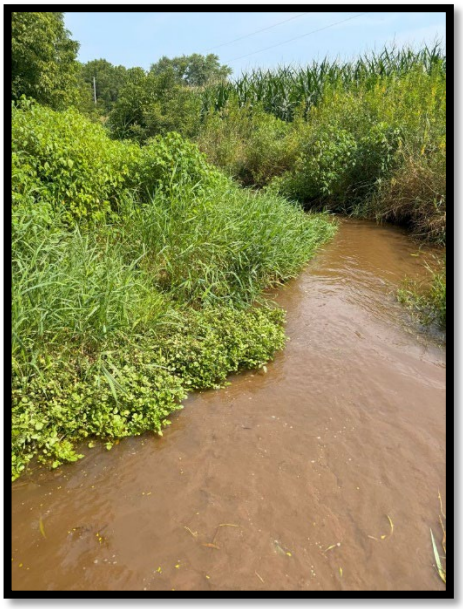
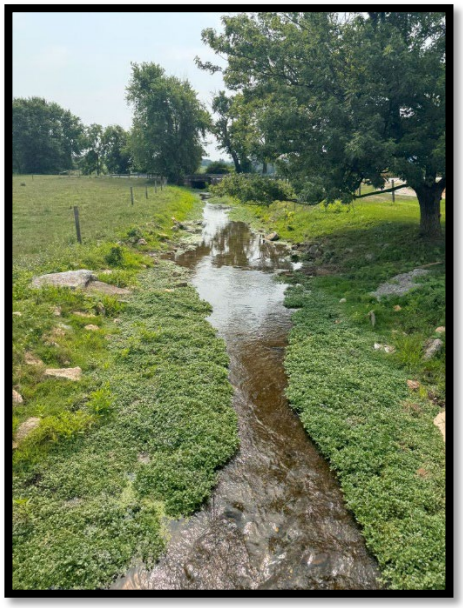
Summer Intern Stream Reconnaissance Surveys 2024
Summary of Existing Conditions and Recommendations

November 2024

CLEAR CREEKS CONSULTING
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Summer Intern Stream Reconnaissance Surveys 2024
Summary of Existing Conditions and Recommendations

Prepared for
Quittapahilla Watershed Association
Doc Fritchey Trout Unlimited
The Lebanon Valley Conservancy
and
Lebanon County Conservation District

Prepared by
Clear Creeks Consulting, LLC

November 2024

Table of Contents

Introduction

A major component of the overall Quittapahilla Creek Watershed Assessment conducted between 2001 and 2003 was the Field Reconnaissance Surveys of the major tributaries to Quittapahilla Creek. The data collected during these surveys was utilized to identify problem areas and potential restoration projects in the subwatersheds. That information was summarized in the Quittapahilla Creek Watershed Restoration and Management Plan (Clear Creeks Consulting, 2006) and more recently in the Quittapahilla Creek Watershed Implementation Plan (Clear Creeks Consulting, 2021).

When the Quittapahilla Watershed Association (QWA) initiated the Summer Intern Program in 2017 the original data was sixteen years old. The Summer Intern Program involves conducting Field Reconnaissance Surveys of the subwatersheds to document current stream reach conditions and determine the continued need for restoration/stabilization along the subwatershed stream reaches.

These surveys have been conducted by summer college interns funded by grants obtained by QWA and trained by Clear Creeks Consulting. The focus of the 2017 surveys was the stream reaches in the Snitz Creek subwatershed. Similar assessments were conducted during summer 2018 and 2019 along Beck Creek and Bachman Run subwatersheds, respectively. COVID prevented internships for 2020 and 2021. Funding was not available in 2022. The 2023 summer's interns surveyed Gingrich Run, Killinger Creek and the Snitz Creek subwatersheds. The summer 2024 interns surveyed the Beck Creek and Bachman Run subwatersheds. Funding for the 2023 and 2024 Intern Programs was provided by the Lebanon County Conservation District (LCCD) with grant administration provided by The Lebanon Valley Conservancy.

Methodology

Protocols

Clear Creeks Consulting developed the protocols for the surveys to provide information that can be utilized to evaluate overall riparian, channel stability, in-stream habitat and water quality conditions. The survey included:

- Characterization of existing riparian land use, channel and in-stream habitat conditions based on:
  - Visual observations, measurements, mapping and photo documentation of Riparian vegetation condition and stream buffer widths;
  - Channel morphology including channel dimensions, streambed material;
  - Channel stability including streambank erosion, streambed erosion or deposition, channel blockages, and channel alterations;
  - In-Stream Habitat including percent shading, riffle embeddedness, pool quality, riffle/pool ratio, in-stream fish cover, and aquatic insect habitat;
  - Water quality including water appearance and nutrient enrichment

Field Forms and Guidance Materials

The interns were provided with the following materials developed by Clear Creeks:

- Stream Visual Assessment Field Data Form
- Stream Visual Assessment Field Data Summary Form
- Reconnaissance Survey Field Guide Book
- Location maps (showing location of Beck Creek and Bachman Run relative to roads)

- Beck Creek and Bachman Run Property Ownership by Stream Reach with Landowner Names and Addresses
- Aerial photographs (showing Property ownership, property boundaries, Reach ID#, reach limits)
- Topographic maps (showing Reach ID#, reach limits)
- Basic Invertebrate Key for identifying stream insects and other invertebrates

Field Equipment

The interns were provided with the following field equipment by QWA:

- 100 ft. Measuring Tape / ft./ 10ths / 100ths
- Level Rod/ ft./10ths / 100ths
- Clinometer
- Ruler, 12 inch (inches and centimeters)

Intern Responsibilities

The interns were responsible for:

- Maintaining field equipment and field forms and additional field materials in good condition and return to Quittapahilla Watershed Association (QWA).
- Completing all Field Data Forms and Field Data Summary Forms for each stream reach evaluated.
- Mapping and photo-documenting the existing conditions along all stream reaches surveyed.
- Compiling a Report/Notebook Binder separated by stream reach that includes the completed field forms and data summary forms, maps and photographs. Appendices include the Aerials with Property/Reach Boundaries and a List of all Property Owners.
- After a QA/QC review by Clear Creeks, the Report/Notebook Binder will be submitted to the Lebanon County Conservation District (LCCD) for distribution to the Quittapahilla Watershed Association, Doc Fritchey Trout Unlimited and The Lebanon Valley Conservancy.

Summary Report and Recommendations

To develop the following narrative, data summary tables and revised aerials Clear Creeks Consulting:

- Analyzed the data provided on the Reconnaissance Survey Data Summary Forms prepared by the interns.
- Analyzed the reach-specific photographic documentation provided by the interns.
- Analyzed the Aerial Imagery provided on the Lebanon County Tax Assessment website's Parcel Viewer.
- Analyzed the Satellite Imagery provided on Google Earth Pro.
- Measured and recorded individual stream reach lengths using the Parcel Viewer GIS tools on the Lebanon County Tax Assessment website.
- Prepared final adjustments to some reach limits and to reach-specific information in the Reconnaissance Survey Data Summary Forms based on Clear Creeks Consulting's review of the above information and discussions with the interns. Those adjustments are included in the narrative, data summary tables and revised aerials.
- Restoration recommendations were developed by Clear Creeks Consulting based on the problems identified and best professional judgment regarding the appropriate techniques for correcting those problems.

Findings of the 2024 Field Reconnaissance Surveys

General

The land use in some of the subwatersheds has changed dramatically since the original reconnaissance surveys were conducted. Areas that were principally agricultural land with active livestock grazing or row crops have been replaced by residential subdivisions and/or commercial uses.

Riparian, channel, in-stream habitat conditions and water quality conditions vary considerably along the stream reaches surveyed. For some sections of the stream reaches, conditions have improved since the original surveys. For other sections of the stream reaches, conditions have deteriorated. Under both situations the changes appear to be directly related to the land management practices of individual property owners and their neighbors.

Beck Creek

The reconnaissance survey of Beck Creek covered 45,028 linear feet or 85.9% of the total 52,375 linear feet of stream in the watershed. This included 28 stream reaches. The remaining 7,347 feet of stream was not evaluated in the field due to landowner denial of access. For those reaches not evaluated in the field, an analysis of aerial images was conducted to gather as much information as possible.

The results of the survey documented that 14,565 linear feet or 32.3% of the stream reaches exhibit some degree of instability. Conditions varied among the reaches. For example, the unstable conditions include moderate to severe bank erosion, undercut trees, debris jams, active head cuts and a failing dam embankment, sedimentation - mid-channel bars along the Upper Reaches. Streambank erosion; aggradation, debris jams; livestock impacts; and infrastructure impacts (i.e., exposed petroleum pipelines,) along the Middle Reaches. Minor streambank erosion, overwide channel, heavy sedimentation and aggradation, trampled banks due to historic or current livestock impacts, lack of adequate buffers along the Lower Reaches. The unstable conditions vary by reach from minor, localized erosion to widespread and severe. The aerial image analysis suggests that an additional 3,400 feet could be rated as moderately unstable or even unstable. Most of the stream reaches had minimal 10 – 15’ or no riparian buffer. Most buffers included grasses and weeds or grasses and weeds with scattered trees.

The original water quality monitoring and field reconnaissance survey conducted along Beck Creek indicated that a significant length of stream has been impacted by sediment. The water quality modeling showed annual sediment loadings of 1,214,073 pounds or 607 tons/year. This is equal to 233 pounds of sediment per acre. The results of this current evaluation are consistent with the earlier studies in that field observation and photo documentation shows heavy sedimentation of fine sediments continues to be a problem along many stream reaches. From the GIS data we know that of the 5,204 acre watershed, 1,448 acres or 27.9% is cultivated land and 2,697 acres or 51.9% is pasture. However, only 611 acres or 11.7% of the cultivated land and 201 acres or 3.8% of the actively grazed pasture drains to the mainstem Beck Creek. These areas are contributing sediment to the creek. However, it appears that the major contributor to the sediment being transported along Beck Creek is streambank erosion

Table 1 below summarizes the results of the survey by stream reach and property ownership. More detailed information is provided in the Stream Visual Assessment Field Data Summary Forms and Photographs included with the Report Binder prepared by the interns and stored with QWA’s Project Records Repository.

Table 1 – Beck Creek Existing Conditions Summary (Revised by R. Powell, 11/10/2024)

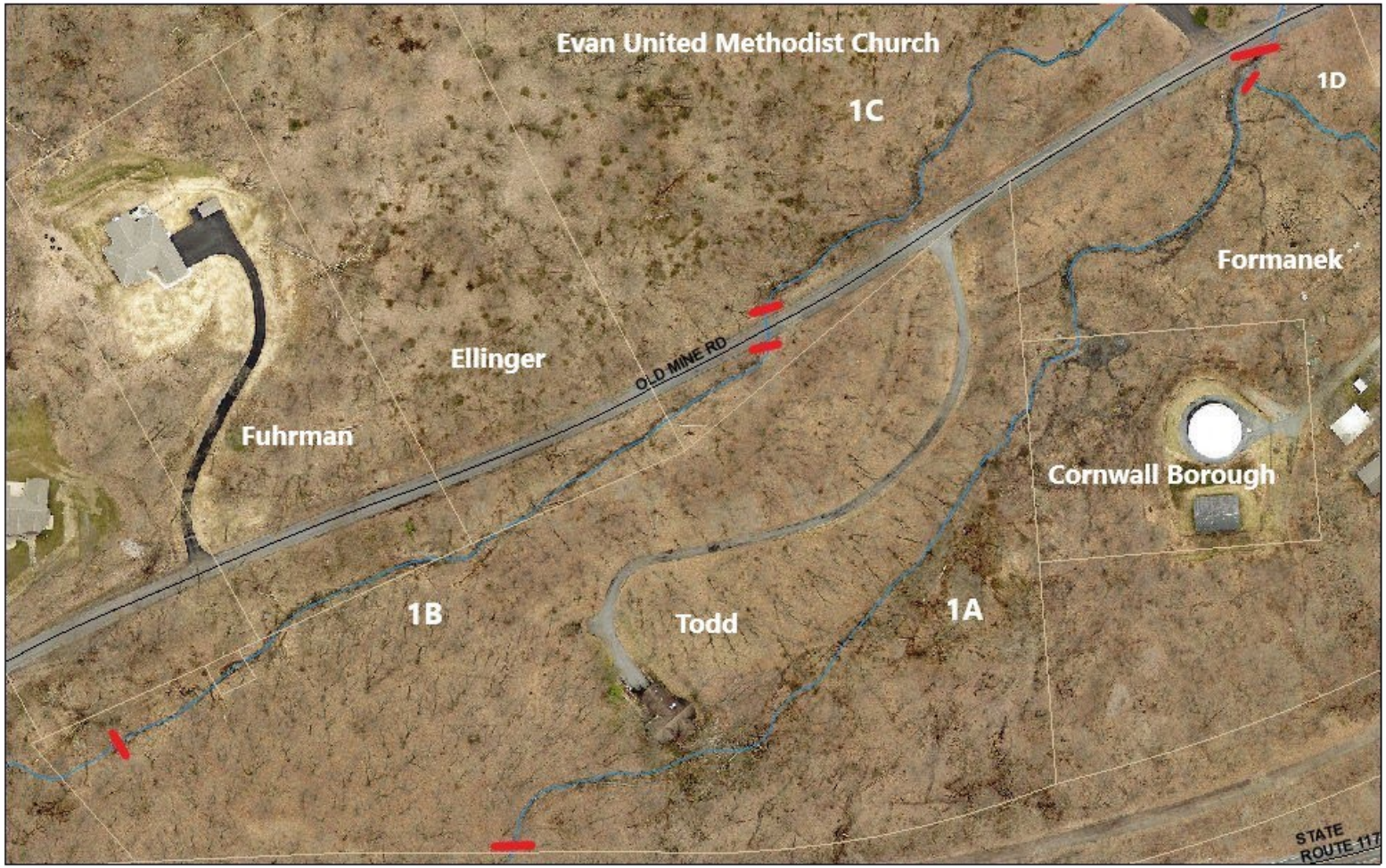
Reach ID	Location	Reach Length (Feet)	Unstable Length (Feet/Percent)	Existing Problems
1A	Todd, Formanek	1,288	225/17.5%	Upper Section – Stable; Lower Section – Incised channel with a high to very high bank erosion rating, failed dam with severe active head cuts threatening to degrade high quality wetland along old pond bottom.
1B	Todd, Fuhrman, Ellinger	887	50/5.6%	Moderately Stable with minor localized bank erosion
1C	East United Methodist Church	798	159.6/20%	Moderately Stable with localized bank erosion
1D	Formanek, Wile, Fancovic, Rudd	490	50/10.2%	Upper Section - Stable; Middle Section – Stable channel, open maintained area along right floodplain; Lower Section - Low banks with moderate erosion, Dirt bike trails in woods and along streambanks, sedimentation - mid-channel bars.
2A	East United Methodist Church	2,990	1,346/45%	Upper Section Moderately stable, localized erosion; Middle Section Unstable eroding, undercut banks with leaning and fallen trees, numerous large debris blockages, aggradation; Lower Section Stable banks, sedimentation, split channels, extensive wetlands along floodplain.
2B	East United Methodist Church	859	172/20%	Stable banks, some aggradation and small to medium debris blockages
3	Good, East United Methodist Church	3,482	174/5%	Low stable banks with minor, localized erosion. Few large debris blockages, extensive wetlands along floodplain.
4A	East United Methodist Church	3,883	263/6.7%	S1 - Stable banks with floodplain wetlands; S2 - Straight, Confined between Pond Embankment and Slope, Stable with minor localized erosion, sedimentation; S3 – Straight, Confined between Pond Embankment and Slope, Stable with Gabions and Boulder Revetment along both banks; S4 – Deeply Incised, Highly Unstable with severe erosion along both banks; S5 - channel starts at outfall pipe at base of dam, Moderately stable, scour hole at outfall, large debris blockages, braiding with wetlands where S5 and S4 join; S6 – Low, stable banks, heavy sedimentation, extensive wetlands along floodplain; S7 – Groundwater seep channel, incised, but stable.
4B	Henry	1,090	380/20%	Moderately stable with localized erosion in some areas and banks trampled by historic (current?) livestock access in multiple areas, two (2) livestock crossings, one is reasonably stable, actively grazed pasture along both sides of channel, livestock fencing in place, but minimal buffers along some sections 0 – 10'. Where adequately buffered stable channel with extensive wetland areas.

