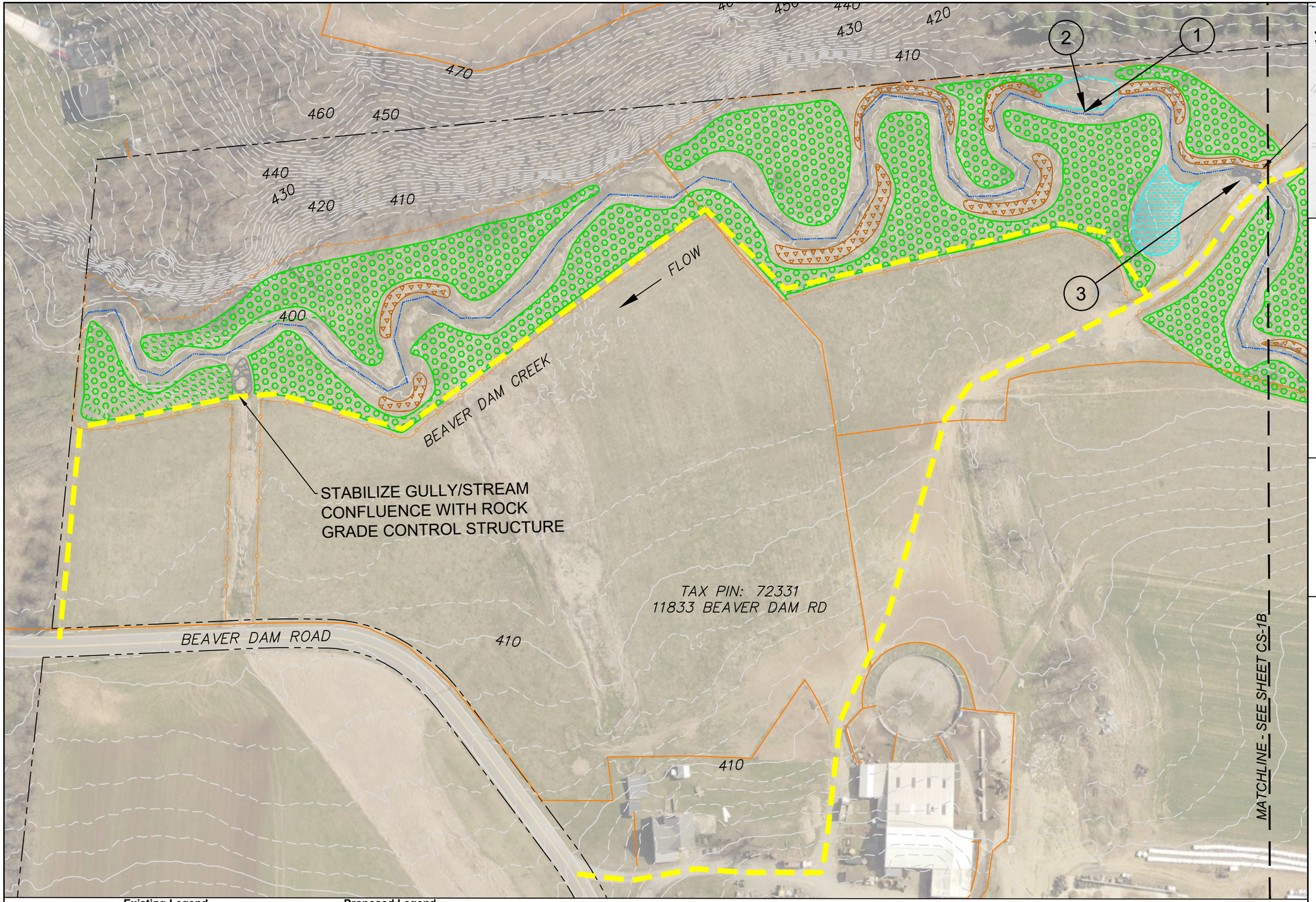
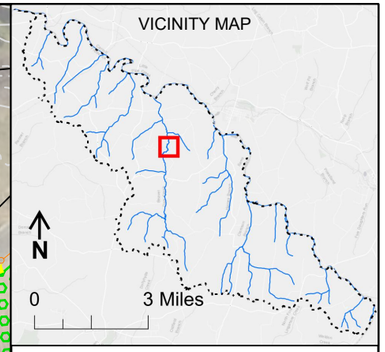
APPENDIX D: RESTORATION CONCEPTS





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
1
NPDES BMP ID:
LIPI-2018-STRE-001
Site ID(s):
34
Prioritization Ranking:
1
Parcel Tax PIN:
72331
Address:
11833 Beaver Dam Road
Union Bridge, MD 21791
BMP Type:
Stream Restoration

Sheet #:
CS-1A

AKRF

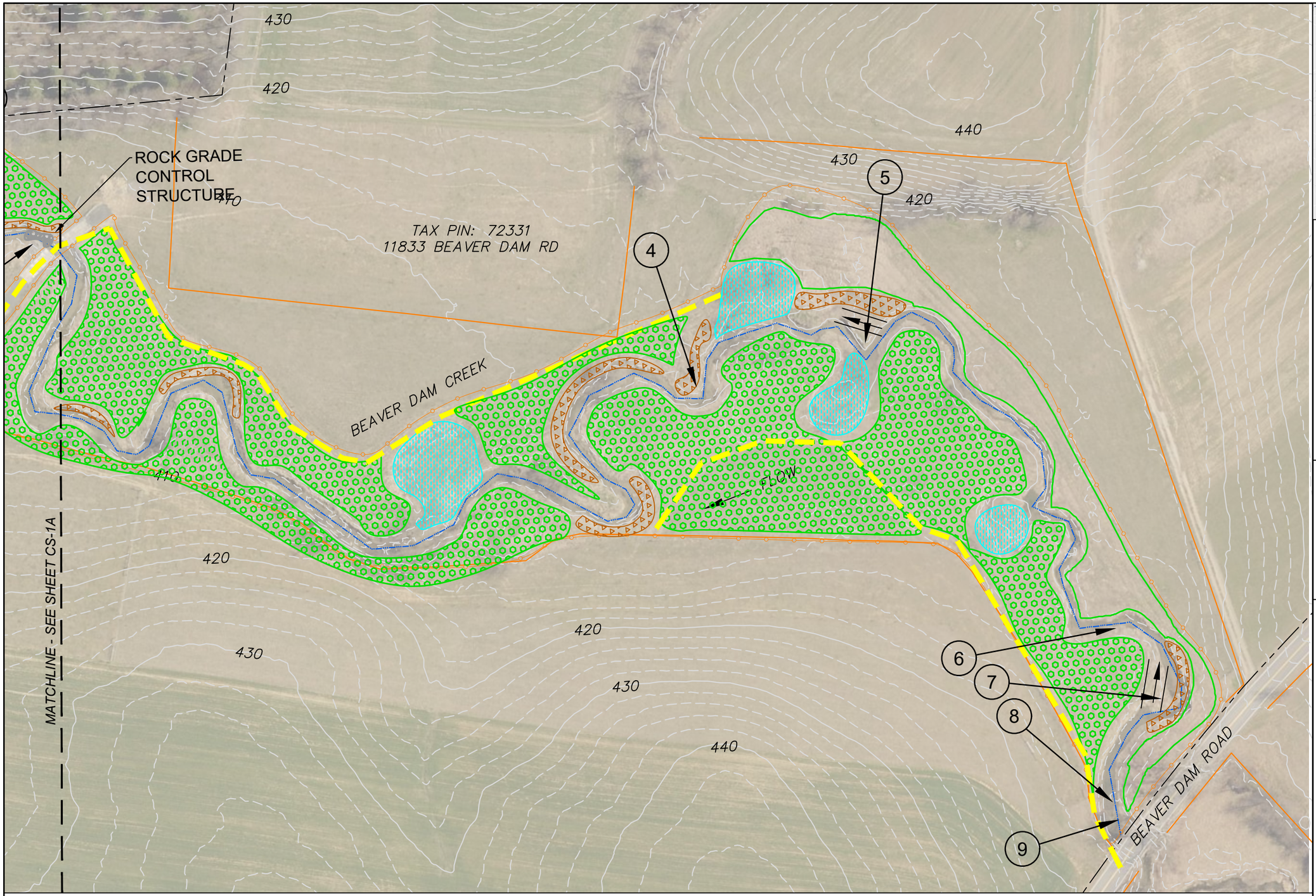
Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

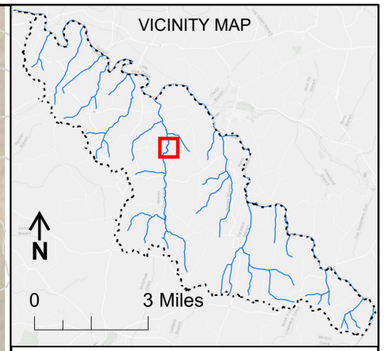
Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstructior
- Access Route
- 1 Photo Location

N

100 0 100 200

Scale 1" = 100'





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- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- (1) Photo Location

N

100 0 100 200

Scale 1" = 100'

AKRF

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
1
NPDES BMP ID:
LIPI-2018-STRE-001
Site ID(s):
34
Prioritization Ranking:
1
Parcel Tax PIN:
72331
Address:
11833 Beaver Dam Road
Union Bridge, MD 21791
BMP Type:
Stream Restoration

Sheet #:

CS-1B

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0001
Site ID:	CS-1
Prioritization Ranking:	1
Structure Location:	11833 Beaver Dam Rd, Union Bridge, MD 21791
Coordinates (Lat, Long):	39.556103, -77.210263
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$2,506,164
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Biological Level
Project Length (LF):	4,298
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	43
TN (lbs/yr):	322
TP (lbs/yr):	292
TSS (lbs/yr):	192,894
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The stream reach of interest is a portion of Beaver Dam Creek that is bounded by Beaver Dam Road on both ends. Drainage area to the site consists of mostly active agriculture, with 12 percent forested and 3 percent impervious area. The site is an active farm and the reach is constrained by electric fencing around the cattle pasture. This fencing crosses the stream upstream and downstream of a concrete ramp heavily armored with rip-rap that is moderately eroded. The floodplain is flat and has poor riparian zone quality, with grassed banks and few mature trees, with a reforestation project installed in recent years. Floodplain connectivity was categorized as “incised within a large floodplain”, indicating that the stream is much lower than the surrounding floodplain. The stream lateral stability was classified as “unstable”, and vertical instability was observed as well. The stream form is a single thread meandering pattern with pool-riffle and plane-bed profile forms throughout. The stream displayed meander migration, meander bend cutoffs (localized channel straightening), severe bank erosion (including collapsed banks), undercut trees, and point bars.	

Restoration Measures	
The proposed restoration measures include channel realignment at a couple of overly eroded and tight meander bends, floodplain reconnection and wetland creation in low-lying floodplain sections and abandoned meander bends. Bank erosion would be addressed through bank regrading and stabilization measures such as installation of live stakes. Riparian buffer restoration would add to and enhance the previous tree planting efforts and would add additional native herbaceous vegetation to create a buffer between the cattle pasture and the stream. The existing livestock crossing would be maintained and enhanced as needed. In-stream rock grade control would be installed or improved downstream of the crossing, and the pool-riffle features in the stream would be maintained or enhanced during construction, the need for which would be determined by a detailed geomorphic survey at a later design phase.	
Anticipated Site Constraints	
Constructability/Access	Easy. The site is easily accessible from the road near both ends of the reach and the floodplain is flat and open, with minimal clearing needed. Temporary removal and replacement of existing fencing will be required. Impacts to recently planted trees shall be minimized.

Selected Site Photos

Photo 1. Large floodplain, with minimal riparian zone coverage. Mid-channel bar and stream bank erosion visible. Rip-rap hardened cattle crossing visible in the background.

Photo 2. Eroded and collapsed banks with mid-channel vegetated bar visible in the foreground.

Photo 3. Rip-rap at cattle crossing in middle of reach. Eroded stream bank visible just downstream of rip-rap.

Photo 4. Streambank erosion on outer meander bends with overhanging vegetation.

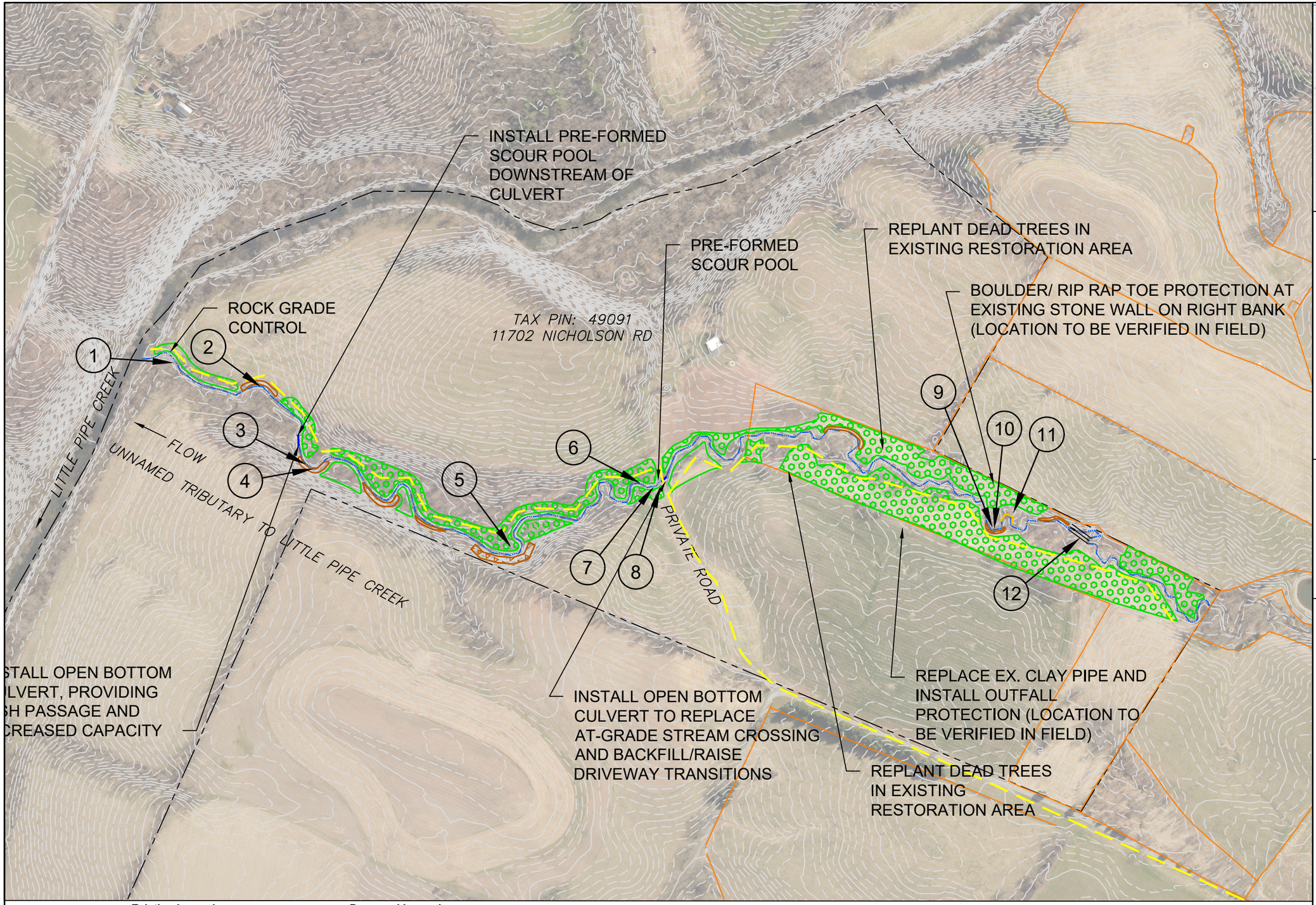
Photo 5. Minimal riparian buffer zone between stream and pasture.

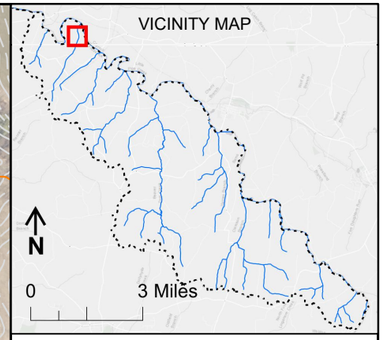
Photo 6. Evidence of past streambank erosion – collapsed bank with vegetation established.

Photo 7. Eroded outer meander bends with over hanging vegetation.

Photo 8. Plane bed form throughout stream segment. Riparian zone was typically a grassed floodplain.

Photo 9. Culverts at upstream reach limit, at Beaver Dam Road.





Existing Legend

- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

300 0 300 600

Scale 1" = 300'

AKRF

Frederick County, MD

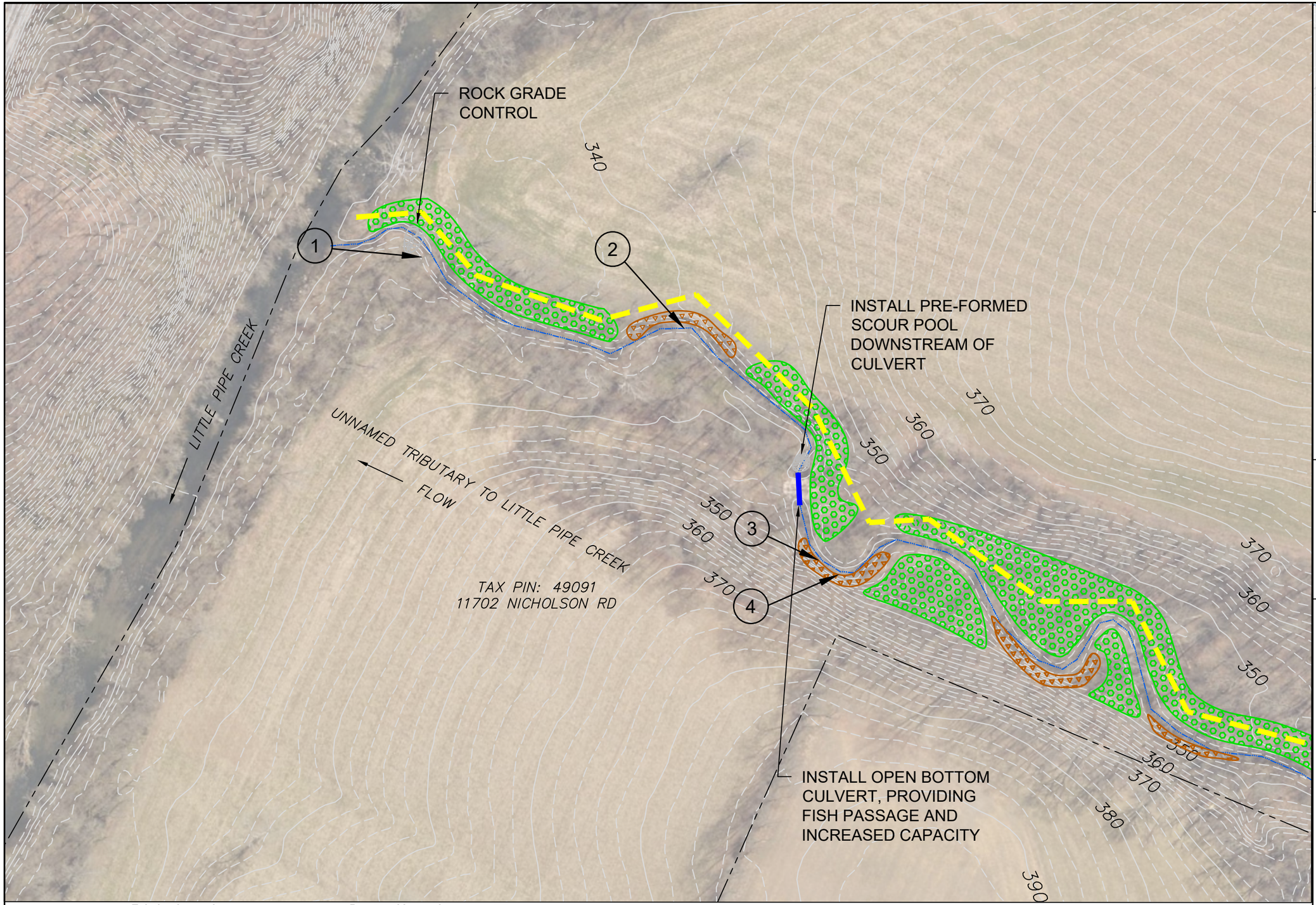
Double Pipe Creek Watershed Assessment

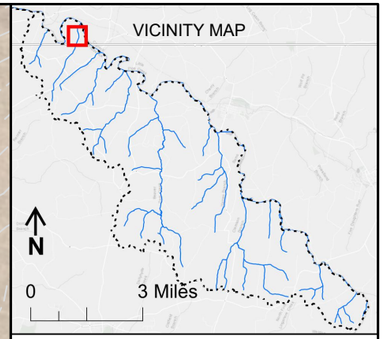
Conceptual Site Restoration Plan

Project:
2
NPDES BMP ID:
LIPI-2018-STRE-0002
Site ID(s):
109
Prioritization Ranking:
2
Parcel Tax PIN:
49091
Address:
11702 Nicholson Rd
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:

CS-2





Existing Legend

- Stream Channel
- Fence
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- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- (1) Photo Location

AKRF

100 0 100 200

Scale 1" = 100'

Frederick County, MD

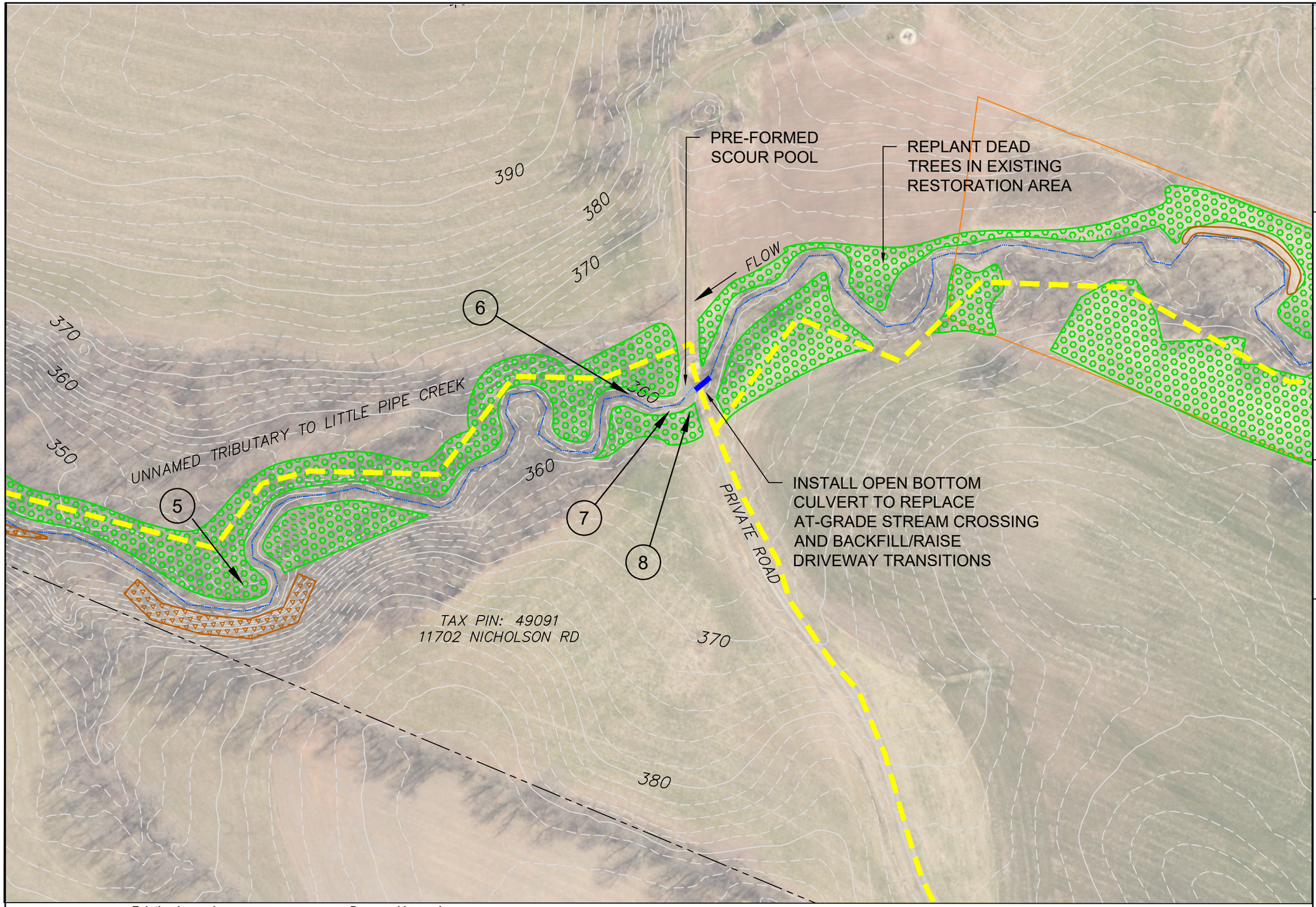
Double Pipe Creek Watershed Assessment

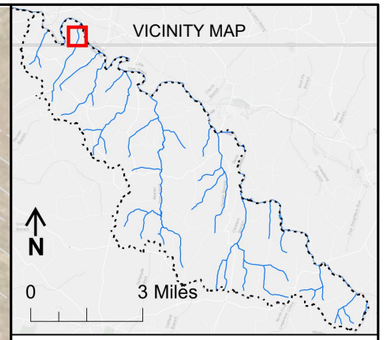
Conceptual Site Restoration Plan

Project:
2
NPDES BMP ID:
LIPI-2018-STRE-0002
Site ID(s):
109
Prioritization Ranking:
2
Parcel Tax PIN:
49091
Address:
11702 Nicholson Rd
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:

CS-2A





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
2
NPDES BMP ID:
LIPI-2018-STRE-0002
Site ID(s):
109
Prioritization Ranking:
2
Parcel Tax PIN:
49091
Address:
11702 Nicholson Rd
Keymar, MD 21757
BMP Type:
Stream Restoration

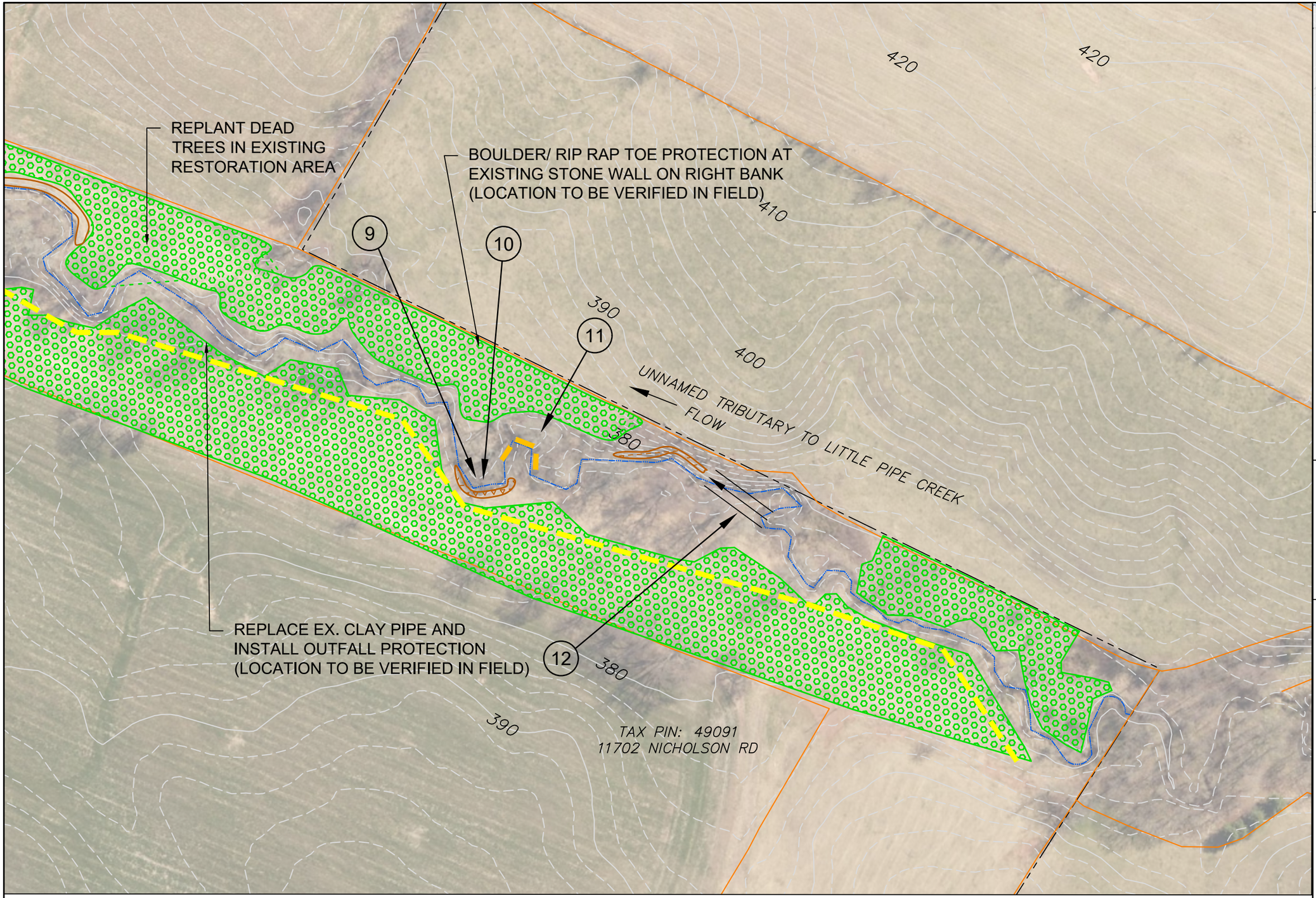
Sheet #:
CS-2B

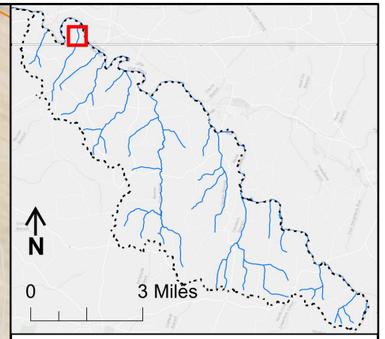
Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

100 0 100 200
Scale 1" = 100'

AKRF





Existing Legend

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- Minor Contour (2 ft interval)
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Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

100 0 100 200

Scale 1" = 100'

AKRF

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
2
NPDES BMP ID:
LIPI-2018-STRE-0002
Site ID(s):
109
Prioritization Ranking:
2
Parcel Tax PIN:
49091
Address:
11702 Nicholson Rd
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:

CS-2C

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0002
Site ID:	CS-2
Prioritization Ranking:	2
Structure Location:	11702 Nicholson Rd Keymar, MD 21757
Coordinates (Lat, Long):	39.597364, -77.252666
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$2,901,506
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Biological Level
Project Length (LF):	4,976
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	50
TN (lbs/yr):	373
TP (lbs/yr):	338
TSS (lbs/yr):	223,323

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition

The stream reach is an unnamed tributary from its confluence with Little Pipe Creek to the fenced boundary of the active agricultural property that the reach is located in. Drainage area to the reach is primarily agricultural, with about 13 percent forested area and 4 percent impervious area. Private roads cross the stream in the middle of the reach via a concrete ford, and in the downstream quarter of the reach via three 24-inch concrete-encased pipes. The reach is surrounded by rolling hills, with a moderate floodplain visible along much of the reach, and several abandoned floodplain terraces and meander bends adjacent to the stream. In the downstream half of the reach, there is no floodplain on the left bank side, and the valley steepens and slopes directly to the top of the tall (> 5 foot) eroded banks. Previous riparian buffer plantings were observed along much of the upstream reach, while the remainder has poor riparian zone quality, with many invasive species. The stream was characterized as a single thread meandering plane-bed with occasional pool-riffle features. The lateral stability of the upstream half was classified as “Unstable” and the downstream half was “Moderately Stable”. The stream displayed signs of meander migration, meander bend cutoffs (localized channel

straightening), bank erosion on the outer meander bends, undercut trees, and vegetated, silty point bars.	
Restoration Measures	
The proposed restoration measures include channel realignment at an overly eroded and tight meander bend, bank regrading and bioengineered stabilization measures such as installation of live stakes, and riparian buffer restoration to enhance the previous tree planting efforts and add additional native vegetation. An existing clay drainage pipe from one of the agricultural fields would be repaired or replaced as needed, and outfall protection would be installed to address the erosion from the pipe. The existing vehicle crossing ford and culvert structures would be replaced with open bottom culverts that provide fish passage and increase capacity with pre-formed scour pools downstream of the crossings. The pool-riffle features in the stream would be maintained or enhanced during construction, the need for which would be determined by a detailed geomorphic survey at a later design phase.	
Anticipated Site Constraints	
Constructability/Access	Moderate. Some tree clearing will be required for construction access and bank grading operations, but this should be minimized and reforestation will be required for all disturbed areas. There are overhead power lines near the right stream bank that need to be protected during construction. The construction access road may be partially constructed along the land owner's existing driveway, with landowner permission, and restoration following project completion.

