

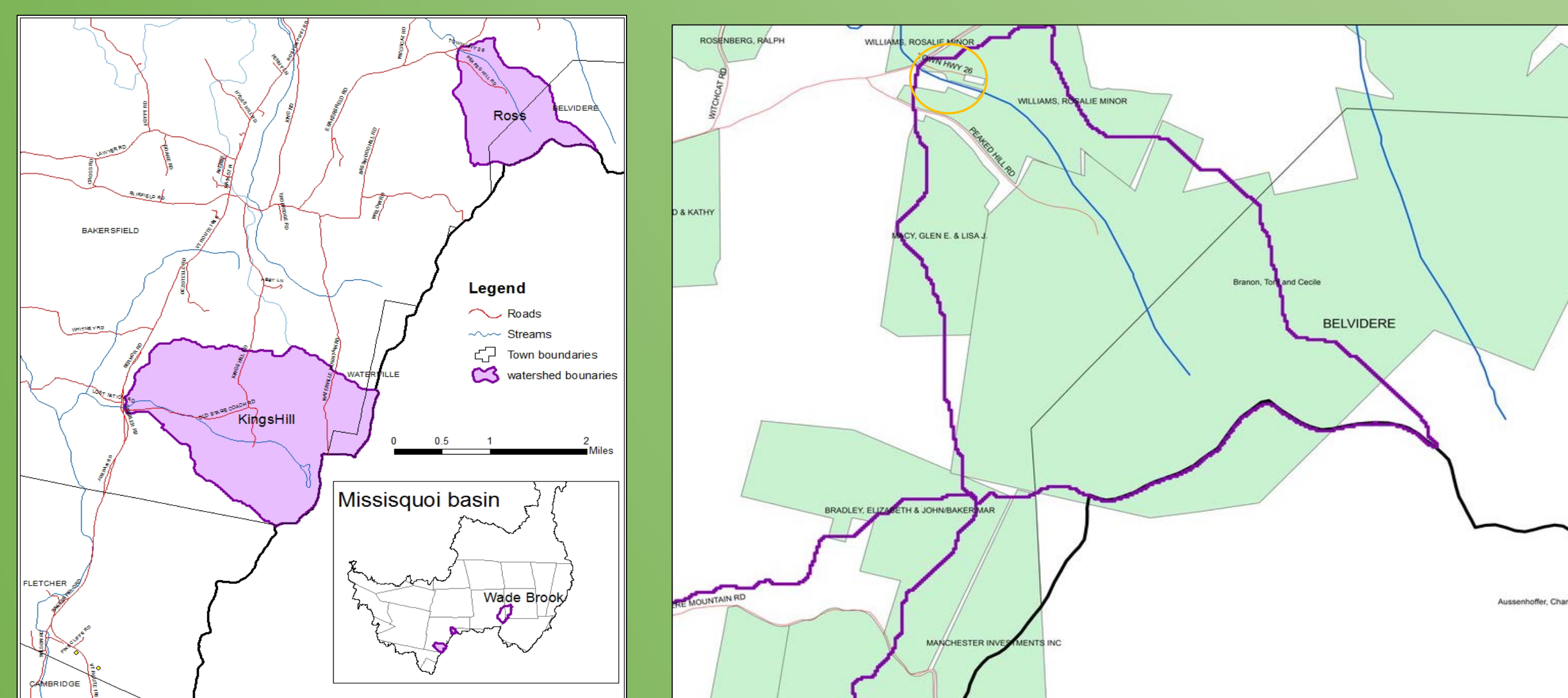
# Examining the effect grazing in Ross Brook on Phosphorus levels

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## Introduction

Cow pastures are lead contributors to increased phosphorus levels in surface water which is harmful to stream ecosystems (Schwarte et.al, 2011). Algae and plants use the available phosphorus and experience rapid growth, decreasing light availability to the stream surface and available oxygen for aquatic life. Dairy cows from the nearby farm were observed defecating and urinating in and near Ross Brook stream. Cow feces and urination have been shown to increase phosphorus levels in nearby waterways (Agouridis et.al, 2005). In addition, the cows contribute to erosion on the pasture adjacent to the stream and on the streambank where here have access.

This project examined how the presence of cows at Ross Brook contributes to phosphorus levels in the water and near the streambank in the soil. The results will contribute to the greater RACC project by measuring the effect of the cows' access to the stream above the water sampling station.



