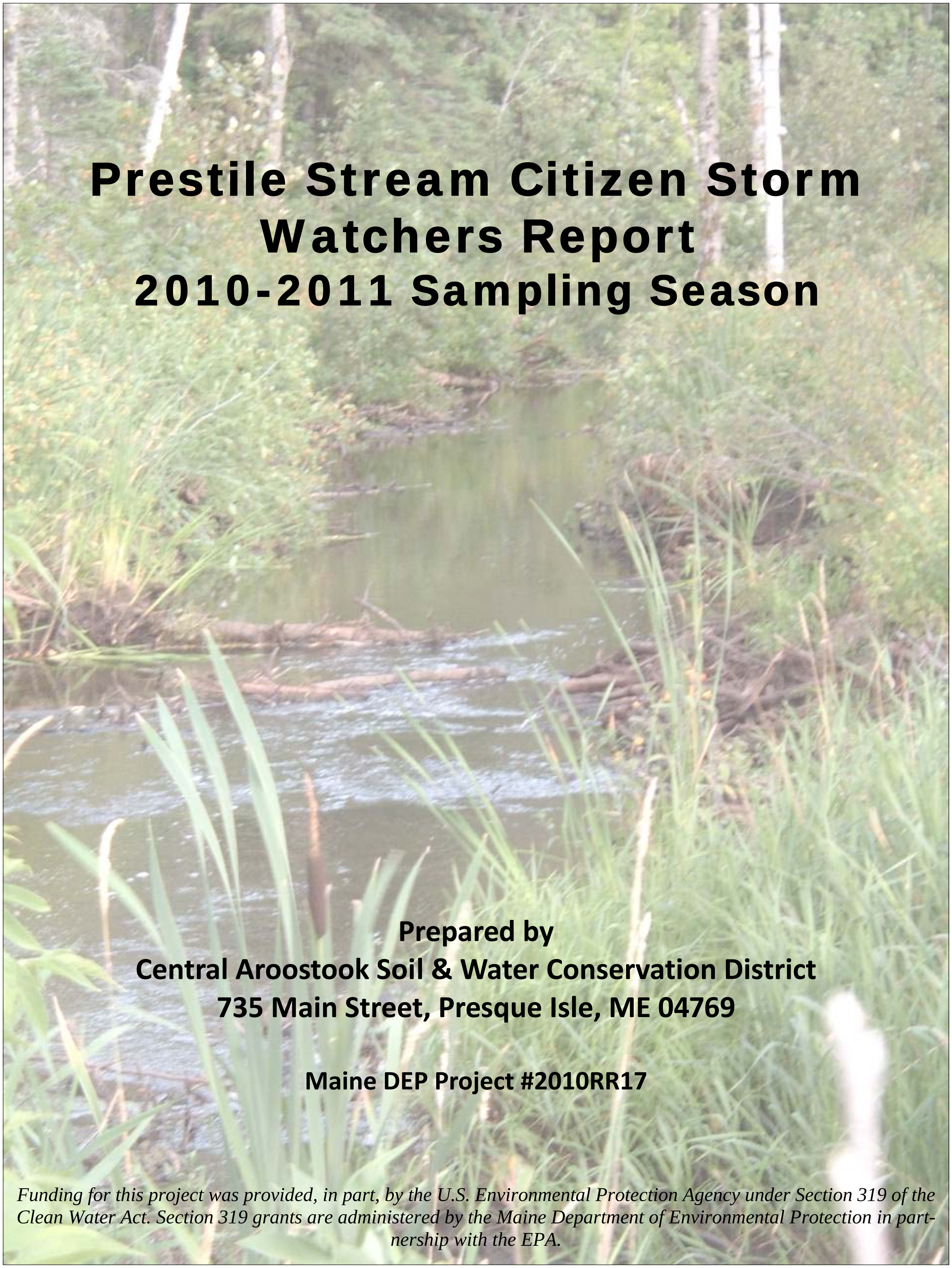

Prestile Stream Citizen Storm Watchers Report
2010-2011 Sampling Season

Prepared by
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Maine DEP Project #2010RR17

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Huber Engineered Woods Easton, ME
Naturally Potatoes Mars Hill, ME

Municipalities in the Prestile Watershed that also show ongoing support for the CASWCD with their mission:

Towns of Blaine, Easton, Mars Hill, Westfield, and the City of Presque Isle

Introduction

The Central Aroostook Soil & Water Conservation District (CASWCD) works closely with the Maine Department of Environmental Protection (DEP), other state and federal agencies, and landowners to protect the area's natural resources. In recent years, the Prestile Stream Watershed has been a priority for the CASWCD due its historic brook trout fishery habitat and its current water quality problems. The "non-attainment" stretch of the stream above the Mars Hill impoundment ("Upper Prestile Stream") that has not met water quality standards set by the State of Maine for a Class A Stream in recent years. The CASWCD worked with landowners and several partner organizations to produce the Prestile Stream Watershed Management Plan (Alverson, 2005) that laid out a multi-year plan to identify and address non-point source (NPS) pollution in the watershed that may be contributing to the degraded water quality of the stream. Two more reports, the Prestile Stream (& Christina Reservoir) Total Maximum Daily Load (TMDL) Report (FB Environmental, 2010) and the Upper Prestile Watershed-Based Management Plan (FB Environmental, 2009) brought forth a more detailed look at the probable contributing NPS pollution and land use within the watershed as well as major goals and strategies for the stakeholders to undertake in order to improve the water quality of the stream.