5	Henry	2,835	567/20%	Upper Section(Forest) – Stable with minor localized erosion and sedimentation; Middle Section (Pasture) - Moderately unstable with localized erosion in some areas, some riprap, banks trampled by historic and current livestock access in multiple areas, two (2) livestock crossings, one is reasonably stable, actively grazed pasture along both sides of channel, livestock fencing in place, but minimal or no buffer along some sections 0 – 10'. Where adequately buffered stable channel with extensive wetland areas.
6A	Robin Hostetter Trustees	1,998	ND	Denied Access. Aerial Analysis – Condition OK, Buffer Field 50 – 100', Yard 10 – 15'
6B	Wise	634	63/10%	Moderately stable, sinuous channel with minor erosion along meander bends and sedimentation. Dense buffer 5 – 45 adjacent to actively grazed pasture.
7A	Good	1,904	1,477/80%	Unstable with bank erosion and aggradation throughout. Streambanks trampled by livestock along the majority of the channel length. Approximately 80% of the channel is overwide with heavy sedimentation. No fencing, no buffers.
7B	Weaver	561	168/30%	Some aggradation with noticeable buildup of stream bottom sediments. Minor erosion along the banks.
8	Weaver	1,248	1,248/100%	Unstable -bank erosion along entire reach, overwide channel, streambank erosion throughout, significant streambed sedimentation, fine silts and organic muck, heavy mats of aquatic vegetation, mid-channel bars.
9	Brummel	1,557	604/38.8%	Bank erosion along upper section, flow diverted to a pond, section relatively stable banks, minor localized erosion. Stacked rock walls along the banks by the house.
10	Reber	1,385	1,108/80%	Unstable – Very tight meander bends along significant portion of reach, bank erosion along two thirds of reach, overwide channel, heavy sedimentation, rock revetment along the stream near the house failing in some locations.
11	Wegner, Dorsch Farm LLC	1,432	1002/70%	Unstable – Tight meander bends along upper section, failing rock revetment, bank erosion throughout, undercut trees, concrete blocks in the stream, overwide channel, heavy sedimentation and aggradation, footbridge, Buffers – upper section 0 - 15', lower section – 25 – 90'.

12	Reber	819	491/60%	Moderately Unstable – Eroding banks, undercut trees, large amounts of debris, overwide channel, sedimentation, mid-channel bars, Buffers – 100’
13	Beck Creek LLC	1,421	995/70%	Upper Section - Moderately Unstable - Tight meander bends with bank erosion, under-cut trees, heavy sedimentation, Buffers – dense grass and trees, 25 – 40’ along right bank, 100’ along left bank. Lower Section – Unstable - Very tight meander bends, extensive bank erosion, heavy sedimentation, no buffers mowed grass to edge of water.
14	Ridinger, Eckenrode	933	397/40%	Moderately Unstable – Bank erosion, overwide channel, heavy sedimentation, dam and streamflow diversion into pond installed by previous landowner, Buffers – 0 - 15’.
15	Bomberger	2,271	341/15%	Moderately Stable – Minor localized bank erosion, widespread heavy sedimentation and aggradation along streambed, Streamflow diversion to pond, Buffer – 5’ of grasses and weeds. Adjacent cultivated land.
16	Forney	1,679	1,343/80%	Stream heavily embedded with sediment, thick algal growth, widespread aggradation, banks sliding into stream, minimal buffer along cultivated fields, ford stream crossing. Buffers – grasses and weeds, 5 – 8’ along left banks, 0 – 5’ along right bank.
17	Royal Roads Properties Seagal Farm	2,258	ND	Denied Access. Aerial Analysis – Condition OK, Buffer - Pasture 10 – 20’, Field – 10 – 35’.
18	Royal Roads Properties	1,013	ND	Denied Access-Aerial Analysis – Condition overwide channel, Minimal Buffers, Field along left bank, Mowed Yard along right bank -0 – 10’.
19	ROGC Golf Partners LP, LEBCC LLC	3,755	1,127/30%	Minor bank erosion throughout, no streambank trees or shrubs, minimal to no buffers of grasses and weeds, overwide channel along some sections, heavy sedimentation, reduced flow from historic levels due to flow diversion into pond, pond has spillway into the stream, thick mats of algal growth, multiple culverted and timber bridge cart crossings; underdrains from tees and greens discharge into stream.
20	LEBCC LLC	1,583	317/20%	Minor, localized bank erosion, buffers - 10 -15’ mostly grasses and weeds, no stream bank trees or shrubs, multiple cart path crossings, thick mats of algal growth; large on-line pond. Owner concerned about loss of streamflow for major portions of the year.

21	Robert Copenhaver, Latz	1,986	0.0/0%	Stable - Channel has minimal erosion with clear waters, aquatic vegetation, wide buffers 75 – 200', extensive natural wetlands, large springs and spring channel with gravel substrate.
22	Robert Copenhaver	1,355	271/20%	Moderately Stable - Overwide channel, heavy siltation, thick algal mats, Fenced areas minimal erosion, Unfenced areas banks trampled and bare soil due to livestock grazing, one very wide and over used livestock crossing with no fencing. Buffers – 5' along both sides of stream. Landowner eager to discuss recommendations to improve conservation.
23	Edwin Copenhaver	926	93/10%	Moderately Stable - Overwide channel with heavy siltation and thick mats of algae and aquatic vegetation, streambanks are stable and low with buffers of 10 - 15' including dense grasses, trees and shrubs,
24	Ronald Copenhaver	2,384	ND	Denied Access-Aerial Analysis – Overwide channel, Buffers Upper Field -5 - 15', Lower Field – 25 – 40'. Between 2018 and 2022 aerial images show a 262' section of channel with a tight meander bend is now a 107' straight channel. Not determined whether channel was intentionally relocated and straightened or formed due to a natural chute cutoff process.
25	Todd	671	134/20%	Moderately Stable – Minor localized erosion, Heavy sedimentation, Buffer – grasses and weed 0 – 10' along left bank and 5' along right bank. Adjacent to cultivated fields.
Total		52,375	14,565/32.3%	

Beck Creek - Reach 1



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2022 Imagery
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Green: Band_2
Blue: Band_3

Property Lines
Roads
Built Street
Planned Street
Municipal Boundaries

1:2,257

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Lebanon County

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Beck Creek - Reach 1D

5/1/2024, 3:58:00 PM

2022 Imagery
Red: Band_1
Green: Band_2
Blue: Band_3

Property Lines
Roads
Built Street
Planned Street
Municipal Boundaries

1:2,257

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Beck Creek - Upper Reach 2A and 2B

3/29/2024, 10:54:00 AM

2022 Imagery
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Green: Band_2
Blue: Band_3

Property Lines
Roads
Built Street
Planned Street
Municipal Boundaries

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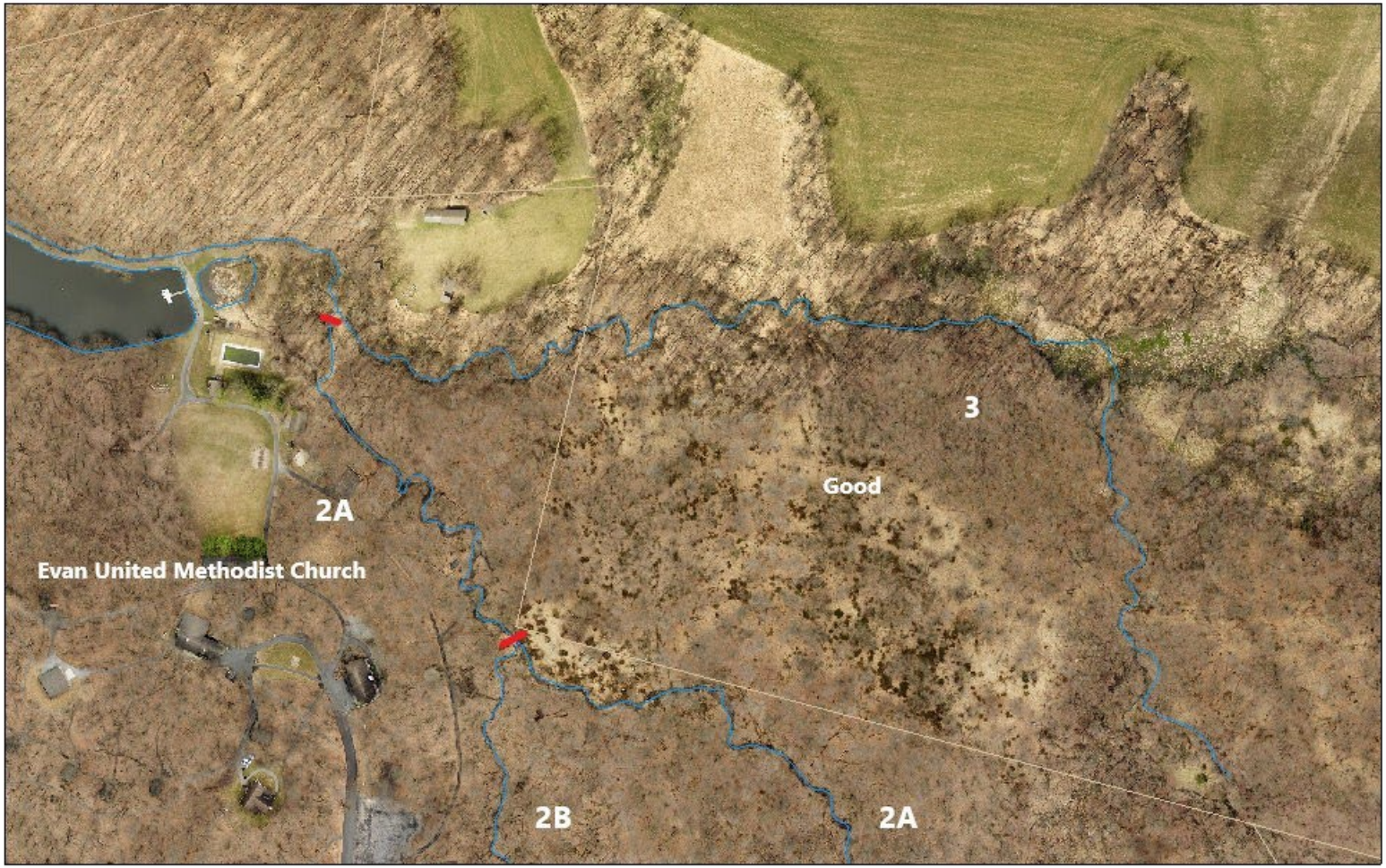
Beck Creek - Lower 2A



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2022 Imagery

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Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Beck Creek - Reach 3

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2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Beck Creek - Reach 4A

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2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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0 0.04 0.09 0.18 km

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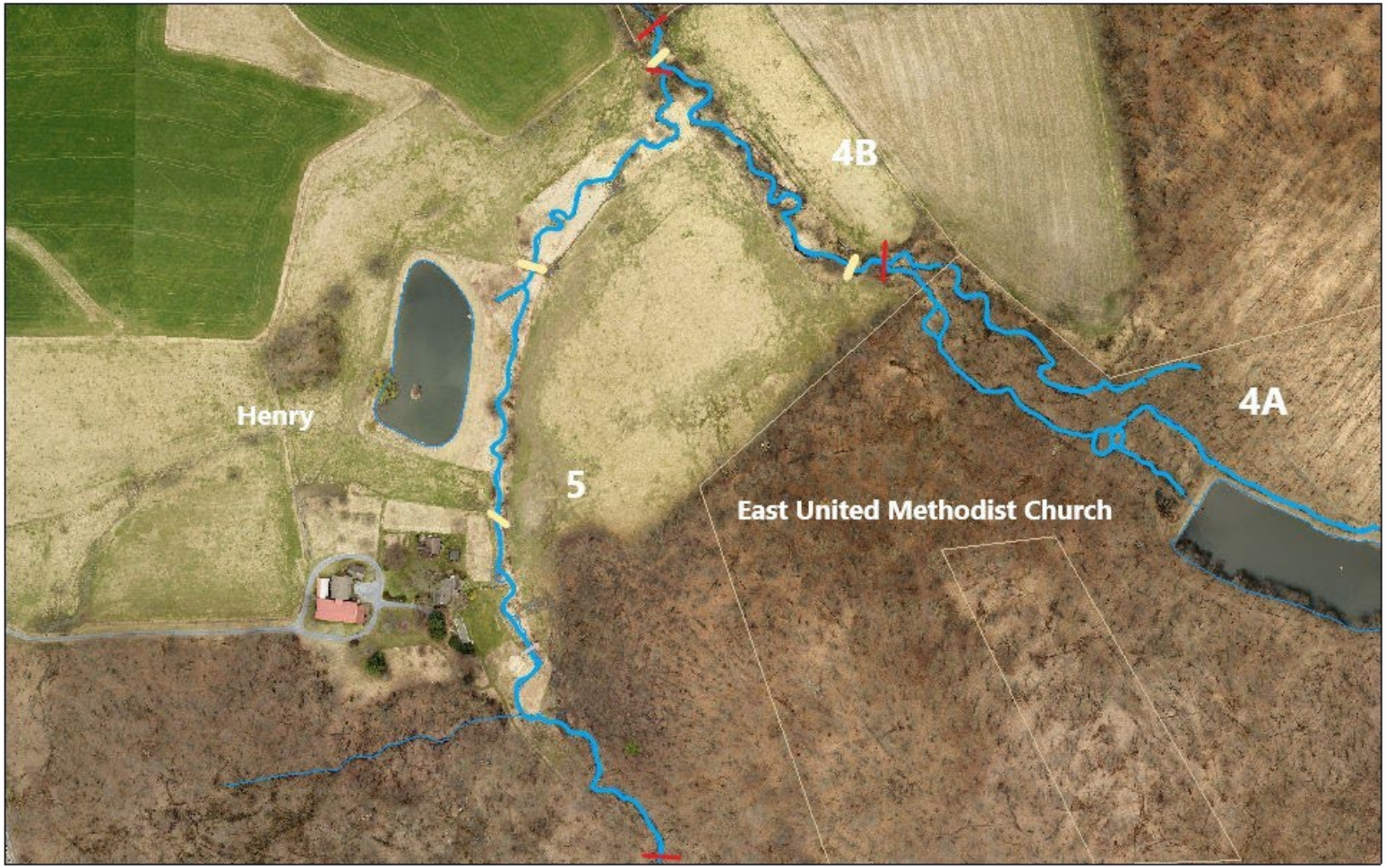
Beck Creek - Reach 4B and 5



