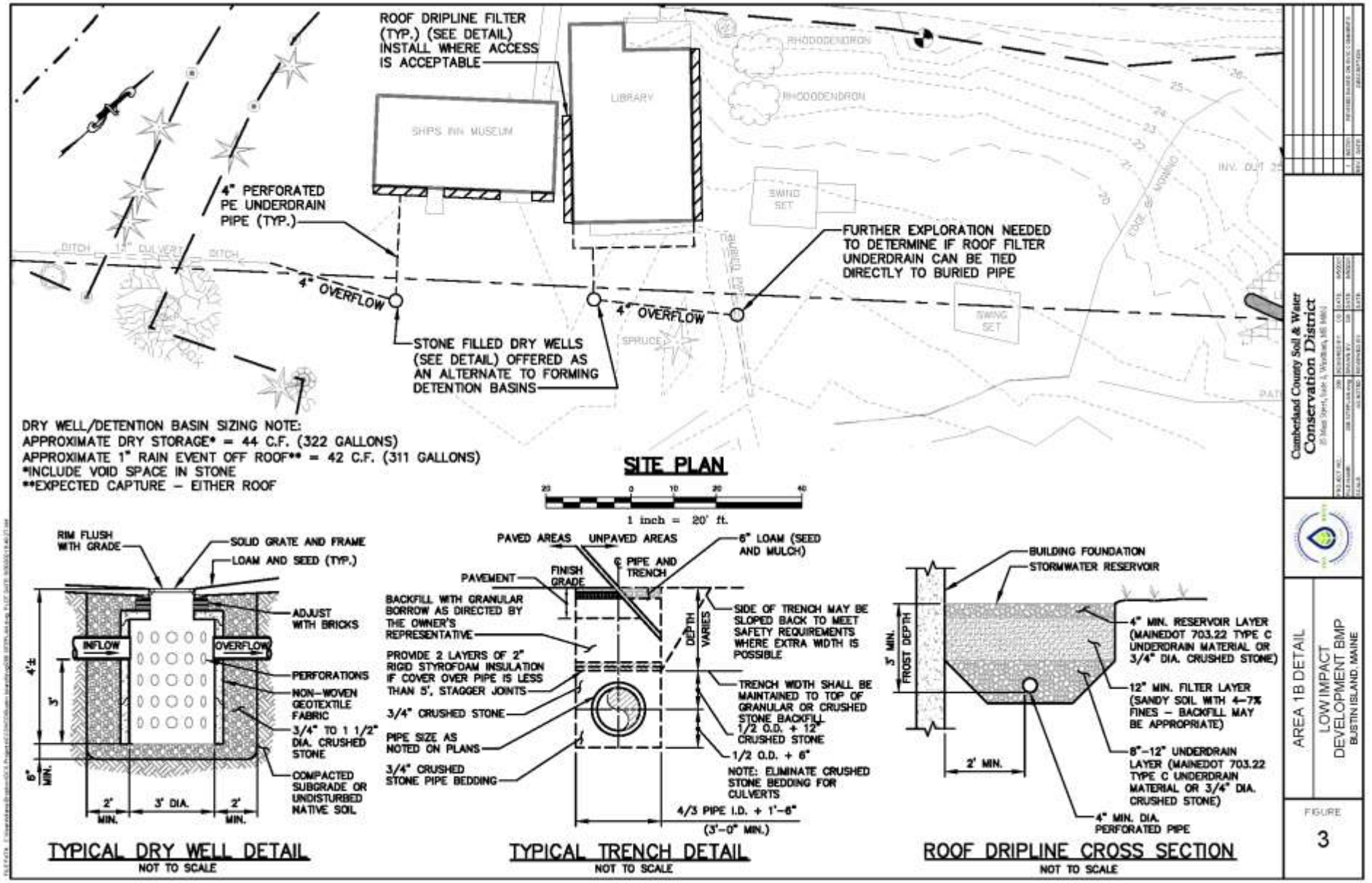
AREA 1A DETAIL