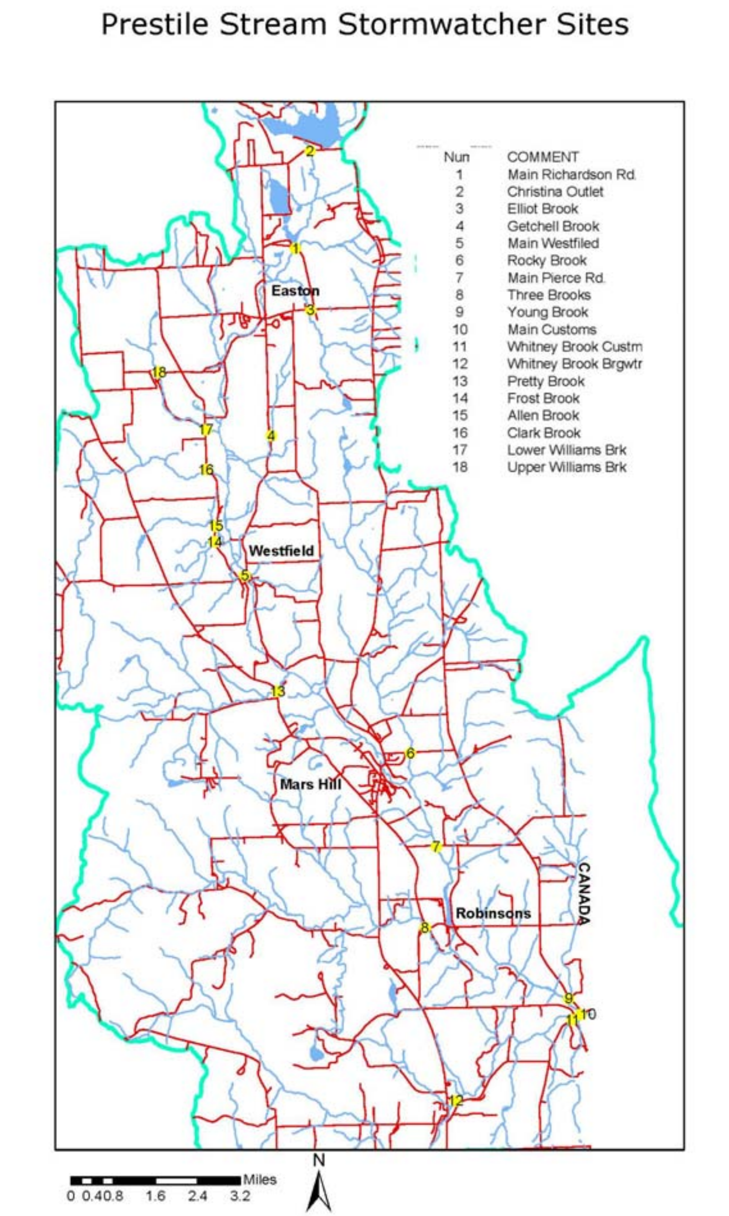


Figure 1 Map of Storm Watcher Sampling Sites

One of the recommendations of the Upper Prestile Stream Watershed-Based Management Plan was to establish a volunteer Prestile Stream Team to both collect stream samples during storm events and to collect annual baseline samples to monitor changes in stream health. The initial step was to collect two seasons' worth of storm samples from easily accessible sites (i.e. road crossings) to identify tributaries and main stem segments that were contributing sediments to the Prestile Stream. This effort has been incorporated into the DEP's Volunteer River Monitoring Program (VRMP) and was funded in part through an EPA Clean Water Act Section 319 grant. Through sampling storm events, the goal was to identify the subwatersheds of the Prestile Stream that were contributing sediment by analyzing stream samples for turbidity and a subset of samples for total suspended solids. The CASWCD, DEP, landowners, and other organizations will then prioritize these subwatersheds for future surveying and conservation work. The District and its partners have also been undertaking sub-watershed surveys within the Prestile Stream Watershed to identify non-point sources of pollution. Three sub-watersheds have been surveyed to date: Frost-Allen Watershed, Christina Reservoir Watershed, and Williams Brook Watershed (Fig. 2). These surveys have led to projects with landowners addressing the NPS sites identified with the goal of reducing runoff entering the Prestile Stream and its tributaries, including CWA 319 grant funded Christina Reservoir Improvement Project 2010RR18. With the considerable size of the watershed, a systematic approach that identifies and addresses problem sites in each sub-watershed is the best way to reach our goal of improving water quality in the Prestile Stream.

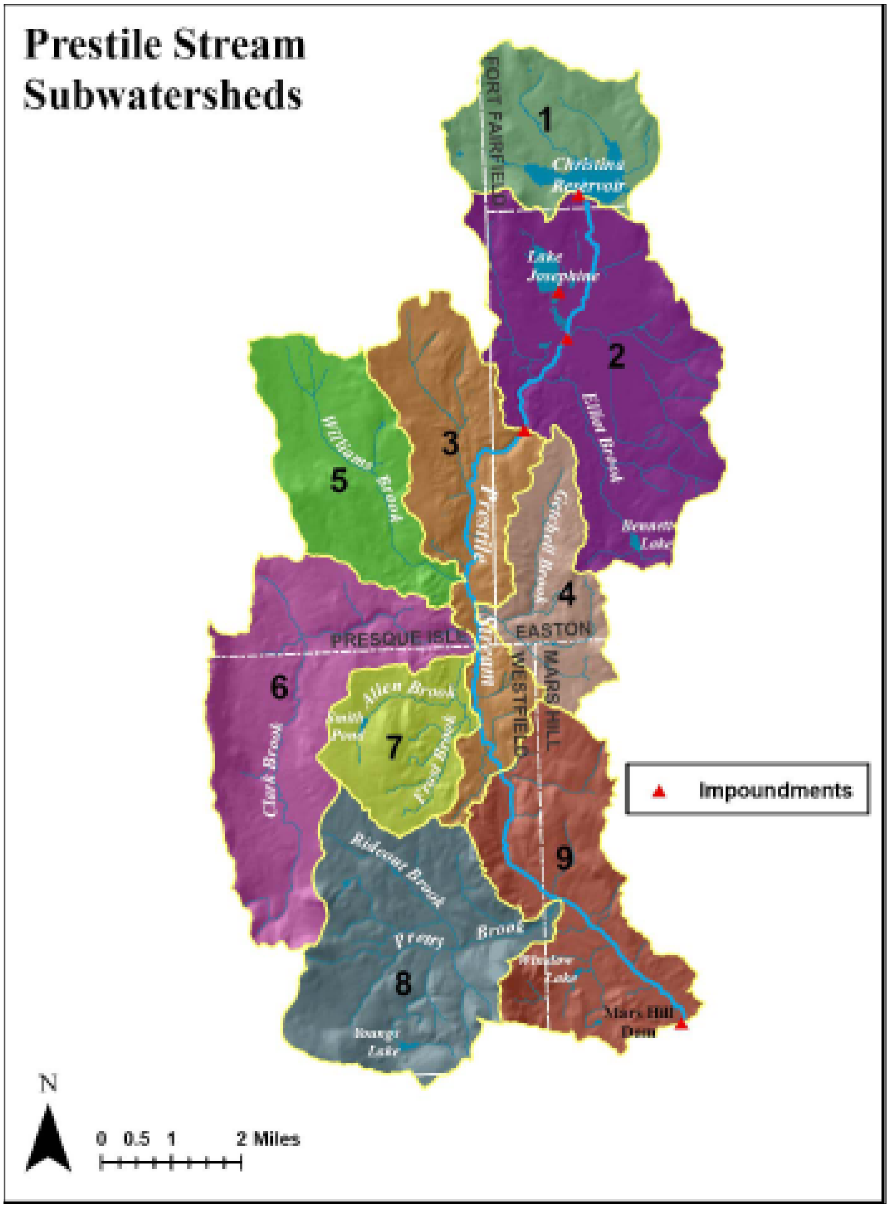


Figure 2. Prestile Stream Sub-Watershed Map. From Total Maximum Daily Load (TMDL) Report Prestile Stream (& Christina Reservoir) Aroostook County, Maine. March 2010.

Prestile Stream Watershed & Turbidity

The Prestile Stream Watershed is a 208 square mile drainage (35 square miles lie in New Brunswick, Canada) that contains sixteen small lakes and 150 miles of tributaries. The Christina Reservoir, a manmade impoundment in Fort Fairfield, Maine and the headwaters for the stream, flows through several towns and five impoundments and eventually crosses the Maine-New Brunswick border in Bridgewater. Land use within the watershed is predominantly mixed forest and agriculture with sparse residential and industrial development. Potatoes are the dominant crop, mostly in rotation with grains (oats and barley), grasses, legumes (clover and soybeans), broccoli, canola, and hay crops (Fig. 4).

Figure 3. Prestile Stream after early June 2011 storm event at Bridgewater data sonde (Site 10).

Due to the high proportion of cropland in the watershed, and much of that land area having bare soil exposed for much of the year, soil erosion is an important issue concerning both soil health and water quality. Wind and water erosion remove the topsoil from the land, taking with it the constituents most important to growing crops: soil, organic matter, and nutrients (Fig. 3). When these are lost, it depletes the fields of these essential ingredients of growing crops. Due to the purpose of this project, the importance of soil erosions to crop production will not be discussed in detail here. Suffice it to say that erosion degrades soil health and, in turn, the ability to grow crops without increasing inputs. The effects of soil erosion and sedimentation on water quality will later be discussed in detail. The CASWCD works with landowners to keep soil (and nutrients) in the fields and out of the water. Due to the nature of agriculture, cultivation is necessary, leaving bare soil and making erosion inevitable. Because of this, the District also works with landowners to develop best management practices (BMPs) to divert and collect sediment before it reaches water bodies to mitigate the impacts on water quality.

If erosion is left unchecked, it will likely end up in water bodies, a process called sedimentation. Sediments that enter water cause it to be muddy, or turbid. Turbidity is a measurement of transparency and is measured in Nephelometric Turbidity Units (NTUs). The more suspended material/particles, the higher the turbidity or the greater the NTU value. A few of the things that effect turbidity include plankton, algae, and suspended soil. For this study, we were interested in the amount of turbidity caused by soil particles, likely eroded from the surrounding watershed.

It isn't just the soil particles that can be the problem in water ecosystems. Eroded soil often carries with it "hitchhikers" such as phosphorous, dripped or spilled petroleum products, pesticides and other human products. For this Prestile Stream study we are, interested predominately in the soil particles because they are the easiest to measure.