Selected Site Photos

Photo 1. Confluence of unnamed tributary with Little Pipe Creek.

Photo 2. Undercut trees along streambank and large woody debris fallen within channel.

Photo 3. Plane-bed is the dominant channel form throughout downstream third of study reach.

Photo 4. Vehicle crossing with three culverts is acting as a barrier to fish passage.

Photo 5. Moderate to severe bank erosion with undercut trees observed at downstream reach.

Photo 6. Denser canopy coverage in downstream reach riparian zone. Aquatic fauna (such as macrophytes, minnows, snapping turtles, and caddisfly), observed within in-stream riffles and pools. Streambed predominantly large gravel and cobbles, determined through visual inspection.

Photo 7. Stream crosses concrete driveway at grade, acting as a barrier to fish passage.

Photo 8. Overhanging dead woody vegetation observed midstream. Generally sparse riparian zone with low canopy coverage.

Photo 9. Streambank erosion with over hanging vegetation throughout upstream reach.

Photo 10. Wide adjacent floodplain. West (downstream-left) banks with notable erosion. Previous riparian buffer restoration planting by others in the foreground.

Photo 11. Incised channel noted upstream. Bank failure observed throughout on outer meander bends.

Photo 12. Observed point bar development.

INSTALL UNPAVED ACCESS ROADS OVER NEW CULVERTS. REMOVE FAILED CULVERT REMNANTS AND INSTALL NEW OPEN- BOTTOM CULVERTS

SHEET CS-3A

TAX PIN: 50416
10120 CLEMSONVILLE RD

CLEMSON BRANCH FLOW

SHEET CS-3B

TAX PIN: 50416
10120 CLEMSONVILLE RD

CLEMSONVILLE RD

SHEET CS-3C

REMOVE FAILED CULVERT REMNANTS AND INSTALL NEW OPEN- BOTTOM CULVERTS. VERIFY LOCATION IN FIELD

UNNAMED ROAD

TAX PIN: 50416
10120 CLEMSONVILLE RD

VICINITY MAP

N

0 3 Miles

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
3
NPDES BMP ID:
LIPI-2018-STRE-0003
Site ID(s):
21
Prioritization Ranking:
3
Parcel Tax PIN:
50416
Address:
10120 Clemsonville Rd
Union Bridge, MD 21791
BMP Type:
Stream Restoration

Sheet #:
CS-3

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

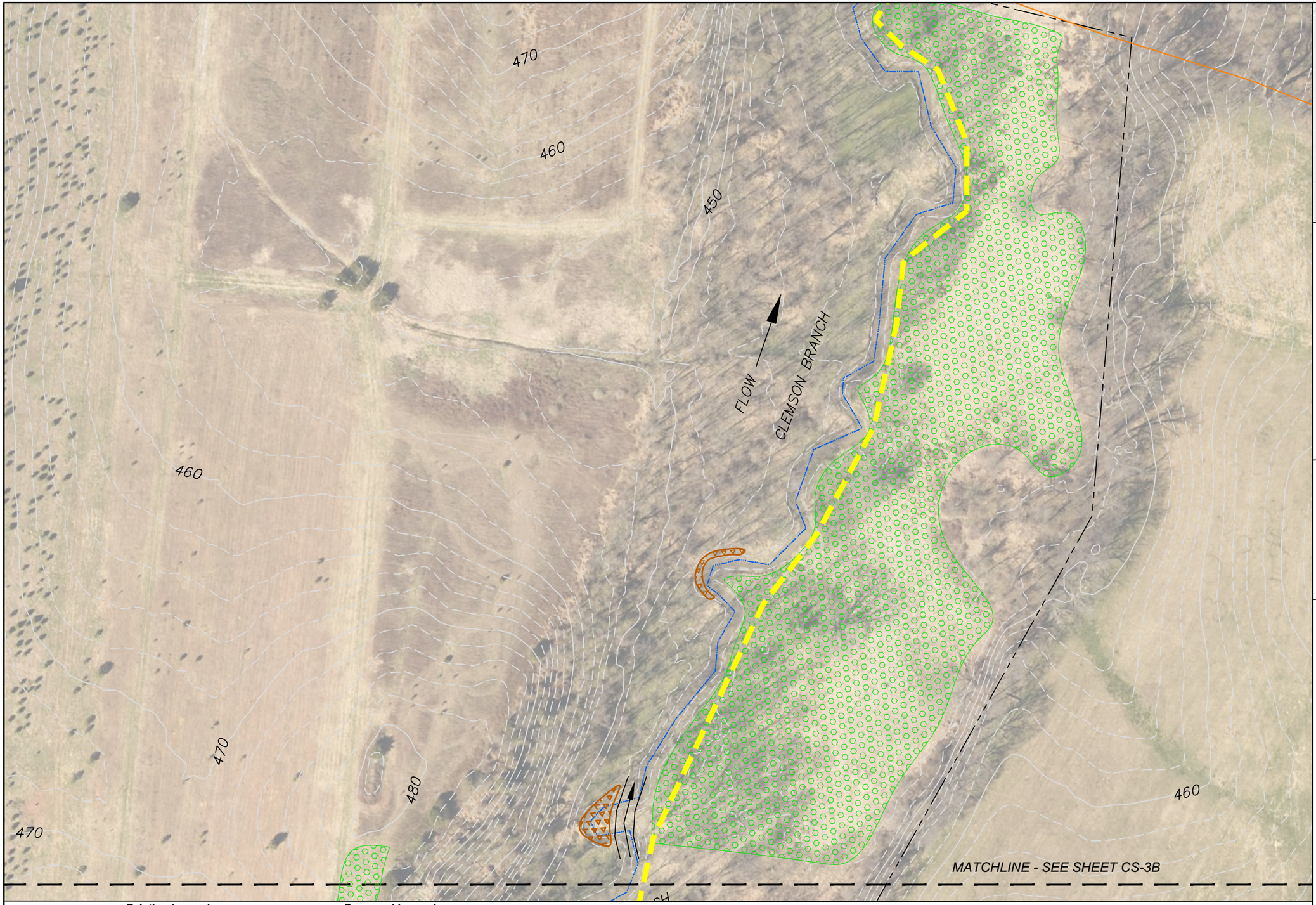
Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

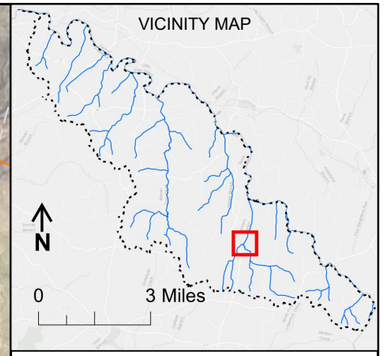
AKRF

N

300 0 300 600

Scale 1" = 300'





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
3
NPDES BMP ID:
LIPI-2018-STRE-0003
Site ID(s):
21
Prioritization Ranking:
3
Parcel Tax PIN:
50416
Address:
10120 Clemsonville Rd
Union Bridge, MD 21791
BMP Type:
Stream Restoration

Sheet #:
CS-3A

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- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

N

100 0 100 200
Scale 1" = 100'

MATCHLINE - SEE SHEET CS-3A

500

490

480

460

450

INSTALL UNPAVED ACCESS ROADS OVER NEW CULVERTS.
REMOVE FAILED CULVERT REMNANTS AND INSTALL NEW OPEN- BOTTOM CULVERTS

CLEMSON BRANCH

FLOW

FLOW

FLOW

FLOW

CLEMSONVILLE RD

MATCHLINE - SEE SHEET CS-3C

VICINITY MAP

N

0 3 Miles

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
3
NPDES BMP ID:
LIPI-2018-STRE-0003
Site ID(s):
21
Prioritization Ranking:
3
Parcel Tax PIN:
50416
Address:
10120 Clemsonville Rd
Union Bridge, MD 21791
BMP Type:
Stream Restoration

Sheet #:
CS-3B

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

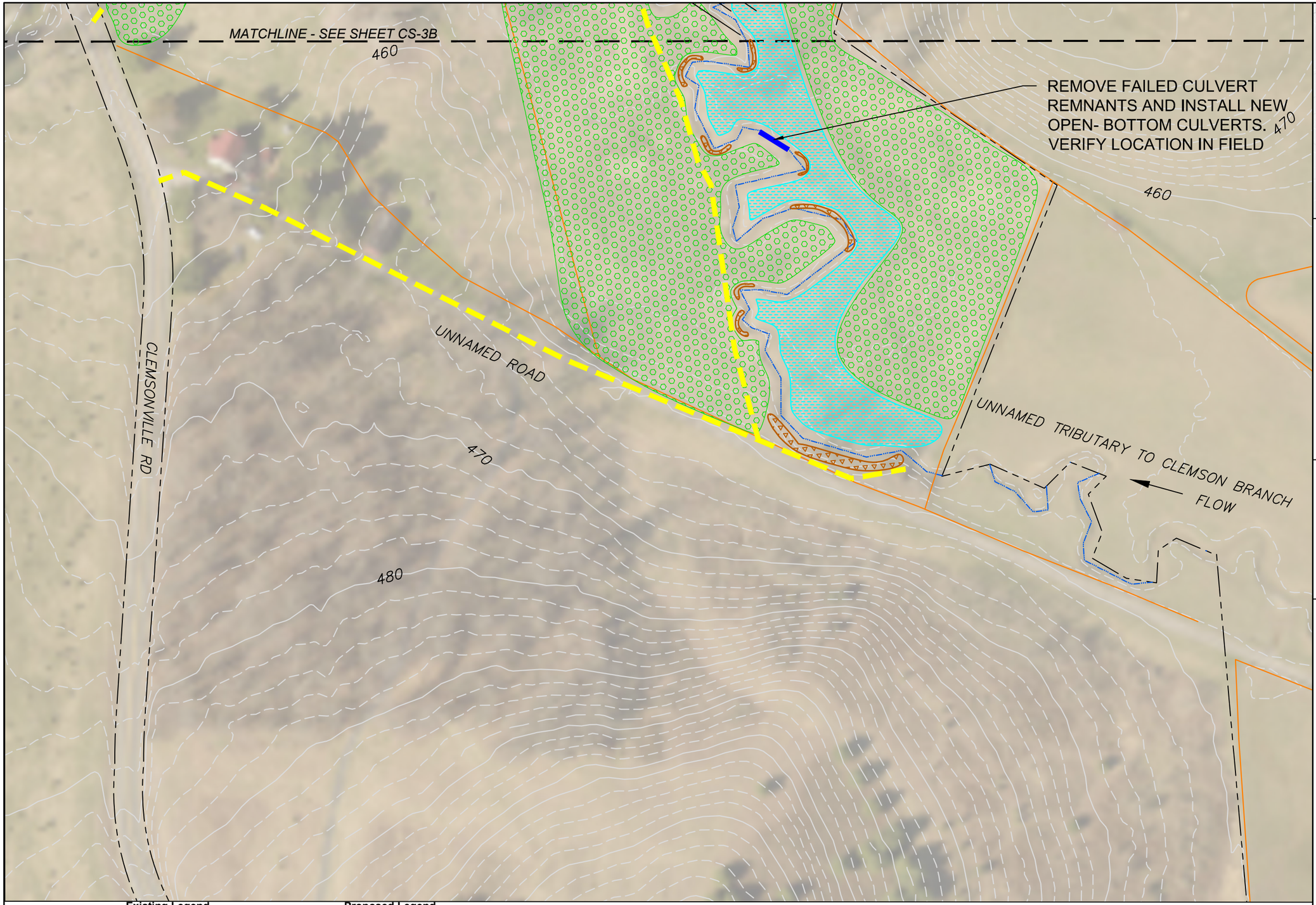
Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

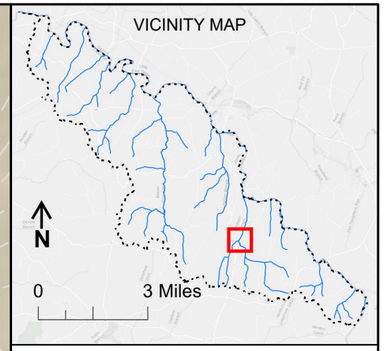
AKRF

N

100 0 100 200

Scale 1" = 100'





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
3
NPDES BMP ID:
LIPI-2018-STRE-0003
Site ID(s):
21
Prioritization Ranking:
3
Parcel Tax PIN:
50416
Address:
10120 Clemsonville Rd
Union Bridge, MD 21791
BMP Type:
Stream Restoration

Sheet #:
CS-3C

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

N

100 0 100 200
Scale 1" = 100'

AKRF

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0003
Site ID:	CS-3
Prioritization Ranking:	3
Structure Location:	10120 Clemsonville Rd, Union Bridge, MD 21791
Coordinates (Lat, Long):	39.516545, -77.174038
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$2,752,232
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Biological Level
Project Length (LF):	4,720
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	47
TN (lbs/yr):	354
TP (lbs/yr):	321
TSS (lbs/yr):	211,834
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The stream reach of interest is a portion of the Clemson Branch located between Clemonsville Road on the upstream end and the property line at the downstream end. Drainage area to the reach is primarily active or historic agricultural, with about 8 percent forested area and 1 percent impervious area. The property was formerly an agricultural site that is no longer in operation. The surrounding floodplain is large and flat and is well connected to both bank sides on most inner meander bends, but is disconnected from the stream by tall eroded banks on most outer meander bends. Terraces are present on both sides of the stream, on the inside meander bends, and in the transition area between meander bends. The stream was characterized as single thread meandering, with a plane-bed and weak pool-riffle bed profile. Culverts vertically confine the channel at the upstream end of the reach and at three other points within the reach, at private dirt road stream crossings. Moderate to severe bank erosion, meander migration, and undercut trees were observed, indicating an “Unstable” lateral condition.	

Restoration Measures	
The proposed restoration measures include bank regrading and stabilization measures such as installation of live stakes to repair and protect the existing steep, eroded stream banks. Additional restoration methods include channel realignment at a couple of overly eroded and tight meander bends, floodplain reconnection and wetland creation in low-lying floodplain sections and abandoned meander bends. Riparian buffer restoration would add to and enhance the previous tree planting efforts and would add additional native vegetation to create a buffer between the cattle pasture and the stream. The three existing culvert structures would be replaced with new open bottom culverts to improve flow conditions and aquatic organism passage and thus habitat connectivity along the stream reach. Pool-riffle features in the stream would be maintained or enhanced during construction, the need for which would be determined by a detailed geomorphic survey at a later design phase.	
Anticipated Site Constraints	
Constructability/Access	Easy. Clearing and grubbing would not be extensive, as much of the site is grassed and there are very few mature trees.

Selected Site Photos

Photo 1. Meander migration, overhanging banks in downstream portion.

Photo 2. Bent six foot wide corrugated metal culvert with farm road on top. Stream has bypassed around culvert and is eroding bank upstream.

Photo 3. Meandering channel migration with point bar development.

Photo 4. Four corrugated metal culverts in line; all appeared to have sediment deposits and standing water. The two left-most culverts allow the stream to flow through them while the remaining culverts were partially blocked with debris.

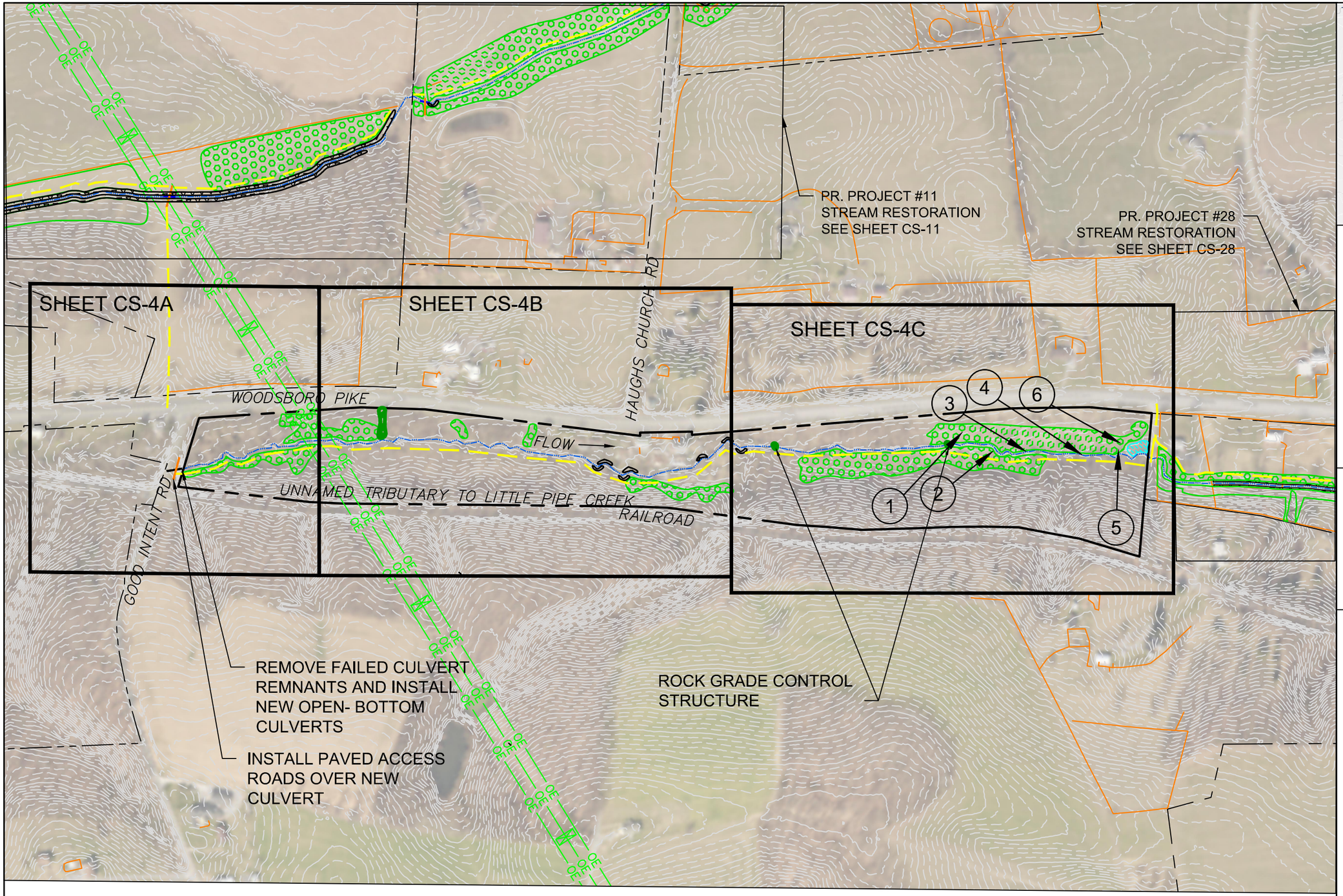
Photo 5. Upstream streambank with observed erosion.

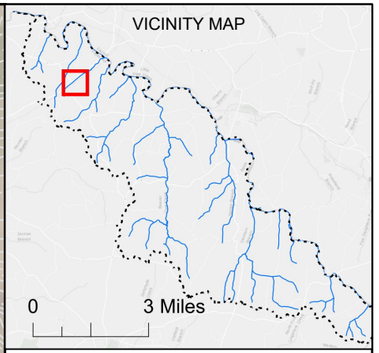
Photo 6. Floodplain connectivity on both left and right banks, minimal riparian vegetative cover upstream.

Photo 7. At upstream limit, approximately 4-foot round metal culvert with concrete base and headwall, small vertical drop and pool downstream.

Photo 8. Mid-stream corrugated metal culvert remnants redirecting flow toward banks, instigating erosion.

Photo 9. Large floodplain with no riparian buffer.





Existing Legend

- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- (1) Photo Location

N

300 0 100 600

Scale 1" = 300'

AKRF

Frederick County, MD

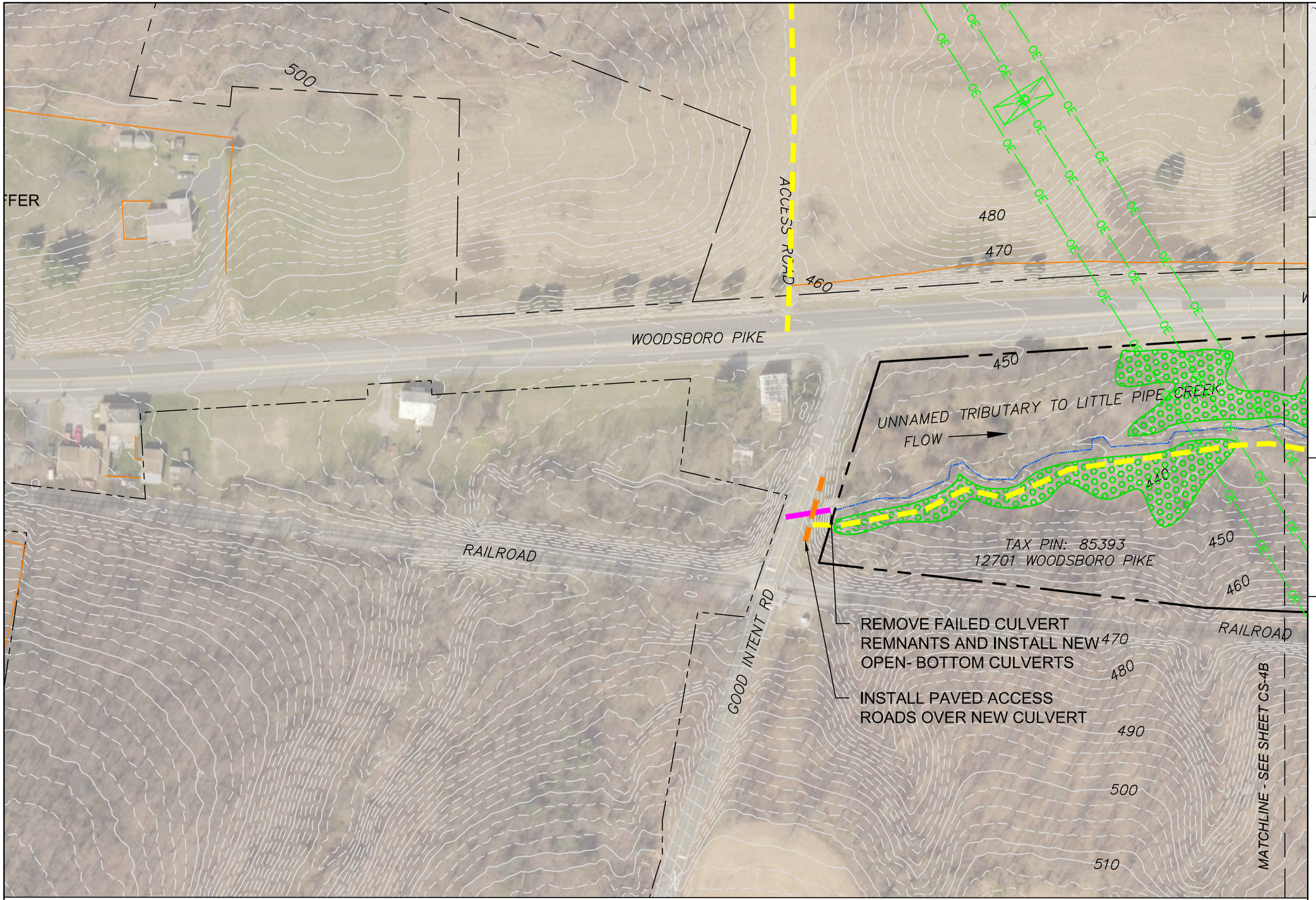
Double Pipe Creek Watershed Assessment

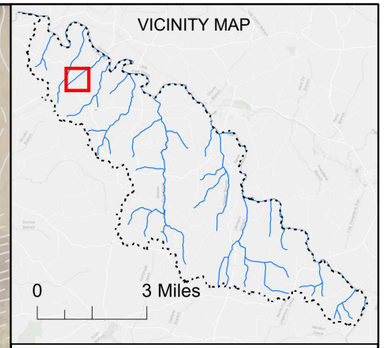
Conceptual Site Restoration

Project:
4
NPDES BMP ID:
LIPI-2018-STRE-0004
Site ID(s):
94
Prioritization Ranking:
4
Parcel Tax PIN:
85393
Address:
12701 Woodsboro Pike
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:

CS-4





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration

Project:
4
NPDES BMP ID:
LIPI-2018-STRE-0004
Site ID(s):
94
Prioritization Ranking:
4
Parcel Tax PIN:
85393
Address:
12701 Woodsboro Pike
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:
CS-4A

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- ① Photo Location

AKRF

N

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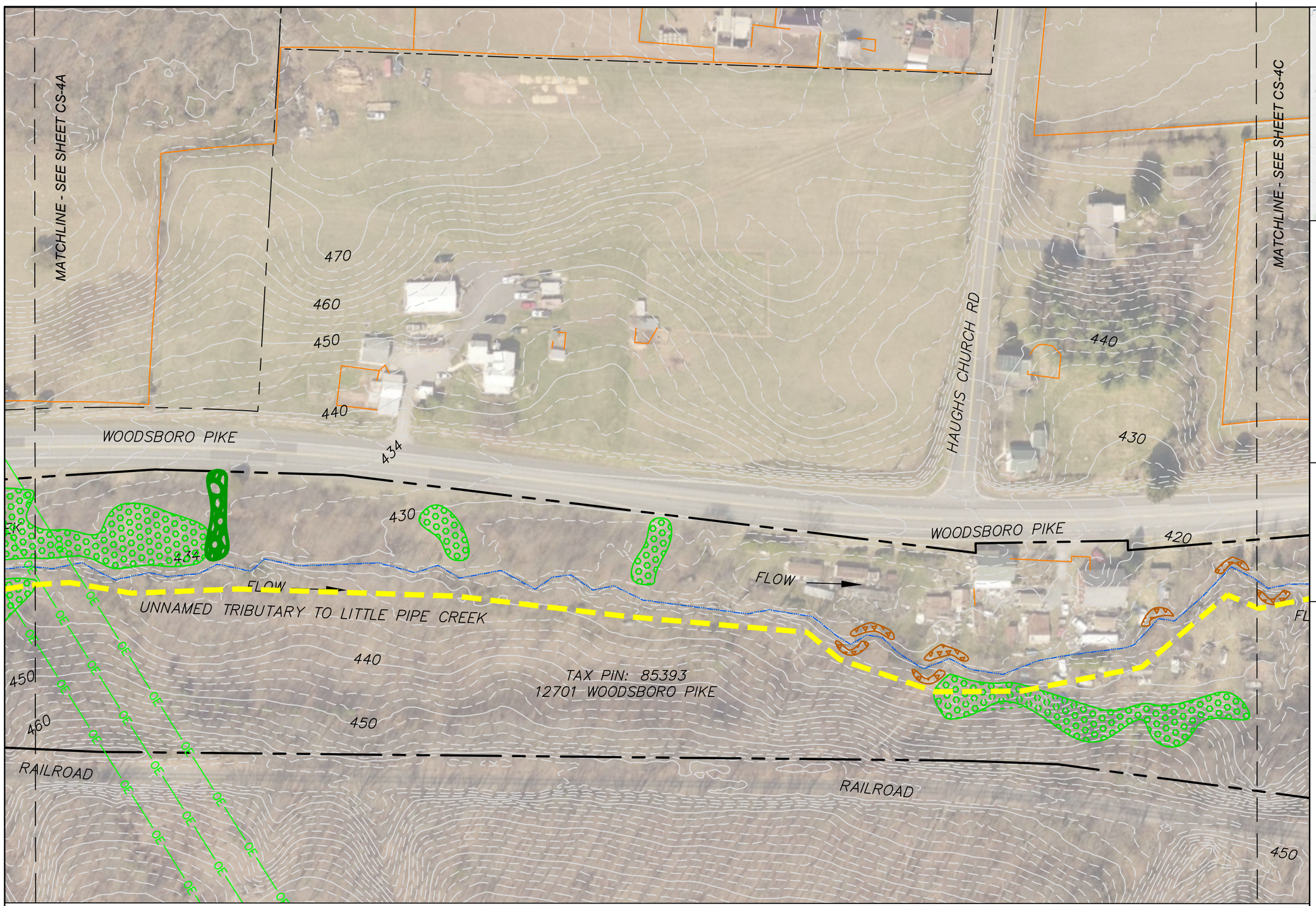
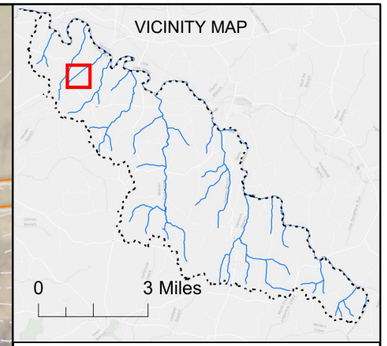
Scale 1" = 100'





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration

Project:
4
NPDES BMP ID:
LIPI-2018-STRE-0004
Site ID(s):
94
Prioritization Ranking:
4
Parcel Tax PIN:
85393
Address:
12701 Woodsboro Pike
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:
CS-4B

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- ① Photo Location

N

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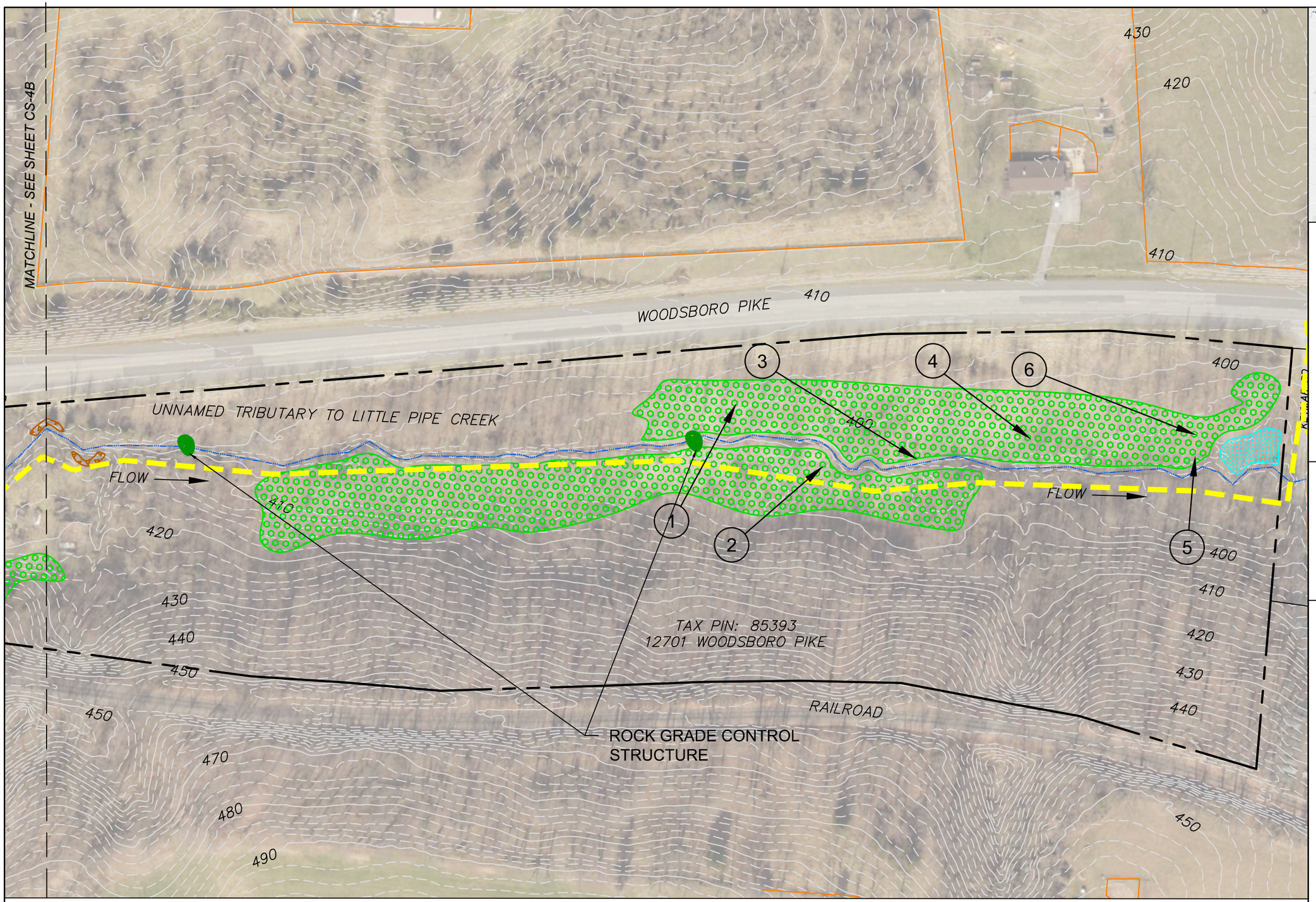
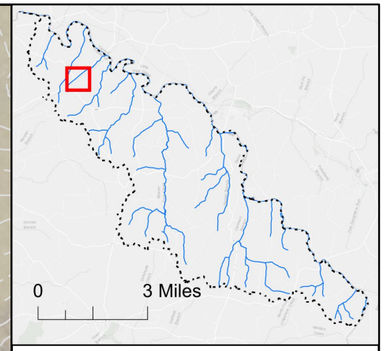
Scale 1" = 100'

AKRF





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration

Project:
4
NPDES BMP ID:
LIPI-2018-STRE-0004
Site ID(s):
94
Prioritization Ranking:
4
Parcel Tax PIN:
85393
Address:
12701 Woodsboro Pike
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:
CS-4C

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

N

100 0 100 200
Scale 1" = 100'

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0004
Site ID:	CS-4
Prioritization Ranking:	4
Structure Location:	12701 Woodsboro Pike, Keymar, MD 21757
Coordinates (Lat, Long):	39.58087, -77.25706
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$1,848,427
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Geomorphic Level
Project Length (LF):	3,170
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	32
TN (lbs/yr):	238
TP (lbs/yr):	216
TSS (lbs/yr):	142,270

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition

The stream reach of interest is a portion of an unnamed tributary to Little Pipe Creek that is bounded by Good Intent Road on the upstream end and by the property driveway on the downstream end. Drainage area to the site consists primarily of agricultural land, 43 percent forested lands, and 5 percent impervious areas. The stream is located within a broad valley, which is confined to the south by railroad tracks and to the north by Woodsboro Pike. The riparian zone spans the width of the valley, with approximately 25-50% vegetative cover throughout, including mature trees, herbaceous, and wetland species in several lower-elevation areas of the floodplain. Floodplain connectivity was varied throughout the reach stream reach and was categorized as “connected”, despite several points where incision along concentrated flow paths was observed. The stream was characterized as a single thread meandering channel with pool-riffle and plane-bed profile. Signs of vertical adjustments were observed throughout the reach, such as point bars, side bars, and three head cuts coincidental with woody debris, including one with a plunge pool downstream of it. Additionally, the culvert at the upstream end of the reach that conveys the tributary under Good Intent Road is broken and a source of debris and instability in the stream. The lateral stability of the channel was characterized as

"moderately stable", with bank erosion varying from mild to severe; bank retreat, meander migration, undercut trees, and point bar development were all observed.	
Restoration Measures	
The proposed restoration measures include bank stabilization through regrading and bioengineering stabilization techniques such as installation of live stakes. Riparian buffer restoration would add additional native and woody vegetation to enhance the existing riparian buffer and restore all areas disturbed during construction. The existing wetland area(s) would be protected during construction and enhanced with additional plantings where appropriate along the regraded banks and floodplain. The vertical erosion that was observed would be addressed through the installation of grade control structures at the observed headcuts, and the existing plunge pool would be stabilized to prevent additional scour and sediment transport. The broken culvert at Good Intent Road would be replaced with an open-bottom culvert, to improve aquatic organism passability in the stream.	
Anticipated Site Constraints	
Constructability/Access	Moderate. Clearing and grubbing is required, and may include removal of trees larger than 12 inches in diameter, although this would be avoided to the maximum extent practical, and specimen trees would not be removed.

