



Built for Versatility

Streambank Failure Mechanisms and Streambank Stabilization on Pistol Creek at McCammon Drive

- Patrick McMahon, S&ME Senior Engineer

Streambank Failure Mechanisms



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- **Streambank Instability: an inherent property of alluvial systems**
- **The incidence and rate of instability is increased by disturbance**

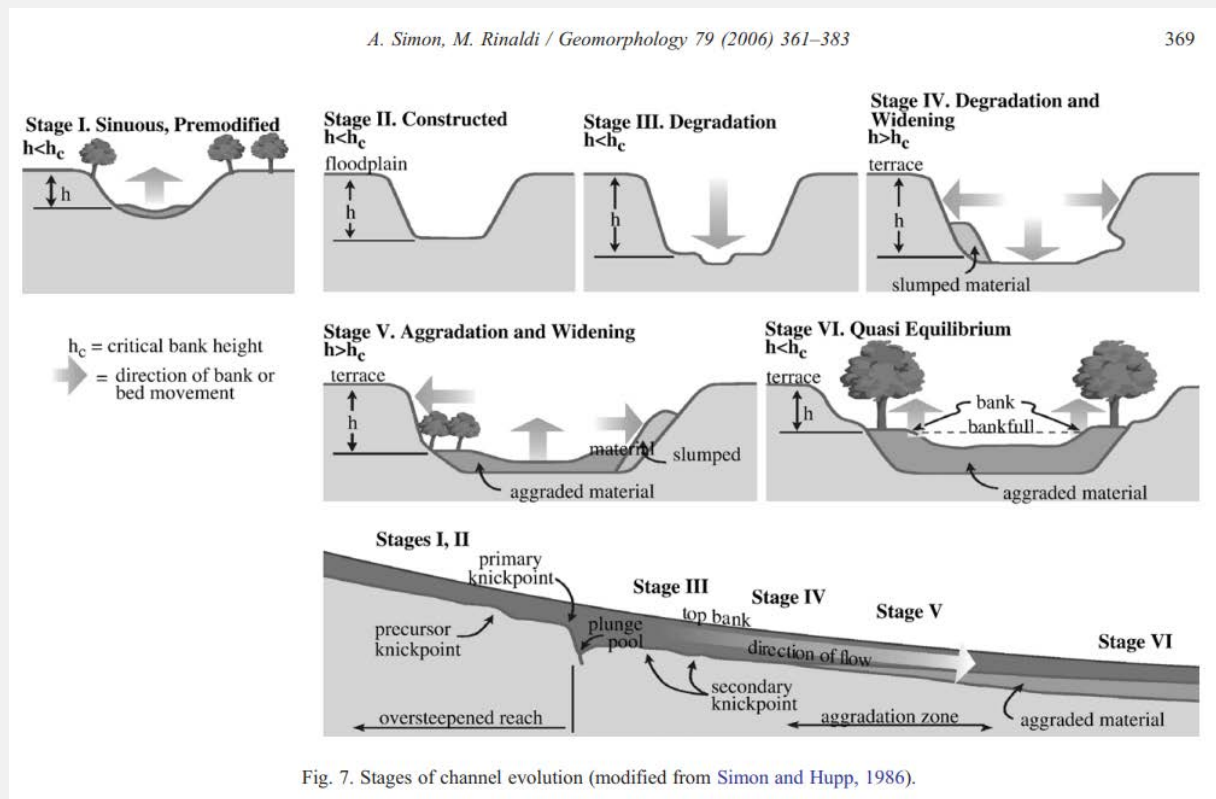
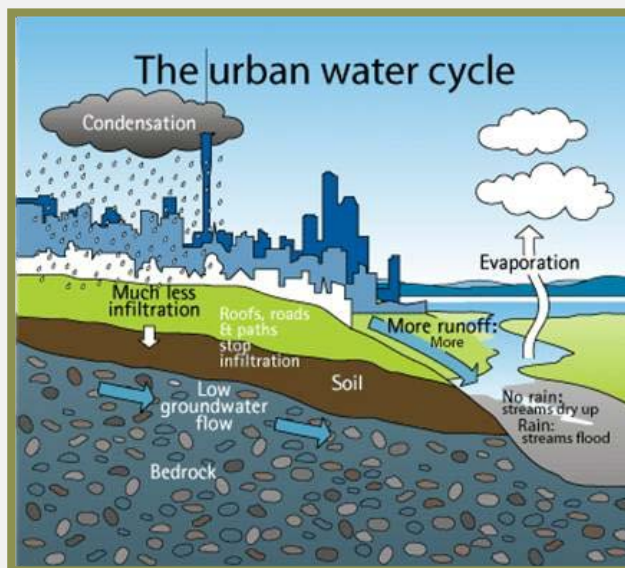
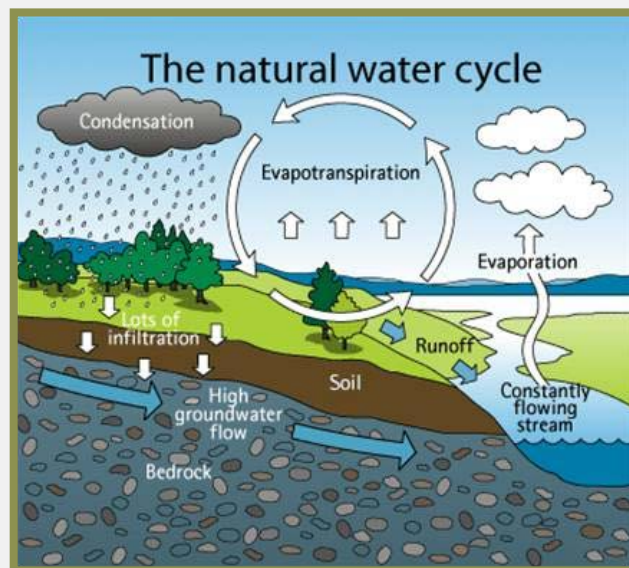