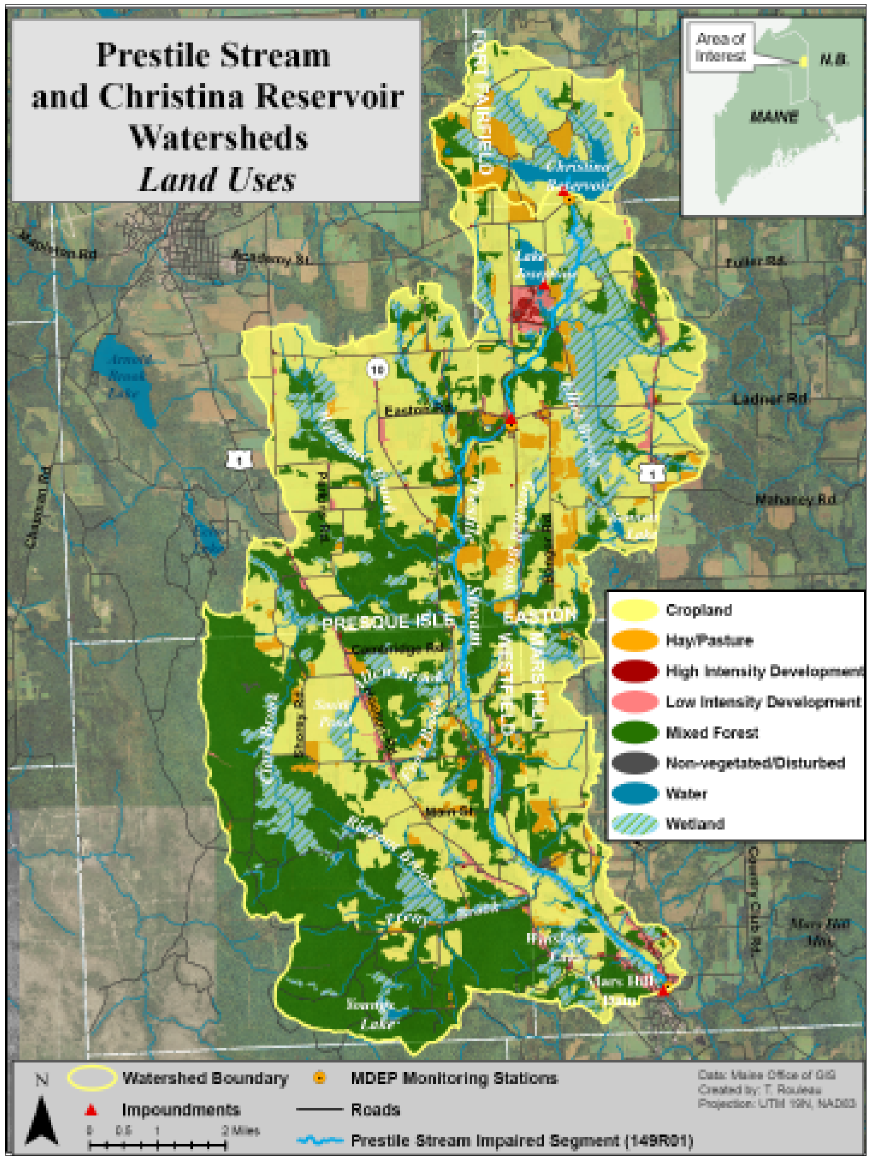


Figure 4. Landuse activities in the Prestile Stream Watershed. From Total Maximum Daily Load (TMDL) Report Prestile Stream (& Christina Reservoir) Aroostook County, Maine. March 2010.

Since aquatic biological communities such as fish, macroinvertebrates (stoneflies, mayflies, midges, dragon flies to name a few) and plants can be negatively impacted by soil particles, turbidity can be used as an indicator of potential stress on the aquatic community. The Prestile Stream is a premier native brook trout fishery, hence focusing on the impact to trout being of prime importance. Suspended sediments can cloud the water making it difficult for fish to locate food and it can also act as sandpaper on their delicate gills. As the sediments settle out to the bottom of the stream it can fill the interstitial spaces between the rocks, eliminating important habitat for fry or actually entombing developing fish eggs.

Phosphorus is a macronutrient required in plant growth, making it an important agricultural fertilizer. In freshwater systems algae is the predominant type of plant and phosphorus is normally limited, keeping algal growth at bay. When excessive phosphorus is introduced to aquatic systems, plant growth flourishes and leads to the Prestile Stream's rocky bottom often being covered with a film of algae during the growing season, as many as a few centimeters thick in some places (Fig. 5 and 13). In the Prestile Stream watershed, there are two dominant sources of nutrients: the first nonpoint source pollution (stormwater runoff carrying soil & fertilizer), and the second the Christina Reservoir. Due to land irrigated wastewater disposal in Christina Reservoir's watershed, it has had serious nutrient soil and water quality issues. These nutrients are discharged from the reservoir into the Prestile Stream, leading to excess phosphorus and algae growth that shifts the macroinvertebrate community in the stream. As the algae decays it uses up oxygen, which is important to a cold water fishes (e.g.trout). The combination of nutrient enrichment and sediment is clearly having an impact on the aquatic community as evidenced in DEP's biomonotoring program which has documented the impact.

Figure 5. Algea growth on rocks at Westfield sample site.

Much more detailed information on the historical land and stream use (e.g. effluent pumping into stream and land application of wastewater), brook trout fishery, stream classification and water quality, etc. can be found in both the Upper Prestile Stream Watershed-Based Management Plan (FB Environmental, 2009) and the Prestile Stream (& Christina Watershed) TMDL Report (FB Environmental, 2010).

Methods

Two methods were used to look at turbidity in the effort that spanned the field season (May-November) in 2010 and 2011. One approach was to have volunteers obtaining grab samples during storm events at sites on the Prestile Stream and along the major tributaries (Fig. 1). There were 19 sampling sites covered by volunteers, although not all were sampled during each event over the two-year sampling period. Each site was easily accessible at a road crossing, either a bridge or culvert, where the volunteer attempted to grab each sample with a 500 mL Nalgene bottle from the thalweg and from as close to mid-depth as possible. The volunteer would also measure the height from a reference point (e.g. top of bridge or culvert) down to the stream surface. This process measuring stream height was used in lieu of finding the stream flow, which would be an extensive process to get accurate flows. We used this stream height as a measure of relative "flow" at each site during each storm. The sampling protocols are detailed in the Prestile Stream Sampling and Analysis Plan (SAP) through the Maine VRMP Quality Assurance Program Plan (QAAP) completed in June 2011.

The CASWCD monitored weather forecasts on the National Weather Service's website (www.weather.gov) and stream flow from the USGS real-time water data website (www.http://waterdata.usgs.gov/nwis/rt) to coordinate volunteers in order to obtain samples during the storm. Efforts were made to grab samples during peak flow, but this was not entirely possible due to the variability of rainfall and stream flows through the watershed and availability of volunteers. Samples were then collected at the CASWCD office and kept refrigerated to be analyzed for turbidity with a LaMotte 2121e Turbidimeter. A subset of samples was sent to the Maine Health and Environmental Testing Laboratory for total suspended solids (TSS) analysis.

Figure 6. Deploying sonde at Bridgewater site (#10).

The second method used was automated data sondes that collected and logged turbidity information hourly. The sondes were deployed at two sites: below Site 5: Prestile Stream at Westfield Bridge and above Site 11: Prestile Stream at Customs (Fig. 1). DEP staff recalibrated the sondes and collected and analyzed information from the data loggers monthly. To visualize the information collected, grab sample turbidity data were plotted spatially on a watershed map (Fig. 7 & 8)while sonde data were presented graphically with rainfall and stream flow data (Fig. 9 & 10). Rainfall data for 2010 and 2011 was obtained from the National Climatic Data Center Stream website and flow data was obtained from both the USGS stream gage located on Williams Brook (site mentioned above) and the Mars Hill Wastewater Treatment Facility, which must monitor Prestile Stream stage in accordance with its wastewater permit.

Results

A total of 144 grab samples were taken at the 19 sites over the course of two field seasons in 2010 and 2011 by volunteers and CASWCD staff, ranging from 10 samples at two sites down to 4 samples at several sites. The samples were taken as a result of 12 separate storm events that were predicted to have at least 1 inch of rain in a 24 hour period. The variance in number of samples is due to volunteer availability and the lack of a volunteer at four sites during the 2010 season. At least one field duplicate was taken every 10 samples for each sampler for quality control and assurance. A total of 12 TSS samples were taken at several sites over the two seasons.