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2022 Imagery

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Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Beck Creek - Reach 6A

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2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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0 0.04 0.09 0.18 km

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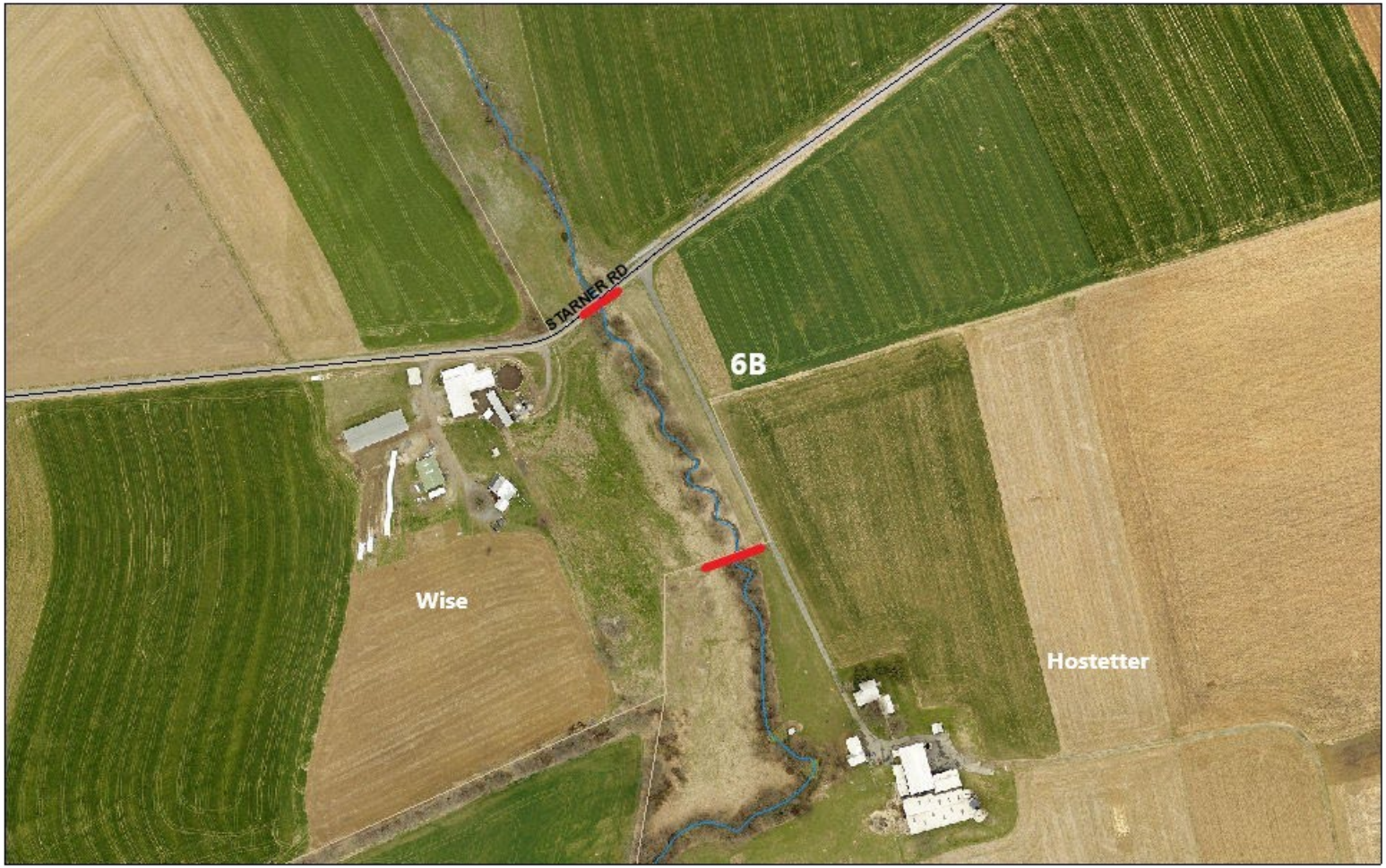
Beck Creek - Reach 6B



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2022 Imagery

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Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Beck Creek - Reach 7A

3/29/2024, 11:24:36 AM

2022 Imagery
Red: Band_1
Green: Band_2
Blue: Band_3

Property Lines
Roads
Built Street
Planned Street
Municipal Boundaries

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0 0.04 0.09 0.18 km

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Beck Creek - Reach 7B

3/29/2024, 11:25:34 AM

2022 Imagery
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Green: Band_2
Blue: Band_3

Property Lines
Roads
Built Street
Planned Street
Municipal Boundaries

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0 0.04 0.09 0.18 km

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Beck Creek - Reach 8

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2022 Imagery
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Green: Band_2
Blue: Band_3

Property Lines
Roads
Built Street
Planned Street
Municipal Boundaries

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0 0.03 0.06 0.11 mi
0 0.04 0.09 0.18 km

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Beck Creek - Reach 9

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2022 Imagery
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Green: Band_2
Blue: Band_3

Property Lines
Roads
Built Street
Planned Street
Municipal Boundaries

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0 0.04 0.09 0.18 km

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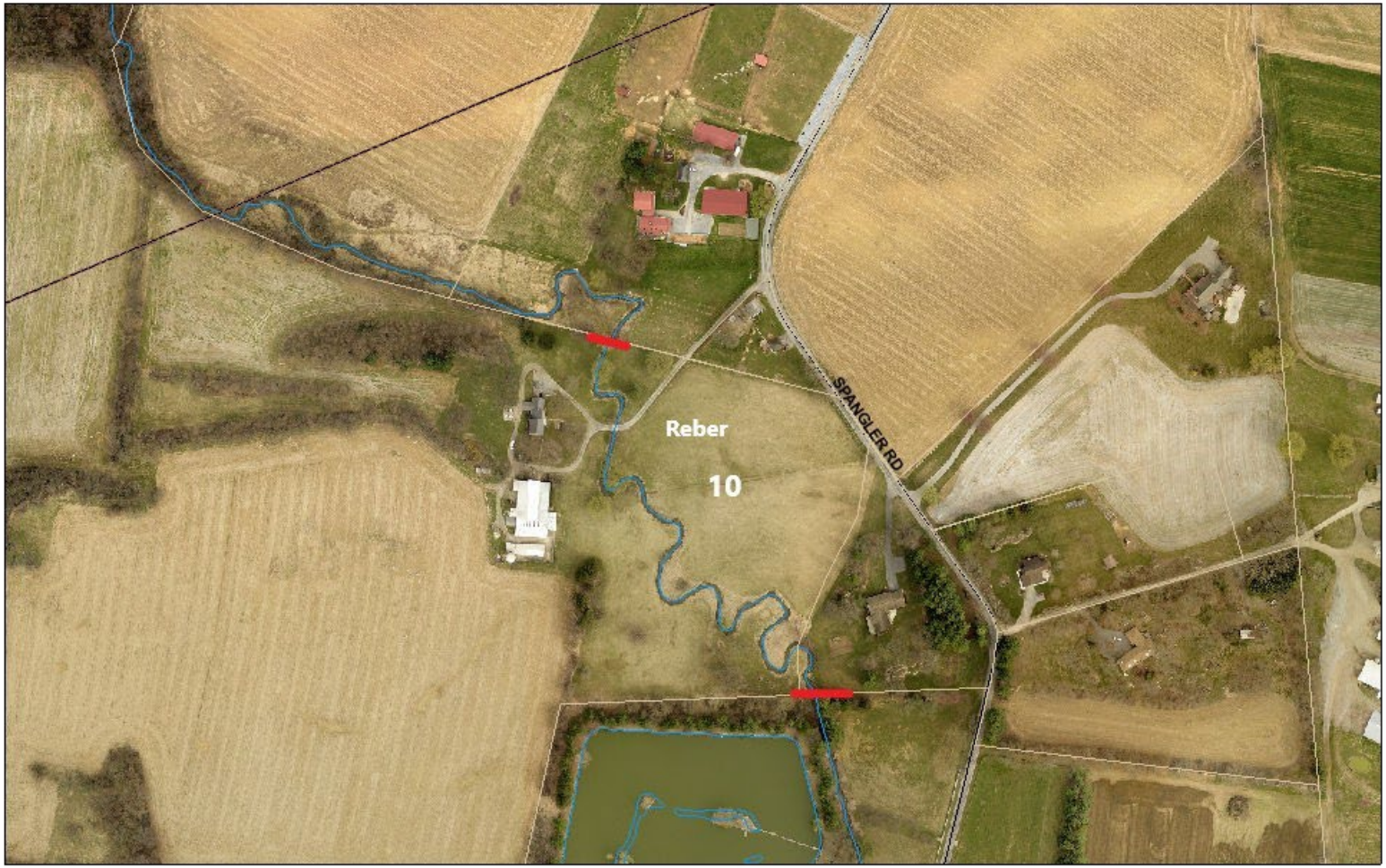
Beck Creek - Reach 10



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2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

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Beck Creek - Reach 11

3/29/2024, 11:36:37 AM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Lebanon County

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Beck Creek - Reach 12

3/29/2024, 11:42:21 AM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Lebanon County

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Beck Creek - Reach 13

3/29/2024, 11:42:59 AM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Lebanon County

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Beck Creek - Reach 14

3/29/2024, 11:45:30 AM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Lebanon County

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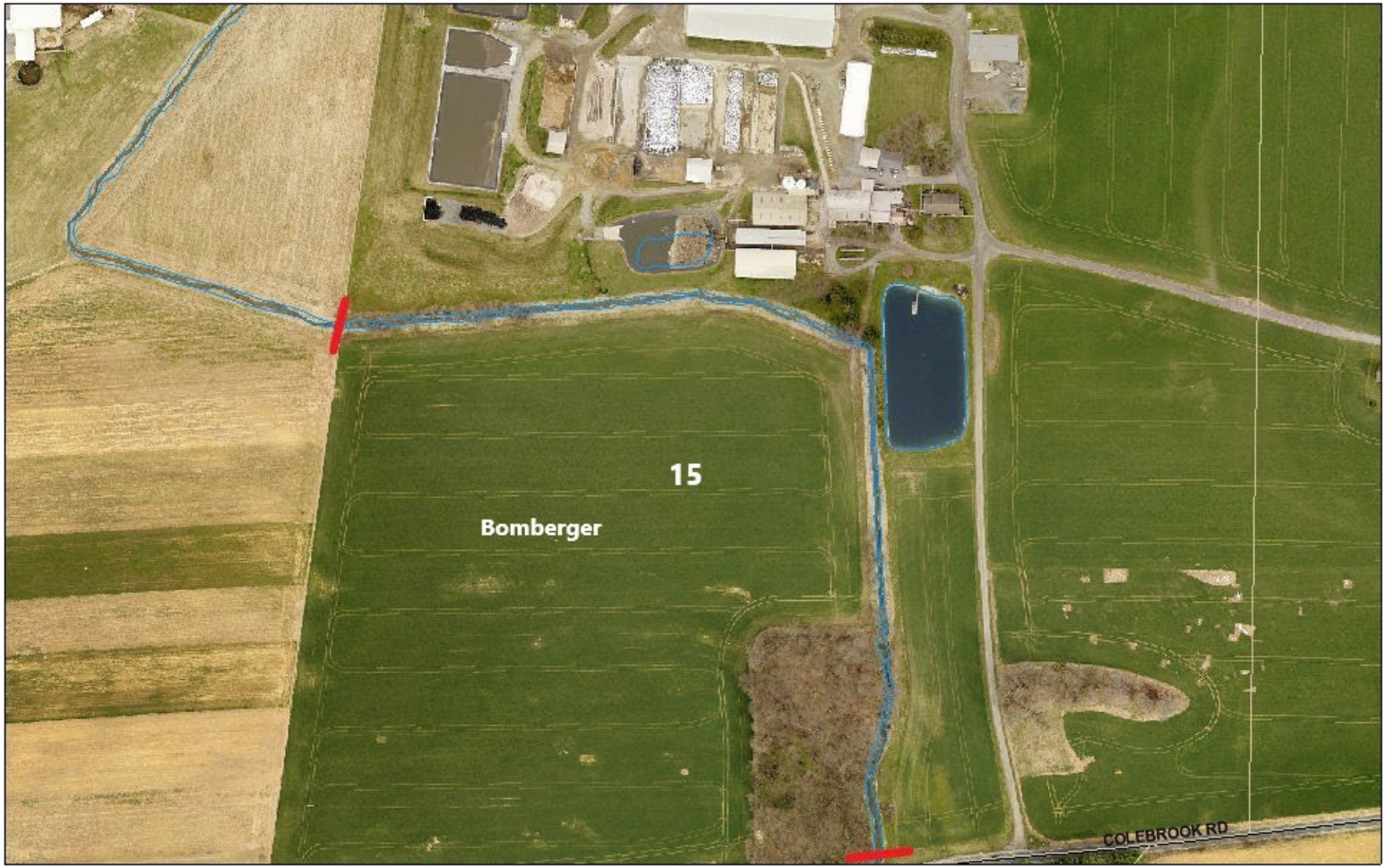
Beck Creek - Reach 15