Selected Site Photos

Photo 1. Mid-reach grade control and pool formed by tree roots.

Photo 2. Eroded streambanks with overhanging vegetation observed throughout. Mid-reach wetland on right floodplain.

Photo 3. Bank erosion on the right bank.

Photo 4. Stream segment in downstream portion of reach.

Photo 5. Connected floodplain on both streambank sides.

Photo 6. Riparian zone with approximately 25-50% canopy cover throughout reach. Well connected to floodplain with wetland species on the downstream end of the reach.

TAX PIN: 73711
12456 WOODSBORO PIKE

TAX PIN: 47274
12506 WOODSBORO PIKE

TAX PIN: 48024
12549 WOODSBORO PIKE

REPAIR OR
REPLACE FENCE

REMOVE
INVASIVE PLANTS

REMOVE EX. IRON
PIPE SEGMENTS

REMOVE
CONSTRUCTION
DEBRIS FROM STREAM

PROTECT EX. SEPTIC PIPE
LOCATE IN FIELD
MAINTAIN 20 FT CONSTRUCTION BUFFER

PROTECT OR
REPLACE FENCE

PR . PROJECT #12
REGENERATIVE
STEP-POOL CONVEYANCE
SEE SHEET CS-12

UNNAMED TRIBUTARY TO LITTLE PIPE CREEK

WOODSBORO PIKE

WARNER ROAD

RAILROAD

MATCHLINE - SEE SHEET CS-5B

470 460 480 490 470 480 490 480 500

1 2 3 4 5 6

VICINITY MAP

N

0 3 Miles

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
5
NPDES BMP ID:
LIPI-2018-STRE-0005
Site ID(s):
112-104-114
Prioritization Ranking:
5
Parcel Tax PIN:
48024, 47274, 73711
Address:
12456 Woodsboro Pike,
12506 Woodsboro Pike,
12549 Woodsboro Pike,
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:
CS-5A

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstructior
- Access Route
- 1 Photo Location

AKRF

N

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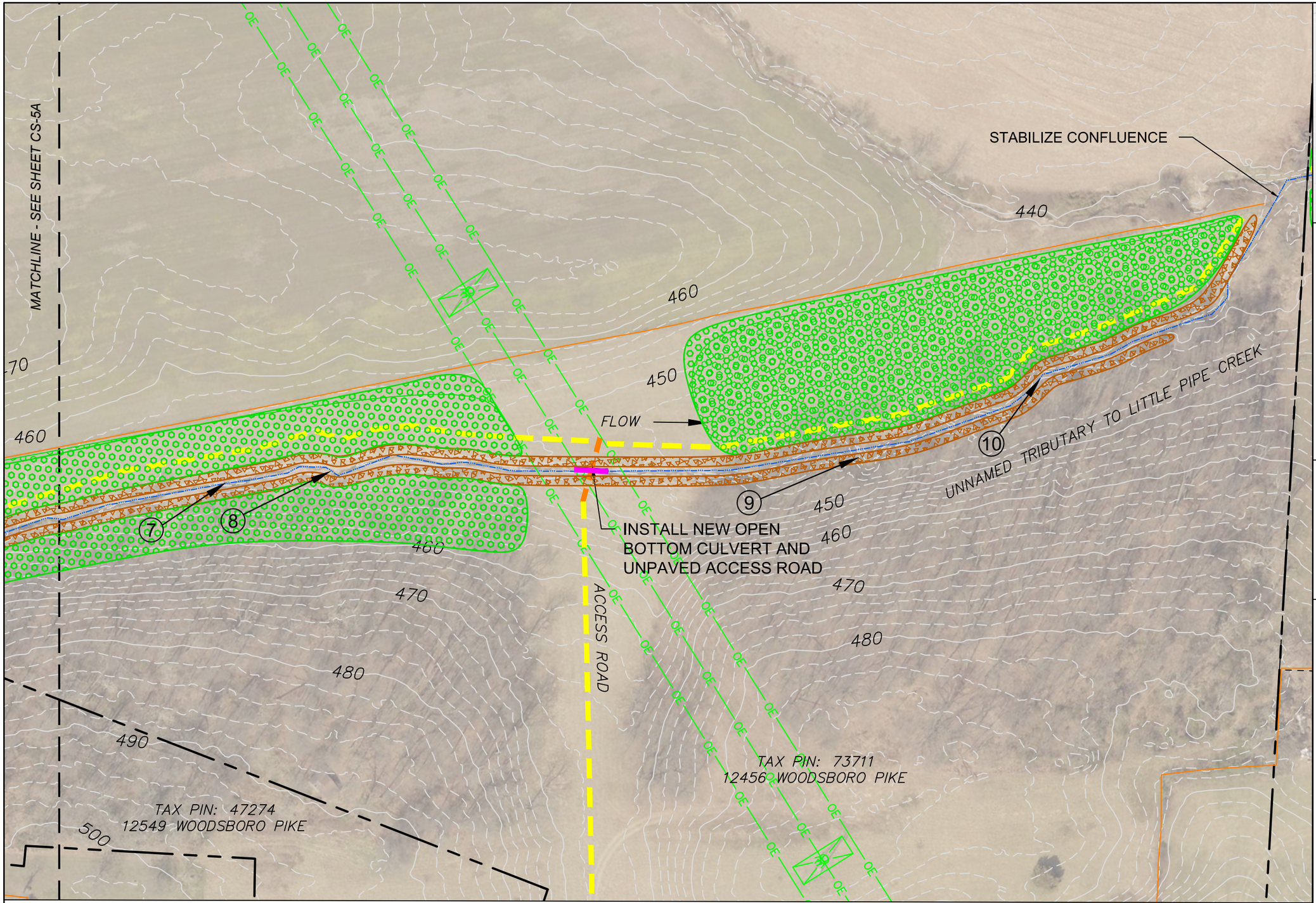
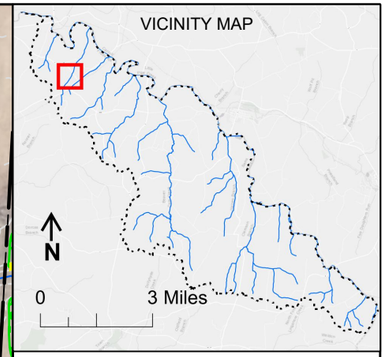
Scale 1" = 100'





Existing Legend

- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- (1) Photo Location

AKRF

100 0 100 200

Scale 1" = 100'

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
5
NPDES BMP ID:
LIPI-2018-STRE-0005
Site ID(s):
112-104-114
Prioritization Ranking:
5
Parcel Tax PIN:
48024, 47274, 73711
Address:
12456 Woodsboro Pike,
12506 Woodsboro Pike
12549 Woodsboro Pike
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:

CS-5B

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0005
Site ID:	CS-5
Prioritization Ranking:	5
Structure Location:	12456 Woodsboro Pike, 12506 Woodsboro Pike, & 12580 Woodsboro Pike Keymar, MD 21757
Coordinates (Lat, Long):	39.57777, -77.26528
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$1,493,319
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Physiochemical Level
Project Length (LF):	2,561
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	26
TN (lbs/yr):	192
TP (lbs/yr):	174
TSS (lbs/yr):	114,938
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The stream reach of interest runs through three properties, and is bounded on the upstream end by a culvert under Woodsboro Pike, and on the downstream end by a fence along the property boundary, at the edge of an agricultural field. The largest property is an active agricultural crop field, and the other two properties are residential lots. The stream channel is incised throughout the reach, with a narrow floodplain in approximately the upstream-most 500 LF and a wider floodplain further downstream. The upstream riparian zone contains scattered trees and shrubs, while downstream on the left bank a grassed buffer parallels an agricultural field and on the right bank is a forested area. Existing fencing and utilities confine the stream reach, including a sewer pipe near the houses in the upstream section of the reach and a high voltage power line in the downstream section of the reach that crosses through the forested and agricultural areas and is serviced by a grassed access road. The stream form was single thread meandering throughout. The streambed profile consisted of some weak pool-riffle forms with a low baseflow depth. Vertical features observed along the reach included	

point bars, a small-diameter plastic septic pipe crossing over the stream near Woodsboro Pike, and the electric transmission lines crossing over the stream mid-reach. The lateral stability of the stream channel varied between stable and unstable, with meander migration, point bar development, and moderate bank erosion-- most of which was observed in the downstream half of the reach on the outer meander bends.	
Restoration Measures	
Bank erosion would be addressed through regrading and bioengineering stabilization measures such as installation of live stakes. Debris within the stream, including the remnants of an old culvert, would be removed and the stream bed pool-riffle features would be enhanced where appropriate. Riparian buffer restoration would add native herbaceous and woody vegetation to create a buffer between the agricultural field, residences, and the stream. Riparian buffer restoration within the 75-meter power line right-of-way would be excluded to prevent interference with the operations and maintenance of the power lines. The existing unpaved access road would be maintained and enhanced as needed, and the culvert under the road would be replaced with an open bottom culvert to promote aquatic organism passage.	
Anticipated Site Constraints	
Constructability/Access	Easy. An existing access road and the flat, largely grassed floodplain make construction access along the stream reach easy – minimal clearing will be required. Temporary removal and replacement of existing fencing will be required. The existing sewer pipe (and other utilities) are to be protected and maintained throughout construction.

Selected Site Photos

Photo 1. Culvert located under Woodsboro Pike at upstream extent of reach.

Photo 2. Minimal riparian coverage in upstream reach. Fence crossing stream and small-diameter plastic septic pipe behind it.

Photo 3. Septic pipe across channel in upstream reach is active and would need to be protected during construction. Roof drain pipe upstream of closed septic pipe discharges stormwater from adjacent building directly into the stream.

Photo 4. Observed gully formation from concentrated overland flow in upstream reach.

Photo 5. Limited floodplain connectivity in upstream reach – confined by infrastructure such as fences and underground pipes.

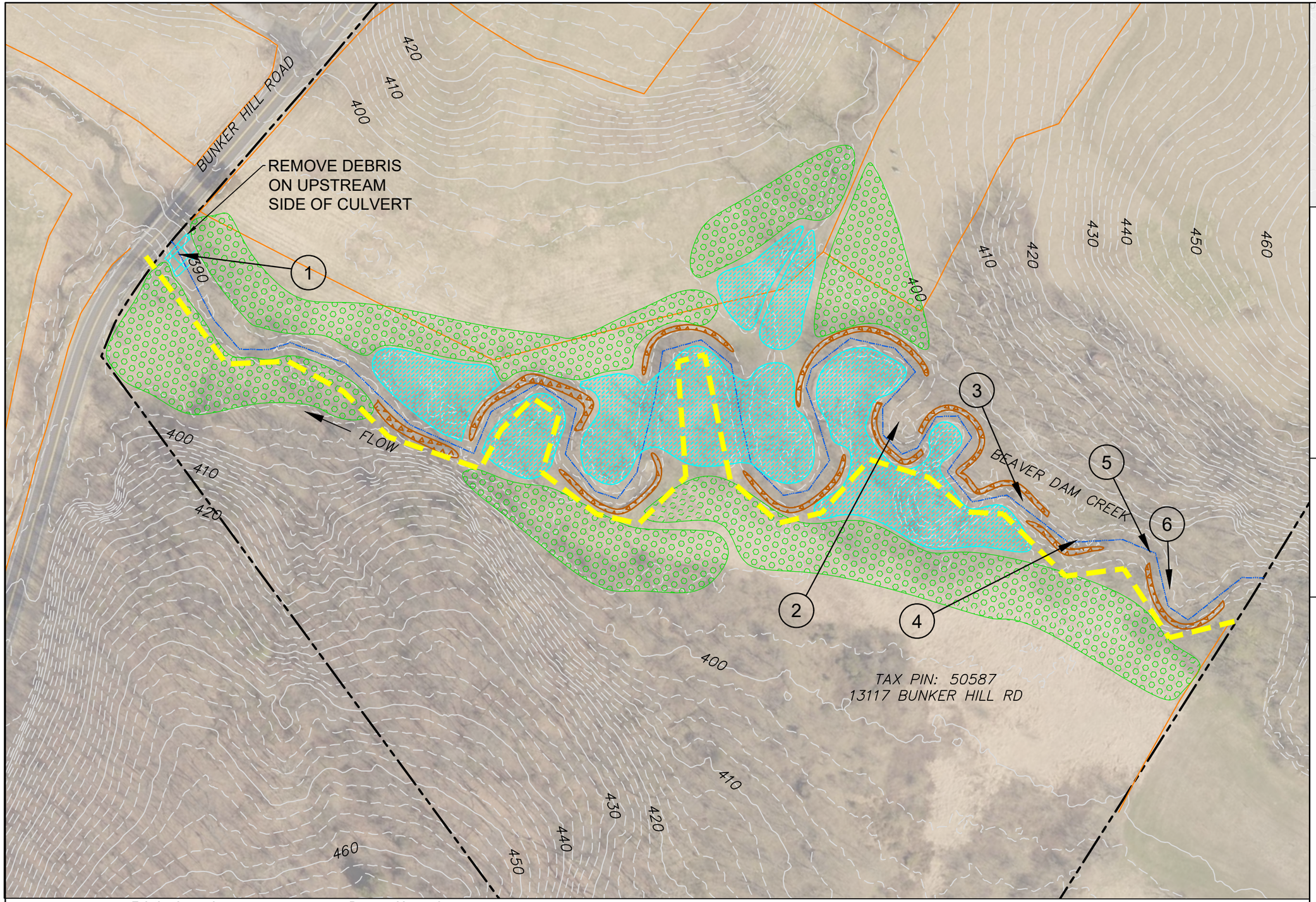
Photo 6. Meandering channel and isolated riparian canopy coverage in upstream reach. Bank erosion visible on outer meander bends.

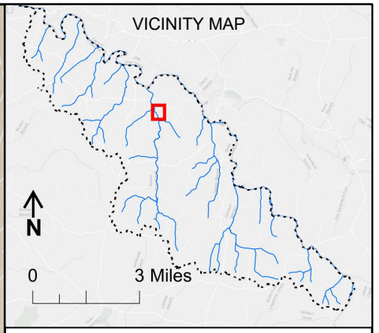
Photo 7. Exposed iron culvert mid-reach in deteriorated condition. It may have once conveyed the channel under a vehicle crossing, but appears to have been flanked by the stream.

Photo 8. Wide floodplain mid-reach. Predominantly plane-bed bedforms throughout reach. Sediment accumulation was evident in the stream.

Photo 9. Riparian zone in downstream reach: left bank has minimal riparian coverage, and right bank contains scattered trees, shrubs, and woody debris.

Photo 10. Streambank erosion on outer meander bends in downstream reach.





Existing Legend

- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

AKRF

100 0 100 200

Scale 1" = 100'

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
6
NPDES BMP ID:
LIPI-2018-STRE-0006
Site ID(s):
38
Prioritization Ranking:
6
Parcel Tax PIN:
45465
Address:
13117 Bunker Hill Rd
Union Bridge, MD 21791
BMP Type:
Stream Restoration

Sheet #:

CS-6

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0006
Site ID:	CS-6
Prioritization Ranking:	6
Structure Location:	13117 Bunker Hill Rd Union Bridge, MD 21791
Coordinates (Lat, Long):	39.563401, -77.211731
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$1,209,933
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Biological Level
Project Length (LF):	2,075
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	21
TN (lbs/yr):	156
TP (lbs/yr):	141
TSS (lbs/yr):	93,126

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition
The stream reach of interest is a portion of Beaver Dam Creek located in a wide, flat floodplain that is approximately 50% wooded and 50% grasses and other herbaceous species. Drainage area to the site includes 3 percent impervious area and 12 percent forested lands. The upstream reach boundary is the property line, and the downstream section ends at the Bunker Hill Road culvert, a quadruple-barreled concrete structure, which was observed to have accumulated woody debris. The stream was classified as single thread meandering in planform, with a plane-bed profile with some minor riffle and pool-like features. Bank erosion was observed primarily on outer meander bends with undercut trees throughout. Lateral stability of stream channel was classified as “moderately stable” and floodplain connection was characterized as “incised with a wide floodplain” available for stream reconnection. Small sediment bars in the stream indicate that there is some vertical instability in the stream, but this was not observed to be extensive.
Restoration Measures
The proposed restoration measures involve floodplain reconnection and wetland creation in low-lying floodplain areas and abandoned meander bends. Bank erosion would be addressed through bank

regrading and bioengineering stabilization measures such as installation of live stakes. Riparian buffer restoration would add to and enhance the existing wooded areas and would add additional native vegetation where appropriate, to create a robust natural vegetated buffer between the along the stream and new wetland features.	
Anticipated Site Constraints	
Constructability/Access	Easy. Clearing and grading requirements can be minimized by utilizing the grassy/herbaceous areas and minimizing tree removals.

Selected Site Photos

Photo 1. Concrete culvert located at downstream boundary (Bunker Hill Road).

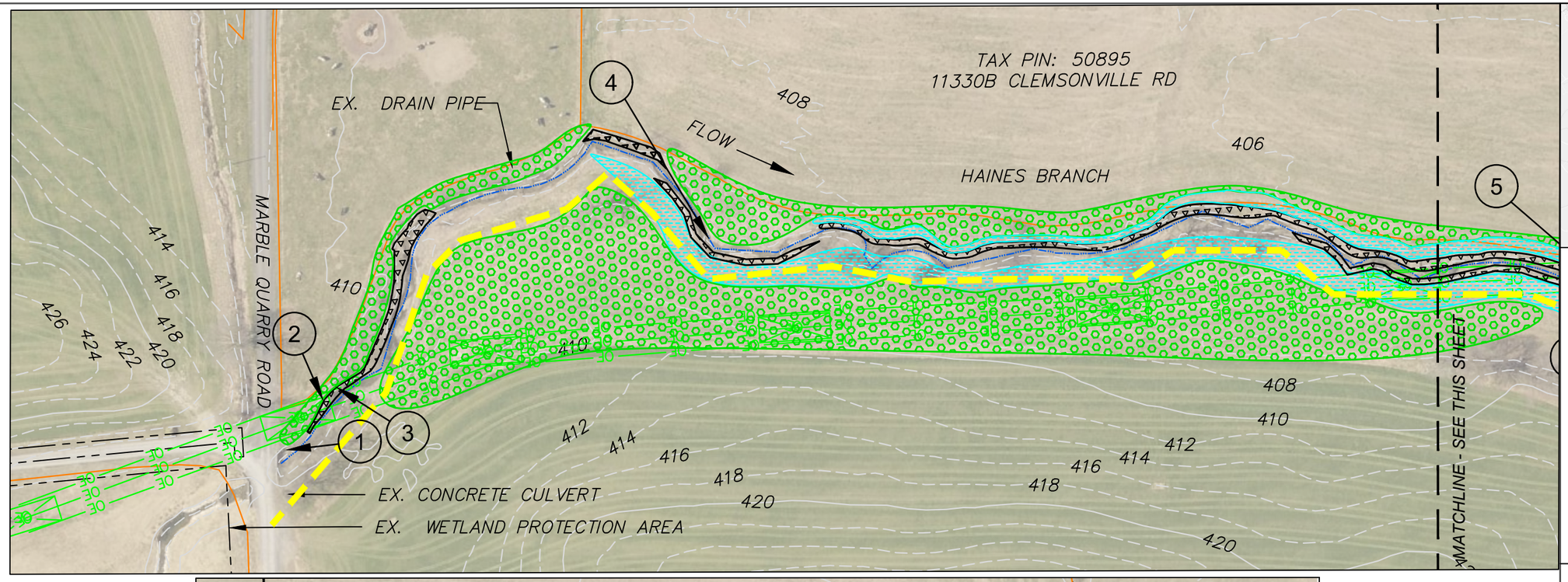
Photo 2. Wide floodplain observed on left and right bank sides throughout stream segment. The purpose of the skid loader Photod above was not clear from observing the area, but indicated construction access is available.

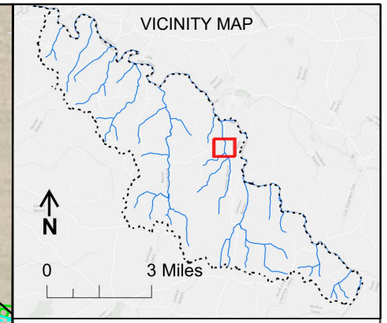
Photo 3. Heavy presence of invasive plants throughout riparian zone, such as Stinging Nettle.

Photo 4. Large woody debris observed in-channel.

Photo 5. Streambank erosion was observed on outer bends in meandering sections throughout the reach.

Photo 6. Meander migration and overhanging banks with exposed tree roots. Sediment point bars observed throughout.





Existing Legend

- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

100 0 100 200

Scale 1" = 100'

AKRF

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
7
NPDES BMP ID:
LIPI-2018-STRE-0007
Site ID(s):
85
Prioritization Ranking:
7
Parcel Tax PIN:
50895
Address:
11330B Clemsonville Rd
Union Bridge, MD 21791
BMP Type:
Stream Restoration

Sheet #:

CS-7

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0007
Site ID:	CS-7
Prioritization Ranking:	7
Structure Location:	11330B Clemsonville Rd, Union Bridge, MD 21791
Coordinates (Lat, Long):	39.548284, -77.181106
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$1,209,350
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Biological Level
Project Length (LF):	2,074
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	21
TN (lbs/yr):	156
TP (lbs/yr):	141
TSS (lbs/yr):	93,081
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The stream reach of interest is a portion of Haines Branch; the downstream limit of the reach is the property boundary, and the upstream boundary is at the Marble Quarry Road culvert, a large double-barreled concrete structure and a 36-inch HDPE drainage pipe that was observed to be flowing during dry-weather conditions. Drainage area to the site is primarily agricultural, with about 8 percent forested land and 0.5 percent impervious area. The site is an active pasture, with livestock pasture fencing and power lines confining the left streambank. Sparsely distributed trees were observed throughout the riparian zone, but were mostly clustered at the most downstream section. The stream was characterized as a straight single thread, meandering channel with a plane-bed profile. Mid-reach, alluvial islands were present, giving the stream a multiple thread-braided formation for several hundred linear feet. The stream is incised and banks are actively eroding, with evidence of bank toe scour and overhanging vegetation. Overall, lateral stability of stream channel was classified as “unstable”, and “incised with limited floodplain connectivity” available.	

Restoration Measures	
The proposed restoration measures include bank regrading and stabilization measures such as installation of live stakes, floodplain reconnection and wetland habitat creation along the length of the reach. Riparian buffer restoration would also extend along the length of the reach, and would add native herbaceous and woody vegetation to create a buffer between the pasture and the stream. The existing livestock fencing would be protected and maintained throughout construction, as would the existing power line structures. One of the utility poles is armored with rip rap, which could be enhanced if needed to provide protection for the proposed stream restoration condition.	
Anticipated Site Constraints	
Constructability/Access	Moderate. The existing fence and overhead power lines constrain work on the left floodplain. The floodplain is flat and open with few trees, so clearing of existing vegetation would be minimal.

Selected Site Photos

Photo 1. Upstream extent of reach at Marble Quarry Road bounded by 4-foot wide concrete culverts.

Photo 2. Near the downstream-left wing wall of concrete culverts (Photo 1) was an active 36-inch HDPE drainpipe.

Photo 3. Severe streambank erosion approximately 100 ft. downstream from culvert.

Photo 44. Little to no woody riparian buffer present along reach. Vegetated mid-channel sediment bars.

Photo 5. Livestock pasture on left floodplain. Minimal aquatic habitat features (e.g. pools, riffles) observed throughout stream.

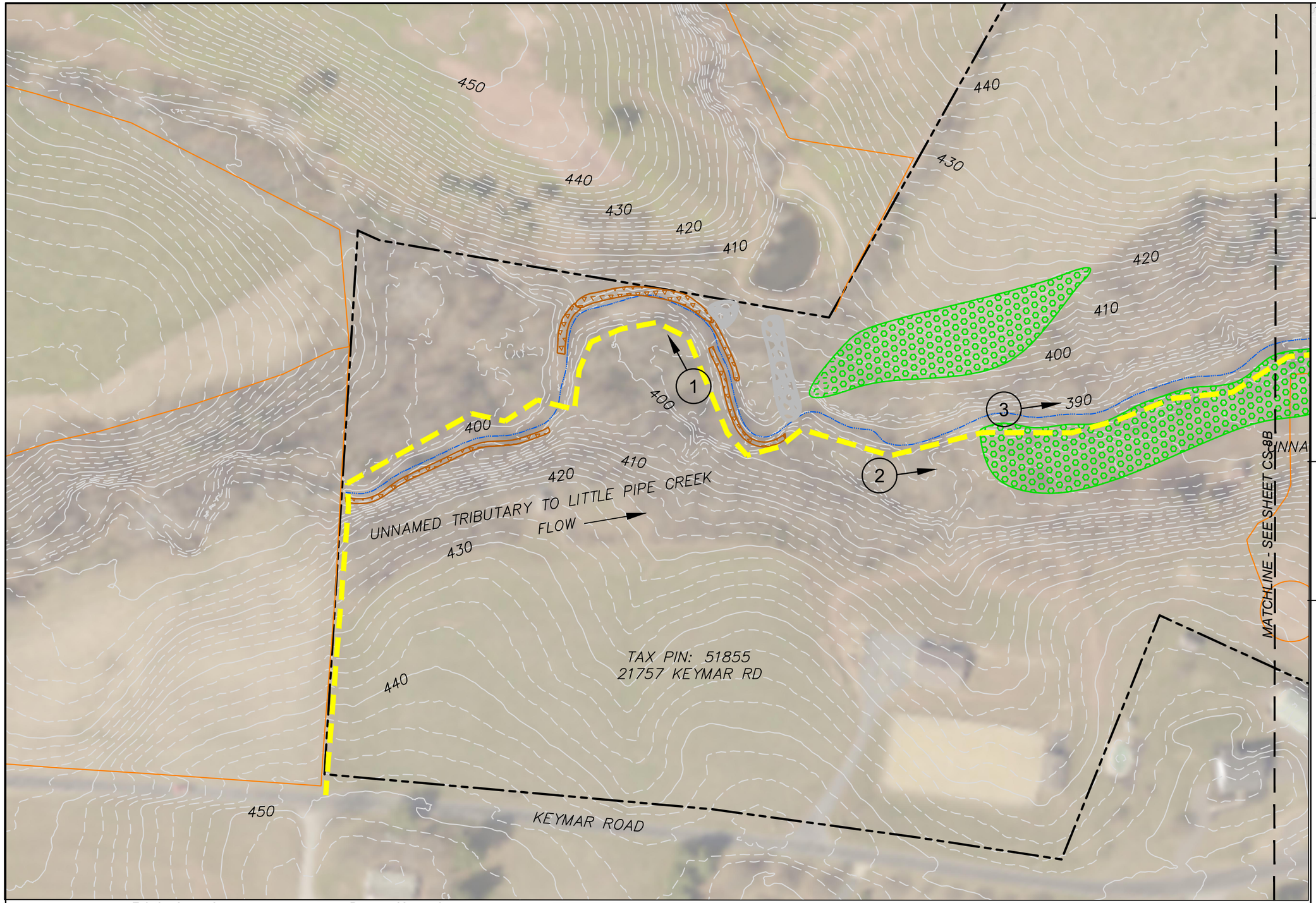
Photo 6. Existing utility pole protected by rip-rap revetment.

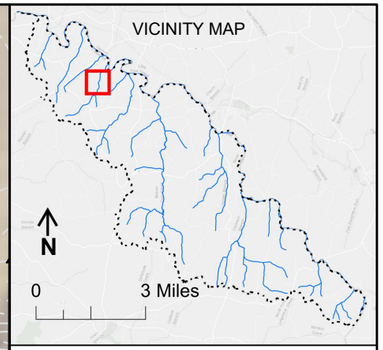
Photo 5. Incised channel and exposed banks. Open riparian zones with minimal canopy coverage downstream.

Photo 8. Mid-channel alluvial vegetative islands throughout stream. Likely related to mass failure/slumping of stream banks.

Photo 9. Example of streambank erosion observed throughout stream segment.

Photo 10. Sparse overhanging trees and woody debris mostly clustered at most downstream section.