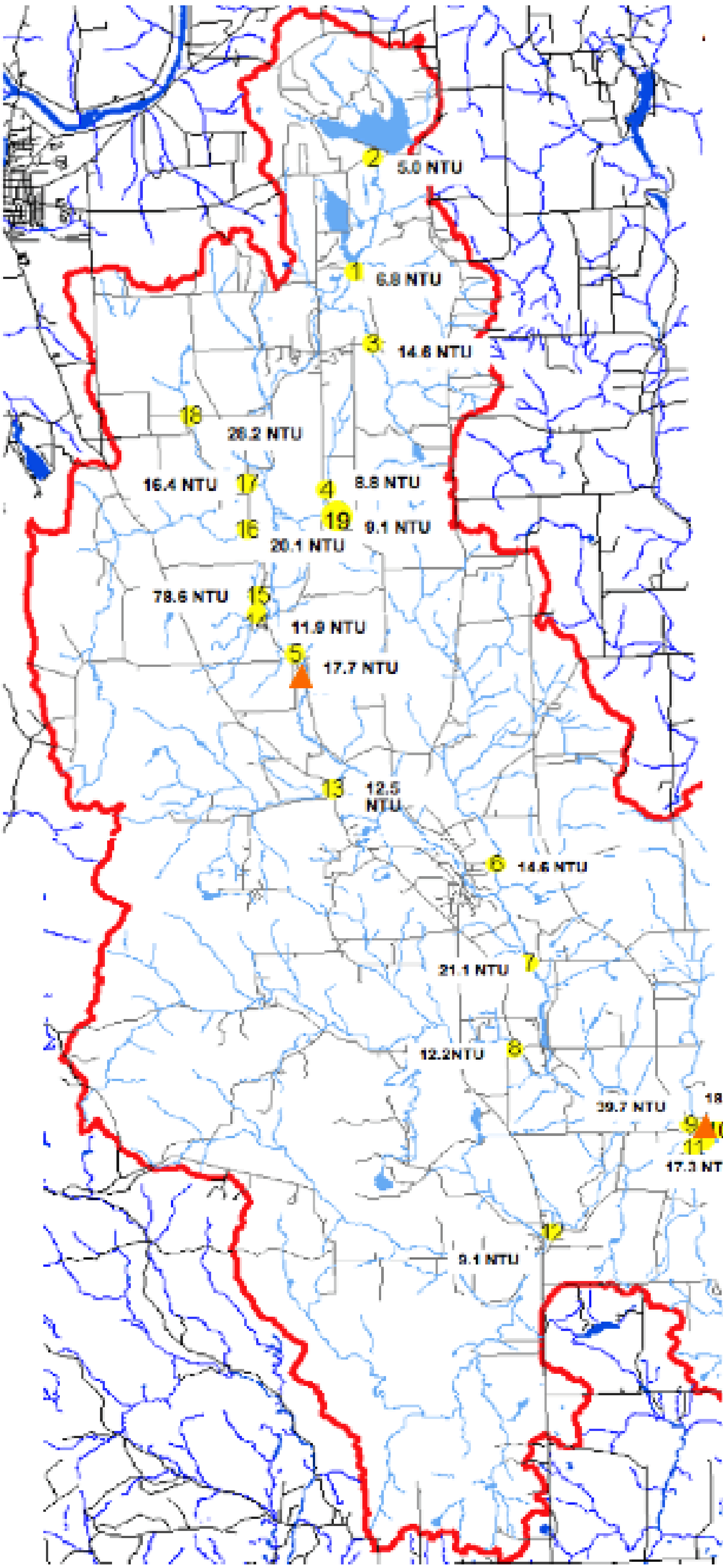
Figure 7

Prestile Stream Average Turbidity: 2010-2011 Sampling

The averages for each site are based on turbidity data gathered during the 2010 and 2011 sampling. The number of samples from each site ranged from N=4 to N=10 (during 13 sampling dates) due to availability of volunteers.

The five highest averages are found at Site 15 (78.6 NTU), Site 9 (39.7 NTU), Site 18 (28.2 NTU), Site 7 (21.1 NTU), and Site 16 (20.1 NTU).

Locations of data sondes are also indicated below Site 5 and above Site 10.



▲ Approximate location of data sondes

Site #	Site ID	Samples (N)
1	Prestile @ Richardson Rd.	10
2	Christina Outlet	10
3	Elliot Brook	9
4	Getchell Brook	9
5	Prestile @ Westfield	9
6	Rocky Brook	9
7	Prestile @ Pierce Rd.	9
8	Three Brooks	9
9	Young Brook	5
10	Prestile @ Customs	5
11	Whitney Brook@ Customs	5
12	Whitney Brook @ Bridgewater	5
13	Pretty Brook	9
14	Frost Brook	10
15	Allen Brook	10
16	Clark Brook	10
17	Lwr. Williams Brook	9
18	Upr. Williams Brook	10
19	Lwr. Getchell Brook	4

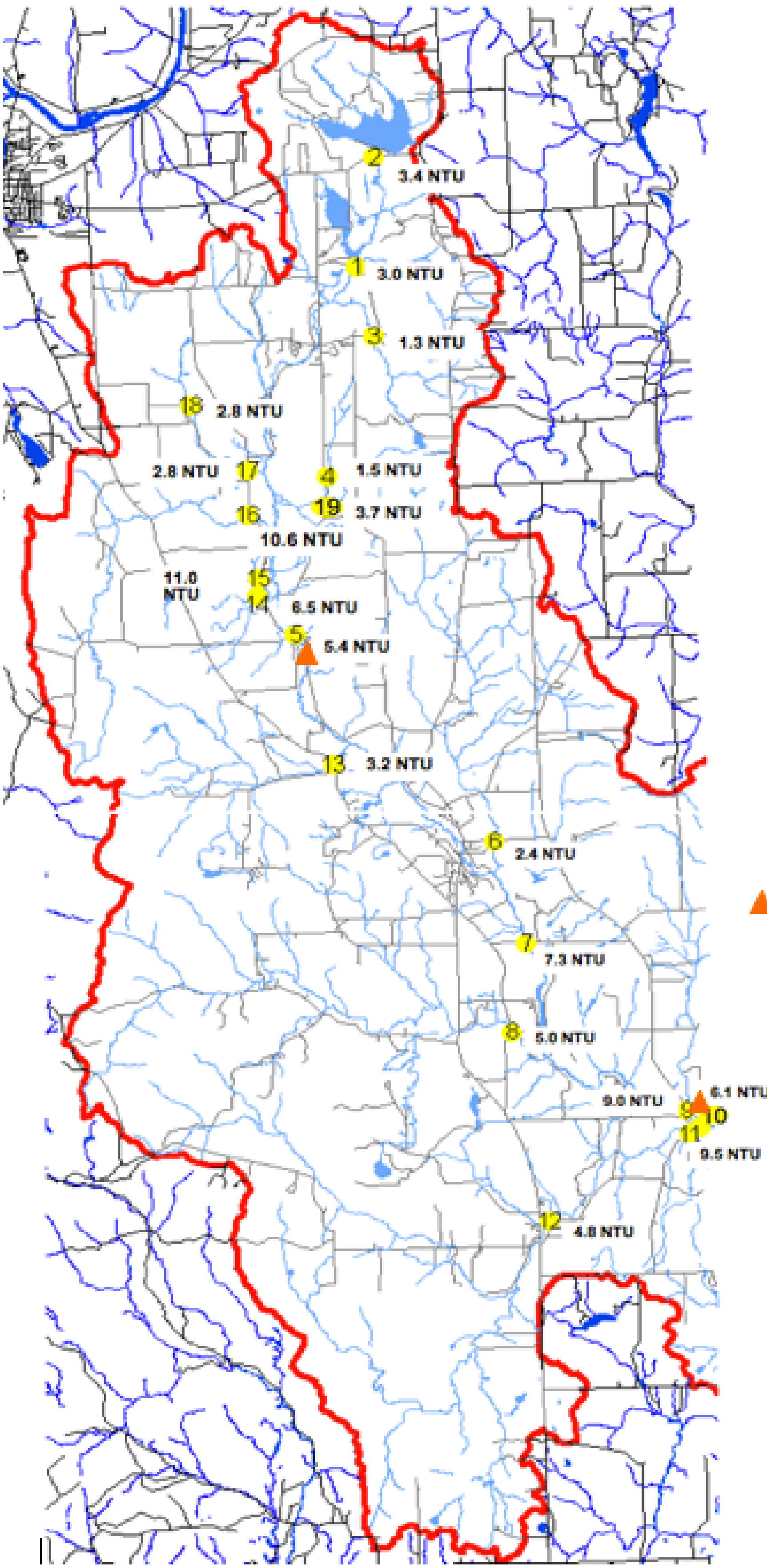


Figure 8

Prestile Stream Median Turbidity: 2010-2011 Sampling

The median turbidity for each site are based on turbidity data gathered during the 2010 and 2011 sampling. The number of samples from each site ranged from N=4 to N=10 (during 13 sampling dates) due to availability of volunteers.