3/29/2024, 11:48:55 AM

2022 Imagery
Red: Band_1
Green: Band_2
Blue: Band_3

Property Lines
Roads
Built Street
Planned Street
Municipal Boundaries

1:4,514
0 0.03 0.06 0.11 mi
0 0.04 0.09 0.18 km

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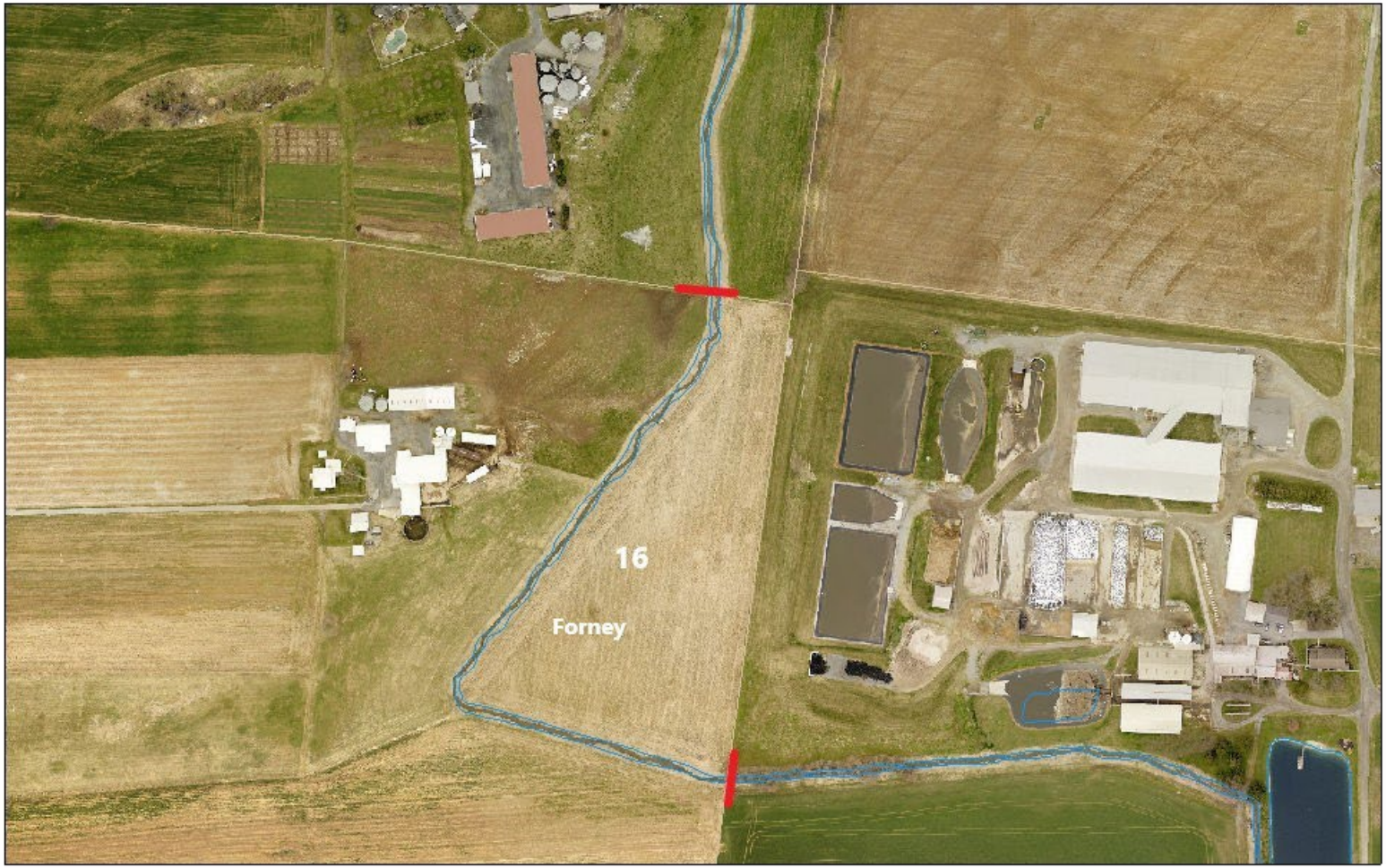
Beck Creek - Reach 16



3/29/2024, 11:49:54 AM

2022 Imagery
Red: Band_1
Green: Band_2
Blue: Band_3

Property Lines
Roads
Built Street
Planned Street
Municipal Boundaries

1:4,514
0 0.03 0.06 0.11 mi
0 0.04 0.09 0.18 km

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Lebanon County

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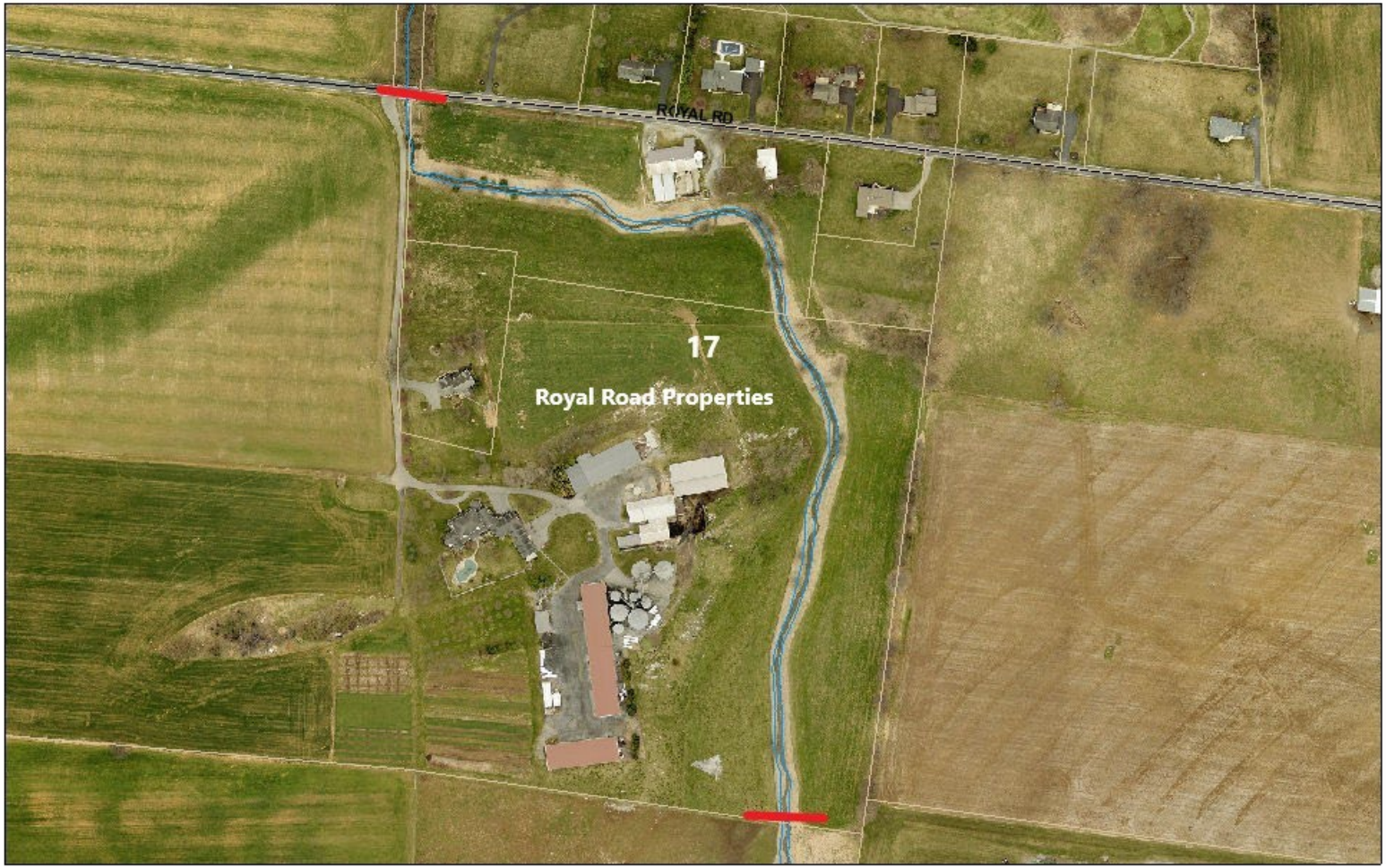
Beck Creek - Reach 17



3/29/2024, 11:55:52 AM

2022 Imagery
Red: Band_1
Green: Band_2
Blue: Band_3

Property Lines
Roads
Built Street
Planned Street
Municipal Boundaries

1:4,514
0 0.03 0.06 0.11 mi
0 0.04 0.09 0.18 km

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Lebanon County

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Beck Creek - Reach 18

3/29/2024, 12:00:21 PM

2022 Imagery
Red: Band_1
Green: Band_2
Blue: Band_3

Property Lines
Roads
Built Street
Planned Street
Municipal Boundaries

1:4,514
0 0.03 0.06 0.11 mi
0 0.04 0.09 0.18 km

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Lebanon County

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Beck Creek - Reach 19

3/29/2024, 12:01:53 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Beck Creek - Reach 20

3/29/2024, 3:57:30 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Beck Creek - Reach 21

3/29/2024, 4:02:09 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Lebanon County

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Beck Creek - Reach 22

3/29/2024, 4:04:11 PM

2022 Imagery
Red: Band_1
Green: Band_2
Blue: Band_3

Property Lines

Roads
Built Street
Planned Street
Municipal Boundaries

1:4,514
0 0.03 0.06 0.11 mi
0 0.04 0.09 0.18 km

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Beck Creek - Reach 23

3/29/2024, 4:06:42 PM

2022 Imagery
Red: Band_1
Green: Band_2
Blue: Band_3

Property Lines

Roads
Built Street
Planned Street
Municipal Boundaries

1:4,514
0 0.03 0.06 0.11 mi
0 0.04 0.09 0.18 km

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Beck Creek - Reach 24

3/29/2024, 4:09:34 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Lebanon County

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Beck Creek - Reach 25

3/29/2024, 4:11:49 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Property Lines

Roads

Built Street

Planned Street

Municipal Boundaries

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Lebanon County

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Bachman Run

The reconnaissance survey of Bachman Run covered 28,515 linear feet or 75.7 % of the total 37,679 linear feet of stream in the watershed. It did not include those stream reaches where the creek runs through residential subdivisions upstream and downstream of Louser Road . This included 8,585 feet of the East Fork, 3,625 feet of the Middle Fork, 5,503 feet of the West Fork and 11,114 feet of the Mainstem Bachman Run. The remaining 8,014 feet of stream was not evaluated in the field due to landowner denying access. For those reaches not evaluated in the field an analysis of aerial images was conducted to gather as much information as possible.

The results of the survey documented that 8,816 linear feet or 30.9% of the 28,515 linear feet of stream reaches evaluated exhibit some degree of instability. Conditions varied among the tributaries. For example, the reaches along the 8,585 feet of the East Fork were rated stable or moderately stable with minor localized erosion. While 571 feet or 15.8% of the 3,625 feet along the Middle Fork were rated as moderately unstable. The reaches along the Mainstem exhibit the highest length of unstable channel with 4,664 feet rated moderately unstable. The aerial image analysis suggests that an additional 3,000 feet could be rated as moderately unstable.

The unstable conditions include moderate to severe bank erosion, trampled banks due to livestock access, undercut and fallen trees, debris jams, active head cuts, heavy sedimentation, such as embedded riffles, mid-channel and/or lateral bars. Most of the stream reaches had minimal 10 – 15’ or no riparian buffer. Most buffers included grasses and weeds or grasses and weeds with scattered trees.

The original water quality monitoring and field reconnaissance survey conducted along Bachman Run indicated that a significant length of stream has been impacted by sediment. The water quality modeling showed annual sediment loadings of 1,187,272 pounds or 593 tons/year. This is equal to 241 pounds of sediment per acre. The results of those studies show that streambank erosion is a contributing factor, but not a major source of the sediment transported along Bachman Run or its tributaries.. The results of this current evaluation are consistent with the earlier studies in that field observation and photo documentation shows heavy sedimentation of fine sediments continues to be a problem along many stream reaches. From the GIS data we know that of the 4933 acre watershed, 1,211 acres or 24.5% is cultivated land. We also know that 1,058 acres or 87% of that cultivated land drains to the mainstem Bachman Run or one of its tributaries. From the field reconnaissance survey we know that the majority of the stream reaches bounded by this cultivated land have minimal or no buffers between the fields and channels. Table 2 below summarizes the results of the survey by stream reach and property ownership.

