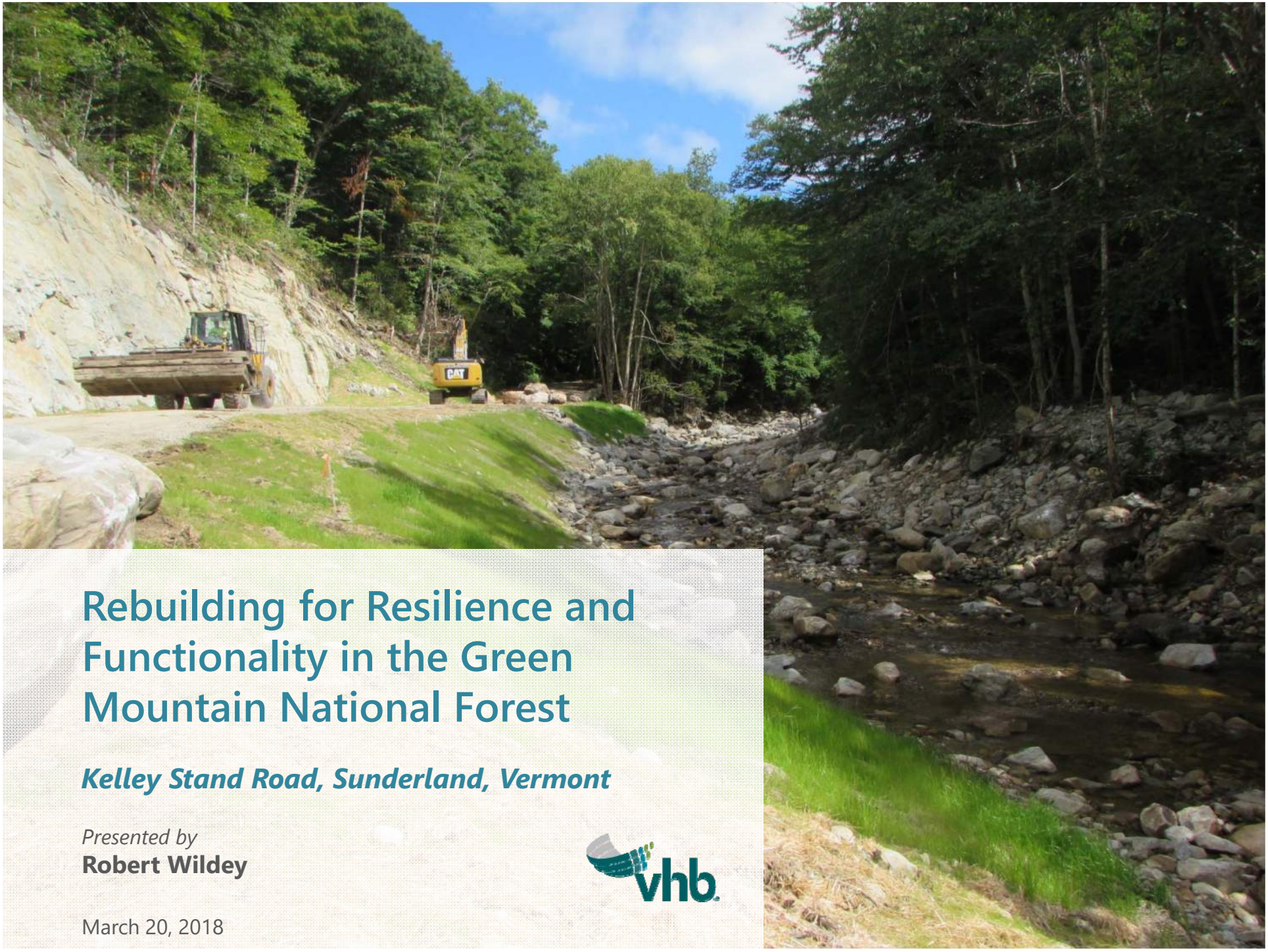
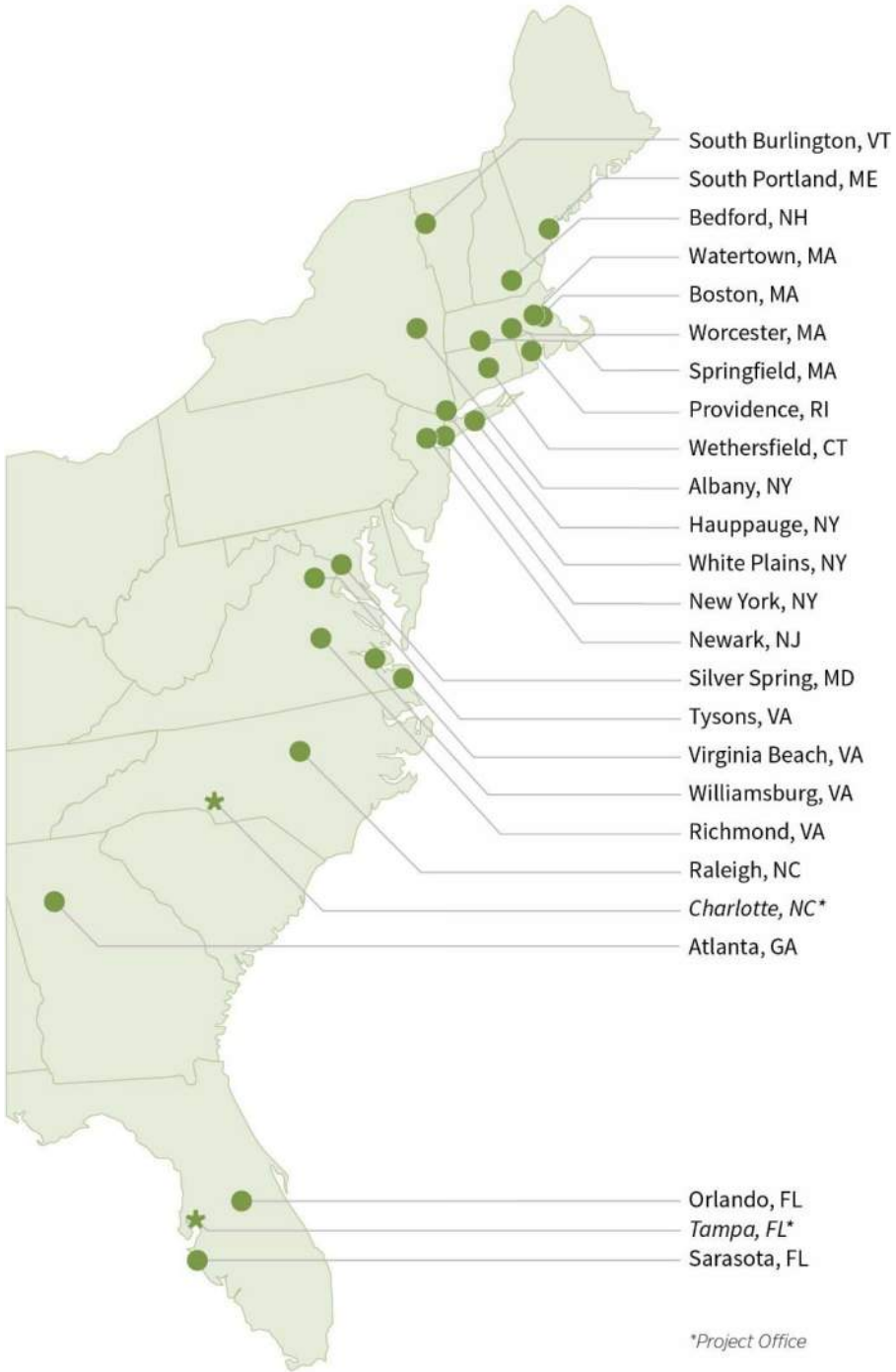