The five highest medians are found at Site 15 (11.0 NTU), Site 16 (10.6 NTU), Site 11 (9.5 NTU), Site 9 (9.0 NTU), and Site 7 (7.3 NTU).

Locations of data sondes are also indicated below Site 5 and above Site 10.

▲ Approximate location of data sondes

Site #	Site ID	Samples (N)
1	Prestile @ Richardson Rd.	10
2	Christina Outlet	10
3	Elliot Brook	9
4	Getchell Brook	9
5	Prestile @ Westfield	9
6	Rocky Brook	9
7	Prestile @ Pierce Rd.	9
8	Three Brooks	9
9	Young Brook	5
10	Prestile @ Customs	5
11	Whitney Brook@ Customs	5
12	Whitney Brook @ Bridgewater	5
13	Pretty Brook	9
14	Frost Brook	10
15	Allen Brook	10
16	Clark Brook	10
17	Lwr. Williams Brook	9
18	Upr. Williams Brook	10
19	Lwr. Getchell Brook	4

From the raw data, there is a fair amount of variability in turbidity both between sites during the same storm and at the same sites between different storms, so no real trends could be found. This is why we decided to look at the average and median to identify the most turbid tributaries or stretches of the Prestile Stream itself. We chose to look at *both* the median and average for our discussion because one high turbidity outlier at one site could skew the average; while with a small sample size of N=4 to N=10, the median may not be representative of all the samples.

Table 1. Five(5) highest average and median turbidity sites.

Sample site	Average (NTU)	Median (NTU)
Prestile @ Pierce Rd (7)	21.1	7.3
Young Brook (9)	39.7	9.0
Whitney Brook @ Customs (11)		9.5
Allan Brook (15)	78.6	11
Clark Brook (16)	20.1	10.6
Upper Williams Brook (18)	28.2	

As can be seen in Table 1, there are several sites that have high average turbidity and several that have high median turbidity from the 13 storm event samples. The five sites with the highest average were Site 15: Allen Brook (78.6 NTU), Site 9: Young Brook (39.7 NTU), Site 18: Upper Williams Brook (28.2 NTU), Site 7: Prestile @ Pierce Rd. (21.1 NTU), and Site 16: Clark Brook (20.1 NTU). The five sites with the highest median were Site 15: Allen Brook (11.0 NTU), Site 16: Clark

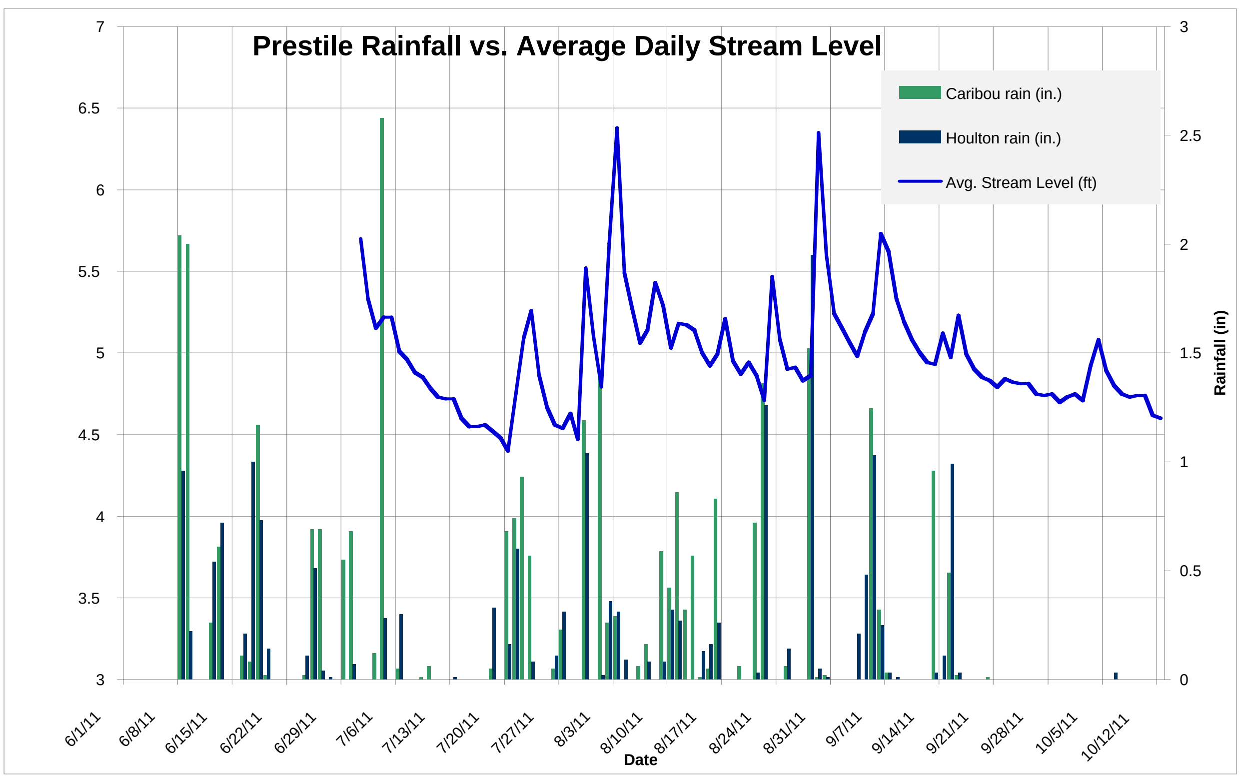


Figure 9. Daily Rainfall amounts at Caribou and Houlton Weather Stations vs. Daily Average Prestile Stream Level at the Mars Hill Wastewater Treatment Facility (MHWTF)

Brook (10.6 NTU), Site 11: Whitney Brook @ Customs (9.5 NTU), Site 9: Young Brook (9.0 NTU), and Site 7: Prestile @ Pierce Rd. (7.3 NTU). Four out of these top five sites are on both lists for highest average and median, which shows that these sites were consistently turbid during the time of the storm events that the volunteers sampled.