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
8
NPDES BMP ID:
LIPI-2018-STRE-0008
Site ID(s):
53-55
Prioritization Ranking:
8
Parcel Tax PIN:
72990, 51855
Address:
12601 Keymar Rd,
21757 Keymar Rd
Detour, MD 21757
BMP Type:
Stream Restoration

Sheet #:
CS-8A

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

AKRF

100 0 100 200
Scale 1" = 100'

MATCHLINE - SEE SHEET CS-8A

TAX PIN: 51855
21757 KEYMAR RD

PIPE DISCHARGES TO CREEK. DISCONNECT TO SURFACE IN PROPOSED BUFFER AND INSTALL RIPRAP SWALE TO CREEK

4 5 6 7 8 9 10 11 12

FLOW

UNNAMED TRIBUTARY TO LITTLE PIPE CREEK

KEYMAR ROAD

PROTECT UTILITY POLE

440 430 420 410 400 390 380 370 470 460 450

VICINITY MAP

N

0 3 Miles

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project: 8
NPDES BMP ID: LIPI-2018-STRE-0008
Site ID(s): 53-55
Prioritization Ranking: 8
Parcel Tax PIN: 72990, 51855
Address: 12601 Keymar Rd, 21757 Keymar Rd, Detour, MD 21757
BMP Type: Stream Restoration

Sheet #: CS-8B

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

100 0 100 200
Scale 1" = 100'

AKRF

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0008
Site ID:	CS-8
Prioritization Ranking:	8
Structure Location:	12601 Keymar Rd; 21757 Keymar Rd Keymar, MD 21757
Coordinates (Long, Lat):	39.58096, -77.24364
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$1,660,086
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Physiochemical Level
Project Length (LF):	2,847
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	28
TN (lbs/yr):	214
TP (lbs/yr):	194
TSS (lbs/yr):	127,773
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The stream reach of interest flows through two properties and is located in a narrow floodplain within a narrow valley. The drainage area to the site is comprised primarily of agricultural lands, with some residential lots, 8 percent forested lands, and 2 percent impervious area. The upstream extent is bounded by a fence that crosses the stream at the property line, and the downstream extent is bounded by Keymar Road and an existing culvert. An active horse farm pasture is located along much of the right side of the stream. The stream is incised with a meandering single thread pattern. The stream bed has fine sand in pools and gravel/cobble in the riffles, and exposed bedrock forms several small riffles and cascades. Streambank erosion and undercut trees were observed throughout the reach. Point bars, mid-channel bars, and side bars, primarily made of large gravels and cobbles and sometimes sparsely vegetated, were observed, indicating lateral adjustments within the channel. Overall, bank erosion was determined to be of moderate severity, and the eroding banks are somewhat protected by moderate riparian zone vegetation coverage. However, the lateral stability was assessed as “unstable” due to the incised channel condition and limited floodplain area.	

Restoration Measures	
The proposed restoration measures include bank stabilization measures such as re-grading with live ranch layering or vegetated encapsulated soil lifts with live branch layering. Riparian buffer restoration would target disturbed areas and invasive plant removal for overall habitat enhancement. Two areas were identified for gully stabilization work, one at an outfall from the horse farm, and one at a farm pond outfall on the left streambank.	
Anticipated Site Constraints	
Constructability/Access	Difficult. The site will require clearing of trees and shrubs. Access will either be from either end of the stream reach, in order to minimize disturbance to the landowner's use. The property owner's driveway is proposed to be utilized, pending permission, but may require additional stabilization. Steep slopes along both sides of the stream limit accessibility by construction vehicles.

Selected Site Photos

Photo 1. Woody debris, riffle embeddedness, bank erosion, and steep confining valley on left bank.

Photo 2. Undercutting of trees along streambank.

Photo 3. Bedrock outcrop observed in channel.

Photo 4. Horse farm pasture along much of right side of stream.

Photo 5. Drainpipe on right bank discharges into stream from farm on floodplain.

Photo 6. Riffle embeddedness, overhanging banks, and limited floodplain access observed on left and right streambanks throughout reach.

Photo 7. Point bars, mid-channel bars, and large woody debris present throughout reach.

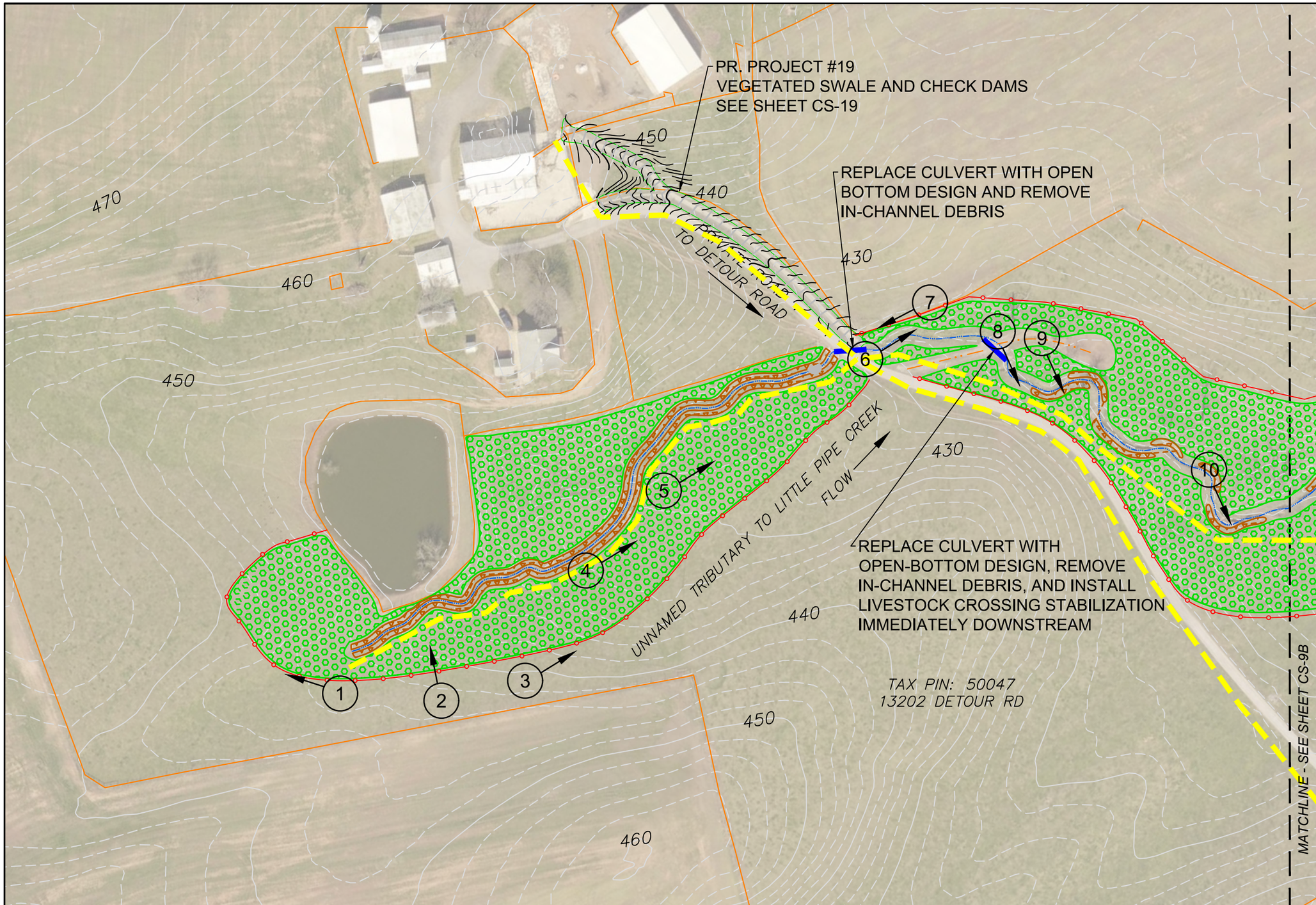
Photo 8. Incised channel with actively eroding banks and overhanging vegetation on streambanks.

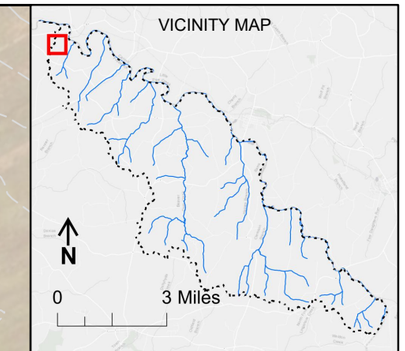
Photo 9. Typical stream and floodplain condition at downstream end of reach.

Photo 10. Stream corridor, looking upstream from Keymar Road/downstream boundary.

Photo 11. Keymar Road Bridge at downstream end of reach with 6 foot-tall metal and concrete culvert.

Photo 12. Keymar Road, downstream boundary extent.





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
9
NPDES BMP ID:
LIPI-2018-STRE-0009
Site ID(s):
130
Prioritization Ranking:
9
Parcel Tax PIN:
50047
Address:
13202 Detour Road
Keymar, MD 21757
BMP Type:
Stream Restoration

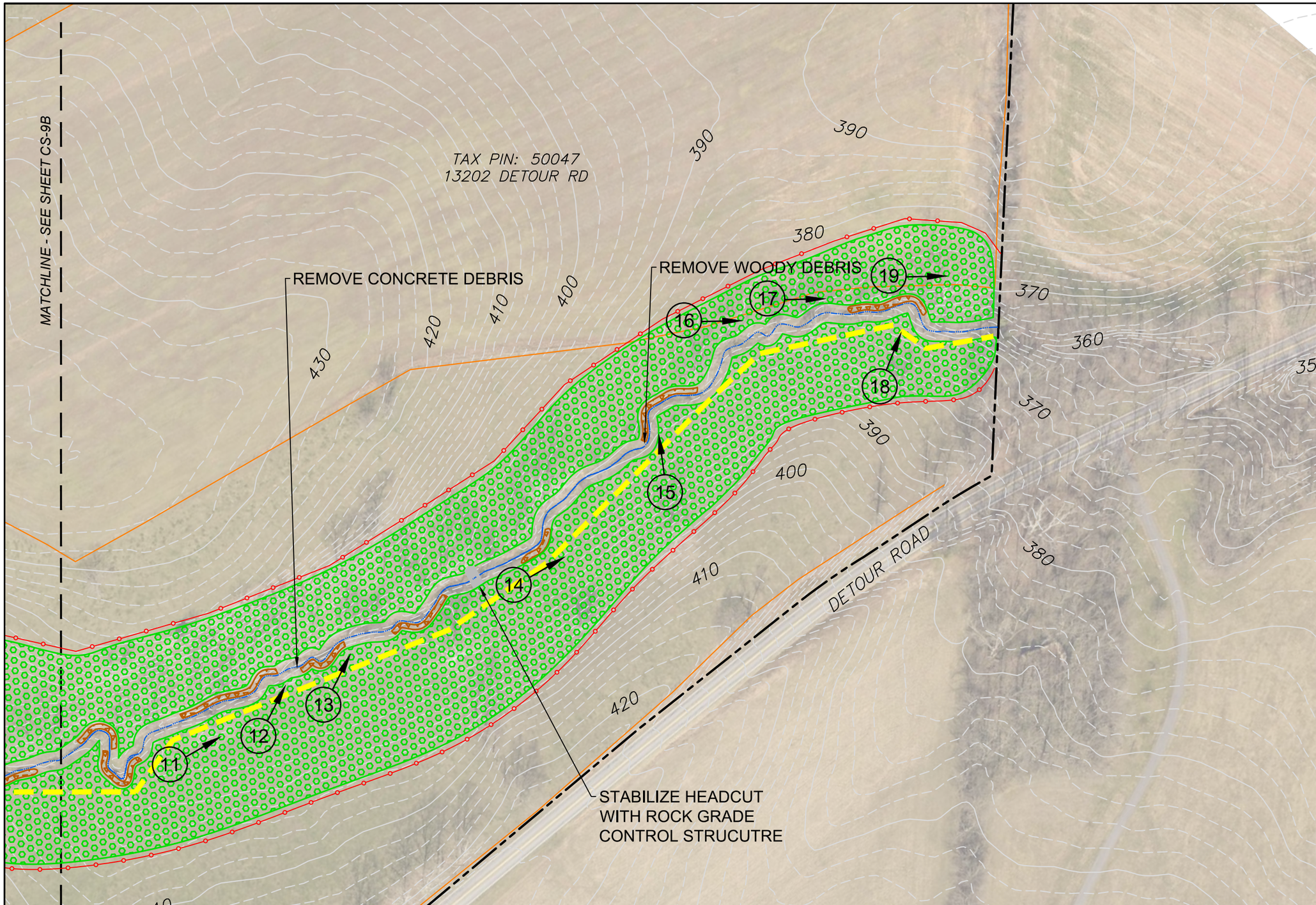
Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

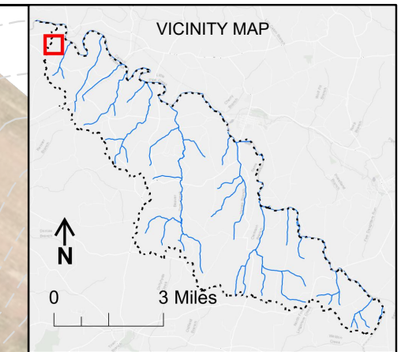
Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- Photo Location

AKRF

100 0 100 200
Scale 1" = 100'

Sheet #:
CS-9A





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
9
NPDES BMP ID:
LIPI-2018-STRE-0009
Site ID(s):
130
Prioritization Ranking:
9
Parcel Tax PIN:
50047
Address:
13202 Detour Road
Keymar, MD 21757
BMP Type:
Stream Restoration

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstructior
- Access Route
- 1 Photo Location

N

100 0 100 200
Scale 1" = 100'

AKRF

Sheet #:
CS-9B

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0009
Site ID:	CS-9
Prioritization Ranking:	9
Structure Location:	13202 Detour Road, Keymar, MD 21757
Coordinates (Lat, Long):	39.590687, -77.255282
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$1,438,508
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Physiochemical Level
Project Length (LF):	2,467
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	25
TN (lbs/yr):	185
TP (lbs/yr):	168
TSS (lbs/yr):	110,719

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition
The stream reach is located in a wide, gently-sloping valley, surrounded by a wide grassed floodplain that is heavily eroded by cattle grazing in the downstream portion of the reach. The upstream portion of the reach is the stream headwaters, as groundwater daylights to the surface and the channel forms near an existing farm pond. The stream crosses underneath a private driveway, then flows through a broken culvert that may have provided vehicle crossing in previous years. The downstream end of the proposed restoration reach is at the fenced property line. Drainage area to the stream consists primarily of agricultural lands, and is 7 percent forested with 1 percent impervious area. The surrounding riparian zone consists of sporadic mature trees, with some multiflora rose shrub and other invasive species on the disturbed stream banks. The stream is a meandering single thread planform with a weak pool-riffle bed profile. The stream exhibits signs of vertical instability, in the form of a headcut and undercut trees downstream of the driveway culvert. Bank erosion was observed throughout the reach but increased in severity in the downstream area. The lateral stability of the stream channel was classified as “unstable”, as the stream appeared to be incised throughout.

Restoration Measures	
The proposed restoration measures include installation of livestock exclusion fencing, vehicle crossing stabilization and restoration with an open-bottom culvert, bank grading with live stakes to protect against future streambank erosion, in-stream grade control to address the observed headcut and grade changes around the culvert structures. An upstream stormwater BMP, a vegetated swale with check dams, identified as NPDES ID LIPI-2018-DSWA-0003, may be installed in conjunction with the stream restoration project, to improve the water quality of stormwater runoff entering the stream.	
Anticipated Site Constraints	
Constructability/Access	Moderate. The existing fencing constrains site access, and the active agricultural operations must be considered in coordinating the work schedule with the property owner.

Selected Site Photos

Photo 1. Large floodplain on both sides of the channel throughout reach. Upstream extent of reach shown above.

Photo 2. Farm pond located in upstream portion of the reach, on the left floodplain.

Photo 3. Shrubs, herbaceous grasses, and few mature trees in upstream portion of reach.

Photo 4. Lack of woody debris and generally poor in-stream habitat in upstream portion of reach.

Photo 5. Poor habitat and little flow diversity throughout upstream portion of reach.

Photo 6. Existing concrete embankment downstream of culvert under driveway.

Photo 7. Concrete culvert embankment and in-stream debris.

Photo 8. Culvert downstream of driveway. Visible streambank erosion due to cattle crossing.

Photo 93. Streambank erosion and development of sediment bars throughout downstream reach.

Photo 10. Eroded streambanks, with overhanging vegetation throughout reach.

Photo 4. Eroded streambanks and undercut trees in downstream reach.

Photo 5. Concrete debris on right bank and eroding left bank in downstream reach.

Photo 6. Minimal vegetative cover on slopes in downstream reach.

Photo 7. Shallow pool, eroded banks, and sediment bars in downstream reach.

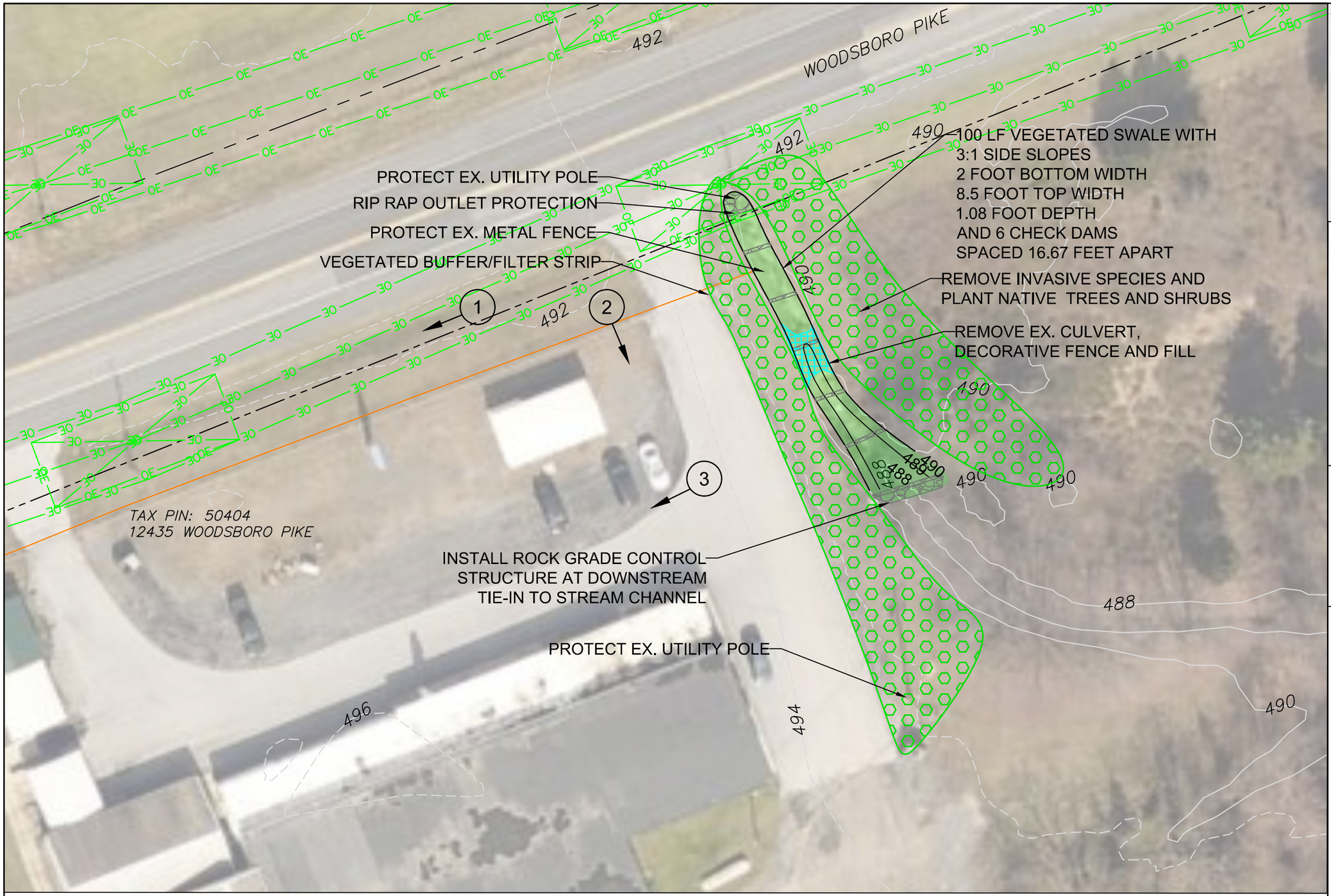
Photo 8. Unrestricted livestock access to stream banks.

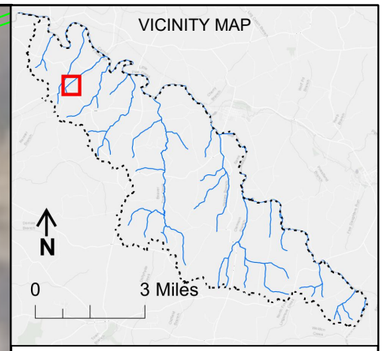
Photo 9. Existing in-stream bedrock acting as a natural grade control in downstream reach.

Photo 10. Embedded riffles in downstream reach.

Photo 11. Step pool-like bed forms in downstream section.

Photo 12. Downstream extent at fenced property line.





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
10
NPDES BMP ID:
LIPI-2018-DSWA-0001
Site ID(s):
4
Prioritization Ranking:
10
Parcel Tax PIN:
50404
Address:
12435 Woodsboro Pike,
Keymar, MD 21757
BMP Type:
Vegetated Swale

Sheet #:
CS-10

Existing Legend
- Stream Channel
- Fence
- Property Boundary
- Major Contour (10ft interval)
- Minor Contour (2 ft interval)

Proposed Legend
- Pool Feature
- Riparian Buffer Restoration
- Rock Grade Control
- Debris Removal
- Access Route
- Bioretention
- Vegetated Swale
- Major Contour (10 ft interval)
- Minor Contour (1 ft interval)
- Photo Location

N

30 0 30 60

Scale 1" = 30'

AKRF

General BMP Information	
NPDES BMP ID:	LIPI-2018-DSWA-0001
Site ID:	CS-10
Prioritization Ranking:	10
Structure Location:	North Glade Feed & Supply 12435 Woodsboro Pike, Keymar, MD 21757
Coordinates (Lat, Long):	39.574631, -77.269095
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$38,068
Estimated Cost/Impervious Acre:	$126,894
Proposed Restoration General Information	
Restoration Type:	Grass Swale with Check Dams or SPSC
Functional Lift Potential:	Geomorphic Level
Project Area (SF):	129,945
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	0.95
TN (lbs/yr):	0.20
TP (lbs/yr):	0.0037
TSS (lbs/yr):	2.59
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	-
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The proposed BMP area of interest is a 'Home and Garden' operation business, with a drainage area consisting of a building roof and parking lot composed of asphalt and gravel, which drain into an existing grass swale to the east of the building and parking lot. During the site visit, there were spots of ponding along the driveway, but no erosion due to the runoff to the grass swale. Inlets from road drainage are concrete culverts, and a metal pipe section (with an approximately 12 to 18-inch RCP pipe) is present mid-swale, providing a grassed vehicle crossing.	
Restoration Measures	
The proposed restoration approach is a vegetated swale with check dams, 100 linear feet (LF) in total length. The existing swale feature would be upgraded by setting slopes and widths to meet Maryland stormwater design standards for water quality treatment and removing the existing mid-swale metal pipe section. The swale feature would terminate in an energy dissipater and grade control structure to convey surface flow along the downstream flow path. The grass areas to either side of the swale would be vegetated with native species to increase infiltration and further slow runoff from the	

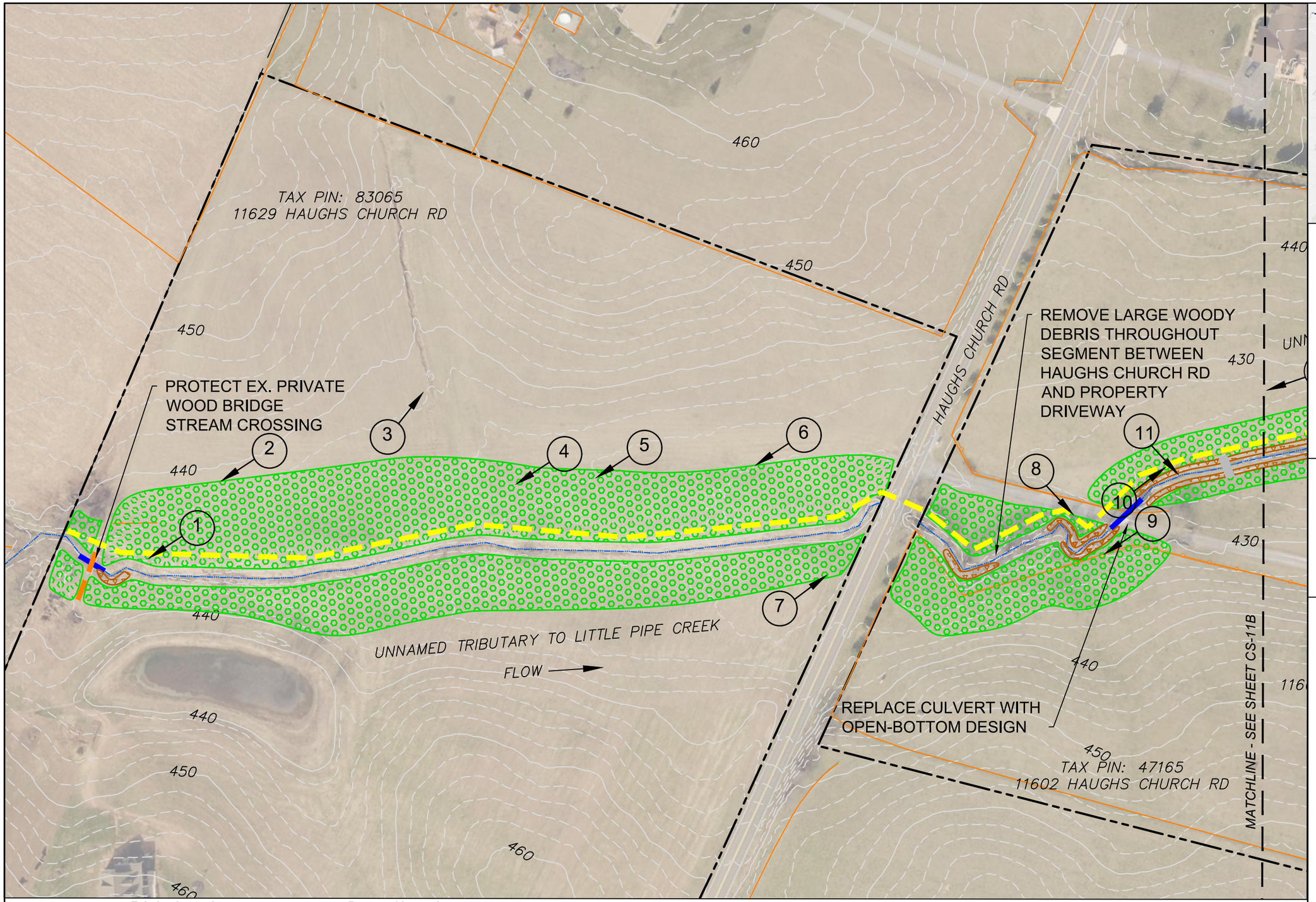
parking lot. An SPSC can be considered as an alternative BMP for this location, and would promote additional stormwater infiltration.	
Anticipated Site Constraints	
Constructability/Access	Difficult. The swale is next to an active driveway, and is constrained by existing infrastructure, including overhead utility lines. It is not known if underground utilities are also present.

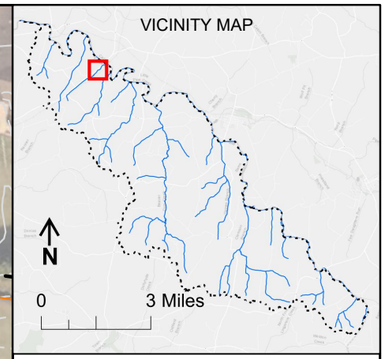
Selected Site Photos

Photo 1. Grass swale in front of property drains into existing grass swale on east side of property, then into stream.

Photo 2. Runoff from roof drains flows over parking lot into existing grass swale.

Photo 3. Some ponding in gravel parking area near edge of asphalt area.





Existing Legend

- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- (1) Photo Location

AKRF

N

100 0 100 200

Scale 1" = 100'

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
11
NPDES BMP ID:
LIPI-2018-STRE-0011
Site ID(s):
111-115
Prioritization Ranking:
11
Parcel Tax PIN:
83065, 47165
Address:
11602 Haughs Church Rd,
11629 Haughs Church Rd,
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:

CS-11A

MATCHLINE - SEE SHEET CS-11A

TAX PIN: 49688
11550 HAUGHS CHURCH RD

REPLACE CULVERT WITH OPEN-BOTTOM DESIGN. RECONSTRUCT UNPAVED ACCESS ROAD OVER CULVERT

FLOW

UNNAMED TRIBUTARY TO LITTLE PIPE CREEK

CHANNEL REALIGNMENT

TAX PIN: 47165
11602 HAUGHS CHURCH RD

450
440
430
420

12 13 14 15 16 17 18 19 20 21 22 23 24 25

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

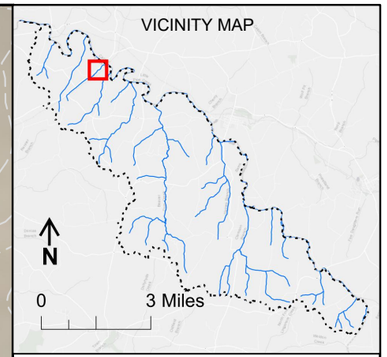
Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

AKRF

N

100 0 100 200
Scale 1" = 100'

VICINITY MAP



Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
11
NPDES BMP ID:
LIPI-2018-STRE-0011
Site ID(s):
111-115
Prioritization Ranking:
11
Parcel Tax PIN:
83065, 47165
Address:
11602 Haughs Church Rd,
11629 Haughs Church Rd
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:
CS-11B

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0010
Site ID:	CS-11
Prioritization Ranking:	11
Structure Location:	11602 Haughs Church Rd; 11629 Haughs Church Rd, Keymar, MD 21757
Coordinates (Lat, Long):	39.58296, -77.260983
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$1,309,060
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Geomorphic Level
Project Length (LF):	2,245
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	22
TN (lbs/yr):	168
TP (lbs/yr):	153
TSS (lbs/yr):	100,756

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition

The stream reach flows through two properties located in a gently sloping valley intersected by Haughs Church Road. The upstream end of the reach is bound by a tree line along the property boundary, and the downstream end of the reach is in a wooded area at the property boundary. Drainage area to the stream is primarily comprised of agricultural land, with some residential lots, 6 percent impervious area, and 12 percent forested areas.

A stable non-eroding pond embankment is located in the downstream section and confines the stream on the right streambank side. The stream reach is vertically confined at three culverts; the first is located upstream under Haughs Church Road, the second located under the property driveway, and the third culvert located under a crossing between fields in the lower third of the reach. The landowner of the downstream property confirmed both culverts on the downstream half of the reach were built and maintained by the landowner. Both culverts have wooden railroad tie end sections

with stone, brick, and concrete on the embankments. Some erosion was observed on the floodplain upstream of the culvert end sections.

The stream planform throughout the reach has a single thread meandering pattern and a plane-bed profile with occasional weak pools and riffles composed of silt/clay sediments with some gravels. Some locally steep segments were observed in the field, but headcuts were not observed. Rip-rap and tree roots confine the right floodplain in between Haughs Church Road and the driveway culverts. A woody debris jam in this section of the reach forced overland floodplain flow at the time of the site visit, during a period of bankfull flow, as well as in the past, as noted by the landowner.

Overall, the floodplain connectivity varied throughout the reach. The riparian-grassed sections of the reach have greater floodplain connectivity, especially during high flows. The downstream section has a left/right alternating floodplain connection. The wooded portion further downstream has higher left streambanks on the outer meander bends, resulting in lower connectivity. Lateral adjustments observed included bank erosion, undercut trees, and point bar development. The grassed sections had mild erosion, while the wooded areas had moderate to severe bank erosion. Overall, the stream lateral stability was characterized as "moderate", with the grassed section rated as "stable" and the wooded sections showing evidence of erosion and instability.

Restoration Measures

Riparian buffer restoration is a particularly important part of the proposed restoration, as the downstream site is used in a hobby-farm type capacity and the owner expressed a preference for a park-like setting rather than a more wild and unkempt look. Attractive, native, water-loving trees and low-lying herbaceous wetland plantings are recommended at this time, and landowner coordination will be especially important for this location. Bank grading with live stakes and channel realignment are proposed to repair and protect against future bank erosion. The existing culverts, with the exception of the one under Haughs Church Road, will be replaced with open bottom culverts to promote better flow and habitat within the stream. The culvert replacement will be accompanied by vehicle crossing stabilization and repair of the eroded areas around the existing structures.

Anticipated Site Constraints

Constructability/Access	Moderate. The existing culverts and fencing (both metal and electric fences) constrain the channel vertically and laterally, and increase difficulty of site access. The downstream half of the reach has occasional pockets of dense vegetation that will require some clearing, although this will be minimized to the maximum extent practicable.

Selected Site Photos

Photo 1. Eroded bank on outer meander bend. Bed material consisted primarily of silt/clay throughout the stream reach. Algae visible on bed sediments.

Photo 2. Grasses and common reed (phragmites) were observed throughout the upstream riparian corridor.

Photo 3. Stream channel with secondary channels entering from the floodplain. Cattails (Typha) visible to the left.

Photo 4. Shallow baseflow depth and a dense cluster of Cattails growing within the stream.

Photo 5. The upstream riparian corridor was dominated by grasses and weeds with minimal tree and shrub coverage.

Photo 6. Upstream in-channel conditions: shallow baseflow depth, few pools or riffles, fine sediment throughout, vegetated mid-channel bars present.

Photo 7. Culvert located at Haughs Church Road, in the mid-reach stream section.

Photo 8. Riparian zone located between two culverts: Haughs Church Road culvert and the property driveway culvert.