Rebuilding for Resilience and Functionality in the Green Mountain National Forest

Kelley Stand Road, Sunderland, Vermont

Presented by
Robert Wildey

March 20, 2018



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Project Overview

Kelley Stand Road

- Town of Sunderland - Town Highway No. 3
- U.S. Forest Service – Forest Access Highway No. 6
- Connects between Sunderland and Stratton
- Open seasonally but also popular snow mobile trail

Roaring Brook

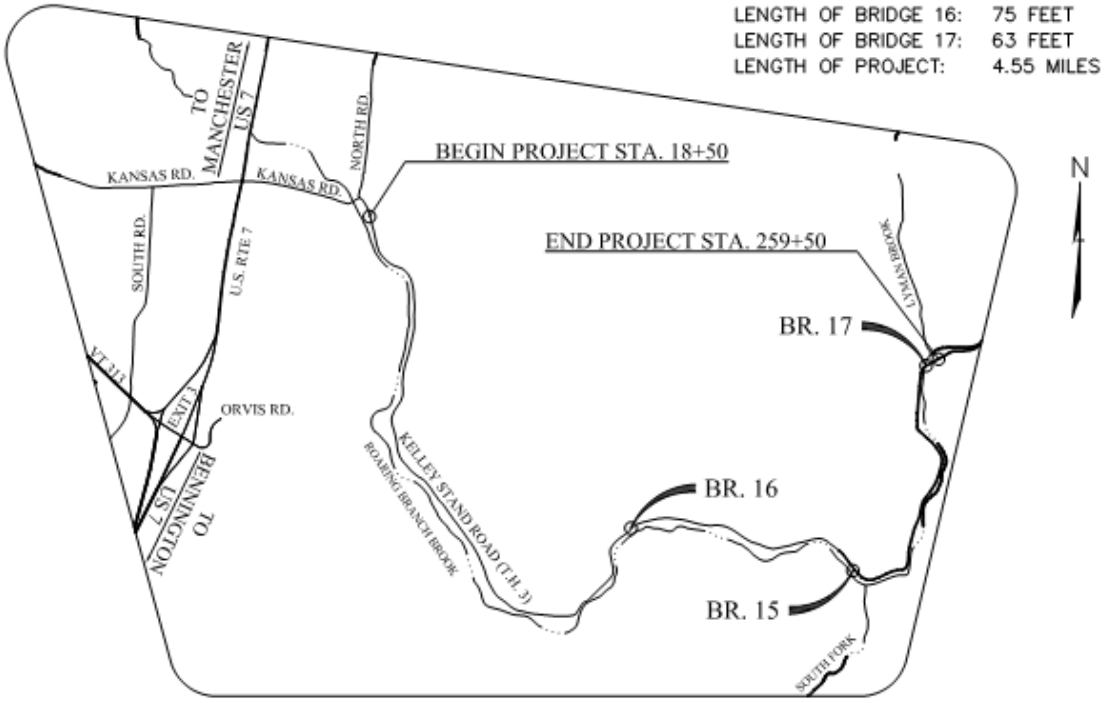
- Tributary to Batten Kill River
- Flows from major tributary “South Fork”
- Steep, confined valley

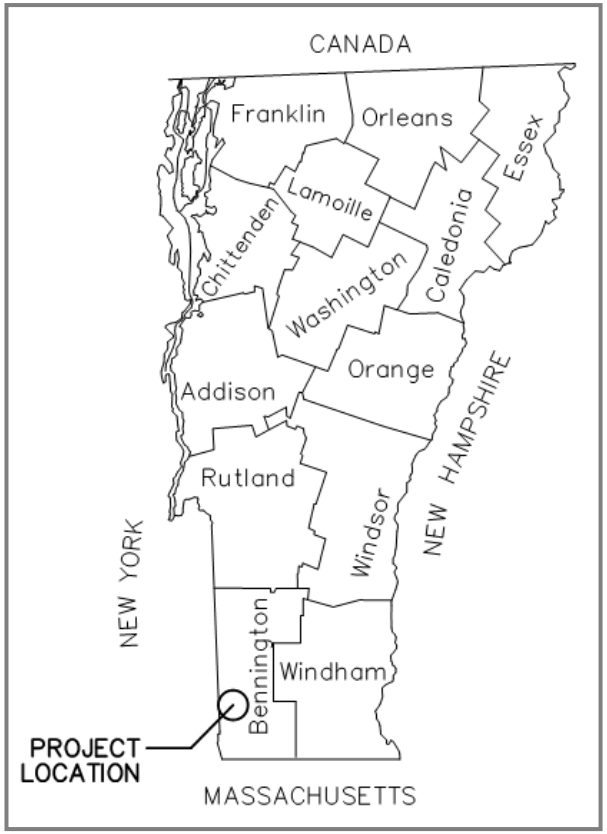
TOWN OF SUNDERLAND
COUNTY OF BENNINGTON
KELLEY STAND ROAD REHABILITATION
TOWN HIGHWAY No. 3
FOREST HIGHWAY No. 6