LEFT: This map displays the water sampling sites in Kings Hill and Ross Brook in the Missisquoi watershed where phosphorus exports from forested watersheds are monitored. This project was focused in Ross Brook.

RIGHT: Zoomed in site map of Ross Brook. The sample site was within the yellow circle.

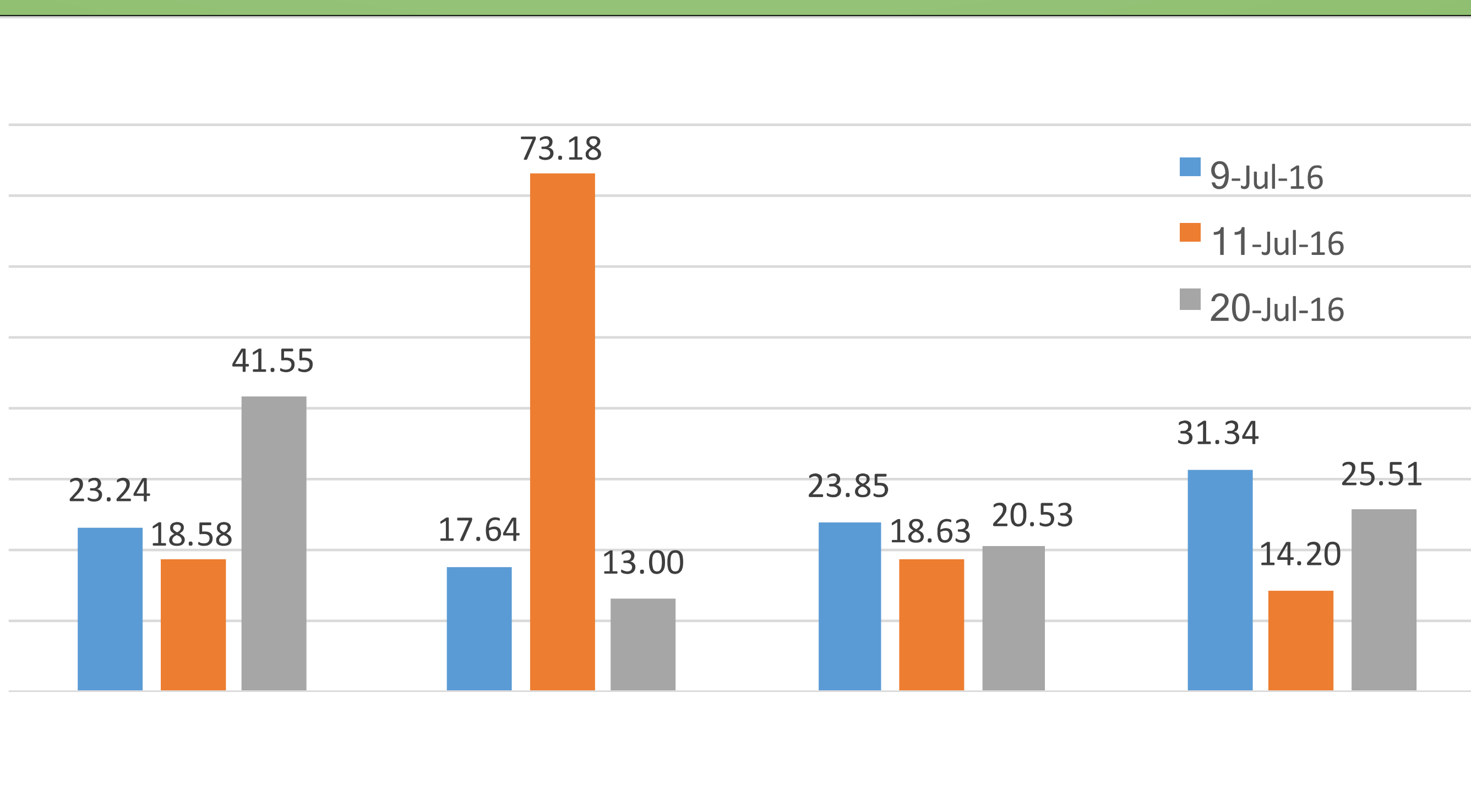
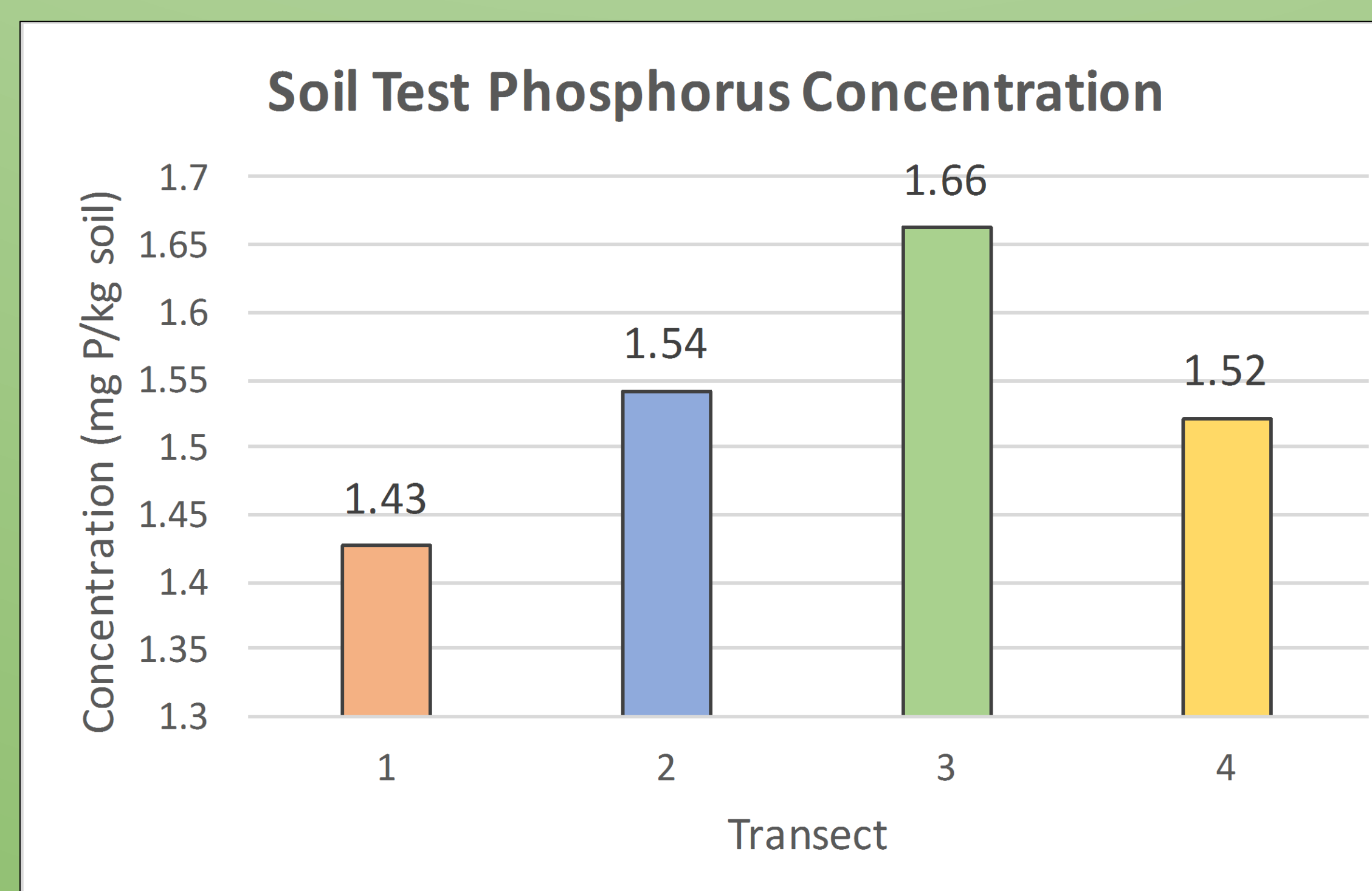
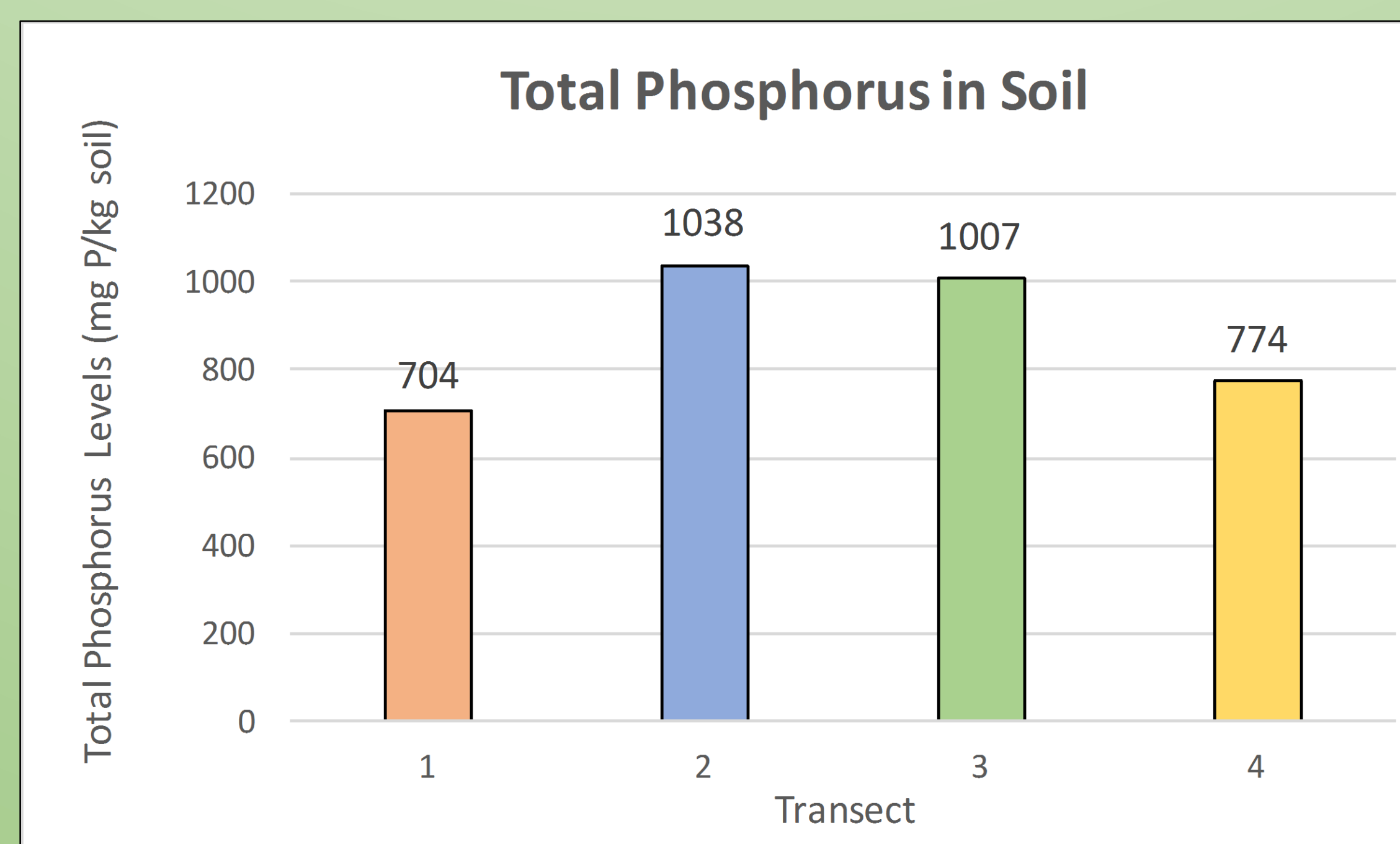
## Materials and methods

