

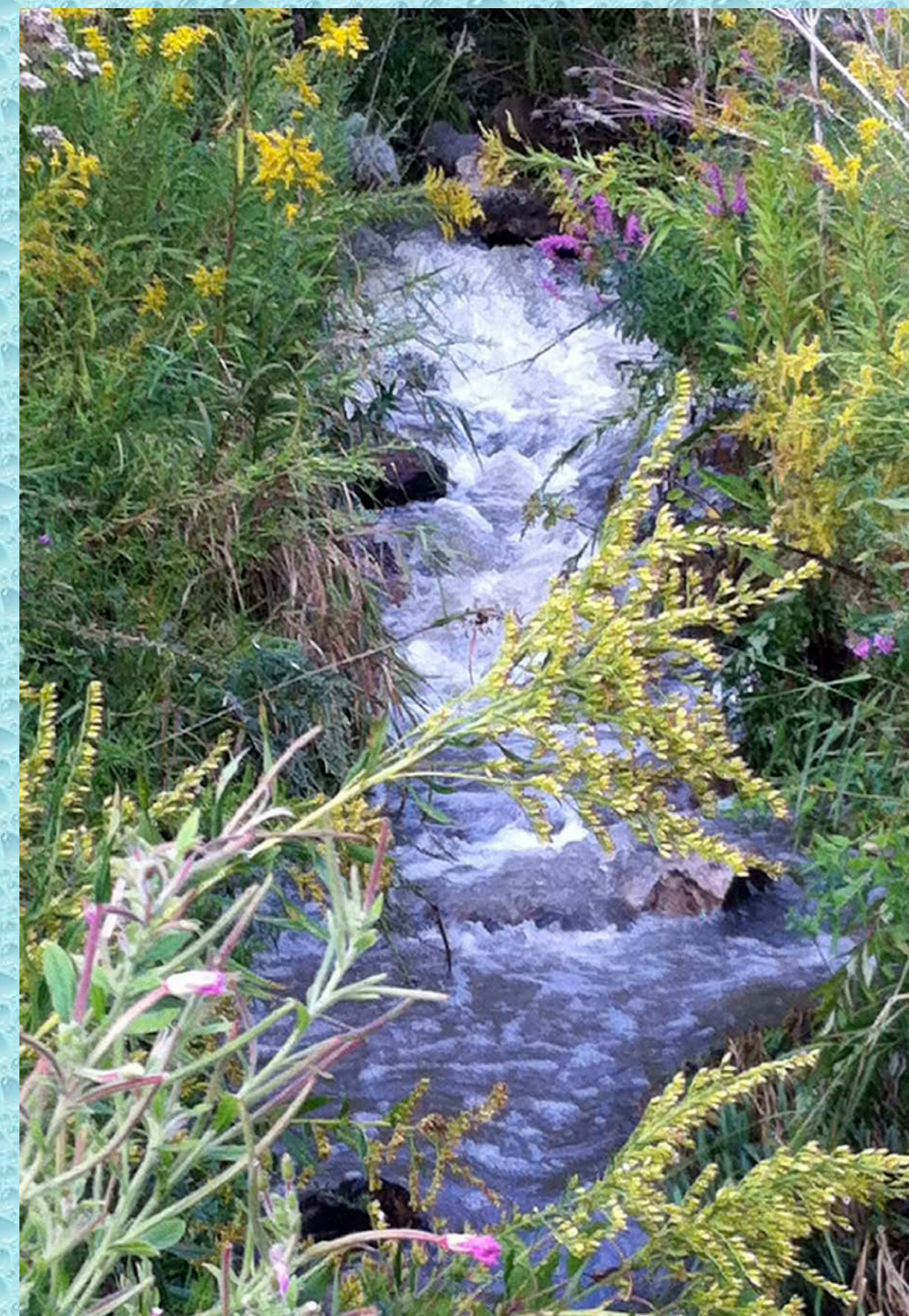


# Weather and Water Quality

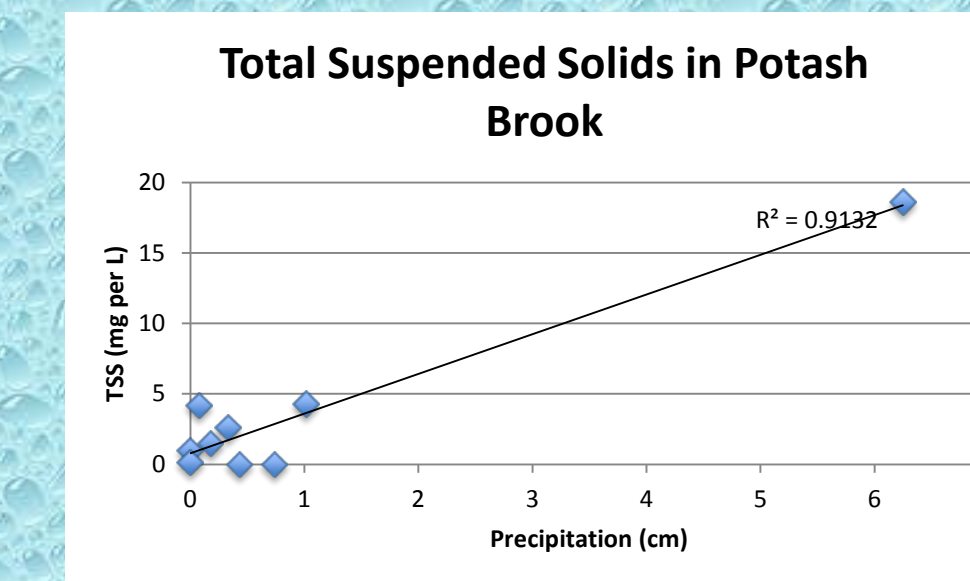