Fig. 7. Stages of channel evolution (modified from Simon and Hupp, 1986).

Streambank Failure Mechanisms



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Flow

Sediment

Frequency

Natural erosion produces nearly 30 percent of the total sediment in the United States. Accelerated erosion from human activities accounts for the remaining 70 percent.

Streambank Failure Mechanisms



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- **Streambank Instability:** an inherent property of alluvial systems
- **Not just a sediment problem...**



Streambank Failure Mechanisms



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Hydraulic Failures

- Occur when tractive force of flows $>$ critical shear materials
- Characteristics:
 - Lack of vegetation
 - high boundary velocities
 - no mass wasting at the toe

Geotechnical Failures

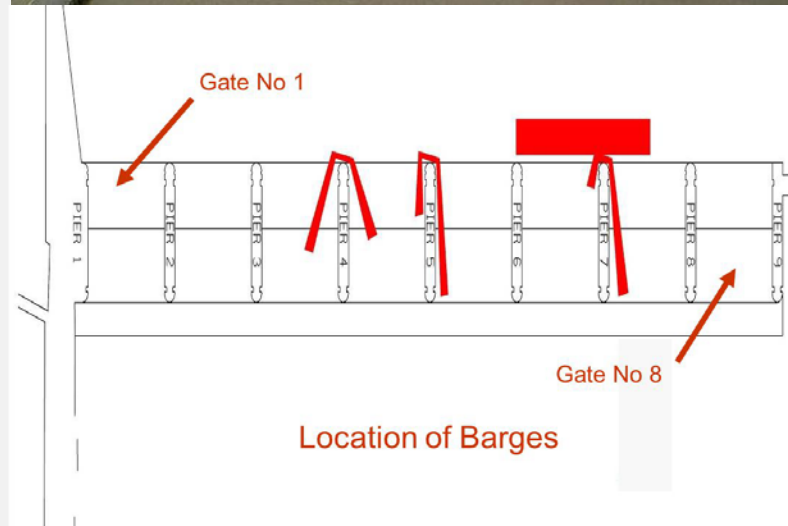
- Unrelated to tractive force
- Typically caused by variations in soil moisture
- Characteristics:
 - Fractures
 - Mass wasting
 - Rotational failures

Streambank Failure Mechanisms



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- **Belleville Locks and Dam, 2005**
- **Geotechnical Failure Due to Rapid Draw Down, Due to...**
- 42 miles upstream to the next dam, plus tributaries
- Rapid draw down up to 14 feet
- Widespread bank failures...