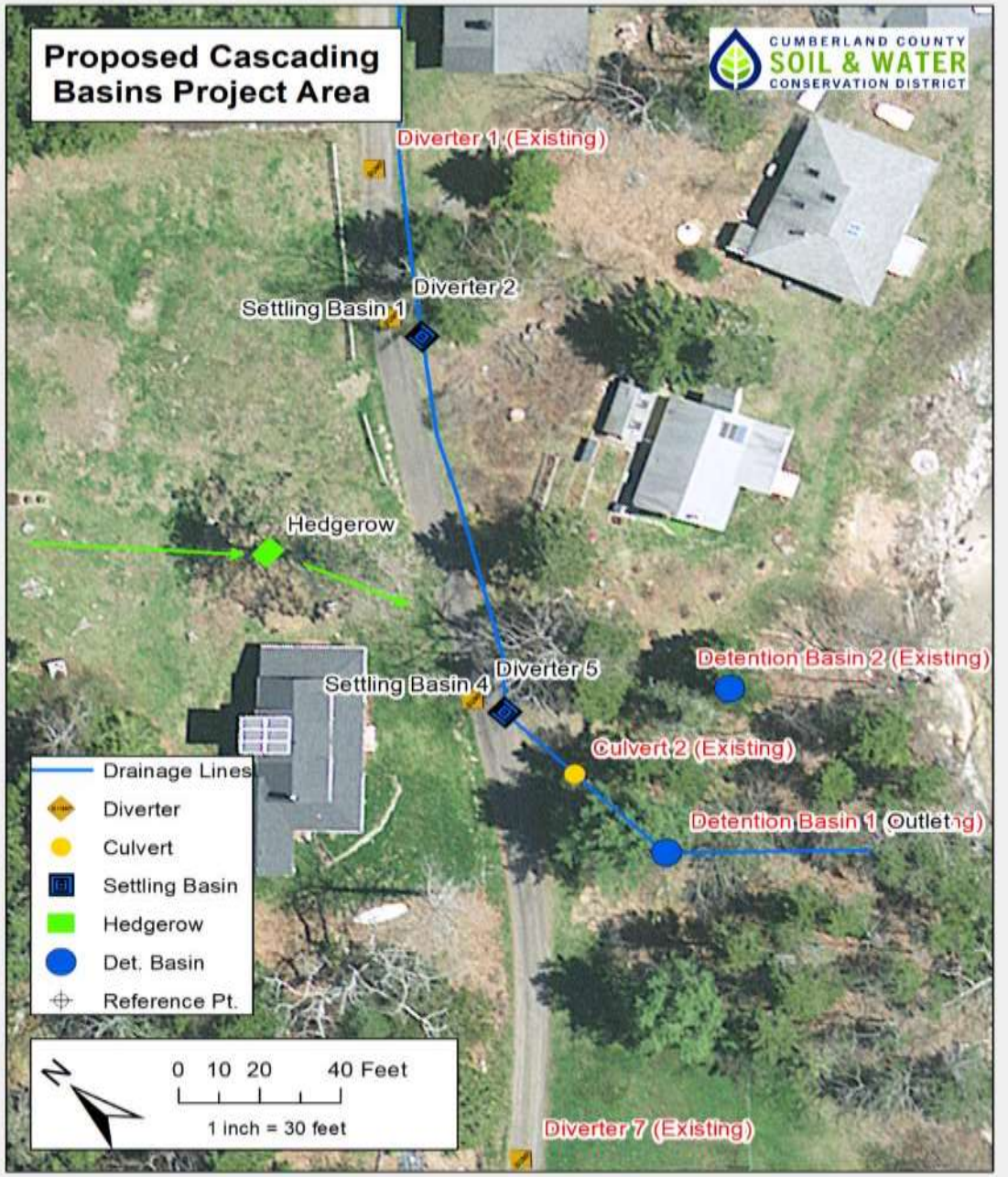
LOW IMPACT DEVELOPMENT BMP
BUSTIN ISLAND, MAINE