The relationship between daily rainfall at the Caribou and Houlton Weather stations with Prestile Stream level is shown in Fig. 9. For reference, the Caribou Weather station is about 14 miles northwest of the Christina Reservoir outlet and the Houlton weather station is about 24 miles south of where the Prestile enters New Brunswick, Canada. There were several storm events that resulted in significant rises in the stream level, which were the events that we hoped to capture in our storm sampling. Data from significant storm events (approximately 1 inch or greater), for the most part, correspond to a sharp rise in stream level. One exception to this, among others is the storm on 7/4/11 where the NOAA Caribou Weather Station recorded over 2.5 inches in one storm event the while Houlton station reported 0.25 inches. This was obviously an intense localized event that only hit the most northern part of the watershed. This storm had little effect on stream flow and turbidity (Fig. 9 and Fig. 10)

As expected, stream levels peak is slightly after rainfall; turbidity similarly peaks slightly after rainfall (Fig. 10). The time between significant rainfall and turbidity seems to vary and there are a few anomalous events where there was sufficient

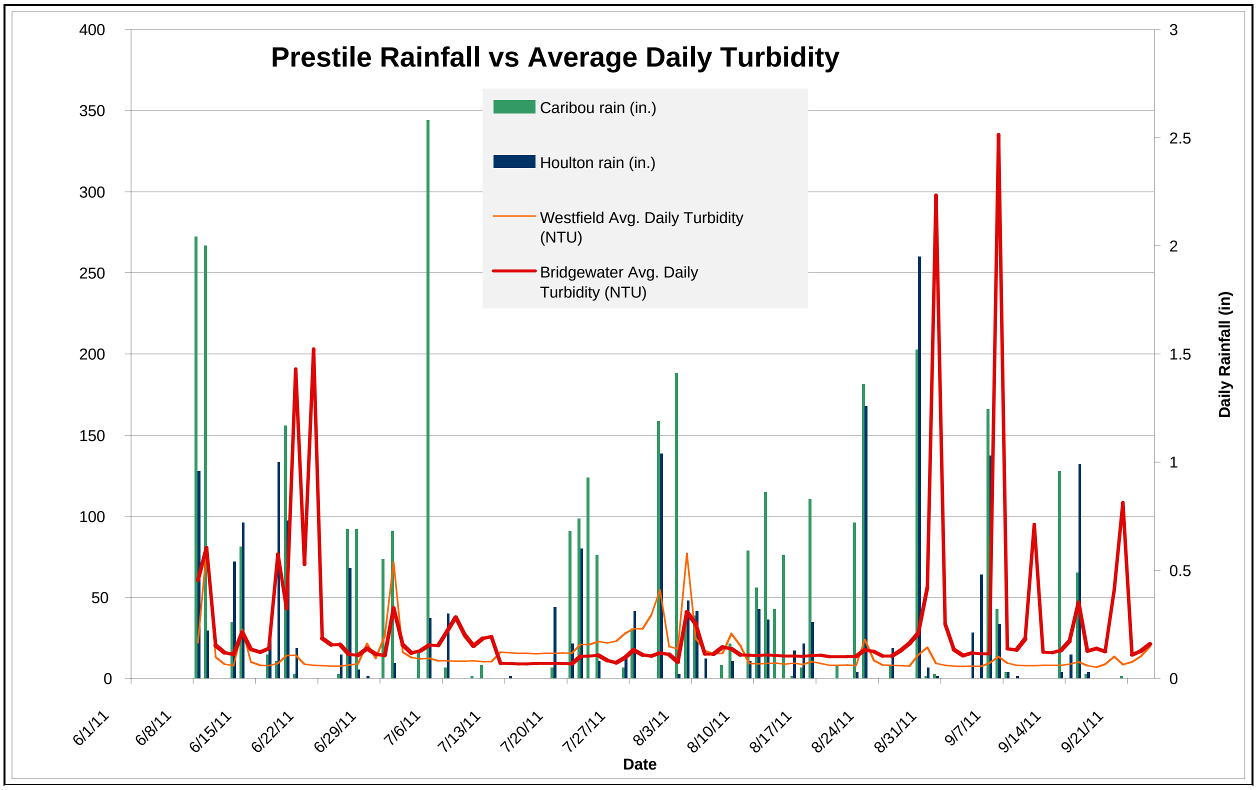


Figure 10. Daily Rainfall amounts at Caribou and Houlton Weather Stations vs. Average Daily Turbidity at both Prestile Sites in Westfield and Bridgewater

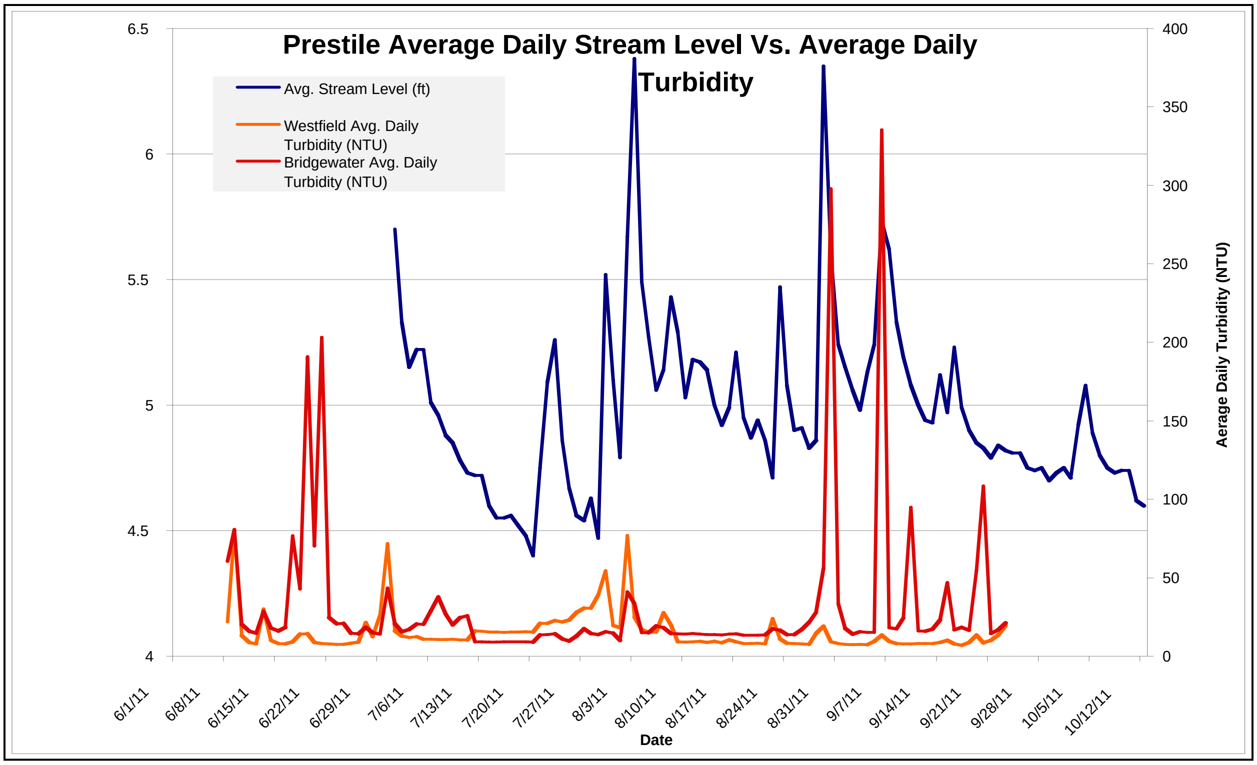


Figure 11. Daily Average Prestile Stream Level from MHWTF vs. Average Daily Turbidity at both

rain with little or no turbidity peak (e.g. 7/4/11 or around 7/23/11). The amount of rain and intensity of the turbidity peak also vary, for example, the storm around 8/30/11 was over 2" of rain and roughly the same spike in turbidity at the Bridgewater sonde as about half as much rainfall on 9/6/11. These same two storms, as well as several others (i.e. 6/22/11, 9/12/11, and 9/20/11) produced a significant turbidity spike at the Bridgewater sonde but little or no spike the Westfield sonde. There is a chance these aberrations are due to equipment, but we tried to account for this by switching sondes during monthly calibrations.

There is also the possibility of particular discrete land use activities impacting the data. With the recent release of the 2011 orthophotographic GIS layer, two material sites previously unknown and located just upstream of Site 10, have come to our attention and need to be investigated once the snow melts. The orthophoto layer should also be reviewed for visibly notable erosion sites. Sites like these adjacent to the stream could be contributing to high turbidity downstream.

Finally, the relationship between stream level and turbidity is shown in Fig. 11. As expected, these data show that there is normally a peak in turbidity that corresponds to a peak in stream level, which corresponds to high rainfall. As with the rainfall vs. turbidity data, this is not always the case (e.g. there is no peak in turbidity at either site for a peak in stream level near 7/23/11), and the intensity of stream peak flow does not always seem to be indicative of the turbidity peak (e.g. the event on 8/3/11 vs. the event on 9/6/11, both have similar stream level peaks of about 6.4 feet but turbidity peaks differ in intensity at both sonde sites).

Discussion

This project would not have been possible without the dedication of the volunteers to trudge out during storm events to collect samples, the work of DEP staff, and the funding by EPA through a Clean Water Act 319 grant; CASWCD thanks all of those that were a part of this effort.