Streambank Failure Mechanisms



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Streambank Failure Mechanisms



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- Most Streambank failures are a combination of hydraulic and geotechnical failure.

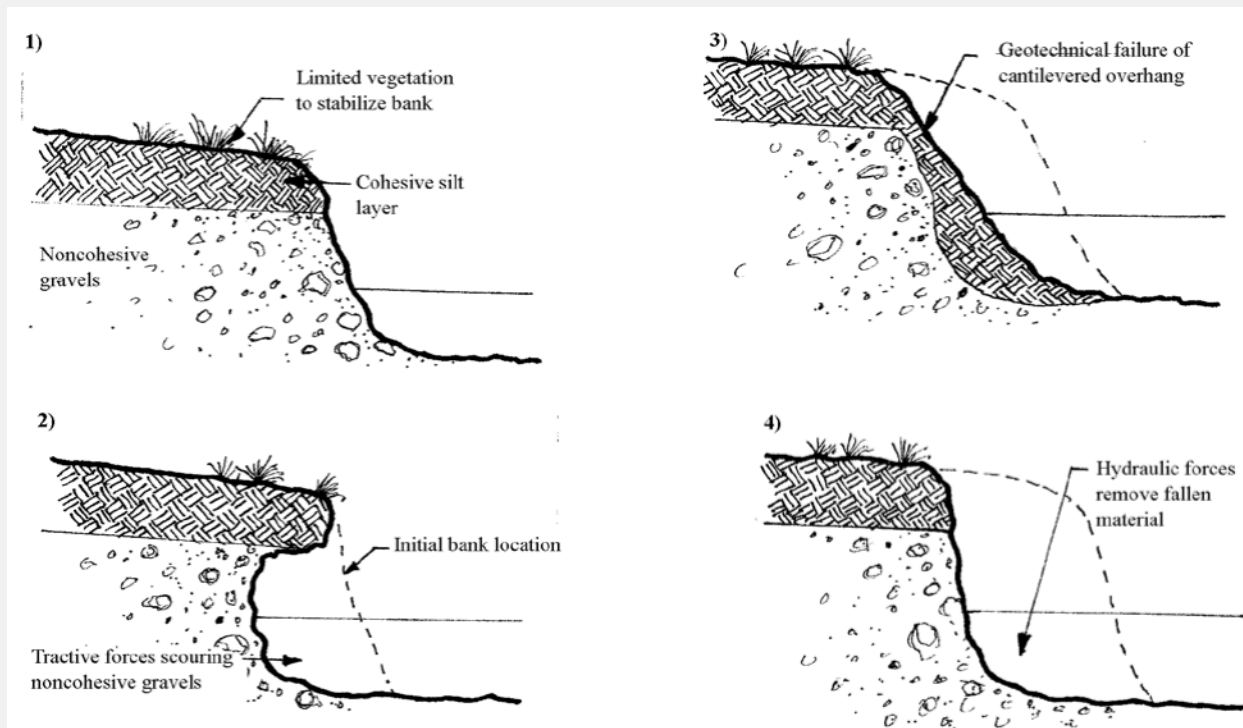
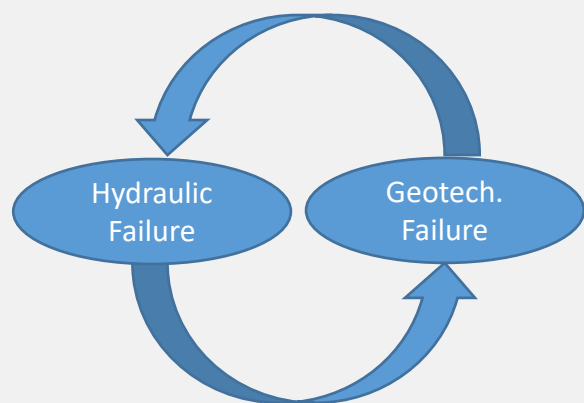