Photo 9. Steep bank with dense vegetation and large woody debris between the Haughs Church Road culvert and property driveway culvert.

Photo 10. Conditions downstream of the property driveway culvert.

Photo 11. Scour pool and widened channel immediately downstream of the property driveway culvert.

Photo 82. Photo taken looking upstream at property driveway culvert. Riprap along right bank side.

Photo 13. Riparian conditions downstream of property driveway culvert: primarily grassed, well-connected floodplain.

Photo 14. Farm pond embankment in lower downstream section.

Photo 15. Grassed riparian area with good floodplain connectivity.

Photo 16. Downstream face of third culvert, with erosion evident behind the culvert wing wall.

Photo 17. Condition of downstream endwall and wing walls of the third culvert. The property owner attempted to repair the erosion by filling scoured areas with bricks and other debris.

Photo 18. Riparian zone in the lower third of the reach. Grass stream banks transitioning into area with higher shrub and tree coverage.

Photo 19. Upstream face of third culvert, locate under a crossing between fields in the lower third of the reach.

Photo 9. Fence crossing stream within the wooded riparian area in the downstream-most reach segment.

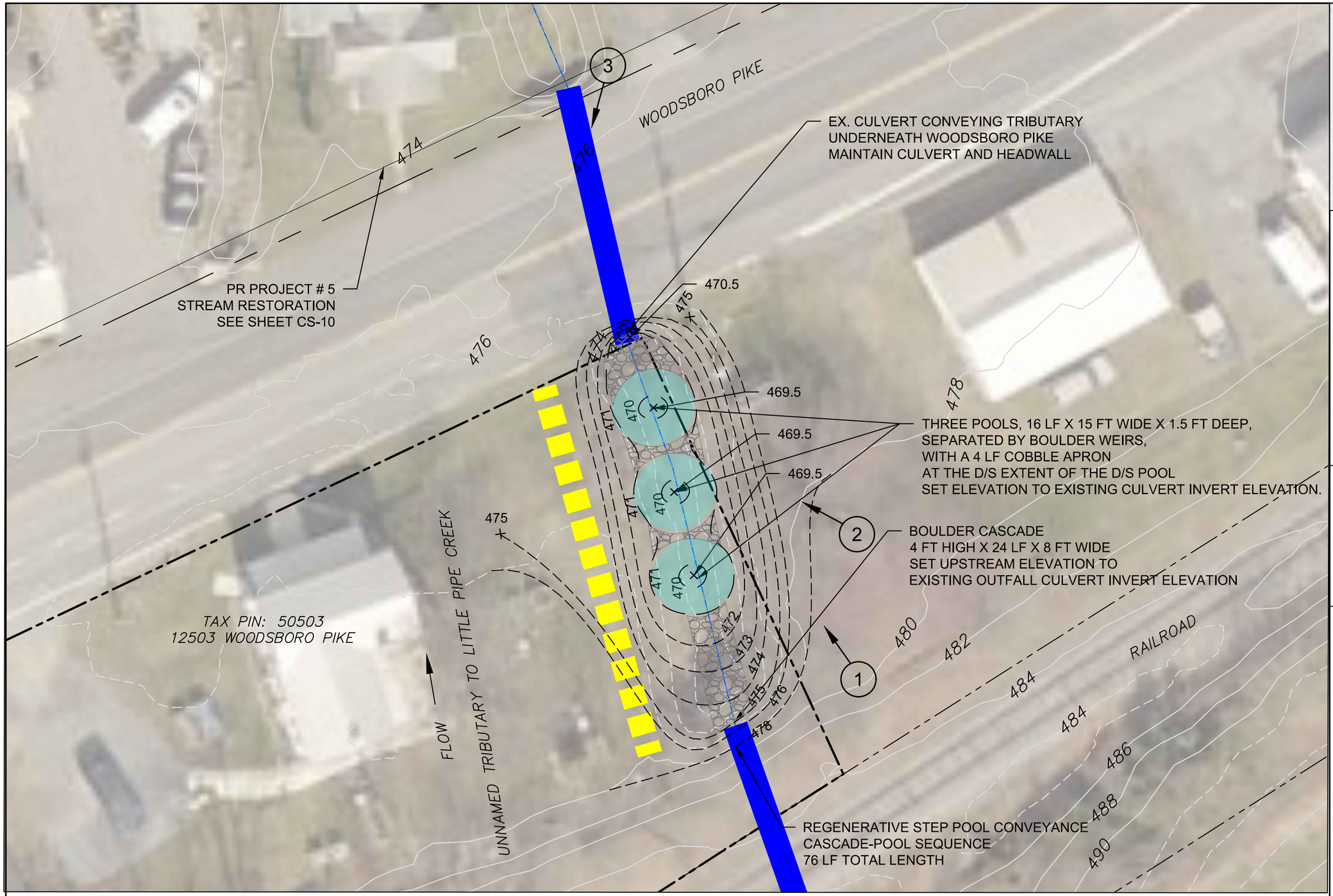
Photo 21. Stream bank conditions in downstream-most reach segment.

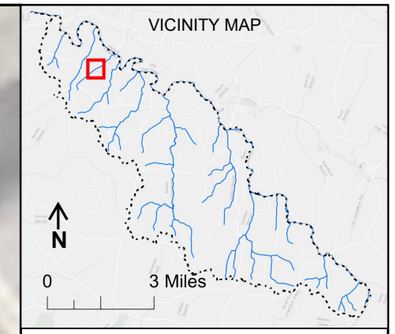
Photo 22. Right floodplain in downstream-most reach segment, with existing fence in riparian buffer.

Photo 23. Downstream end of stream reach – pools and riffles present and higher canopy coverage.

Photo 24. Riparian coverage in lower downstream section.

Photo 25. Access road in wooded section, to the right of stream.





Existing Legend

- Stream Channel
- Fence
- Property Boundary
- Major Contour (10ft interval)
- Minor Contour (2 ft interval)

Proposed Legend

- Pool Feature
- Riparian Buffer Restoration
- Rock Grade Control
- Debris Removal
- Access Route
- Bioretention
- Vegetated Swale
- Major Contour (10 ft interval)
- Minor Contour (1 ft interval)
- Photo Location

20 0 20 40

Scale 1" = 20'

AKRF

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
12
NPDES BMP ID:
LIPI-2018-RSC-0001
Site ID(s):
117
Prioritization Ranking:
12
Parcel Tax PIN:
50503
Address:
12503 Woodsboro Pike
Ladiesburg, MD 21759
BMP Type:
Regenerative Step Pool Conveyance

Sheet #:

CS-12

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0011
Site ID:	CS-12
Prioritization Ranking:	12
Structure Location:	12404 Simpsons Mill Rd, Keymar, MD 21757
Coordinates (Lat, Long):	39.583076, -77.228917
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$959,200
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Physiochemical Level
Project Length (LF):	1,645
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	16
TN (lbs/yr):	123
TP (lbs/yr):	112
TSS (lbs/yr):	73,828

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition

The stream reach of interest is an unnamed tributary to Little Pipe Creek, located in a cattle pasture and bounded by a concrete bridge upstream, and by an electric fence along the property line on the downstream end. The electric fencing also runs outside the riparian buffer on both sides of the stream, and woody debris collects on the fencing and can flood the concrete bridge during high flow periods, according to the landowner. The drainage area to the site is primarily agricultural land, with about 3 percent impervious area and 14 percent forested areas. A floodplain is present along the left bank throughout the reach, while the floodplain on the right bank is confined by the valley slope; overall, floodplain connectivity was characterized as “incised with limited floodplain access”. The stream pattern was classified as meandering single thread, and a pool-riffle bed form profile was observed throughout. The dominant stream bed material is bedrock, which acts as a vertical confinement on the channel and, in some locations, as a lateral confinement. Side bars and mid-channel bars, primarily composed of gravels, were also present in the channel, indicating instability in the system. The lateral stability was characterized as “unstable”, as streambank erosion was severe,

especially on outer meander bends, and toe scour and undercut trees were observed throughout. Cattle access clearly contributes to some of the observed bank erosion.	
Restoration Measures	
The primary restoration approach is livestock exclusion fencing to reduce stream bank erosion. Vehicle crossing stabilization efforts at the concrete bridge will include removal of existing debris and modification of the fence and crossing structure as needed to prevent roadway flooding and debris buildup. Bank erosion would be addressed through bank regrading and stabilization measures such as installation of live stakes or live branch layering. Riparian buffer restoration would add to and enhance the existing trees and herbaceous vegetation through the addition of native species to create a buffer between the cattle pasture and the stream.	
Anticipated Site Constraints	
Constructability/Access	Easy. The site will not require significant clearing, and tree removal should be minimized or avoided. No utilities and only one existing fence are present at the site. Restriction of cattle access to the stream during construction will need to be coordinated with the landowner.

Selected Site Photos

Photo 1. Good floodplain connectivity at upstream half of reach – view from concrete bridge. Woody debris and vegetation caught on fencing

Photo 2. Stream condition upstream of concrete bridge.

Photo 3. Streambank erosion, including collapsed banks and toe scour, were observed in upstream half of reach.

Photo 4. Sloping valley on right streambank side with evidence of erosion and gully formation along concentrated flow paths.

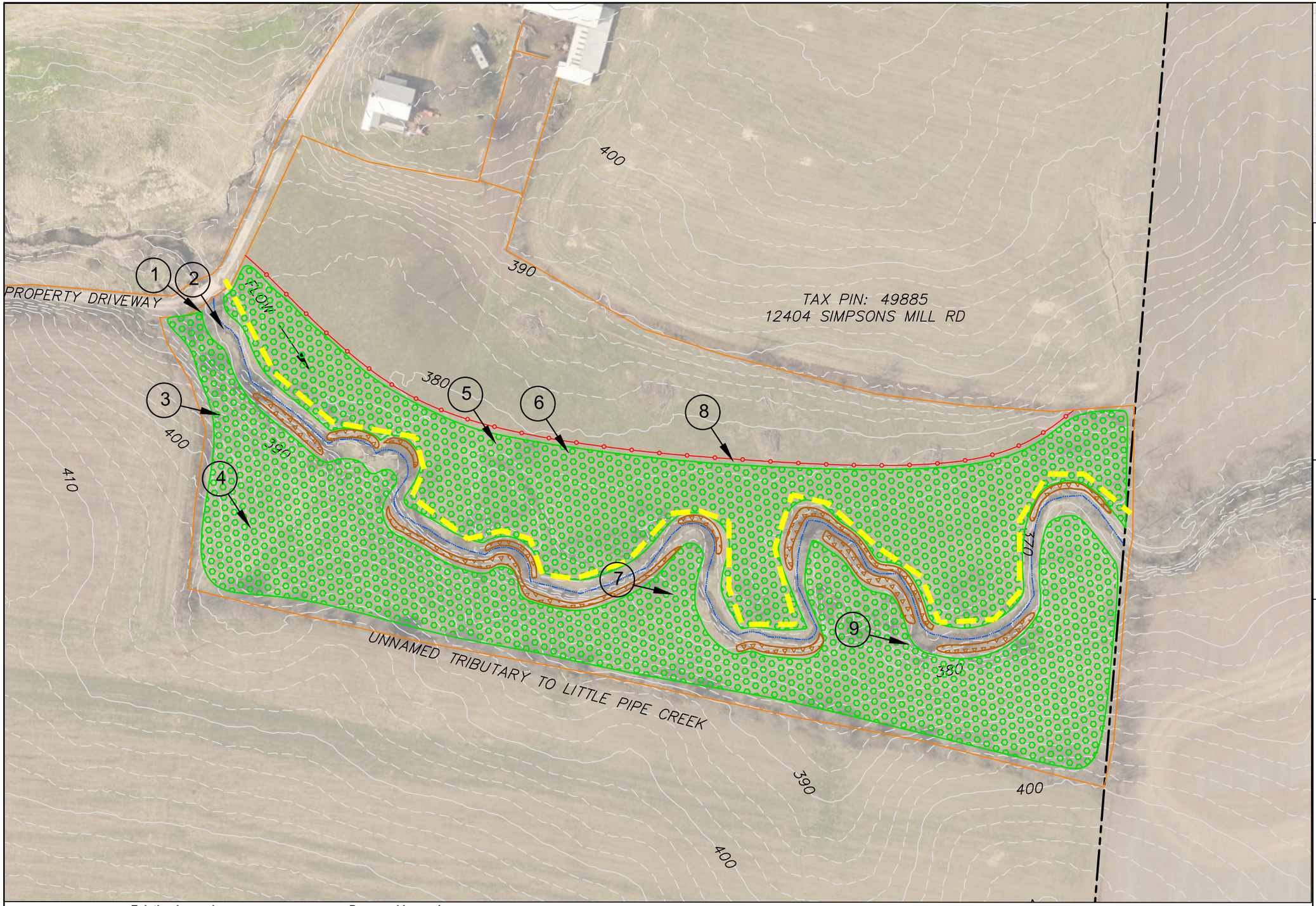
Photo 5. Narrow riffle segment widens into silt/clay pool mid-reach.

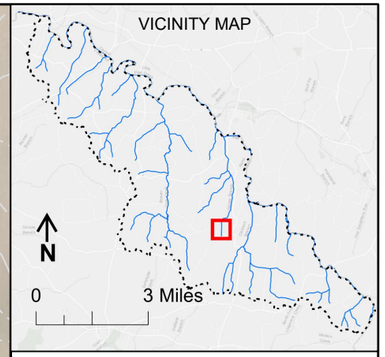
Photo 6. Streambank erosion observed on outer meander bends throughout reach. Stream narrows at riffle section in the mid-ground of the Photo, then widens downstream to form another pool.

Photo 7. Low to moderate canopy coverage in riparian zone throughout reach.

Photo 8. Unrestricted access by cattle – multiple crossings contributing to bank disturbance throughout reach.

Photo 9. New floodplain forming, potentially from old collapsed bank material and/or side bar deposited from upstream.





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
13
NPDES BMP ID:
LIPI-2018-STRE-0012
Site ID(s):
49
Prioritization Ranking:
13
Parcel Tax PIN:
49885
Address:
12404 Simpsons Mill Rd
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:
CS-13

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstructior
- Access Route
- 1 Photo Location

AKRF

100 0 100 200
Scale 1" = 100'

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0012
Site ID:	CS-13
Prioritization Ranking:	13
Structure Location:	10345 Fountain School Rd; 10413 Fountain School Rd, Union Bridge, MD 21791
Coordinates (Lat, Long):	39.51882, -77.2016
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$965,031
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Biological Level
Project Length (LF):	1,655
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	17
TN (lbs/yr):	124
TP (lbs/yr):	113
TSS (lbs/yr):	74,276
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The stream reach of interest is an unnamed tributary to Little Pipe Creek, located in a broad valley with a narrow grassy riparian corridor throughout. The upstream boundary is the property line, while the downstream boundary is at a culvert that conveys the creek under Fountain School Road. Drainage to the stream is primarily active agriculture, with about 8 percent forest and 3 percent impervious areas. The valley slopes are steeper on the right side in the upstream portion of the reach. The right floodplain is predominantly forested, and on the left side is a small open farm field with an active pasture that is fenced, keeping the livestock out of the stream. The stream has a single thread meandering pattern with some side bars, mid-channel bars, and evidence of meander migration in the upstream portion of the reach. The plane-bed profile contains some riffle features throughout the reach. There is a woody debris jam (possibly a beaver dam) present mid-reach which caused flooding/ponding of water onto the floodplain during a rain event at the time of the site visit. The woody debris jam increased floodplain connectivity in the center of the reach, and although the downstream portion of the reach was determined to be less connected and more incised than the	

upstream half of the reach, the overall floodplain connectivity assessment for the site is “connected”. Overall lateral stability was assessed to be “moderately stable”, as the channel has some overhanging banks, erosion on outer meander bends, and is confined by a brick and concrete revetment parallel to the driveway in the downstream portion of the reach.	
Restoration Measures	
The proposed restoration measures include channel realignment at a pair of overly eroded and tight meander bends, floodplain reconnection and wetland creation in low-lying floodplain sections and abandoned meander bends. The floodplain connection at the existing debris jam/beaver dam would be protected during construction. Bank erosion would be addressed through bank regrading and stabilization measures such as installation of live stakes or live branch layering. Instream debris removal and installation of grade control would be included in the restoration to ensure vertical stability of the channel. Riparian buffer restoration would add to and enhance the existing trees, shrubs, and herbaceous species with native vegetation, to enhance the riparian buffer along the stream.	
Anticipated Site Constraints	
Constructability/Access	Moderate. Site accessibility is limited by riparian vegetation, which will need to be cleared for construction access and some of the proposed bank grading work. Access to the site from the east is restricted by steeper valley slopes.

Selected Site Photos

Photo 1. Large woody debris affecting stream flow.

Photo 2. Large woody debris affecting stream flow.

Photo 3. Large woody debris affecting stream flow.

Photo 4. Primarily grasses, moss and algae present in riparian corridor. Mature trees add to shading.

Photo 5. Primarily grasses present in riparian corridor with low habitat and flow diversity.

Photo 6. Mature trees, grasses and herbaceous plants present. Low baseflow depth observed.

Photo 7. Dominant native and invasive species present.

Photo 8. Bank erosion and some woody debris present.

Photo 9. Woody debris affecting stream flow.

Photo 10. Meander bend in upstream portion of reach (looking upstream). Eroded banks are visible.

Photo 11. Typical stream condition in upper half of reach.

Photo 12. Typical stream condition in upper half of reach.

Photo 13. Erosion on right bank. Herbaceous and woody vegetation on both banks.

Photo 14. Existing fencing on left floodplain. Pasture area partially inundated under storm flow conditions. Erosion and ground disturbance evident from livestock.

Photo 15. Woody debris jam exacerbating storm-related flooding.

Photo 16. Floodplain inundation due to debris jam near mid-reach, potentially a beaver dam. Bank erosion and preferential flow paths visible at right.

Photo 17. High woody debris loading from upstream. Woody debris on banks and debris dams or beaver dam creating ponding upstream and flow on floodplain to bypass dam.

Photo 28. High flow/flooding at the time of site visit. Vertical features observed in-channel but unable to be identified under flow conditions.

Photo 19. Mid-reach channel condition under high/storm flows.

Photo 20. Typical stream form (single thread meandering channel) and riparian buffer observed during site visit.

Photo 21. High woody debris loading from upstream. Debris dams observed to block flow in multiple locations in channel.

Photo 22. Woody debris on point bar. Erosion on right bank upstream of point bar may be leading to meander cutoff.

Photo 23. Cobble and brick revetment along bank close to driveway in downstream portion of reach.

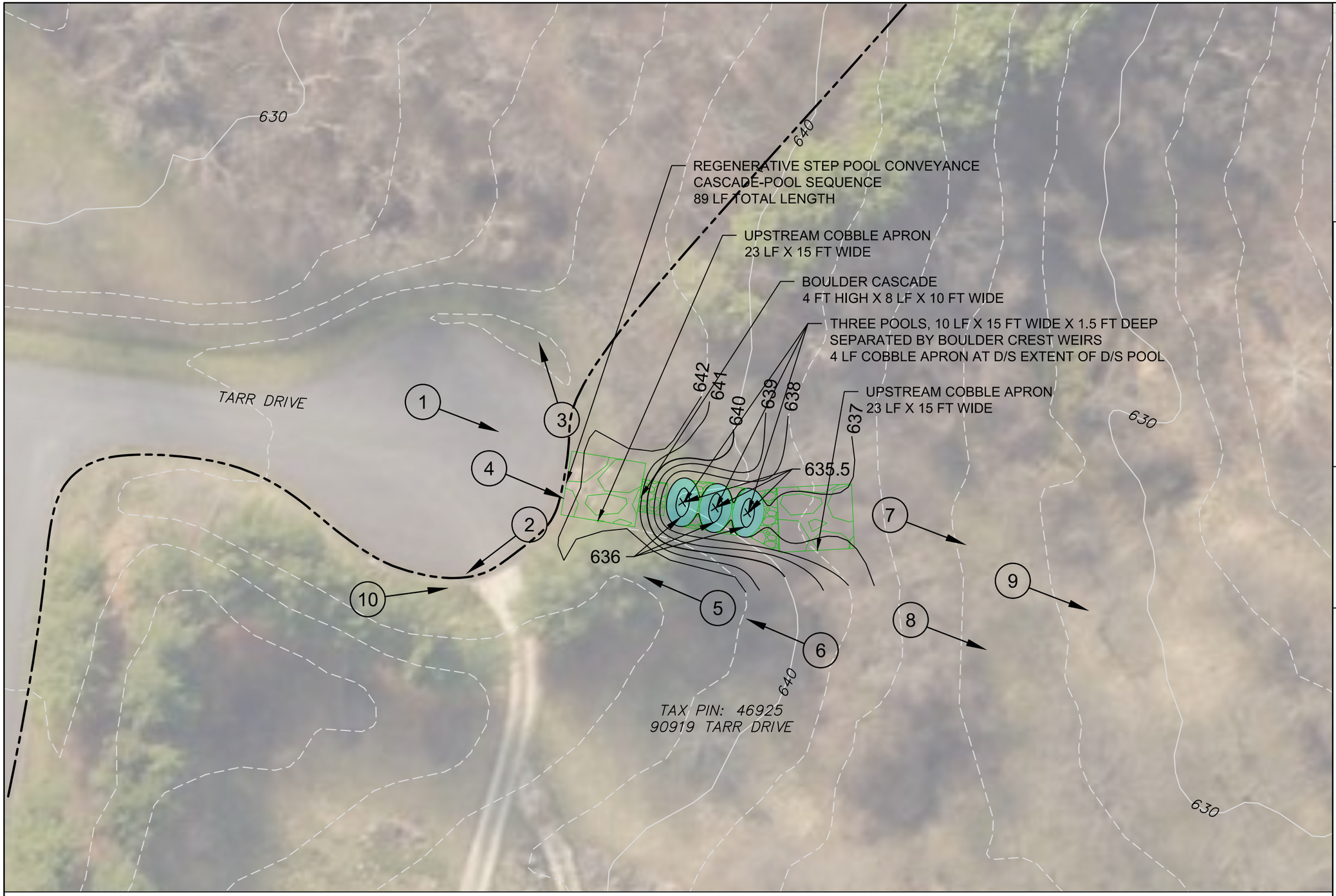
Photo 24. High flow conditions in downstream portion of reach after rain event. Woody debris deposited on left floodplain. Cobble and brick revetment on left bank.

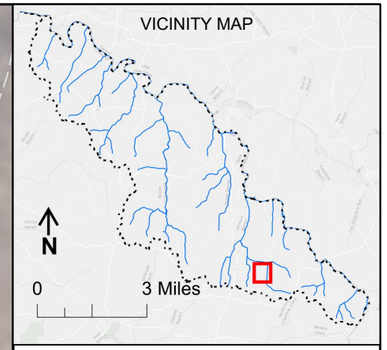
Photo 25. Woody debris on left floodplain. High flow levels obscured in-stream feature that caused visible grade change.

Photo 26. High flow conditions in downstream portion of reach, but bank erosion on outer meander bend still visible.

Photo 27. Bank erosion and overhanging banks in downstream quarter of reach.

Photo 28. Culvert conveying stream under Fountain School Road at downstream end of reach.





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
14
NPDES BMP ID:
LIPI-2018-RSC-0001
Site ID(s):
12
Prioritization Ranking:
14
Parcel Tax PIN:
46925
Address:
90919 Tarr Drive
New Windsor, MD 21776
BMP Type:
Regenerative Step Pool Conveyance

Sheet #:
CS-14

Existing Legend
- Stream Channel
- Fence
- Property Boundary
- Major Contour (10ft interval)
- Minor Contour (2 ft interval)

Proposed Legend
- Pool Feature
- Riparian Buffer Restoration
- Rock Grade Control
- Debris Removal
- Access Route
- Bioretention
- Vegetated Swale
- Major Contour (10 ft interval)
- Minor Contour (1 ft interval)
- Photo Location

30 0 30 60
Scale 1" = 30'

AKRF

General BMP Information	
NPDES BMP ID:	LIPI-2018-RSC-0001
Site ID:	CS-14
Prioritization Ranking:	14
Structure Location:	90919 Tarr Drive, New Windsor, MD 21779
Coordinates (Lat, Long):	39.50968, -77.20136
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$179,928
Estimated Cost/Impervious Acre:	$74,970
Proposed Restoration General Information	
Restoration Type:	RSC
Functional Lift Potential:	Geomorphic Level
Project Length (LF):	89
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	0.98
TN (lbs/yr):	0.13
TP (lbs/yr):	0.0024
TSS (lbs/yr):	1.70
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	-
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The proposed BMP area of interest is located at the end of a cul-de-sac with a small vegetated drainage swale in a small residential area characterized by grassed lawns and a wooded area. The drainage area to this point is about 34 acres, and is primarily active agricultural land, with 19 percent impervious area, 12 percent forested areas, and several residences. Runoff from roof and road surfaces was observed to be causing visible erosion along a concentrated flow path at the end of the cul-de-sac. Some rip-rap and carpeting had been placed in the area, in what appeared to be an attempt to stabilize the erosion.	
Restoration Measures	
A step-pool stormwater conveyance (SPSC) structure is the proposed restoration method. The SPSC would be approximately 89 LF in total length, with a boulder cascade and set of three pools with boulder weirs in between and cobble aprons at the upstream downstream ends of the SPSC to convey flow from the existing roadside swale into the SPSC, then out of the SPSC onto the existing floodplain, without creating additional erosion.	

Anticipated Site Constraints	
Constructability/Access	Difficult. The location of the site at the end of a cul-de-sac limits access to the site, and some of the mature trees onsite may need to be removed, increasing difficulty.

Selected Site Photos

Photo 1. Upstream extent of existing concentrated flow path, covered with carpet and riprap.

Photo 2. Property to the right of the existing carpet and rip rap flow path

Photo 3. To the left of the existing carpet and rip-rap flow path.

Photo 4. Minor erosion downstream of carpeted area

Photo 5. Photo taken looking from mid-proposed BMP area to upstream extent; carpet and rip-rap flow path.

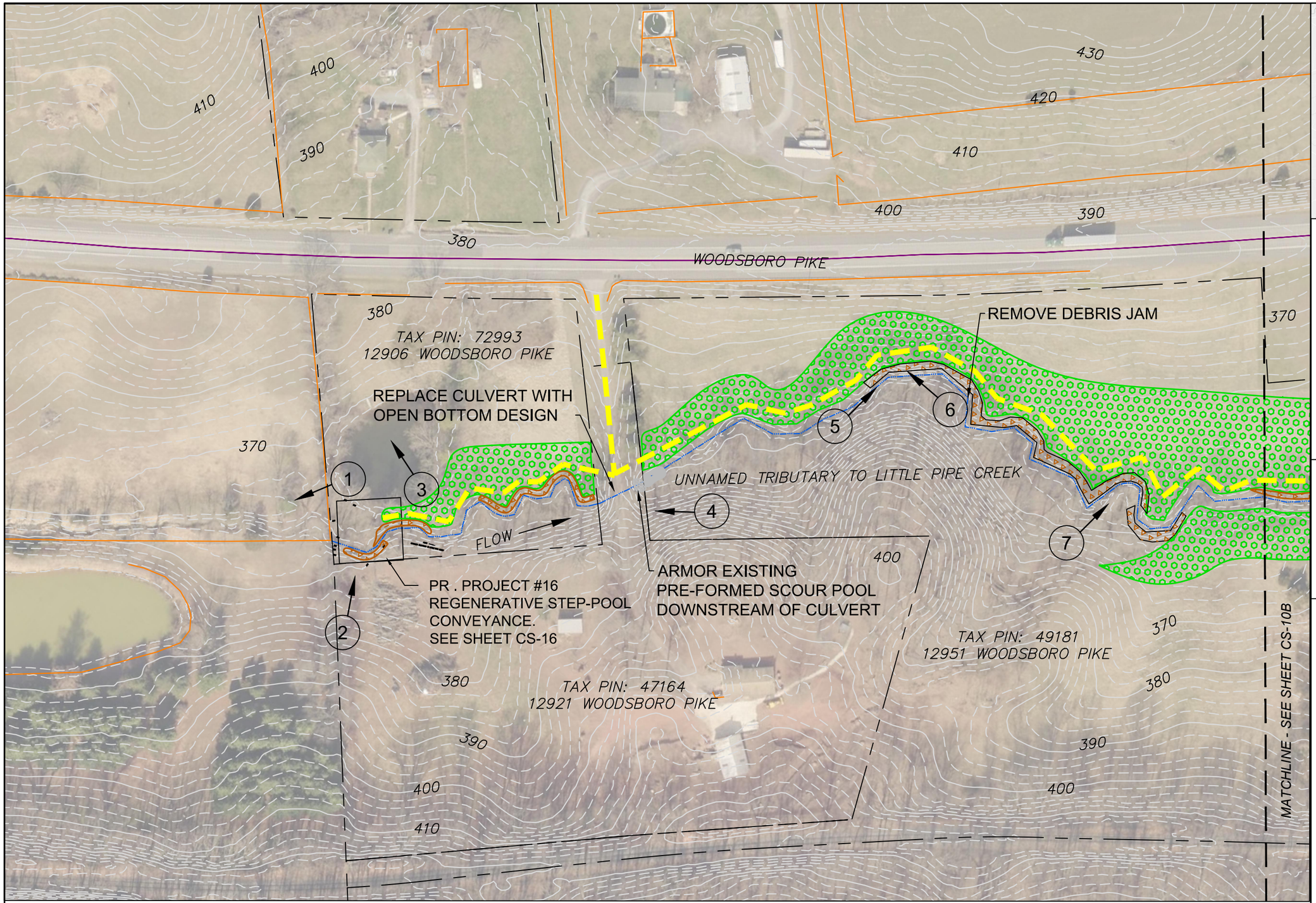
Photo 6. Photo taken looking upstream from mid-proposed BMP area. Predominantly wooded area.

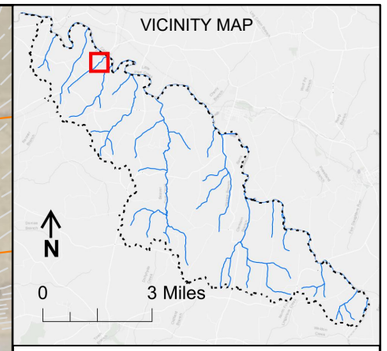
Photo 7. High canopy cover downstream in proposed BMP area.

Photo 8. Mix of native and invasive species in wooded area.

Photo 9. Dense wooded area further down the slope.

Photo 10. Inlet to culvert under driveway on parcel.