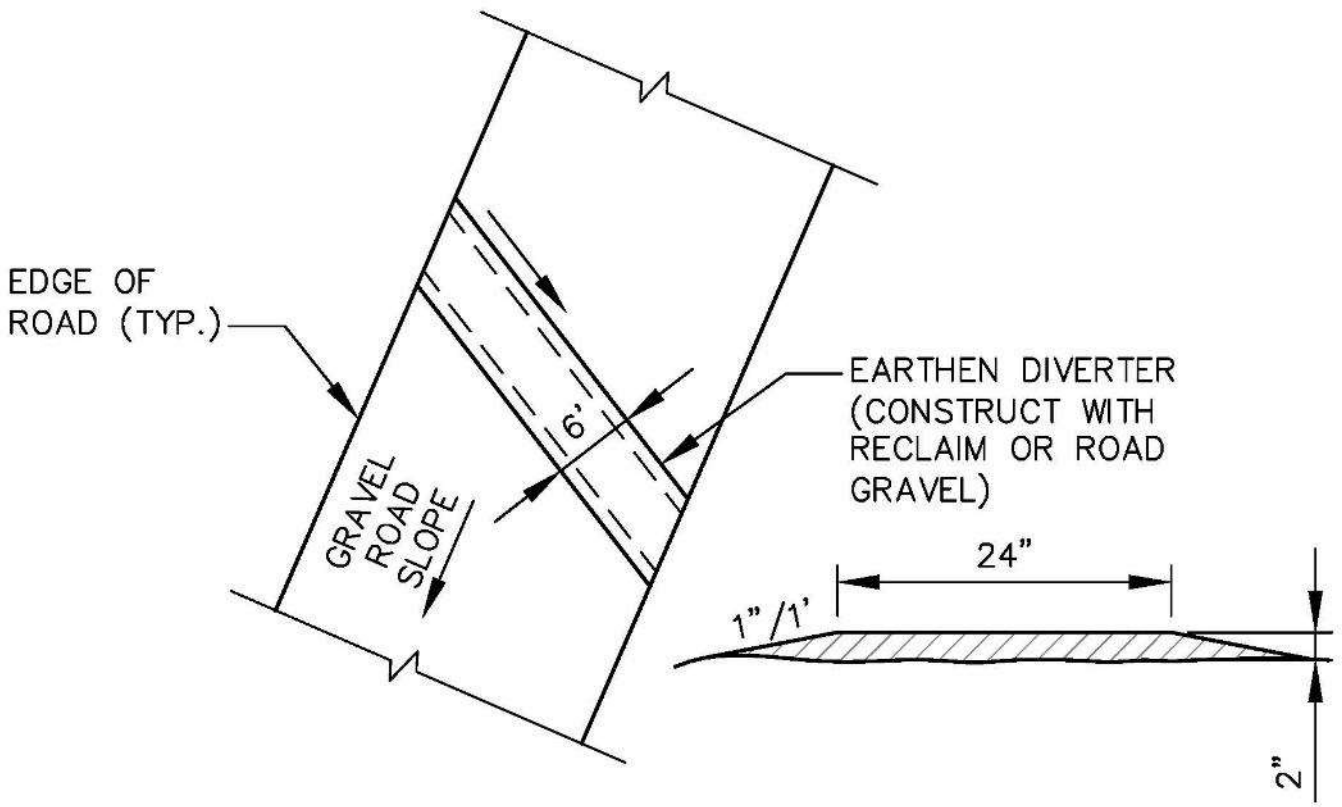
FIGURE
2


ROOF DRIPLINE FILTER (TYP.) (SEE DETAIL) INSTALL WHERE ACCESS IS ACCEPTABLE
4" PERFORATED PE UNDERDRAIN PIPE (TYP.)
4" OVERFLOW
4" OVERFLOW
STONE FILLED DRY WELLS (SEE DETAIL) OFFERED AS AN ALTERNATE TO FORMING DETENTION BASINS
FURTHER EXPLORATION NEEDED TO DETERMINE IF ROOF FILTER UNDERDRAIN CAN BE TIED DIRECTLY TO BURIED PIPE
LIBRARY
SHIPS INN MUSEUM
RHODODENDRON
RHODODENDRON
SWING SET
SWING SET
SPRUCE
DITCH
14" CULVERT
DITCH
INV. OUT
DRY WELL/DETENTION BASIN SIZING NOTE:
APPROXIMATE DRY STORAGE* = 44 C.F. (322 GALLONS)
APPROXIMATE 1" RAIN EVENT OFF ROOF** = 42 C.F. (311 GALLONS)
*INCLUDE VOID SPACE IN STONE
**EXPECTED CAPTURE – EITHER ROOF
SITE PLAN
1 inch = 20' ft.
RIM FLUSH WITH GRADE
SOLID GRATE AND FRAME
LOAM AND SEED (TYP.)
ADJUST WITH BRICKS
INFLOW
OVERFLOW
PERFORATIONS
NON-WOVEN GEOTEXTILE FABRIC
3/4" TO 1 1/2" DIA. CRUSHED STONE
COMPACTED SUBGRADE OR UNDISTURBED NATIVE SOIL
4'±
3'
6" MIN.
2' MIN.
3' DIA.
2' MIN.
TYPICAL DRY WELL DETAIL
NOT TO SCALE
PAVED AREAS
UNPAVED AREAS
6" LOAM (SEED AND MULCH)
PAVEMENT
FINISH GRADE
PIPE AND TRENCH