Figure 3: Stratified Streambanks and Combination Failures (Adapted from Johnson and Stypula 1993)

Streambank Failure Mechanisms



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- **Most Streambank failures are a combination of hydraulic and geotechnical failure.**



Streambank Failure Mechanisms



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Entry #24, West Prong Little Pigeon River Bank Stabilization



Photo 1, After: Completed Bank Work and Installed Rock Vanes Following Construction

Pistol Creek at Mammon Drive



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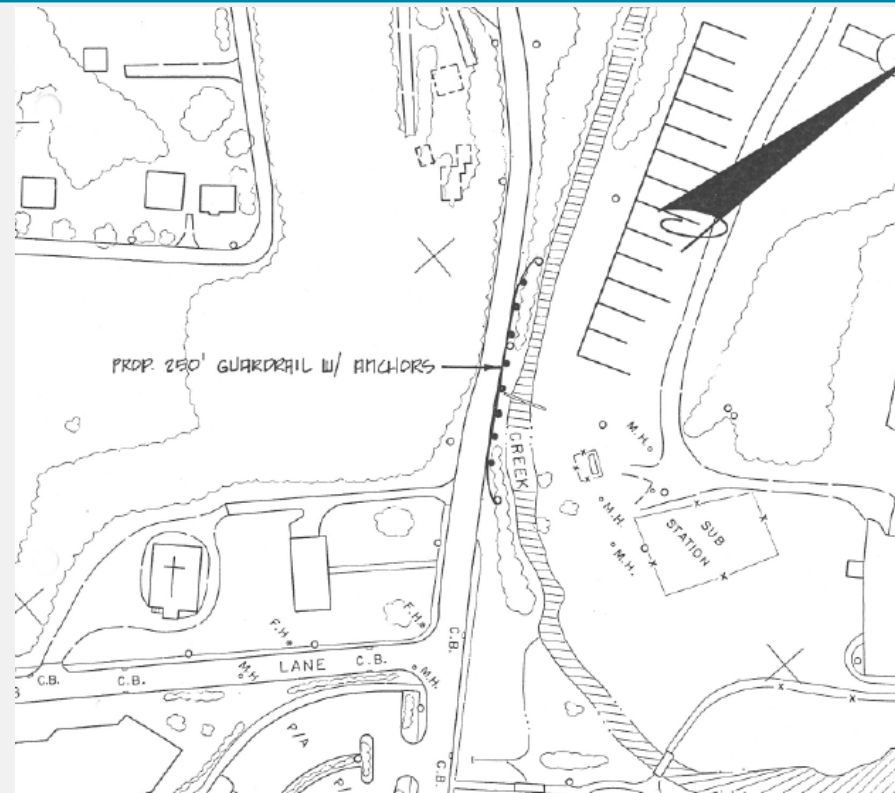
REPORT ON DRAINAGE STUDY OF THE CITY OF MARYVILLE

PREPARED BY

CITY OF MARYVILLE
ENGINEERING DEPARTMENT

APRIL 19, 1989

PROJECT # 30-85-164



LOCATION

Louisville Rd. 400' North of Library

PROBLEM

West bank Pistol Creek too eroding Eastern edge Louisville Rd.

SOLUTION

Install guardrail on Eastern edge Louisville Rd.