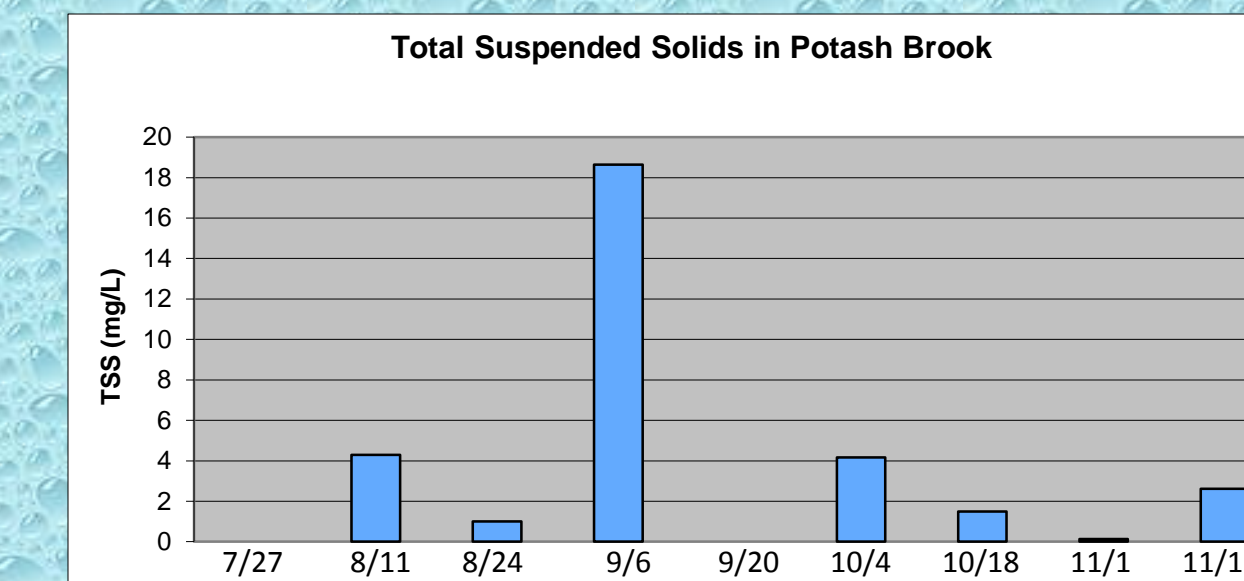
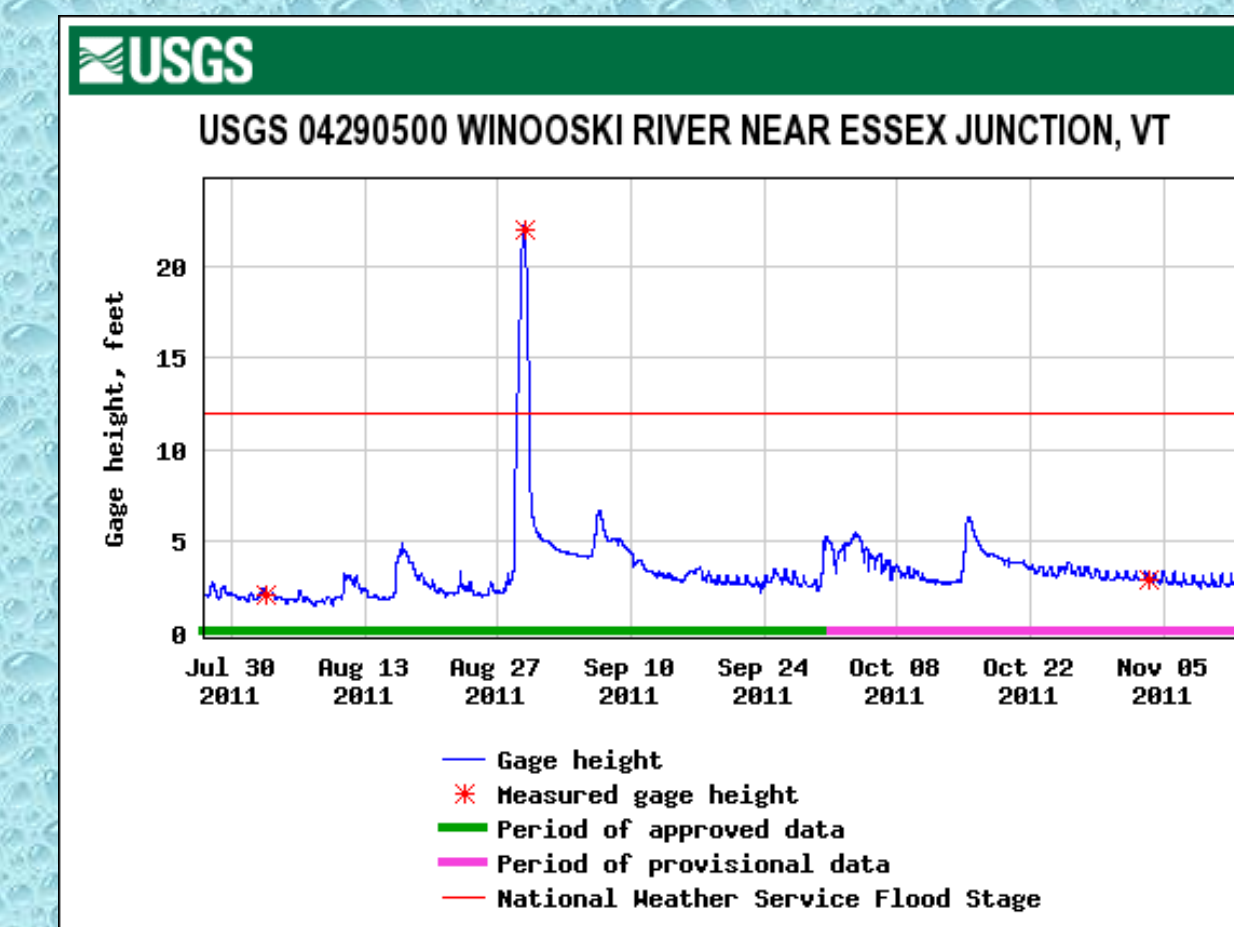