Figure 12. Westfield sample site.

While we were unable to answer many of our original questions and in fact raised more than we answered, this was an invaluable first step in understanding the watershed and water quality dynamics in the Prestile Stream. CASWCD will use what we have learned to prioritize our continuing efforts to survey the subwatersheds for nonpoint sources (NPS) of pollution and then use the information to work with landowners to correct these sites.

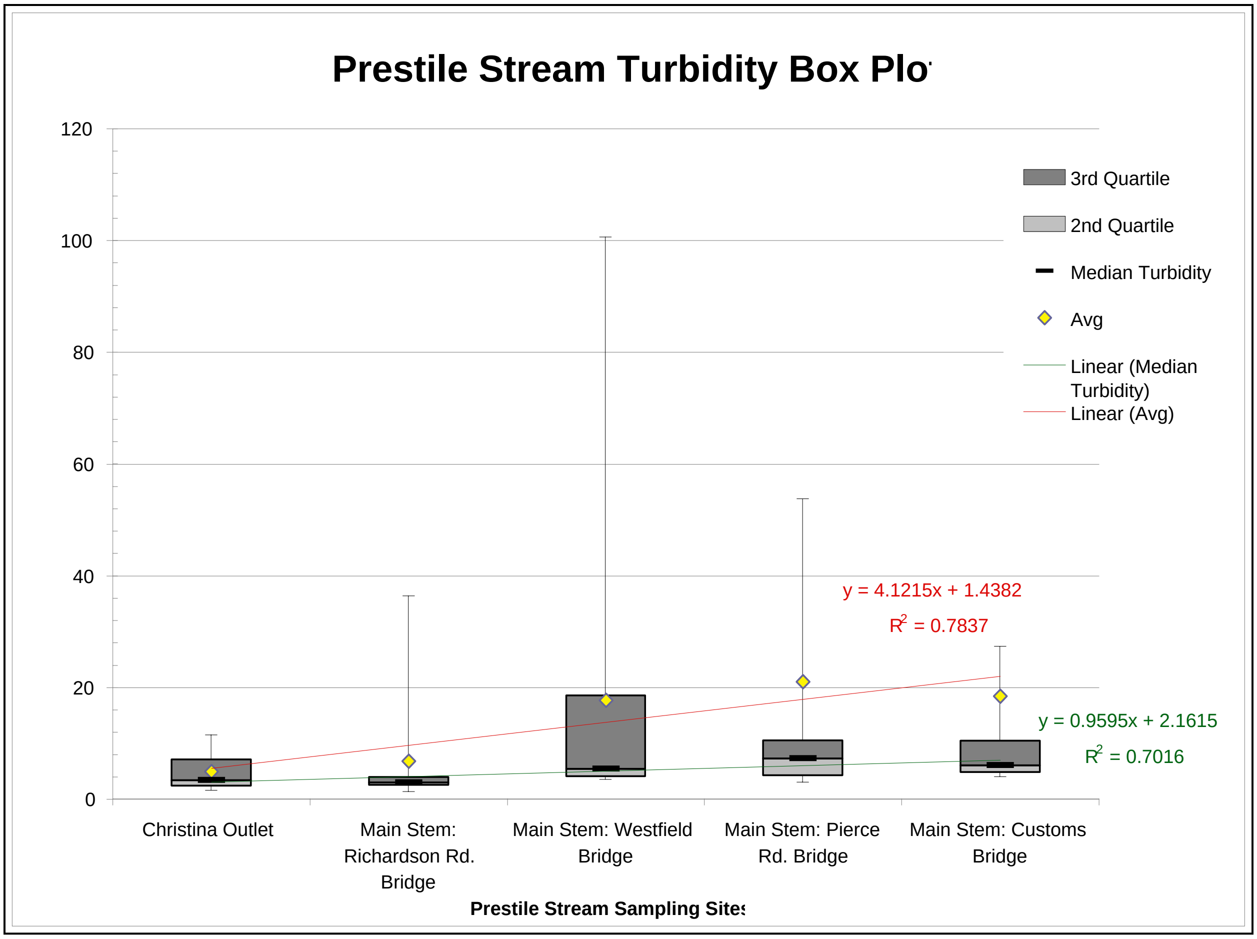


Figure 13. Box Plot of Prestile Stream 2010-2011 sampling sites showing 2nd quartile, 3rd quartile, median turbidity, and average turbidity with trendlines. The trendlines indicate, although with uncertainty, that the grab samples taken tended to be more turbid as sites progressed downstream.

Another goal was to raise public awareness of water quality issues in the Prestile while extending the District's network of committed volunteers through the Storm Watchers Group. This goal was certainly achieved with a group of at least 12 volunteers, many of whom are committed to the continuation of projects like this in the Prestile Watershed and taking an active part in their community's comprehensive planning.

VMRP Grab Sampling Results

Due to the project design and duration of this study we were not yet able to determine with certainty which tributaries were contributing significant sediment to the Prestile. However, there were several tributaries that tended to consistently have higher turbidity, which may be indicative of a higher sediment load (Allen Brook, Young Brook, and Clark Brook). Without flow volumes and a good regression between turbidity and TSS it is impossible to calculate pollutant load (see Fig. 15). We can however, use this data to at least prioritize our survey and conservation construction work. The site along the main stem at Pierce Rd. (Site 7) also tended to have higher turbidities during the storms, indicating that either the tributaries above that site could be having a cumulative effect or the direct subwatershed in that area may have erosion problems resulting in direct sedimentation to the main stem.

The DEP sets a water quality goal of Class A for the Prestile Stream from the head waters at Christina Reservoir to the Mars Hill dam. From the Mars Hill dam to the international boarder a water quality goal of Class B. Since this water quality goal was enacted in the early 1990s DEP's macroinvertebrate biomonitoring program has found that all areas of the upper Prestile Stream had failed to Class A water quality criteria until recently. The Richard Road sampling station still fails to meet Class A (meets Class B) while the Westfield sample site attains Class A in the most recent sampling event in 2009 (Fig. 12). Prestile Stream below the Mars Hill impoundment at the Perice Road crossing has traditionally met Class B standards until the most recently when it failed to meet Class B (met Class C). More information on these data can be found at the Maine DEP's biomonitoring website (http://www.maine.gov/dep/ water/monitoring/biomonitoring/index.html). These recent findings seem to be consistent with 2010-2011 storm watcher sampling that shows both average and median turbidity of grab samples got progressively higher going downstream at the five sites along the main stem of the Prestile (Fig. 13). Of course, this is oversimplifying the dynamics of what is happening within the watershed and the Prestile Stream itself, as well with the localized nature of storms and timing of samples, but a possible indication of problem watersheds nonetheless.

Figure 14. Sonde in PVC protection at Westfleld site. Note heavy algae on substrate and PVC.

There was also an extreme disparity between the two sampling seasons. The first year, 2010, was one of the driest years on record for Aroostook County. In contrast, northern Aroostook County saw the most rainfall during June, July, and August since records have been kept. Southern Aroostook, however, saw significant rainfall, but had long periods that did not see the same precipitation that was seen in northern Aroostook. These extremes in rainfall made it both difficult to plan and coordinate sampling among the volunteers, it also makes the data we collected anomalous compared to “normal” seasons

It should be noted that the present crop rotation system further complicates data interpretation. Present potato culture recommends a minimum of a 3 year rotation with one year of potatoes, one year of a grain crop and one year in a cover crop. Broccoli is also grown on several thousand acres, which further alters the rotation and number of years without cover. Depending on where the fields are in their rotation, there can be more or less cover at any one time in a subwatershed as well as a change in the cover of field adjacent to a stream. Therefore the noise created by the ever changing weather as well as the yearly variation in crop cover complicates data interpretation.

