Evaluation of Water Quality Benefits of Prairie Strips in Iowa

Contract Number: AG-3151-P-16-0255
Iowa State University

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Quarterly Report October – December 2017

Objectives: The specific objectives are to estimate 1) the impacts of integrating variable width contour strips within row-cropped agricultural landscapes, and 2) the impacts of maintaining contour strips on CRP fields returning to crop production - on reducing erosion and sediment, nitrogen, and phosphorus leaving fields.

Progress:

Project Status
Surface water runoff monitoring for the season concluded at the beginning of November due to freezing temperatures. The automated water samplers were shut down and brought in from the field until next monitoring season. In early October, there was a single runoff sample collected from the Rhodes site (experimental control watershed). Groundwater continues to be monitored on a monthly basis. Minor maintenance and upkeep to the flumes and water samplers continues throughout the season. Progress has been made with nutrient analyses.

Below, figures 1-4 display data related to surface water monitoring such as rain and surface runoff, total suspended solids, dissolved nitrogen (nitrate and nitrite) and dissolved phosphorus (orthosphosphate) for the 2016 season as well as the most up to date set of data from 2017. These represent a subset of the water quality parameters we are measuring. Other measurements (total nitrogen, total phosphorus) have yet to be fully analyzed by our water quality laboratory. Our experimental sites, both in 2016 and 2017, have experienced somewhat rare conditions in terms of a relatively few number of significant surface runoff-producing rain events. Generally speaking, when there is a noticeable difference within sites and between the control (watershed with no prairie strips) and treatment (watershed with prairie strips), the cumulative export of total suspended solids and nutrients is less in the treatment watersheds. One exception to this generalization is the McNay site in 2017. This year, we have had a problem with runoff being diverted around the control site's monitoring equipment. Here, our equipment is located within the grassed waterway, but due to a significant "lip" on the edges of the grassed waterway a portion of the surface runoff is not entering the waterway. This has led to underrepresented runoff estimates at the McNay control watershed which is being corrected for future monitoring.

Figures 5-7 illustrate our most up to date set of groundwater data including depth from ground surface, dissolved nitrogen and dissolved phosphorus concentrations. Sites have 3 shallow groundwater wells, except for the Guthrie site, which has 2 since there is no control watershed at that site. There is a single well placed at the top (graphed dotted lines) and bottom (graphed solid lines) edges of the most downhill prairie strip in the treatment (TRT, graphed blue lines) watersheds, and a well placed at the bottom of the control (CTL, graphed red lines) watershed. Early in the year, groundwater at most sites was relatively shallow and tended to slowly get deeper until about September, when levels began to rebound. Nitrate-N concentrations are

consistently in the 10 mg/L range and we see reductions in concentrations of nitrate-N at the downstream side of the bottom prairie strip at three of the sites. Overall the level of dissolved P is less than 0.1 mg/L at most sites and we see little treatment effect of prairie strips.

Next steps:

- First quarter of 2018 – Continue working on data summarization. Clean and perform any necessary maintenance on water samplers. Collect groundwater data on monthly basis.

