

Longitudinal Changes in Stream Chemistry and Discharge Influenced by Streamflow in a Restored Stream

Joseph Malin (GEOL 393)

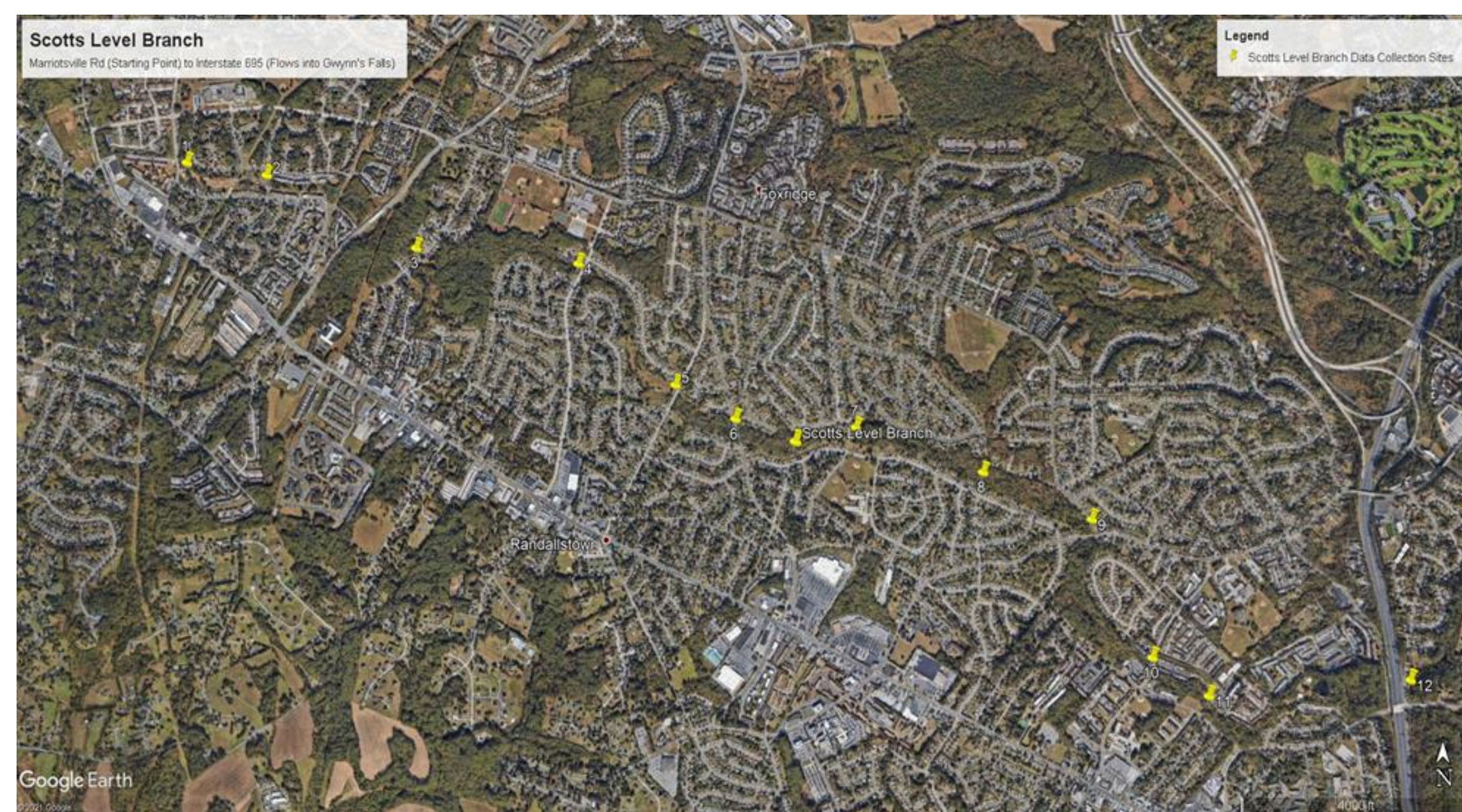
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Introduction

Scotts Level Branch is a small stream in western Baltimore County, Maryland, undergoing restorations to improve water quality in hopes of bettering the Chesapeake Bay watershed. Surrounding landscapes will be reshaped through floodplain reconnections. This will inherently impact streamflow over time.