Table 2 – Bachman Run Existing Conditions Summary

Reach ID	Location	Reach Length (Feet)	Unstable Length (Feet/Percent)	Existing Problems
East 1	Philhaven/Wellspan	1,654	0/0%	Stable - No bank erosion. Minimal buffer 10'. No flow for the first 30'.
East 2	Philhaven/Wellspan	910	40/4.4%	Stable – Livestock fenced out of the stream. Minimal buffer 10 – 15'.
East 3	Smith Quarries Inc.	968	101/10.4%	Moderately Stable - Minor localized erosion and undercut banks. Buffer 15 – 25'.
East 4	Smith Quarries Inc.	2,603	260/10%	Stable - Minimal erosion, minimal sedimentation. wooded buffer 20 – 100' plus. No flow for the last 80'.
East 5	J. and R. Risser	1,915	192/10%	Moderately Stable - Low banks, well vegetated, heavy sedimentation and algae growth. Wooded and emergent wetland buffer 25 – 100' plus.
East 6	J. and R. Risser	535	54/10%	Moderately Stable - Low banks, well vegetated, minor localized erosion. Minimal buffer 0 – 15' along mowed yard.
Middle 1	Smith Quarries Inc.	355	71/20%	Moderately Stable - Minor localized erosion, mostly around culverts.
Middle 2	A. Brown R. and D, Hoover	582	146/25%	Moderately Stable - Minor localized erosion. The fence on the left was very close to the top of the bank.
Middle 3	R. and D. Hoover	931	233/25%	Moderately Stable - Roadside ditch, dry channel, no flow with localized erosion, Minimal buffer 0 – 10'.
Middle 4	J. and R. Risser	1,322	397/30%	Moderately Unstable - Roadside ditch, dry channel, no flow with localized erosion, Minimal buffer 0 – 10'.
Middle 5	J. and R. Risser	435	174/40%	Moderately Unstable – Bank erosion concentrated near culvert and along outside bend, stacked rock wall along one section, many debris blockages, heavy sedimentation.
West 1	G.&J. Weaber, D.&E. Weaver, R. & S. Humagain	929	279/30%	Moderately Unstable - Bank erosion and undercutting. Medium to large debris. Densely vegetated.
West 2	R. and S. Sattazahn	811	405/50%	Moderately Unstable - Upper section incised 5' banks, some erosion, fallen trees. Lower section low, stable, well vegetated banks and floodprone area. Channel dry until joining small tributary outfalling from pond.
West 3	J. and C. Martin	914	-	Landowner Denied Access – Aerial – Very tight meanders, overwide channel in sections, fallen trees and debris jams obvious. Wooded buffers > 50'.
West 4	J. and C. Martin	307	-	Landowner Denied Access – Aerial – Very tight meanders, overwide channel in sections, fallen trees and debris jams obvious. Wooded buffers > 50'.
West 5	R. Bastian, J. Conkle	280	0/0%	Stable - stream banks rip-rapped with boulders and stacked rock wall along the entire reach. No buffer along left bank – mowed yard.
West 6	Galbraith, Blount, Fies	967	145/15%	Moderately Stable - Banks low and well vegetated, minor erosion along banks in some sections, one small head-cut. No buffer along bank – mowed yard

West 7	D. and B. White R. and D. Hoover	995	199/20%	Moderately Stable - Minor localized erosion. Minimal buffer along left bank 10', 35' buffer along right bank. Horse pasture along both sides of stream.
West 8	D. and B. White J. and R. Risser	1,521	608/40%	Moderately Unstable – Localized erosion, mostly along bends, banks low and well vegetated. Upper Section - Minimal buffers along left bank on White Property 10 – 15', 10 – 20' along right bank on Risser Property. Lower Section Minimal buffers along both banks on Risser Property adjacent cultivated fields. One farm equipment crossing.
MS 1	J. and R. Risser	654	252/20%	Moderately Stable – Minor localized erosion, low banks, generally well vegetated. Buffers along both banks 20 – 80'. Cultivated fields along both sides of stream. Two petroleum pipeline crossings.
MS 2	D. Waybright	1,540	-	Landowner Denied Access – Aerial – Trout hatcheries on springs to either side of channel. Footbridge over stream provides access to spring hatchery areas; Overwide channel throughout, lower sections with thick growth of aquatic vegetation. Observations from driveway showed moderate amount of bank erosion. . Landowner did allow access to one area of concern – High bank (10 – 15') along bend on right side of channel exhibits significant erosion. Well buffered throughout, woods 50 -100' plus.
MS 3	E. Church, T.&W. Inman, J.&K. Inman	1,591	500/31.4%	Upper Section - Stable with rock walls along both banks, low dam and footbridge. Middle Section - Moderately stable, low banks, well-vegetated. Lower Section (Approx. 500')– Moderately unstable, bank erosion, undercut and leaning trees, channel overwide, heavy sedimentation and thick growth of aquatic vegetation. Minimal Buffer throughout 5 – 15' along both banks.
MS 4	Gary & Lucinda Horst	803	803/100%	Unstable – Severe bank erosion throughout, tight meander bends; Trampled banks and overwide channel due to historic livestock access; heavy sedimentation. One unstable livestock crossing. No buffers.
MS 5	Lillian & Gerald Horst	1,224	1,224/100%	Unstable – Bank erosion throughout, Trampled banks and overwide channel in sections due to historic livestock access; heavy sedimentation. Multiple unstable livestock crossings. Minimal buffers 0 – 10'.
MS 6	Lillian & Gerald Horst	780	780/100%	Unstable – Bank erosion throughout, Trampled banks and overwide channel in sections due to historic livestock access; heavy sedimentation. Multiple unstable livestock crossings. Minimal buffers 0 – 10'.
MS 7	Horning	1,309	758/58%	Upper Section (231') – Moderately stable, narrow, well vegetated banks. Middle Section (758')- Moderately unstable, low-moderate bank height, actively eroding, overwide channel, heavy sedimentation, one unstable livestock crossing, rip-rap along some sections of right bank. Lower Section (320') – Moderately stable, narrow, well vegetated banks along major portion of length, some sections rip-rapped. Minimal buffers 0 – 10' throughout.

MS 8	Gary & Lucinda Horst	979	293/30%	Upper Section (230') – Moderately stable, rip-rap along both banks, livestock fencing and bridge, Buffers – 10' right bank, 15' left bank; Middle Section (255') – Stable with a 30 foot concrete wall left bank downstream of bridge, stacked rock wall both banks – 130' right bank and 75' left bank, and additional 75' of rip-rap left bank, one unstable ford crossing downstream end of this section, large pile of junk and debris left floodplain, Buffers – 10 - 30' right bank and 5 – 10' left bank; Lower Section (494') – Moderately stable, low banks with minor localized erosion and well vegetated grasses, trees and shrubs, heavy sedimentation. Buffers – 20' along both banks. Adjacent cultivated fields.
MS 9	D.&R. Copenhaver, D. Pence	971	306/31.5%	Upper Section (504') Copenhaver – Moderately Unstable – Low banks, well-vegetated, minor localized erosion, some sections overwide, heavy sedimentation, unstable equipment crossing. According to the landowner, the streambed has filled-in with silt over the past decade. Buffers 10 – 15'. Lower Section - (450') Pence - Moderately Unstable – Low banks, well-vegetated, minor localized erosion, overwide channel throughout, heavy sedimentation. Buffers 10 – 15'.
MS 10	Forney	881	176/20%	Moderately Stable - minor, localized erosion, less embedded than previous reach. Buffers – Left bank adjacent to cultivated fields 20 – 50', Right bank adjacent to pasture 10 – 20'.
MS 11	McCue	906	-	Landowner Denied Access – Aerial – Wider channel, no obvious problems, Buffers - Left bank adjacent to cultivated field 20 – 40, Right bank adjacent to pasture 0 – 15' .
MS 12	Swank	887	222/25%	Moderately Stable - Narrower channel with low banks, well vegetated, Buffers 15' on both sides. Active buffer restoration project.
MS 13	Swank	990	198/20%	Moderately Stable - Low banks, well vegetated, minor localized erosion, rip-rap and rock walls along some short sections. Livestock fencing and crossing. Buffers 10 - 25' both sides.
MS 14	R.&B. Copenhaver	2,291	-	Landowner Denied Access – Aerial – Upper Section – Narrow channel with buffers 10 – 30'. Equipment Bridge. Lower Section - Overwide channel, heavy growth of aquatic vegetation; spring channel along left floodplain, footbridge, Buffers 50 – 80'.

MS 15	Royal Road Properties	1,585	-	Landowner Denied Access – Aerial - Overwide channel, heavy growth of aquatic vegetation; split channel with island, ford crossing near middle of reach. Buffers 50 – 135'.
MS 16	R.&B. Copenhaver	1,357	-	Landowner Denied Access - Aerial – Upper Section – Narrower channel with buffers 10 – 35'. Equipment Bridge; Middle Section - Narrow channel with buffers 5 – 10'; Lower Section - Wider channel, heavy growth of aquatic vegetation, Buffers 5 – 40'.
Total		37,679	8,816/23.4%	

Bachman Run: Philhaven-Smith Quarries Properties - East Fork Reaches 1 - 4

5/25/2019, 10:52:32 AM

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan,

Lebanon County

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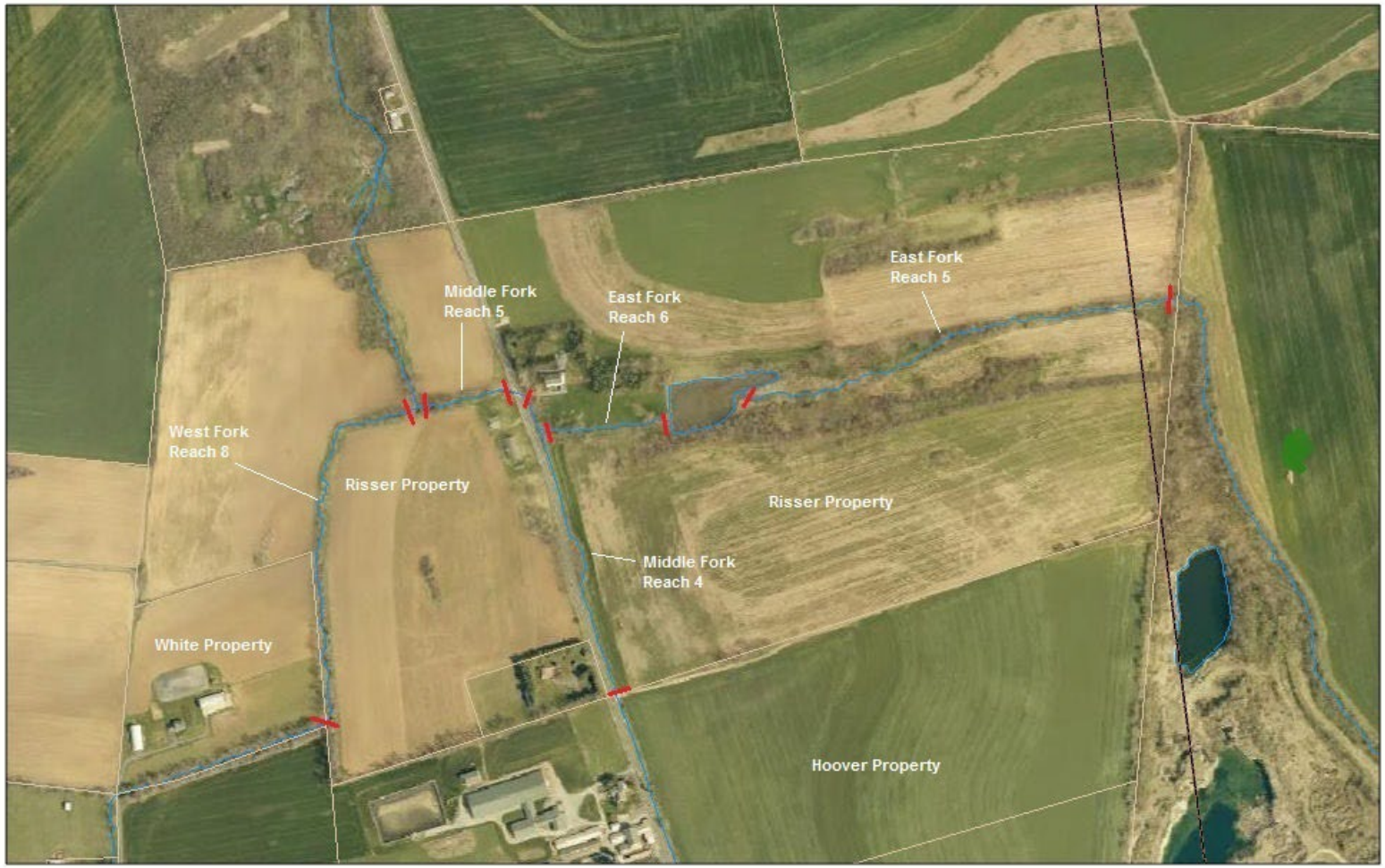
Bachman Run: Risser Property - East Fork Reaches 5 and 6



5/31/2019, 3:43:08 PM

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan,

Lebanon County

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Bachman Run: Smith Quarries-Brown-Hoover Properties - Middle Fork Reaches 1 and 2

6/2/2019, 11:01:46 AM

1:2,257

0 0.01 0.03 0.05 mi

0 0.02 0.04 0.09 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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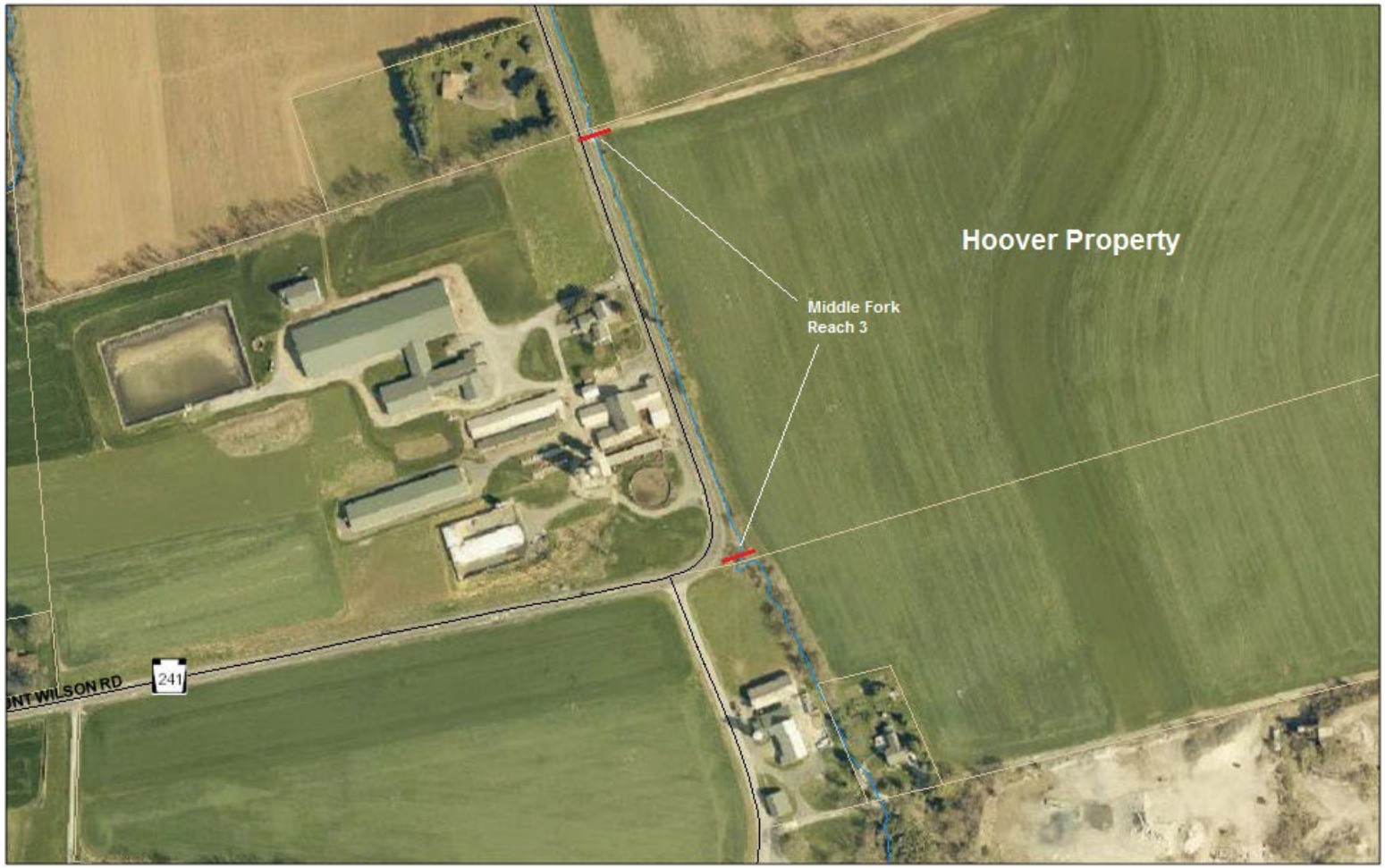
Bachman Run: Hoover Property - Middle Fork Reach 3