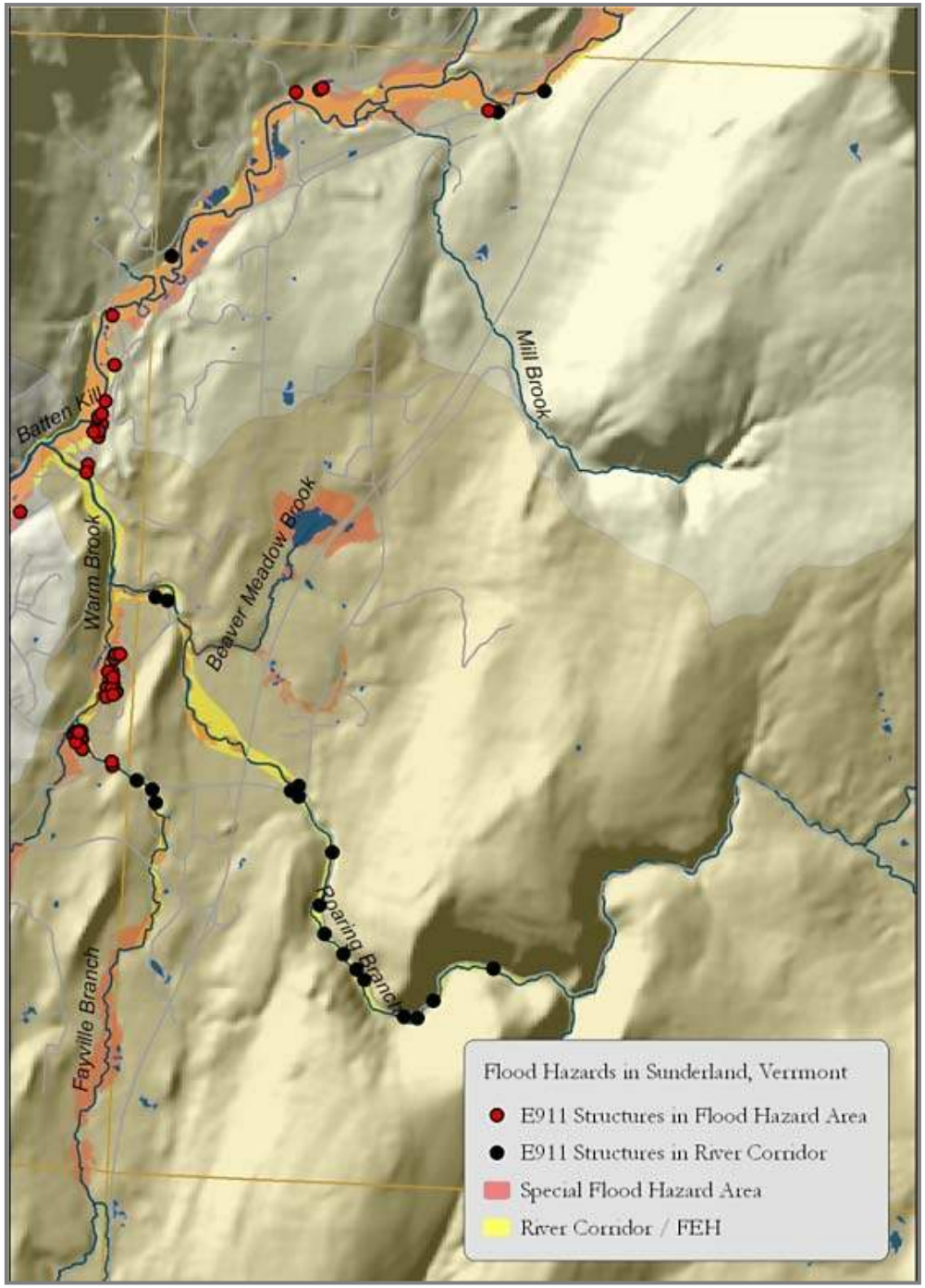
PROJECT LOCATION: LOCATED IN SUNDERLAND, VT, T.H. 3 (KELLEY STAND ROAD) BRANCHES OFF FROM KANSAS ROAD APPROXIMATELY 575 FT EAST OF THE U.S. ROUTE 7 OVERPASS.

PROJECT DESCRIPTION: WORK TO BE PERFORMED UNDER THIS PROJECT INCLUDES ROADWAY REPAIRS AND RECONSTRUCTION, STREAMBANK ARMORING, BRIDGE REHABILITATION, AND BRIDGE REMOVAL AND REPLACEMENT.

LENGTH OF ROADWAY:	4.52 MILES
LENGTH OF BRIDGE 16:	75 FEET
LENGTH OF BRIDGE 17:	63 FEET
LENGTH OF PROJECT:	4.55 MILES



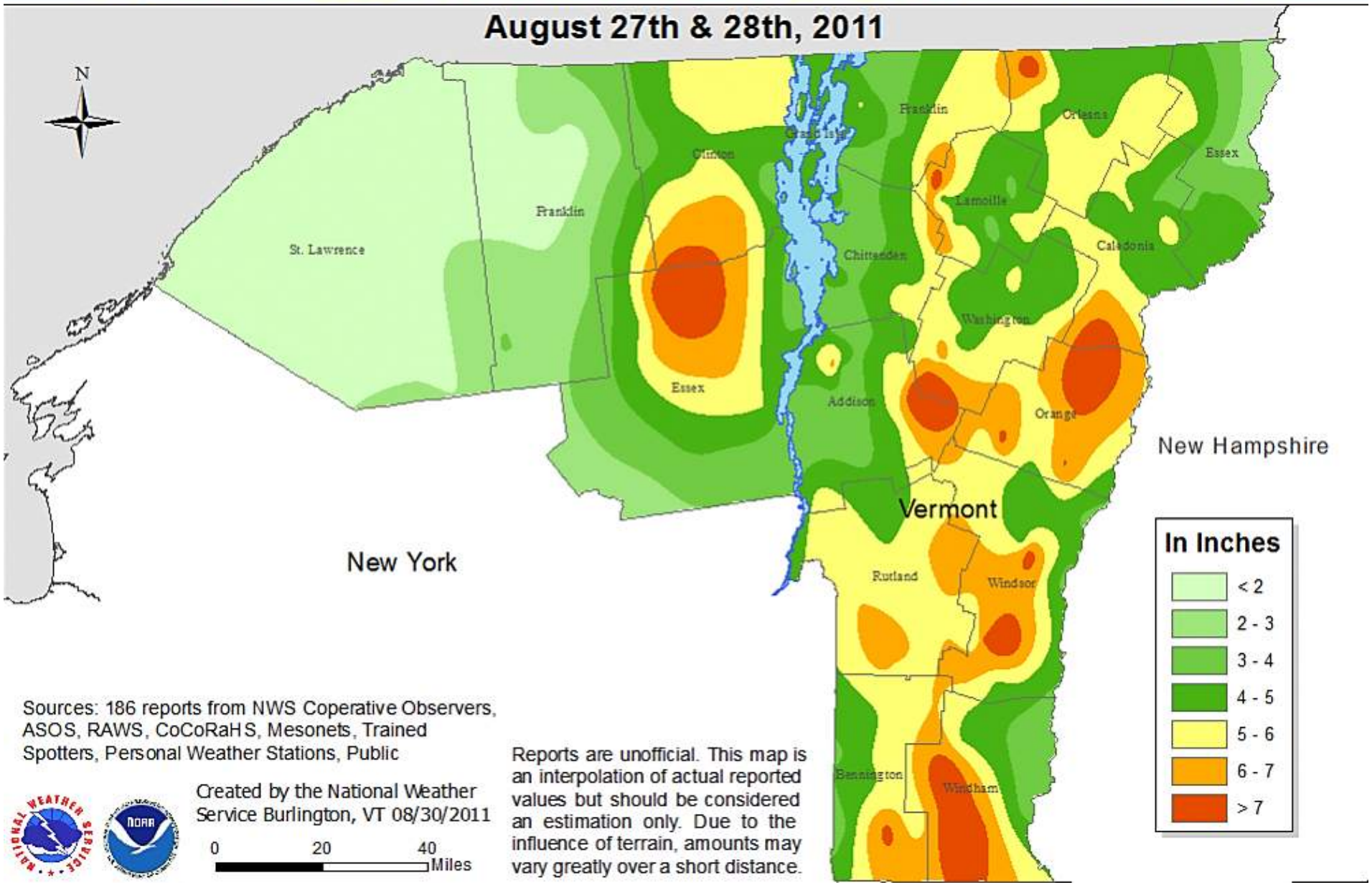



Batten Kill
Warm Brook
Beaver Meadow Brook
Mill Brook
Roaring Branch
Fayville Branch
Flood Hazards in Sunderland, Vermont
E911 Structures in Flood Hazard Area
E911 Structures in River Corridor
Special Flood Hazard Area
River Corridor / FEH