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
15
NPDES BMP ID:
LIPI-2018-STRE-0013
Site ID(s):
95-102-97
Prioritization Ranking:
15
Parcel Tax PIN:
72993, 47164, 49181
Address:
12906 Woodsboro Pike,
12921 Woodsboro Pike,
12951 Woodsboro Pike,
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:

CS-15A

Existing Legend

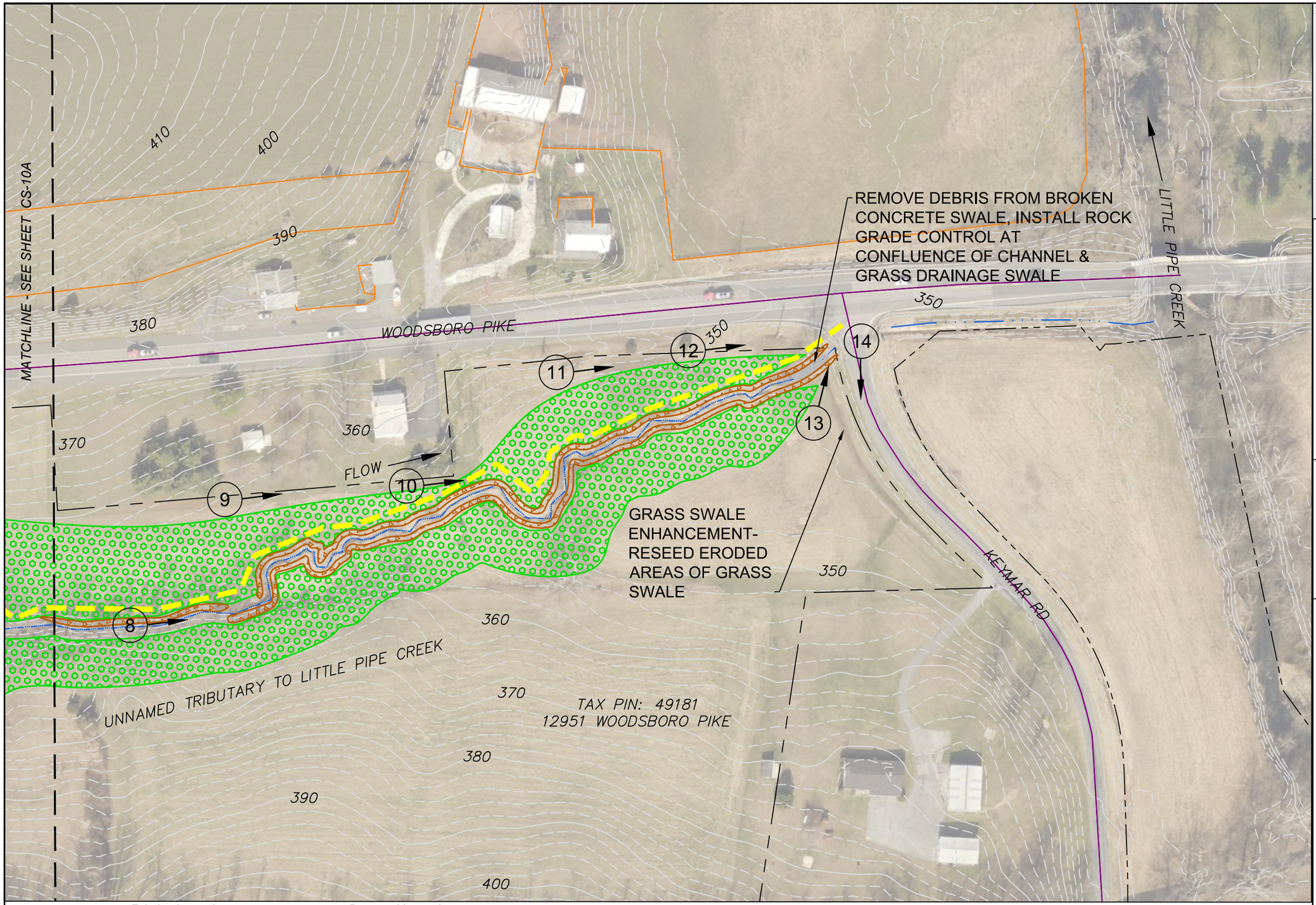
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

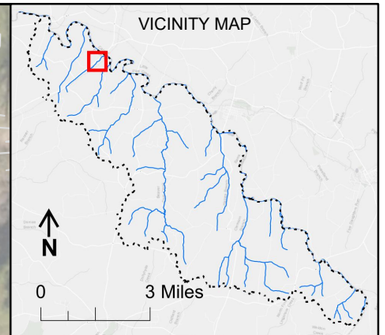
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

100 0 100 200

Scale 1" = 100'



VICINITY MAP



Existing Legend

- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstructior
- Access Route
- 1 Photo Location

AKRF

100 0 100 200

Scale 1" = 100'

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
15
NPDES BMP ID:
LIPI-2018-STRE-0013
Site ID(s):
95-102-97
Prioritization Ranking:
15
Parcel Tax PIN:
72993, 47164, 49181
Address:
12906 Woodsboro Pike,
12921 Woodsboro Pike,
12951 Woodsboro Pike,
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:

CS-15B

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0013
Site ID:	CS-15
Prioritization Ranking:	15
Structure Location:	12906 Woodsboro Pike; 12921 Woodsboro Pike; 12951 Woodsboro Pike, Keymar, MD 21757
Coordinates (Lat, Long):	39.58704, -77.24684
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$1,328,302
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Geomorphic Level
Project Length (LF):	2,278
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	23
TN (lbs/yr):	171
TP (lbs/yr):	155
TSS (lbs/yr):	102,237
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The stream reach of interest flows through two properties and runs parallel to Woodsboro Pike through a floodplain confined by a notable slope on the right side within the valley. The upstream area is bounded by the property fence line and the downstream end is bounded by a 5-foot wide culvert under Keymar Road. Drainage area to the site is a mix of agricultural lands and residential lots, with 37 percent forested, and 6 percent impervious. Two culverts vertically confine the stream within the reach—one under the driveway between the two main parcels, and one at Keymar Road. The floodplain appeared limited in the forested area upstream, and has few visible terraces throughout. The surrounding riparian area has approximately 50-75% canopy cover, with grasses appearing more prevalent downstream. A farm pond is located on the left floodplain, and the outfall and overflow is eroded.	

The stream form is a single meandering thread and appeared incised throughout, with limited floodplain connectivity. The stream plane-bed profile appeared to contain very few riffle and pool features. Bank erosion was primarily observed along the outer meander bends, indicating meander migration. Other indications of lateral instability included banks with undercut trees in several locations, abandoned meander bends, and point bar development. Bank erosion was determined to be moderate and the lateral stability was rated as moderate. Segments within the downstream channel appear lined with concrete, and transition into a concrete channel just upstream of Little Pipe Creek.	
Restoration Measures	
The proposed restoration measures include channel realignment at a couple of overly eroded and tight meander bends, floodplain reconnection and wetland creation in low-lying floodplain sections and abandoned meander bends. Bank erosion would be addressed through bank regrading and stabilization measures such as installation of live stakes. Riparian buffer restoration would enhance existing riparian buffer through the addition of native species. The existing culverts would be replaced with open bottom structures to promote improved flow and habitat conditions, and the existing scour pool would be stabilized to prevent additional erosion. An SPSC is proposed for stabilization of overflow from the farm pond – NPDES ID# LIPI-2018-RSC-0002.	
Anticipated Site Constraints	
Constructability/Access	Moderate. Site accessibility is limited by the steep slope on the right floodplain, and the upstream portion of the stream will require clearing of trees and shrubs to access the stream and repair the eroded banks.

Selected Site Photos

Photo 1. Overhanging bank and point bar.

Photo 2. Clay pipe in farm pond and concentrated overflow path.

Photo 2. Algae/eutrophication in farm pond.

Photo 4. Culvert outfall under driveway at mid-reach section. Formation of scour pool– stream is deeper and wider than in downstream or upstream portions of reach.

Photo 5. Riparian buffer with moderately dense mature canopy layer, but sparse understory layer. Stream appears to have down-cut and widened. Mid-reach meander bend neck cutoff evident on left bank.

Photo 6. High eroded banks.

Photo 7. Mid-reach channel condition. Left bank has narrow to no riparian corridor, right bank is wooded, and the channel has moderate access to the floodplain

Photo 8. Point bar and overhanging bank.

Photo 9. Meander migration and woody debris on banks and in-stream.

Photo 10. Sparse riparian trees observed in the downstream third of reach. Incision evident, but banks appeared stabilized with grasses.

Photo 11. Invasive plant species, such as multi-flora, in stream riparian buffer zone.

Photo 12. Existing grass swale at downstream extent of reach. Some erosion evident, with nonexistent riparian buffer.

Photo 13. Keymar Road at downstream extent of reach with culvert, in-stream sediment bar, and broken concrete swale structure.

Photo 14. Downstream—most sections of reach were lined with concrete, to the confluence with Little Pipe Creek.

REGENERATIVE STEP POOL CONVEYANCE
CASCADE-POOL SEQUENCE
40 LF TOTAL LENGTH

UPSTREAM COBBLE APRON
5 LF X 8 FT WIDE

BOULDER CASCADE
4 FT HIGH X 8 LF X 8 FT WIDE

THREE POOLS, 6 LF X 15 FT WIDE X 1.5 FT DEEP
SEPARATED BY BOULDER CREST WEIRS
D/S POOL TIED IN TO EX. STREAM CHANNEL

PR. PROJECT #95
STREAM RESTORATION
SEE SHEET CS-10

FLOW
UNNAMED TRIBUTARY TO LITTLE PIPE CREEK

TAX PIN: 72993
ADDRESS: 12906 WOODSBORO PIKE

VICINITY MAP
0 3 Miles

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
16
NPDES BMP ID:
LIPI-2018-RSC-0003
Site ID(s):
95
Prioritization Ranking:
16
Parcel Tax PIN:
72993
Address:
12906 Woodsboro Pike
Keymar, MD 21757
BMP Type:
Regenerative Step Pool Conveyance

Sheet #:
CS-16

Existing Legend
- Stream Channel
- Fence
- Property Boundary
- Major Contour (10ft interval)
- Minor Contour (2 ft interval)

Proposed Legend
- Pool Feature
- Riparian Buffer Restoration
- Rock Grade Control
- Debris Removal
- Access Route
- Bioretention
- Vegetated Swale
- Major Contour (10 ft interval)
- Minor Contour (1 ft interval)
- Photo Location

10 0 10 20
Scale 1" = 10'

AKRF

General BMP Information	
NPDES BMP ID:	LIPI-2018-DSWA-0002
Site ID:	CS-16
Prioritization Ranking:	16
Structure Location:	11721 Bunker Hill Ct, Union Bridge, MD 21791
Coordinates (Lat, Long):	39.55685, -77.21684
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$211,999
Estimated Cost/Impervious Acre:	$123,976
Proposed Restoration General Information	
Restoration Type:	Grass Swale
Functional Lift Potential:	Geomorphic Level
Project Area (SF):	371,580
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	1.24
TN (lbs/yr):	0.13
TP (lbs/yr):	0.0024
TSS (lbs/yr):	1.66
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	-
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The proposed BMP area of interest is located in a small development on Bunker Hill Court that terminates in a cul-de-sac, in a developed residential area surrounded by grassed lawns with landscaped trees and shrubs. Drainage area to the site is primarily suburban residential lots, with no forested areas and about 23 percent impervious areas. The residential lots have steep slopes not well-suited to treat stormwater runoff in a single location. During the site walk, the edge of the road and the property asphalt had visible points of erosion. Some of the existing street right-of-way (ROW) is already a vegetated grass swale.	
Restoration Measures	
A vegetated swale is proposed along the entire length of Bunker Hill Court, to capture and infiltrate stormwater from the impervious areas in the development. In areas where a grass swale is present along the ROW, it would be retrofitted to meet all applicable design requirements and treat as much stormwater runoff as possible.	

Anticipated Site Constraints	
Constructability/Access	Moderate. The swale is proposed along the existing street ROW and would require coordination with property owners for any potential impacts to individual driveways.

Selected Site Photos

Photo 1. Drainage area. No culverts or stormwater inlets present along Bunker Hill Ct.

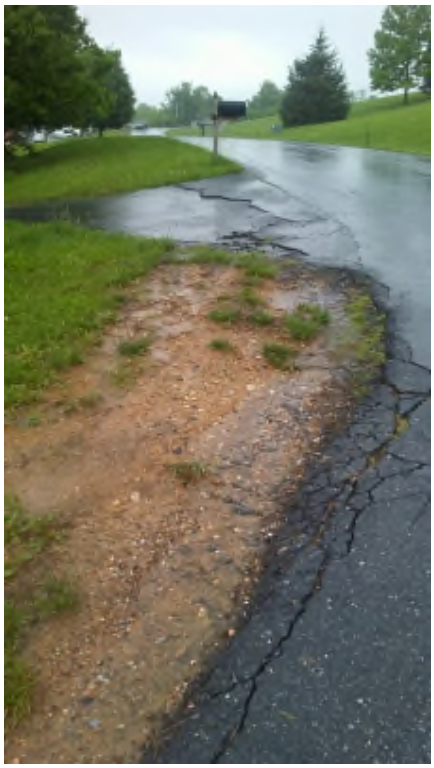


Photo 2. Visible erosion at roadway edge in cul-de-sac upstream of proposed BMP.

Photo 3. Concentrated flow on the right side of site cul-de-sac, upstream of proposed BMP.

Photo 4. Erosion in drainage area, upstream of proposed BMP. Improve grading and vegetation for conveyance into new BMP.

Photo 5. Concentrated stormwater flow path crossing existing driveway upstream and to the left of the proposed BMP.

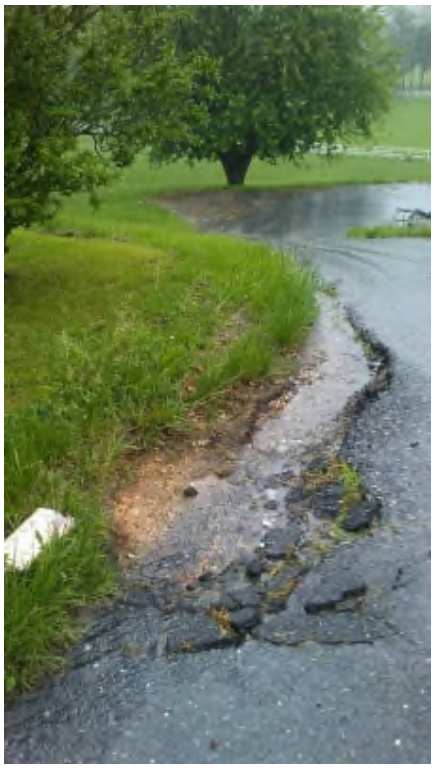


Photo 6. Concentrated flow path at upstream extent of proposed BMP - stormwater thalweg eroding side of property driveway.

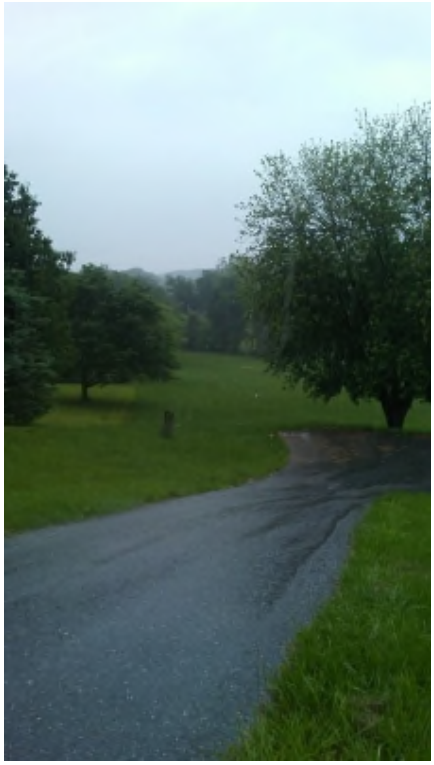
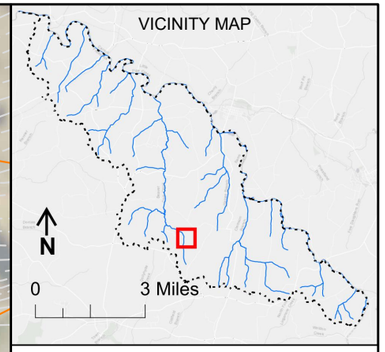


Photo 7. Field where proposed bioretention basin would be located. White dot in the foreground is a septic system; depth to system to be verified prior to further design work.



Existing Legend

- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- (1) Photo Location

N

100 0 100 200

Scale 1" = 100'

AKRF

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
17

NPDES BMP ID:
LIPI-2018-STRE-0013

Site ID(s):
9-10

Prioritization Ranking:
17

Parcel Tax PIN:
49210, 49993

Address:
10345 Fountain School Rd,
10413 Fountain School Rd,
Union Bridge, MD 21791

BMP Type:
Stream Restoration

Sheet #:

CS-17A

TAX PIN: 49210
10345 FOUNTAIN SCHOOL RD

MATCHLINE - SEE SHEET CS-17B

FOUNTAIN SCHOOL ROAD

WOODY DEBRIS REMOVAL

MAINTAIN BEAVER DAM DEBRIS FOR FLOODPLAIN CONNECTION

VICINITY MAP

N

0 3 Miles

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
17
NPDES BMP ID:
LIPI-2018-STRE-0013
Site ID(s):
9-10
Prioritization Ranking:
17
Parcel Tax PIN:
49210, 49993
Address:
10345 Fountain School Rd,
10413 Fountain School Rd
Union Bridge, MD 21791
BMP Type:
Stream Restoration

Sheet #:
CS-17B

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

100 0 100 200
Scale 1" = 100'

AKRF

General BMP Information	
NPDES BMP ID:	LIPI-2018-RSC-0002
Site ID:	CS-17
Prioritization Ranking:	17
Structure Location:	12906 Woodsboro Pike, Keymar, MD 21757
Coordinates (Lat, Long):	39.586584, -77.247410
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$22,491
Estimated Cost/Impervious Acre:	$74,970
Proposed Restoration General Information	
Restoration Type:	RSC
Functional Lift Potential:	Geomorphic Level
Project Length (LF):	40
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	0.00
TN (lbs/yr):	0.00
TP (lbs/yr):	0.0001
TSS (lbs/yr):	0.05
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The proposed BMP area of interest is at a farm pond in an elevated embankment, which overflows into the nearby stream through a clay pipe. A concentrated overflow path has formed over the clay pipe, exposing it upstream of the channel. The drainage area to the site is 0.66 acres, primarily active agricultural lands, with 0 acres of impervious area. The site has about 50-75% riparian cover, with woody debris within the channel, and is upstream of proposed stream restoration project NPDES ID# LIPI-2018-STRE-0013.	
Restoration Measures	
A regenerative step-pool stormwater conveyance (SPSC) is the proposed restoration method to repair the erosion in the pond outfall. The SPSC would be approximately 40 linear feet (LF) total length, with a boulder cascade and set of three pools with boulder weirs in between and cobble aprons at the upstream downstream ends of the SPSC to convey flow from the existing farm pond into the SPSC, then out of the SPSC onto the existing stream channel, without creating additional erosion.	

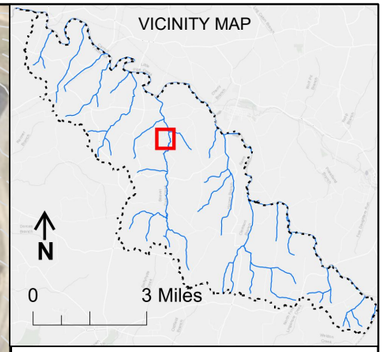
Anticipated Site Constraints	
Constructability/Access	Moderate. Site accessibility is limited by the steep slope on the right floodplain, and the some clearing of trees and shrubs would be needed to access the farm pond and install the SPSC.

Selected Site Photos

Photo 1. Overhanging bank and point bar in stream channel downstream of proposed BMP.

Photo 2. Clay pipe in farm pond embankment and stream bank and concentrated overflow path from farm pond.

Photo 2. Algae/eutrophication in farm pond.



Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
18
NPDES BMP ID:
LIPI-2018-USF-0001
Site ID(s):
3-BMP
Prioritization Ranking:
18
Parcel Tax PIN:
51964
Address:
11721 Bunker Hill
Union Bridge, MD 21791
BMP Type:
Vegetated Swale with Check Dams and Bioretention Basin

Sheet #:

CS-18

Existing Legend

- Stream Channel
- Fence
- Property Boundary
- Major Contour (10ft interval)
- Minor Contour (2 ft interval)

Proposed Legend

- Pool Feature
- Riparian Buffer Restoration
- Rock Grade Control
- Debris Removal
- Access Route
- Bioretention
- Vegetated Swale
- Major Contour (10 ft interval)
- Minor Contour (1 ft interval)
- (1) Photo Location

50 0 50 100

Scale 1" = 50'

AKRF

General BMP Information	
NPDES BMP ID:	LIPI-2018-DSWA-0003
Site ID:	CS-18
Prioritization Ranking:	18
Structure Location:	13202 Detour Rd, Keymar, MD 21757
Coordinates (Lat, Long):	39.59829, -77.27719
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$38,068
Estimated Cost/Impervious Acre:	$126,894
Proposed Restoration General Information	
Restoration Type:	Grass Swale with Check Dams
Functional Lift Potential:	Geomorphic Level
Project Area (SF):	130,990
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	0.30
TN (lbs/yr):	0.04
TP (lbs/yr):	0.0007
TSS (lbs/yr):	0.49
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The proposed BMP area of interest is located in a wide valley, surrounded by a mostly grassed floodplain, although there are eroded areas in the heavily used agricultural yard, and is the location of proposed stream restoration project NPDES ID# LIPI-2018-STRE-0009. The property has an active agricultural operation, with a building compound in the center. The drainage area to the site is 6.64 acres, primarily active agricultural lands, with 0.3 acres of impervious area. Runoff from impervious surfaces of buildings is conveyed alongside the property driveway in an existing concrete ditch and into a first order stream that begins in the south end of the property and runs through a culvert underneath a driveway and continues downstream.	
Restoration Measures	
A 'Y' – shaped vegetated swale with check dams is proposed to replace the existing concrete channel and capture and treat the stormwater runoff from the existing agricultural buildings and heavily compacted bare soil yard areas. The vegetated swale will allow for the infiltration of stormwater, and will reduce flow velocities upstream of the unnamed tributary to Little Pipe Creek, which is proposed stream restoration project NPDES ID# LIPI-2018-STRE-0009.	

Anticipated Site Constraints	
Constructability/Access	Moderate. The concrete channel that is to be replaced is relatively accessible, but is impacted by some existing fencing, which will need to be maintained and possibly replaced. Additionally, the site is an active farm, so construction operations will need to be coordinated with typical operations.

Selected Site Photos

Photo 1. Existing concrete embankment downstream of culvert under driveway. Photo taken looking downstream at stream, past confluence with proposed BMP.

Photo 2. Deteriorating culvert embankment and in-stream debris. Proposed BMP confluence with stream to the right, near fallen metal sign post. No field pictures or proposed BMP location available.

VEGETATD SWALE WITH CHECK DAMS
"Y" SHAPED SWALE 445 LF TOTAL LENGTH
2 FT BOTTOM WIDTH
14 FT TOP WIDTH
3:1 SIDE SLOPES
2 FT TOTAL DEPTH
1.25 FT CHECK DAM HEIGHT
TIE UPSTREAM AND DOWNSTREAM EXTENTS
INTO EXISTING CHANNEL ELEVATIONS

WESTERN SWALE - 127 LF
11 % LONGITUDINAL SLOPE
12 CHECK DAMS SPACED ~11.5 FT

MAIN SWALE - 250 LF
8 % LONGITUDINAL SLOPE
16 CHECK DAMS SPACED ~15.5 FT

CHECK DAM (TYP.)

PR. PROJECT #9
STREAM RESTORATION
SEE SHEET CS-9

TAX PIN: 50047
13202 DETOUR ROAD

PRIVATE ROAD
TO DETOUR ROAD

SOUTHWESTERN SWALE - 68 LF
12 % LONGITUDINAL SLOPE
7 CHECK DAMS SPACED ~10.5 FT

FLOW

UNNAMED TRIBUTARY TO LITTLE PIPE CREEK

450 440 430 420

477 453 452 451 450 449 448 447 446 445 444 443 442 441 440 439 438 437 436 435 434 433 432 431 430 429 428 427 426 425 424 423 422 421

1 2

VICINITY MAP

N

0 3 Miles

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
19
NPDES BMP ID:
LIPI-2018-DSWA-0002
Site ID(s):
130
Prioritization Ranking:
19
Parcel Tax PIN:
50047
Address:
13202 Detour Road
Keymar, MD 21757
BMP Type:
Vegetated Swale with Check Dams

Sheet #:
CS-19

Existing Legend
- Stream Channel
- Fence
- Property Boundary
- Major Contour (10ft interval)
- Minor Contour (2 ft interval)

Proposed Legend
- Pool Feature
- Riparian Buffer Restoration
- Rock Grade Control
- Debris Removal
- Access Route
- Bioretention
- Vegetated Swale
- Major Contour (10 ft interval)
- Minor Contour (1 ft interval)
- (1) Photo Location

N

40 0 40 80

Scale 1" = 40'

AKRF

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0014
Site ID:	CS-19
Prioritization Ranking:	19
Structure Location:	12503 Woodsboro Pike, Keymar, MD 21757
Coordinates (Lat, Long):	39.57618, -77.26517
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$56,977
Estimated Cost/Impervious Acre:	$74,970
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Geomorphic Level
Project Length (LF):	76
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	6.50
TN (lbs/yr):	0.46
TP (lbs/yr):	0.0088
TSS (lbs/yr):	6.14

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition
The proposed BMP area of interest is located along an unnamed tributary to Little Pipe Creek that flows from a culvert under a railroad to a culvert under Woodsboro Pike. Drainage area to the site is primarily agricultural land and residential lots with grass lawns and some landscaping, 21 percent forested lands, and 11 percent impervious area. The railroad culvert is perched, and a plunge pool has formed underneath it immediately downstream. A riparian buffer is present in the transitioning downstream end before the culvert under Woodsboro Pike. Fish passage impediments are visible, and debris is present before the entrance of the culvert under Woodsboro Pike. Proposed stream restoration project NPDES ID# LIPI-2018-STRE-0005 is just downstream of the proposed BMP reach, at the downstream end of the Woodsboro Pike culvert.
Restoration Measures
A step-pool stream conveyance system is the proposed restoration method to mitigate the large plunge pool and streambank erosion downstream of the railroad outfall. Approximately 76 linear feet (LF) total length is proposed, with one boulder cascade, a series of three pools with boulder weirs in between, and a cobble apron at downstream end of final pool, to convey the flow into the existing

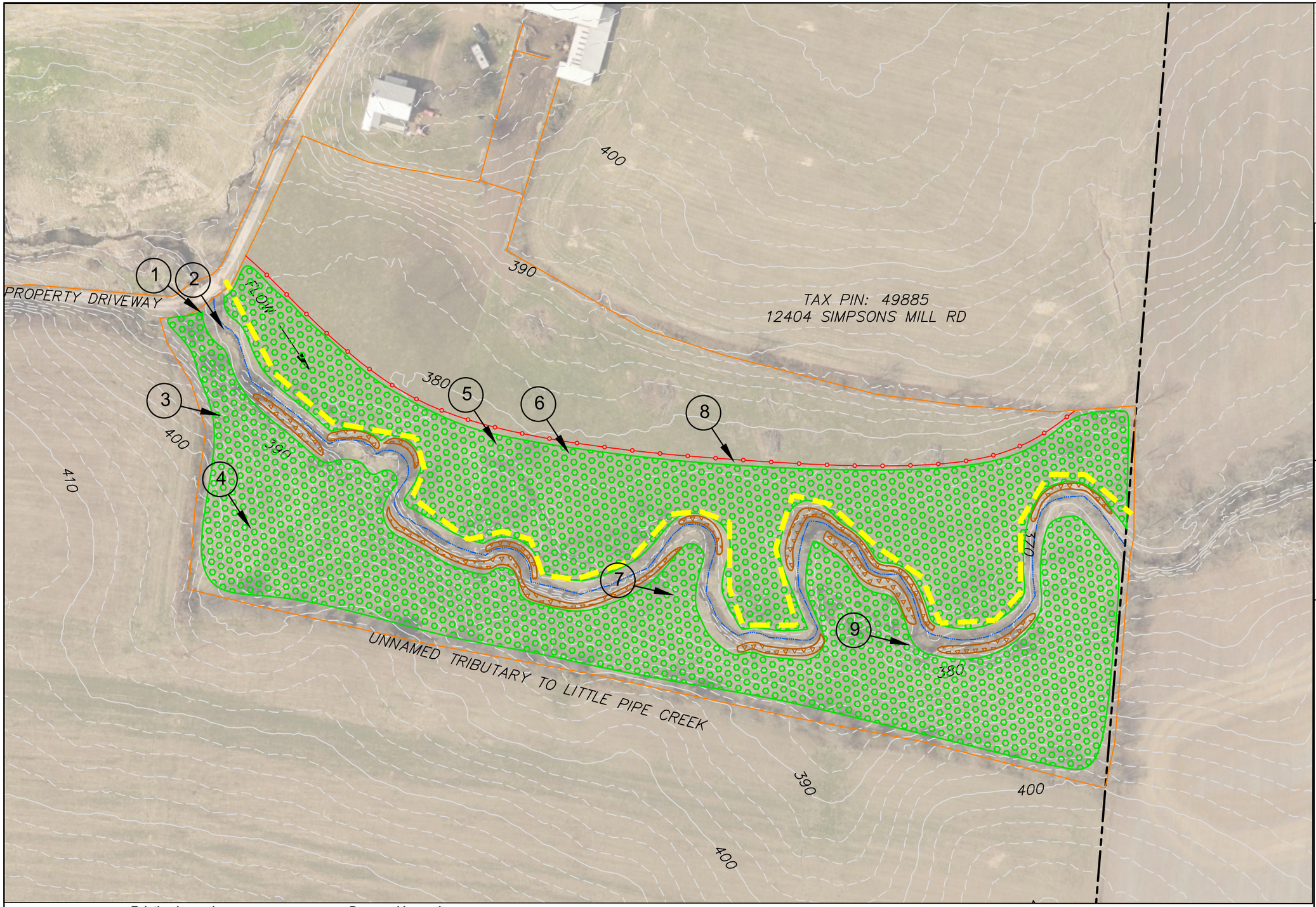
culvert and underneath Woodsboro Pike, into proposed restoration reach NPDES ID# LIPI-2018-STRE-0005.	
Anticipated Site Constraints	
Constructability/Access	Moderate. Construction will be impacted by the existing utilities, including overhead power lines. Additionally, some tree and shrub clearing will likely be needed to properly install the RSC.

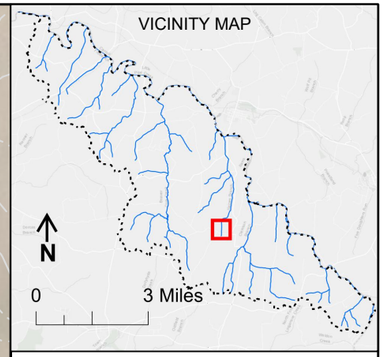
Selected Site Photos

Photo 1. Photo taken downstream of elevated railroad culvert. A plunge pool has formed under the outfall due to a high energy flow.

Photo 2. Downstream section of site, transition of riparian buffer leading to the downstream culvert under Woodsboro Pike.

Photo 3. Photo of Woodsboro Pike culvert, from the downstream side.





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
20
NPDES BMP ID:
LIPI-2018-STRE-0015
Site ID(s):
49
Prioritization Ranking:
20
Parcel Tax PIN:
49885
Address:
12404 Simpsons Mill Rd
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:
CS-20

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstructior
- Access Route
- 1 Photo Location

AKRF

N

100 0 100 200

Scale 1" = 100'

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0015
Stream ID:	CS-20
Prioritization Ranking:	20
Structure Location:	13202 Coppermine Rd, Union Bridge, MD 21791
Coordinates (Lat, Long):	39.508297, -77.200792
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$724,793
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Physiochemical Level
Project Length (LF):	1,243
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	12
TN (lbs/yr):	93
TP (lbs/yr):	85
TSS (lbs/yr):	55,786

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition

The stream reach is set in a narrow tree- and shrub-lined riparian corridor. Drainage area to the site is primarily active agricultural lands, with some residential lots, 10 percent forested lands, and 1 percent impervious area. The upstream section of the stream runs along a cattle pasture, and the lower half of the reach is in a grass field. A floodplain is present along much of the stream reach, alternating sides of the channel at lower elevations. The upstream portion of the reach was characterized as having a meandering single-thread planform, with a dominant pool-riffle bedform and silt/clay bed throughout. The downstream portion of the reach was characterized as multiple-thread braided form with vegetated islands, and preferential flow paths over the floodplain that would create cutoff-like flow under higher flow conditions. High flows during the field visit obscured some bed features, including the unidentified steep segment at the boundary between the upstream and downstream reaches. Other vertical features observed in the field included a headcut and a large woody debris jam. Lateral stability of stream channel was determined as unstable, with moderate to severe bank erosion. Lateral adjustments observed included undercut trees, meander migration, and neck and chute meander cutoffs.

Restoration Measures	
The proposed restoration measures focus on bank stabilization through regrading and installation of live stakes or live branch layering. Riparian buffer restoration would add native herbaceous and woody vegetation to create a buffer on both sides of the stream. In-stream rock grade control would be installed at key points in the stream to stabilize headcut areas and an existing nearly 90-degree meander bend.	
Anticipated Site Constraints	
Constructability/Access	Moderate. The existing fencing on the site and the dense vegetation on the right floodplain increase the difficulty of construction access.

Selected Site Photos

Photo 1. Upstream extent of stream reach. Gently sloping valley with cattle pasture and agricultural fields on left floodplain, narrow forest riparian buffer on right stream bank.

Photo 2. Sharp meander bend with high flows moving over the floodplain and bank erosion undermining fence post.

Photo 4. Typical meander bend in upstream half of the reach.

Photo 5. Meander bend in upstream portion of reach, with a mid-channel sediment bar and eroding outer bank undermining the existing fence.

Photo 6. Large woody debris in channel and on floodplain.

Photo 7. Mid-reach in-channel step/drop obscured by high flows. Undercut tree on inner meander bend in foreground of image.

Photo 8. Eroding outer meander bend and fresh sediment deposits on upstream side of point bar. Cattle pasture upstream of narrow riparian corridor on left bank.

Photo 8. Large woody debris and secondary channel in downstream braided section of stream reach.

Photo 9. Braided section of downstream reach.

Photo 10. Flow condition in downstream braided portion of reach.

Photo 11. Headcut in downstream portion of the reach.

Photo 12. Large woody debris in downstream portion of reach.

Photo 13. Downstream end of reach.

Photo 14. Mid-reach stream and floodplain conditions.

Photo 15. Side-channel confluence with stream reach. Mid-channel sediment bar present.

