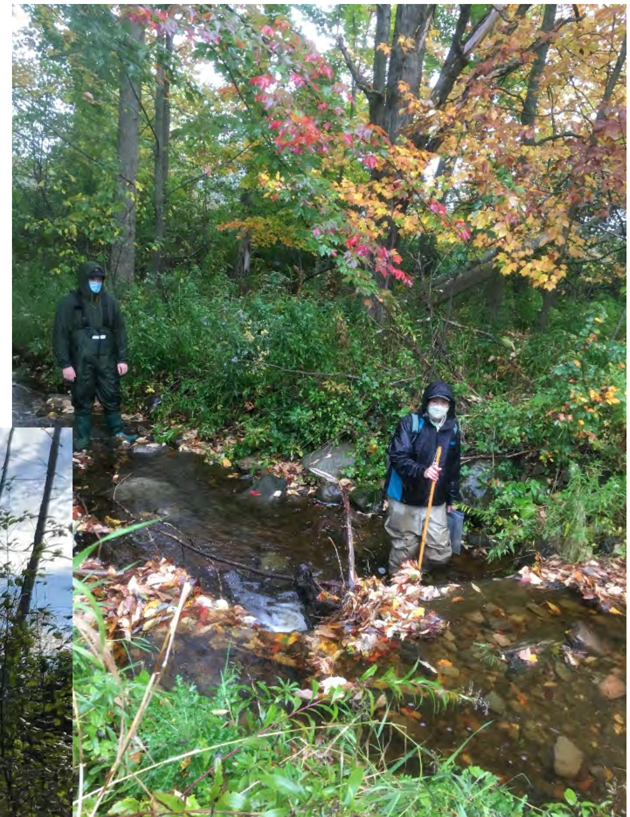
2020 Stream Walk of Marsh Brook

December 28, 2020



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Introduction

During the fall of 2020, a stream walk was undertaken on Marsh Brook to determine possible sources of sediment contributing to the large delta in Lake Carmi at the confluence of Marsh Brook. The stream walk was done over four days 8/31, 9/25, 10/2, and 10/6. The stream walk was led by River Scientist Staci Pomeroy. Joining Staci was Peter Benevento (for first day), Tucker Wehner (all days) and Karen Bates (last 3 days). Tucker is the Watershed Coordinator for the Franklin Watershed Committee (FWC), Peter is a member of the FWC, and Karen Bates is the Tactical Basin Planner for this area.

The stream walk was conducted to make observations of the current condition of the stream, document bank erosion, and identify possible project areas for improvement to the stream condition and/or reduce sediment loading to the stream. A Phase 2 Stream Geomorphic Assessment was done in 2006 on reaches M4T2.3S8.02 and M4T2.3S8.04 by Brendan O'Shea of Carmi Consulting. The stream walk provided a way to review how the stream has changed over the last 14 years and to capture information on additional reaches.

Executive Summary

The stream walk was conducted over four reaches: from the confluence with Lake Carmi to the upper reaches of the brook (Figure 1 & 2). These reaches were further refined through segmentation to capture differences along the brook for stream type and conditions; a total of 9 segments were created (Table 1). One segments, M4T2.3S8.04-B, was not evaluated due to the difficulty of walking the segment in deep narrow channel with very high vegetation. Suggestion is to evaluate this segment in late winter /early spring when dense herbaceous vegetation is limited. Of the 8 segments, 3 were in fair condition and the remaining 5 were in good condition. The three segments in fair condition were the one most downstream and the two most upper segments assessed. Based on a map and remote sensing review of the segment M4T2.3S8.04-B is likely in poor to fair condition.

Table 1:Segment ID and Rapid Geomorphic Assessment (RGA) Condition (Appendix A- RGA forms)

Segment ID	RGA Rating
M4T2.3S8.02-A	Fair
M4T2.3S8.02-B	Good
M4T2.3S8.03-A	Good
M4T2.3S8.03-B	Good
M4T2.3S8.04-A	Good
M4T2.3S8.04-B	Not Assessed
M4T2.3S8.05-A	Good
M4T2.3S8.05-B	Fair
M4T2.3S8.02-C	Fair

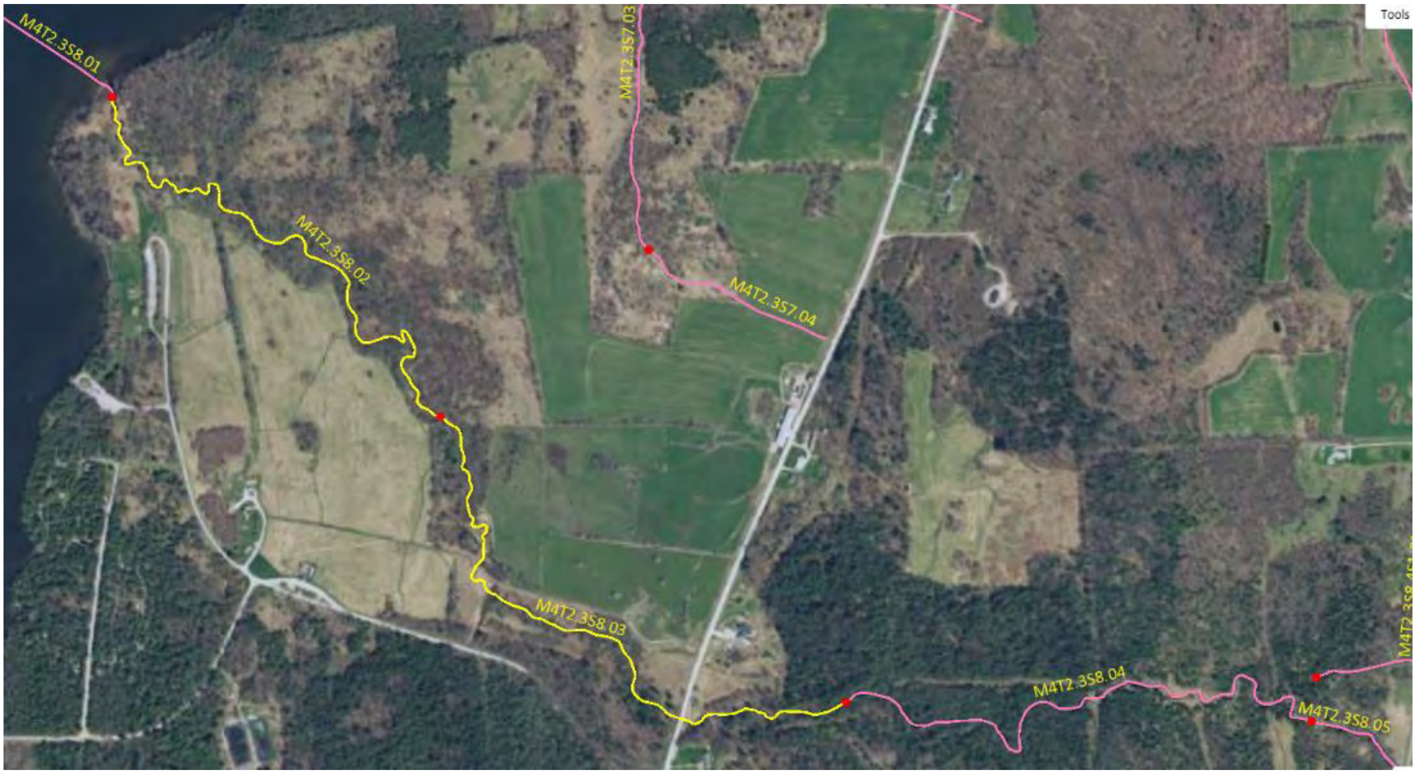


Figure 1 Marsh Brook lower reaches

Figure 2 Marsh Brook upper reaches

As part of this work, a review of current and historical orthophotos was done to help with understanding more of the impacts to the brook over time that are contributing to the current condition of the brook. The earliest photos easily available are the 1962 orthophotos, available on the VT Center for Geographic Information (https://vcgi.vermont.gov/). Google Earth Imagery has additional orthophotographs from 1995 to 2018. Additional orthophotos for years between 1962 and 1995 may be available at the NRCS office but, due to Covid-19 restrictions on in person office visits, were not accessed for this work. The 1962 ortho (Appendix B) clearly shows much of the Marsh Brook having been extensively channelized with limited riparian vegetation on most segments; the exception being reach M4T2.3S8.04 that was well forested in the 1962 orthophotos and showed little/no evidence of channel management. By the 1995 the lower reaches showed signs of planform adjustment and meander development from the straightened condition and riparian vegetation becoming established. The extensive historical channel straightening and channel management have contributed to the current condition of the channel as the stream is works to regain a more natural planform and connection to floodplain.

In all but the upper two segments, a review of the LIDAR shows evidence of channel planform adjustment since at least the 1999 Vermont Hydrography Data (VHD) streamline. These adjustments have allowed the stream to move toward a more stable condition but have also contributed to the sediment load in the stream and development of the delta at the mouth of the brook in Lake Carmi. The recent stream walk showed that there still some adjustment occurring, but no large-scale erosion and/or planform adjustment were noted. Due to the extensive riparian vegetation that has become established along the stream banks and floodplain the rate of channel adjustment and streambank erosion appears to be moderated and contributing less sediment load to the stream.

Part of the goal of the stream walk was to help identify possible projects to reduce sediment and/or erosion areas along the brook. While there is less sediment load coming to the stream from planform and bank erosion, there were still some areas that are impacted from the historic channelization and remain incised, having less access to floodplain during the 2-year(bankfull) discharge event, and may represent areas of possible restoration to improve floodplain connection. A large portion of the brook has good woody riparian vegetation, but there are a few areas where buffer planting can enhance/improve existing conditions. Undersized culverts, bridges and road drainage also contributed to erosion impacts and sediment loading. Replacing undersized structures cannot only improve geomorphic conditions but also allow for improved aquatic organism passage. Additional investigation around road drainage contribution is also needed. A total of 21 possible project areas were identified during the walk (Table 2).

The projects identified in Table 2 are considered preliminary and will require additional project development and investigation to determine the feasibility of the project. Projects are listed by the order at which they were identified during the stream walk (walking upstream). Reach maps are provided in Appendix C to show location of preliminary projects.

A preliminary priority for projects has been assigned based on level of sediment contribution, potential impacts to other natural resource were the project to be pursued, opportunity to engage landowners in looking at localized areas of inputs, area still being impacted from historic channel management, and area in the watershed where current conditions reduce the potential for sediment/nutrient attenuation. Higher priority projects are those where restoration and/or protection would provide the greatest improvement for the stream condition and overall watershed attenuation benefits. Lower priority projects are those where there is likely to be a large impact to another natural resource, and/or are areas of smaller localized sediment sources or impact. Other factors such as landowner interest, permitting and economic considerations will also influence the project feasibility and priority of when a project is pursued. In general, next steps for all the projects identified is to begin reaching out to landowners and, where noted, regulatory programs to evaluate possible next steps.   A holistic approach to develop projects along the entire stream corridor will provide the greatest benefits to the brook and ultimately Lake Carmi.

Table 2: Preliminary Project Identification

Project #	Segment ID	Project	Next Steps	Preliminary Priority	Considerations
1	M4T2.3S8.02-A	Potential Floodplain restoration to reduce incision	Contact State Park Coordinator to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements.	Low	Intact Class 2 wetland. Active restoration would impact important wetland area. Access to floodplain is available at moderate to high flows. Rare and Uncommon Species noted on BioFinder in this area
2	M4T2.3S8.02-B	Small stream bank stabilization project	Contact State Park Coordinator to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	Low	Bank erosion localized area and due to natural scour around downed tree. Area immediately upstream of rip-rap bank for crossing. Could be done with bioengineering to provide improved bank conditions for vegetation to become established
3	M4T2.3S8.02-B	Investigate overland flow from State Park field	Walk filed edge during late winter /early spring after snow melt and before vegetation growth starts to	Mod	Identifying areas where concentrated flow maybe occurring and contributing to erosion/sediment sources

			locate possible overland flow paths		
4	M4T2.3S8.03-A	Potential Floodplain/Wetland restoration	Contact landowner to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	Mod	Bank erosion moderate Localized area of incision that can be improved Wetlands Program confirmed wetland area
5	M4T2.3S8.03-A	Buffer Planting	Contact landowner to determine potential interest in exploring this project	High	Planting to be done back from top of bank to recognize future channel adjustment Provides important connection between up/downstream forested areas
6	M4T2.3S8.03-A	VAST / TH-33 Bridge improvement -	Contact local VAST club to determine potential interest in exploring this project	Low	Small sediment source. Bridge abutments impacted by scour and localized creating scour on banks.
7	M4T2.3S8.03-B	Buffer Planting	Contact landowner to determine potential interest in exploring this project	High	Provides important connection between up/downstream forested areas
8	M4T2.3S8.03-B	State Park Road (Rte. 236) Culvert Replacement	Contact VTrans to determine potential interest in exploring this project	High	Largest cause of active scour along the entire brook. Structure creates Aquatic Organism Passage impacts for all species. Noted as important Riparian wildlife crossing on BioFinder
9	M4T2.3S8.03-B	Road Drainage Evaluation and	Contact VTrans and State Park Coordinator to	Mod	Identifying areas where concentrated flow maybe occurring and

		project development	determine potential interest in this project		contributing to erosion/sediment sources
10	M4T2.3S8.03-B	Private Bridge – explore options to reduce erosion under bridge	Contact landowner to determine potential interest in exploring this project	Mod	Localized sediment source. Underside of bridge beams impacted by scour and localized creating scour on banks.
11	M4T2.3S8.03-B	Buffer Planting	Contact landowner to determine potential interest in exploring this project	Low	Area along upper slope of valley. Provides further connection of forested slope in this area.
12	M4T2.3S8.04-A	Stream Ford - assess possible erosion sources	Contact landowner to determine potential interest in exploring this project	Low	Minor sediment source. Ford does have steeper access road slopes on either side of channel that may concentrate flow in the roadbed
13	M4T2.3S8.04-B	Potential Active Floodplain restoration to reduce incision	Contact landowner to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	Mod	Wetlands Program confirmed wetland area Known that beavers historically affected this area Minimal active restoration may be needed if area able to be protected and beavers in area
14	M4T2.3S8.04-B	River Corridor Easement	Contact landowner to determine potential interest in exploring this project. Engage Rivers Program to determine potential strategies for this area	High	Protection of this area would reduce landowner conflict with beaver impacts and/or future channel adjustments. Area important in upper part of the watershed for long

					term sediment/nutrient attenuation
15	M4T2.3S8.05-A	Towel Neighborhood Rd. - Culvert Replacement Planning	Contact town of Franklin to determine potential interest in supporting this project	Mod	Engaging in planning activities to help with long term strategies at this structure.
16	M4T2.3S8.05-A	Towel Neighborhood Rd. – Hydrologically Connected Road Segment	Contact town of Franklin to determine possible projects under the Municipal General Road Permit for this section of road	Mod	Engaging in planning activities to help with long term strategies along this section of road.
17	M4T2.3S8.05-B	Potential Floodplain/Wetland restoration	Contact landowner to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	High	Wetlands Program confirmed wetland area Area still impacted from historic channel straightening
18	M4T2.3S8.02-C	Potential Floodplain/Wetland restoration	Contact landowner to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	High	Wetlands Program confirmed wetland area Channel still impacted from historic channel straightening Headwater area where sediment/nutrient attenuation can be enhanced
19	M4T2.3S8.02-C	Investigate opportunity with landowner to replace undersized culvert	Contact landowner to determine potential interest in project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	Low	Minor sediment source Structure undersized and contributes to localized impacts in the channel
20	M4T2.3S8.02-C // M4T2.3S8.5S1.01	Buffer Planting	Contact landowner to determine	Low	Planting close to the straightened and

			potential interest in exploring this project		incised channel would contribute to the stream being locked in that condition. If a wider buffer is possible, then planting 15-20 ft back from the channel may allow for some channel adjustment over time.
21	M4T2.3S8.02-C // M4T2.3S8.5S1.01	Potential small tributary / wetland restoration project	Contact landowner to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	High	Wetlands Program confirmed wetland area Channel still impacted from historic channel straightening Headwater area where sediment/nutrient attenuation can be enhanced Enhance important habitat for wildlife corridor to stream and wetlands

Reach Descriptions:

Reach M4T2.3S8.02 - Reach M4T2.3S8.02 was divided into 2 segments (Figure 3)

Segment A: Starting approximately 250 ft downstream of the State Park stream ford, the stream becomes a beautiful wetland stream. This reach was not segmented in the 2006 SGA work, but was determined to be important to create a segment in the 2020 stream walk to recognize the difference in stream type and process in this area as comparted to the upper portions of this reach. The channel dimensions become narrower (~10-15 ft) and the banks higher (~4-5 ft). This is expected in this type of system as the slope is very low and the soils are cohesive; allowing the stream to set up a narrower width and deeper channel than expected from the Hydraulic Geometry Curve channel estimates. The stream has a very sinuous planform. The current planform shows several more meanders than the VHD streamline (released in 1999).

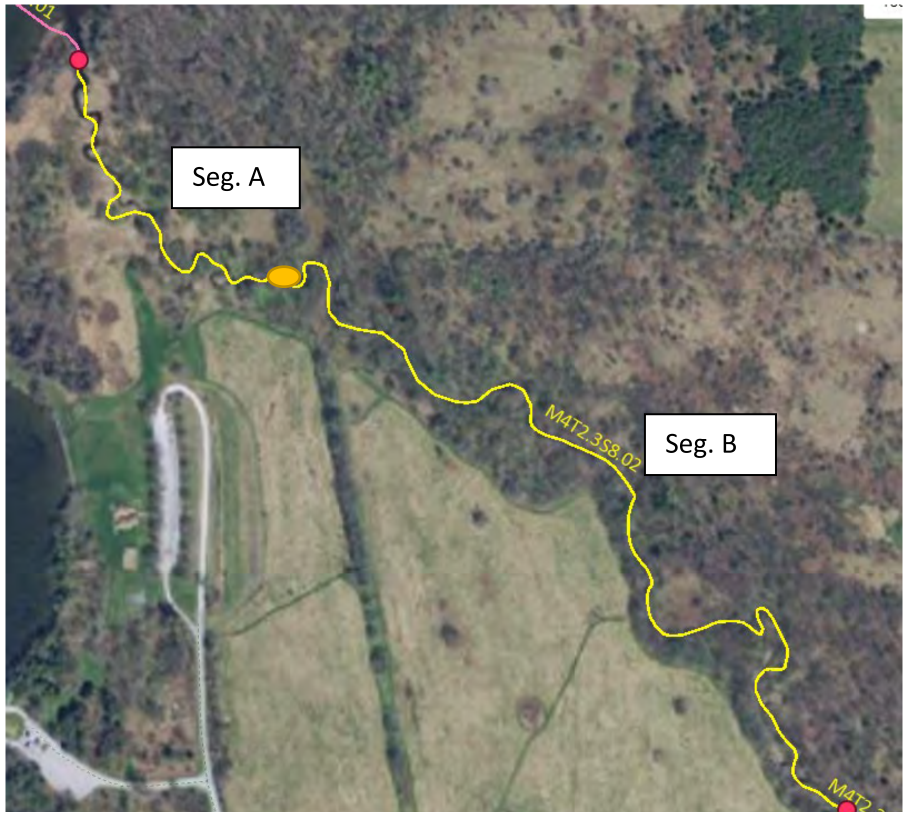


Figure 3 Reach M4T2.3S8.02

The geology maps for this area show that the Champlain Sea (Figure 4) had an influence in this area of the State Park lands. The entire Marsh Brook stream area was also influenced by the Glacial Lake Vermont – Upper & Lower Fort Ann Phase. The soils we saw in the stream bank reflect the sediments that these large waterbodies left behind. The streambank material was made up of fine silts/sands and clay.; and the stream bed materials were fine gravels and sands. The soils in this area are a “Rumney variant silt loam”; often associated with floodplain soils that can be frequently flooded.

There was minimum bank erosion seen during the stream walk. While there are bare banks, there were no slumping/failed banks seen. Incision (the amount the stream is disconnected from its floodplain), was moderate; meaning that at those 1-2 year events there is limited floodplain access; but that at flows are in the 10-50 year events there is floodplain access available.

Evidence of sediment deposition in the floodplain was noted during the walk. The last large flood event in this area was Oct.30/Nov. 1st, 2019.

- Explore potential floodplain restoration/lowering to provide more floodplain access during lower storm events.
- This area is a Class II wetland and has Rare and Uncommon Species noted on BioFinder

Figure 4: Area of Champlain Sea along Marsh Brook

Geomorphic Condition: Fair – Extensive historic channelization was cause of the historic incision in the reach. Significant planform adjustment since at least the 1999 VHD (~ 20 years) has benefited the stream by creating a more sinuous channel, reducing the slope in the channel, developing habitat and creating some access to lower floodplain, but has also generated significant sediment as the meander development occurred. Current planform adjustment appears to be minimized.