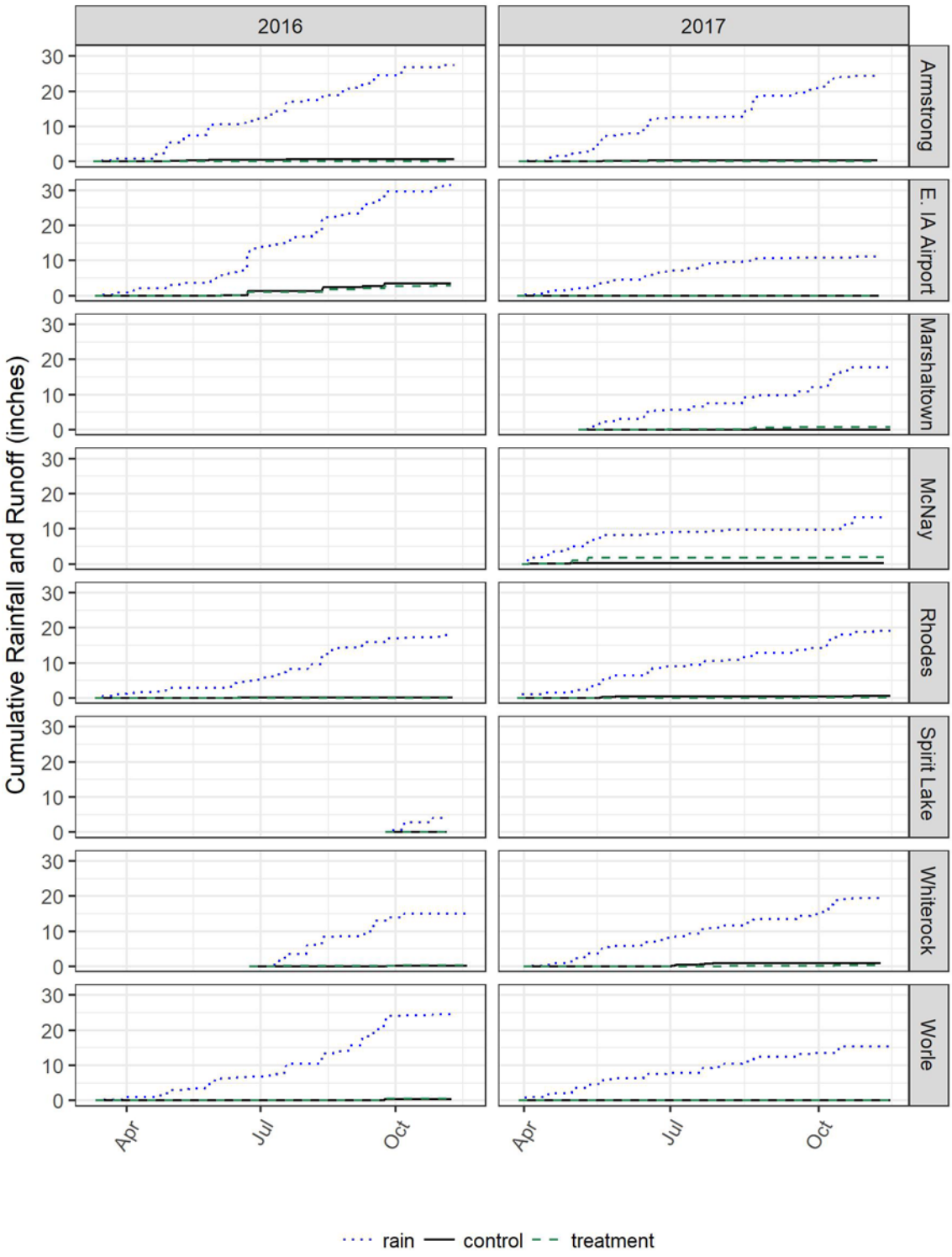

Figure 1: Rain and Surface runoff in 2016 and 2017. Lack of many intense rain events has led to little surface runoff across the sites, relative to the rainfall totals.