Tropical Storm Irene

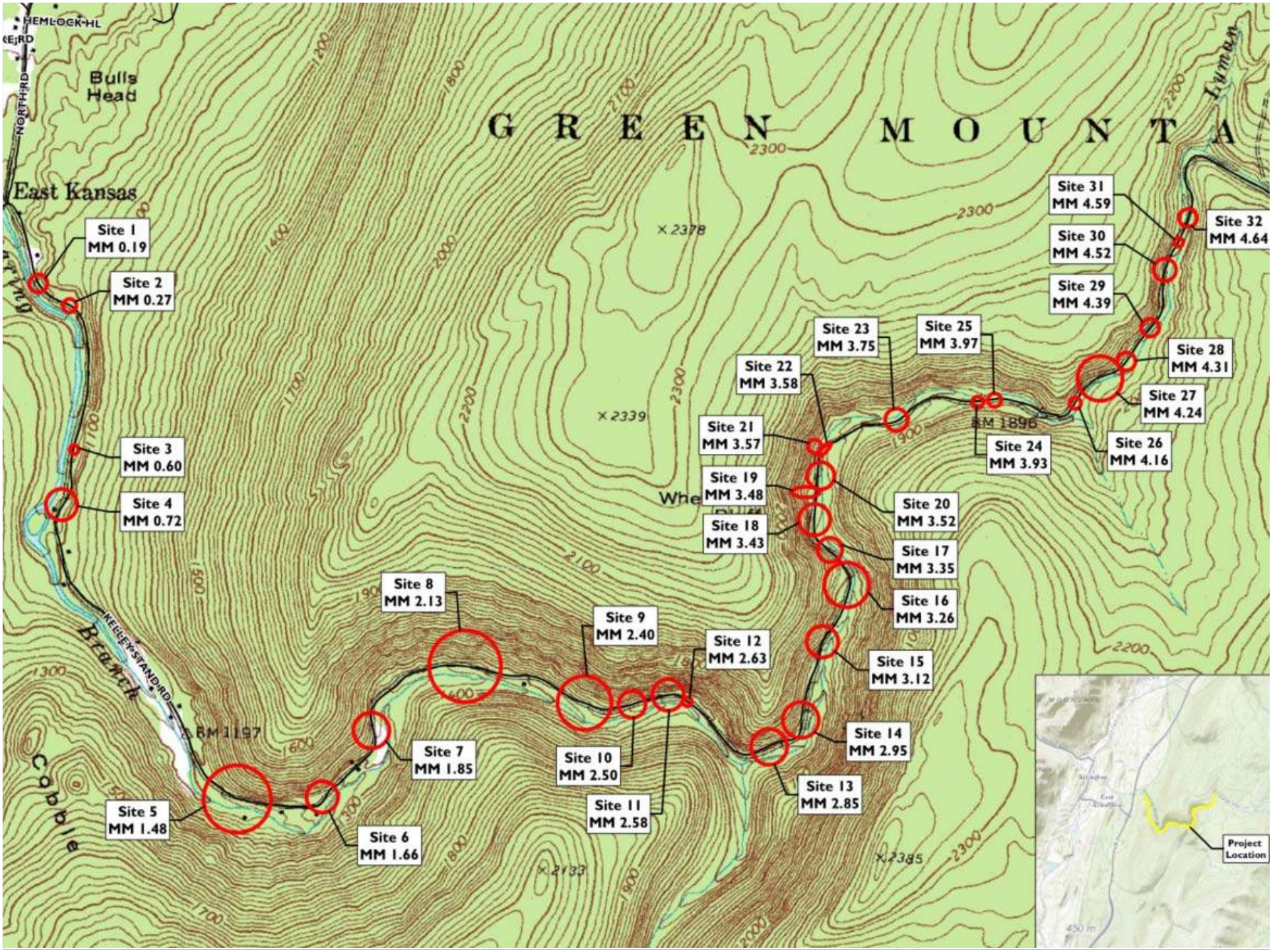
- August 27-28, 2011
- 5.16 inches of rain recorded during event at Sunderland rain gage (located downstream)
- Between a 10 and 25-yr storm event for this area
- Watershed Areas:
  - 9.3 square miles upstream
  - 19.3 square miles downstream
- Resultant stream flows
  - 1,000 cfs upstream
  - 2,000 cfs downstream

Tropical Storm Irene Total Rainfall - Northern New York & Vermont



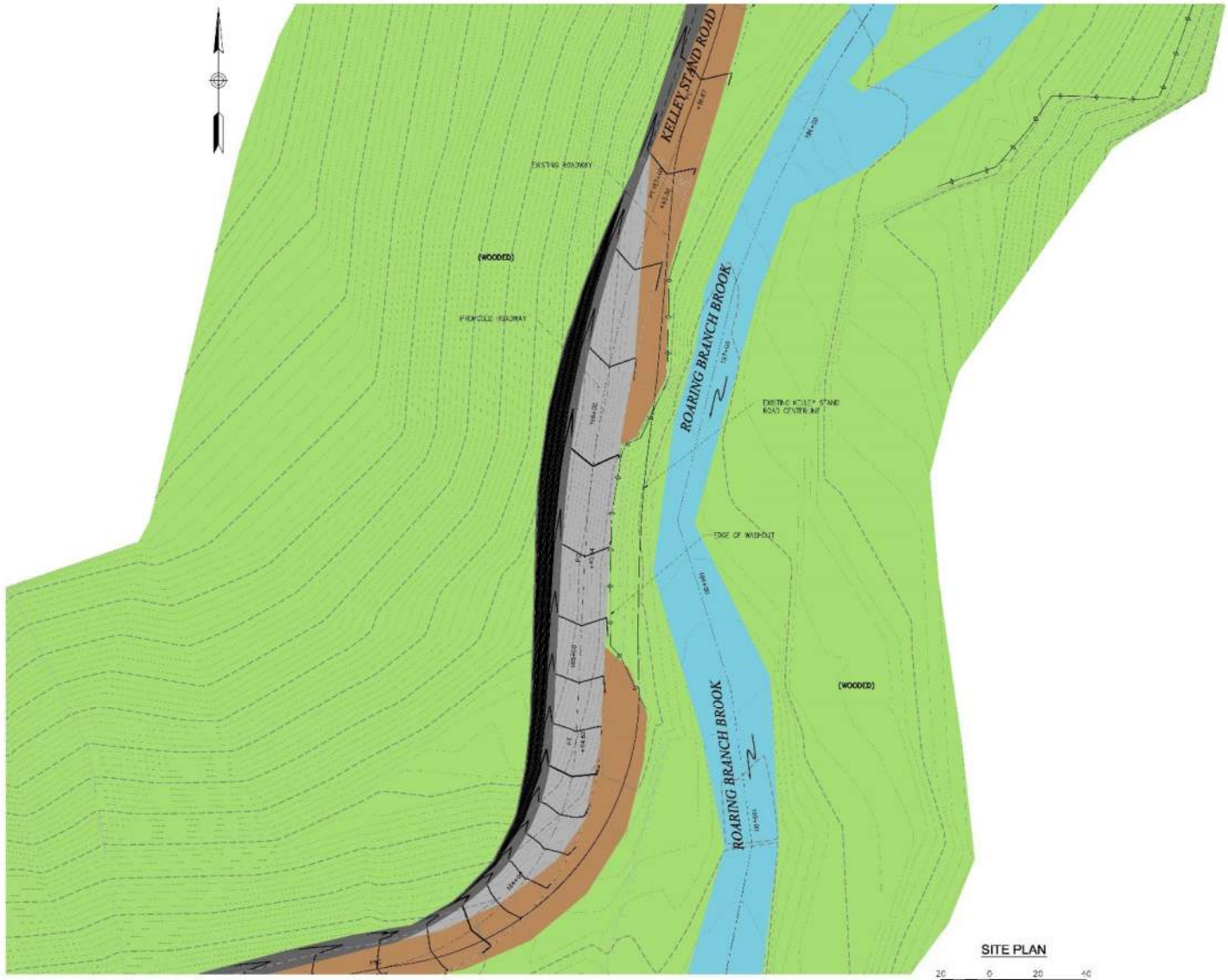
Post-Irene Investigation and Design

- Downstream reaches cleared following storm
- Majority of roadway remained closed
- 32 locations where treatments required
- Stream cross-sections and measurements
- Geotechnical investigation
- Bridge analysis and design
- Ledge outcrops and decision to blast
- Stormwater management