6/3/2019, 1:05:14 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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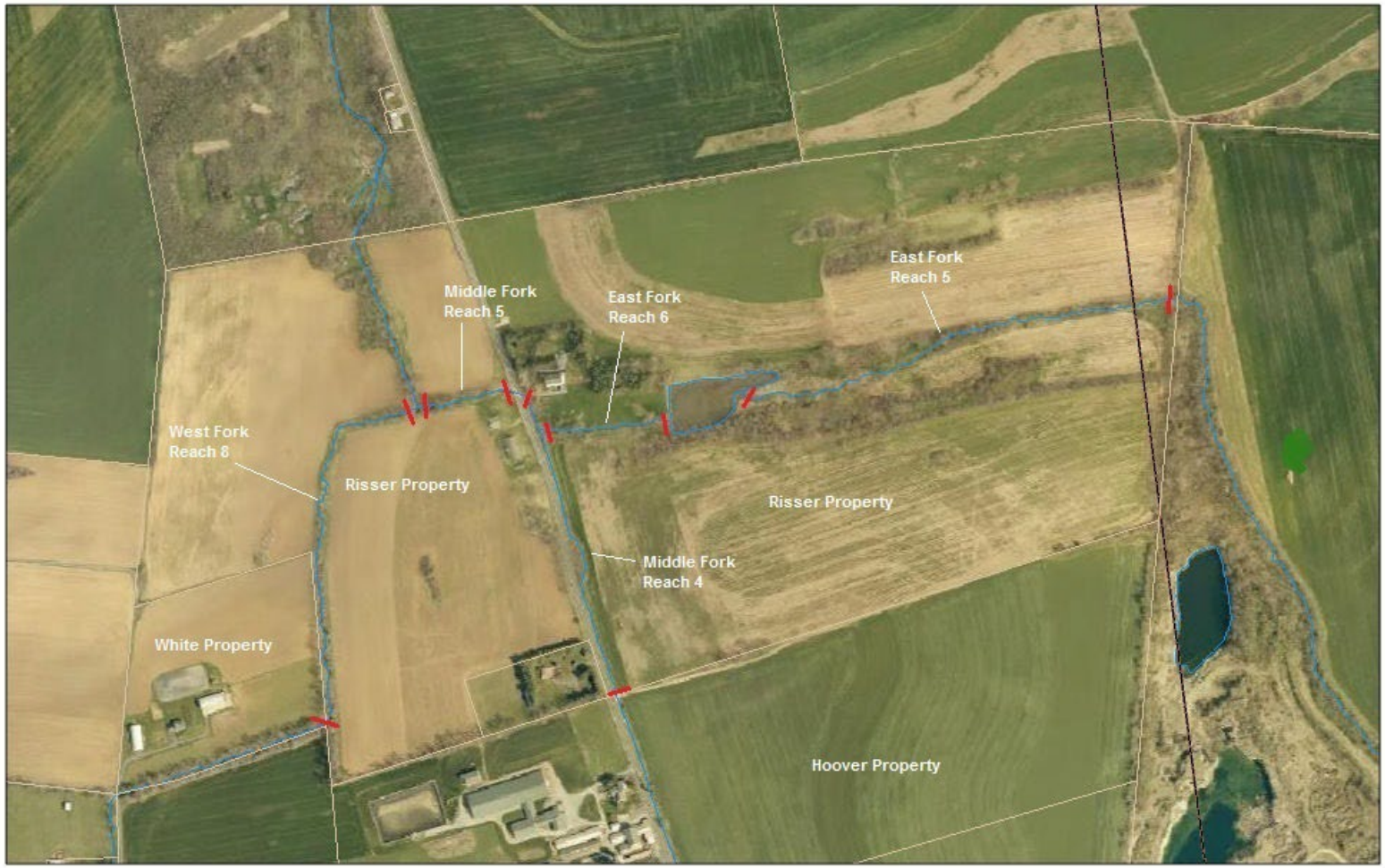
Bachman Run: Risser Property - Middle Fork Reaches 4 and 5



5/31/2019, 3:43:08 PM

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan,

Lebanon County

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Bachman Run: Weaber-Humagain Properties West Fork Reach 1

5/25/2019, 10:57:57 AM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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Bachman Run: Sattazzahn-Martin West Fork Reaches 2 - 4

5/25/2019, 11:02:13 AM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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Bachman Run: Bastion-Conkle-Little Willow Fark-Blount-Fies Properties West Fork Reaches 5 and 6

5/25/2019, 11:03:46 AM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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Bachman Run: White-Hoover Properties - West Fork Reach 7

5/25/2019, 4:55:40 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

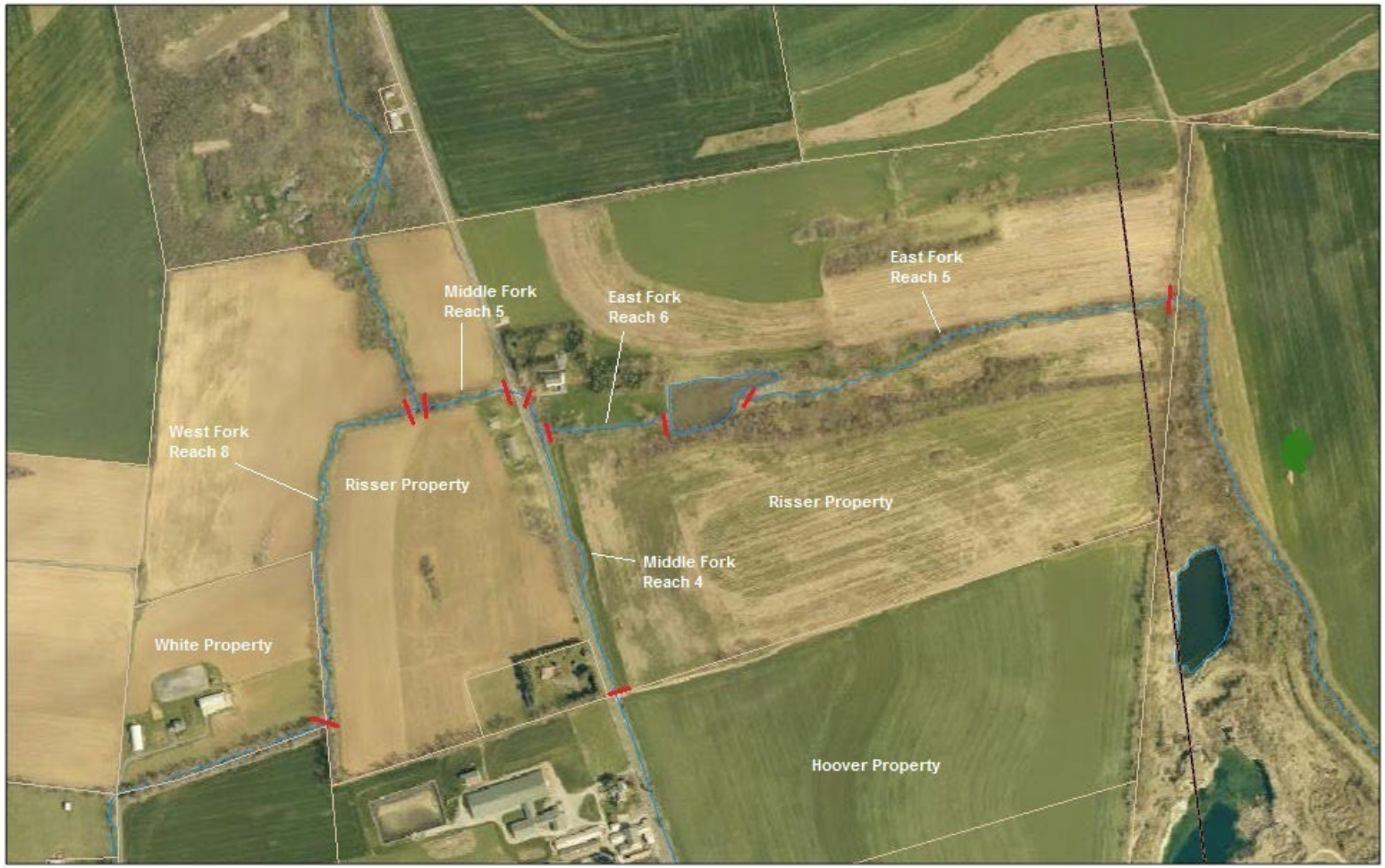
Municipal Boundaries

LCCGIS

Lebanon County

Disclaimer: Tax maps show the approximate boundaries of taxable and non-taxable property. The property boundaries depicted should not be interpreted as the legal boundary description. The legal boundary description can be obtained from the property's deed.

Bachman Run: White-Risser Properties - West Fork Reach 8



5/31/2019, 3:43:08 PM

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan,

Lebanon County

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Bachman Run: Risser-Waybright-Church-Inman Properties - MS Reaches 1 - 3

5/25/2019, 4:04:05 PM

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan,

Lebanon County

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Bachman Run: Bachman Property - MS Reach 4

5/25/2019, 11:18:19 AM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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Bachman Run: L. Horst Farm - MS Reaches 5 and 6

5/25/2019, 5:15:27 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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Bachman Run: Horning Farm - MS Reach 7

5/25/2019, 5:16:54 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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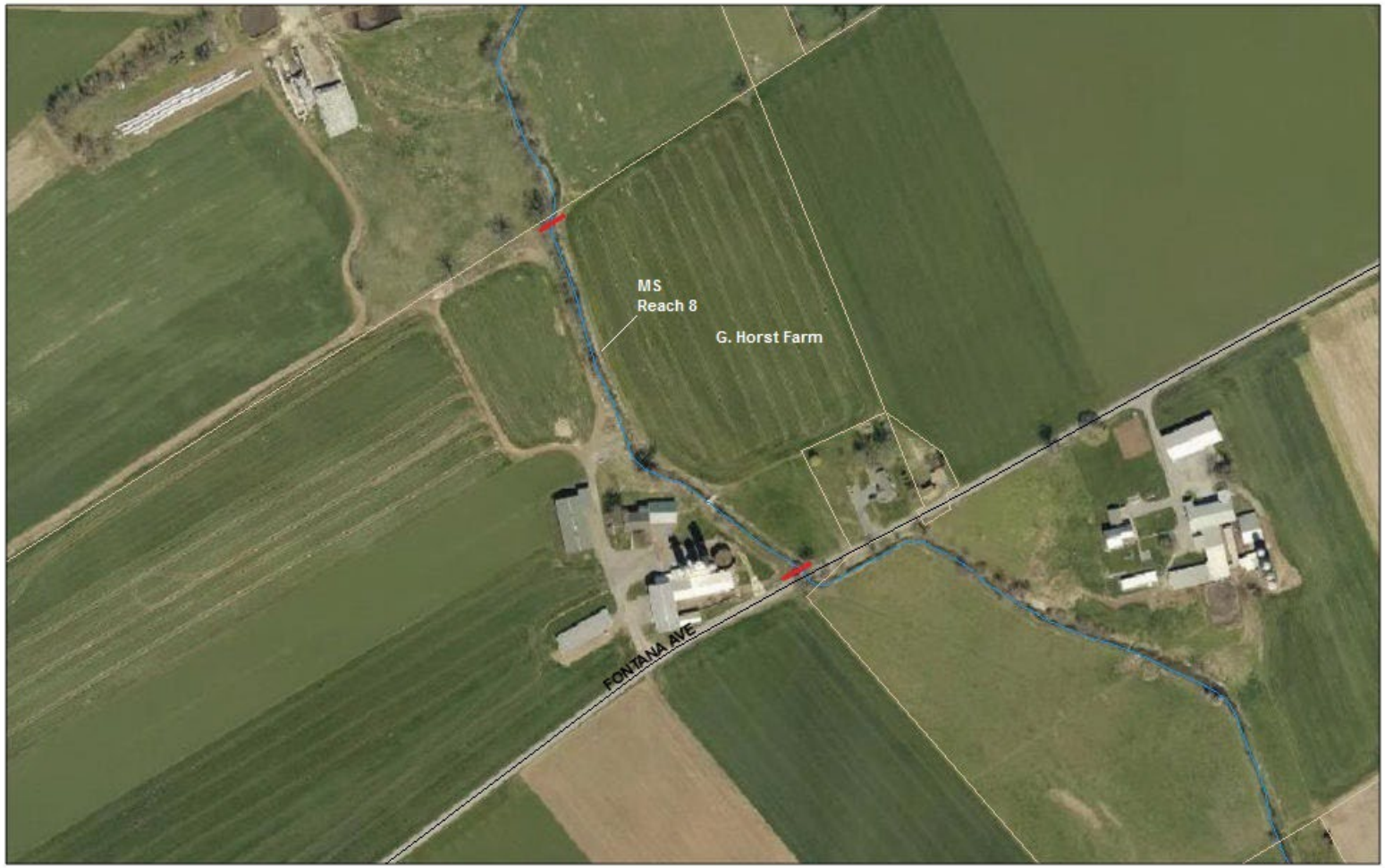
Bachman Run: G. Horst Farm - MS Reach 8



5/25/2019, 5:19:46 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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Bachman Run: D. Copenhaver-Pence Properties - MS Reach 9

5/25/2019, 5:21:21 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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Bachman Run: Forney-McCue Properties - MS Reaches 10 and 11

5/31/2019, 4:00:00 PM

Subdivision Lots

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

LCCGIS

Lebanon County

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Bachman Run: Swank Property - MS Reaches 12 and 13

5/25/2019, 5:24:35 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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Bachman Run: R. Copenhaver Farm - MS Reach 14

5/31/2019, 4:06:58 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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Bachman Run: Royal Road Properties - MS Reach 15

5/25/2019, 5:26:49 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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Bachman Run: R. Copenhaver Property - MS Reach 16

5/31/2019, 4:13:42 PM

1:4,514

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.18 km

Subdivision Lots

Lakes and Bodies of Water

Lakes and Bodies of Water

Swamp or Marsh

Municipal Boundaries

LCCGIS

Lebanon County

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Bachman Run - Lower Reaches Not Included in 2024 Recon Survey

6/20/2024, 8:35:00 AM

2022 Imagery

Red: Band_1

Green: Band_2

Blue: Band_3

Subdivision Lots

Property Lines

Municipal Boundaries

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

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Lebanon County

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Recommendations

Based on the results of the reconnaissance survey, potential restoration projects and best management practices have been identified to correct the problems documented along Beck Creek and Bachman Run. Most of these projects were previously identified in the Quittapahilla Creek Watershed Implementation Plan (Clear Creeks Consulting, 2021).