KEYMAR ROAD

UNNAMED TRIBUTARY TO LITTLE PIPE CREEK

FLOW

520

510

500

REPLACE CULVERTS WITH OPEN-BOTTOM DESIGN. RECONSTRUCT ACCESS ROADS OVER CULVERTS

REPLACE CULVERTS WITH OPEN-BOTTOM DESIGN. RECONSTRUCT ACCESS ROADS OVER CULVERTS

PRE-FORMED SCOUR POOL

TAX PIN: 50587
11601 KEYMAR RD

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

VICINITY MAP

N

0 3 Miles

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
21
NPDES BMP ID:
LIPI-2018-STRE-0016
Site ID(s):
87
Prioritization Ranking:
21
Parcel Tax PIN:
50587
Address:
11601 Keymar Rd
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:
CS-21

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

100 0 100 200
Scale 1" = 100'

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0016
Site ID:	CS-21
Prioritization Ranking:	21
Structure Location:	11601 Keymar Rd, Keymar, MD 21757
Coordinates (Lat, Long):	39.554696, -77.243317
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$433,243
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Geomorphic Level
Project Length (LF):	743
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	7
TN (lbs/yr):	56
TP (lbs/yr):	51
TSS (lbs/yr):	33,346

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition
The stream is set in a partially confined floodplain, and in the middle of the reach there is a shed/garage about 20 feet from the right bank. The upstream boundary of the stream reach is a road culvert and the downstream boundary is the tree line on the property line. The drainage area to the site is primarily agricultural land, with some residential lots, 3 percent forested land, and 3 percent impervious area. The riparian buffer is very narrow and bounded by a mowed area on the right bank and part of the left bank. The stream plan form geometry was primarily single-thread straight, with a plane-bed profile with some pools but no defined riffles. The stream was incised with limited floodplain access, and the lateral stability of stream channel was determined to be unstable with moderate bank erosion, undercut trees, and drainage pipes from the building adjacent to the stream.
Restoration Measures
The proposed restoration measures involve bank stabilization measures such as live stakes or live branch layering. Riparian buffer restoration along the length of the reach would seek to replace the turf grass condition present along much of the right floodplain with appropriate native wetland and upland species. The existing vehicle crossings would be enhanced through the addition of open

bottom culverts that improve flow and habitat conditions. Downstream of the Keymar Road outfall, the existing scour pool would be stabilized to prevent additional erosion.	
Anticipated Site Constraints	
Constructability/Access	Moderate. The site is accessible from the road and minimal clearing of trees will be required, however, the landowner has infrastructure (several drainpipes, vehicle crossings, and a shed) near the stream that will need to be protected.

Selected Site Photos

Photo 1. Culvert under Keymar Road at upstream extent of the stream reach. Stream is slightly wider and deeper here than downstream.

Photo 2. Herbaceous riparian plants and narrow channel in upstream part of the reach.

Photo 3. Single thread meandering channel with herbaceous riparian plants and occasional trees.

Photo 4. Typical mid-reach stream condition.

Photo 5. Riffles were moderately embedded with fine silt/clay material. Debris in channel visible in background.

Photo 6. Significant riffle embeddedness with silt/clay fines, and woody debris in channel and on bank.

Photo 7. Undercut banks and tree on left floodplain. Wooden poles placed across the stream.

Photo 8. Bank erosion and undercut trees and banks. Drainpipe from garage empties into channel.

Photo 9. Grassed floodplain, eroded bank, and in-stream sediment deposition.

Photo 10. Point bar, overhanging bank, and mild riffle embeddedness observed in reach.

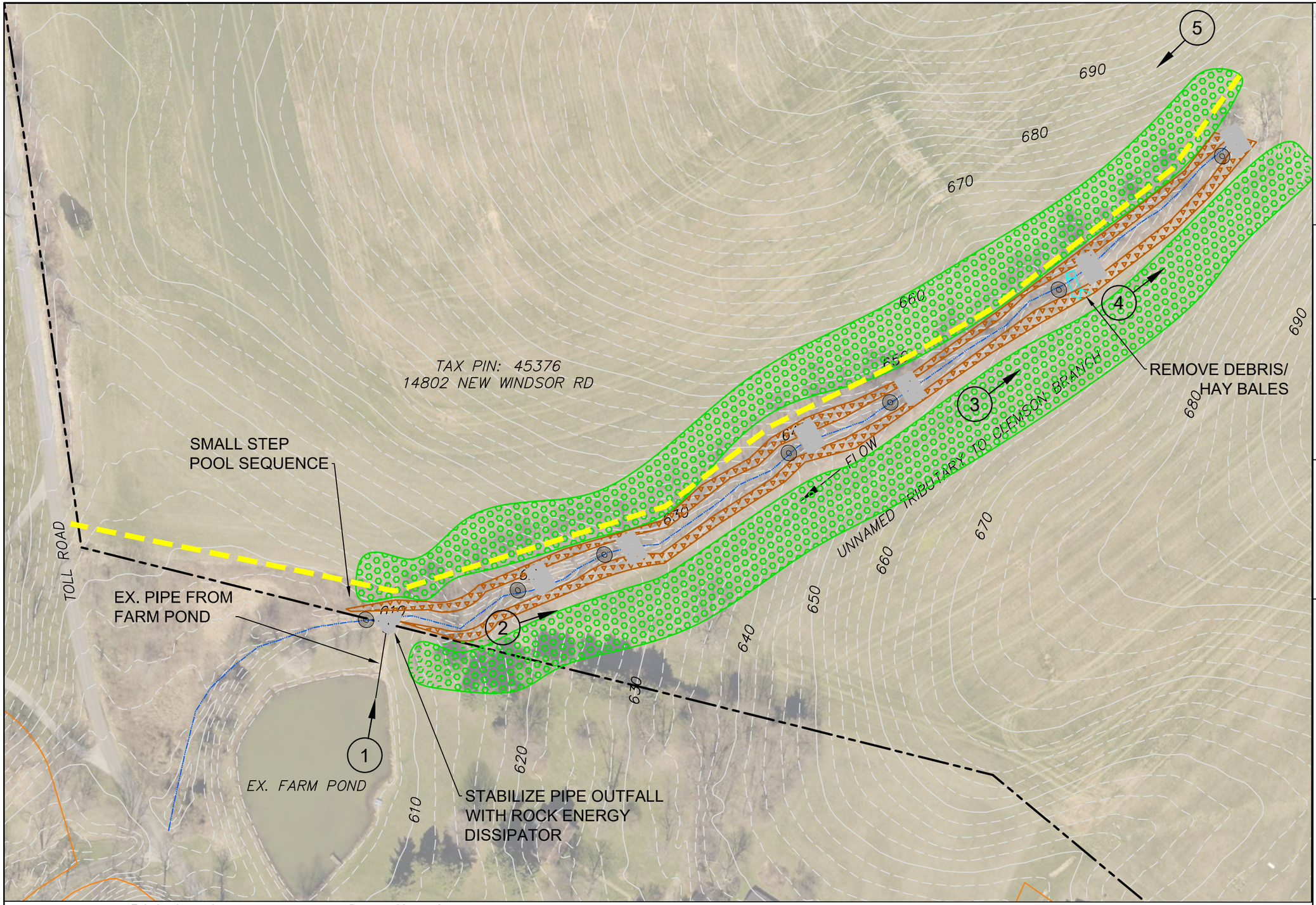
Photo 11. Overhanging banks on outer meander bend.

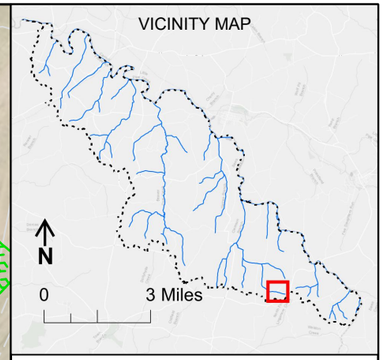
Photo 12. Point bar on inner meander bend. Erosion on right terrace. Undercut tree on left bank. Culvert for vehicle crossing on left side of image.

Photo 13. Woody debris in channel, trees close to left bank, and erosion on outer meander bend.

Photo 14. Cobble swale/drainage feature on right floodplain.

Photo 15. Point bar and eroded outer bank at downstream extent of stream reach.





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
22
NPDES BMP ID:
LIPI-2018-STRE-0017
Site ID(s):
8
Prioritization Ranking:
22
Parcel Tax PIN:
45376
Address:
14802 New Windsor Rd
New Windsor, MD 21776
BMP Type:
Stream Restoration

Sheet #:
CS-22

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

AKRF

100 0 100 200
Scale 1" = 100'

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0017
Site ID:	CS-22
Prioritization Ranking:	22
Structure Location:	14802 New Windsor Rd, New Windsor, MD 21776
Coordinates (Lat, Long):	39.496155, -77.148581
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$260,063
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Geomorphic Level
Project Length (LF):	1,062
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	11
TN (lbs/yr):	80
TP (lbs/yr):	72
TSS (lbs/yr):	47,663

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition
The stream reach of interest is a first order stream; the channel is well-formed approximately 400 LF downstream of the culvert at New Windsor Road, and the downstream end of the reach is at the property line – immediately upstream of a farm pond. As this is a headwater stream, drainage area to the stream is primarily agricultural lands, with zero percent forested land, and 1 percent impervious area. The riparian zone was approximately 20 feet wide with a mix of native and invasive woody vegetation. The stream planform is single-thread straight throughout, steeply sloped, with little or no base flow. The stream was characterized as incised mainly due to the limited surrounding floodplain area; the stream bank and upland valley slopes are continuous and approximately the same slope. The streambanks were mostly overgrown with woody and herbaceous plants, exposed tree roots, and some small side sediment bars. The lateral stability of stream channel was determined to be “stable”.
Restoration Measures
Rock grade control structures are proposed to guard against future vertical downcutting. Bank regrading and stabilization with live stakes is proposed along the eroded stream banks. The outfall

from the pond will be stabilized with step-pool features to mitigate bank erosion and treat the overflow water instead of discharging it directly into the stream via the existing 12 inch pipe.	
Anticipated Site Constraints	
Constructability/Access	Moderate. Site accessibility is moderately difficult, due to the presence of brush and several trees that would need to be cleared to access the stream.

Selected Site Photos

Photo 1. Pond discharges into channel through partially submerged 12" corrugated metal pipe.

Photo 2. Banks mostly overgrown with marooned trees and exposed tree roots in upstream section.

Photo 3. Steep gradient and relatively straight channel throughout reach.

Photo 4. Hay bales observed in-stream.

Photo 5. Dominant bed materials composed of silt/clay with gravel and cobbles also visible.

TAX PIN: 72989
11958 KEYMAR RD

UNNAMED TRIBUTARY TO LITTLE PIPE CREEK

FLOW

510
500
490
480
470

1
2
3
4
5

VICINITY MAP

N

0 3 Miles

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
23
NPDES BMP ID:
LIPI-2018-STRE-0018
Site ID(s):
42
Prioritization Ranking:
23
Parcel Tax PIN:
72989
Address:
11958 Keymar Road
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:
CS-23

Existing Legend

- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

AKRF

N

100 0 100 200

Scale 1" = 100'

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0018
Site ID:	CS-23
Prioritization Ranking:	23
Structure Location:	11958 Keymar Road Keymar, MD 21757
Coordinates (Lat,Long):	39.56085, -77.2403
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$526,539
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Physiochemical Level
Project Length (LF):	903
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	9
TN (lbs/yr):	68
TP (lbs/yr):	61
TSS (lbs/yr):	40,527

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition
The stream reach is set at the base of a steep valley between two agricultural fields along a densely wooded riparian area. The upstream and downstream extents for the reach are bounded by the property line. Drainage area to this site is primarily agricultural land, with some residential lots, 13 percent forested land, and 4 percent impervious area. The upstream portion was predominantly single thread straight pattern, while the rest of the stream was characterized with a single thread meandering form. The bed profile contains pools, riffles, and sediment sidebars throughout the reach. The stream is incised with limited floodplain access - bank erosion and lateral stability were classified as moderate throughout the reach and undercut trees were present in multiple locations.
Restoration Measures
A step-pool stormwater conveyance (SPSC) system is the proposed restoration method to control streambank erosion in the steep wooded stream. A series of boulder cascades or riffles and pools with boulder weirs in between them would be installed to provide grade control, energy dissipation, and improve habitat conditions in the reach. Bank regrading and stabilization with live stakes will be installed along the eroded stream banks, especially on the outside of meander bends.

Anticipated Site Constraints	
Constructability/Access	Moderate. Site accessibility is moderately difficult, due to the presence of brush and several trees that would need to be cleared to access the stream.

Selected Site Photos

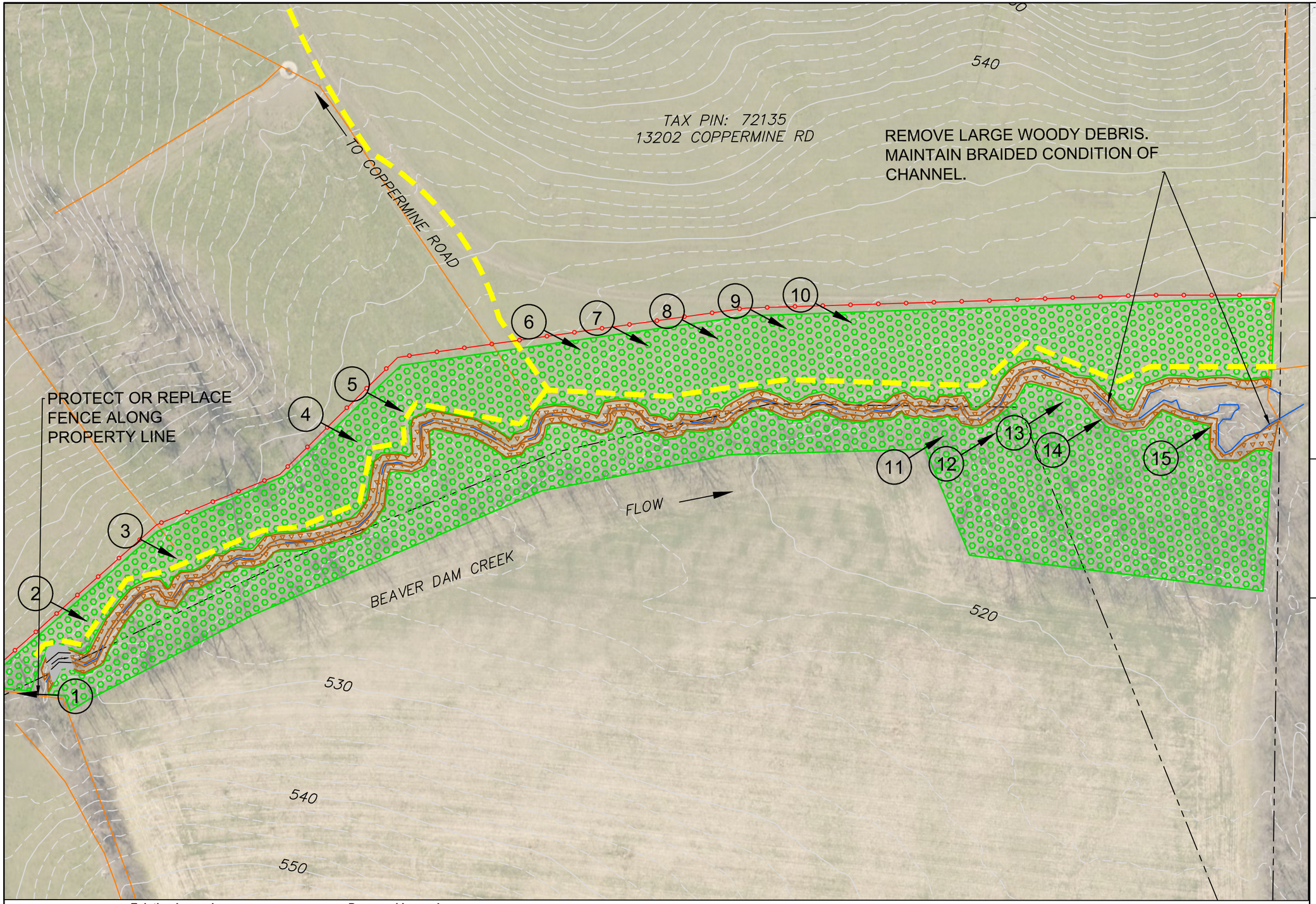
Photo 1. Upstream section of the reach with riffles embedded with fine sediment.

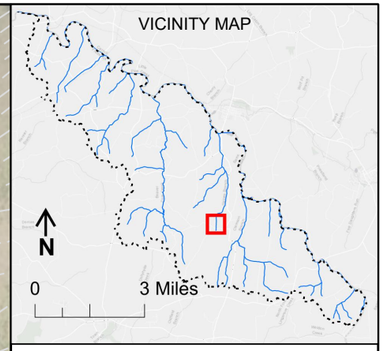
Photo 2. Upstream section with herbaceous and woody riparian corridor.

Photo 3. Mid-reach woody debris jam.

Photo 4. Mid-reach channel condition looking downstream. Steeper right bank, more access to floodplain on left bank. Vegetated mid-channel bars visible.

Photo 5. Pool in meander bend downstream of riffle, near downstream limit of reach.





Existing Legend

- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstructior
- Access Route
- 1 Photo Location

N

100 0 100 200

Scale 1" = 100'

AKRF

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
24
NPDES BMP ID:
LIPI-2018-STRE-0014
Site ID(s):
13
Prioritization Ranking:
24
Parcel Tax PIN:
72135
Address:
13202 Coppermine Rd
Union Bridge, MD 21791
BMP Type:
Stream Restoration

Sheet #:

CS-24

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0019
Site ID:	CS-24
Prioritization Ranking:	24
Structure Location:	14802 Toll Road, New Windsor, MD 21776
Coordinates (Lat, Long):	39.50375, -77.1484
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$187,425
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	RSC
Functional Lift Potential:	Geomorphic Level
Project Length (LF):	250
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	2.88
TN (lbs/yr):	0.21
TP (lbs/yr):	0.0040
TSS (lbs/yr):	2.76
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The proposed BMP area of interest is an eroded gully upstream of proposed stream restoration project NPDES ID# LIPI-2018-STRE-0021. Drainage area to the site is primarily agricultural lands and 40 percent forested lands, with about 8 percent impervious area. The upstream extent is a highly saturated wetland headwaters of an unnamed tributary to Little Pipe Creek. The gully is in a wooded area and has a steep slope, with no floodplain access, and woody debris in the channel. At the downstream extent of the gully, the existing channel slope decreases and the floodplain is connected to the channel.	
Restoration Measures	
A weir-step-pool stream conveyance system is the proposed restoration method to mitigate the large plunge pool and streambank erosion downstream of the railroad outfall. Approximately 250 linear feet (LF) total length is proposed, with a series of boulder cascades and three pools with boulder weirs in between them, and cobble aprons at the upstream and downstream ends of the structure to convey the flow from the wetland restoration area into the unnamed tributary to Little Pipe Creek, which is proposed to be restored under NPDES ID# LIPI-2018-STRE-0021.	

Anticipated Site Constraints	
Constructability/Access	Difficult. The gully side slopes confine access to the proposed step-pool system construction area, and brush will be removed in order to access the site.

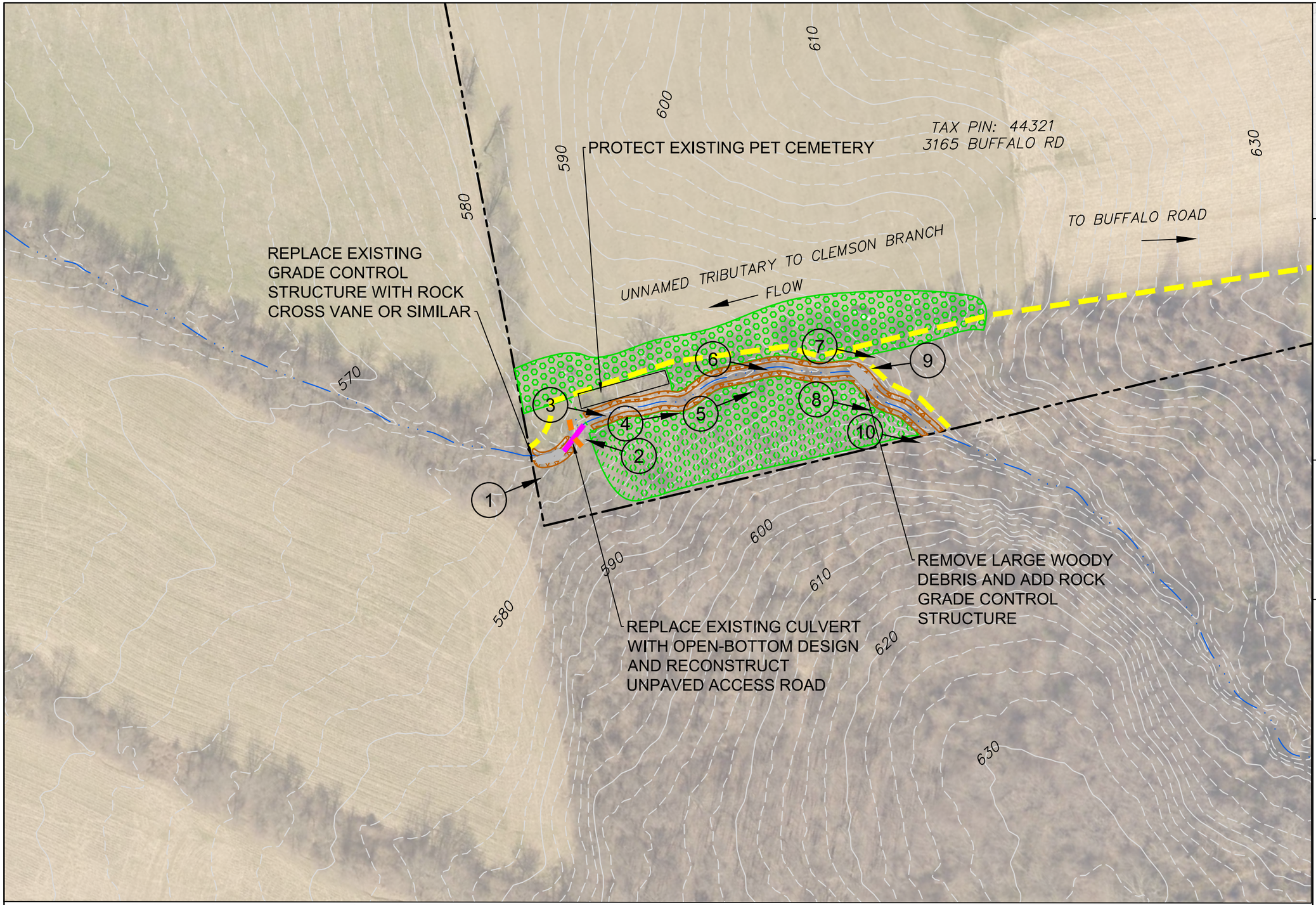
Selected Site Photos

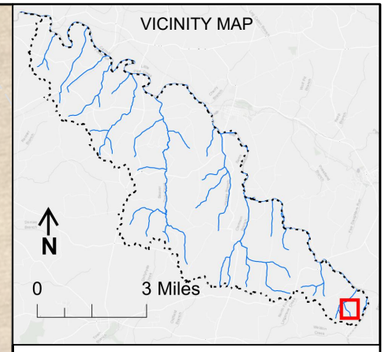
Photo 1. Upland wetland/headwaters area.

Photo 2. Drain pipes directed into stream channel and typical channel condition downstream of proposed RSC.

Photo 3. Upstream, gully formation immediately downstream of wetland/headwaters area. Bank erosion and woody debris present in channel.

Photo 4. Gully formation downstream of wetland/headwaters area. Bank erosion and woody debris present in channel.





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
25
NPDES BMP ID:
LIPI-2018-STRE-0020
Site ID(s):
4
Prioritization Ranking:
25
Parcel Tax PIN:
44321
Address:
3165 Buffalo Rd
New Windsor, MD 21776
BMP Type:
Stream Restoration

Sheet #:
CS-25

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

AKRF

100 0 100 200
Scale 1" = 100'

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0020
Site ID:	CS-25
Prioritization Ranking:	25
Structure Location:	3165 Buffalo Rd, New Windsor, MD 21776
Coordinates (Lat, Long):	39.488838, -77.117102
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$619,252
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Geomorphic Level
Project Length (LF):	446
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	4
TN (lbs/yr):	33
TP (lbs/yr):	30
TSS (lbs/yr):	20,016
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The stream reach of interest is located in a valley with limited floodplain connectivity at varying elevations throughout the reach. The drainage area to the stream site is comprised primarily of agricultural land, with some residential lots, 11 percent forested lands, and 3 percent impervious area. The stream starts and ends in brush and forested areas; the left bank is on the edge of a forested area and the right bank is a grassed field. The riparian corridor is mature and dense, with specimen trees reaching 50 feet or more in height, many invasive species, and dense, woody understory. The stream is incised and characterized as a straight single-thread planform with a few gentle meanders. The plane-bed profile has a couple of mid-reach grade control features, including a culvert, step-pool structure, and wooden debris jams. The lateral stability of stream channel was assessed as stable, with mild to moderate bank erosion and undercut trees observed throughout the reach. Near the mid-reach culvert, the landowner has a small seating area and a pet cemetery.	
Restoration Measures	
In the proposed restoration project, bank erosion would be addressed through bank regrading and stabilization measures such as installation of live stakes. Rock grade control structures would be	

installed at two locations within the stream where grade control is currently controlled by a naturally occurring large woody debris jam and by the mid-reach culvert structure. Riparian buffer restoration would add native herbaceous and woody vegetation to create a buffer between the agricultural field, residences, and the stream. The existing unpaved access road would be maintained and enhanced as needed. Particular consideration must be given to the landowner's use of the downstream area, and is an important project consideration in the riparian buffer restoration plantings – these will seek to enhance the project area without impeding use of the site.	
Anticipated Site Constraints	
Constructability/Access	Difficult. Existing site features should be protected during construction, and the extent of the protection should be coordinated with the property owner. Additionally, the upstream portion of the project is dense with brush that will need to be cleared in order to install the proposed restoration features.

Selected Site Photos

Photo 1. Vehicle crossing culvert and grassed floodplain in downstream portion of reach.

Photo 2. Concrete bag culvert embankment (upstream end).

Photo 3. Downstream of culvert/vehicle crossing - step-pool form and left bank stabilization using concrete bags.

Photo 4. Downstream portion of reach, below vehicle crossing.

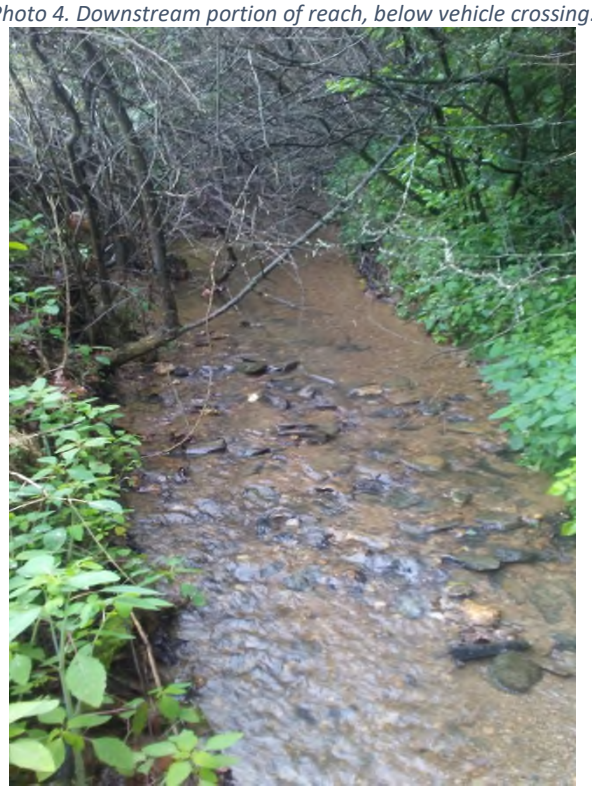


Photo 5. Mid-reach stream condition.

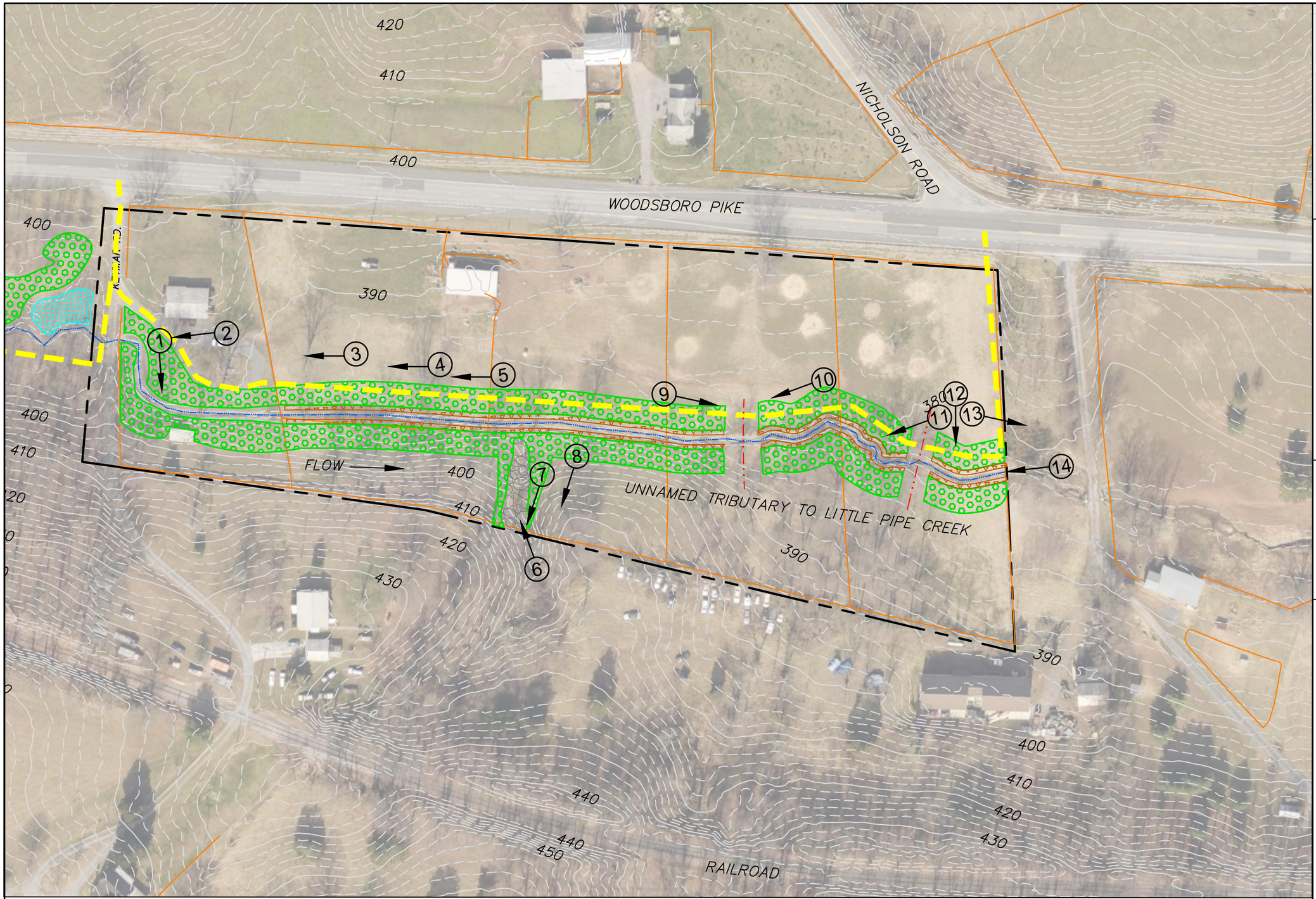
Photo 6. Typical upstream condition. Gravel-dominated, plane-bed stream and overhanging riparian vegetation.

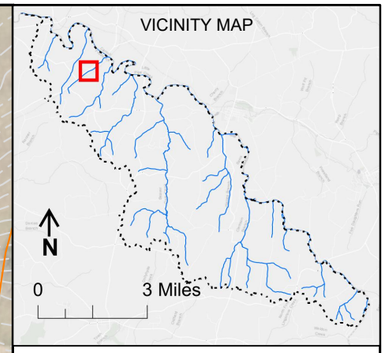
Photo 7. Woody debris jam acting as grade control near mid-reach. Mid-channel sediment bar upstream of debris jam.

Photo 8. Concentrated flow path on left floodplain.

Photo 9. Mid-reach, looking upstream. Steeper banks on outer meander bends, low point bars on right floodplain. Pet cemetary along right bank is visible in the background.

Photo 10. Mid-reach condition under storm flow. Eroded right bank, undercut tree, large woody debris, and riffle-pool bedforms.