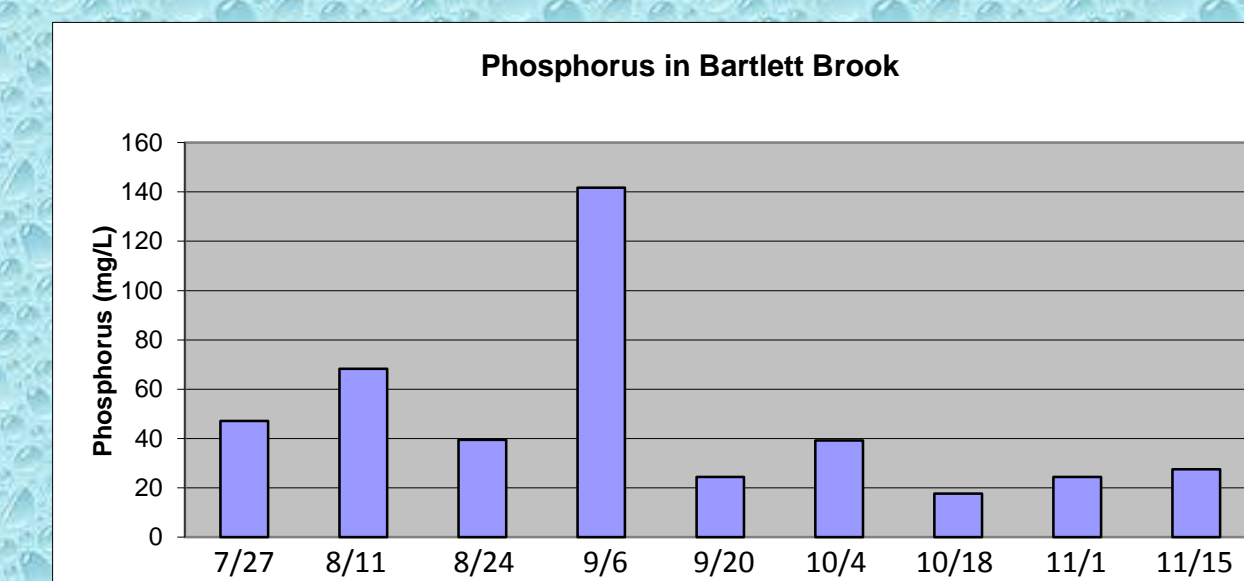
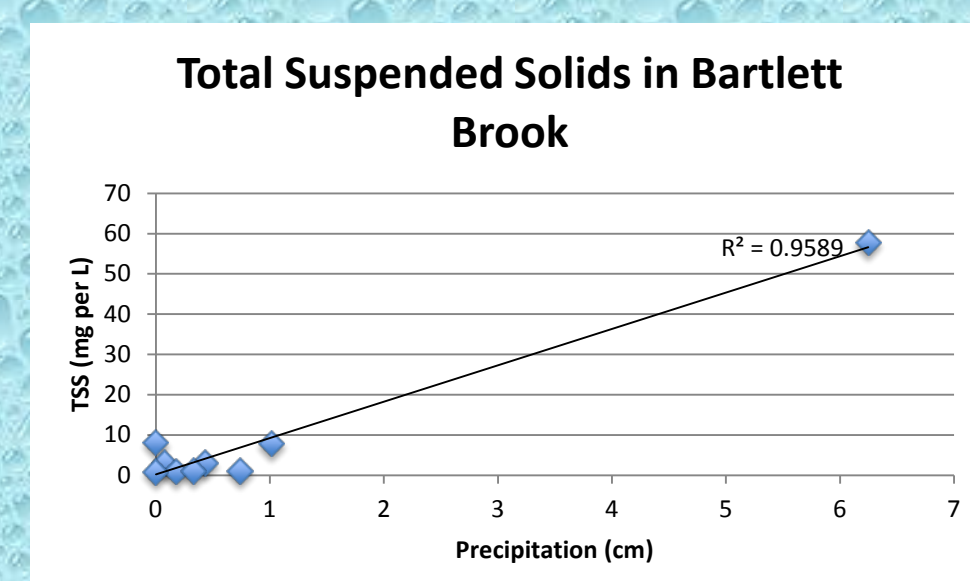