<u>Segment B</u>: As one moves upstream, and approaches the State Park ford, the stream begins to gain a little more slope and the stream transitions from a wetland stream to a more forested area, and the channel becomes wider (~18-20 ft) and the banks shallower (~3-4 ft). The stream is shown as a relatively straight line on the VHD-stream line. There were sections of the channel in this area that were narrower with higher banks

Based on the stream walk, and LIDAR (Figure 5) evidence, the stream has regained a greater sinuosity than what was documented in 1999. This may be due to how the VHD was created using orthophotos and topographic maps as a basis for stream location, since LIDAR was not available at that time. Given the densely wooded riparian in this area, the stream is hard to see in detail on the orthophotos and, changes in the stream channel may not have been captured during the VHD process. For the purposes of this planning effort, it will be assumed that changes have occurred since the 1999 VHD layer was published. There have been several larger flood events that have occurred during the last 20 or so years, likely contributing to the channel changes that are seen.

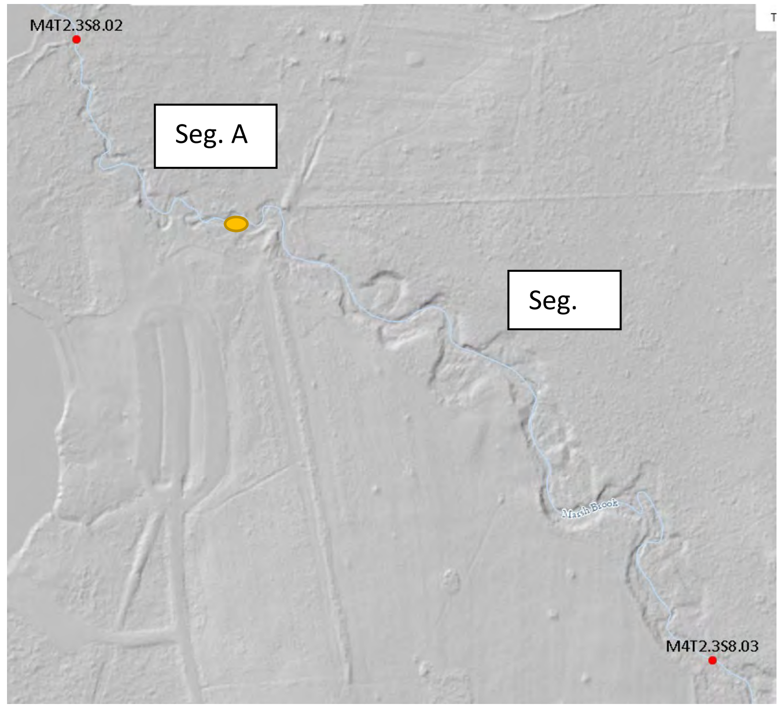


Figure 5: LIDAR imagery showing change in stream channel

The streambank material was made up of fine silts/sands, along with courser materials gravels/cobbles.; and the stream bed materials were gravels and cobbles. Small point bars have developed on the inside of the meander bends. The soils in this area continue to be a "Rumney variant silt loam"; often associated with floodplain soils that can be frequently flooded.

There was minimum bank erosion seen during the stream walk. While there are bare banks, there were no slumping/failed banks seen. Bank erosion was generally associated with outside meander bends, channel along a valley wall, and locations of reduced riparian vegetation.

- One area just upstream of the State Park stream ford is an eroding bank that could be explored for possible remediation of the erosion. Toe protection of the bank through wood addition and planting of the upper bank is an example of possible project type in this location.

Incision was minor to moderate; meaning that this section of stream had lower floodplains that are being accessed at those 1-2 year events and have higher floodplains are accessed during the larger events. Evidence of sediment deposition on both areas of floodplain was noted during the walk. The 2006 SGA reported this segment to be in good condition; 14 years later, this segment is still in good condition for channel stability and connection with its floodplain.

Wood riparian vegetation became a larger factor in this area of stream. The stream banks and floodplain has extensive woody riparian vegetation in this area; as well as there being significant alder growth that is directly along the bank and extending into the channel (Figure 6). More wood debris was also seen in the channel, contributing to connection to the floodplain, channel adjustments, channel braiding, sediment storage, and habitat in the channel.

Figure 6: Alder tress across channel holding sediment

There were a few locations that were seen to have overland contributions coming from the upland areas. The tall herbaceous vegetation prevented a good view of the track of the overland flow and where it originated. There was minor erosion started in the lower portion of the flow paths that were seen along the river.

- Further investigation of the overland flow paths when vegetation is more limited (ie: late winter when no snow / early spring before vegetation become established) will help with determining where they originate and what extent erosion concerns are.

Geomorphic Condition: Good –Extensive historic channelization was cause of the historic incision in the reach. Significant planform adjustment since at least the 1999 VHD (~ 20 years) has benefited the stream by creating a more sinuous channel, reducing the slope in the channel, developing habitat, and creating access to lower floodplain, but has also generated significant sediment as the meander development occurred. Current planform adjustment appears to be minimized. Stream is stabilizing as riparian vegetation has become well-established on both stream banks and floodplain. Sediment storage is seen in the channel as point bar development and associated with woody vegetation in the stream channel. Fine sediment storage was also noted on the floodplain.

<u>Reach M4T2.3S8.03</u> Reach M4T2.3S8.03 was divided into 2 segments (Figures 7 & 8)

Figure 7: Reach M4T2.3S8.03

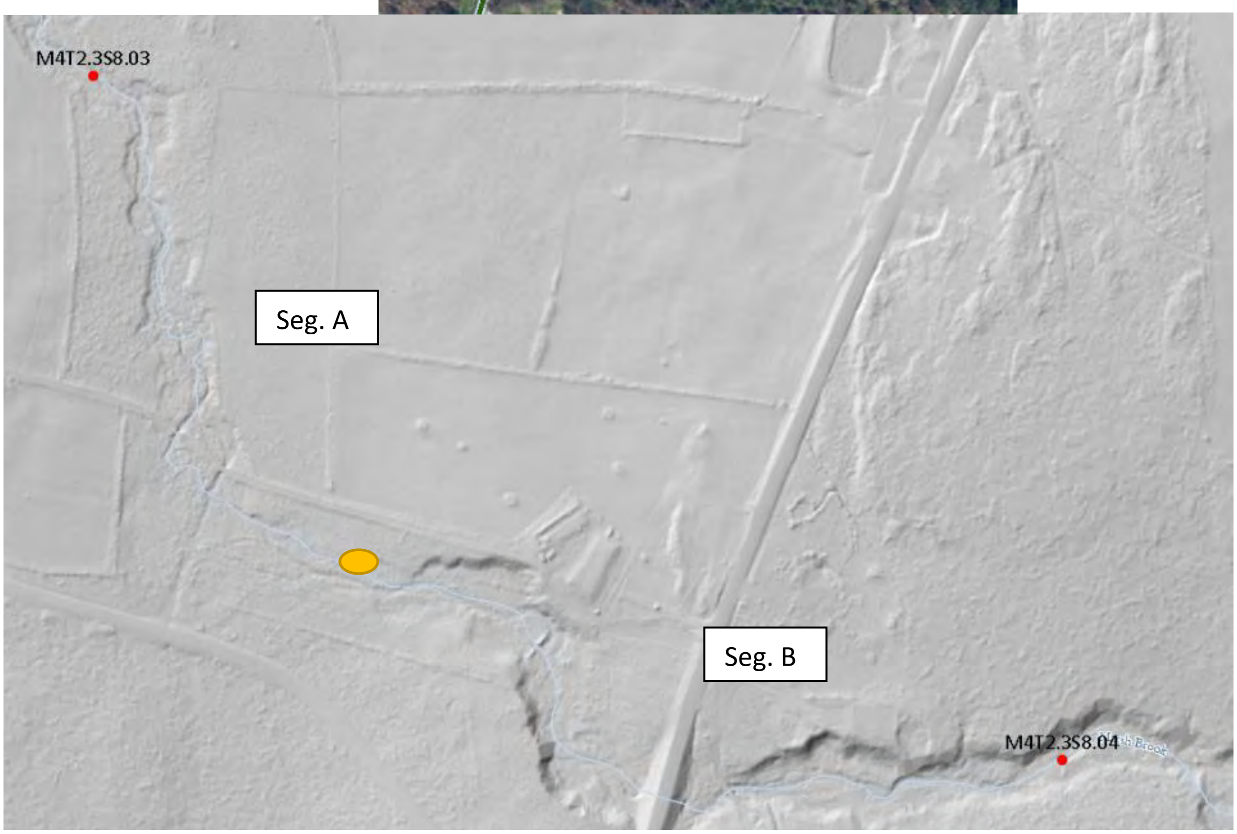


Figure 8: LIDAR for Reach M4T2.3S8.03

<u>Segment A</u>: The first portion of this reach is very similar M4T2.3S8.02 Segment B, with stream bed and bank materials, valley type, floodplain access, and vegetation type remaining the same as the downstream segment. This segment also is influenced by amble speckled-alder growth along and across the channel. The channel has areas of braiding around debris jams and areas of sediment storage in the channel associated with wood in the channel. As with the downstream segment, channel changes can be seen on the LIDAR.

Figure9: Incised channel under power line

Through most of the segment, incision was minor to moderate; with lower floodplains developing in historically incised channels. One area where the channel remains more incised and still showing evidence of historic management, in the area of the power line crossing (Figure 9). In this area the channel become much narrower and deeper than the upstream and downstream channel dimensions.

- Area could be a location to explore potential for restoration project to reduce incision through floodplain connection.

Overall, the segment has a well forested, greater than 100 ft, riparian buffer; however there are a couple small areas where the riparian woody-vegetation is less than 25 ft near the stream bank. These areas do not appear to be highly managed and there is a well-established herbaceous buffer vegetation.

- This area could be looked at for possible tree planting to further the connection with the overall wider woody riparian buffer of the stream.

There is one stream crossing are seen on this segment. The VAST trail crosses on the old Town Highway 33. The crossing consists of 2 small bridges that span the floodplain. The crossing had previously been 2 undersized culverts. The structures were replaced about 2 years ago by local VAST snowmobile club. Flow appears to generally go through the right (looking downstream) structure and while there is some flow in the left structure it appears to be primarily accessed during higher flow events. While the bridges are wider, the abutments are essentially right on the stream bank and experiencing erosion along the waste-block abutments.

- Continuing to work with VAST to look at long term crossing needs and options for wider structures to move abutments back from stream bank. This will reduce erosion impacts to abutments and provide wider opening for stream flow and debris to move through the structure.

- Opportunity for bridge project and floodplain restoration project to be looked at together as a larger project for this area.

The stream braids through a few different channels immediately upstream of the bridges. This may be due, in part to the historic undersized culvert crossing causing additional sediment and debris to be stored upstream of the culverts, contributing to the stream working around that stored material. This area is also well vegetated with alders, and as with the downstream segment, these trees are growing right along the stream bank and across the channel, contributing to sediment and debris storage and the stream moving around these obstacles.

Geomorphic Condition: Good –Current planform adjustment appears to be minimized. Stream is stabilizing as riparian vegetation has become well-established on both stream banks and floodplain. Small portion of stream still incised and showing impact of channel management and reduced riparian vegetation.

Segment B: Approximately 650 ft upstream of the TH 33/VAST crossing the valley begins to become narrower, with higher valley walls, and a steeper valley slope. The vegetation along the stream bank changes from a dominant alder to a mixed hardwood overstory with herbaceous and shrub understory. The stream bed becomes more cobbles and boulders, while streambanks are a till mix of fines and course materials.

Figure 10: LIDAR showing old dam location

Approximately 520 ft downstream of the State Park Road (Rte. 236), there is evidence of an old dam. This can be seen on the LIDAR (Figure 10). In talking with a local landowner, this was likely associated with a historic mill. A large section of the old dam remains across the left (looking downstream) side of the valley. The structure is a very large dry-stacked stone wall (Figure 11). It is difficult to determine the full extent that the historic structure has contributed to the current condition of the stream. Historically, the structure may have contributed to upstream aggradation (build up) of sediment in the area of the impoundment, and downstream channel incision by creating hungry water. Hungry water is river flow. with excess transport capacity. It has more stream power to transport than

Figure11: Picture of old dam

available sediment. As a result, it tends to erode its bed and banks to compensate. When the longitudinal continuity of sediment transport is interrupted (e.g., from dams), hungry water results. The remaining portion of the dam does affect flooding in this area by creating a barrier across the left side of the floodplain. The valley wall across from the remaining dam section is very steep and evidence of past erosion/mass failure were noted. The erosion appears to be stabilizing, with limited bare soils seen and vegetation beginning to be established on the slope. This area is still vulnerable to erosion due to its location on the steep valley wall and limited floodplain access.

Between the Rte. 236 crossing and the old dam site, the river has access to floodplain and there is a large flood-chute across the back side of the left (looking downstream) floodplain. The flood-chute channel bumps up against the valley wall in one location and a small mass failure was seen. During high flows the mass failure likely experiences some scour along the face of failure but is not generally a source of sediment to the stream during regular flows. The mass failure also has some natural large wood along the base of the failure that is helping to contribute to stability along the base of the failure.

This segment has a culvert stream crossing on State Park Road (Rte. 236). A culvert assessment completed in 2011, showed that the current structure width, 6 ft., is considerably undersized, only 40% of the affective bankfull width, 15ft. On the downstream side, the structure contributes to significant scour and erosion (Figure 12), creating a large sour hole and erosion issues around the failing culvert outlet wall. The structure is rated as an aquatic organism passage structure due to the large perch at the outlet and low flow in the structure. On the upstream side, the under sized structure is causing sediment build up (Figure 13); contributing to a poor alignment with the stream and culvert inlet, as well as erosion along the streambanks as the river makes a sharp turn to enter the culvert. The wingwalls are stacked stone and there is evidence of erosion between the culvert and the wingwalls.

Figure12:State Park Road (Rte. 236) culvert outlet

- Over the entire distance of stream walked, the structure is the most noteworthy feature that is directly causing erosion in the stream channel. Planning for replacement of the undersized structure should be looked at to determine potential time frame in VTrans structure work. This would be considered a priority project due to the structure being geomorphically incompatible; contributing to a significant erosion at the outlet, sediment aggradation and planform adjustment at the inlet, and creates an aquatic organism passage issue.

On both sides of the culvert road runoff from Rte. 236 enters the brook through road ditches. On the downstream side of the culvert, the road drainage coming from the State Park side, crosses under the entrance road to the park, flows down the steep bank and then across the floodplain downstream of the culvert. There did not appear to be a significant source of erosion from the road runoff on this side, but the drainage is a potential source of concentrated flow that could contribute to erosion in this area. On the right side (looking downstream) the road drainage appears to sheet flow down the steep bank; however, the herbaceous vegetation was very tall, making it difficult to see if any areas of erosion associated with flow along the bank.

Figure13: State Park Road (Rte. 236) culvert inlet

On the upstream side of the culvert, the road drainage across from the state park entrance is contributing to a gully formation along the valley wall leading to the brook. There has been some rip-rap work done on the upper most part of the gully where the runoff enters the gully, but erosion continues along remaining bank and channel before entering the brook. As with the downstream right side (looking downstream) the herbaceous vegetation was very tall, making it difficult to see if any areas of erosion were associated with flow in the ditch and/or along the bank.

- Further investigation of the road drainage on both sides of the road and either side of the culvert is warranted to determine if erosion issues can be addressed, document condition of areas not able to be seen due to high vegetation and consider if additional ditch practices to slow/reduce water being delivered to the stream would be feasible.

Moving upstream from the culvert the stream continues in a narrow valley with a high valley wall on the right bank and more gradual valley and historic higher terrace on the left side. Approximately 140 ft upstream of the Rte.236 crossing there is a private bridge crossing. Though the bridge spans the stream and does not appear to be affecting the stream process in this area. There is some evidence of erosion under the bridge along the stream banks. This appears to be an access road for farm/logging work.

- There may be programs to work with the landowner to investigate if the erosion is a sediment source that needs to be/can be addressed.
- Tree planting along the road to the private cemetery

Further up from the private bridge the stream shows evidence of also changing since the 1999 VHD streamline. The stream showed signs of historic incision but has developed a lower floodplain along much of its channel. The channel stream bed is dominated by cobbles and gravels with boulders seen throughout. The stream banks are a mix of fines and course material.

Erosion in section from the State Park road crossing to the reach point is minimal, and generally on outside bends where it would be expected. No large sources of sediment were seen that needed to be addressed.

Within this portion of the segment there were also some small gullies noted that were coming in from the uplands on either side of the valley. Walking up the gullies showed that these gullies were typically associated with natural seeps and wetlands draining the soils. Soils in this area are Cabot silt loams and are poorly drained; likely contributing to the number of seeps and forested wetlands seen. The gullies were not large or considered as significant sediment sources.

Figure 14: Well established large trees on streambank

This upper portion of the segment has had a wooded riparian area since at least the 1962 orthophotos. There are large trees along the stream banks (Figure 14) and a mixed forest in the floodplain. The understory tended to be more open with the denser canopy cover. This has also likely contributed to the large wood that was seen in the stream channel. The wood was seen to be providing sediment storage and habitat in the channel.

A large old stone wall, similar to the downstream old dams' wall, was seen in this upper portion of the segment. A review of old maps of the area shows a saw mill in this location on the 1857 map (Franklin Historical society webpage). The remaining parts of the wall do not have any impacts on the river or floodplain.

Geomorphic Condition: Good –Current planform adjustment appears to be minimal. Stream has well established riparian vegetation on both stream banks and floodplain. Impact from State Park Rd. (Rte.236) contributing to current impacts on the channel in the immediate area of the culvert as well as upstream and downstream of the culvert.

Reach M4T2.3S8.04 Reach M4T2.3S8.04 was divided into 2 segments (Figure 15 & 16)

Figure 15: Reach M4T2.3S8.04

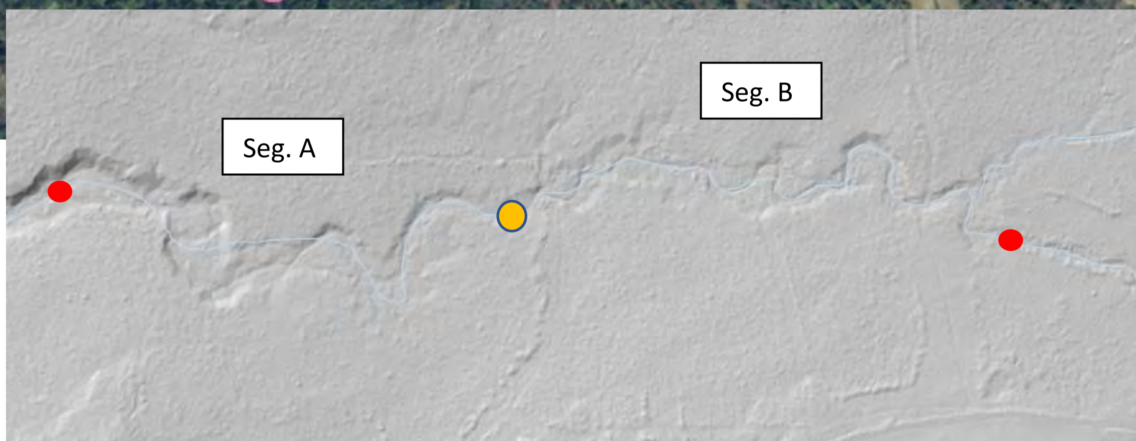


Figure 16: LIDAR of Reach M4T2.3S8.04

Segment A: As one moves upstream from M4T2.3S8.030-B, the valley wall on the right bank becomes less steep and the valley and stream slope becomes slightly lower. A review of the LIDAR shows that the stream channel in this area has also undergone channel adjustment and planform changes since the 1999 VHD streamline was delineated. There is evidence historic incision however, there are new lower floodplains throughout much of the segment (Figure 17). The bed materials are gravel/cobble dominant with fewer boulders seen than in the

Figure17: Area showing historic floodplain and lower floodplain

downstream segment. The streambanks continue to be a mix of fines and course material that are unconsolidated. Erosion was minimal and no large sources of sediment were noted for needing to be addressed.

This area too has been well forested since at least 1962 orthophoto. There are large trees along much of the streambank and the floodplain is a mix tree with limited understory due to dense canopy cover.

There is a stream ford approximately 470 ft upstream of the reach break. The forestry road and ford were generally in good condition. The road is steep coming into and out of the ford and could become a location for water to become concentrated and cause erosion.

- There may be programs to work with the landowner to evaluate the ford and access road to assess possible management strategies that help reduce potential erosion concerns.

The segment is in good geomorphic condition.

Geomorphic Condition: Good –Current planform adjustment and erosion appear to be minimal. Stream has well established riparian vegetation on both stream banks and floodplain. Evidence of historic incision, but channel has developed lower floodplain access throughout the segment.

Segment B: Segment B begins approximately 1,750 ft upstream of the Reach break. There is a change in valley type to a wider and lower slope condition. The change in valley slope is reflected in the change to more of a wetland stream type; narrower and deeper. Vegetation changed from mixed tree dominated to an herbaceous and shrub dominated condition. Soils mapped also change in this area back to a hydric condition. The channel became deeper and narrower dense grass along the banks; making it difficult to walk through the channel. The vegetation along the floodplain was also very dense, tall grass that made walking difficult. For this reason we were unable to complete a stream walk in the area.