The restoration of Beck Creek would include 21 projects across 21 stream reaches. Nine of those reaches include referrals to LCCD for implementation of agricultural BMPs, such as livestock fencing, livestock crossings, and riparian buffers along grazed pastures and grass buffers along cultivated fields. The restoration of Bachman Run would include 20 projects across 20 stream reaches. Eight of those reaches include referrals to LCCD for implementation of agricultural BMPs, such as livestock fencing, livestock crossings, and riparian buffers along grazed pastures and grass buffers along cultivated fields.

Tables 3 and 4 below summarize the recommended restoration projects and best management practices by subwatershed, stream reach and property ownership. The project lengths do not reflect length of unstable reaches, instead they are the recommended lengths required to implement all BMPs identified. Unlike the tables in the Watershed Implementation Plan, no cost estimates have been included for design ad permitting or construction, given that the actual start of a specific project could be years out.

The Watershed Implementation Plan prioritizes projects in order of subwatershed and location within the subwatershed, that is, starting in the headwaters and working in a downstream direction. As part of an overall effort to develop a new strategy for prioritizing and funding projects, the projects identified in this report will fall into one of three categories. The following is an outline of that strategy.

Track 1 – Watershed Implementation Plan Prioritized Subwatersheds

1. Priorities
    a. Snitz Creek
    b. Killinger Creek and Gingrich Run
    c. Beck Creek
    d. Bachman Run
2. Highest Priority and Order of Implementation
    a. Larger/More Complex Projects in Single Watershed – Top Down
        1) Snitz Creek 2
        2) Snitz Creek 3
        3) Snitz Creek 4
    b. Design and Permitting Phase
    c. Construction Phase
3. Funding Sources
    a. Growing Greener Plus Grants
    b. 319 Non-Point Source Management Grants
    c. Community and Economic Development Watershed Restoration and Protection Grants
    d. National Fish and Wildlife Foundation (NFWF) Innovative Nutrient and Sediment Reduction Grants
    e. LCCD Agricultural Conservation Assistance Program (ACAP) Grants

Track 2 – WIP Prioritized Subwatersheds

1. Priorities
    a. Snitz Creek
    b. Killinger Creek and Gingrich Run
    c. Beck Creek
    d. Bachman Run
2. Highest Priority and Order of Implementation
    a. Smaller (<500 LF)/Less Complex Projects in Alternating Subwatersheds – Top Down (Flexible)
        1) Gingrich Run 1 (Gully Stabilization - 390 LF)
        2) Beck Creek 1 (Breached dam with active head-cuts and incised channel - 175 LF)
    b. Design-Build Competitively Bid On-Call Contracts
3. Funding Sources
    a. LCCD Countywide Action Plan (CAP) Grants
    b. PA Fish and Boat Commission Grants

Track 3 - WIP Prioritized Subwatersheds

1. Priorities
    - Snitz Creek
    - Killinger Creek and Gingrich Run
    - Beck Creek
    - Bachman Run
2. Highest Priority and Type of BMP to be Implemented
    - Agricultural BMPs – Farms where stream reaches are being impacted by agricultural activities, and a determination has been made that channel restoration is not necessary because natural recovery process has a high potential for success if BMPs are implemented.
        1) BMPs in and along Cultivated Fields
            a) Grassed Waterways
            b) Stream Buffers
            c) Constructed Wetland WQ Basins
        2) BMPs in and along Livestock Grazing Areas
            a) Exclusion Fencing
            b) Stabilized Livestock Crossings
            c) Stream Buffers
            d) Watering Facilities
    - Projects identified during Summer Field Reconnaissance Surveys will be referred to LCCD for BMP Funding and Implementation
3. Funding Sources
    - LCCD Funding Programs

Table 3 – Beck Creek Prioritized Projects Summary Table

Reach ID	Location	Reach Length (Feet)	Existing Problems	Proposed Solution
1A	Todd, Formanek	225	Lower Section – Incised channel with a high to very high bank erosion rating, failing dam with severe active head cuts threatening to degrade high quality wetland along old pond bottom.	Stabilizing the Pond Embankment and Head-Cuts would involve: • Removing the large trees from the top of the embankment. • Widening the gap to reduce the potential for future erosion by grading the cut faces to a more stable angle of repose and stabilizing with grasses and coir matting. • Stabilizing the active head-cut in the breach gap by backfilling with a layer of clay, a layer of compacted soil and installing a Boulder Cascade. Stabilizing the Unstable Channel Downstream of the Dam would involve: • Raising the streambed with a layer of compacted soil backfill and installing a series of Timber Boulder Step Pools. • Grading and stabilizing banks along the channel in areas where there are no large bank trees. • Planting the streambanks with native shrubs.
2A	East United Methodist Church	1,345	Middle Section Unstable eroding, undercut banks with leaning and fallen trees, numerous large debris blockages, aggradation.	Stabilizing the Unstable Channel would involve: • Removing fallen trees and debris blockages. • Grading banks to a stable angle of repose and stabilizing with grasses and coir matting. • Planting the streambanks with native trees and shrubs.
4A	East United Methodist Church	263	S4 – Deeply Incised, Highly Unstable with severe erosion along both banks.	Stabilizing the Unstable Channel would involve: • Raising the streambed with a layer of compacted soil backfill and installing a series of Timber Boulder Step Pools. • Grading banks to a stable angle of repose and stabilizing with grasses and coir matting. • Planting the streambanks with native shrubs.

4B	Henry	380	Moderately stable with localized erosion in some areas and banks trampled by historic (current?) livestock access in multiple areas, two (2) livestock crossings, one is reasonably stable, actively grazed pasture along both sides of channel, livestock fencing in place, but minimal buffers along some sections 0 – 10'. Where adequately buffered stable channel with extensive wetland areas.	Refer to LCCD for implementation of the following BMPs: • Fencing set back from the stream channel 30'. • Installing a stable livestock crossing. • Planting a 25' riparian buffer from top of bank with native trees and shrubs.
5	Henry	567	Middle Section (Pasture) - Moderately unstable with localized erosion in some areas, some riprap, banks trampled by historic and current livestock access in multiple areas, two (2) livestock crossings, one is reasonably stable, actively grazed pasture along both sides of channel, livestock fencing in place, but minimal or no buffer along some sections 0 – 10'. Where adequately buffered stable channel with extensive wetland areas.	Refer to LCCD for implementation of the following BMPs: • Fencing set back from the stream channel 30'. • Installing a stable livestock crossing. • Planting a 25' riparian buffer from top of bank with native trees and shrubs.
7A	Good	1,477	Unstable with bank erosion and aggradation throughout. Streambanks trampled by livestock along the majority of the channel length. Approximately 80% of the channel is overwide with heavy sedimentation. No fencing, no buffers.	Refer to LCCD for implementation of the following BMPs: • Fencing set back from the stream channel 30'. • Installing a stable livestock crossing. • Planting a 25' riparian buffer from top of bank with native trees and shrubs.
8	Weaver	1,224	Unstable -bank erosion along entire reach, overwide channel, streambank erosion throughout, significant streambed sedimentation, fine silts and organic muck, heavy mats of aquatic vegetation, mid-channel bars.	Active Project
9	Brummel	626	Unstable -bank erosion along entire upper section, flow diverted to a pond, debris jams.	Active Project
10	Reber	1,108	Unstable – Very tight meander bends along significant portion of reach, bank erosion along two thirds of reach, overwide channel, heavy sedimentation, rock revetment along the stream near the house failing in some locations. Good buffers along upstream section. No buffer along yard.	Stabilizing the Unstable Channel would involve: • Removing rock revetment. • Adjusting meander geometry to smooth out tight bends. • Along straight sections – Grade banks to a stable angle of repose and install toe benches with soil lifts to reconstruct bank and narrow channel.

				• Along the outside of reconstructed meander bends - Install toe wood and soil lifts. • Planting the streambanks with native trees and shrubs. • Establish a 15’ riparian buffer along both sides adjacent to yard.
11	Wegner, Dorsch Farm LLC	1,002	Unstable – Tight meander bends along upper section, failing rock revetment, bank erosion throughout, undercut trees, concrete blocks in the stream, overwide channel, heavy sedimentation and aggradation, footbridge, Buffers – upper section 0 - 15’, lower section – 25 – 90’.	Stabilizing the Unstable Channel would involve: • Removing rock revetment. • Adjusting meander geometry to smooth out tight bends. • Along straight sections – Grade banks to a stable angle of repose and install toe benches with soil lifts to narrow channel. • Along the outside of reconstructed meander bends - Install toe wood and soil lifts. • Planting the streambanks with native trees and shrubs. • Establish a 15’ riparian buffer along both sides adjacent to yard. • Maintain existing riparian buffers along lower section.
12	Reber	491	Moderately Unstable – Eroding banks, undercut trees, large amounts of debris, overwide channel, sedimentation, mid-channel bars, Buffers – 100’.	Stabilizing the Unstable Channel would involve: • Removing fallen trees and debris blockages. • Grading banks to a stable angle of repose and stabilizing with grasses and coir matting. • Installing toe benches with soil lifts to narrow channel. • Planting the streambanks with native trees and shrubs. • Maintain existing riparian buffers.
13	Beck Creek LLC	995	Upper Section - Moderately Unstable - Tight meander bends with bank erosion, under-cut trees, heavy sedimentation, Buffers – dense grass and trees, 25 – 40’ along right bank, 100’ along left bank.	Stabilizing the Unstable Channel would involve: • Adjusting meander geometry to smooth out tight bends.

			Lower Section – Unstable - Very tight meander bends, extensive bank erosion, heavy sedimentation, no buffers mowed grass to edge of water.	• Along straight sections – Grade banks to a stable angle of repose and install toe benches with soil lifts to narrow channel. • Along the outside of reconstructed meander bends - Install toe wood and soil lifts. • Planting the streambanks with native trees and shrubs. • Establish a 15' riparian buffer along both sides adjacent to yard. • Maintain existing riparian buffers.
14	Ridinger, Eckenrode	397	Moderately Unstable – Bank erosion, overwide channel, heavy sedimentation, dam and streamflow diversion into pond installed by previous landowner, channel confined between left bank and pond embankment to right. Buffers – 0 - 15'.	Stabilizing the Unstable Channel would involve: • Reconstructing right bank by installing toe benches with soil lifts to narrow channel and protect pond embankment. • Establish a 10' riparian buffer along both sides of channel, trees and shrubs along left bank and grasses along right bank (pond embankment).
15	Bomberger	341	Moderately Stable – Minor localized bank erosion, widespread heavy sedimentation and aggradation along streambed, Buffer – 5' of grasses and weeds. Adjacent cultivated fields.	Refer to LCCD for implementation of the following BMPs: • Adjacent to cultivated fields establish a 25' riparian zone along both sides of stream including a buffer of native grasses, trees and shrubs to filter runoff from cultivated fields. • Established Buffer Length - RB – 821', LB – 1,651'
16	Forney	1,343	Stream heavily embedded with sediment, thick algal growth, widespread aggradation, banks sliding into stream, minimal buffer along cultivated fields, ford stream crossing. Buffers – grasses and weeds, 5 – 8' along left banks, 0 – 5' along right bank.	Refer to LCCD for implementation of the following BMPs: • Grading eroding banks to stable angle of repose. • Installing a stable stream crossing. • Along pasture establish a riparian buffer 25' from top of bank with native trees and shrubs. • Adjacent to cultivated fields establish a 25' riparian zone along both sides of stream including a buffer of native grasses, trees and shrubs to filter runoff from cultivated fields. • Established Buffer Length - RB – 1,565', LB Pasture – 467', LB Cultivated Field – 1,185'

19	ROGC Golf Partners LP, LEBCC LLC	1,127	Minor bank erosion throughout, no streambank trees or shrubs, minimal to no buffers of grasses and weeds, overwide channel along some sections, heavy sedimentation, reduced flow from historic levels due to flow diversion into pond, pond has spillway into the stream, thick mats of algal growth, multiple culverted and timber bridge cart crossings; underdrains from tees and greens discharge into stream.	Work with Golf Course Owner to: • Grade and stabilize eroding streambanks. • Establish a 15' buffer of native grasses and shrubs with large shade trees spaced at 25 – 35' o.c. along banks. • Plant rough areas with native trees and shrubs. • Route underdrains into grass swales, bioretention basins, or constructed wetlands created along the edge of tees, greens or fairways and in rough areas.
20	LEBCC LLC	317	Minor, localized bank erosion, buffers - 10 -15' mostly grasses and weeds, no streambank trees or shrubs, multiple cart path crossings, thick mats of algal growth; large on-line pond. Owner concerned about loss of baseflow for significant portions of the year.	Work with Golf Course Owner to: • Grade and stabilize eroding stream banks along upper section. • Possible channel, spring and wetland restoration along section through pond. • Establish a 15' buffer of native grasses and shrubs with large shade trees spaced at 25 – 35' o.c. along banks. • Plant rough areas with native trees and shrubs. • Evaluate potential streamflow augmentation measures.
22	Robert Copenhaver	1,355	Moderately Unstable - Overwide channel, heavy siltation, thick algal mats, Fenced areas minimal erosion, Unfenced areas banks trampled and bare soil due to livestock grazing, one very wide and over used livestock crossing with no fencing. Buffers – 5' along both sides of stream. Landowner eager to discuss recommendations to improve conservation.	Stabilizing the Unstable Channel would involve: • Reconstructing banks by installing toe benches with soil lifts to narrow channel. • Planting new banks with native grasses, and shrubs. Refer to LCCD for implementation of the following BMPs: • Fencing set back from the stream channel 30'. • Installing a stable livestock crossing. • Planting a 25' riparian buffer of native grasses, trees and shrubs.
23	Edwin Copenhaver	926	Moderately Unstable - Overwide channel with heavy siltation and thick mats of algae and aquatic vegetation, streambanks are stable and low with	Stabilizing the Unstable Channel would involve: • Reconstructing banks by installing toe benches with soil lifts to narrow channel.