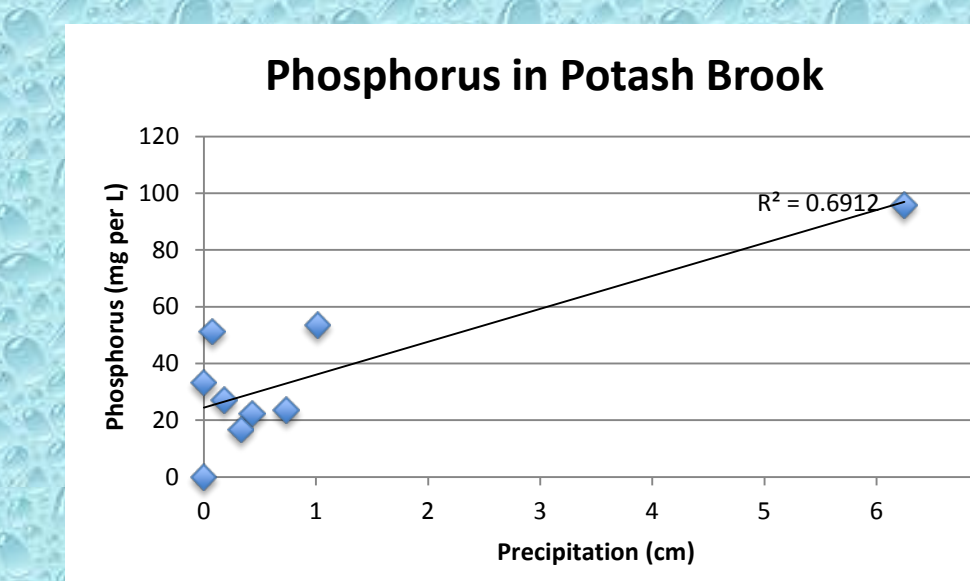
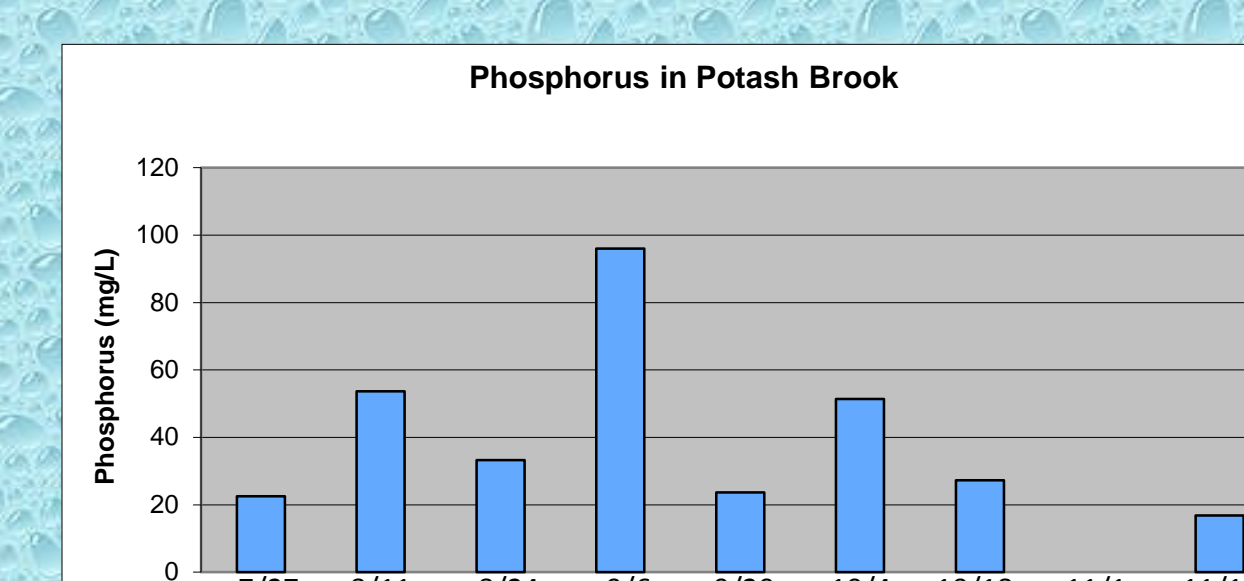
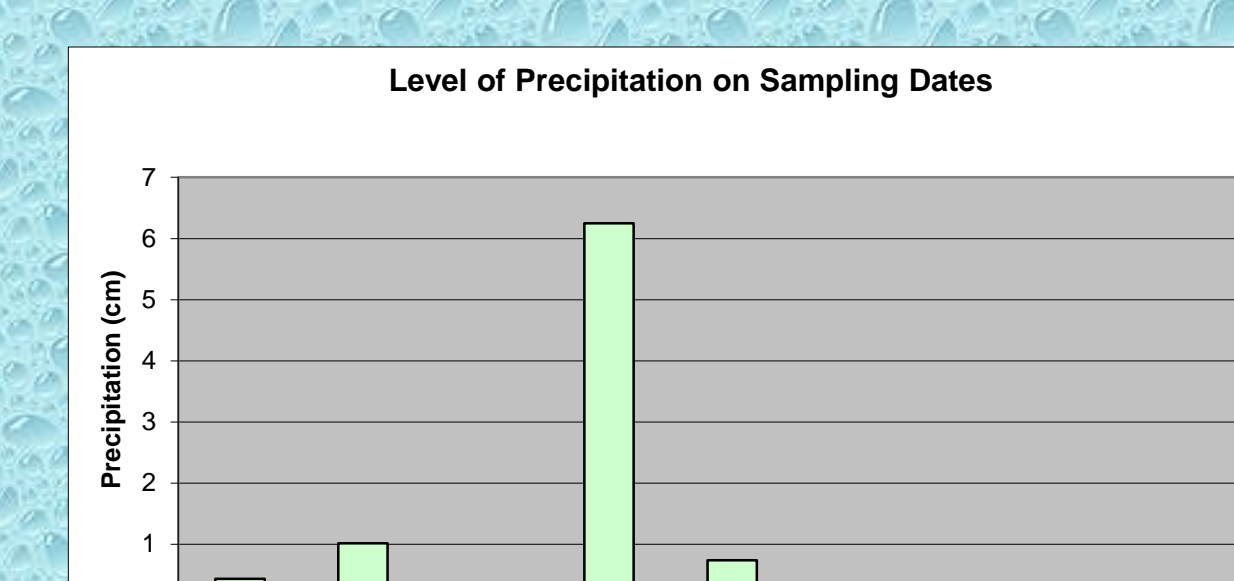