A map review was done of the segment to help provide an initial assessment and recommendations for next steps.

Map review: The earliest orthophotos found were from 1962 and showed this area forested. Google Earth Imagery has orthophotos from 1995, 2003, 2004,2006,2008,2009,2011, 2012,2015,2017, and 2018. There are two farm roads that cross the stream on either end of the segment. Between the two roads the area appears to have changed sometime between 1995 and 2003 from a forested condition to start to a more open condition. It is difficult to tell from the imagery if there may have been beaver ponding on the stream; in 2004 seems to show ponded conditions on some parts of the stream. The imagery in 2007 is not very clear, but by the 7/15/2008 photo the area is clearly seen to be no longer forested around the stream.

The 6/9/2018 imagery is of good resolution and allowed for a remote review of the channel condition. Though difficult to full say from just the image, there appears to be bank slumping along much of the channel; this is based on what look to be fracture lines in the along the top of the bank and areas of small rill erosion along some bank faces. The 5/19/2012 and 5/12/2015 images seem to show a slightly wider channel, but also likely steeper bank faces. The imagery in

2018 was also a month later than those in 2012 and 2015, so the channel may also be more obscured by vegetation in 2018.

This area should be walked when there is no and/or minimal vegetation growth, ie: end of winter when minimal/no snow and/or early spring. This would provide information on potential incision, bank erosion concerns, and floodplain condition.

From imagery review channel conditions appear to be poor to fair condition. Considerations for additional site walks and investigation on this segment.

- This area has hydric soils and is in a location of the watershed that would provide important attenuation assists. A review of potential wetland/stream restoration opportunities would be warranted.
  - Check with landowner to see if this area had beaver influence in the past and/or if recall any historic channel management. The downstream portion of this segment appears to be very straight; possibly indicating past channel management.
- River Corridor Easement – Passive restoration through reducing potential beaver / channel adjustment with landowner. May reduce need for/level of active restoration if beaver able to be reintroduced in this area.
- Buffer planting may be difficult as a stand-alone project. Based on the dense herbaceous vegetation it may be difficult to get trees established unless resources and methods available to do help trees out compete the grasses.

Reach M4T2.3S8.05 Reach M4T2.3S8.05 was divided into 3 segments (Figure 18 & 19)

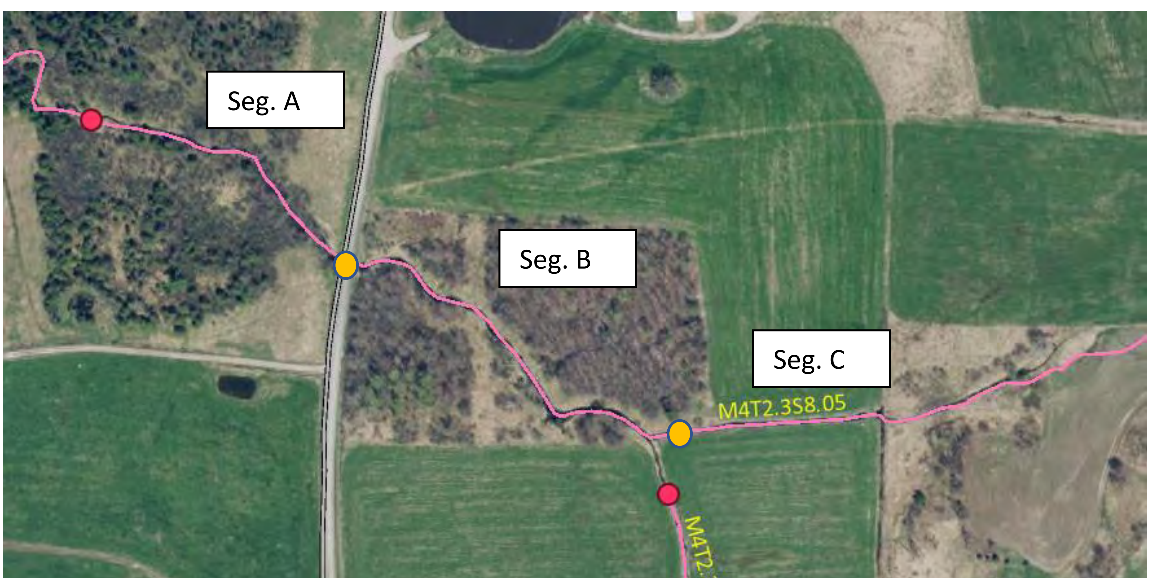


Figure18: Reach M4T2.3S8.05

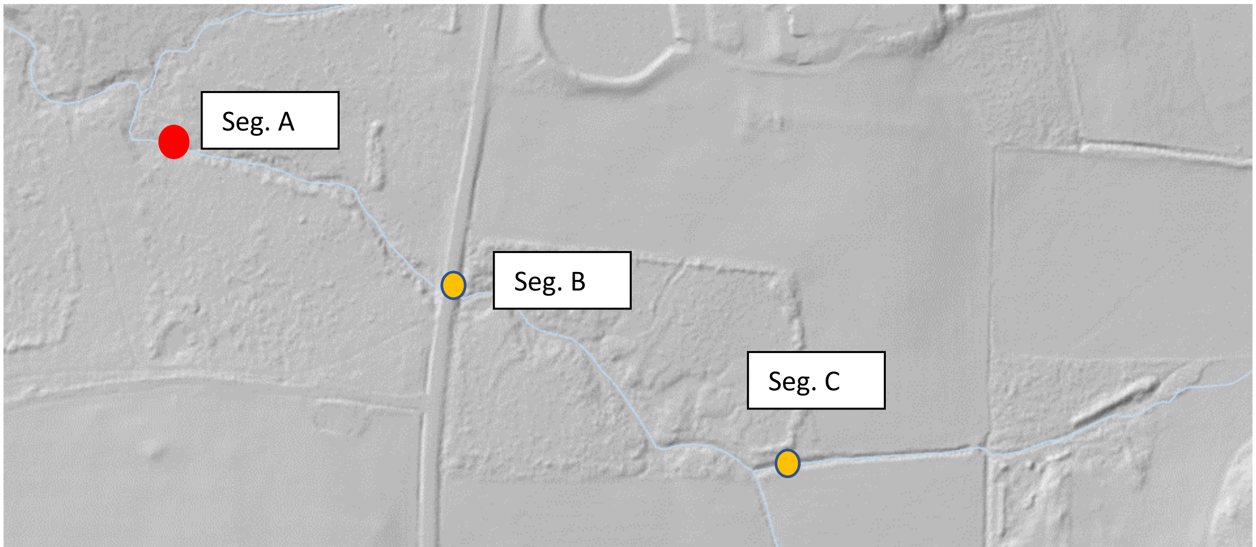


Figure19: LIDAR of Reach M4T2.3S8.05

Segment A: Segment A starts just upstream of the confluence of the small tributary coming in from the north and goes approximately 845 ft to the Towle Neighborhood Rd. crossing. The small tributary was not walked.

Moving up from the small tributary confluence the stream bed became small gravels and cobbles. Once again, the alders became dominant along the channel and the floodplain (Figure 20). The channel has access to floodplain through much of the segment. Minimal erosion was noted in this segment.

Observation of a greater number of fines and algae on the stream bed was noted. As there was limited erosion in the segment, the increase in fines may be an indication that perhaps upstream there were inputs. Flows during the summer were generally low and may not have accessed the floodplain during these smaller storm events; allowing sediment to settle out in the channel.


Figure20: Dense vegetation along banks and floodplain

Geomorphic Condition: Good –Current planform adjustment and erosion appear to be minimal. Stream has well established riparian vegetation on both stream banks and floodplain.

Segment B: Segment B starts at the Towle Neighborhood culvert crossing and continues upstream about 900 ft to the confluence of a small tributary entering from the south. The Towle Neighborhood Rd. crossing is a 4 ft corrugated metal pipe. There is minimal impact from the culvert on the stream channel in this area. The slope is low and there is sufficient water throughout the structure and no perch at the outlet (Figure 21). Some erosion of the downstream banks was noted. There is no header around the outlet of the structure and some erosion was noted on either side of the culvert.


Figure21: Towle Neighborhood Rd. culvert

- Based on the watershed size, 1.6 sq. mile, and VT hydraulic geometry curve (VT HGC) bankfull estimate, the structure size should be approximately 16 ft wide. The wetland stream type and cohesive soils would suggest a narrower bankfull width, than suggested by the VT HGC, would be likely to occur in this segment of the stream. The channel has also been managed overtime in this area, creating a potentially different bankfull width than expected. Review with town to determine if any known issues with the culvert (ie: beaver and/or debris plugging; flooding, condition) and timing for potential culvert replacement. Effort is for general planning for future work that may be needed on the structure in this area.
- This section of Towle Neighborhood road is considered Hydrologically connected under the Municipal Road General Permit (MRGP) considerations. Continuing to work with the town to determine if the road is meeting the MRGP requirements and/or what steps are needed to bring the road into compliance.


Figure22: Fine sediment and muck clouded water

On the upstream side of the culvert there was a sharp change in the stream type and bed materials. Once again, the stream transitioned into a wetland stream, being narrower and deeper. Unlike downstream wetland section that had fine gravels and sand beds, that were generally firm underfoot; this streambed materials in this segment were muck and very soft underfoot. Fine sediments and material were stirred up when walking in the channel (Figure 22)

- The landowner noted that this area has had frequent beaver influence over the years and channel management to try and address flooding of the fields due to beavers and water back up. A review of the 1857 map (Franklin Historical Society) (Appendix B) shows there was a sawmill impoundment in this area. It is unclear the extent of the impoundment, or how long it was in place; but is a part of the story in this area and may have contributed to the type of legacy soils seen in the floodplain along the channel. The 1962 orthophoto shows the stream still maintained a few meanders in its planform. By the 1995 orthophoto the channel had been fully straightened. The stream has incised in this area and there was limited lower floodplain noted. The low valley slope and undersized culvert are contributing to this area being more depositional and impounded.

- Based on the historic channel management modifying the channel planform and the incision, this area could offer potential restoration opportunity. Further evaluation of the site is needed to consider possible wetland/stream restoration strategies.
    - If a restoration were feasible a River Corridor Easement would be also be explored for possible incentive payments for the landowner as well as long term protection of the restoration project.
- The landowner does have concerns with possible impacts from beaver becoming established in this area that would contribute to flooding of hay fields.
- Evaluation of the muck in the channel could help determine if the material is a high phosphorus source.

Geomorphic Condition: Fair – Minimal current planform adjustment and erosion. Historic channel management still contributing to current condition. Deposition and storage of fines in the channel causing channel to have very mucky streambed materials. Channel incision limiting floodplain access to deposit materials on the floodplain.

Segment C: Segment C begins just upstream of the small tributary confluence and continues upstream about 490 ft. to the property line boundary. Imagery review show this segment has been managed essentially as a field ditch since at least the 1962 orthophoto. The stream is incised and has no lower floodplain available (Figure 23). Due to the incision and very straight condition of the channel, it is functioning as a transport reach; meaning sediments being delivered to it are quickly passing to downstream reaches. There is no woody riparian buffer and hay is mowed up to the top of the channel bank.

Figure 3: Channel managed as a farm ditch

The end of the segment has a 3 ft. culvert across the channel. The culvert is contributing to some scour on the downstream side and likely water back up during higher flows.

- Due to the incision and past channel management this area could be a potential restoration site. Because the landowner is concerned about flooding of the fields, a lower, inset floodplain (often called a two-stage channel) may be a way to gain some floodplain for lower flows within the incised channel.
    - If a restoration were feasible a River Corridor Easement would be also be explored for possible incentive payments for the landowner as well as long term protection of the restoration project.
- Investigation a potentially larger project involving both Segment B and C would increase the overall benefits and opportunities for restoration of this section of stream.
- Buffer planting as a standalone project is not suggested. Planting around the incised channel may provide benefits but will also lock the channel in the straightened condition. Working with landowner to move mowing back from the top of bank to allow for natural revegetation along the stream bank over time, while allowing some natural channel adjustments to potentially occur.
- Replacing the undersized culvert with a larger structure will help reduce scour on the downstream side and impounding on the upstream side.
- Small tributary and Wetland restoration potential for tributary coming in from south. Impacts from historic channel management still affecting stream and wetland condition. Area important to look at for holistic approach along both segment B &C.

Geomorphic Condition: Fair – Minimal current planform adjustment and erosion. Historic channel management still contributing to current condition. Deposition and storage of fines in the channel causing channel to have very mucky streambed materials. Channel incision limiting floodplain access to deposit materials on the floodplain.

The remaining portion of Marsh Brook upstream from the private culvert on Segment C was not walked. Stream is buried in the upper segment and landowner engaged with other partners.

Conclusion

The stream walk has preliminary identified many potential projects. Coordination with landowners, State regulatory and technical staff, and municipalities to review restoration projects collectively will allow for a more watershed scale evaluation of project priority and benefit to the overall Marsh Brook condition.

While most of the channel is in good condition the brook is still adjusting from historic channel management practices. Restoration plans/projects should be consistent with the objective of reestablishing a dynamic equilibrium; recognizing the stream will, and needs to be able to, adjust over time. The goal is not to eliminate all erosion and sediment load from the stream process, as these are natural aspects to a stable stream; rather to identify areas where restoration can help reduce current impacts that are increasing erosion/sediment and/or move the stream toward a more stable state through remediating past impacts that are contributing to excess erosion/sediment.

Projects noted in Table 2 are areas where the stream walk showed that there was an opportunity for reducing erosion/sediment sources, reconnecting floodplain, enhancing riparian conditions, and improving the geomorphic condition of the channel. No one area will be able to mitigate impacts from the larger watershed; a holistic approach to develop projects along the entire stream corridor will provide the greatest benefits to the brook and ultimately Lake Carmi.

Appendix A

Rapid Geomorphic Assessment Forms

VT RAPID GEOMORPHIC ASSESSMENT ----- UNCONFINED STREAMS

For narrow and broad to very broad valley types (confinement ratio ≥ 4) Typically Riffle-pool and Dune-Ripple Stream Types

Stream Name: Marsh Brook
Location: ______________________

Observers: Staci Pomeroy, Tucker, Pete
Organization /Agency: ______________
Reference Stream Type E ☐ Modified
(If alluvial fan or naturally braided system see Handbook Protocols)

Segment I.D: M4T2.3S8.02 - A
Date: 9/31/2020
Town: ______________
Elevation: ______________ ft.
Weather: sunny
Rain Storm within past 7 days: Y / N

Adjustment Process	Reference	Good	Fair	Poor
7.1 Channel Degradation (Incision)	☐ Little evidence of localized slope increase or nickpoints.	☐ Minor localized slope increase or nickpoints.	☐ Sharp change in slope, head cuts present, and/or tributaries rejuvenating.	☐ Sharp change in slope and / or multiple head cuts present. Tributaries rejuvenating.
• Exposed till or fresh substrate in the stream bed and exposed infrastructure(bridge footings)	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **OR** Entrenchment ratio ≤ 2.0
• New terraces or recently abandoned floodplains. • Headcuts, or nickpoints that are 2-3 times steeper than typical riffle.	☐ Riffle heads complete and comprised of courser sediments (≥D80). Full complement of expected bed features.	☐ Riffle heads mostly complete. Riffle lengths may appear shorter. Full complement of expected bed features.	☐ Riffles or dunes may appear incomplete; bed profile dominated by runs.	☐ Riffle-pool or ripple-dune features replaced by plane bed features.
• Freshly eroded, vertical banks. • Alluvial (river) sediments that are imbricated (stacked like dominoes) high in bank.	☐ No significant human-caused change in channel confinement or valley type.	☐ Only minor human-caused change in channel confinement but no change in valley type.	☐ Significant human-caused change in channel confinement enough to change valley type, but still unconfined.	☐ Human-caused change in valley type, unconfined or narrow changed to confined.
• Tributary rejuvenation, observed through the presence of nickpoints at or upstream of the mouth of a tributary. • Bars with steep faces, usually occurring on the downstream end of a bar.	☐ No evidence of historic / present channel straightening, gravel mining, dredging and/or channel avulsions.	☐ Evidence of minor bar scalping on a point bar and/or channel avulsion; but minor to no historic channel straightening, gravel mining, or dredging.	☐ Evidence of significant historic channel straightening, dredging, gravel mining and/or channel avulsions.	☐ Extensive historic channel straightening, commercial gravel mining, and/or recent channel avulsion.
Stream Type Departure ☐ **Type of STD:**______________	☐ No known flow alterations (i.e., increases in flow or decreases in sediment supply).	☐ Minor flow alterations, some flow increase and/or reduction of sediment load.	☐ Major historic flow alterations, greater flows and/or reduction of sediment load.	☐ Major existing flow alterations, greater flows and/or reduction of sediment load.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.2 Channel Aggradation • Shallow pool depths.	☐ Complete riffle heads and deep pools in riffle-pool systems.** Full complement of expected bed features.	☐ Mostly complete riffles and/or some filling of pools with fine sediment. Pools may only be slightly deeper and wider than runs.**	☐ Incomplete riffles or dunes and dominated by runs. Significant filling of pools with sediment, pools may be absent with runs prevailing.	☐ Riffle-pool or ripple-dune features replaced by plane bed features.
• Abundant sediment deposition on point bars and mid-channel bars and extensive sediment deposition at obstructions, channel constrictions, and at the upstream end of tight meander bends. Islands may be present.	☐ Minor point or delta bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Major sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
• Most of the channel bed is exposed during typical low flow periods.	☐ No apparent increase in fine gravel/sand substrates (pebble count).**	☐ Some increase in fine gravel/sand substrates that may comprise over 50% of the sediments.	☐ Large incr. in fine gravel/ sand substrates that may comprise over 70% of the sediments. Sediment feels soft underfoot.	☐ Homogenous fine gravel/ sand substrates may comprise over 90% of the sediments. Sediment feels soft underfoot.
• High frequency of debris jams.	☐ Low width/depth ratio ≤ 20 for C or B type channels ≤ 10 for E type channels	☐ Low to moderate W/d ratio >20 ≤ 30 for C or B channels >10 ≤ 12 for E channels	☐ Moderate to high W/d ratio >30 ≤ 40 for C or B channels >12 ≤ 20 for E channels	☐ High width/depth ratio >40 for C or B type channels >20 for E type channels
• Coarse gravels, cobbles, and boulders may be embedded with sand/silt and fine gravel.	☐ No known flow alterations (i.e., decrease in flow or increase in sediment supply).	☐ Minor reduction in flow and/or increase in sediment load. Flood-related sediment working through reach, seen as enlarged bars.	☐ Major historic flow alterations, reduction in flows and / or increase in sediment load.	☐ Major existing flow alterations, extreme reduction in flows and / or increase in sediment load.
** This parameter may be a difficult to infeasible to evaluate in ripple-dune stream types **Stream Type Departure** ☐ **Type of STD:**______________	☐ No human-made constrictions causing upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive upstrm / dwnstrm deposition and flow bifurcation.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Adjustment Process	Condition Category: Reference	Good	Fair	Poor
7.3 Widening Channel	☐ Low width/depth ratio ≤ 20 for C or B type channels ≤ 10 for E type channels	☐ Low to moderate W/d ratio >20 ≤ 30 for C or B channels >10 ≤ 12 for E channels	☐ Moderate to high W/d ratio >30 ≤ 40 for C or B channels >12 ≤ 20 for E channels	☐ High width/depth ratio >40 for C or B type channels >20 for E type channels
• Active undermining of bank vegetation on both sides of the channel; many unstable bank overhangs that have little vegetation holding soils together. • Erosion on both right and left banks in riffle sections.	☐ Little to no scour and erosion at the base of both banks at the riffle section. Negligible bank overhangs, fracture lines at top of banks, leaning trees or freshly exposed tree roots.	☐ Minimal to moderate scour and erosion at the base of both banks at the riffle section. Some overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Moderate to high scour and erosion at the base of both banks at the riffle section. Many bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Continuous and laterally extensive scour and erosion at the base of both banks at the riffle section. Continuous bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.
• Recently exposed tree roots (fresh roots are 'green' and do not break easily, older roots are brittle and will break easily in your hand).	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **OR** Entrenchment ratio ≤ 2.0
• Fracture lines at the top of the bank that appear as cracks parallel to the river. • Mid-channel bars and side bars may be present.	☐ Minor point or delta bars present. Depositional features less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Major sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
• Urbanization and stormwater outfalls leading to higher rate and duration of runoff and channel enlargement.	☐ No known channel and / or flow alterations (i.e., increase in flow and / or change in sediment supply).	☐ Minor increase in watershed input of flows or sediment. Episodic (flood) discharges through reach resulting in short-term enlargement.	☐ Major channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).	☐ Major and extensive channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.4 Change in Planform	☐ Low bank erosion on outside bends, little or no change in sinuosity within the reach.	☐ Low to moderate lateral bank erosion on outside bends, may include minor change in sinuosity within the reach.	☐ Moderate to high lateral bank erosion on most outside bends, may include potential neck cut-offs and moderate change in sinuosity.	☐ Extensive lateral bank erosion on most outside bends, may include impending neck cut-offs and major change in sinuosity within the reach.
• Flood chutes or neck cut-offs may be present. • Channel avulsions may be evident or impending. • Change or loss in bed form structure, sometimes resulting in a mix of plane bed and riffle- pool forms. • Island formation and/or multiple thread channels.	☐ Little evidence of flood chutes crossing inside of meander bends, only minor point or delta bars.	☐ Minor flood chutes crossing inside of meander bends, evidence of minor to moderate unvegetated mid-channel, delta, or diagonal bars. Some potential for channel avulsion.	☐ Historic or active flood chutes crossing inside of meander bends, evidence of channel avulsion, islands, and unvegetated mid-channel, delta, or diagonal bars.	☐ Active large flood chutes crossing inside of most meander bends, evidence of recent channel avulsion, multiple thread channels, islands, and unvegetated mid-channel, delta, or diagonal bars.
• In meandering streams the thalweg, or deepest part of the channel, typically travels from the outside of a meander bend to the outside of the next meander bend. Pools are located on downstream third of the concave bends. Riffles are at the cross-over between the pools on successive bends.	☐ No additional deposition and scour features in the channel length typically occupied by a single riffle-pool sequence. Thalweg lined up with planform.	☐ Additional minor deposition and scour features in the channel length typically occupied by a single riffle-pool sequence.	☐ Additional large deposition and scour features in the channel length typically occupied by a single riffle-pool sequence. Thalweg not lined up with planform.	☐ Multiple sequences of large deposition and scour features in the channel length typically occupied by a single riffle-pool sequence.
During planform adjustments, the thalweg may not line up with or follow this pattern.	☐ No human-caused alteration of channel planform and / or the width of the floodprone area.	☐ Minor to moderate alteration of channel planform and/or width of the floodprone area resulting from floodplain encroachment, channel straightening, or dredging.	☐ Major alteration of channel planform and/or the width of the floodprone area resulting from historic floodplain encroachment, dredging, or channel straightening.	☐ Major alteration of channel planform and width of the floodprone area resulting from recent and extensive floodplain encroachment, dredging, and/or channel straightening.
As a result of the lateral extension of meander bends, additional deposition and scour features may be in a channel length typically occupied by a single riffle-pool sequence.	☐ Human-made constrictions causing only negligible upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive and major upstrm / downstrm deposition and flow bifurcation.
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