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
26
NPDES BMP ID:
LIPI-2018-STRE-0021
Site ID(s):
100
Prioritization Ranking:
26
Parcel Tax PIN:
47095
Address:
12737 Woodsboro Pike
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:
CS-26

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

AKRF

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Scale 1" = 100'

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0021
Site ID:	CS-26
Prioritization Ranking:	26
Structure Location:	12737 Woodsboro Pike, Keymar, MD 21757
Coordinates (Lat, Long):	39.584687, -77.250958
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$611,672
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Geomorphic Level
Project Length (LF):	1,049
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	10
TN (lbs/yr):	79
TP (lbs/yr):	71
TSS (lbs/yr):	47,079

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition

The stream reach is set in a wide valley, where the right floodplain increases in slope for most of the reach. The stream runs parallel between Woodsboro Pike to the north, and a railroad to the south. The upstream end is bounded by a culvert under Keymar Road, and the downstream end is bounded by the property fence line. Drainage area to the site is primarily agricultural lands and 40 percent forested lands, with about 6 percent impervious area.

The reach is bounded by property fencing, which breaks the site into four segments that are used for rotating sheep pastures, with livestock access to the stream throughout most of the property. Floodplain connectivity varies and the stream was characterized as “incised with limited floodplain access”. The surrounding floodplain is primarily grassed and there is an ephemeral gully on the right floodplain near mid-reach. The stream planform varied from a single-thread meandering pattern upstream, to single-thread straight further downstream. The stream plane-bed profile has some weak pool-riffle features and several headcuts. The owner installed rock revetments along the upstream section of the reach, near most of the existing infrastructure, and there are older rock revetments

embedded into the bank throughout the reach. Despite this, the overall bank erosion level was assessed to be moderate, as the many livestock crossings appeared to have flattened the banks in many places, and undercut trees were observed wherever a tree was close to the stream. Lateral stability of stream channel was determined to be moderately stable.	
Restoration Measures	
As part of the proposed restoration plan, the existing rip-rap stabilization features will be retained. The bank erosion downstream of the existing stabilized areas will be mitigated through minor bank regrading and bioengineering stabilization with live stakes. Stabilized livestock crossings will be installed in each pasture, in locations where the animals currently cross the stream. Riparian buffer restoration will be chosen with care to suit the needs of both channel protection and livestock use of the area. The existing gully on the right bank will be stabilized with stone, to remove that source of sediment.	
Anticipated Site Constraints	
Constructability/Access	Moderate. The site contains several small pastures separated by fencing, which will need to be protected and maintained throughout construction. Additionally, the active sheep farm operations will need to be considered when scheduling and phasing construction activities.

Selected Site Photos

Photo 1. Riprap revetment along upstream section of reach. Infrastructure close to stream, such as the light pole, to be protected during construction.

Photo 2. Pedestrian bridge over rip-rap lined portion of the channel. Culvert under driveway at upstream boundary of the reach appears to be in good condition.

Photo 3. Mid-reach stream condition - no livestock crossings and embedded revetments on left bank.

Photo 4. Photo taken facing upstream, a steeper slope throughout the reach on the right side, and a flatter floodplain on left.

Photo 5. Mid-reach channel condition, upstream of confluence with gully. Stream banks flattened and sparsely vegetated. Leaf litter collecting along base of fence.

Photo 6. Gully downstream of culvert/vehicle crossing. Typical left floodplain condition visible in background.

Photo 7. Gully upstream of culvert/vehicle crossing.

Photo 8. Mid-reach gully downstream of vehicle crossing and culvert.

Photo 9. Typical downstream channel and floodplain condition.

Photo 10. Mid-reach channel with visible stream bank erosion. Narrow channel due to livestock crossing.

Photo 11. Undercut trees on stream bank edge. Cobble revetment embedded into left bank.

Photo 12. Eroded livestock crossing and typical pasture condition along reach floodplain.

Photo 13. Upstream extent of reach. Bank erosion, in-channel vegetation, leaf litter collected on fence, and cobble revetments visible upstream of fence.

Photo 14. Downstream channel condition at fence between pastures. Fence acts as point for sediment and leaf litter accumulation, resulting in in-channel vegetation recruitment and colonization. Cobble revetment on left bank, and erosion from livestock crossing on both banks.

PRIVATE DRIVEWAY TO TOLL ROAD

TAX PIN: 52058
14802 TOLL RD

REPLACE CULVERT WITH OPEN-BOTTOM DESIGN AND RECONSTRUCT UNPAVED ACCESS ROAD

PROTECT EXISTING ROOF DRAINS AND SPRING HOUSE NEAR SYSTEM

PR. PROJECT #15
REGENERATIVE STEP-POOL CONVEYANCE
(SEE SHEET CS-15)

BMP-25
RSC, 240 LF

UNNAMED TRIBUTARY TO LITTLE PIPE CREEK

FLOW

650 640 630 620 610 600 590 580

VICINITY MAP

N

0 3 Miles

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
27
NPDES BMP ID:
LIPI-2018-STRE-0022
Site ID(s):
25
Prioritization Ranking:
27
Parcel Tax PIN:
52058
Address:
14802 Toll Rd
New Windsor, MD 21776
BMP Type:
Stream Restoration

Sheet #:
CS-27

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- (1) Photo Location

100 0 100 200
Scale 1" = 100'

AKRF

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0022
Site ID:	CS-27
Prioritization Ranking:	27
Structure Location:	14802 Toll Rd New Windsor, MD 21776
Coordinates (Lat, Long):	39.503754, -77.148403
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$583,100
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Biological Level
Project Length (LF):	1,000
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	10
TN (lbs/yr):	75
TP (lbs/yr):	68
TSS (lbs/yr):	44,880

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition

The stream reach of interest is a first order stream, influenced by a highly saturated upstream wetland area, as well as another wetland area at the downstream end of the reach. The middle portion of the reach passes through grassed fields heavily used by the owner. Upstream of the vehicle crossing and culvert on the right side of the stream, the landowner regraded the valley, creating some floodplain connectivity**.** The majority of the stream is surrounded by a visible floodplain observed on both sides of the stream, but narrower on the left bank side. In the wooded area upstream, the slope was steeper and no floodplain was present. The drainage area to the site is primarily agricultural lands, with some residential lots, about 33 percent forested lands, and about 8 percent impervious area. The stream was characterized as a single-thread meandering pattern with a pool-riffle bed profile form. Overall, floodplain connectivity was assessed as “connected”, since the stream did not appear incised and only the upstream wooded portion did not have floodplain access. The lateral stability of the stream channel was determined to be stable, with little erosion outside of the area around the vehicle crossing and the portion of the stream that passes through the steep wooded upstream section.

Restoration Measures	
The proposed restoration measures feature wetland restoration both upstream and downstream of the main channel restoration area, to enhance the existing wetland communities present. The bank erosion observed within the channel would be addressed through bank regrading and stabilization measures such as installation of live stakes. Riparian buffer restoration would add native herbaceous and woody vegetation to create a buffer along both sides of the stream. The existing unpaved access road would be regraded and stabilized as needed, and the culvert under the road would be replaced with an open bottom culvert to promote aquatic organism passage and improved streamflow. A weir-step-pool conveyance system is proposed for gully stabilization (NPDES ID# LIPI-2018-STRE-0018)	
Anticipated Site Constraints	
Constructability/Access	Moderate. The gully side slopes confine access to the upstream construction areas, existing wetland habitat will need to be protected to the maximum extent possible, and brush will be removed in order to access the site.

Selected Site Photos

Photo 1. Upland wet area.

Photo 2. Drain pipes directed into stream channel upstream of vehicle crossing.

Photo 3. Photo taken looking upstream, channel formation immediately downstream of wet area. Bank erosion and woody debris present in channel.

Photo 4. Channel formation downstream of wet area. Bank erosion and woody debris present in channel.

Photo 5. Sediment deposits forming mid-channel bars upstream of vehicle crossing. Disturbed soil from previous land regrading visible on floodplains. Non-existent riparian buffer.

Photo 6. Photo taken looking upstream at channel. Confluence with concentrated flow path from uplands visible.

Photo 2. Small drop from the lip of the vehicle crossing culvert to the stream bed resulting in some scour of the bed.

Photo 3. Local widening and pool formation in the channel downstream of vehicle crossing. Old spring house in foreground, on left floodplain.

Photo 4. Downstream of the pool, the stream enters a transition zone of riparian wooded area.

Photo 5. Greater canopy coverage on left floodplain mid-reach. The channel is narrow and shallow, with some bank erosion observed.

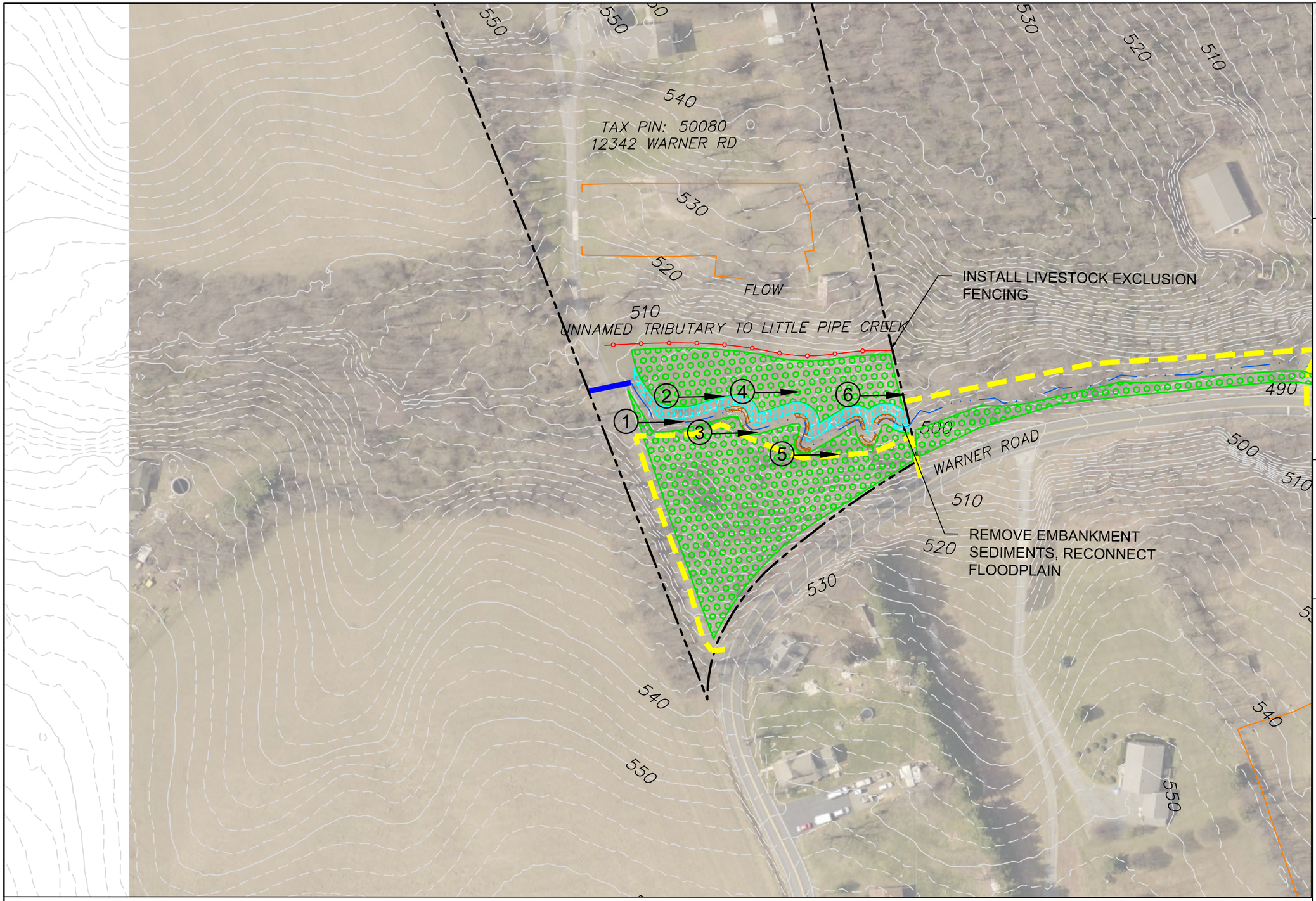
Photo 6. Channel condition in lower third of the reach.

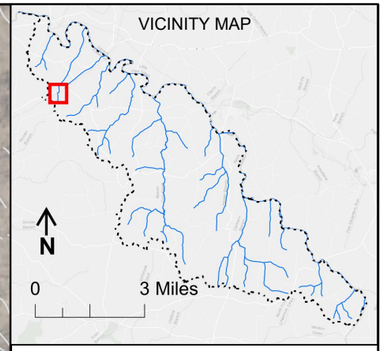
Photo 7. Secondary channel in downstream section, observed wet area.

Photo 8. Eroded, overhanging bank in the lower third of the reach. Right floodplain observed as a wet area. Bank erosion was typically less severe than this in the remainder of the reach.

Photo 9. Channel condition entering the stream-wetland complex.

Photo 10. Stream wetland complex. Secondary channel visible to the right.





Existing Legend

- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend

- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

100 0 100 200

Scale 1" = 100'

AKRF

Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
28
NPDES BMP ID:
LIPI-2018-STRE-0023
Site ID(s):
120
Prioritization Ranking:
28
Parcel Tax PIN:
50080
Address:
12342 Warner Rd
Keymar, MD 21757
BMP Type:
Stream Restoration

Sheet #:

CS-28

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0023
Site ID:	CS-28
Prioritization Ranking:	28
Structure Location:	12342 Warner Rd, Keymar, MD 21757
Coordinates (Lat, Long):	39.57318, -77.26577
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$213,998
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Physiochemical Level
Project Length (LF):	367
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	4
TN (lbs/yr):	28
TP (lbs/yr):	25
TSS (lbs/yr):	16,471

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition

The stream is located at the bottom of a gently sloping valley, in a primarily grassed floodplain that is used as a horse pasture and well-connected to the stream throughout the reach. The drainage area to the site is primarily residential lots with grass lawns and some landscaping; about 20 percent of the drainage area is comprised of forested lands, and about 8 percent is impervious area.

The upstream end of the reach is formed by the property owner's driveway, which has a culvert to convey the stream underneath, and the owner identified the previous installation of a berm along the downstream end of the reach to create a pond. The berm has since been partially removed to allow the stream to flow freely, although a vernal pool was observed on the left floodplain at the downstream end of the reach, upstream of the remnants of the berm. The stream was characterized as having a single-thread meandering plan form and plane-bed profile with weak pool-riffle features. Small, sporadic bedrock outcrops vertically confined the reach in some locations. Mild bank erosion and evidence of meander migration were observed. The lateral stability of the channel was characterized as stable.

Restoration Measures	
The proposed restoration measures include bank regrading and stabilization measures such as installation of live stakes, floodplain reconnection and wetland habitat creation along the length of the reach. Riparian buffer restoration would also extend along the length of the reach, and would add native herbaceous and woody vegetation to create a buffer between the pasture and the stream. New livestock fencing would be added to keep horses out of the stream.	
Anticipated Site Constraints	
Constructability/Access	Moderate. The existing electric fence will need to be maintained and replaced if damaged. Horses in the pasture will need to be kept out of the work area, so the proposed livestock exclusion fencing should be one of the early features to install.

Selected Site Photos

Photo 1. Upstream end of reach setting and typical stream condition. Meandering stream, well vegetated with grasses, but only a few trees and little other riparian vegetation. Electric fencing in image foreground is the outermost edge of the horse pasture, on the right floodplain; the horse has unrestricted access to the stream along the entire reach.

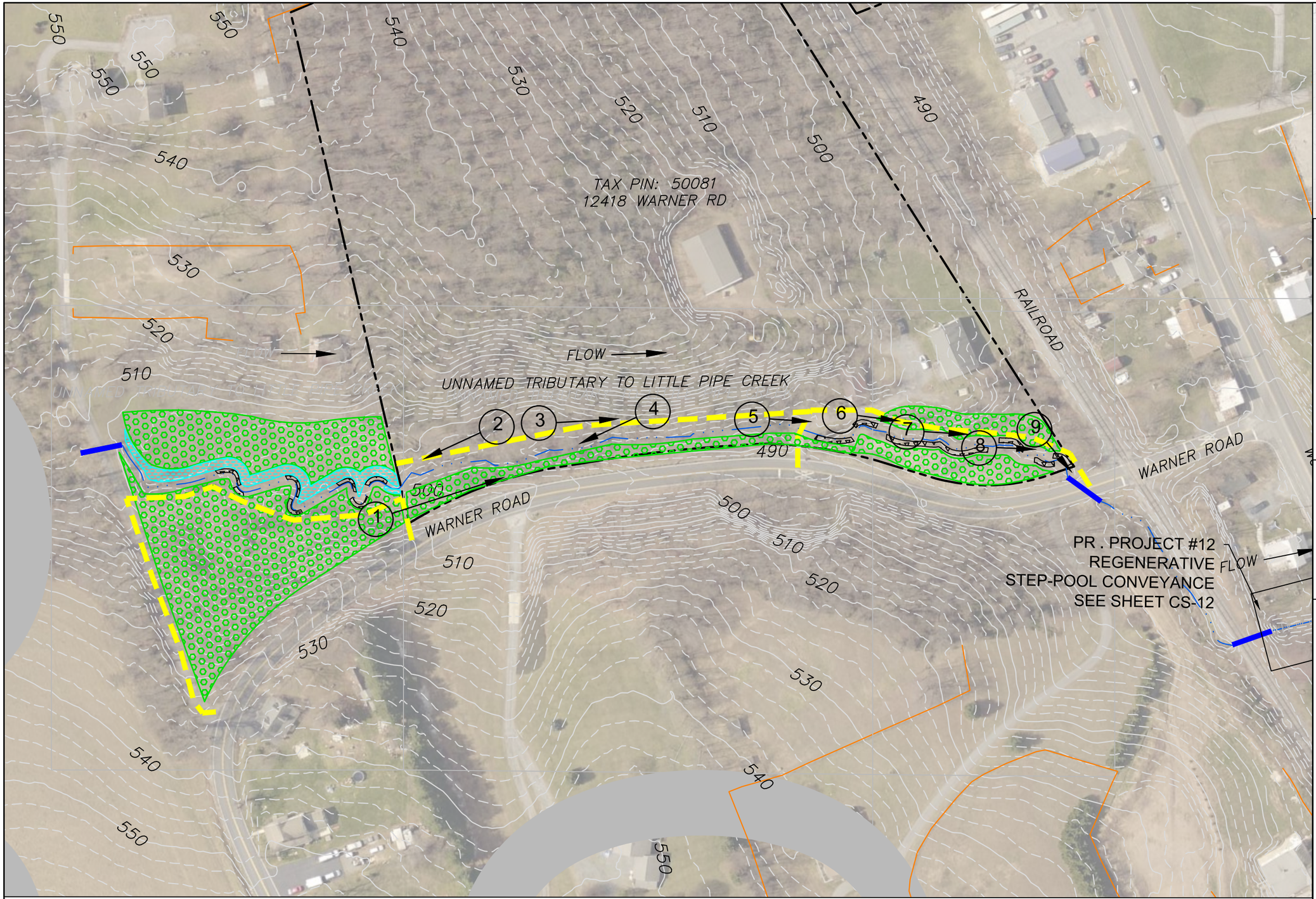
Photo 2. Typical mid-reach stream and floodplain condition.

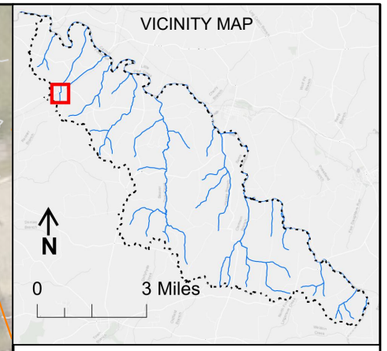
Photo 3. Remnants of berm at downstream limits of reach. Small woody debris visible in stream. Sheet flow and wet floodplain areas visible on right bank. Sand and gravel point bar on left bank.

Photo 4. Mid-reach channel condition under storm flow.

Photo 5. Bank erosion on left bank. Evidence of floodplain disturbance by horse on the right floodplain and point bar. Much of the right floodplain was saturated at the time of the field visit.

Photo 6. Upstream portion of reach – driveway visible in background. Woody debris jam mid-reach.





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
29
NPDES BMP ID:
LIPI-2018-STRE-0024
Site ID(s):
121
Prioritization Ranking:
29
Parcel Tax PIN:
50081
Address:
12418 Warner Rd
Ladiesburg, MD 21759
BMP Type:
Stream Restoration

Sheet #:
CS-29

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

AKRF

N

100 0 100 200

Scale 1" = 100'

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0024
Site ID:	CS-29
Prioritization Ranking:	29
Structure Location:	12418 Warner Rd, Keymar, MD 21757
Coordinates (Lat, Long):	39.574526, -77.265802
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$427,995
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Physiochemical Level
Project Length (LF):	734
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	7
TN (lbs/yr):	55
TP (lbs/yr):	50
TSS (lbs/yr):	32,942

Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-

Existing Condition
The stream reach of interest is located in a gently sloping valley and is confined by the valley hillslope on the left bank and Warner Road on the right bank. The drainage area to the site is primarily residential lots with grass lawns and some landscaping; about 23 percent of the drainage area is comprised of forested lands, and about 10 percent is impervious area. The floodplain is generally well vegetated (although invasive species are well represented), with the exception of a small portion of the road embankment, and the floodplain is wider on the left than on the right. The stream was classified as having a single-thread meandering planform and a plane-bed profile with weak pool-riffle features. One woody debris jam was observed near the downstream end of the reach. The channel is not incised and there is a floodplain on both sides of the stream for most of the reach, despite the close roadway embankment. The lateral stability of stream channel was determined to be stable, as banks were generally well vegetated.
Restoration Measures
The proposed restoration method includes targeted areas of bank regrading and stabilization with live stakes on several outside meander bends. Riparian buffer restoration would also be targeted to

specific locations and would be aimed towards enhancing the existing plant communities, with a focus on introducing more native species and removing invasive species.	
Anticipated Site Constraints	
Constructability/Access	Moderate. The roadway embankment and guardrail limit upstream access of the site, and the existing herbaceous vegetation would require some clearing, with a goal of minimizing disturbance and tree removals.

Selected Site Photos

Photo 1. Road embankment near stream bank lacking in vegetation along the reach. Stream is wider here, then narrows slightly in the mid-ground of the image where both banks are vegetated.

Photo 2. Upstream portion of reach. Typical riparian zone and valley condition along reach.

Photo 3. Typical mid-reach condition.

Photo 4. View of the valley mid-reach, looking upstream. Channel is obscured by vines/shrubs spanning the channel.

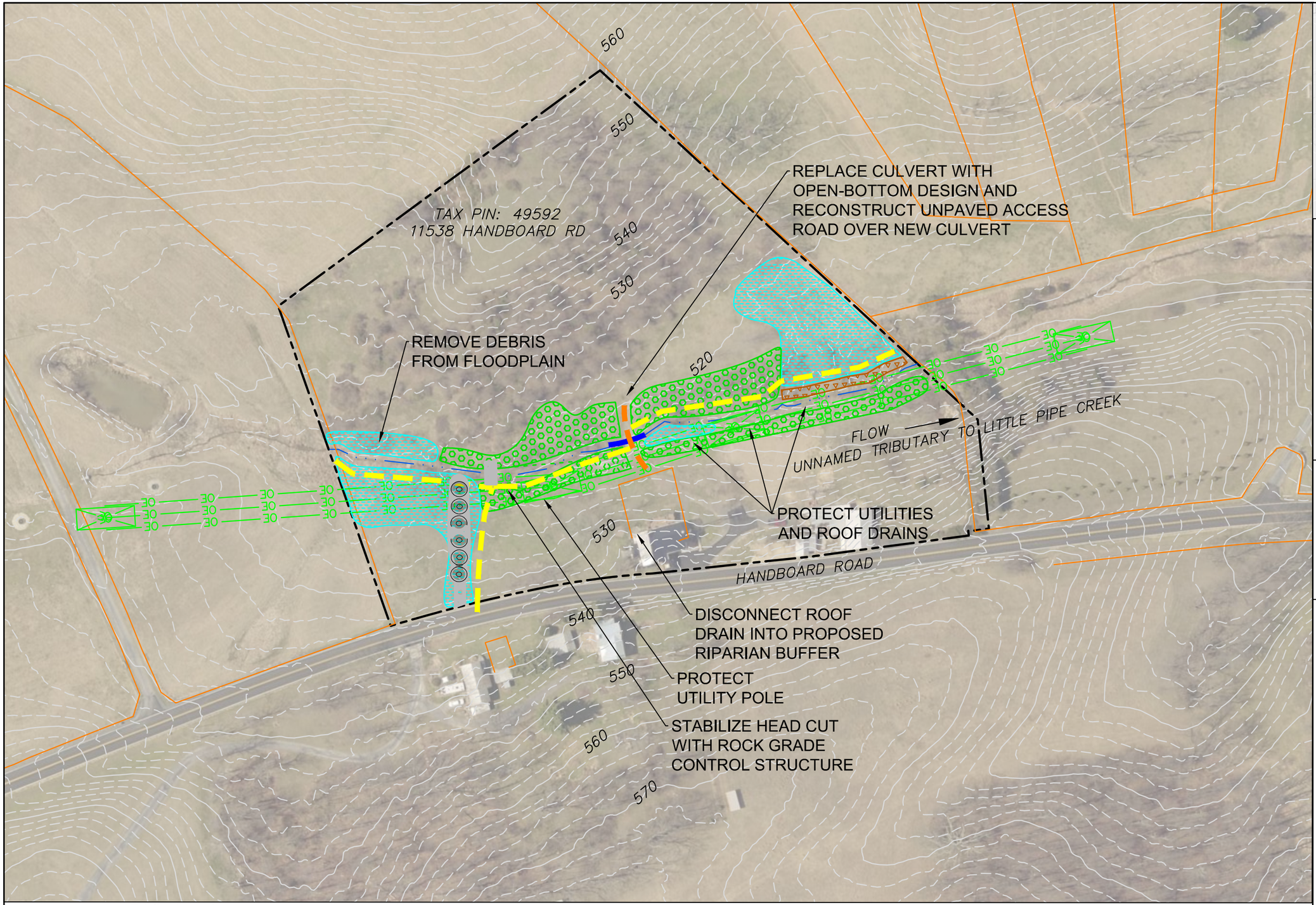
Photo 5. Typical mid-reach condition. Guardrail from road visible on right bank.

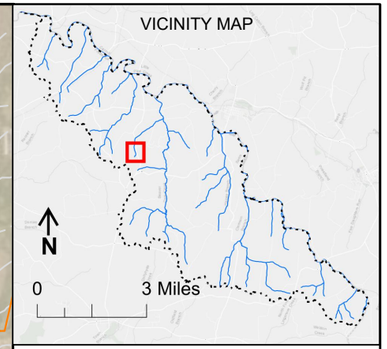
Photo 6. Downstream portion of channel. Mid-stream vegetated sediment bar visible. Transition from a plane-bed or pool-like feature to a riffle-like feature visible.

Photo 7. Grade change and riffle at downstream end of reach.

Photo 8. Downstream end of reach.

Photo 9. Downstream end portion of reach. Channel enters culvert under roadway in dark brush area.





Frederick County, MD

Double Pipe Creek Watershed Assessment

Conceptual Site Restoration Plan

Project:
33
NPDES BMP ID:
LIPI-2018-STRE-0023
Site ID(s):
78
Prioritization Ranking:
33
Parcel Tax PIN:
49592
Address:
11538 Handboard Rd
Union Bridge, MD 21791
BMP Type:
Stream Restoration

Sheet #:
CS-30

Existing Legend
- Stream Channel
- Fence
- Property Boundary (Subject)
- Property Boundary (Adjoiner)
- 480 Major Contour (10 ft interval)
- Minor Contour (2 ft interval)
- Culvert

Proposed Legend
- Bank Stabilization
- Riparian Buffer Restoration
- Floodplain Reconnection
- Debris Removal
- Channel Realignment
- Rock Grade Control
- Gully Stabilization
- Livestock Crossing Stabilization
- Livestock Exclusion Fencing
- Vehicle Crossing Reconstruction
- Access Route
- 1 Photo Location

AKRF

100 0 100 200
Scale 1" = 100'

General BMP Information	
NPDES BMP ID:	LIPI-2018-STRE-0025
Site ID:	CS-30
Prioritization Ranking:	30
Structure Location:	11538 Handboard Rd, Union Bridge, MD 21791
Coordinates (Lat, Long):	39.551774, -77.226882
NPDES Watershed:	Little Pipe Creek
MDE 8 Digit Watershed:	Double Pipe Creek (02140304)
Planning/Construction Level Cost Estimate:	$374,933
Estimated Cost/Impervious Acre:	$58,310
Proposed Restoration General Information	
Restoration Type:	Stream Restoration
Functional Lift Potential:	Biological Level
Project Length (LF):	643
Estimated Treatment/Reductions	
Impervious Area Credit (ac):	6
TN (lbs/yr):	48
TP (lbs/yr):	44
TSS (lbs/yr):	28,858
Required Permitting	
Joint Federal/State Application to MDE and USACE for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland	X
MDE General Permit for Stormwater Associated with Construction Activity and Notice of Intent (NOI)	X
Frederick County Grading/ SWM Permit	X
Catoctin & Frederick Soil Conservation Districts, Erosion and Sediment Control (E&S) Approval	X
Other:	-
Existing Condition	
The stream runs parallel to Handboard Road and set in a wide gently sloping valley through a scattered wooded and grassed residential property. The upstream and downstream reach limits are at the property lines, by the edges of neighboring agricultural fields. The drainage area to the site is primarily agricultural lands, with some residential lots, about 7 percent forested lands, and about 3 percent impervious area. The stream headwaters appear to be on the next property upstream, and highly saturated riparian areas appear in both upstream and downstream ends of the reach. It was observed that groundwater seeps in the upstream quarter of the reach. The stream planform was characterized as single-thread meandering, with a pool-riffle bed profile throughout most of the reach. Floodplain connectivity was visible and lateral stability of stream channel was stable, with the exception of the stream banks just downstream of the mid-reach culvert and vehicle crossing, which were collapsed and eroded. A small headcut was observed in a clay segment of the bed, near the upstream end of reach, and gravel side bars were observed in the unstable area downstream of the culvert and vehicle crossing.	

Restoration Measures	
The proposed restoration measures include bank regrading and stabilization measures, such as installation of live stakes, as well as floodplain reconnection and wetland habitat enhancement in several large areas on the upstream and downstream ends of the reach. A regenerative step-pool stormwater conveyance (SPSC) feature is proposed at an outfall from Handboard Road, to treat the stormwater from the impervious area. Riparian buffer restoration is proposed along the length of the reach, and would add native herbaceous and woody vegetation to create a buffer between the lawn and the stream. Grade control structures are proposed at the identified headcut locations, to maintain vertical stability in the channel. The existing pedestrian and vehicle crossing locations would be protected and enhanced as needed, and the existing culvert would be replaced with an open bottom culvert that would improve the stream flow patterns and habitat availability.	
Anticipated Site Constraints	
Constructability/Access	Moderate. Clearing of existing vegetation is expected to be minimal, but removal of woody debris on floodplain is anticipated, unless the property owner removes this prior to project implementation. Existing wetland features should be identified and projected as needed. There are utilities and roof drains, a shed, and several pedestrian bridges near the stream that will need to be protected and worked around during construction.

Selected Site Photos

Photo 1. Upstream portion of reach. Channel impacted by woody debris on floodplain.

Photo 2. Upstream channel and floodplain. Surface water on the floodplain associated with groundwater seeps is visible in the right foreground.

Photo 3. Low-lying concentrated flow paths through right floodplain convey drainage from upstream of Handboard Road into riparian area and channel.

Photo 4. Channel and riparian zone upstream of mid-reach culvert and vehicle crossing.

Photo 5. Small headcut in upper portion of the reach. Predominantly silt and clay bed. Grasses and wetland species dominant on floodplain.

Photo 6. Upstream reach and floodplain. Large brush pile visible in background, on the left floodplain.

Photo 7. Photo taken immediately downstream of culvert and vehicle crossing. Livestock enclosure and spring house on the right floodplain in the mid-ground. Shed on the right floodplain in the foreground.

Photo 8. Mid-reach culvert and vehicle crossing. Tile drainpipe (pictured right) creating erosion due to concentrated flow path from the left floodplain.

Photo 9. Floodplain and channel condition downstream of vehicle crossing. Eroded left floodplain with groundwater seep.

Photo 10. Photo taken facing upstream, standing in lower reach portion. Note utility pole and wire on both floodplains that require protection during construction. Several wooden bridges currently span channel.

Photo 11. Photo taken facing downstream of typical channel condition and riparian cover.