**Soil:** Three samples (A, B, C) were taken along four transects perpendicular to Ross Brook. These values were averaged for analysis. To choose transect locations, high erosion areas and cows' access to the stream were considered. Transect 1 was furthest upstream, before the herd had access to the stream. Transect 2 was in the area where the herd could drink from the stream. Transects 3 and 4 were downstream of the cow access area and placed along runoff pathways entering the stream where erosion was clearly observed. The soil samples were only taken once because it was determined that there would not be a significant difference in phosphorus levels over the short sampling period.

**Water:** Parallel to each transect, a water sample was collected within six minutes of each other during events. A storm event was defined as any time there was rainfall over the sampling area. Samples were taken successively, starting from the furthest point downstream (point 4) and moving upstream to not cause a disturbance between sampling points. Three events were sampled: One storm event (9-Jul-16) and two regular samples (11 & 20-Jul-16).



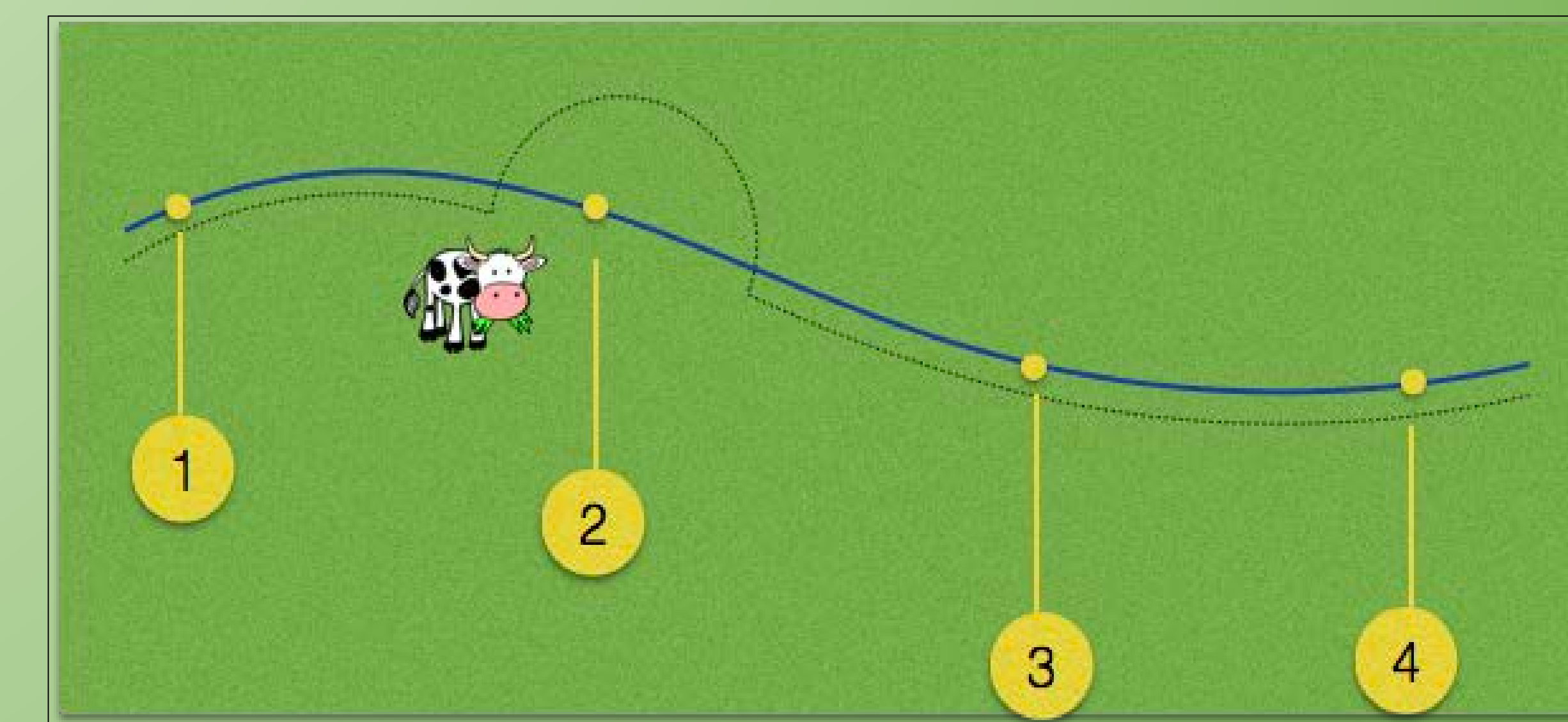
## Results:



- Total phosphorus for soil samples was measured with Inductively Coupled Plasma (ICP-OES) after microwave assisted nitric acid digestion (Method 3051a; USEPA 2007).

- Soil Test phosphorus was determined with a modified Morgan extraction (pH 4.8 ammonium acetate buffer in 1:5 ration, McIntosh, 1969) and Murphy-Riley colorimetric method.