7.5 Channel Adjustment Scores – Stream Condition – Channel Evolution Stage

Condition Departure	Reference N/S	Good Minor	Fair Major	Poor Extreme	STD*	Historic
Degradation		13				X
Aggradation		14				
Widening		13				
Planform		11				

Condition Rating: (Total Score / 80)
51 / 80 = 0.63

7.6 Stream Condition: Fair (0.35-0.64)

Channel Evolution Stage: 3

Channel Adjustment Processes: planform

7.7 Stream Sensitivity: Very Low / Low / Moderate / High / Very High / Extreme

* Channel Condition "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Channel Condition default to poor - Due to channel alterations from work in channel after flood: **Y/N**

* Stream Sensitivity "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Stream Sensitivity "default" to **poor** Due to channel alterations from work in channel after flood: **Y/N**

VT RAPID GEOMORPHIC ASSESSMENT ----- UNCONFINED STREAMS

For narrow and broad to very broad valley types (confinement ratio ≥ 4) Typically Riffle-pool and Dune-Ripple Stream Types

Stream Name: Marsh Brook

Location: ______________________

Observers: ______________________

Organization /Agency: ______________________

Reference Stream Type ______________ ☐ Modified

(If alluvial fan or naturally braided system see Handbook Protocols)

Segment I.D: M4T2.3S8.02 - B

Date: 9/22/20 & 10/2/20

Town: ______________________

Elevation: ______________ ft.

Weather: sunny- 9/22; rain 10/2

Rain Storm within past 7 days: Y / N

Adjustment Process	Condition Category: Reference	Good	Fair	Poor
7.1 Channel Degradation (Incision) • Exposed till or fresh substrate in the stream bed and exposed infrastructure(bridge footings) • New terraces or recently abandoned floodplains. • Headcuts, or nickpoints that are 2-3 times steeper than typical riffle. • Freshly eroded, vertical banks. • Alluvial (river) sediments that are imbricated (stacked like dominoes) high in bank. • Tributary rejuvenation, observed through the presence of nickpoints at or upstream of the mouth of a tributary. • Bars with steep faces, usually occurring on the downstream end of a bar.	☐ Little evidence of localized slope increase or nickpoints.	☐ Minor localized slope increase or nickpoints.	☐ Sharp change in slope, head cuts present, and/or tributaries rejuvenating.	☐ Sharp change in slope and / or multiple head cuts present. Tributaries rejuvenating.
	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **OR** Entrenchment ratio ≤ 2.0
	☐ Riffle heads complete and comprised of courser sediments (≥D80). Full complement of expected bed features.	☐ Riffle heads mostly complete. Riffle lengths may appear shorter. Full complement of expected bed features.	☐ Riffles or dunes may appear incomplete; bed profile dominated by runs.	☐ Riffle-pool or ripple-dune features replaced by plane bed features.
	☐ No significant human-caused change in channel confinement or valley type.	☐ Only minor human-caused change in channel confinement but no change in valley type.	☐ Significant human-caused change in channel confinement enough to change valley type, but still unconfined.	☐ Human-caused change in valley type, unconfined or narrow changed to confined.
	☐ No evidence of historic / present channel straightening, gravel mining, dredging and/or channel avulsions.	☐ Evidence of minor bar scalping on a point bar and/or channel avulsion; but minor to no historic channel straightening, gravel mining, or dredging.	☐ Evidence of significant historic channel straightening, dredging, gravel mining and/or channel avulsions.	☐ Extensive historic channel straightening, commercial gravel mining, and/or recent channel avulsion.
Stream Type Departure ☐ **Type of STD:**______________	☐ No known flow alterations (i.e., increases in flow or decreases in sediment supply).	☐ Minor flow alterations, some flow increase and/or reduction of sediment load.	☐ Major historic flow alterations, greater flows and/or reduction of sediment load.	☐ Major existing flow alterations, greater flows and/or reduction of sediment load.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.2 Channel Aggradation • Shallow pool depths. • Abundant sediment deposition on point bars and mid-channel bars and extensive sediment deposition at obstructions, channel constrictions, and at the upstream end of tight meander bends. Islands may be present. • Most of the channel bed is exposed during typical low flow periods. • High frequency of debris jams. • Coarse gravels, cobbles, and boulders may be embedded with sand/silt and fine gravel. ** This parameter may be a difficult to infeasible to evaluate in ripple-dune stream types	☐ Complete riffle heads and deep pools in riffle-pool systems.** Full complement of expected bed features.	☐ Mostly complete riffles and/or some filling of pools with fine sediment. Pools may only be slightly deeper and wider than runs.**	☐ Incomplete riffles or dunes and dominated by runs. Significant filling of pools with sediment, pools may be absent with runs prevailing.	☐ Riffle-pool or ripple-dune features replaced by plane bed features.
	☐ Minor point or delta bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Major sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
	☐ No apparent increase in fine gravel/sand substrates (pebble count).**	☐ Some increase in fine gravel/sand substrates that may comprise over 50% of the sediments.	☐ Large incr. in fine gravel/sand substrates that may comprise over 70% of the sediments. Sediment feels soft underfoot.	☐ Homogenous fine gravel/sand substrates may comprise over 90% of the sediments. Sediment feels soft underfoot.
	☐ Low width/depth ratio ≤ 20 for C or B type channels ≤ 10 for E type channels	☐ Low to moderate W/d ratio >20 ≤ 30 for C or B channels >10 ≤ 12 for E channels	☐ Moderate to high W/d ratio >30 ≤ 40 for C or B channels >12 ≤ 20 for E channels	☐ High width/depth ratio >40 for C or B type channels >20 for E type channels
	☐ No known flow alterations (i.e., decrease in flow or increase in sediment supply).	☐ Minor reduction in flow and/or increase in sediment load. Flood-related sediment working through reach, seen as enlarged bars.	☐ Major historic flow alterations, reduction in flows and / or increase in sediment load.	☐ Major existing flow alterations, extreme reduction in flows and / or increase in sediment load.
Stream Type Departure ☐ **Type of STD:**______________	☐ No human-made constrictions causing upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive upstrm / dwnstrm deposition and flow bifurcation.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Adjustment Process	Condition Category: Reference	Good	Fair	Poor
7.3 Widening Channel ● Active undermining of bank vegetation on both sides of the channel; many unstable bank overhangs that have little vegetation holding soils together. ● Erosion on both right and left banks in riffle sections. ● Recently exposed tree roots (fresh roots are 'green' and do not break easily, older roots are brittle and will break easily in your hand). ● Fracture lines at the top of the bank that appear as cracks parallel to the river. ● Mid-channel bars and side bars may be present. ● Urbanization and stormwater outfalls leading to higher rate and duration of runoff and channel enlargement.	☐ Low width/depth ratio $\leq$ 20 for C or B type channels $\leq$ 10 for E type channels	☐ Low to moderate W/d ratio >20 $\leq$ 30 for C or B channels >10 $\leq$ 12 for E channels	☐ Moderate to high W/d ratio >30 $\leq$ 40 for C or B channels >12 $\leq$ 20 for E channels	☐ High width/depth ratio >40 for C or B type channels >20 for E type channels
	☐ Little to no scour and erosion at the base of both banks at the riffle section. Negligible bank overhangs, fracture lines at top of banks, leaning trees or freshly exposed tree roots.	☐ Minimal to moderate scour and erosion at the base of both banks at the riffle section. Some overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Moderate to high scour and erosion at the base of both banks at the riffle section. Many bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Continuous and laterally extensive scour and erosion at the base of both banks at the riffle section. Continuous bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.
	☐ Incision Ratio $\geq$ 1.0 < 1.2 **and** Entrenchment ratio > 2.0	☐ Incision Ratio $\geq$ 1.2 < 1.4 **and** Entrenchment ratio > 2.0	☐ Incision Ratio $\geq$ 1.4 < 2.0 **and** Entrenchment ratio > 2.0	☐ Incision ratio $\geq$ 2.0 **OR** Entrenchment ratio $\leq$ 2.0
	☐ Minor point or delta bars present. Depositional features less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Major sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
	☐ No known channel and / or flow alterations (i.e., increase in flow and / or change in sediment supply).	☐ Minor increase in watershed input of flows or sediment. Episodic (flood) discharges through reach resulting in short-term enlargement.	☐ Major channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).	☐ Major and extensive channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).
Score: **Historic** ☐	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
7.4 Change in Planform ● Flood chutes or neck cut-offs may be present. ● Channel avulsions may be evident or impending. ● Change or loss in bed form structure, sometimes resulting in a mix of plane bed and riffle- pool forms. ● Island formation and/or multiple thread channels. ● In meandering streams the thalweg, or deepest part of the channel, typically travels from the outside of a meander bend to the outside of the next meander bend. Pools are located on downstream third of the concave bends. Riffles are at the cross-over between the pools on successive bends. During planform adjustments, the thalweg may not line up with or follow this pattern. As a result of the lateral extension of meander bends, additional deposition and scour features may be in a channel length typically occupied by a single riffle-pool sequence.	☐ Low bank erosion on outside bends, little or no change in sinuosity within the reach.	☐ Low to moderate lateral bank erosion on outside bends, may include minor change in sinuosity within the reach.	☐ Moderate to high lateral bank erosion on most outside bends, may include potential neck cut-offs and moderate change in sinuosity.	☐ Extensive lateral bank erosion on most outside bends, may include impending neck cut-offs and major change in sinuosity within the reach.
	☐ Little evidence of flood chutes crossing inside of meander bends, only minor point or delta bars.	☐ Minor flood chutes crossing inside of meander bends, evidence of minor to moderate unvegetated mid-channel, delta, or diagonal bars. Some potential for channel avulsion.	☐ Historic or active flood chutes crossing inside of meander bends, evidence of channel avulsion, islands, and unvegetated mid-channel, delta, or diagonal bars.	☐ Active large flood chutes crossing inside of most meander bends, evidence of recent channel avulsion, multiple thread channels, islands, and unvegetated mid-channel, delta, or diagonal bars.
	☐ No additional deposition and scour features in the channel length typically occupied by a single riffle-pool sequence. Thalweg lined up with planform.	☐ Additional minor deposition and scour features in the channel length typically occupied by a single riffle-pool sequence.	☐ Additional large deposition and scour features in the channel length typically occupied by a single riffle-pool sequence. Thalweg not lined up with planform.	☐ Multiple sequences of large deposition and scour features in the channel length typically occupied by a single riffle-pool sequence.
	☐ No human-caused alteration of channel planform and / or the width of the floodprone area.	☐ Minor to moderate alteration of channel planform and/or width of the floodprone area resulting from floodplain encroachment, channel straightening, or dredging.	☐ Major alteration of channel planform and/or the width of the floodprone area resulting from historic floodplain encroachment, dredging, or channel straightening.	☐ Major alteration of channel planform and width of the floodprone area resulting from recent and extensive floodplain encroachment, dredging, and/or channel straightening.
	☐ Human-made constrictions causing only negligible upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive and major upstrm / downstrm deposition and flow bifurcation.
Score: **Historic** ☐	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

7.5 Channel Adjustment Scores – Stream Condition – Channel Evolution Stage

Condition / Departure	Reference / N/S	Good / Minor	Fair / Major	Poor / Extreme	STD*	Historic	Condition Rating: (Total Score / 80)	Channel Evolution Stage:
Degradation	13					x	54/80= 0.67	4
Aggradation	15							
Widening	15						**7.6 Stream Condition:** Good (0.65-0.84)	
Planform	11							

Channel Adjustment Processes: planform and widening, historic degradation

7.7 Stream Sensitivity: Very Low / Low / Moderate / High / Very High / Extreme

* Channel Condition "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Channel Condition default to poor - Due to channel alterations from work in channel after flood: **Y/N**

* Stream Sensitivity "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Stream Sensitivity "default" to **poor** Due to channel alterations from work in channel after flood: **Y/N**

VT RAPID GEOMORPHIC ASSESSMENT ----- UNCONFINED STREAMS

For narrow and broad to very broad valley types (confinement ratio ≥ 4) Typically Riffle-pool and Dune-Ripple Stream Types

Stream Name: Marsh Brook
Location: ______
Observers: ______
Organization /Agency: ______
Reference Stream Type ______ ☐ Modified
(If alluvial fan or naturally braided system see Handbook Protocols)

Segment I.D: M4T2.3S8.03 - A
Date: 10/02/2020 & 10/06/202
Town: ______
Elevation: ______ ft.
Weather: rain 10/2, sunny 10/6
Rain Storm within past 7 days: Y / N

Adjustment Process	Reference	Good	Fair	Poor
7.1 Channel Degradation (Incision) • Exposed till or fresh substrate in the stream bed and exposed infrastructure(bridge footings) • New terraces or recently abandoned floodplains. • Headcuts, or nickpoints that are 2-3 times steeper than typical riffle. • Freshly eroded, vertical banks. • Alluvial (river) sediments that are imbricated (stacked like dominoes) high in bank. • Tributary rejuvenation, observed through the presence of nickpoints at or upstream of the mouth of a tributary. • Bars with steep faces, usually occurring on the downstream end of a bar.	☐ Little evidence of localized slope increase or nickpoints.	☐ Minor localized slope increase or nickpoints.	☐ Sharp change in slope, head cuts present, and/or tributaries rejuvenating.	☐ Sharp change in slope and / or multiple head cuts present. Tributaries rejuvenating.
	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **OR** Entrenchment ratio ≤ 2.0
	☐ Riffle heads complete and comprised of courser sediments (≥D80). Full complement of expected bed features.	☐ Riffle heads mostly complete. Riffle lengths may appear shorter. Full complement of expected bed features.	☐ Riffles or dunes may appear incomplete; bed profile dominated by runs.	☐ Riffle-pool or ripple-dune features replaced by plane bed features.
	☐ No significant human-caused change in channel confinement or valley type.	☐ Only minor human-caused change in channel confinement but no change in valley type.	☐ Significant human-caused change in channel confinement enough to change valley type, but still unconfined.	☐ Human-caused change in valley type, unconfined or narrow changed to confined.
	☐ No evidence of historic / present channel straightening, gravel mining, dredging and/or channel avulsions.	☐ Evidence of minor bar scalping on a point bar and/or channel avulsion; but minor to no historic channel straightening, gravel mining, or dredging.	☐ Evidence of significant historic channel straightening, dredging, gravel mining and/or channel avulsions.	☐ Extensive historic channel straightening, commercial gravel mining, and/or recent channel avulsion.
Stream Type Departure ☐ **Type of STD:** ______	☐ No known flow alterations (i.e., increases in flow or decreases in sediment supply).	☐ Minor flow alterations, some flow increase and/or reduction of sediment load.	☐ Major historic flow alterations, greater flows and/or reduction of sediment load.	☐ Major existing flow alterations, greater flows and/or reduction of sediment load.
Score: Historic ☐	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1
7.2 Channel Aggradation • Shallow pool depths. • Abundant sediment deposition on point bars and mid-channel bars and extensive sediment deposition at obstructions, channel constrictions, and at the upstream end of tight meander bends. Islands may be present. • Most of the channel bed is exposed during typical low flow periods. • High frequency of debris jams. • Coarse gravels, cobbles, and boulders may be embedded with sand/silt and fine gravel.	☐ Complete riffle heads and deep pools in riffle-pool systems.** Full complement of expected bed features.	☐ Mostly complete riffles and/or some filling of pools with fine sediment. Pools may only be slightly deeper and wider than runs.**	☐ Incomplete riffles or dunes and dominated by runs. Significant filling of pools with sediment, pools may be absent with runs prevailing.	☐ Riffle-pool or ripple-dune features replaced by plane bed features.
	☐ Minor point or delta bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Major sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
	☐ No apparent increase in fine gravel/sand substrates (pebble count).**	☐ Some increase in fine gravel/sand substrates that may comprise over 50% of the sediments.	☐ Large incr. in fine gravel/ sand substrates that may comprise over 70% of the sediments. Sediment feels soft underfoot.	☐ Homogenous fine gravel/ sand substrates may comprise over 90% of the sediments. Sediment feels soft underfoot.
	☐ Low width/depth ratio ≤ 20 for C or B type channels ≤ 10 for E type channels	☐ Low to moderate W/d ratio >20 ≤ 30 for C or B channels >10 ≤ 12 for E channels	☐ Moderate to high W/d ratio >30 ≤ 40 for C or B channels >12 ≤ 20 for E channels	☐ High width/depth ratio >40 for C or B type channels >20 for E type channels
** This parameter may be a difficult to infeasible to evaluate in ripple-dune stream types	☐ No known flow alterations (i.e., decrease in flow or increase in sediment supply).	☐ Minor reduction in flow and/or increase in sediment load. Flood-related sediment working through reach, seen as enlarged bars.	☐ Major historic flow alterations, reduction in flows and / or increase in sediment load.	☐ Major existing flow alterations, extreme reduction in flows and / or increase in sediment load.
Stream Type Departure ☐ **Type of STD:** ______	☐ No human-made constrictions causing upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive upstrm / dwnstrm deposition and flow bifurcation.
Score: Historic ☐	20 | 19 | 18 | 17 | 16	15 | 14 | 13 | 12 | 11	10 | 9 | 8 | 7 | 6	5 | 4 | 3 | 2 | 1