Site 1
MM 0.19
Site 2
MM 0.27
Site 3
MM 0.60
Site 4
MM 0.72
Site 5
MM 1.48
Site 6
MM 1.66
Site 7
MM 1.85
Site 8
MM 2.13
Site 9
MM 2.40
Site 10
MM 2.50
Site 11
MM 2.58
Site 12
MM 2.63
Site 13
MM 2.85
Site 14
MM 2.95
Site 15
MM 3.12
Site 16
MM 3.26
Site 17
MM 3.35
Site 18
MM 3.43
Site 19
MM 3.48
Site 20
MM 3.52
Site 21
MM 3.57
Site 22
MM 3.58
Site 23
MM 3.75
Site 24
MM 3.93
Site 25
MM 3.97
Site 26
MM 4.16
Site 27
MM 4.24
Site 28
MM 4.31
Site 29
MM 4.39
Site 30
MM 4.52
Site 31
MM 4.59
Site 32
MM 4.64
Project Location
GREEN MOUNTA
Bulls Head
East Kansas
Cobble
Branch
HEMLOCK HL
NORTH RD
KELLEY STAND RD
BM 1197
BM 1896
X 2378
X 2339
X 2133
X 2385

Design Criteria and Construction Planning

- Relocate road where feasible and pull back to unerodable section for road bed
- Stacked boulder detail with pinned and grouted boulders to make vertical banks (6 to 8 feet high in some locations)
- Provide stable foundation for roadway, stable streambank for future events, flood bench where feasible
- Provide additional material for construction
- Crusher on-site to process in-place
- Brought-in crushed aggregate for roadway
- Woody debris added into site for grubbing materials – woody debris left in place



SITE PLAN

20 0 20 40

SCALE IN FEET

LEGEND

EXISTING

MAJOR CONTOURS

MINOR CONTOURS

PROPOSED

CONTOURS

STRIP FOOTING

SILT FENCE

1'-0" RIPRAP CLASS 3 &
1' 0" GRUBBING MATERIAL

TABLE OF TERMS

CL	CENTERLINE
FG	FINISHED GRADE
LT	LEFT
LP	LOW POINT
POB	POINT OF BEGINNING
PC	POINT OF CURVATURE
POE	POINT OF ENDING
PI	POINT OF INFLECTION
PT	POINT OF TANGENCY
R	RADIUS
RT	RIGHT
TBV	TEMPORARY BENCH MARK

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE - REGION 9
GREEN MOUNTAIN Hatboro Forest

DESIGNED BY: DESIGN1 DATE: DATE1
DRAWN BY: DRAWN1 DATE: DATE2
CHECKED BY: CHECKED1 DATE: DATE3

REVISIONS

NO.	REVISION	BY	APPROVED	DATE

KELLEY STAND ROAD REHABILITATION

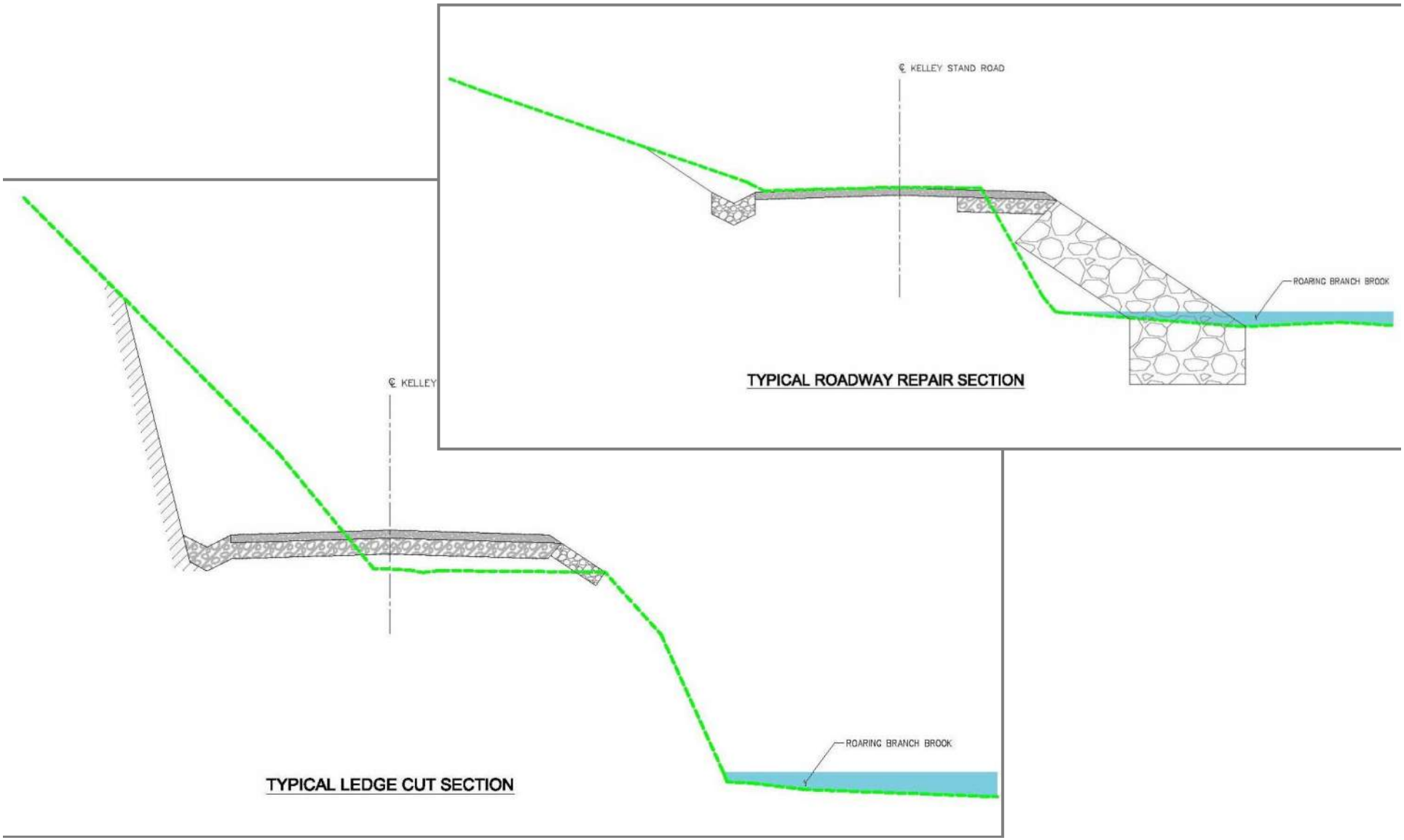
SITE 11 REPAIRS

SCALE: 1" = 20'