Pistol Creek at Mammon Drive



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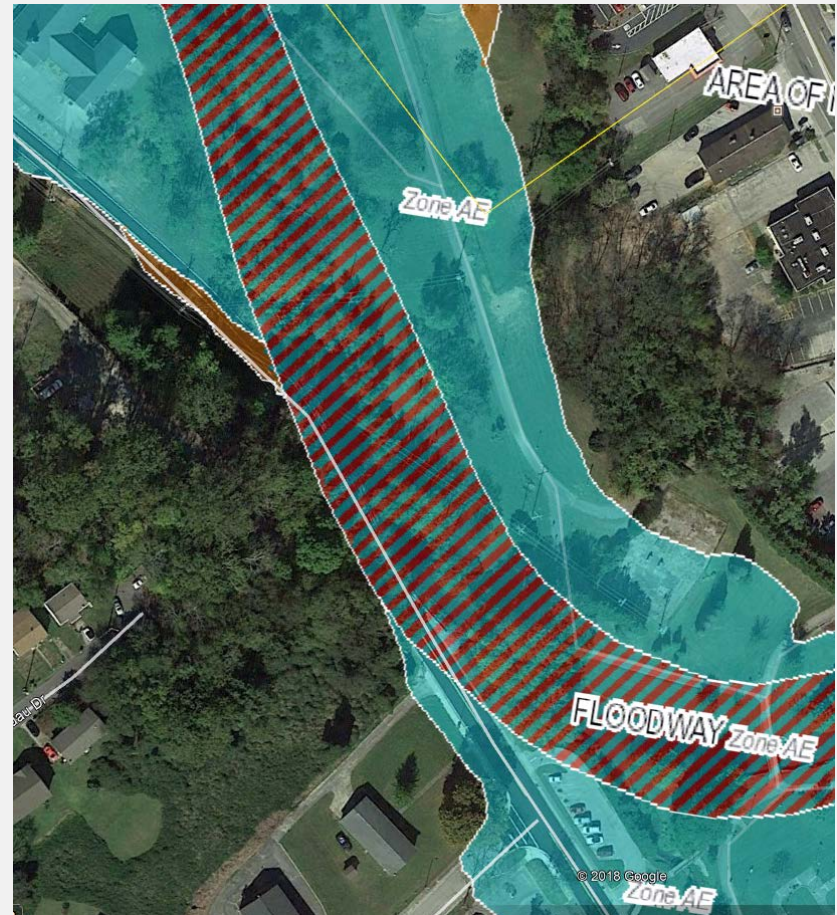
Pistol Creek at Mammon Drive



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Services

- Analysis, design, and permitting in 2016
 - General ARAP for Bank Stabilization, 290'
 - T&E Species Review
 - Bat Habitat Survey
 - NFIP Compliance
- Bid Documents / Bid Period Support
- Construction Oversight
- Construction Completed February 1, 2017
- Ahead of Schedule and on Budget