Figure 1: Satellite map of Scotts Level Branch with data collection site markers.

Marriottsville Rd to Interstate 695



Hypothesis

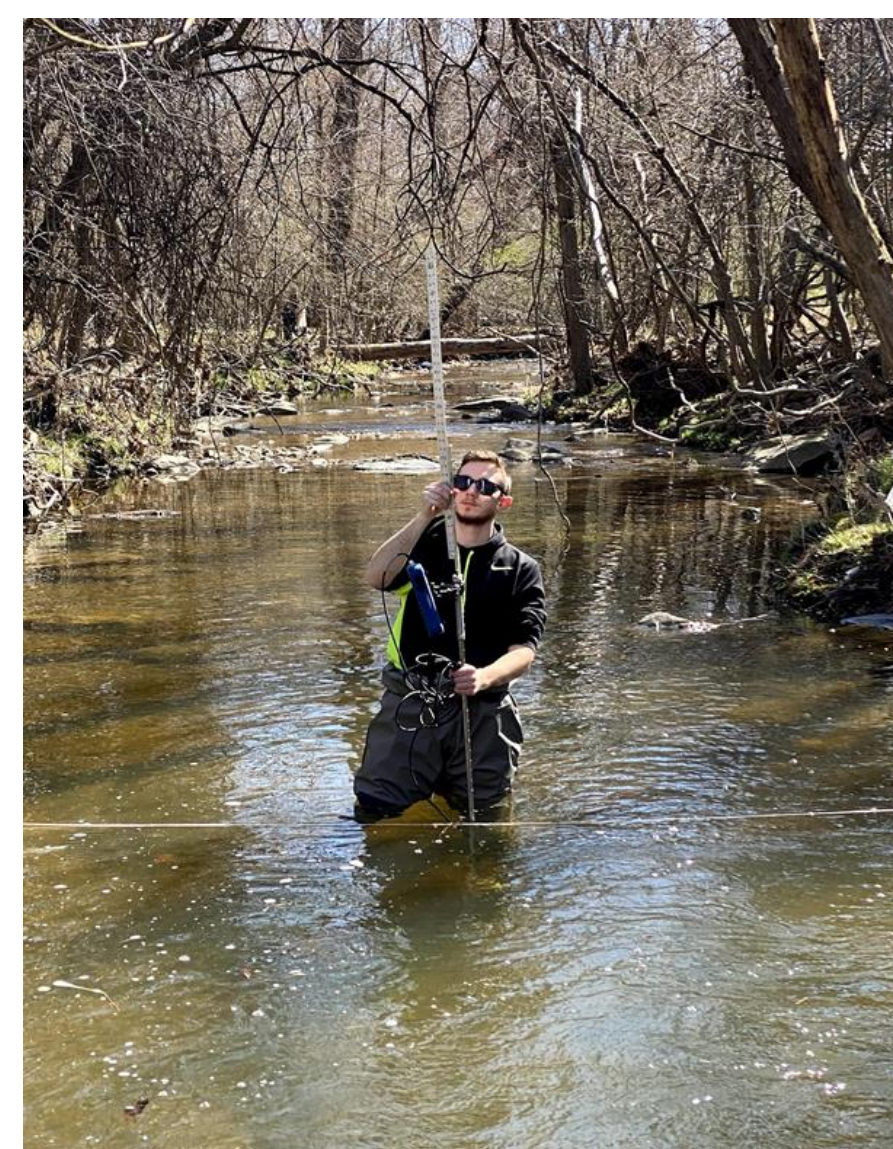
Stream chemistry and geometry are different from headwaters to downstream in a restored stream due to changes in streamflow.

Methods

Analyses of USGS Stream Gage data and field data collection at 12 sites along SLB. Stream width and depth, along with analyses of velocity, pH, TDS, specific conductance, and temperature were found. Discharge has been calculated for all localities.

Figure 2: Data collection procedures shown at Site 7 (Greenway Bridge) (Left) and Site 10 (Rolling Rd) (Right).

Site 10 features the USGS Stream Gage and associated measurement tools.