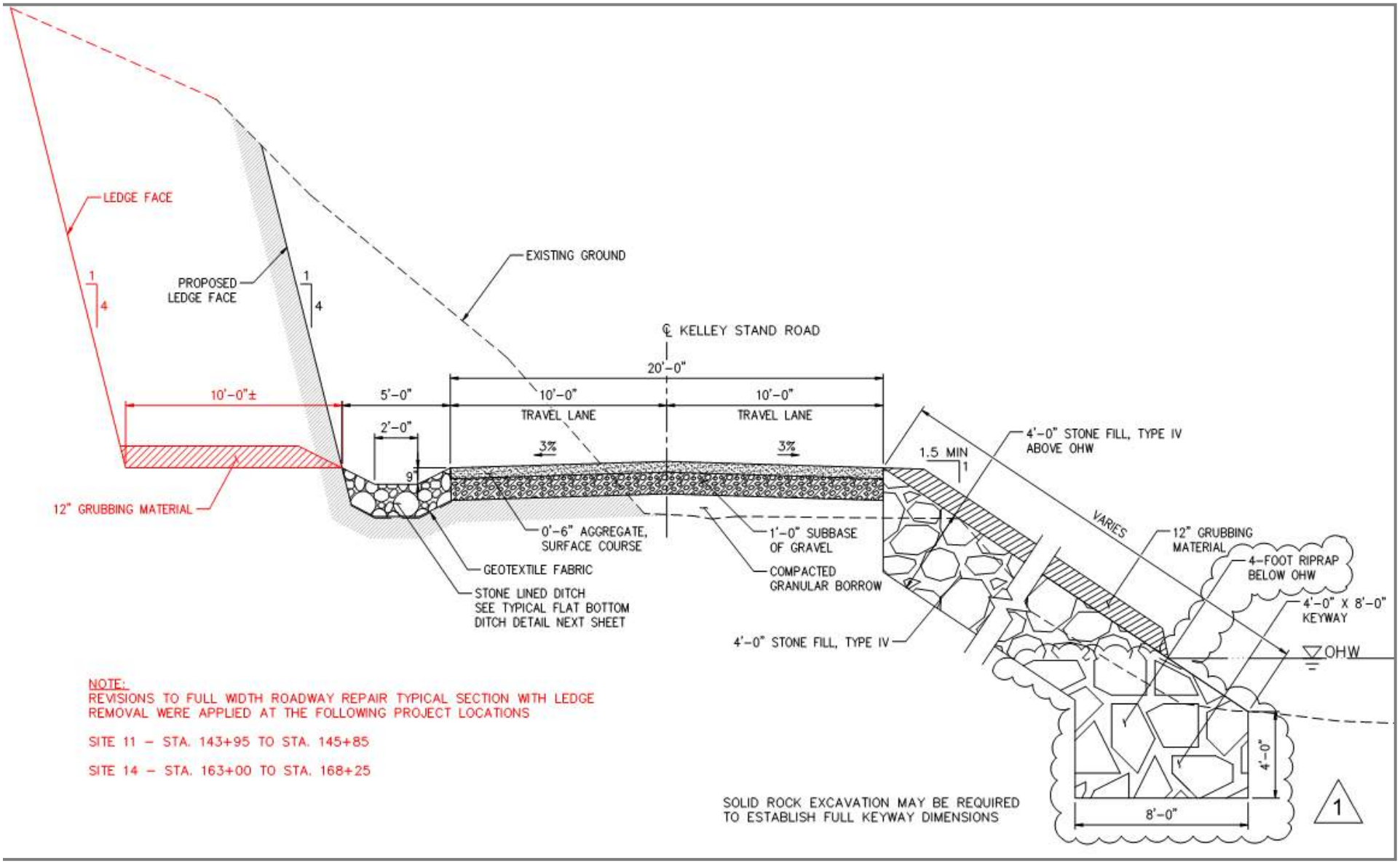
SHEET: 13of 20

CONTRACT NO:

Idealized Cross Sections



As-Built Cross Section

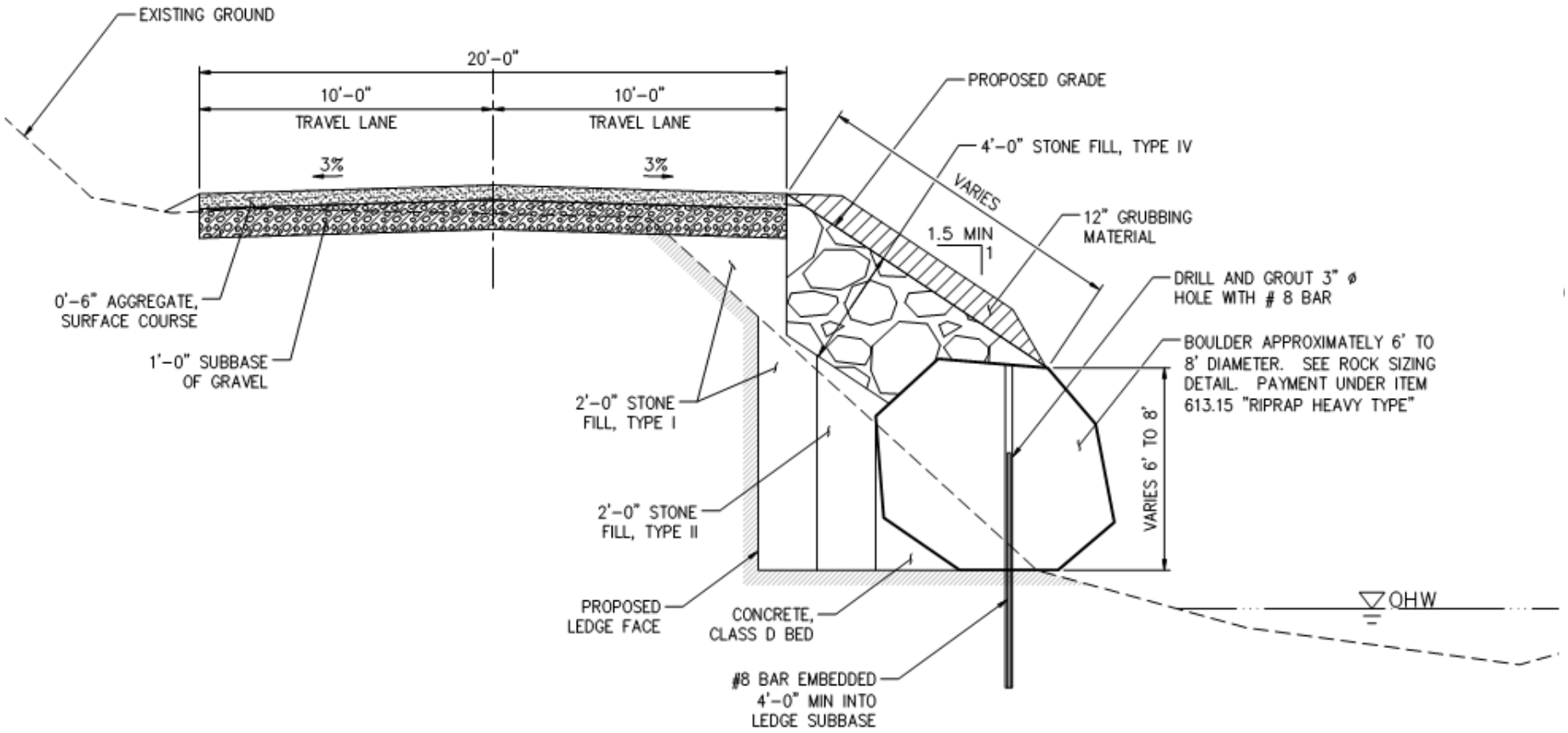


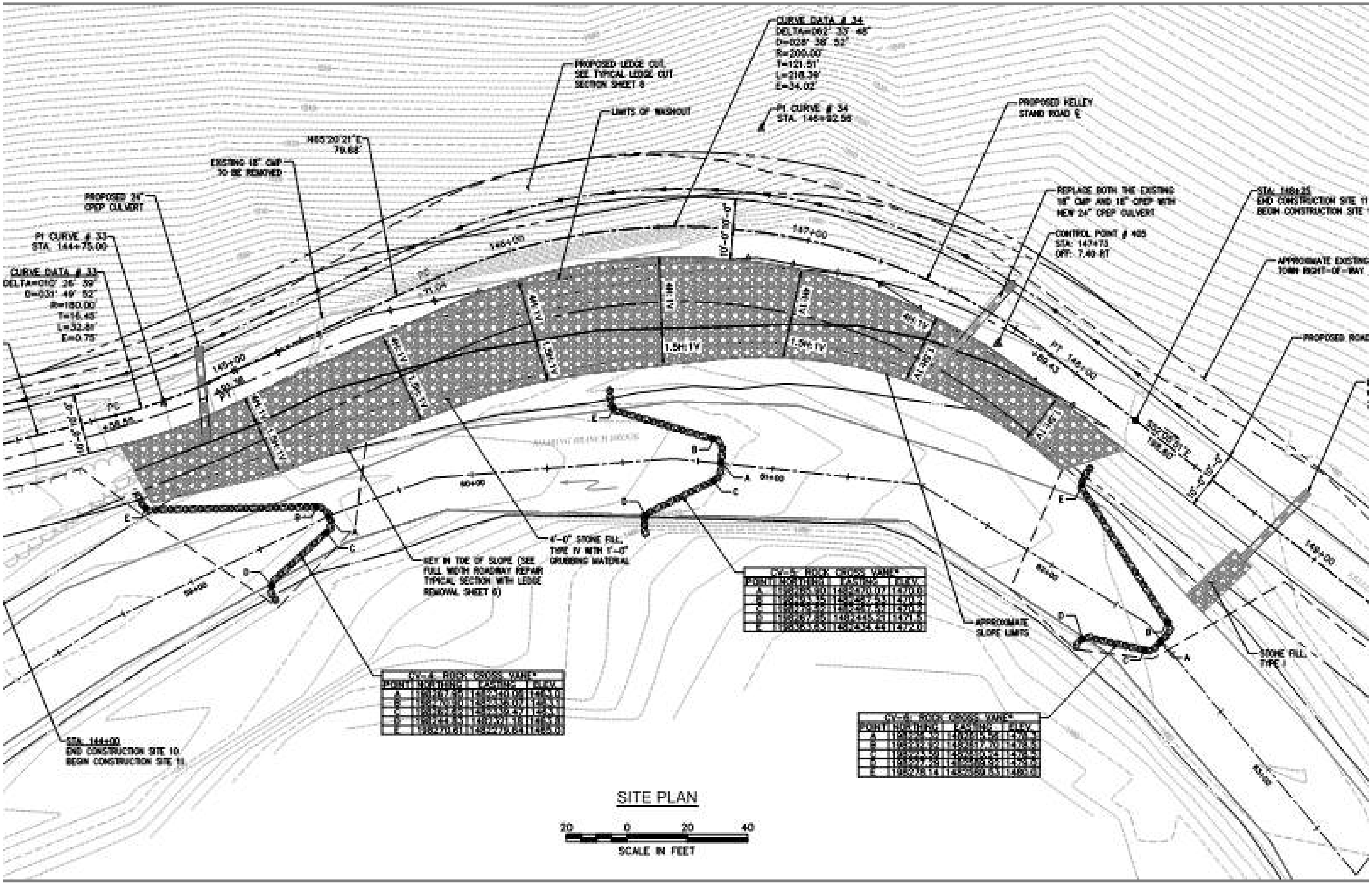
NOTE:
REVISIONS TO FULL WIDTH ROADWAY REPAIR TYPICAL SECTION WITH LEDGE REMOVAL WERE APPLIED AT THE FOLLOWING PROJECT LOCATIONS