BACKFILL WITH GRANULAR BORROW AS DIRECTED BY THE OWNER'S REPRESENTATIVE
PROVIDE 2 LAYERS OF 2" RIGID STYROFOAM INSULATION IF COVER OVER PIPE IS LESS THAN 5', STAGGER JOINTS
3/4" CRUSHED STONE
PIPE SIZE AS NOTED ON PLANS
3/4" CRUSHED STONE PIPE BEDDING
DEPTH VARIES
SIDE OF TRENCH MAY BE SLOPED BACK TO MEET SAFETY REQUIREMENTS WHERE EXTRA WIDTH IS POSSIBLE
TRENCH WIDTH SHALL BE MAINTAINED TO TOP OF GRANULAR OR CRUSHED STONE BACKFILL
1/2 O.D. + 12" CRUSHED STONE
1/2 O.D. + 6"
NOTE: ELIMINATE CRUSHED STONE BEDDING FOR CULVERTS
4/3 PIPE I.D. + 1'-6"
(3'-0" MIN.)
TYPICAL TRENCH DETAIL
NOT TO SCALE
BUILDING FOUNDATION
STORMWATER RESERVOIR
3' MIN. FROST DEPTH
4" MIN. RESERVOIR LAYER (MAINEDOT 703.22 TYPE C UNDERDRAIN MATERIAL OR 3/4" DIA. CRUSHED STONE)
12" MIN. FILTER LAYER (SANDY SOIL WITH 4–7% FINES – BACKFILL MAY BE APPROPRIATE)
8"–12" UNDERDRAIN LAYER (MAINEDOT 703.22 TYPE C UNDERDRAIN MATERIAL OR 3/4" DIA. CRUSHED STONE)
2' MIN.
4" MIN. DIA. PERFORATED PIPE
ROOF DRIPLINE CROSS SECTION
NOT TO SCALE
Cumberland County Soil & Water Conservation District
AREA 1B DETAIL
LOW IMPACT DEVELOPMENT BMP
BUSTIN ISLAND, MAINE
FIGURE
3