<table>
<tr><th rowspan="2">Adjustment Process</th><th colspan="4">Condition Category</th></tr>
<tr><th>Reference</th><th>Good</th><th>Fair</th><th>Poor</th></tr>
<tr><td rowspan="5">7.3 Widening Channel
• Active undermining of bank vegetation on both sides of the channel; many unstable bank overhangs that have little vegetation holding soils together.
• Erosion on both right and left banks in riffle sections.
• Recently exposed tree roots (fresh roots are ‘green’ and do not break easily, older roots are brittle and will break easily in your hand).
• Fracture lines at the top of the bank that appear as cracks parallel to the river.
• Mid-channel bars and side bars may be present.
• Urbanization and stormwater outfalls leading to higher rate and duration of runoff and channel enlargement.</td>
<td>☐ Low width/depth ratio
≤ 20 for C or B type channels
≤ 10 for E type channels</td>
<td>☐ Low to moderate W/d ratio
>20 ≤ 30 for C or B channels
>10 ≤ 12 for E channels</td>
<td>☐ Moderate to high W/d ratio
>30 ≤ 40 for C or B channels
>12 ≤ 20 for E channels</td>
<td>☐ High width/depth ratio
>40 for C or B type channels
>20 for E type channels</td></tr>
<tr><td>☐ Little to no scour and erosion at the base of both banks at the riffle section. Negligible bank overhangs, fracture lines at top of banks, leaning trees or freshly exposed tree roots.</td>
<td>☐ Minimal to moderate scour and erosion at the base of both banks at the riffle section. Some overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.</td>
<td>☐ Moderate to high scour and erosion at the base of both banks at the riffle section. Many bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.</td>
<td>☐ Continuous and laterally extensive scour and erosion at the base of both banks at the riffle section. Continuous bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.</td></tr>
<tr><td>☐ Incision Ratio ≥ 1.0 < 1.2
and
Entrenchment ratio > 2.0</td>
<td>☐ Incision Ratio ≥ 1.2 < 1.4
and
Entrenchment ratio > 2.0</td>
<td>☐ Incision Ratio ≥ 1.4 < 2.0
and
Entrenchment ratio > 2.0</td>
<td>☐ Incision ratio ≥ 2.0
OR
Entrenchment ratio ≤ 2.0</td></tr>
<tr><td>☐ Minor point or delta bars present. Depositional features less than half bankfull stage in height.</td>
<td>☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.</td>
<td>☐ Multiple unvegetated mid-channel or diagonal bars present. Major sediment buildup at the head of bendways leading to steep riffles and flood chutes.</td>
<td>☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.</td></tr>
<tr><td>☐ No known channel and / or flow alterations (i.e., increase in flow and / or change in sediment supply).</td>
<td>☐ Minor increase in watershed input of flows or sediment. Episodic (flood) discharges through reach resulting in short-term enlargement.</td>
<td>☐ Major channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).</td>
<td>☐ Major and extensive channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).</td></tr>
<tr><td>Score: Historic ☐</td><td>20 | 19 | 18 | 17 | 16</td><td>15 | 14 | 13 | 12 | 11</td><td>10 | 9 | 8 | 7 | 6</td><td>5 | 4 | 3 | 2 | 1</td></tr>
<tr><td rowspan="5">7.4 Change in Planform
• Flood chutes or neck cut-offs may be present.
• Channel avulsions may be evident or impending.
• Change or loss in bed form structure, sometimes resulting in a mix of plane bed and riffle- pool forms.
• Island formation and/or multiple thread channels.
• In meandering streams the thalweg, or deepest part of the channel, typically travels from the outside of a meander bend to the outside of the next meander bend. Pools are located on downstream third of the concave bends. Riffles are at the cross-over between the pools on successive bends. During planform adjustments, the thalweg may not line up with or follow this pattern. As a result of the lateral extension of meander bends, additional deposition and scour features may be in a channel length typically occupied by a single riffle-pool sequence.</td>
<td>☐ Low bank erosion on outside bends, little or no change in sinuosity within the reach.</td>
<td>☐ Low to moderate lateral bank erosion on outside bends, may include minor change in sinuosity within the reach.</td>
<td>☐ Moderate to high lateral bank erosion on most outside bends, may include potential neck cut-offs and moderate change in sinuosity.</td>
<td>☐ Extensive lateral bank erosion on most outside bends, may include impending neck cut-offs and major change in sinuosity within the reach.</td></tr>
<tr><td>☐ Little evidence of flood chutes crossing inside of meander bends, only minor point or delta bars.</td>
<td>☐ Minor flood chutes crossing inside of meander bends, evidence of minor to moderate unvegetated mid-channel, delta, or diagonal bars. Some potential for channel avulsion.</td>
<td>☐ Historic or active flood chutes crossing inside of meander bends, evidence of channel avulsion, islands, and unvegetated mid-channel, delta, or diagonal bars.</td>
<td>☐ Active large flood chutes crossing inside of most meander bends, evidence of recent channel avulsion, multiple thread channels, islands, and unvegetated mid-channel, delta, or diagonal bars.</td></tr>
<tr><td>☐ No additional deposition and scour features in the channel length typically occupied by a single riffle-pool sequence. Thalweg lined up with planform.</td>
<td>☐ Additional minor deposition and scour features in the channel length typically occupied by a single riffle-pool sequence.</td>
<td>☐ Additional large deposition and scour features in the channel length typically occupied by a single riffle-pool sequence. Thalweg not lined up with planform.</td>
<td>☐ Multiple sequences of large deposition and scour features in the channel length typically occupied by a single riffle-pool sequence.</td></tr>
<tr><td>☐ No human-caused alteration of channel planform and / or the width of the floodprone area.</td>
<td>☐ Minor to moderate alteration of channel planform and/or width of the floodprone area resulting from floodplain encroachment, channel straightening, or dredging.</td>
<td>☐ Major alteration of channel planform and/or the width of the floodprone area resulting from historic floodplain encroachment, dredging, or channel straightening.</td>
<td>☐ Major alteration of channel planform and width of the floodprone area resulting from recent and extensive floodplain encroachment, dredging, and/or channel straightening.</td></tr>
<tr><td>☐ Human-made constrictions causing only negligible upstream deposition.</td>
<td>☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / downstrm deposition.</td>
<td>☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / downstrm deposition.</td>
<td>☐ Human-made constrictions significantly smaller than bankfull width, causing extensive and major upstrm / downstrm deposition and flow bifurcation.</td></tr>
<tr><td>Score: Historic ☐</td><td>20 | 19 | 18 | 17 | 16</td><td>15 | 14 | 13 | 12 | 11</td><td>10 | 9 | 8 | 7 | 6</td><td>5 | 4 | 3 | 2 | 1</td></tr>
</table>

7.5 Channel Adjustment Scores – Stream Condition – Channel Evolution Stage

<table>
<tr><th>Condition
Departure</th><th>Reference
N/S</th><th>Good
Minor</th><th>Fair
Major</th><th>Poor
Extreme</th><th>STD*</th><th>Historic</th><th>Condition Rating:
(Total Score / 80)</th><th>Channel Evolution Stage:</th></tr>
<tr><td>Degradation</td><td>13</td><td></td><td></td><td></td><td></td><td>x</td><td rowspan="2">54/80= 0.67</td><td rowspan="4">4</td></tr>
<tr><td>Aggradation</td><td>15</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Widening</td><td>15</td><td></td><td></td><td></td><td></td><td></td><td rowspan="2">7.6 Stream Condition: Good (0.65-0.84)</td></tr>
<tr><td>Planform</td><td>11</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Channel Adjustment Processes: planform , historic degradation

7.7 Stream Sensitivity: Very Low / Low / Moderate / High / Very High / Extreme

* Channel Condition “default” to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Channel Condition default to poor - Due to channel alterations from work in channel after flood: **Y/N**

* Stream Sensitivity “default” to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Stream Sensitivity “default” to **poor** Due to channel alterations from work in channel after flood: **Y/N**

VT RAPID GEOMORPHIC ASSESSMENT ----- PLANE BED STREAMS

Typically found in semi-confined to narrow valley types (confinement ratio ≥ 3 and ≤ 5)

Reminder: This RGA form should only be used on streams which are plane bed systems by reference. Many existing plane bed streams in Vermont represent a departure from another stream type.

Stream Name: Marsh Brook
Location: ______
Observers: Staci , Tucker, Karen
Organization /Agency: ______
Reference Stream Type ______ ☐ Modified
(If alluvial fan or naturally braided system see Handbook Protocols)

Segment I.D: M4T2.3S8.03 - B
Date: 10/06/20
Town: ______
Elevation: ______ ft.
Weather: ______
Rain Storm within past 7 days: Y / N

Adjustment Process	Condition Category: Reference	Good	Fair	Poor
7.1 Channel Degradation (Incision)	☐ Little evidence of localized slope increase or nickpoints.	☐ Minor localized slope increase or nickpoints.	☐ Sharp change in slope, head cuts present, and/or tributaries rejuvenating.	☐ Sharp change in slope and / or multiple head cuts present. Tributaries rejuvenating.
• Exposed till or fresh substrate in the stream bed and exposed infrastructure (bridge footings). • New terraces or recently abandoned floodplains.	☐ Incision ratio ≥ 1.0 < 1.2 **and** Where channel slope > 2% Entrenchment ratio > 1.4 Where channel slope ≤ 2% Entrenchment ratio > 2.0	☐ Incision ratio ≥ 1.2 < 1.4 **and** Where channel slope > 2% Entrenchment ratio > 1.4 Where channel slope ≤ 2% Entrenchment ratio > 2.0	☐ Incision ratio ≥ 1.4 < 2.0 **and** Where channel slope > 2% Entrenchment ratio > 1.4 Where channel slope ≤ 2% Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **and** Where channel slope > 2% Entrenchment ratio ≤ 1.4 Where channel slope ≤ 2% Entrenchment ratio ≤ 2.0
• Headcuts, or nickpoints that are 2-3 times steeper than typical riffle. • Freshly eroded, vertical banks.	☐ No significant human-caused change in channel confinement or valley type.	☐ Only minor human-caused change in channel confinement but no change in valley type.	☐ Significant human-caused change in channel confinement enough to change valley type, but still not narrowly confined.	☐ Human-caused change to a narrowly confined valley type.
• Alluvial (river) sediments that are imbricated (stacked like dominoes) high in bank. • Tributary rejuvenation, observed through the presence of nickpoints at or upstream of the mouth of a tributary.	☐ No evidence of historic or present channel straightening, gravel mining, dredging and/or channel avulsions.	☐ Evidence of minor mid-channel bar scalping and/or channel avulsion, but minor to no historic channel straightening, gravel mining or dredging.	☐ Evidence of significant historic channel straightening, dredging, gravel mining and/or channel avulsions.	☐ Extensive historic channel straightening, commercial gravel mining, and/or recent channel avulsion.
Stream Type Departure ☐ **Type of STD:** ______	☐ No known flow alterations (i.e., increases in flow or decreases in sediment supply).	☐ Minor flow alterations, some flow increase and/or minor reduction of sediment load.	☐ Major historic flow alterations, greater flows and/or reduction of sediment load.	☐ Major existing flow alterations, greater flows and/or reduction of sediment load.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Adjustment Process	Reference	Good	Fair	Poor
7.2 Channel Aggradation	☐ Minor side, point or delta bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
• Very shallow pocket pools around and below boulders. • Abundant sediment deposition on side, point and mid-channel bars and extensive sediment deposition at obstructions, channel constrictions, and at the upstream end of tight bendways. Islands may be present.	☐ No apparent increase in fine gravel/sand substrates (pebble count).	☐ Some increase in fine gravel/sand substrates that may comprise over 50% of the sediments.	☐ Large increase in fine gravel/sand substrates that may comprise over 70% of the sediments. Fine sediment feels soft underfoot.	☐ Homogenous fine gravel/sand substrates may comprise over 90% of the sediments. Fine sediment feels soft underfoot.
• Most of the channel bed is exposed during typical low flow periods.	☐ Low width/depth ratio W/d ≤ 20	☐ Low to moderate W/d ratio W/d >20 ≤ 30	☐ Moderate to high W/d ratio W/d >30 ≤ 40	☐ High width/depth ratio W/d >40
• Increased frequency of woody debris in channel.	☐ No known flow alterations (i.e., decrease in flow or increase in sediment supply).	☐ Minor reduction in flow and/or increase in sediment load. Flood-related sediment working through reach, seen as enlarged bars.	☐ Major historic flow alterations, reduction in flows and / or increase in sediment load.	☐ Major existing flow alterations, extreme reduction in flows and / or increase in sediment load.
• Coarse gravels, cobbles, and boulders may be embedded with sand/silt and fine gravel. **Stream Type Departure** ☐ **Type of STD:** ______	☐ No human-made constrictions causing upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive upstrm / dwnstrm deposition and flow bifurcation.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Adjustment Process	Condition Category: Reference	Good	Fair	Poor
7.3 Widening Channel • Active undermining of bank vegetation on both sides of the channel; many unstable bank overhangs that have little vegetation holding soils together. • Erosion on both right and left banks in riffle sections. • Recently exposed tree roots (fresh roots are 'green' and do not break easily, older roots are brittle and will break easily in your hand). • Fracture lines at the top of the bank that appear as cracks parallel to the river. • Mid-channel bars and side bars may be present. • Urbanization and stormwater outfalls leading to higher rate and duration of runoff and channel enlargement.	☐ Low width/depth ratio W/d ≤ 20	☐ Low to moderate W/d ratio W/d >20 ≤ 30	☐ Moderate to high W/d ratio W/d >30 ≤ 40	☐ High width/depth ratio W/d >40
	☐ Little to no scour and erosion at the base of both banks. Negligible bank overhangs, fracture lines at top of banks, leaning trees or freshly exposed tree roots.	☐ Minimal to moderate scour and erosion at the base of both banks. Some overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Moderate to high scour and erosion at the base of both banks. Many bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Continuous and laterally extensive scour and erosion at the base of both banks. Continuous bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.
	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Where channel slope > 2% Entrenchment ratio > 1.4 Where channel slope ≤ 2% Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Where channel slope > 2% Entrenchment ratio > 1.4 Where channel slope ≤ 2% Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Where channel slope > 2% Entrenchment ratio > 1.4 Where channel slope ≤ 2% Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **and** Where channel slope > 2% Entrenchment ratio ≤ 1.4 Where channel slope ≤ 2% Entrenchment ratio ≤ 2.0
	☐ Minor side, point or delta bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
	☐ No known channel and / or flow alterations (i.e., increase in flow and/or change in sediment supply).	☐ Minor increase in watershed input of flows or sediment. Episodic (flood) discharges through reach resulting in short-term enlargement.	☐ Major channel and / or flow alterations, increase in flows and/or change in sediment load (increase or decrease).	☐ Major and extensive -channel and/or flow alterations, increase in flows and / or change in sediment load (increase or decrease).
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.4 Change in Planform • Flood chutes may be present. • Channel avulsions may be evident or impending. • Change or loss in bed form structure, sometimes resulting in a mix of plane bed and riffle- pool forms. • Island formation and/or multiple thread channels.	☐ Low bank erosion on outside bends, little or no change in sinuosity within the reach.	☐ Low to moderate lateral bank erosion on outside bends, may include minor change in sinuosity within the reach.	☐ Moderate to high lateral bank erosion on most outside bends, may include moderate change in sinuosity.	☐ Extensive lateral bank erosion on most outside bends, may include major change in sinuosity within the reach.
	☐ Little evidence of flood chutes crossing inside of bends, only minor side, point, or delta bars.	☐ Minor flood chutes crossing inside of bends, evidence of single to multiple unvegetated mid-channel, delta, or diagonal bars. Some potential for channel avulsion.	☐ Historic or active flood chutes crossing inside of bends, evidence of channel avulsion, islands, and multiple unvegetated mid-channel, delta, or diagonal bars.	☐ Active large flood chutes, evidence of recent channel avulsion, multiple thread channels, islands, and multiple unvegetated mid-channel, delta, or diagonal bars.
	☐ No human-caused alteration of channel planform and / or the width of the floodprone area.	☐ Minor to moderate alteration of channel planform and/or width of the floodprone area resulting from floodplain encroachment, channel straightening, or dredging.	☐ Major alteration of channel planform and/or the width of the floodprone area resulting from historic floodplain encroachment, dredging, or channel straightening.	☐ Major alteration of channel planform and width of the floodprone area resulting from recent and extensive floodplain encroachment, dredging, and/or channel straightening.
	☐ Human-made constrictions causing only negligible upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive and major upstrm / downstrm deposition and flow bifurcation.
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

7.5 Channel Adjustment Scores – Stream Condition – Channel Evolution Stage

Condition Departure	Reference N/S	Good Minor	Fair Major	Poor Extreme	STD*	Historic	Condition Rating: (Total Score / 80)	Channel Evolution Stage:
Degradation	13							
Aggradation	15						53/80=0.66	
Widening	15						**7.6 Stream Condition:**	
Planform	10						Good (0.65-0.84)	
Sub-totals:					**Total Score:**			

Channel Adjustment Processes: ______________________________

7.7 Stream Sensitivity: Very Low / Low / Moderate / High / Very High / Extreme

* Channel Condition "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Channel Condition default to poor - Due to channel alterations from work in channel after flood: **Y/N**

* Stream Sensitivity "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Stream Sensitivity "default" to **poor** Due to channel alterations from work in channel after flood: **Y/N**

VT RAPID GEOMORPHIC ASSESSMENT ----- PLANE BED STREAMS

Typically found in semi-confined to narrow valley types (confinement ratio ≥ 3 and ≤ 5)

Reminder: This RGA form should only be used on streams which are plane bed systems by reference. Many existing plane bed streams in Vermont represent a departure from another stream type.

Stream Name: Marsh Brook
Location:
Observers: Tucker, Staci, Karen
Organization /Agency:
Reference Stream Type ☐ Modified
(If alluvial fan or naturally braided system see Handbook Protocols)

Segment I.D: M4T2.3S8.04- A
Date: 10/06/2020
Town:
Elevation: ft.
Weather: sunny
Rain Storm within past 7 days: Y / N

Adjustment Process	Reference	Good	Fair	Poor
7.1 Channel Degradation (Incision)	☐ Little evidence of localized slope increase or nickpoints.	☐ Minor localized slope increase or nickpoints.	☐ Sharp change in slope, head cuts present, and/or tributaries rejuvenating.	☐ Sharp change in slope and / or multiple head cuts present. Tributaries rejuvenating.
• Exposed till or fresh substrate in the stream bed and exposed infrastructure (bridge footings). • New terraces or recently abandoned floodplains.	☐ Incision ratio ≥ 1.0 < 1.2 **and** Where channel slope > 2% Entrenchment ratio > 1.4 Where channel slope ≤ 2% Entrenchment ratio > 2.0	☐ Incision ratio ≥ 1.2 < 1.4 **and** Where channel slope > 2% Entrenchment ratio > 1.4 Where channel slope ≤ 2% Entrenchment ratio > 2.0	☐ Incision ratio ≥ 1.4 < 2.0 **and** Where channel slope > 2% Entrenchment ratio > 1.4 Where channel slope ≤ 2% Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **and** Where channel slope > 2% Entrenchment ratio ≤ 1.4 Where channel slope ≤ 2% Entrenchment ratio ≤ 2.0
• Headcuts, or nickpoints that are 2-3 times steeper than typical riffle. • Freshly eroded, vertical banks.	☐ No significant human-caused change in channel confinement or valley type.	☐ Only minor human-caused change in channel confinement but no change in valley type.	☐ Significant human-caused change in channel confinement enough to change valley type, but still not narrowly confined.	☐ Human-caused change to a narrowly confined valley type.
• Alluvial (river) sediments that are imbricated (stacked like dominoes) high in bank. • Tributary rejuvenation, observed through the presence of nickpoints at or upstream of the mouth of a tributary.	☐ No evidence of historic or present channel straightening, gravel mining, dredging and/or channel avulsions.	☐ Evidence of minor mid-channel bar scalping and/or channel avulsion, but minor to no historic channel straightening, gravel mining or dredging.	☐ Evidence of significant historic channel straightening, dredging, gravel mining and/or channel avulsions.	☐ Extensive historic channel straightening, commercial gravel mining, and/or recent channel avulsion.
Stream Type Departure ☐ **Type of STD:**______	☐ No known flow alterations (i.e., increases in flow or decreases in sediment supply).	☐ Minor flow alterations, some flow increase and/or minor reduction of sediment load.	☐ Major historic flow alterations, greater flows and/or reduction of sediment load.	☐ Major existing flow alterations, greater flows and/or reduction of sediment load.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.2 Channel Aggradation	☐ Minor side, point or delta bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
• Very shallow pocket pools around and below boulders. • Abundant sediment deposition on side, point and mid-channel bars and extensive sediment deposition at obstructions, channel constrictions, and at the upstream end of tight bendways. Islands may be present.	☐ No apparent increase in fine gravel/sand substrates (pebble count).	☐ Some increase in fine gravel/sand substrates that may comprise over 50% of the sediments.	☐ Large increase in fine gravel/sand substrates that may comprise over 70% of the sediments. Fine sediment feels soft underfoot.	☐ Homogenous fine gravel/sand substrates may comprise over 90% of the sediments. Fine sediment feels soft underfoot.
• Most of the channel bed is exposed during typical low flow periods.	☐ Low width/depth ratio W/d ≤ 20	☐ Low to moderate W/d ratio W/d >20 ≤ 30	☐ Moderate to high W/d ratio W/d >30 ≤ 40	☐ High width/depth ratio W/d >40
• Increased frequency of woody debris in channel.	☐ No known flow alterations (i.e., decrease in flow or increase in sediment supply).	☐ Minor reduction in flow and/or increase in sediment load. Flood-related sediment working through reach, seen as enlarged bars.	☐ Major historic flow alterations, reduction in flows and / or increase in sediment load.	☐ Major existing flow alterations, extreme reduction in flows and / or increase in sediment load.
• Coarse gravels, cobbles, and boulders may be embedded with sand/silt and fine gravel. **Stream Type Departure** ☐ **Type of STD:**______	☐ No human-made constrictions causing upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive upstrm / dwnstrm deposition and flow bifurcation.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Adjustment Process	Condition Category: Reference	Good	Fair	Poor
7.3 Widening Channel ● Active undermining of bank vegetation on both sides of the channel; many unstable bank overhangs that have little vegetation holding soils together. ● Erosion on both right and left banks in riffle sections. ● Recently exposed tree roots (fresh roots are 'green' and do not break easily, older roots are brittle and will break easily in your hand). ● Fracture lines at the top of the bank that appear as cracks parallel to the river. ● Mid-channel bars and side bars may be present. ● Urbanization and stormwater outfalls leading to higher rate and duration of runoff and channel enlargement.	☐ Low width/depth ratio W/d ≤ 20	☐ Low to moderate W/d ratio W/d >20 ≤ 30	☐ Moderate to high W/d ratio W/d >30 ≤ 40	☐ High width/depth ratio W/d >40
	☐ Little to no scour and erosion at the base of both banks. Negligible bank overhangs, fracture lines at top of banks, leaning trees or freshly exposed tree roots.	☐ Minimal to moderate scour and erosion at the base of both banks. Some overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Moderate to high scour and erosion at the base of both banks. Many bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Continuous and laterally extensive scour and erosion at the base of both banks. Continuous bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.
	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Where channel slope > 2% Entrenchment ratio > 1.4 Where channel slope ≤ 2% Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Where channel slope > 2% Entrenchment ratio > 1.4 Where channel slope ≤ 2% Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Where channel slope > 2% Entrenchment ratio > 1.4 Where channel slope ≤ 2% Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **and** Where channel slope > 2% Entrenchment ratio ≤ 1.4 Where channel slope ≤ 2% Entrenchment ratio ≤ 2.0
	☐ Minor side, point or delta bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
	☐ No known channel and / or flow alterations (i.e., increase in flow and/or change in sediment supply).	☐ Minor increase in watershed input of flows or sediment. Episodic (flood) discharges through reach resulting in short-term enlargement.	☐ Major channel and / or flow alterations, increase in flows and/or change in sediment load (increase or decrease).	☐ Major and extensive channel and/or flow alterations, increase in flows and / or change in sediment load (increase or decrease).
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.4 Change in Planform ● Flood chutes may be present. ● Channel avulsions may be evident or impending. ● Change or loss in bed form structure, sometimes resulting in a mix of plane bed and riffle- pool forms. ● Island formation and/or multiple thread channels.	☐ Low bank erosion on outside bends, little or no change in sinuosity within the reach.	☐ Low to moderate lateral bank erosion on outside bends, may include minor change in sinuosity within the reach.	☐ Moderate to high lateral bank erosion on most outside bends, may include moderate change in sinuosity.	☐ Extensive lateral bank erosion on most outside bends, may include major change in sinuosity within the reach.
	☐ Little evidence of flood chutes crossing inside of bends, only minor side, point, or delta bars.	☐ Minor flood chutes crossing inside of bends, evidence of single to multiple unvegetated mid-channel, delta, or diagonal bars. Some potential for channel avulsion.	☐ Historic or active flood chutes crossing inside of bends, evidence of channel avulsion, islands, and multiple unvegetated mid-channel, delta, or diagonal bars.	☐ Active large flood chutes, evidence of recent channel avulsion, multiple thread channels, islands, and multiple unvegetated mid-channel, delta, or diagonal bars.
	☐ No human-caused alteration of channel planform and / or the width of the floodprone area.	☐ Minor to moderate alteration of channel planform and/or width of the floodprone area resulting from floodplain encroachment, channel straightening, or dredging.	☐ Major alteration of channel planform and/or the width of the floodprone area resulting from historic floodplain encroachment, dredging, or channel straightening.	☐ Major alteration of channel planform and width of the floodprone area resulting from recent and extensive floodplain encroachment, dredging, and/or channel straightening.
	☐ Human-made constrictions causing only negligible upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive and major upstrm / downstrm deposition and flow bifurcation.
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