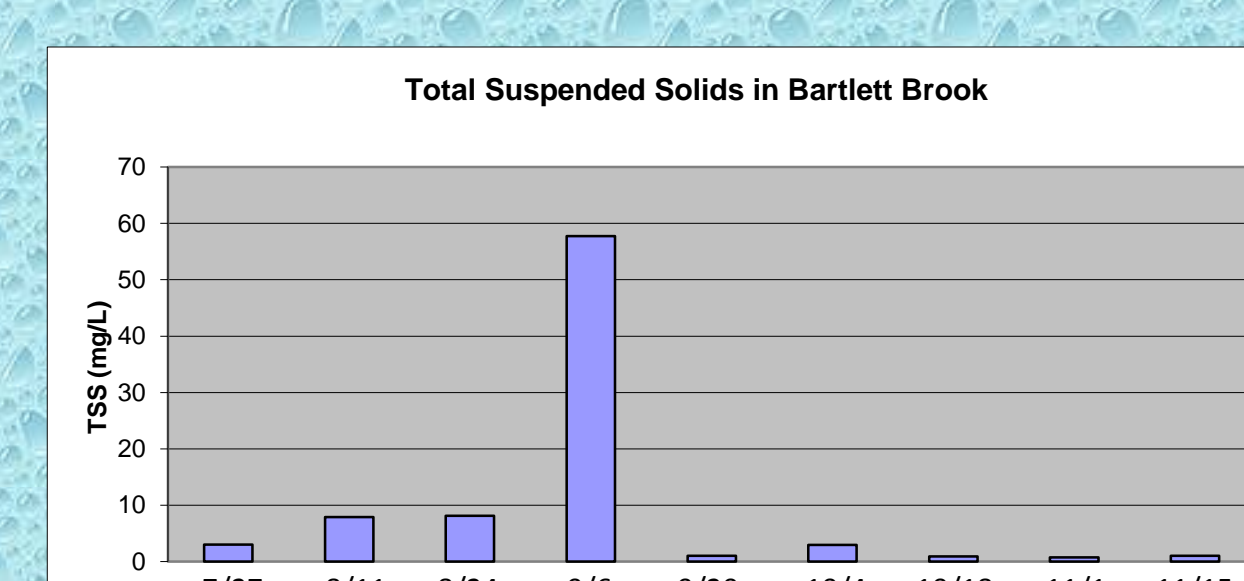
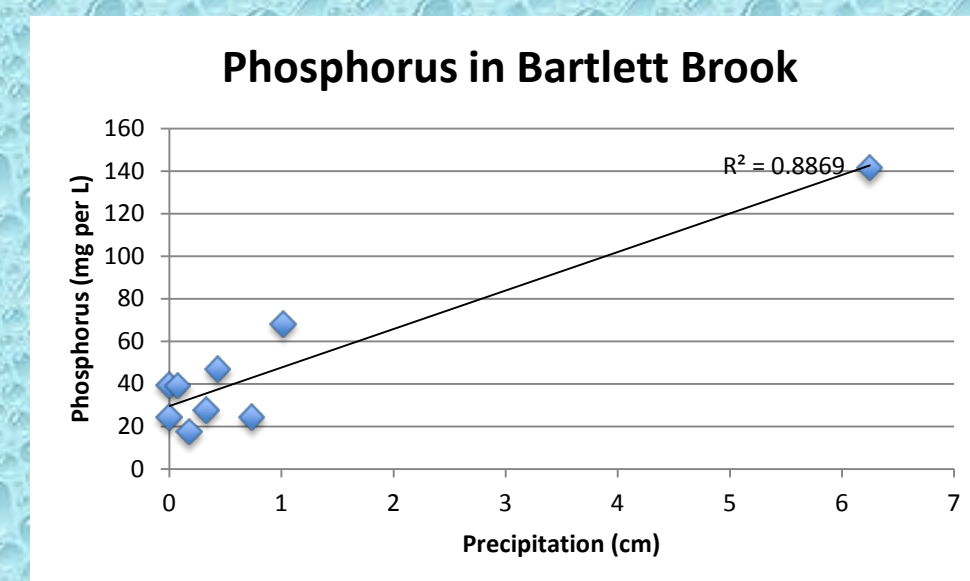