Test Pit Investigation

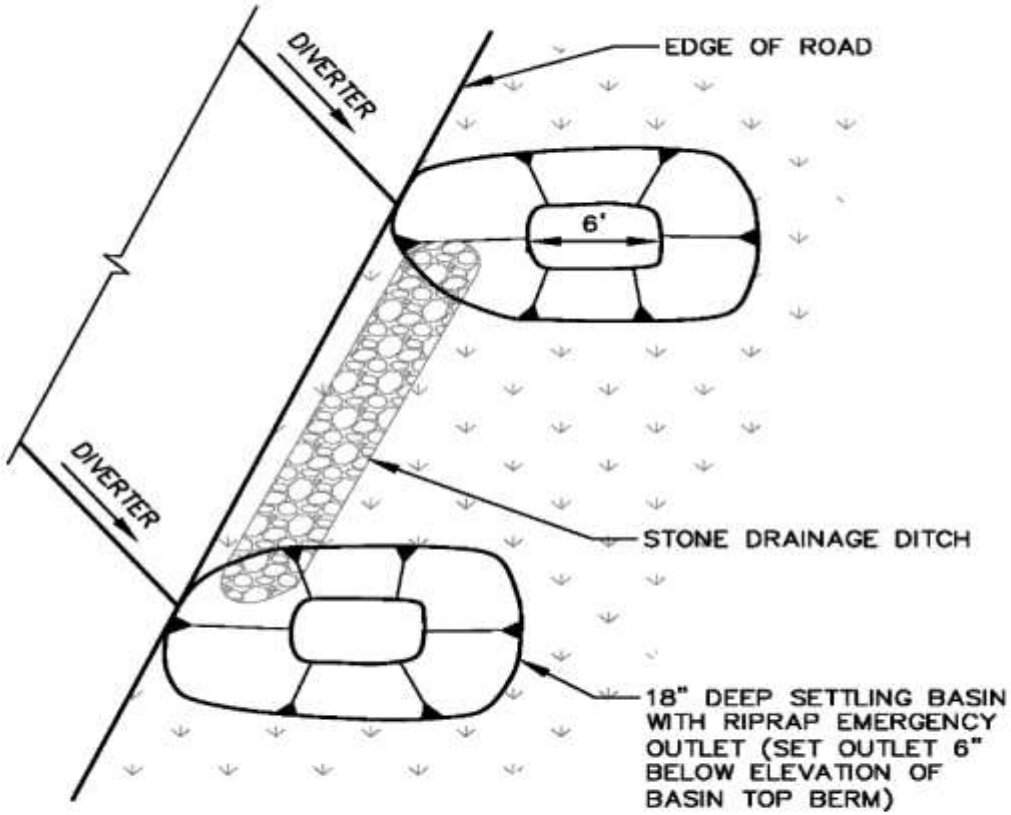
Area 2 Proposed Solution: Divert road runoff into constructed & natural settling basins