7.5 Channel Adjustment Scores – Stream Condition – Channel Evolution Stage

Condition Departure	Reference N/S	Good Minor	Fair Major	Poor Extreme	STD*	Historic	Condition Rating: (Total Score / 80)	Channel Evolution Stage:
Degradation	15						56/80= 0.7	
Aggradation	13							
Widening	13						**7.6 Stream Condition:**	4
Planform	15							
Sub-totals:					**Total Score:**		Good (0.65-0.84)	

Channel Adjustment Processes: ______________________________

7.7 Stream Sensitivity: Very Low / Low / Moderate / High / Very High / Extreme

* Channel Condition "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Channel Condition default to poor - Due to channel alterations from work in channel after flood: **Y/N**

* Stream Sensitivity "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Stream Sensitivity "default" to **poor** Due to channel alterations from work in channel after flood: **Y/N**

VT RAPID GEOMORPHIC ASSESSMENT ----- UNCONFINED STREAMS

For narrow and broad to very broad valley types (confinement ratio ≥ 4) Typically Riffle-pool and Dune-Ripple Stream Types

Stream Name: Marsh Brook
Location: ______________________

Observers: Tucker, Staci, Karen
Organization /Agency: ______________________
Reference Stream Type ______________________ ☐ Modified
(If alluvial fan or naturally braided system see Handbook Protocols)

Segment I.D: M4T2.3S8.05 - A
Date: 10/06/2020
Town: ______________________
Elevation: ______________________ ft.
Weather: sunny
Rain Storm within past 7 days: Y / N

Adjustment Process	Reference	Good	Fair	Poor
7.1 Channel Degradation (Incision)	☐ Little evidence of localized slope increase or nickpoints.	☐ Minor localized slope increase or nickpoints.	☐ Sharp change in slope, head cuts present, and/or tributaries rejuvenating.	☐ Sharp change in slope and / or multiple head cuts present. Tributaries rejuvenating.
• Exposed till or fresh substrate in the stream bed and exposed infrastructure(bridge footings)	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **OR** Entrenchment ratio ≤ 2.0
• New terraces or recently abandoned floodplains. • Headcuts, or nickpoints that are 2-3 times steeper than typical riffle. • Freshly eroded, vertical banks.	☐ Riffle heads complete and comprised of courser sediments (≥D80). Full complement of expected bed features.	☐ Riffle heads mostly complete. Riffle lengths may appear shorter. Full complement of expected bed features.	☐ Riffles or dunes may appear incomplete; bed profile dominated by runs.	☐ Riffle-pool or ripple-dune features replaced by plane bed features.
• Alluvial (river) sediments that are imbricated (stacked like dominoes) high in bank.	☐ No significant human-caused change in channel confinement or valley type.	☐ Only minor human-caused change in channel confinement but no change in valley type.	☐ Significant human-caused change in channel confinement enough to change valley type, but still unconfined.	☐ Human-caused change in valley type, unconfined or narrow changed to confined.
• Tributary rejuvenation, observed through the presence of nickpoints at or upstream of the mouth of a tributary. • Bars with steep faces, usually occurring on the downstream end of a bar.	☐ No evidence of historic / present channel straightening, gravel mining, dredging and/or channel avulsions.	☐ Evidence of minor bar scalping on a point bar and/or channel avulsion; but minor to no historic channel straightening, gravel mining, or dredging.	☐ Evidence of significant historic channel straightening, dredging, gravel mining and/or channel avulsions.	☐ Extensive historic channel straightening, commercial gravel mining, and/or recent channel avulsion.
Stream Type Departure ☐ **Type of STD:**______________	☐ No known flow alterations (i.e., increases in flow or decreases in sediment supply).	☐ Minor flow alterations, some flow increase and/or reduction of sediment load.	☐ Major historic flow alterations, greater flows and/or reduction of sediment load.	☐ Major existing flow alterations, greater flows and/or reduction of sediment load.
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Adjustment Process	Reference	Good	Fair	Poor
7.2 Channel Aggradation • Shallow pool depths.	☐ Complete riffle heads and deep pools in riffle-pool systems.** Full complement of expected bed features.	☐ Mostly complete riffles and/or some filling of pools with fine sediment. Pools may only be slightly deeper and wider than runs.**	☐ Incomplete riffles or dunes and dominated by runs. Significant filling of pools with sediment, pools may be absent with runs prevailing.	☐ Riffle-pool or ripple-dune features replaced by plane bed features.
• Abundant sediment deposition on point bars and mid-channel bars and extensive sediment deposition at obstructions, channel constrictions, and at the upstream end of tight meander bends. Islands may be present.	☐ Minor point or delta bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Major sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
• Most of the channel bed is exposed during typical low flow periods.	☐ No apparent increase in fine gravel/sand substrates (pebble count).**	☐ Some increase in fine gravel/sand substrates that may comprise over 50% of the sediments.	☐ Large incr. in fine gravel/ sand substrates that may comprise over 70% of the sediments. Sediment feels soft underfoot.	☐ Homogenous fine gravel/ sand substrates may comprise over 90% of the sediments. Sediment feels soft underfoot.
• High frequency of debris jams.	☐ Low width/depth ratio ≤ 20 for C or B type channels ≤ 10 for E type channels	☐ Low to moderate W/d ratio >20 ≤ 30 for C or B channels >10 ≤ 12 for E channels	☐ Moderate to high W/d ratio >30 ≤ 40 for C or B channels >12 ≤ 20 for E channels	☐ High width/depth ratio >40 for C or B type channels >20 for E type channels
• Coarse gravels, cobbles, and boulders may be embedded with sand/silt and fine gravel.	☐ No known flow alterations (i.e., decrease in flow or increase in sediment supply).	☐ Minor reduction in flow and/or increase in sediment load. Flood-related sediment working through reach, seen as enlarged bars.	☐ Major historic flow alterations, reduction in flows and / or increase in sediment load.	☐ Major existing flow alterations, extreme reduction in flows and / or increase in sediment load.
** This parameter may be a difficult to infeasible to evaluate in ripple-dune stream types **Stream Type Departure** ☐ **Type of STD:**______________	☐ No human-made constrictions causing upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive upstrm / dwnstrm deposition and flow bifurcation.
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Adjustment Process	Condition Category: Reference	Good	Fair	Poor
7.3 Widening Channel	☐ Low width/depth ratio $\leq$ 20 for C or B type channels $\leq$ 10 for E type channels	☐ Low to moderate W/d ratio >20 $\leq$ 30 for C or B channels >10 $\leq$ 12 for E channels	☐ Moderate to high W/d ratio >30 $\leq$ 40 for C or B channels >12 $\leq$ 20 for E channels	☐ High width/depth ratio >40 for C or B type channels >20 for E type channels
• Active undermining of bank vegetation on both sides of the channel; many unstable bank overhangs that have little vegetation holding soils together. • Erosion on both right and left banks in riffle sections. • Recently exposed tree roots (fresh roots are 'green' and do not break easily, older roots are brittle and will break easily in your hand). • Fracture lines at the top of the bank that appear as cracks parallel to the river. • Mid-channel bars and side bars may be present. • Urbanization and stormwater outfalls leading to higher rate and duration of runoff and channel enlargement.	☐ Little to no scour and erosion at the base of both banks at the riffle section. Negligible bank overhangs, fracture lines at top of banks, leaning trees or freshly exposed tree roots.	☐ Minimal to moderate scour and erosion at the base of both banks at the riffle section. Some overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Moderate to high scour and erosion at the base of both banks at the riffle section. Many bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Continuous and laterally extensive scour and erosion at the base of both banks at the riffle section. Continuous bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.
	☐ Incision Ratio $\geq$ 1.0 < 1.2 **and** Entrenchment ratio > 2.0	☐ Incision Ratio $\geq$ 1.2 < 1.4 **and** Entrenchment ratio > 2.0	☐ Incision Ratio $\geq$ 1.4 < 2.0 **and** Entrenchment ratio > 2.0	☐ Incision ratio $\geq$ 2.0 **OR** Entrenchment ratio $\leq$ 2.0
	☐ Minor point or delta bars present. Depositional features less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Major sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
	☐ No known channel and / or flow alterations (i.e., increase in flow and / or change in sediment supply).	☐ Minor increase in watershed input of flows or sediment. Episodic (flood) discharges through reach resulting in short-term enlargement.	☐ Major channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).	☐ Major and extensive channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.4 Change in Planform	☐ Low bank erosion on outside bends, little or no change in sinuosity within the reach.	☐ Low to moderate lateral bank erosion on outside bends, may include minor change in sinuosity within the reach.	☐ Moderate to high lateral bank erosion on most outside bends, may include potential neck cut-offs and moderate change in sinuosity.	☐ Extensive lateral bank erosion on most outside bends, may include impending neck cut-offs and major change in sinuosity within the reach.
• Flood chutes or neck cut-offs may be present. • Channel avulsions may be evident or impending. • Change or loss in bed form structure, sometimes resulting in a mix of plane bed and riffle- pool forms. • Island formation and/or multiple thread channels. • In meandering streams the thalweg, or deepest part of the channel, typically travels from the outside of a meander bend to the outside of the next meander bend. Pools are located on downstream third of the concave bends. Riffles are at the cross-over between the pools on successive bends. During planform adjustments, the thalweg may not line up with or follow this pattern. As a result of the lateral extension of meander bends, additional deposition and scour features may be in a channel length typically occupied by a single riffle-pool sequence.	☐ Little evidence of flood chutes crossing inside of meander bends, only minor point or delta bars.	☐ Minor flood chutes crossing inside of meander bends, evidence of minor to moderate unvegetated mid-channel, delta, or diagonal bars. Some potential for channel avulsion.	☐ Historic or active flood chutes crossing inside of meander bends, evidence of channel avulsion, islands, and unvegetated mid-channel, delta, or diagonal bars.	☐ Active large flood chutes crossing inside of most meander bends, evidence of recent channel avulsion, multiple thread channels, islands, and unvegetated mid-channel, delta, or diagonal bars.
	☐ No additional deposition and scour features in the channel length typically occupied by a single riffle-pool sequence. Thalweg lined up with planform.	☐ Additional minor deposition and scour features in the channel length typically occupied by a single riffle-pool sequence.	☐ Additional large deposition and scour features in the channel length typically occupied by a single riffle-pool sequence. Thalweg not lined up with planform.	☐ Multiple sequences of large deposition and scour features in the channel length typically occupied by a single riffle-pool sequence.
	☐ No human-caused alteration of channel planform and / or the width of the floodprone area.	☐ Minor to moderate alteration of channel planform and/or width of the floodprone area resulting from floodplain encroachment, channel straightening, or dredging.	☐ Major alteration of channel planform and/or the width of the floodprone area resulting from historic floodplain encroachment, dredging, or channel straightening.	☐ Major alteration of channel planform and width of the floodprone area resulting from recent and extensive floodplain encroachment, dredging, and/or channel straightening.
	☐ Human-made constrictions causing only negligible upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive and major upstrm / downstrm deposition and flow bifurcation.
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

7.5 Channel Adjustment Scores – Stream Condition – Channel Evolution Stage

Condition / Departure	Reference / N/S	Good / Minor	Fair / Major	Poor / Extreme	STD*	Historic	Condition Rating: (Total Score / 80)	Channel Evolution Stage:
Degradation	14						57/80=.71	
Aggradation	15							
Widening	15						**7.6 Stream Condition:** Good (0.65-.085)	
Planform	13							

Channel Adjustment Processes: ______________________________

7.7 Stream Sensitivity: Very Low / Low / Moderate / High / Very High / Extreme

* Channel Condition "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Channel Condition default to poor - Due to channel alterations from work in channel after flood: **Y/N**

* Stream Sensitivity "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Stream Sensitivity "default" to **poor** Due to channel alterations from work in channel after flood: **Y/N**

VT RAPID GEOMORPHIC ASSESSMENT ----- UNCONFINED STREAMS

For narrow and broad to very broad valley types (confinement ratio ≥ 4) Typically Riffle-pool and Dune-Ripple Stream Types

Stream Name: Marsh Brook

Location:

Observers: Tucker, Karen, Staci

Organization /Agency:

Reference Stream Type E ☐ Modified

(If alluvial fan or naturally braided system see Handbook Protocols)

Segment I.D: M4T2.3S8.05-B

Date: 10/06/2020

Town:

Elevation: ___ ft.

Weather: sunny

Rain Storm within past 7 days: Y / N

Adjustment Process	Reference	Good	Fair	Poor
7.1 Channel Degradation (Incision) • Exposed till or fresh substrate in the stream bed and exposed infrastructure(bridge footings) • New terraces or recently abandoned floodplains. • Headcuts, or nickpoints that are 2-3 times steeper than typical riffle. • Freshly eroded, vertical banks. • Alluvial (river) sediments that are imbricated (stacked like dominoes) high in bank. • Tributary rejuvenation, observed through the presence of nickpoints at or upstream of the mouth of a tributary. • Bars with steep faces, usually occurring on the downstream end of a bar.	☐ Little evidence of localized slope increase or nickpoints.	☐ Minor localized slope increase or nickpoints.	☐ Sharp change in slope, head cuts present, and/or tributaries rejuvenating.	☐ Sharp change in slope and / or multiple head cuts present. Tributaries rejuvenating.
	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **OR** Entrenchment ratio ≤ 2.0
	☐ Riffle heads complete and comprised of courser sediments (≥D80). Full complement of expected bed features.	☐ Riffle heads mostly complete. Riffle lengths may appear shorter. Full complement of expected bed features.	☐ Riffles or dunes may appear incomplete; bed profile dominated by runs.	☐ Riffle-pool or ripple-dune features replaced by plane bed features.
	☐ No significant human-caused change in channel confinement or valley type.	☐ Only minor human-caused change in channel confinement but no change in valley type.	☐ Significant human-caused change in channel confinement enough to change valley type, but still unconfined.	☐ Human-caused change in valley type, unconfined or narrow changed to confined.
	☐ No evidence of historic / present channel straightening, gravel mining, dredging and/or channel avulsions.	☐ Evidence of minor bar scalping on a point bar and/or channel avulsion; but minor to no historic channel straightening, gravel mining, or dredging.	☐ Evidence of significant historic channel straightening, dredging, gravel mining and/or channel avulsions.	☐ Extensive historic channel straightening, commercial gravel mining, and/or recent channel avulsion.
Stream Type Departure ☐ **Type of STD:** ______	☐ No known flow alterations (i.e., increases in flow or decreases in sediment supply).	☐ Minor flow alterations, some flow increase and/or reduction of sediment load.	☐ Major historic flow alterations, greater flows and/or reduction of sediment load.	☐ Major existing flow alterations, greater flows and/or reduction of sediment load.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.2 Channel Aggradation • Shallow pool depths. • Abundant sediment deposition on point bars and mid-channel bars and extensive sediment deposition at obstructions, channel constrictions, and at the upstream end of tight meander bends. Islands may be present. • Most of the channel bed is exposed during typical low flow periods. • High frequency of debris jams. • Coarse gravels, cobbles, and boulders may be embedded with sand/silt and fine gravel. ** This parameter may be a difficult to infeasible to evaluate in ripple-dune stream types	☐ Complete riffle heads and deep pools in riffle-pool systems.** Full complement of expected bed features.	☐ Mostly complete riffles and/or some filling of pools with fine sediment. Pools may only be slightly deeper and wider than runs.**	☐ Incomplete riffles or dunes and dominated by runs. Significant filling of pools with sediment, pools may be absent with runs prevailing.	☐ Riffle-pool or ripple-dune features replaced by plane bed features.
	☐ Minor point or delta bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Major sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
	☐ No apparent increase in fine gravel/sand substrates (pebble count).**	☐ Some increase in fine gravel/sand substrates that may comprise over 50% of the sediments.	☐ Large incr. in fine gravel/ sand substrates that may comprise over 70% of the sediments. Sediment feels soft underfoot.	☐ Homogenous fine gravel/ sand substrates may comprise over 90% of the sediments. Sediment feels soft underfoot.
	☐ Low width/depth ratio ≤ 20 for C or B type channels ≤ 10 for E type channels	☐ Low to moderate W/d ratio >20 ≤ 30 for C or B channels >10 ≤ 12 for E channels	☐ Moderate to high W/d ratio >30 ≤ 40 for C or B channels >12 ≤ 20 for E channels	☐ High width/depth ratio >40 for C or B type channels >20 for E type channels
	☐ No known flow alterations (i.e., decrease in flow or increase in sediment supply).	☐ Minor reduction in flow and/or increase in sediment load. Flood-related sediment working through reach, seen as enlarged bars.	☐ Major historic flow alterations, reduction in flows and / or increase in sediment load.	☐ Major existing flow alterations, extreme reduction in flows and / or increase in sediment load.
Stream Type Departure ☐ **Type of STD:** ______	☐ No human-made constrictions causing upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive upstrm / dwnstrm deposition and flow bifurcation.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Adjustment Process	Condition Category: Reference	Good	Fair	Poor
7.3 Widening Channel • Active undermining of bank vegetation on both sides of the channel; many unstable bank overhangs that have little vegetation holding soils together. • Erosion on both right and left banks in riffle sections. • Recently exposed tree roots (fresh roots are 'green' and do not break easily, older roots are brittle and will break easily in your hand). • Fracture lines at the top of the bank that appear as cracks parallel to the river. • Mid-channel bars and side bars may be present. • Urbanization and stormwater outfalls leading to higher rate and duration of runoff and channel enlargement.	☐ Low width/depth ratio ≤ 20 for C or B type channels ≤ 10 for E type channels	☐ Low to moderate W/d ratio >20 ≤ 30 for C or B channels >10 ≤ 12 for E channels	☐ Moderate to high W/d ratio >30 ≤ 40 for C or B channels >12 ≤ 20 for E channels	☐ High width/depth ratio >40 for C or B type channels >20 for E type channels
	☐ Little to no scour and erosion at the base of both banks at the riffle section. Negligible bank overhangs, fracture lines at top of banks, leaning trees or freshly exposed tree roots.	☐ Minimal to moderate scour and erosion at the base of both banks at the riffle section. Some overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Moderate to high scour and erosion at the base of both banks at the riffle section. Many bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Continuous and laterally extensive scour and erosion at the base of both banks at the riffle section. Continuous bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.
	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **OR** Entrenchment ratio ≤ 2.0
	☐ Minor point or delta bars present. Depositional features less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Major sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
	☐ No known channel and / or flow alterations (i.e., increase in flow and / or change in sediment supply).	☐ Minor increase in watershed input of flows or sediment. Episodic (flood) discharges through reach resulting in short-term enlargement.	☐ Major channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).	☐ Major and extensive channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.4 Change in Planform • Flood chutes or neck cut-offs may be present. • Channel avulsions may be evident or impending. • Change or loss in bed form structure, sometimes resulting in a mix of plane bed and riffle- pool forms. • Island formation and/or multiple thread channels. • In meandering streams the thalweg, or deepest part of the channel, typically travels from the outside of a meander bend to the outside of the next meander bend. Pools are located on downstream third of the concave bends. Riffles are at the cross-over between the pools on successive bends. During planform adjustments, the thalweg may not line up with or follow this pattern. As a result of the lateral extension of meander bends, additional deposition and scour features may be in a channel length typically occupied by a single riffle-pool sequence.	☐ Low bank erosion on outside bends, little or no change in sinuosity within the reach.	☐ Low to moderate lateral bank erosion on outside bends, may include minor change in sinuosity within the reach.	☐ Moderate to high lateral bank erosion on most outside bends, may include potential neck cut-offs and moderate change in sinuosity.	☐ Extensive lateral bank erosion on most outside bends, may include impending neck cut-offs and major change in sinuosity within the reach.
	☐ Little evidence of flood chutes crossing inside of meander bends, only minor point or delta bars.	☐ Minor flood chutes crossing inside of meander bends, evidence of minor to moderate unvegetated mid-channel, delta, or diagonal bars. Some potential for channel avulsion.	☐ Historic or active flood chutes crossing inside of meander bends, evidence of channel avulsion, islands, and unvegetated mid-channel, delta, or diagonal bars.	☐ Active large flood chutes crossing inside of most meander bends, evidence of recent channel avulsion, multiple thread channels, islands, and unvegetated mid-channel, delta, or diagonal bars.
	☐ No additional deposition and scour features in the channel length typically occupied by a single riffle-pool sequence. Thalweg lined up with planform.	☐ Additional minor deposition and scour features in the channel length typically occupied by a single riffle-pool sequence.	☐ Additional large deposition and scour features in the channel length typically occupied by a single riffle-pool sequence. Thalweg not lined up with planform.	☐ Multiple sequences of large deposition and scour features in the channel length typically occupied by a single riffle-pool sequence.
	☐ No human-caused alteration of channel planform and / or the width of the floodprone area.	☐ Minor to moderate alteration of channel planform and/or width of the floodprone area resulting from floodplain encroachment, channel straightening, or dredging.	☐ Major alteration of channel planform and/or the width of the floodprone area resulting from historic floodplain encroachment, dredging, or channel straightening.	☐ Major alteration of channel planform and width of the floodprone area resulting from recent and extensive floodplain encroachment, dredging, and/or channel straightening.
	☐ Human-made constrictions causing only negligible upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive and major upstrm / downstrm deposition and flow bifurcation.
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