			buffers of 10 - 15’ including dense grasses, trees and shrubs,	• Planting new banks with native grasses, and shrubs. Refer to LCCD for implementation of the following BMPs: • Fencing set back from the stream channel 30’. • Installing a stable livestock crossing. Planting a 25’ riparian buffer of native grasses, trees and shrubs.
24	Ronald Copenhaver	1,634	Denied Access-Aerial – Overwide channel, Buffers Upper Field -5 - 15’, Lower Field – 25 – 40’. Between 2018 and 2022 aerial images show a 262’ section of channel with a tight meander bend is now a 107‘ straight channel. Not determined whether channel was intentionally relocated and straightened or formed due to a natural chute cutoff process.	Refer to LCCD for implementation of the following BMPs: • Fencing set back from the stream channel 30’. • Installing a stable livestock crossing. • Planting a 25’ riparian buffer of native grasses, trees and shrubs. • Maintain existing buffers along lower field.
25	Todd	134	Moderately Stable – Minor localized erosion, Heavy sedimentation, Buffer – grasses and weed 0 – 10’ along left bank and 5’ along right bank. Adjacent to cultivated fields.	Refer to LCCD for implementation of the following BMPs: • Adjacent to cultivated fields establish a 25’ riparian zone along both sides of stream including a buffer of native grasses, trees and shrubs to filter runoff from cultivated fields. Established Buffer Length - RB – 605’, LB – 636’.
Total	Channel Restoration	15,645		
Total	Buffer Establishment	7,854		

Table 4 – Bachman Run Prioritized Projects Summary Table

Reach ID	Location	Reach Length (Feet)	Existing Problems	Proposed Solution
Middle 5	J. and R. Risser	420	Moderately unstable, outside bends actively eroding, undercut banks, leaning and fallen trees, many debris blockages, heavy sedimentation.	Stabilizing the unstable channel would involve: • Grading eroding banks to stable angle of repose. • Stabilizing graded banks with coir matting and native grasses, trees and shrubs. • Adjacent to cultivated fields, establishing a 25' riparian zone with native grasses, trees and shrubs to filter runoff from cultivated fields. • Established Buffer Length – RB - 299' ,LB - 226'.
West 1	G.& J. Weaber, D.&E. Weaver, Humagain	279	Moderately unstable. Bank erosion and undercutting. Medium to large debris. Densely vegetated.	Stabilizing the unstable channel would involve: • Grading eroding banks to stable angle of repose. • Stabilizing graded banks with coir matting and native grasses, trees and shrubs.
West 2	R. and S. Satazahn	405	Moderately Unstable - Upper section incised 5 - 6' banks, some erosion, fallen trees.	Stabilizing the unstable channel would involve: • Grading eroding banks to stable angle of repose. • Stabilizing graded banks with coir matting and native grasses, trees and shrubs.
West 7	D. and B. White R. and D. Hoover	199	Moderately Stable - Minor localized erosion. Minimal buffer 10 - 15' buffer along both banks. Horse pasture along left side and cultivated field along right side of stream.	Refer to LCCD for implementation of the following BMPs: • Adjacent to pasture establish a 25' riparian buffer of native grasses, trees and shrubs. • Adjacent to cultivated fields establish a 25' riparian zone along both sides of stream including a buffer of native grasses, trees and shrubs to filter runoff from cultivated fields. • Established Buffer Length – 916' both banks.
West 8	D. and B. White J. and R. Risser	608	Moderately Unstable – Minor localized erosion, banks low and well vegetated. Upper Section - Minimal buffers along both 10 – 15' on White and	Refer to LCCD for implementation of the following BMPs:

			Risser Properties. Lower Section - Minimal buffers along both banks on Risser Property adjacent cultivated fields. One farm equipment crossing.	• Adjacent to pasture establish a 25' riparian buffer of native grasses, trees and shrubs. • Adjacent to cultivated fields establish a 25' riparian zone along both sides of stream including a buffer of native grasses, trees and shrubs to filter runoff from cultivated fields. • Established Buffer Length – 1,572' both banks.
1	J. and R. Risser	252	Moderately Stable – Minor localized erosion, low banks, generally well vegetated. Buffers along both banks 20'. Cultivated fields along both sides of stream. Two petroleum pipeline crossings.	Refer to LCCD for implementation of the following BMPs: • Adjacent to cultivated fields establish a 25' riparian zone along both sides of stream including a buffer of native grasses, trees and shrubs to filter runoff from cultivated fields. • Established Buffer Length – 760' both banks.
2	D. Waybright	1,540	Denied Access – Aerial Analysis - Overwide channel throughout, lower sections with thick growth of aquatic vegetation. Extent of bank erosion is unknown. Landowner's main area of concern – High bank (10 – 15') along bend on right side of channel exhibits significant erosion. Well buffered throughout, woods 50 - 100' plus	Work with Landowner to address main area of concern: • Reconstructing high eroding bank by installing toe benches with soil lifts. • Planting native trees and shrubs along restored bank. • Recommend evaluating other areas with potential bank erosion problems.
3	E. Church, T.&W. Inman, J.&K. Inman	500	Lower Section (Approx. 500')– Moderately unstable, bank erosion, undercut and leaning trees, channel overwide, heavy sedimentation and thick growth of aquatic vegetation. Minimal buffer throughout 5 – 15' along both banks.	Stabilizing the unstable channel would involve: • Reconstructing the eroding banks by installing toe benches and soil lifts to stabilize banks and narrow the channel. • Planting a 25' riparian buffer from top of new banks with native grasses, trees and shrubs.
4	Gary & Lucinda Horst	803	Several tight meander bends, severely eroding banks, overwide channel, heavy sedimentation, some banks trampled by livestock, unstable crossing.	Active Project
5	Lillian & Gerald Horst	1,224	Eroding banks, overwide channel, heavy sedimentation, banks trampled by livestock, unstable crossings	Active Project

6	Lillian & Gerald Horst	780	Eroding banks, overwide channel, heavy sedimentation, banks trampled by livestock, unstable crossings	Active Project
7	L. and A. Horning	758	Middle Section (758')- Moderately unstable, low-moderate bank height, actively eroding, overwide channel, heavy sedimentation, one unstable livestock crossing, rip-rap along some sections of right bank. Minimal buffers 0 – 10' throughout.	Stabilizing the unstable channel would involve: • Reconstructing the eroding banks by installing toe benches and soil lifts to stabilize banks and narrow the channel. • Installing livestock fencing set back from the top of new stream bank 30'. • Installing a stable livestock crossing. • Planting a 25' riparian buffer from top of new bank with native grasses, trees and shrubs. • Established Buffer Length – 1,309' both banks.
MS 8	Gary & Lucinda Horst	293	Upper Section (230') – Moderately stable, rip-rap along both banks, livestock fencing and bridge, Buffers – 10' right bank, 15' left bank; Middle Section (255') – Stable with a 30 foot concrete wall left bank downstream of bridge, stacked rock wall both banks – 130' right bank and 75' left bank, and additional 75' of rip-rap left bank, one unstable ford crossing downstream end of this section, large pile of junk and debris left floodplain, Buffers – 10 -30' right bank and 5 – 10' left bank; Lower Section (494') – Moderately stable, low banks with minor localized erosion and well vegetated grasses, trees and shrubs, overwide channel last 100', heavy sedimentation. Buffers – 20' along both banks. Adjacent cultivated fields.	Stabilizing the unstable channel along the Lower Section would involve: • Reconstructing the eroding banks by installing toe benches and soil lifts to stabilize banks and narrow the channel. • Planting native grasses, trees and shrubs along the new banks.. Refer to LCCD for implementation of the following BMPs: • Adjacent to cultivated fields establish a 25' riparian zone along both sides of stream including a buffer of native grasses, trees and shrubs to filter runoff from cultivated fields. • Established Buffer Length – RB - 700' LB – 440'
MS 9	D.&R. Copenhaver, D. Pence	650	Upper Section (504') Copenhaver – Moderately Unstable – Low banks, well-vegetated, minor localized erosion, some sections overwide, heavy sedimentation, unstable equipment crossing. According to the landowner, the streambed has filled-in with silt over the past decade. Buffers 10 – 15'.	Stabilizing the unstable channel along the Overwide sections would involve: • Reconstructing the eroding banks by installing toe benches and soil lifts to stabilize banks and narrow the channel. • Planting native grasses, trees and shrubs along the new banks.

			Lower Section - (450') Pence - Moderately Unstable – Low banks, well-vegetated, minor localized erosion, overwide channel throughout, heavy sedimentation. Buffers 10 – 15'.	• Installing livestock fencing set back from the top of new stream bank 30'. • Installing a stable livestock crossing. • Planting a 25' riparian buffer from top of new bank with native grasses, trees and shrubs. • Established Buffer Length – RB - 704' LB – 954'
MS 10	G. and J. Forney	176	Moderately Stable - minor, localized erosion, less embedded than previous reach. Buffers – Left bank adjacent to cultivated fields 20 – 50', Right bank adjacent to pasture 10 – 20'.	Refer to LCCD for implementation of the following BMPs: • Establish a 25' riparian zone along both sides of stream including a buffer of native grasses, shrubs, and trees. • Established Buffer Length – 881' both banks. • Maintain existing buffers >25'.
MS 11	M. and D. McCue	-	Landowner Denied Access – Aerial – Wider channel, no obvious problems, Buffers - Left bank adjacent to cultivated field 20 – 40, Right bank adjacent to pasture 0 – 15'.	Refer to LCCD for implementation of the following BMPs: • Establish a 25' riparian zone along both sides of stream including a buffer of native grasses, shrubs and trees. • Established Buffer Length – 906' both banks.
MS 12	M. and R. Swank	222	Moderately Stable - Narrower channel with low banks, well vegetated, Buffers 15' on both sides. Active buffer restoration project.	Refer to LCCD for implementation of the following BMPs: • Establish a 25' riparian zone along both sides of stream including a buffer of native grasses, shrubs and trees. • Established Buffer Length – 887' both banks.
MS 13	M. and R. Swank	198	Moderately Stable - Low banks, well vegetated, minor localized erosion, rip-rap and rock walls along some short sections. Livestock fencing and crossing. Buffers 10 - 25' both sides.	Refer to LCCD for implementation of the following BMPs: • Establish a 25' riparian zone along both sides of stream including a buffer of native grasses, shrubs and trees. • Established Buffer Length – 990' both banks.

14	R. & B. Copenhaver	2,291	Denied Access – Aerial Analysis – Upper Section – narrow channel with buffers 10 – 30'. Equipment Bridge. Lower Section - Overwide channel, heavy growth of aquatic vegetation; spring channel along left floodplain, footbridge, Buffers 50 – 80'.	Refer to LCCD for implementation of the following BMPs along the Upper Section: • Establish a 25' riparian zone along both sides of stream including a buffer of native grasses, shrubs and trees. • Established Buffer Length – 580' both banks. • Maintain existing buffers >25'.
15	Royal Road Properties	1,585	Denied Access – Aerial Analysis - Overwide channel, heavy growth of aquatic vegetation; split channel with island, unstable ford crossing near middle of reach. Buffers 50 – 135'.	Stabilizing the unstable channel would involve: • Reconstructing a single thread channel where channel splits at island. • Reconstructing the overwide section by installing toe benches with soil lifts to narrow channel. • Planting native grasses, trees and shrubs along the new banks. • Installing a stable ford crossing or bridge.
16	R. & B. Copenhaver	1,357	Denied Access – Aerial Analysis -Upper Section – Narrower channel with buffers 10 – 35', Equipment Bridge; Middle Section – Narrow channel with buffers 5 – 10'; Lower Section – Wider channel, heavy growth of aquatic vegetation, with buffers 5 – 40'.	Refer to LCCD for implementation of the following BMPs: • Establish a 25' riparian zone along both sides of stream including a buffer of native grasses, shrubs and trees. • Established Buffer Length – 1,357' both banks. • Maintain existing buffers >25'.
Total	Channel Restoration	9,237		
Total	Buffer Establishment	15,418		

Final Thoughts

The results of this Summer's Field Reconnaissance Survey confirm that land use in the subwatersheds has changed and will continue to change as new development encroaches on forest and farmland. This is particularly the case in the Lower Bachman Run subwatershed. In addition, land management practices will change with property ownership. The streams draining all of the subwatersheds have and will continue to adjust in response to these changes in land use and land management practices.

Tables 5 and 6 provide a comparison of the results of the 2004 field reconnaissance survey and the 2024 survey.

Subwatershed	Total Stream Length (LF)	Length Field Evaluated (LF)	Length Unstable (LF)	Percent Unstable (%)
Beck Creek	52,375	52,375	26,122	49.9
Bachman Run	37,727	37,727	16,880	44.7

Table 5 – Results of 2004 Field Reconnaissance Survey

Subwatershed	Total Stream Length (LF)	Length Field Evaluated (LF)	Length Unstable (LF)	Percent Unstable (%)
Beck Creek	52,375	45,028	14,565	32.3
Bachman Run	37,727	28,515	8,816	30.9

Table 6 – Results of 2004 Field Reconnaissance Survey
Note: Difference between Total Stream Length and Length Field Evaluated is related to 1) downstream limits of the survey and 2) landowner denial of access to some stream reaches. As previously noted these stream reaches were evaluated using aerial image analysis to the extent practical.

These results indicate that land management practices have improved along stream reaches in both subwatersheds. Implementation of livestock exclusion fencing, establishment of even minimal buffers and the natural recovery process have all contributed to these observed improvements. It also indicates that additional efforts are needed to meet the water quality, stream channel stability and in-stream habitat improvement objectives for these subwatersheds.

Finally, these results demonstrate that providing reasonably current information on stream and riparian conditions throughout the subwatersheds is critical to the continuing restoration and management efforts of the Quittapahilla Watershed Association and their partners. The Summer Intern Program provides the most cost effective means of gathering that necessary information.

It is not necessary to conduct these surveys every year. A more reasonable frequency for conducting them would be on a four to five year cycle, that is, evaluating each subwatershed every 4 to 5 years.