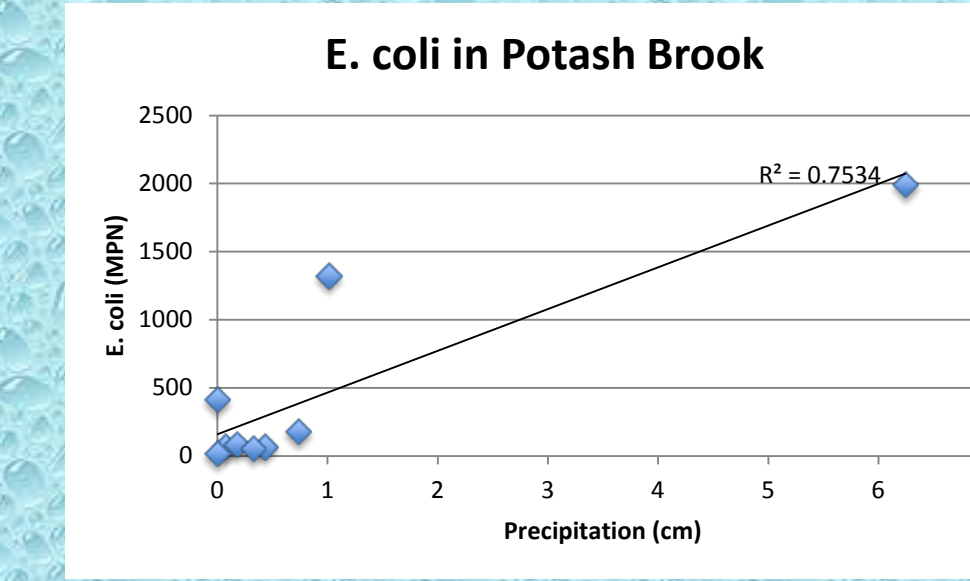
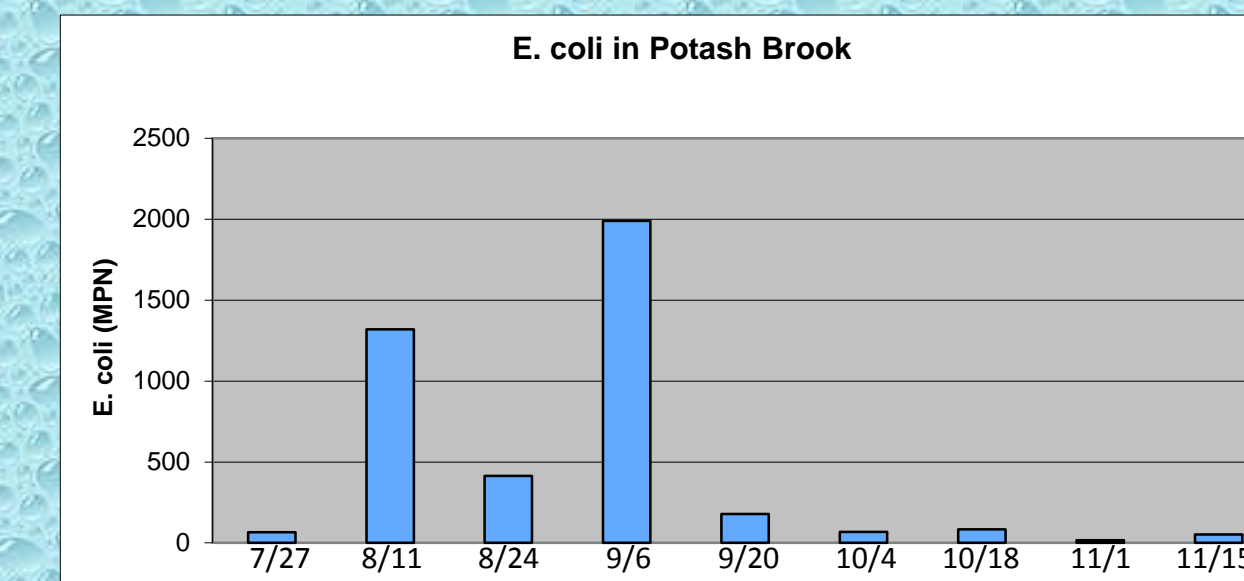
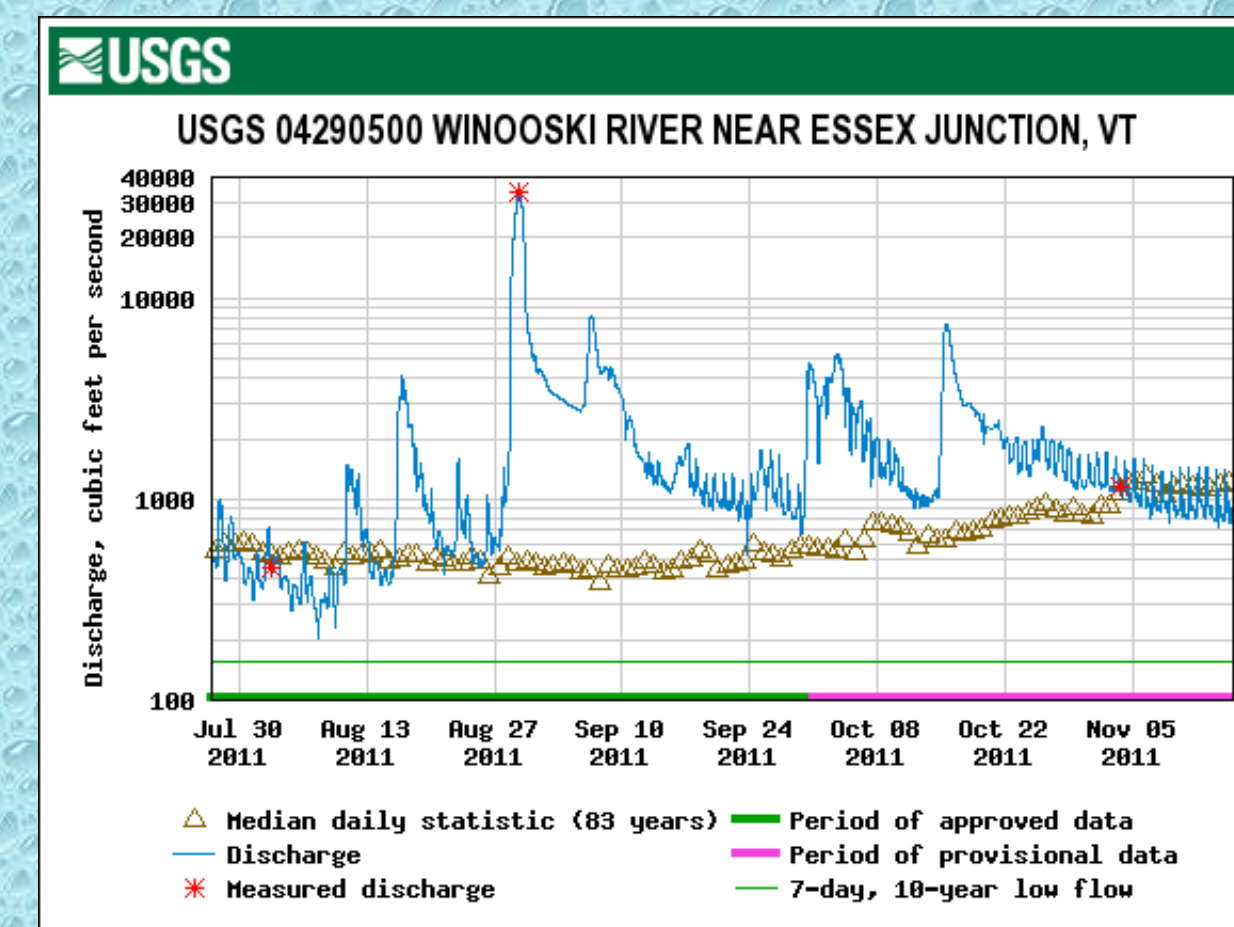