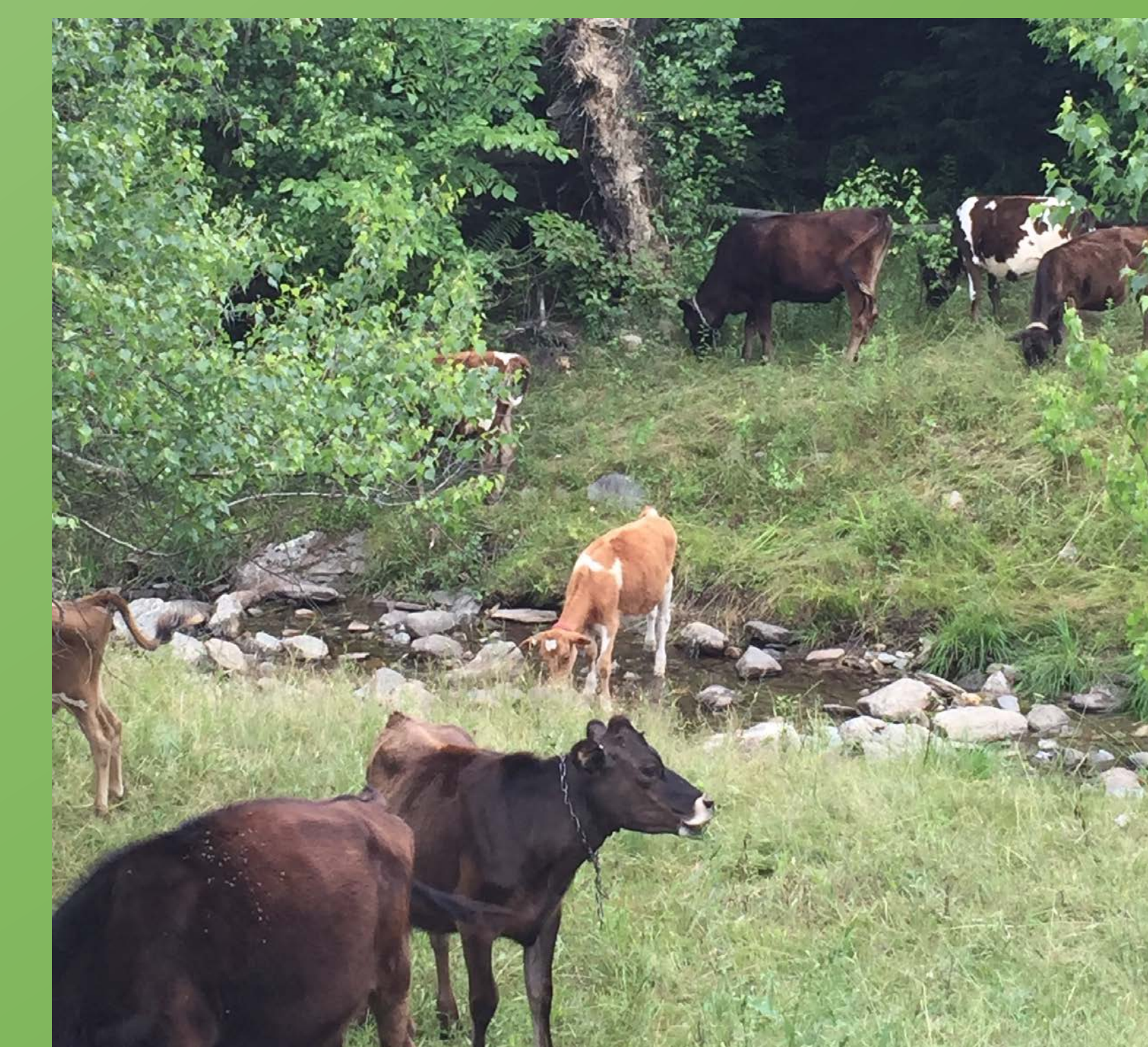
- Total phosphorus for water samples was analyzed with a persulfate digestion and measured with a Murphy-Riley colorimetric method.



This model represents the transect and water sampling sites. The dotted line represents the electric fence in place, the blue line is Ross Brook, and the yellow lines are the sampling locations.

## Conclusions

Total phosphorus is the concentration of all phosphorus in the soil, whereas Soil Test phosphorus is considered what will be available for plants and algae to use. Transect 2, which was the point that the cows accessed the stream, had the highest total and second greatest available phosphorus levels in the soil. The first transect soil sample, above where the cows were accessing the stream had the lowest concentrations of total phosphorus and available phosphorus. The available phosphorus in the water samples was not conclusive due to a lack of data, however some trends were observed. For example, during the storm event (9-Jul-16), higher phosphorus concentrations were observed downstream the access point. In the concentration for available phosphorus in water, there was an outlier on 11-Jul-16 at sampling site 2 (73.18mg/L). More data at these sites will allow for stronger conclusions about the water concentrations.



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## Literature Cited

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- Schwarte, K. A., Russell, J. R., Kovar, J., & Morrill. (2011). Grazing Management Effects on Sediment , Phosphorus , and Pathogen Loading of Streams in Cool-Season Grass Pastures.