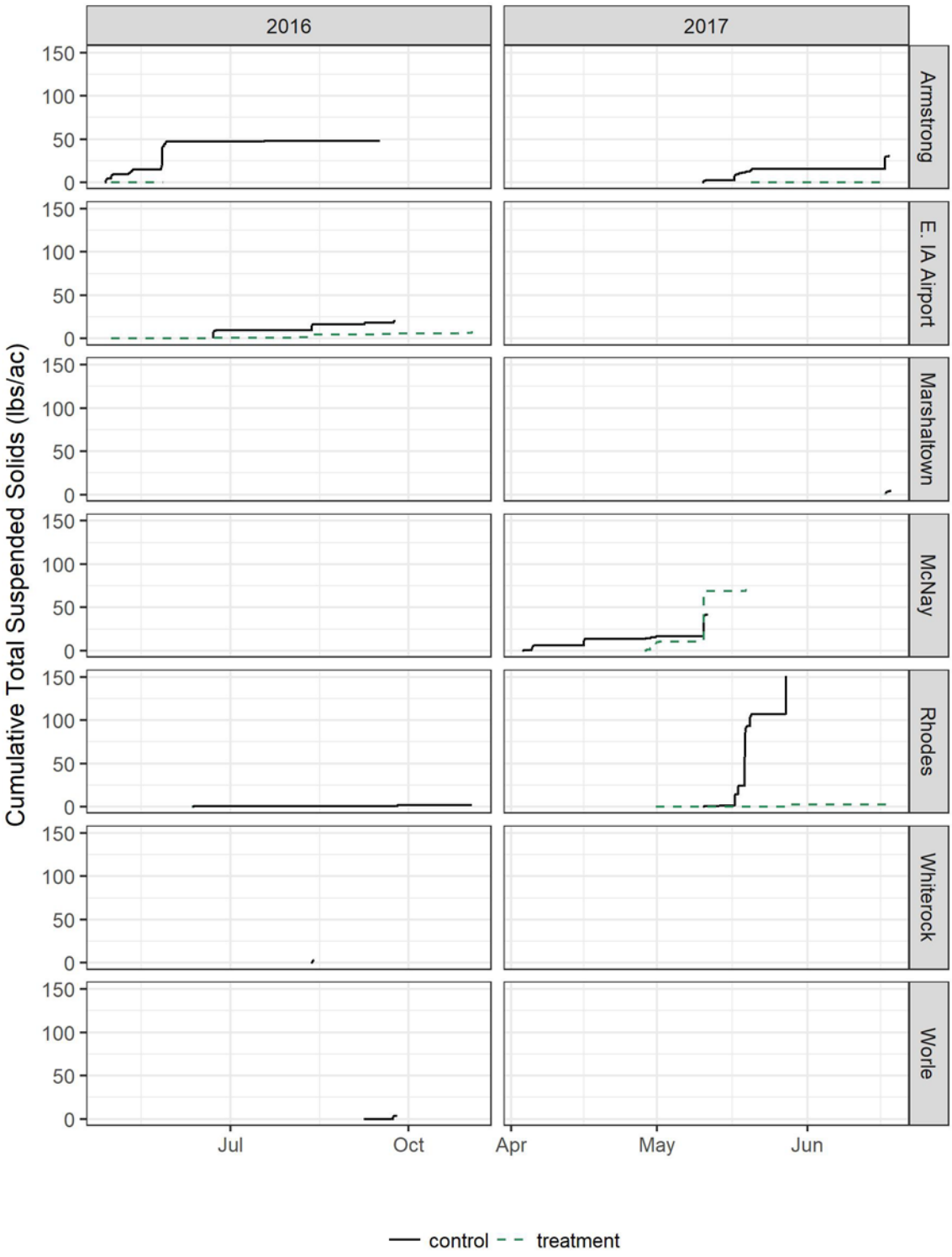

Figure 2: Total suspended solids exported from the experimental watersheds. Cumulative totals are low due to little surface runoff from both the control and treatment. At most sites, there does still appear to be a reducing effect on suspended solids loss by the prairie strips (treatment).