7.5 Channel Adjustment Scores – Stream Condition – Channel Evolution Stage

Condition Departure	Reference N/S	Good Minor	Fair Major	Poor Extreme	STD*	Historic	Condition Rating: (Total Score / 80)	Channel Evolution Stage:
Degradation	11						48/80= 0.6	
Aggradation	11							
Widening	13						**7.6 Stream Condition:** Fair (0.35-0.64)	
Planform	13							

Channel Adjustment Processes: ___________________________________

7.7 Stream Sensitivity: Very Low / Low / Moderate / High / Very High / Extreme

* Channel Condition "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Channel Condition default to poor - Due to channel alterations from work in channel after flood: **Y/N**

* Stream Sensitivity "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Stream Sensitivity "default" to **poor** Due to channel alterations from work in channel after flood: **Y/N**

VT RAPID GEOMORPHIC ASSESSMENT ----- UNCONFINED STREAMS

For narrow and broad to very broad valley types (confinement ratio ≥ 4) Typically Riffle-pool and Dune-Ripple Stream Types

Stream Name: Marsh Brook
Location: ______________________

Observers: Tucker, Staci, Karen
Organization /Agency: ______________________
Reference Stream Type ______________________ ☐ Modified
(If alluvial fan or naturally braided system see Handbook Protocols)

Segment I.D: M4T2.3S8.05-C
Date: 10/06/2020
Town: ______________________
Elevation: ______________________ ft.
Weather: sunny
Rain Storm within past 7 days: Y / N

Adjustment Process	Condition Category: Reference	Good	Fair	Poor
7.1 Channel Degradation (Incision) • Exposed till or fresh substrate in the stream bed and exposed infrastructure(bridge footings) • New terraces or recently abandoned floodplains. • Headcuts, or nickpoints that are 2-3 times steeper than typical riffle. • Freshly eroded, vertical banks. • Alluvial (river) sediments that are imbricated (stacked like dominoes) high in bank. • Tributary rejuvenation, observed through the presence of nickpoints at or upstream of the mouth of a tributary. • Bars with steep faces, usually occurring on the downstream end of a bar.	☐ Little evidence of localized slope increase or nickpoints.	☐ Minor localized slope increase or nickpoints.	☐ Sharp change in slope, head cuts present, and/or tributaries rejuvenating.	☐ Sharp change in slope and / or multiple head cuts present. Tributaries rejuvenating.
	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **OR** Entrenchment ratio ≤ 2.0
	☐ Riffle heads complete and comprised of courser sediments (≥D80). Full complement of expected bed features.	☐ Riffle heads mostly complete. Riffle lengths may appear shorter. Full complement of expected bed features.	☐ Riffles or dunes may appear incomplete; bed profile dominated by runs.	☐ Riffle-pool or ripple-dune features replaced by plane bed features.
	☐ No significant human-caused change in channel confinement or valley type.	☐ Only minor human-caused change in channel confinement but no change in valley type.	☐ Significant human-caused change in channel confinement enough to change valley type, but still unconfined.	☐ Human-caused change in valley type, unconfined or narrow changed to confined.
	☐ No evidence of historic / present channel straightening, gravel mining, dredging and/or channel avulsions.	☐ Evidence of minor bar scalping on a point bar and/or channel avulsion; but minor to no historic channel straightening, gravel mining, or dredging.	☐ Evidence of significant historic channel straightening, dredging, gravel mining and/or channel avulsions.	☐ Extensive historic channel straightening, commercial gravel mining, and/or recent channel avulsion.
Stream Type Departure ☐ **Type of STD:**______________	☐ No known flow alterations (i.e., increases in flow or decreases in sediment supply).	☐ Minor flow alterations, some flow increase and/or reduction of sediment load.	☐ Major historic flow alterations, greater flows and/or reduction of sediment load.	☐ Major existing flow alterations, greater flows and/or reduction of sediment load.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.2 Channel Aggradation • Shallow pool depths. • Abundant sediment deposition on point bars and mid-channel bars and extensive sediment deposition at obstructions, channel constrictions, and at the upstream end of tight meander bends. Islands may be present. • Most of the channel bed is exposed during typical low flow periods. • High frequency of debris jams. • Coarse gravels, cobbles, and boulders may be embedded with sand/silt and fine gravel.	☐ Complete riffle heads and deep pools in riffle-pool systems.** Full complement of expected bed features.	☐ Mostly complete riffles and/or some filling of pools with fine sediment. Pools may only be slightly deeper and wider than runs.**	☐ Incomplete riffles or dunes and dominated by runs. Significant filling of pools with sediment, pools may be absent with runs prevailing.	☐ Riffle-pool or ripple-dune features replaced by plane bed features.
	☐ Minor point or delta bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Major sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
	☐ No apparent increase in fine gravel/sand substrates (pebble count).**	☐ Some increase in fine gravel/sand substrates that may comprise over 50% of the sediments.	☐ Large incr. in fine gravel/ sand substrates that may comprise over 70% of the sediments. Sediment feels soft underfoot.	☐ Homogenous fine gravel/ sand substrates may comprise over 90% of the sediments. Sediment feels soft underfoot.
	☐ Low width/depth ratio ≤ 20 for C or B type channels ≤ 10 for E type channels	☐ Low to moderate W/d ratio >20 ≤ 30 for C or B channels >10 ≤ 12 for E channels	☐ Moderate to high W/d ratio >30 ≤ 40 for C or B channels >12 ≤ 20 for E channels	☐ High width/depth ratio >40 for C or B type channels >20 for E type channels
** This parameter may be a difficult to infeasible to evaluate in ripple-dune stream types	☐ No known flow alterations (i.e., decrease in flow or increase in sediment supply).	☐ Minor reduction in flow and/or increase in sediment load. Flood-related sediment working through reach, seen as enlarged bars.	☐ Major historic flow alterations, reduction in flows and / or increase in sediment load.	☐ Major existing flow alterations, extreme reduction in flows and / or increase in sediment load.
Stream Type Departure ☐ **Type of STD:**______________	☐ No human-made constrictions causing upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive upstrm / dwnstrm deposition and flow bifurcation.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Adjustment Process	Condition Category: Reference	Good	Fair	Poor
7.3 Widening Channel • Active undermining of bank vegetation on both sides of the channel; many unstable bank overhangs that have little vegetation holding soils together. • Erosion on both right and left banks in riffle sections. • Recently exposed tree roots (fresh roots are 'green' and do not break easily, older roots are brittle and will break easily in your hand). • Fracture lines at the top of the bank that appear as cracks parallel to the river. • Mid-channel bars and side bars may be present. • Urbanization and stormwater outfalls leading to higher rate and duration of runoff and channel enlargement.	☐ Low width/depth ratio ≤ 20 for C or B type channels ≤ 10 for E type channels	☐ Low to moderate W/d ratio >20 ≤ 30 for C or B channels >10 ≤ 12 for E channels	☐ Moderate to high W/d ratio >30 ≤ 40 for C or B channels >12 ≤ 20 for E type channels	☐ High width/depth ratio >40 for C or B type channels >20 for E type channels
	☐ Little to no scour and erosion at the base of both banks at the riffle section. Negligible bank overhangs, fracture lines at top of banks, leaning trees or freshly exposed tree roots.	☐ Minimal to moderate scour and erosion at the base of both banks at the riffle section. Some overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Moderate to high scour and erosion at the base of both banks at the riffle section. Many bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Continuous and laterally extensive scour and erosion at the base of both banks at the riffle section. Continuous bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.
	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Entrenchment ratio > 2.0	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Entrenchment ratio > 2.0	☐ Incision ratio ≥ 2.0 **OR** Entrenchment ratio ≤ 2.0
	☐ Minor point or delta bars present. Depositional features less than half bankfull stage in height.	☐ Single to multiple mid-channel or diagonal bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or diagonal bars present. Major sediment buildup at the head of bendways leading to steep riffles and flood chutes.	☐ Multiple unvegetated mid-channel or diagonal bars present splitting or braiding flows even under low flow conditions.
	☐ No known channel and / or flow alterations (i.e., increase in flow and / or change in sediment supply).	☐ Minor increase in watershed input of flows or sediment. Episodic (flood) discharges through reach resulting in short-term enlargement.	☐ Major channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).	☐ Major and extensive channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.4 Change in Planform • Flood chutes or neck cut-offs may be present. • Channel avulsions may be evident or impending. • Change or loss in bed form structure, sometimes resulting in a mix of plane bed and riffle- pool forms. • Island formation and/or multiple thread channels. • In meandering streams the thalweg, or deepest part of the channel, typically travels from the outside of a meander bend to the outside of the next meander bend. Pools are located on downstream third of the concave bends. Riffles are at the cross-over between the pools on successive bends. During planform adjustments, the thalweg may not line up with or follow this pattern. As a result of the lateral extension of meander bends, additional deposition and scour features may be in a channel length typically occupied by a single riffle-pool sequence.	☐ Low bank erosion on outside bends, little or no change in sinuosity within the reach.	☐ Low to moderate lateral bank erosion on outside bends, may include minor change in sinuosity within the reach.	☐ Moderate to high lateral bank erosion on most outside bends, may include potential neck cut-offs and moderate change in sinuosity.	☐ Extensive lateral bank erosion on most outside bends, may include impending neck cut-offs and major change in sinuosity within the reach.
	☐ Little evidence of flood chutes crossing inside of meander bends, only minor point or delta bars.	☐ Minor flood chutes crossing inside of meander bends, evidence of minor to moderate unvegetated mid-channel, delta, or diagonal bars. Some potential for channel avulsion.	☐ Historic or active flood chutes crossing inside of meander bends, evidence of channel avulsion, islands, and unvegetated mid-channel, delta, or diagonal bars.	☐ Active large flood chutes crossing inside of most meander bends, evidence of recent channel avulsion, multiple thread channels, islands, and unvegetated mid-channel, delta, or diagonal bars.
	☐ No additional deposition and scour features in the channel length typically occupied by a single riffle-pool sequence. Thalweg lined up with planform.	☐ Additional minor deposition and scour features in the channel length typically occupied by a single riffle-pool sequence.	☐ Additional large deposition and scour features in the channel length typically occupied by a single riffle-pool sequence. Thalweg not lined up with planform.	☐ Multiple sequences of large deposition and scour features in the channel length typically occupied by a single riffle-pool sequence.
	☐ No human-caused alteration of channel planform and / or the width of the floodprone area.	☐ Minor to moderate alteration of channel planform and/or width of the floodprone area resulting from floodplain encroachment, channel straightening, or dredging.	☐ Major alteration of channel planform and/or the width of the floodprone area resulting from historic floodplain encroachment, dredging, or channel straightening.	☐ Major alteration of channel planform and width of the floodprone area resulting from recent and extensive floodplain encroachment, dredging, and/or channel straightening.
	☐ Human-made constrictions causing only negligible upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / downstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive and major upstrm / downstrm deposition and flow bifurcation.
Score: Historic ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

7.5 Channel Adjustment Scores – Stream Condition – Channel Evolution Stage

Condition / Departure	Reference / N/S	Good / Minor	Fair / Major	Poor / Extreme	STD*	Historic	Condition Rating: (Total Score / 80)	Channel Evolution Stage:
Degradation	5						42/80= 0.52	2
Aggradation	13							
Widening	11						**7.6 Stream Condition:** Fair (0.35-0.64)	
Planform	13							

Channel Adjustment Processes: ______________________________

7.7 Stream Sensitivity: Very Low / Low / Moderate / High / Very High / Extreme

* Channel Condition "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Channel Condition default to poor - Due to channel alterations from work in channel after flood: **Y/N**

* Stream Sensitivity "default" to **poor** – significant flood damage (not able to get accurate channel data) **Y/N ;**

* Stream Sensitivity "default" to **poor** Due to channel alterations from work in channel after flood: **Y/N**

Appendix B

1962 Orthophotos, 1995 GoogleEarth Imagery, 1857 Map


VT-62-H 23-38


5-10-62
VT-62-H 23-22
290
CFL151.33


1962 Ortho zoomed in to downstream reaches

1962 Ortho zoomed in to mid-stream reaches

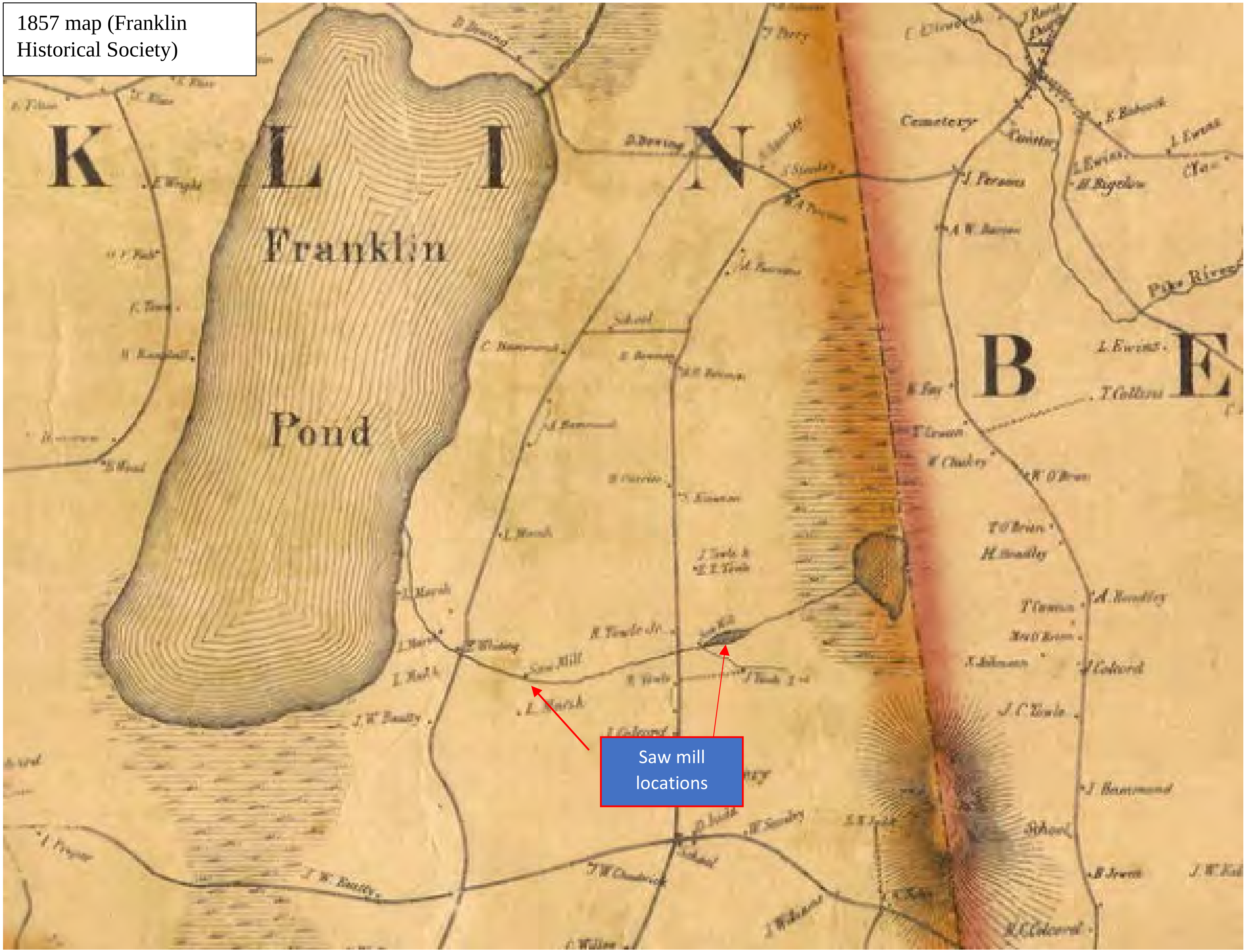
1962 Ortho zoomed in to upstream reaches

1995 Google Earth Imagery zoomed in to downstream reaches

1995 Google Earth Imagery zoomed in to mid-stream reaches

1995 Google Earth Imagery zoomed in to upstream reaches

1857 map (Franklin Historical Society)



Appendix C

Project Table and Reach Map – Project Location

The projects identified in Table 2 are considered preliminary and will require additional project development and investigation to determine the feasibility of the project. Projects are listed by the order at which they were identified during the stream walk (walking upstream). Reach maps are provided to show location of preliminary projects.

A preliminary priority for projects has been assigned based on; level of sediment contribution, potential impacts to other natural resource were the project to be pursued, opportunity to engage landowners in looking at localized areas of inputs, area still being impacted from historic channel management, and area in the watershed where current conditions reduce the potential for sediment/nutrient attenuation. Higher priority projects are those where restoration and/or protection would provide the greatest improvement for the stream condition and overall watershed attenuation benefits. Lower priority projects are those where there is likely to be a large impact to another natural resource, and/or are areas of smaller localized sediment sources or impact. Other factors such as landowner interest, permitting and economic considerations will also influence the project feasibility and priority of when a project is pursued. In general, the next step for all the projects identified is to begin reaching out to landowners and, where noted, regulatory programs to evaluate possible next steps in project development. A holistic approach to develop projects along the entire stream corridor will provide the greatest benefits to the brook and ultimately Lake Carmi.