Pistol Creek at Mammon Drive



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Design Challenges

Utilities

Confined Work Space

Utilities

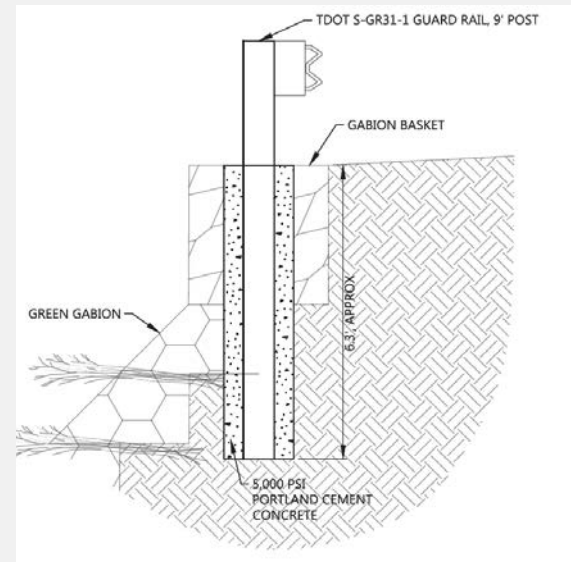
Traffic

Floodway

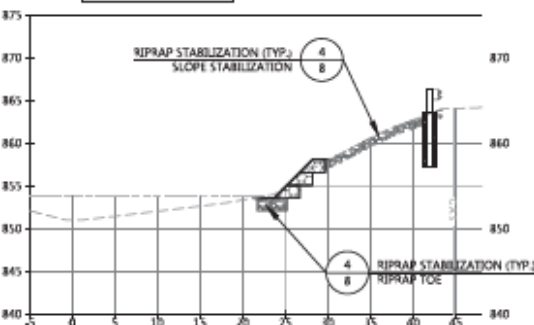
Failure Mechanisms

Erosion and Sediment Control

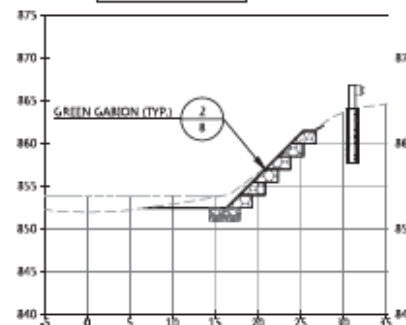
Space for Guardrail



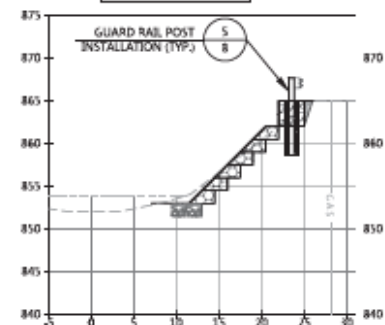
SECTION 1



SECTION 2



SECTION 3



Pistol Creek at Mammon Drive



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Construction Challenges

More Utilities

Stubborn Drivers

Surprise Spring

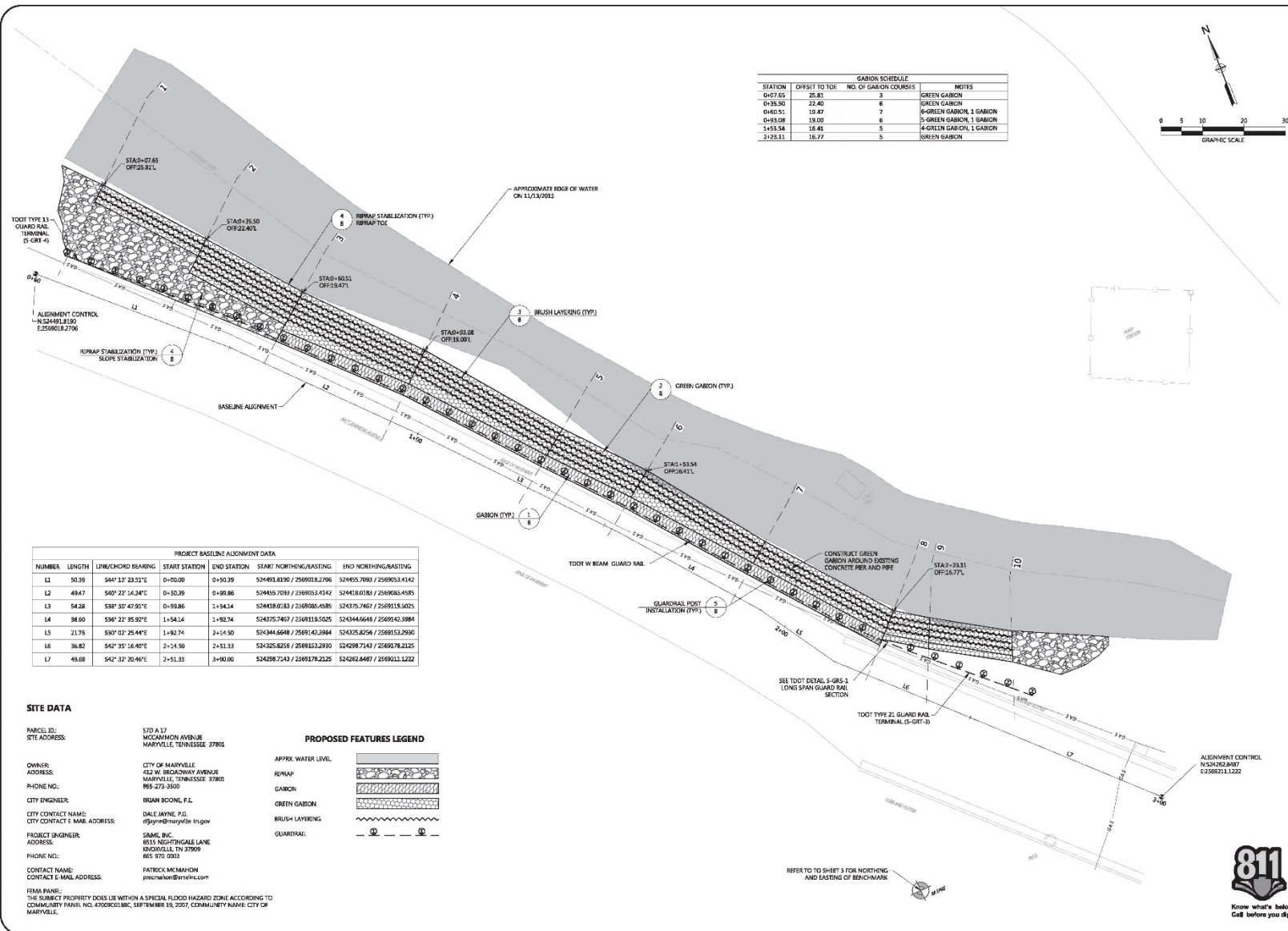
**Construction Loading /
Geotechnical Hazards**