Results

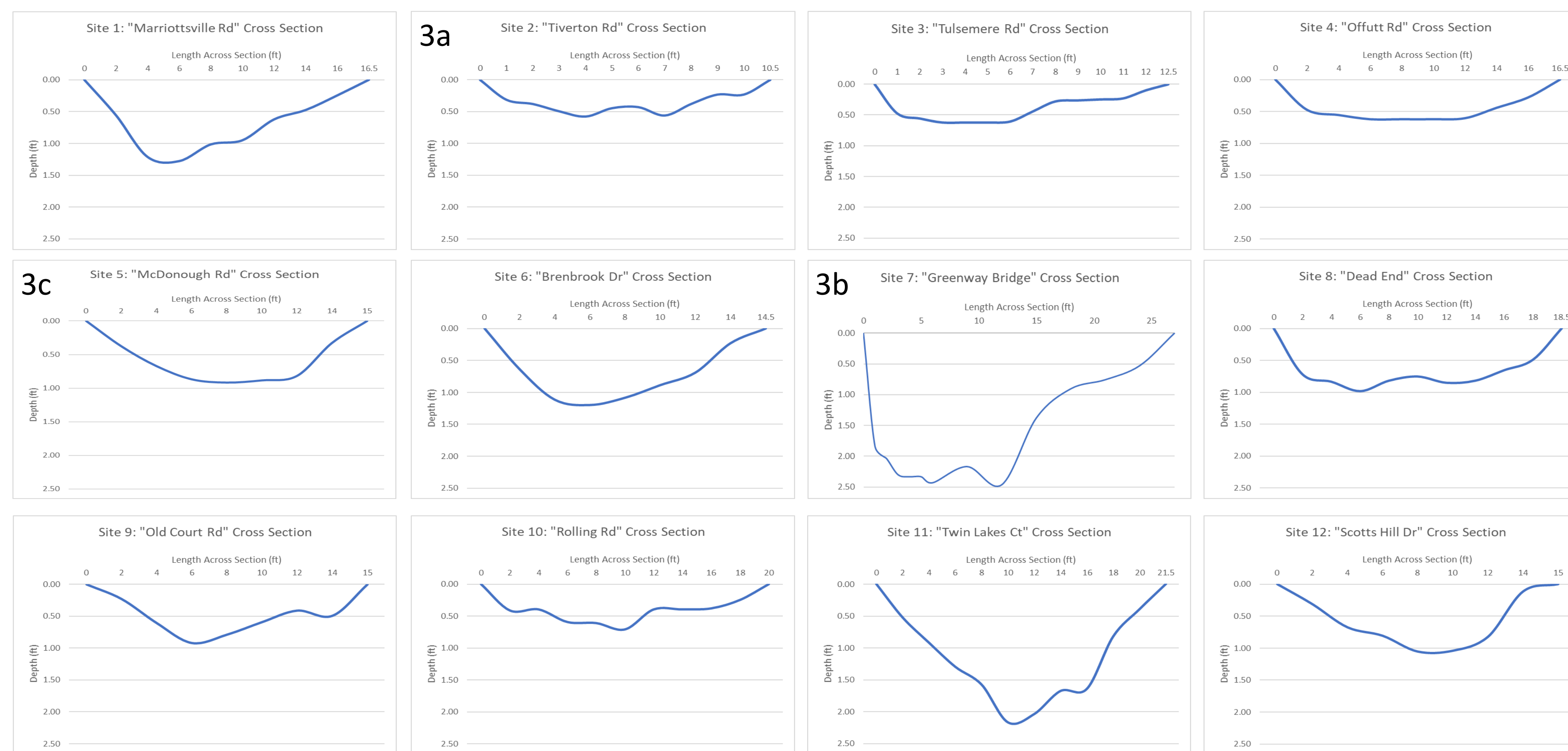


Figure 3: Stream Site Cross Sections

- Few well-defined trends in streambed geometry from site to site.
- Site 2 (3a) has narrowest stream width (10.5 ft) and shallowest average depth (0.40 ft).
- Site 7 (3b) has widest overall width (27 ft) and deepest average depth (1.79 ft).
- Site 2 (3a) and Site 5 (3c) are the only sites that fall within restored sections of SLB.