Table 1: Preliminary Project Identification

Project #	Segment ID	Project	Next Steps	Preliminary Priority	Considerations
1	M4T2.3S8.02-A	Potential Floodplain restoration to reduce incision	Contact State Park Coordinator to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	Low	Intact Class 2 wetland. Active restoration would impact important wetland area. Access to floodplain is available at moderate to high flows. Rare and Uncommon Species noted on BioFinder in this area
2	M4T2.3S8.02-B	Small stream bank stabilization project	Contact State Park Coordinator to determine potential interest in exploring this project. Engage Rivers Program to determine potential strategies for this area and permitting requirements.	Low	Bank erosion localized area and due to natural scour around downed tree. Area immediately upstream of rip-rap bank for crossing. Could be done with bioengineering to provide improved bank conditions for vegetation to become established

3	M4T2.3S8.02-B	Investigate overland flow from State Park field	Walk filed edge during late winter /early spring after snow melt and before vegetation growth starts to locate possible overland flow paths	Mod	Identifying areas where concentrated flow maybe occurring and contributing to erosion/sediment sources
4	M4T2.3S8.03-A	Potential Floodplain/Wetland restoration	Contact landowner to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	Mod	Bank erosion moderate Localized area of incision that can be improved Wetlands Program confirmed wetland area
5	M4T2.3S8.03-A	Buffer Planting	Contact landowner to determine potential interest in exploring this project	High	Planting to be done back from top of bank to recognize future channel adjustment Provides important connection between up/downstream forested areas
6	M4T2.3S8.03-A	VAST / TH-33 Bridge improvement -	Contact local VAST club to determine potential interest in exploring this project	Low	Small sediment source. Bridge abutments impacted by scour and localized creating scour on banks.
7	M4T2.3S8.03-B	Buffer Planting	Contact landowner to determine potential interest in exploring this project	High	Provides important connection between up/downstream forested areas
8	M4T2.3S8.03-B	State Park Road (Rte. 236) Culvert Replacement	Contact VTrans to determine potential interest in exploring this project	High	Largest cause of active scour along the entire brook. Structure creates Aquatic Organism Passage impacts for all species. Noted as important Riparian wildlife crossing on BioFinder
9	M4T2.3S8.03-B	Road Drainage Evaluation and project development	Contact VTrans and State Park Coordinator to determine potential interest in this project	Mod	Identifying areas where concentrated flow maybe occurring and contributing to erosion/sediment sources
10	M4T2.3S8.03-B	Private Bridge – explore options to reduce erosion under bridge	Contact landowner to determine potential interest in exploring this project	Mod	Localized sediment source. Underside of bridge beams impacted by scour and localized creating scour on banks.

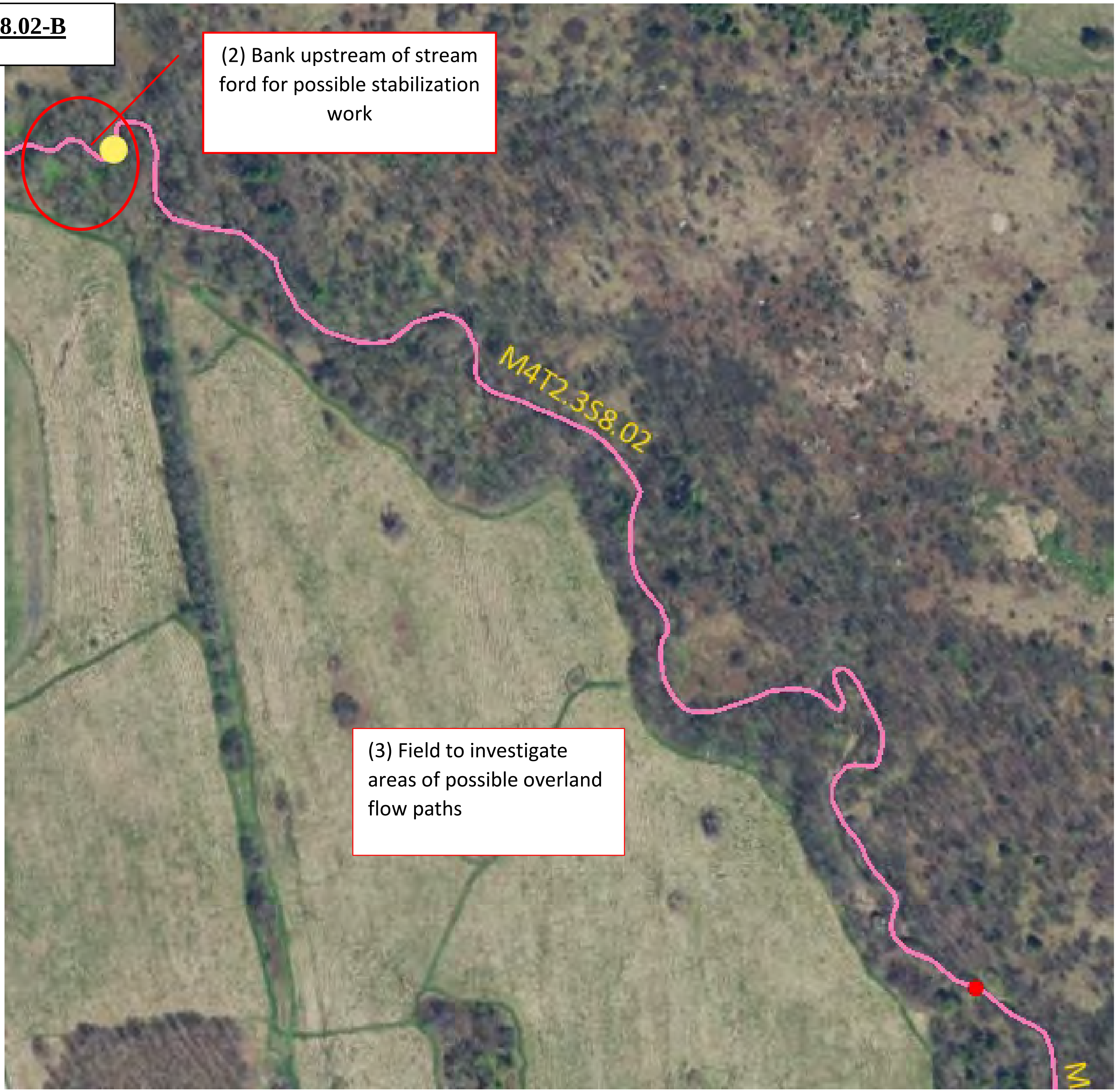
11	M4T2.3S8.03-B	Buffer Planting	Contact landowner to determine potential interest in exploring this project	Low	Area along upper slope of valley. Provides further connection of forested slope in this area.
12	M4T2.3S8.04-A	Stream Ford - assess possible erosion sources	Contact landowner to determine potential interest in exploring this project	Low	Minor sediment source. Ford does have steeper access road slopes on either side of channel that may concentrate flow in the roadbed
13	M4T2.3S8.04-B	Potential Active Floodplain restoration to reduce incision	Contact landowner to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	Mod	Wetlands Program confirmed wetland area Known that beavers historically affected this area Minimal active restoration may be needed if area able to be protected and beavers in area
14	M4T2.3S8.04-B	River Corridor Easement	Contact landowner to determine potential interest in exploring this project. Engage Rivers Program to determine potential strategies for this area	High	Protection of this area would reduce landowner conflict with beaver impacts and/or future channel adjustments. Area important in upper part of the watershed for long term sediment/nutrient attenuation
15	M4T2.3S8.05-A	Towel Neighborhood Rd. - Culvert Replacement Planning	Contact town of Franklin to determine potential interest in supporting this project	Mod	Engaging in planning activities to help with long term strategies at this structure.
16	M4T2.3S8.05-A	Towel Neighborhood Rd. – Hydrologically Connected Road Segment	Contact town of Franklin to determine possible projects under the Municipal General Road Permit for this section of road	Mod	Engaging in planning activities to help with long term strategies along this section of road.
17	M4T2.3S8.05-B	Potential Floodplain/Wetland restoration	Contact landowner to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for	High	Wetlands Program confirmed wetland area Area still impacted from historic channel straightening

			strategies for this area and permitting requirements		
18	M4T2.3S8.02-C	Potential Floodplain/Wetland restoration	Contact landowner to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	High	Wetlands Program confirmed wetland area Channel still impacted from historic channel straightening Headwater area where sediment/nutrient attenuation can be enhanced
19	M4T2.3S8.02-C	Investigate opportunity with landowner to replace undersized culvert	Contact landowner to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	Low	Minor sediment source Structure undersized and contributes to localized impacts in the channel
20	M4T2.3S8.02-C // M4T2.3S8.5S1.01	Buffer Planting	Contact landowner to determine potential interest in exploring this project	Low	Planting close to the straightened and incised channel would contribute to the stream being locked in that condition. If a wider buffer is possible, then planting 15-20 ft back from the channel may allow for some channel adjustment over time.
21	M4T2.3S8.02-C // M4T2.3S8.5S1.01	Potential small tributary / wetland restoration project	Contact landowner to determine potential interest in exploring this project. Engage Wetlands and Rivers Program for strategies for this area and permitting requirements	High	Wetlands Program confirmed wetland area Channel still impacted from historic channel straightening Headwater area where sediment/nutrient attenuation can be enhanced Enhance important habitat for wildlife corridor to stream and wetlands

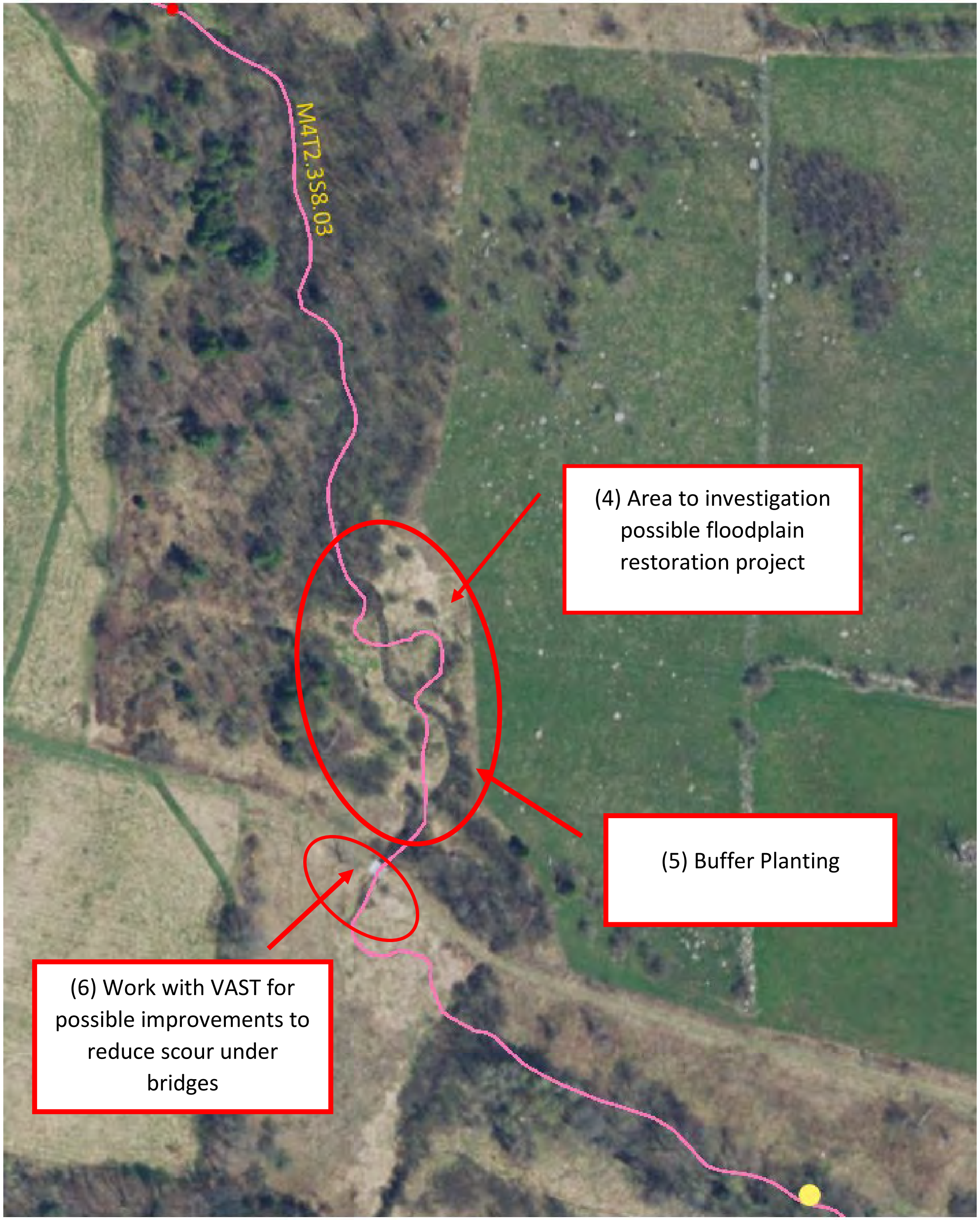
M4T2.3S8.02-A


M4T2.3S8.02
(1) Potential floodplain restoration area. Class II wetland considerations

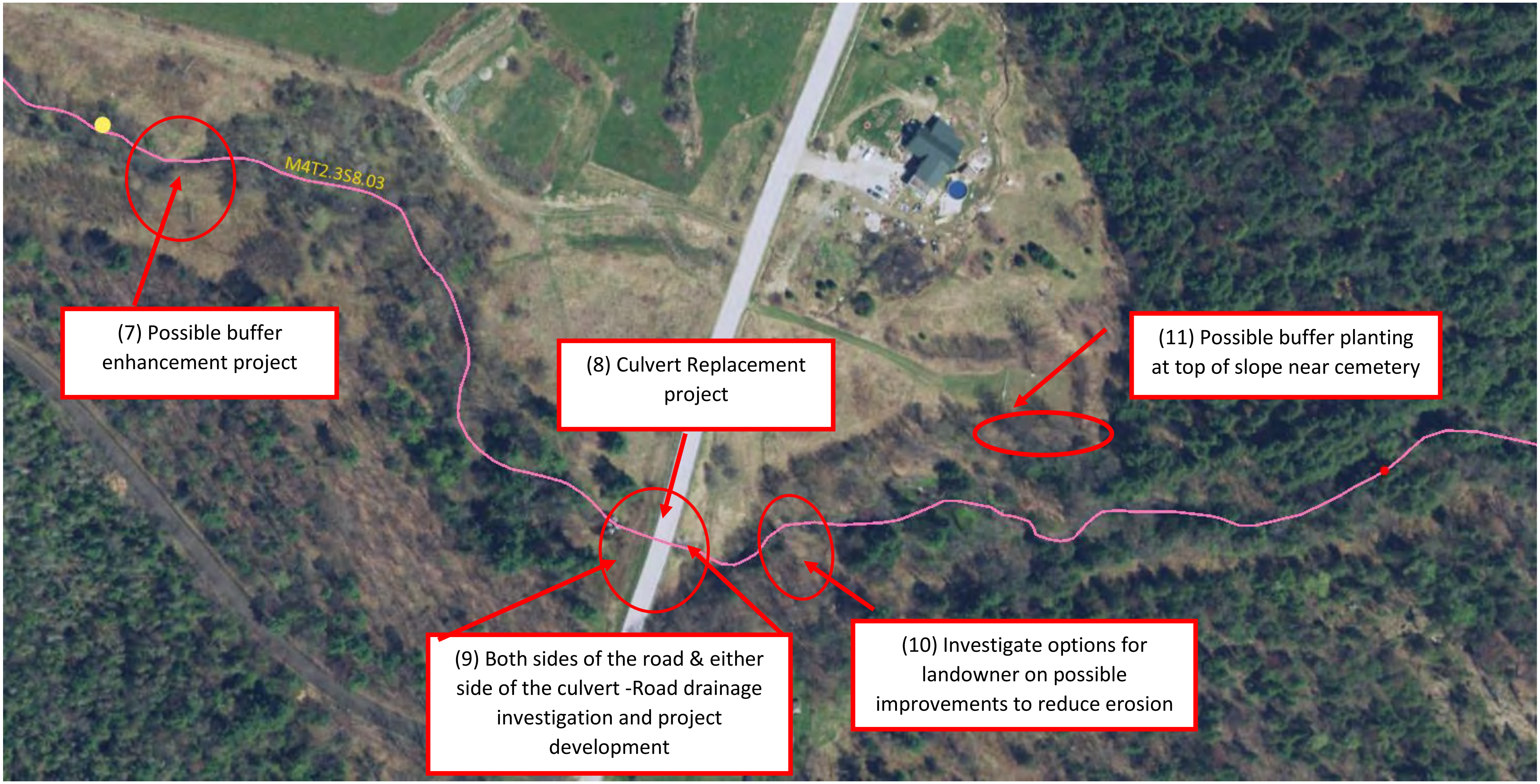
M4T2.3S8.02-B


(2) Bank upstream of stream ford for possible stabilization work
M4T2.3S8.02
(3) Field to investigate areas of possible overland flow paths

M4T2.3S8.03 A


M4T2.3S8.03
(4) Area to investigation possible floodplain restoration project
(5) Buffer Planting
(6) Work with VAST for possible improvements to reduce scour under bridges

M4T2.3S8.03-B


M4T2.3S8.03
(7) Possible buffer enhancement project
(8) Culvert Replacement project
(11) Possible buffer planting at top of slope near cemetery
(9) Both sides of the road & either side of the culvert -Road drainage investigation and project development
(10) Investigate options for landowner on possible improvements to reduce erosion


M4T2.3S8.04-A
M4T2.3S8.04
(12) Investigate options for landowner on possible resources to evaluate ford and access road to assess possible erosion sources

M4T2.3S8.04-B - Not Assessed

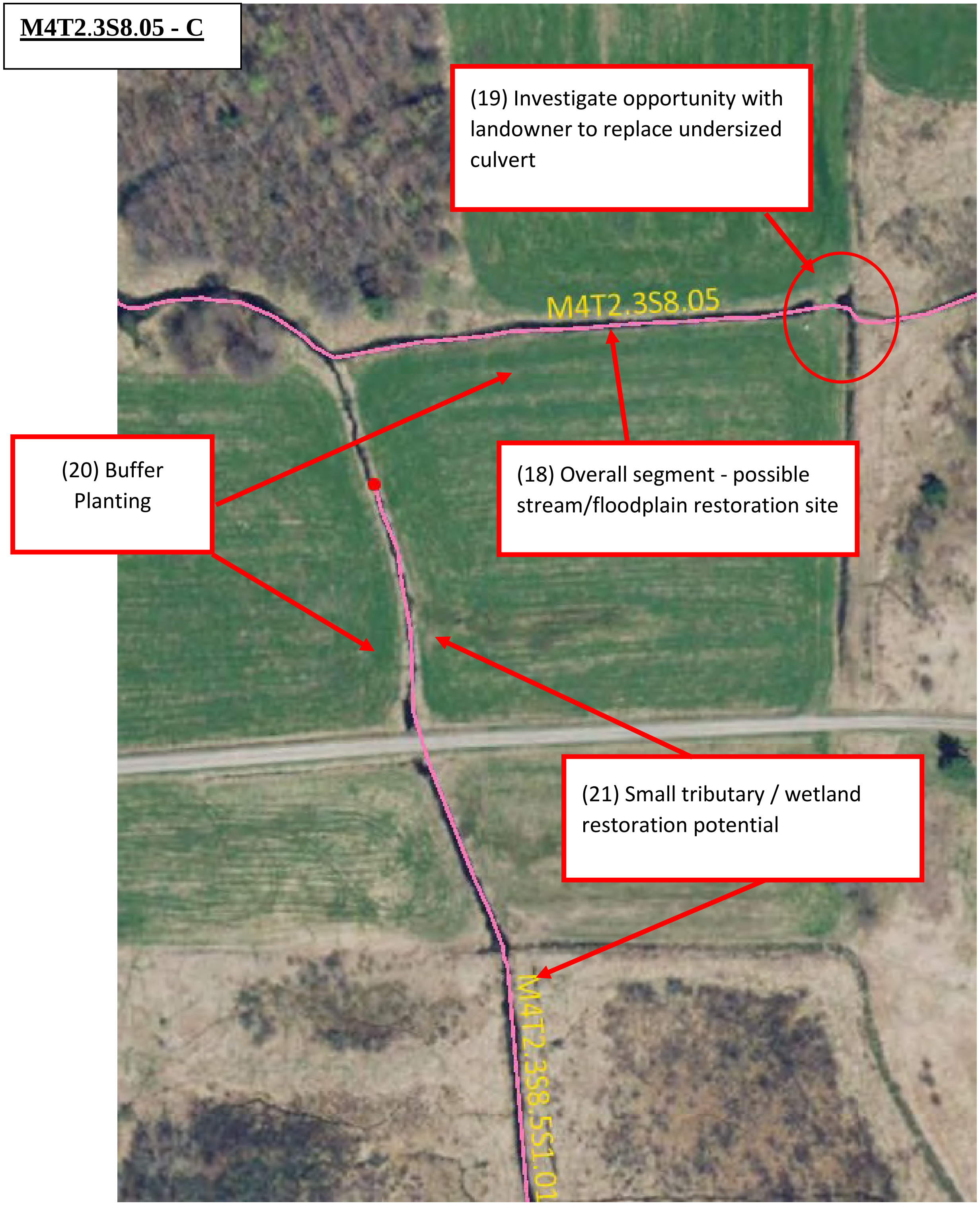
M4T2.3S8.05-A


M4T2.3S8.05
(16) Hydrologically connected – MRGP section of road - Work with town for planning on road needs
(15) Work with town for planning culvert replacement needs

M4T2.3S8.05-B


M4T2.3S8.05
(17) Overall segment - possible stream/floodplain/wetland restoration site
1:500

M4T2.3S8.05 - C


(19) Investigate opportunity with landowner to replace undersized culvert
M4T2.3S8.05
(20) Buffer Planting
(18) Overall segment - possible stream/floodplain restoration site
(21) Small tributary / wetland restoration potential
M4T2.3S8.5S1.01