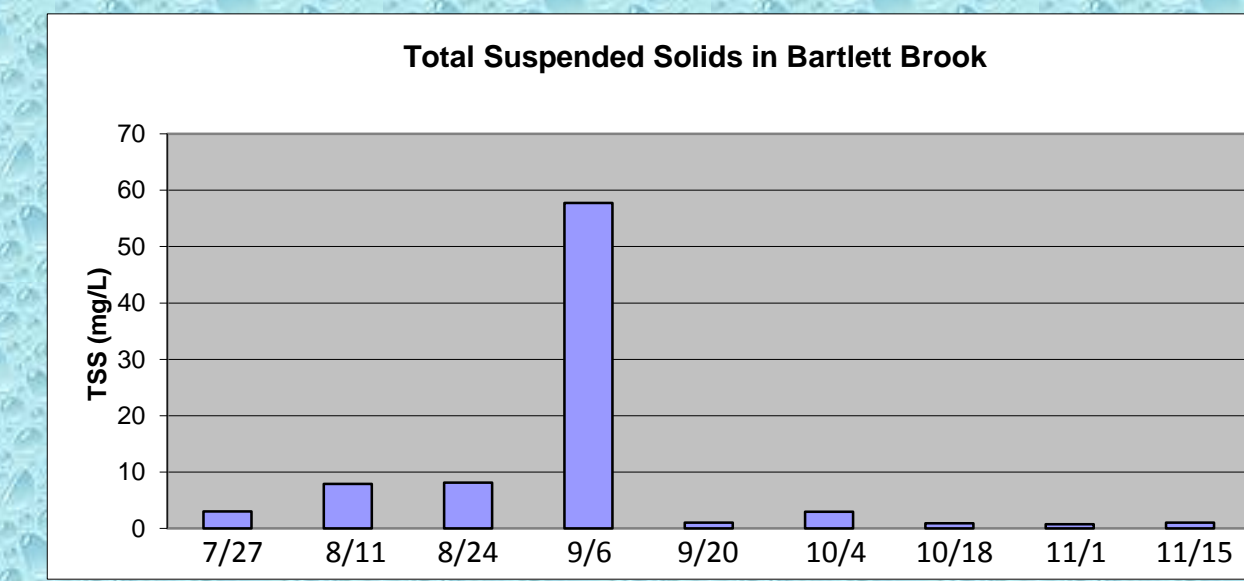
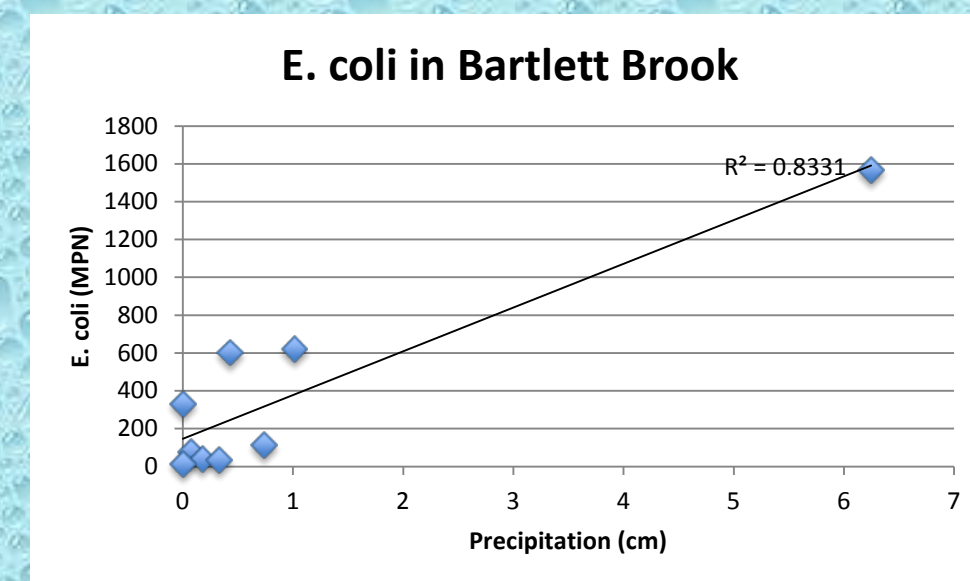