DIVERTER BERM

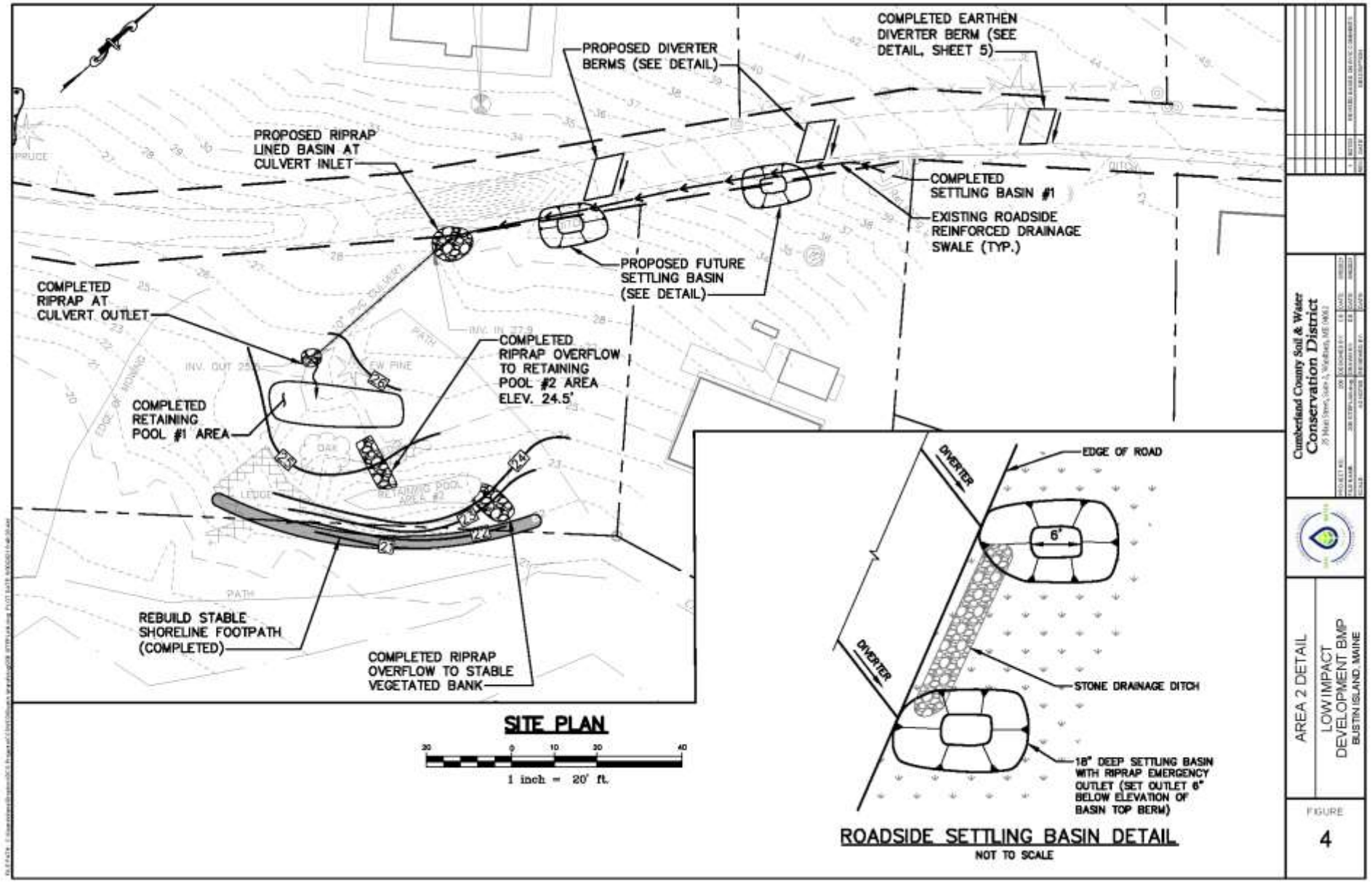
NOT TO SCALE



ROADSIDE SETTLING BASIN

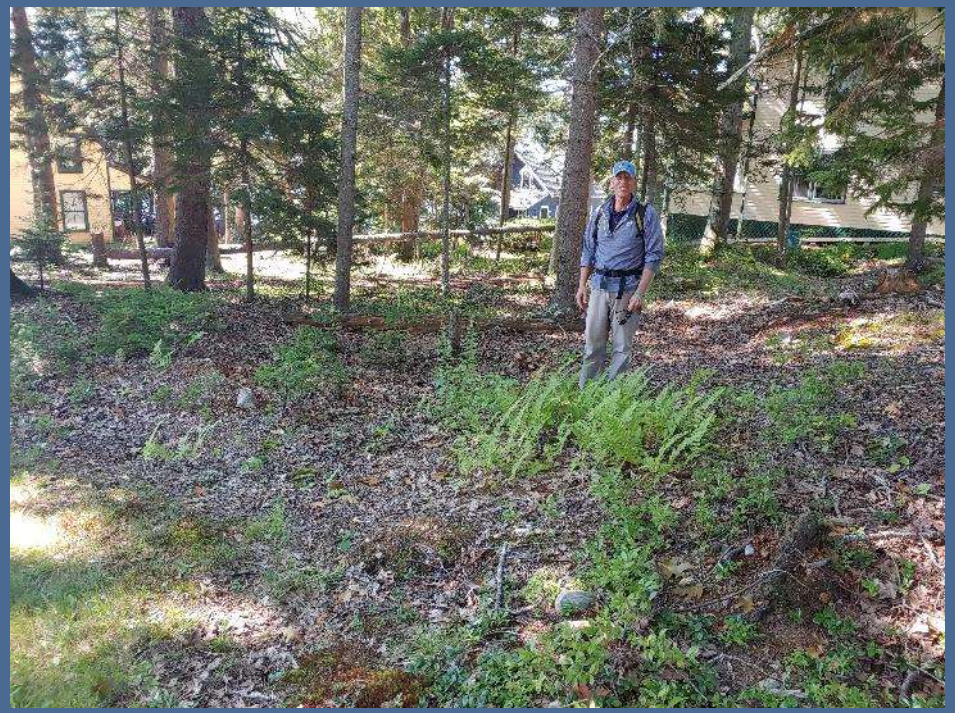