Figure 6: Select USGS Stream Gage Data (Site 10)

SLB discharge data from Jan 2013, before restoration project (Left) compared to data from Mar 2021, during restoration project (Right).

- Discharge returning to base level after comparable precipitation events.
- Similar rises and falls from pre- and post-restoration.
- Post-restoration is slightly less steep than pre-restoration.

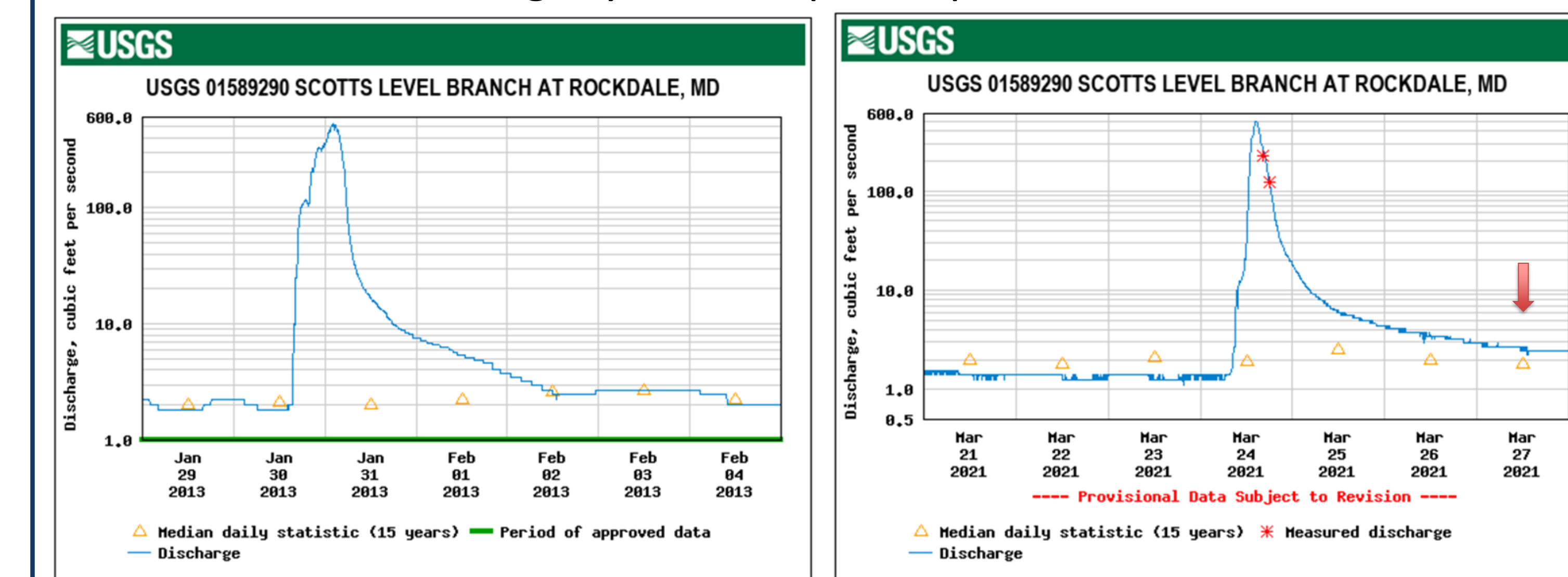


Figure 4: Stream Flow and Geometry

- Discharge increases from site to site when Site 7 outlier is not considered (4a & 4b).
- Average stream depth and width plots presented increasing downstream trends, indicating an increasing cross-sectional area trend (4c).
- Depth to width ratio showed slight increasing trend downstream.
- Average stream velocity showed an increasing trend downstream (4d).