SITE 11 – STA. 143+95 TO STA. 145+85

SITE 14 – STA. 163+00 TO STA. 168+25

Pinned Boulder Detail

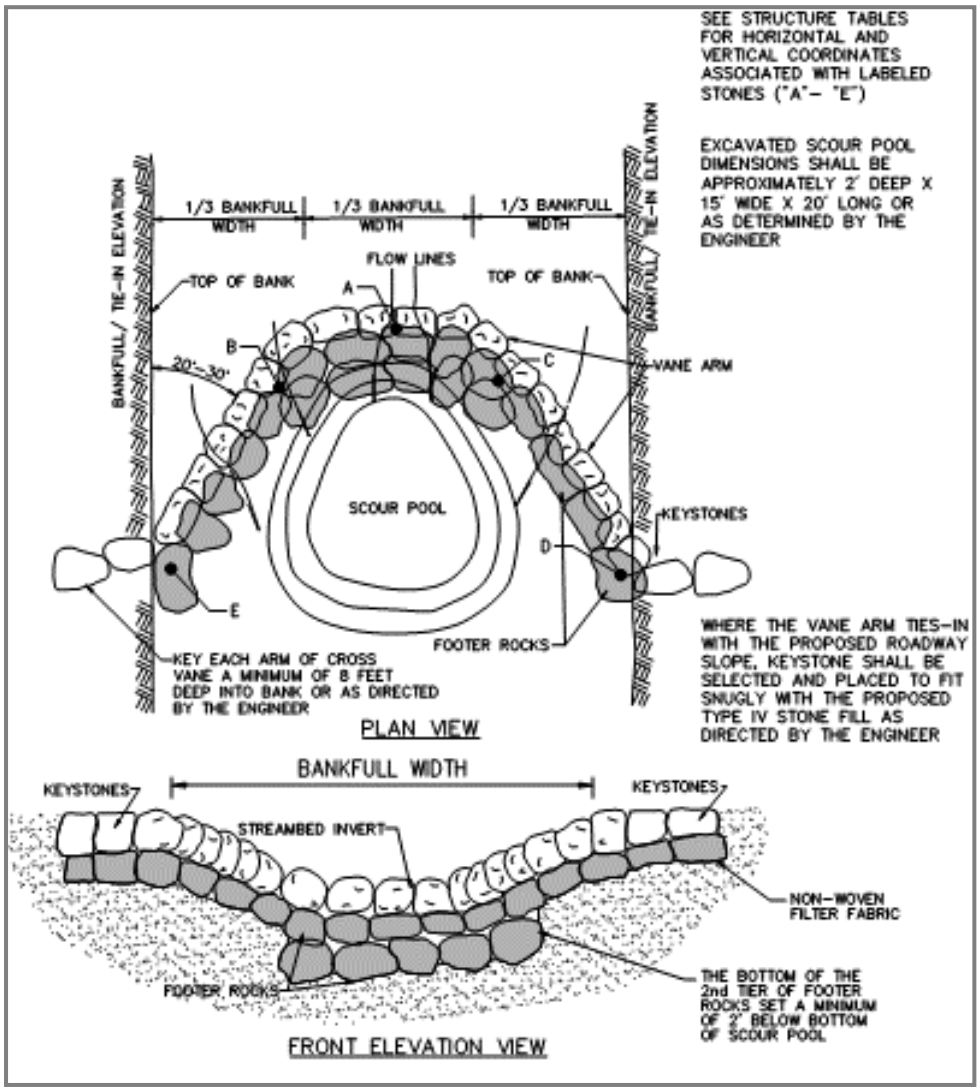


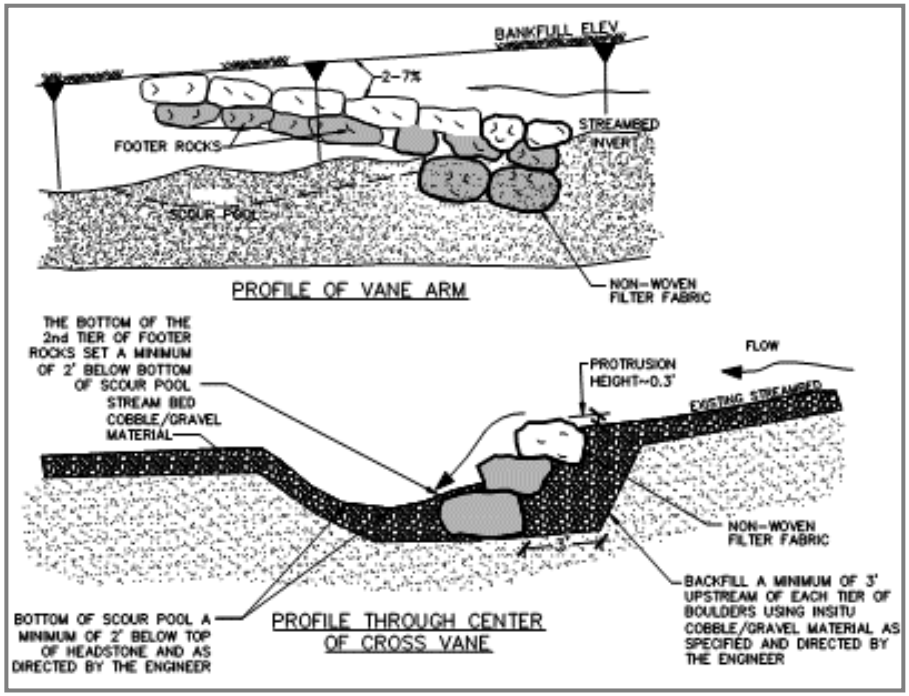


CV-4: ROCK CROSS VANE*			
POINT	NORTHING	EASTING	ELEV.
A	[illegible]	[illegible]	[illegible]
B	[illegible]	[illegible]	[illegible]
C	[illegible]	[illegible]	[illegible]
D	[illegible]	[illegible]	[illegible]
E	[illegible]	[illegible]	[illegible]

CV-5: ROCK CROSS VANE*			
POINT	NORTHING	EASTING	ELEV.
A	[illegible]	[illegible]	[illegible]
B	[illegible]	[illegible]	[illegible]
C	[illegible]	[illegible]	[illegible]
D	[illegible]	[illegible]	[illegible]
E	[illegible]	[illegible]	[illegible]

CV-6: ROCK CROSS VANE*			
POINT	NORTHING	EASTING	ELEV.
A	[illegible]	[illegible]	[illegible]
B	[illegible]	[illegible]	[illegible]
C	[illegible]	[illegible]	[illegible]
D	[illegible]	[illegible]	[illegible]
E	[illegible]	[illegible]	[illegible]


SEE STRUCTURE TABLES FOR HORIZONTAL AND VERTICAL COORDINATES ASSOCIATED WITH LABELED STONES ("A"– "E")
EXCAVATED SCOUR POOL DIMENSIONS SHALL BE APPROXIMATELY 2' DEEP X 15' WIDE X 20' LONG OR AS DETERMINED BY THE ENGINEER
1/3 BANKFULL WIDTH
1/3 BANKFULL WIDTH
1/3 BANKFULL WIDTH
BANKFULL/ TIE-IN ELEVATION
BANKFULL/ TIE-IN ELEVATION
TOP OF BANK
TOP OF BANK
FLOW LINES
A
B
C
D
E
20°-30°
VANE ARM
SCOUR POOL
KEYSTONES
FOOTER ROCKS
KEY EACH ARM OF CROSS VANE A MINIMUM OF 8 FEET DEEP INTO BANK OR AS DIRECTED BY THE ENGINEER
WHERE THE VANE ARM TIES-IN WITH THE PROPOSED ROADWAY SLOPE, KEYSTONE SHALL BE SELECTED AND PLACED TO FIT SNUGLY WITH THE PROPOSED TYPE IV STONE FILL AS DIRECTED BY THE ENGINEER
PLAN VIEW
BANKFULL WIDTH
KEYSTONES
KEYSTONES
STREAMBED INVERT
NON-WOVEN FILTER FABRIC
FOOTER ROCKS
THE BOTTOM OF THE 2nd TIER OF FOOTER ROCKS SET A MINIMUM OF 2' BELOW BOTTOM OF SCOUR POOL
FRONT ELEVATION VIEW


BANKFULL ELEV
2-7%
FOOTER ROCKS
STREAMBED INVERT
SCOUR POOL
NON-WOVEN FILTER FABRIC
PROFILE OF VANE ARM
THE BOTTOM OF THE 2nd TIER OF FOOTER ROCKS SET A MINIMUM OF 2' BELOW BOTTOM OF SCOUR POOL
STREAM BED COBBLE/GRAVEL MATERIAL
PROTRUSION HEIGHT=0.3'
FLOW
EXISTING STREAMBED
3'
NON-WOVEN FILTER FABRIC
BACKFILL A MINIMUM OF 3' UPSTREAM OF EACH TIER OF BOULDERS USING INSITU COBBLE/GRAVEL MATERIAL AS SPECIFIED AND DIRECTED BY THE ENGINEER
BOTTOM OF SCOUR POOL A MINIMUM OF 2' BELOW TOP OF HEADSTONE AND AS DIRECTED BY THE ENGINEER
PROFILE THROUGH CENTER OF CROSS VANE

Construction

- Contractor had limited experience with in-stream work but was open to receiving direction; such collaboration was an important part of construction success
- Operators needed time to come up to speed
- Known at outset and planned for, senior geomorphologist spent a week in field with training
- Some structures were taken down and rebuilt following inspection
- Overburden removal didn't always reveal stable rock face that was anticipated
- Challenging site conditions within and adjacent to active channel


J.A. McDONALD
345C


J.A. McDONALD
735
CAT


J.A. McDONALD


CAT


WIDE LOAD

Acknowledgements

- Town of Sunderland
- U.S. Forest Service – Green Mountain National Forest
- J.A. MacDonald, Inc.

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