NOT TO SCALE

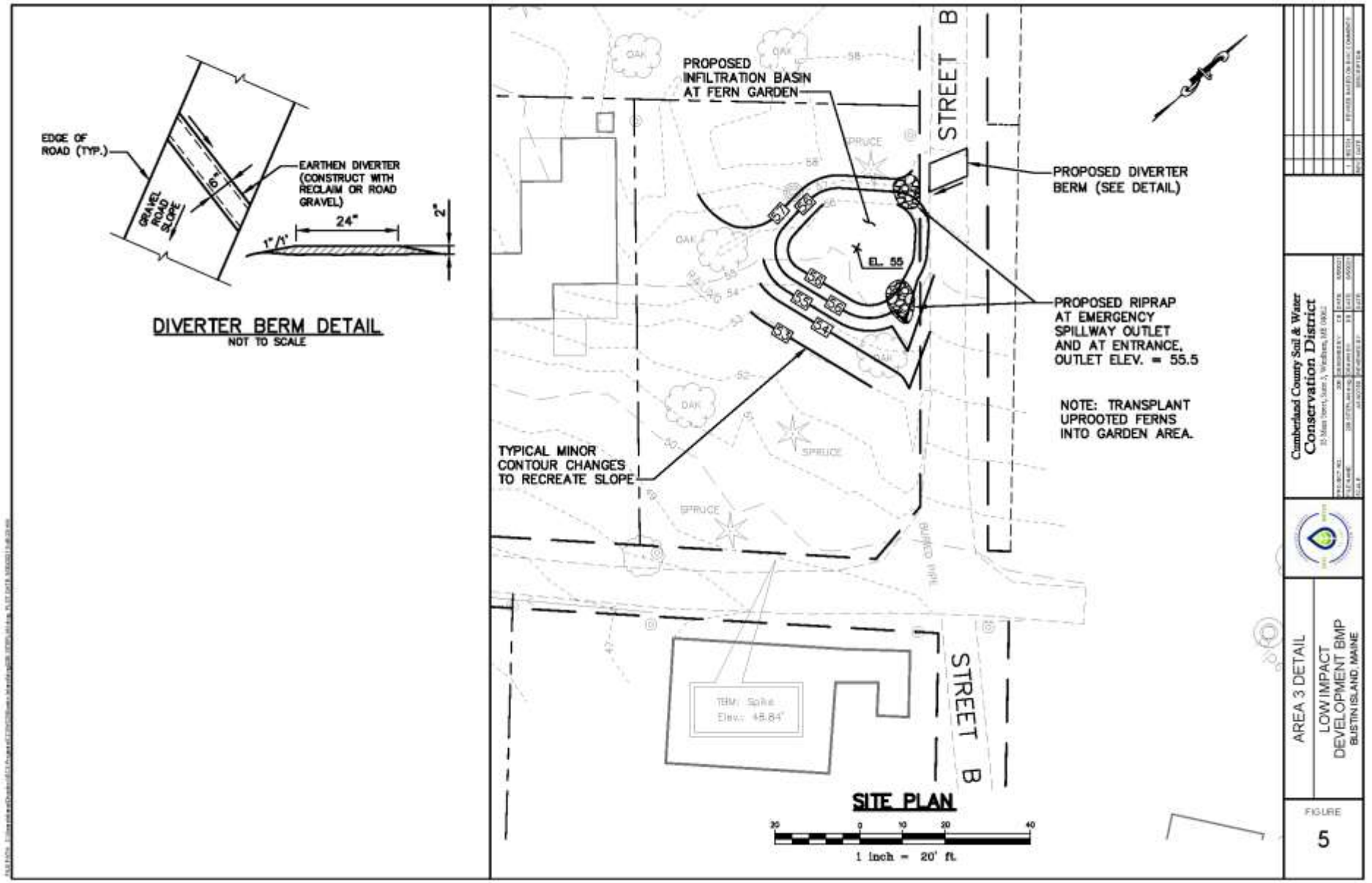
Pilot Project: Constructed roadside basin at top of road which now flows into ditch