Field Adjustments

Wick Drains Beneath the Road

French Drain at Spring





STATION	OFFSET TO TOE	NO. OF GABION COURSES	NOTES
0+07.65	25.81	3	GREEN GABION
0+35.50	22.40	6	GREEN GABION
0+60.51	19.47	7	6-GREEN GABION, 1 GABION
0+93.08	19.00	6	5-GREEN GABION, 1 GABION
1+53.54	16.41	5	4-GREEN GABION, 1 GABION
2+28.11	16.77	5	GREEN GABION

PROJECT BASELINE ALLOCATION DATA						
NUMBER	LENGTH	UNIFORM BEARING	START STATION	END STATION	START NORTHING/EASTING	END NORTHING/EASTING
L1	50.39	S44°13'23.52"E	0+00.00	0+50.39	S240871.8130 / 2569018.2796	S24055.700 / 2569063.414
L2	49.67	S40°22'14.34"E	0+50.39	0+99.96	S240455.700 / 2569033.414	S24016.767 / 2569038.408
L3	54.28	S38°02'59.92"E	0+99.96	1+54.24	S240483.8130 / 2569048.408	S24075.767 / 2569053.414
L4	38.50	S36°22'39.92"E	1+54.24	1+92.74	S240375.740 / 2569103.414	S240444.668 / 2569153.408
L5	21.75	S30°02'59.92"E	1+92.74	2+14.50	S240344.668 / 2569143.408	S24035.8256 / 2569153.408
L6	36.82	S42°35'16.00"E	2+14.50	2+51.33	S240325.8256 / 2569120.212	S240298.743 / 2569170.212
L7	45.88	S42°35'16.00"E	2+51.33	3+00.00	S240298.743 / 2569170.212	S240298.743 / 2569170.212

SITE DATA

PARCEL ID: 57D A 17
SITE ADDRESS: MCCAMMON AVENUE
MARYVILLE, TENNESSEE 37801

OWNER: CITY OF MARYVILLE
ADDRESS: 412 W. BROADWAY AVENUE
MARYVILLE, TENNESSEE 37803
PHONE NO.: 865-273-3500

CITY ENGINEER: BRIAN BOONE, P.E.
CITY CONTACT NAME: DALE JAYNE, P.G.
CITY CONTACT E-MAIL ADDRESS: djayne@marville.com

PROJECT ENGINEER:
ADDRESS:
PHONE NO.:

SB&ME, INC.
6515 NIGHTINGALE LANE
KNOXVILLE, TN 37909
615 970 0003

CONTACT NAME: PATRICK MCMAHON
CONTACT E-MAIL ADDRESS: pmcmahon@smi-inc.com

FEMA PANEL:
THE SUBJECT PROPERTY DOES LIE WITHIN A SPECIAL FLOOD HAZARD ZONE ACCORDING TO
COMMUNITY PANEL NO. 47009C0188C, SEPTEMBER 19, 2007, COMMUNITY NAME: CITY OF
MARYVILLE.

PROPOSED FEATURES LEGEND

APPRX. WATER LEVEL.

RECAP

GABON

GREEN GABION

BRUSH LAYERING

GUARDRAIL

erence

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Lessons Learned

Know the utility personnel and their cell number

Plan time for construction, labor intensive

Construction oversight is critical to schedule and budget

Contractor communication

Coordinate with maintenance crews



Thank you



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Patrick McMahon, S&ME
pmcmahon@smeinc.com