This project also hoped to identify a relationship between turbidity and Total Suspended Solids (TSS). If a relationship can be found between the two, we may be able to extrapolate TSS values, using a regression equation, from actual turbidity

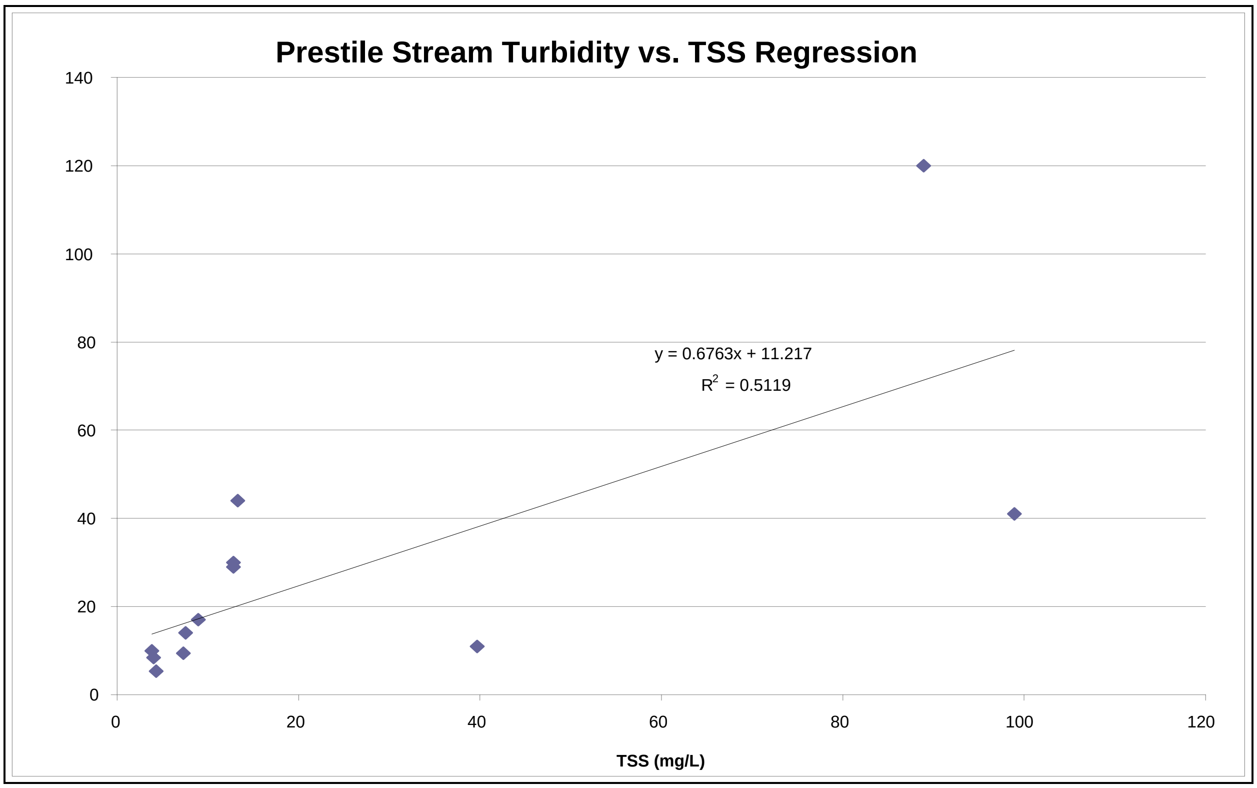


Figure 15. Prestile Stream Turbidity vs. Total Suspended Solids for samples taken during 2010-2011. The variability of samples (low R^2), especially those with turbidity over 20 NTU, indicates the rela-

alyzed with an inexpensive turbidimeter, while TSS is a costly lab analysis that must be shipped. Total suspended solids also gives us a quantitative amount of which can be used to estimate sediment in the water column, while turbidity is a qualitative measure of transparency of the water. As can be seen in Fig. 15, the regression shows a possible relationship between the two, although variability of the samples means that relationship is weak, at best. A similar relationship between turbidity and TSS was found on the Sheepscot River in mid-coast Maine and shows that water that has high turbidity tends to have high TSS as well (Whiting, 2009). More data need to be collected to hopefully develop a stronger relationship between the two.

Figure 16. Collecting grab turbidity samples as part of sonde QA.

DEP Sonde Data Results

As noted earlier, the two sondes were deployed in the main stem and allowed for continuous (hourly readings) of turbidity. The sondes provided turbidity data throughout the storm event and as the stream level rose and fell. Yet even with this plethora of turbidity data (thousands of data points) the noise created by weather events, location, and crop rotation make it difficult to draw any firm conclusions. However, analyzing the data does reveal a few possible trends.

First, turbidity spikes generally correspond to both significant rainfall events and peaks in streamflow. This is typical and due to heavy rainfall causing erosion and runoff from the watershed, which results in eventual sedimentation into the streams. Something that cannot be explained from our data is why similar peaks in rainfall and/or stream level do not always result in similar turbidity peaks. This may be due to storm event location, intensity or duration. Differences among the rainfall at Caribou and Houlton Weather Stations, stream level data from the MHWTF, and/or turbidity at the two sonde sites indicates that location of rain events (i.e. localized thunderstorms) has a significant effect but each environmental variable may not be measured at all sites.

The difference may also be attributed to variation in crop canopy cover. Early in the growing season (May-June) the soils are bare, in mid summer (July and early August) full crop canopy cover and late in the season (mid August on) bare ground. This could explain the relative lack of strong turbidity events from mid-July to late-August despite strong rainfall and rapid stream level rise (Fig. 10 & 11). During times before canopy is established and after harvest, soil is left bare and the erosive effect of rain is unimpeded, leading to increased runoff.

Research indicates that salmonids, depending on their life stage, are impacted differently by both the exposure of significantly high turbidity even if for only a short period and duration of exposure.There were several storm events that resulted in turbidity in excess of 75 NTU, which would translate to a TSS of about 60 mg/L using our regression. Acknowledging the limited use of our regression, even a TSS of 48 mg/L for extended periods can cause moderate physiological stress for adult and juvenile salmonids (specifically trout) and almost lethal effects to eggs and fry (Whiting, 2009). This was the case from 6/17/11 to 6/22/11 where there was consistent turbidity over 75 NTU. Also, extremely high turbidity events for short duration can result in moderate physiological stress for all life stages of salmonids (Whiting, 2009). There were over several turbidity readings that were in excess of 600 NTU. It is possible that there were multiple storm events that resulted in turbidity that could have moderate to severe impact on the brook trout, at all life stages, and their habitat that make the Prestile Stream so appealing to fisherman.

Conclusions

We set out to identify the tributaries that were contributing the greatest amount of sediment so that we could work with landowners and other organizations to find and address the issues in the watershed that were contributing to water quality degradation. Several tributaries, based on our limited data, have consistently had higher turbidity: Clark Brook, Allen Brook, and Young Brook. A watershed survey for Allen/Frost Brooks was completed in 2004. The next steps involve working towards correcting the identified NPS in Allen Brook watershed and surveying Clark and Young Brook and working toward correcting the problems identified in those watersheds.

Given the variability of storm events and crop rotations as well as the timing of sample collection during a storm event, collecting more turbidity data as well as TSS would provide a clearer picture of what is happening in the watershed and stream. It maybe possible to develop a closer correlation between turbidity and TSS as well. Also, collecting more data over many years would allow us to establish baseline conditions and then monitor changes and improvements as conservation practices (BMPs) are installed and NPS pollution sites reduced or eliminated.

We expected to see turbidity to be greater during the spring and fall, while there is little or no cover on much of the cropland within the Prestile watershed. The sonde data from 2011 did appear to show this, quite significantly at the Bridgewater site. However, we certainly need data collected of several years to see a trend that might actually be due to what is happening in the watershed and not just a single year. Many watershed and climate factors likely influence the amount of erosion and sedimentation that occur, and we would be remiss to consider canopy cover as the only factor based on one year's worth of information. Again, this shows the need for ongoing monitoring in order to see what is really happening.

Watersheds and the streams they feed are very dynamic systems that are influenced by myriad factors and cannot be deduced to simple cause and effect relationships. Our sampling and information collected by the data sondes helps to give us a glimpse of a small piece of the whole picture that will help us in future conservation efforts. To do more would necessitate a large, and expensive, research project that the CASWCD does not have the means to do. Therefore, we hope to continue both storm sampling and data collection utilizing the help of volunteers and DEP staff to monitor turbidity and suspended solids in the Prestile Stream.

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