## A Correlation of Precipitation and Water Quality Metrics

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Bartlett Brook on September 6, 2011 at slightly more than "bank full"



Typical stream depth at Potash Brook



Potash Brook on September 6, 2012 Eight days after Hurricane Irene

### Introduction

As part of the Vermont EPSCoR Streams Project, this research began as an examination of the physical, chemical, and biological attributes of two low-order streams in South Burlington, VT, Bartlett Brook and Potash Brook, which empty directly into Lake Champlain.

With unprecedented rainfall and saturation of the ground associated with Hurricane Irene, it was thought that there might be a correlation between that data set and precipitation. In a typical summer, the fluctuations in average rainfall are usually so minimal that this correlation is rarely apparent. As Bartlett Brook and Potash Brooks are impacted urban streams, any amount of precipitation in the previous 24-hours can have an effect on runoff, and corresponding stream volume.

*E. coli* is a bacteria naturally found in human and animal fecal waste, and is an indicator of surface runoff from yards and farms, as well as discharge from septic and wastewater treatment facilities. Certain strains of *E. coli* have been shown to cause disease in humans, and may be indicative of other pathogenic bacteria in the water supply. Phosphorus is commonly applied to lawns, gardens, and crops as a fertilizer, and is a naturally occurring part of most soils. During large rain events, soil washes into rivulets which eventually find their way into streams, increasing not only the phosphorus, but also the sediment load of the stream. Excess phosphorus in Lake Champlain has been linked to blooms of cyanobacteria (blue-green algae) which, in turn, has been linked to human and animal illness.

**Hypothesis:** If rainfall increases, then there should be an increase in the amount of runoff, and a corresponding increase in the concentration and amount of *E. coli*, phosphorus, and sediment in stream water.

### Methods

On an approximately 2-week schedule, the team collected water samples, measured stream discharge, pH, and temperature for the 2 sites. Three water samples were collected for each of the measured attributes: *E. coli*, phosphorus, and total suspended solids (TSS). Control blanks were poured in the field for *E. coli* and phosphorus samples. Water samples and controls were sent to the UVM water quality lab for analysis. Data were uploaded to a common data base by both the UVM water quality lab and the Rice Memorial High School team. The results for the 3 samples for each date were averaged for the purposes of this study.

### Analysis

All of the water quality attributes showed a similar trends to the precipitation events of the field season, including the sampling the week after Hurricane Irene. Precipitation tallies for the previous 24 hours were accessed from the National Weather Service. All of the metrics showed positive correlations with precipitation, with the highest R-squared values for TSS.

Discharge and water gage graphs for the nearby Winooski were downloaded from the USGS website. These were included to show river volume trends for the same time period, as group data was irregular.

### Conclusion

The data show a positive correlation between 24-hour precipitation and each metric (*E. coli*, phosphorus, and TSS). The surface runoff associated with these events not only increase the amount of these pollutants moving into the stream, but show an increase in concentration of the pollutants during storm water increase. This increased concentration may be due to increased velocity of surface runoff due to the abundant impervious surfaces in the study area. Understanding the correlation between large rain events and the increase of pollutants in stream water demonstrates the relationship between weather and runoff, and ultimately will help with monitoring and controlling the contaminants that enter Lake Champlain.

### References

USGS National Water Information System: Web Interface; Winooski River data available at [http://waterdata.usgs.gov/vt/nwis/uv?site\\_no=04290500](http://waterdata.usgs.gov/vt/nwis/uv?site_no=04290500)

NWS Precipitation Data for South Burlington, VT available at <http://www.cocorahs.org/ViewData/StateDailyPrecipReports.aspx?state=VT>

Water quality information available from the US Environmental Protection Agency at <http://water.epa.gov/drink/contaminants/#List>