PROPOSED DIVERTER BERMS (SEE DETAIL)
COMPLETED EARTHEN DIVERTER BERM (SEE DETAIL, SHEET 5)
PROPOSED RIPRAP LINED BASIN AT CULVERT INLET
COMPLETED SETTLING BASIN #1
EXISTING ROADSIDE REINFORCED DRAINAGE SWALE (TYP.)
PROPOSED FUTURE SETTLING BASIN (SEE DETAIL)
COMPLETED RIPRAP AT CULVERT OUTLET
COMPLETED RIPRAP OVERFLOW TO RETAINING POOL #2 AREA ELEV. 24.5'
COMPLETED RETAINING POOL #1 AREA
REBUILD STABLE SHORELINE FOOTPATH (COMPLETED)
COMPLETED RIPRAP OVERFLOW TO STABLE VEGETATED BANK
SITE PLAN
1 inch = 20' ft.
EDGE OF ROAD
DIVERTER
DIVERTER
6'
STONE DRAINAGE DITCH
18" DEEP SETTLING BASIN WITH RIPRAP EMERGENCY OUTLET (SET OUTLET 6" BELOW ELEVATION OF BASIN TOP BERM)
ROADSIDE SETTLING BASIN DETAIL
NOT TO SCALE
Cumberland County Soil & Water Conservation District
AREA 2 DETAIL
LOW IMPACT DEVELOPMENT BMP
BUSTIN ISLAND, MAINE
FIGURE
4

Pilot Project: Natural Settling Basins at System Outlet

Area 3 Proposed Concept: Divert road runoff into constructed settling/infiltration basin "Fern Garden"




EDGE OF ROAD (TYP.)
EARTHEN DIVERTER (CONSTRUCT WITH RECLAIM OR ROAD GRAVEL)
GRAVEL ROAD SLOPE
16"
24"
2"
1" /1"
DIVERTER BERM DETAIL
NOT TO SCALE
PROPOSED INFILTRATION BASIN AT FERN GARDEN
STREET B
PROPOSED DIVERTER BERM (SEE DETAIL)
EL. 55
PROPOSED RIPRAP AT EMERGENCY SPILLWAY OUTLET AND AT ENTRANCE. OUTLET ELEV. = 55.5
NOTE: TRANSPLANT UPROOTED FERNS INTO GARDEN AREA.
TYPICAL MINOR CONTOUR CHANGES TO RECREATE SLOPE
OAK
SPRUCE
STREET B
SITE PLAN
1 inch = 20' ft.
Cumberland County Soil & Water Conservation District
AREA 3 DETAIL
LOW IMPACT DEVELOPMENT BMP
BUSTIN ISLAND, MAINE
FIGURE
5

Questions?

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