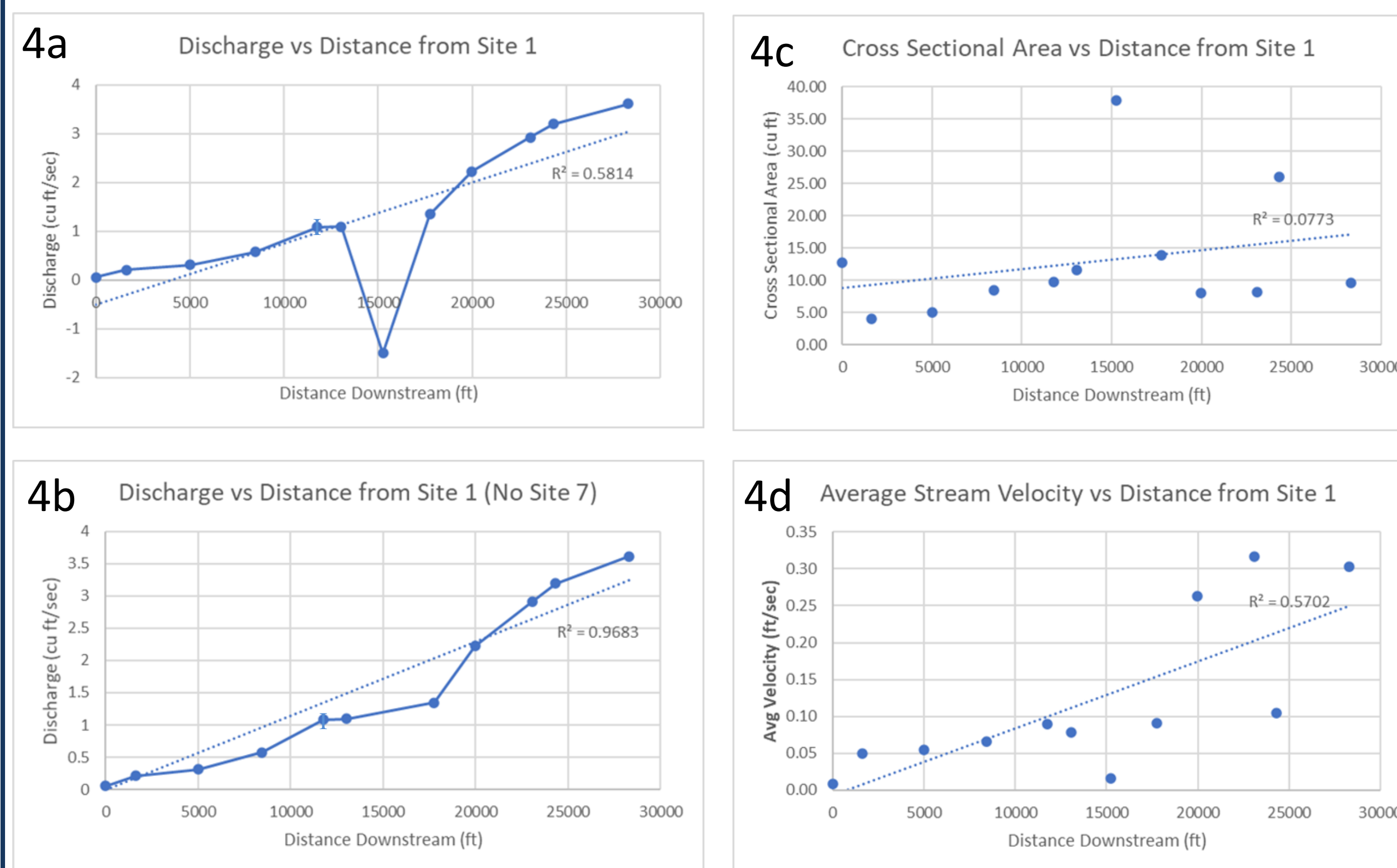
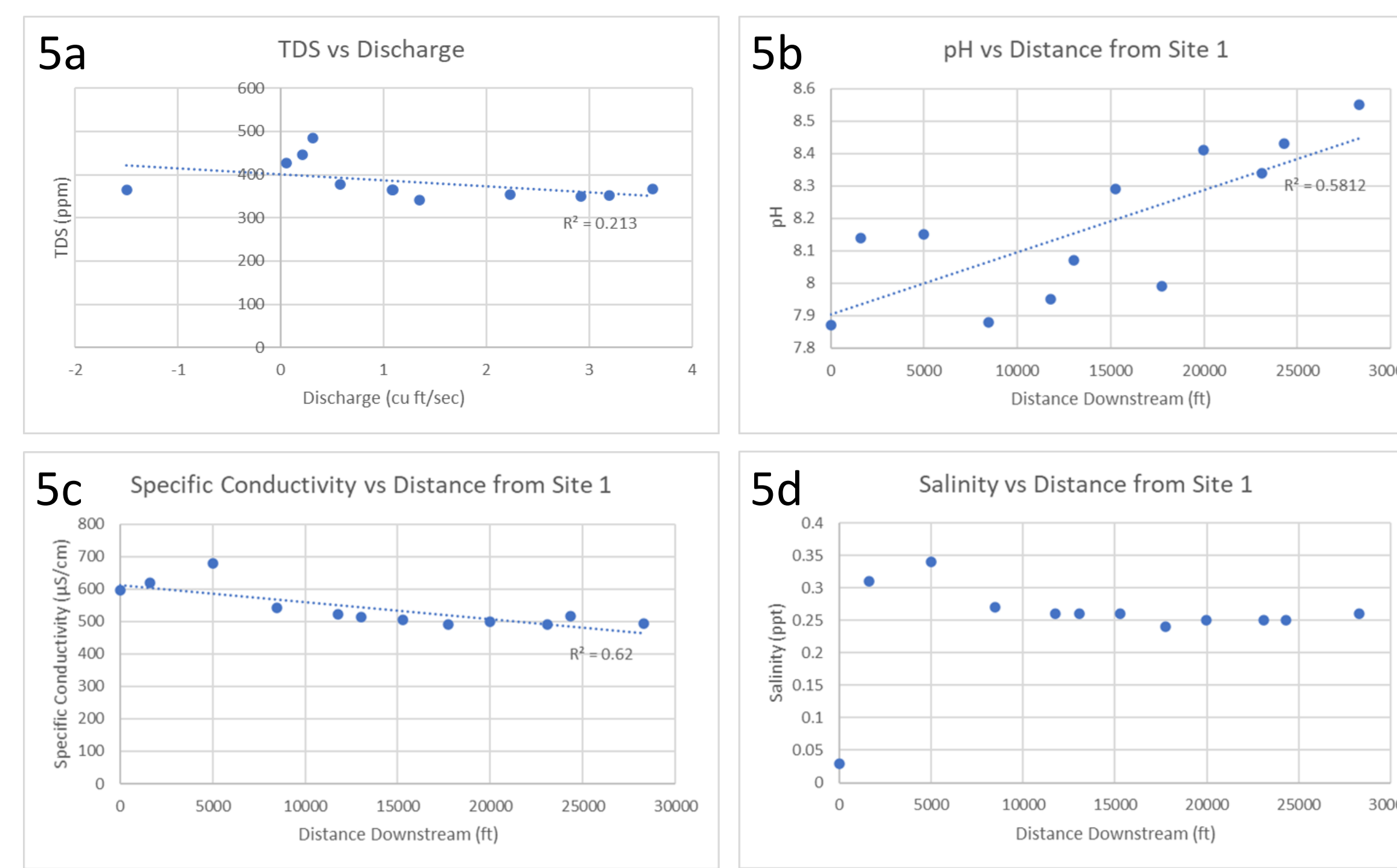


Figure 5: Water Chemistry

- Dilution in total dissolved solids relative to discharge (5a).
- pH increases with water temperature due to photosynthesis of nearby plant life pulling CO₂ from the water (5b).
- Correlation between specific conductance and salinity expressed by similar decreasing trends downstream (5c & 5d).



Conclusions

- Changes in streamflow will impact stream geometry downstream as discharge and stream velocity affect rate of erosion of streambed.
- Dilution of total dissolved solids, as well as decreasing salinity downstream, agrees with hypothesized change in stream chemistry.
- Analysis of pre- and post- restoration are required for best analysis of hypothesis, so future data collection after the project is needed.

Acknowledgements and References

Current Conditions for USGS 01589290 Scotts Level Branch At Rockdale, MD. (n.d.). Retrieved March 31, 2021, from <https://waterdata.usgs.gov/usa/nwis/uv?01589290>

Malin, J. (2021). *Longitudinal Changes in Stream Chemistry and Discharge Influenced by Streamflow in a Restored Stream* (thesis).

Stream chemistry data provided by Carly Maas. Photos of fieldwork taken and provided by Christiana Hoff