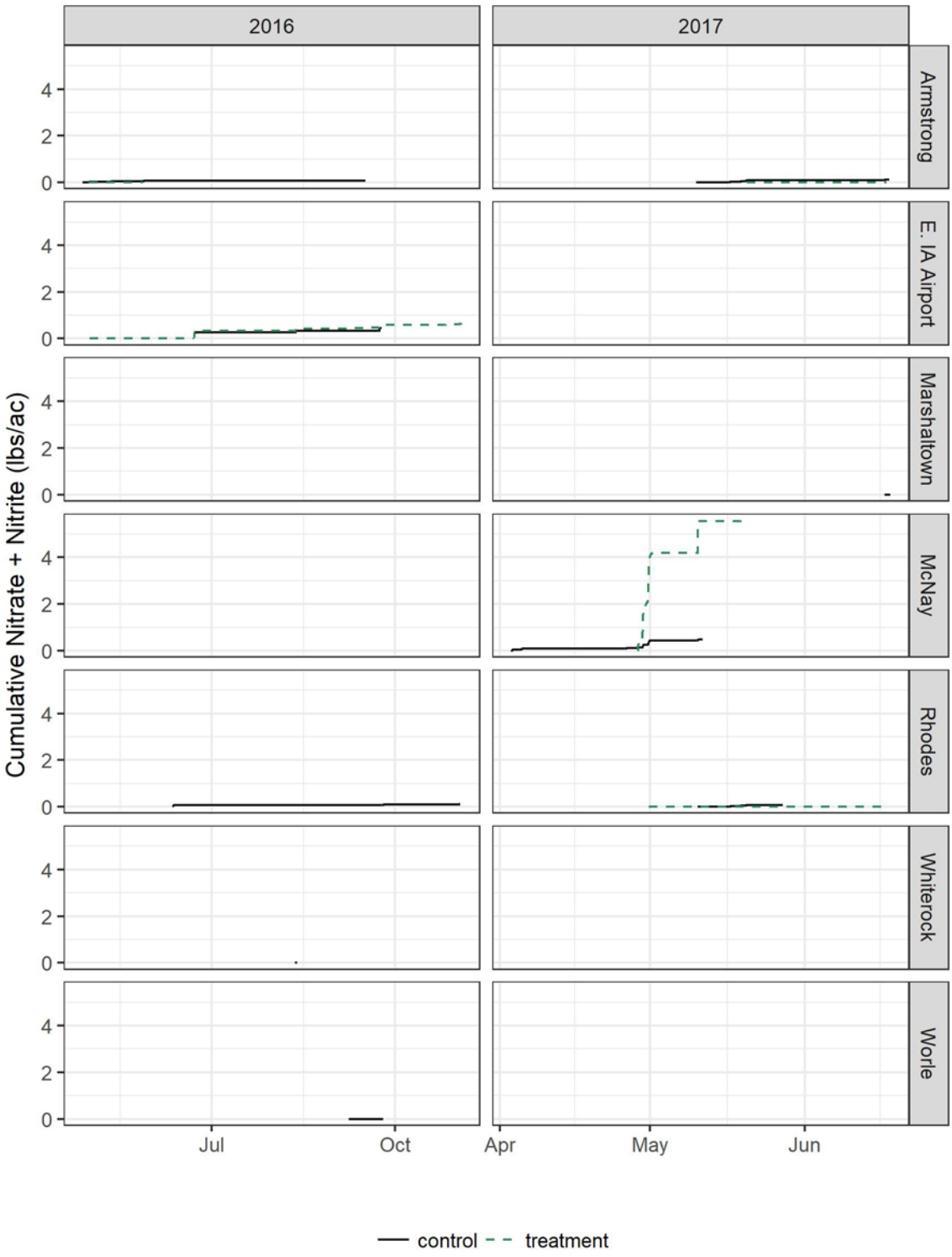

Figure 3: Nitrate exported from the experimental watersheds. Most sites have almost no nitrate losses due to small amounts of surface runoff. McNay treatment in 2017 has yielded relatively high levels of nitrate.

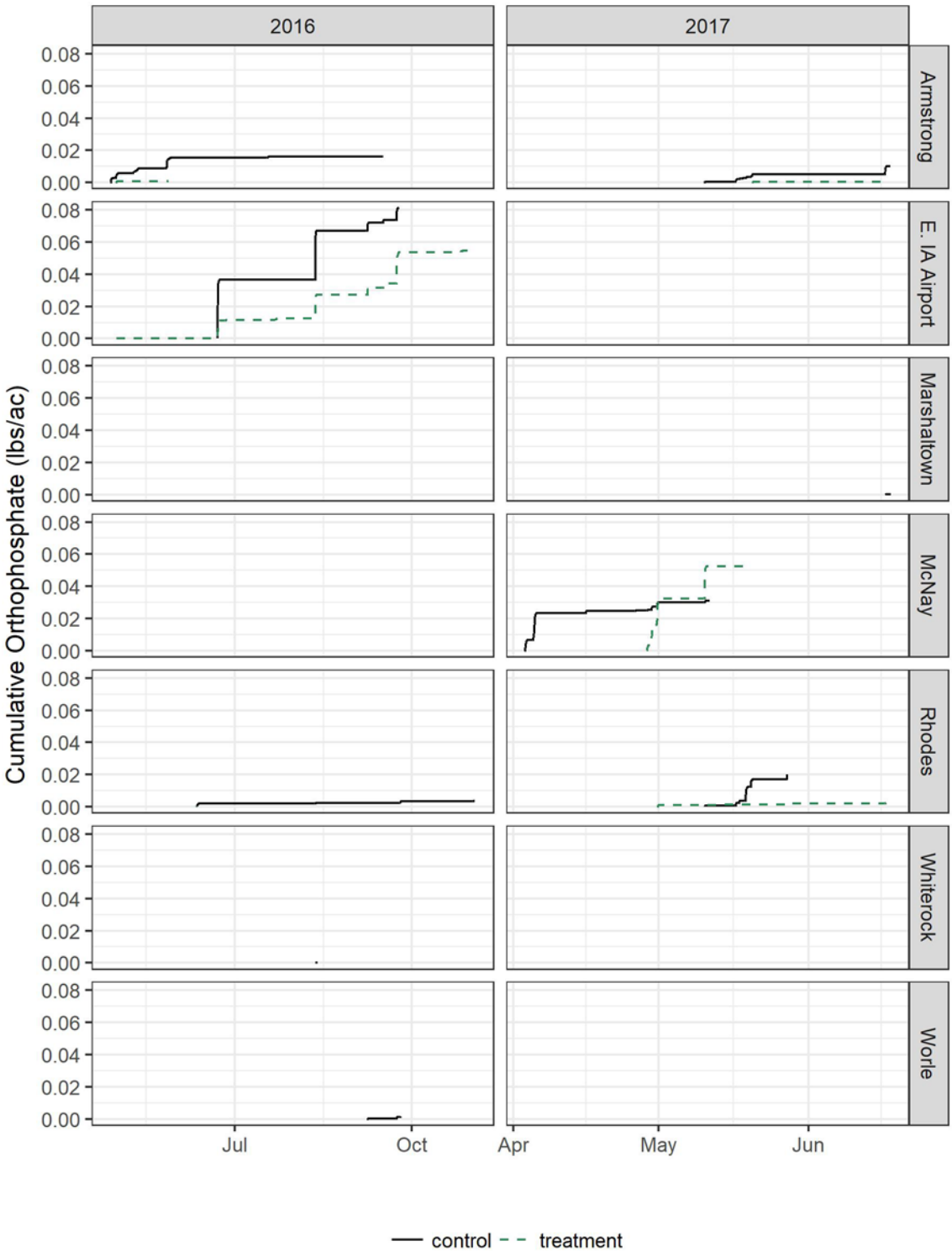

Figure 4: Orthophosphate exported from experimental watersheds. Orthophosphate export levels have been relatively low. Most sites demonstrate a reduction in orthophosphate loss where there are prairie strips.

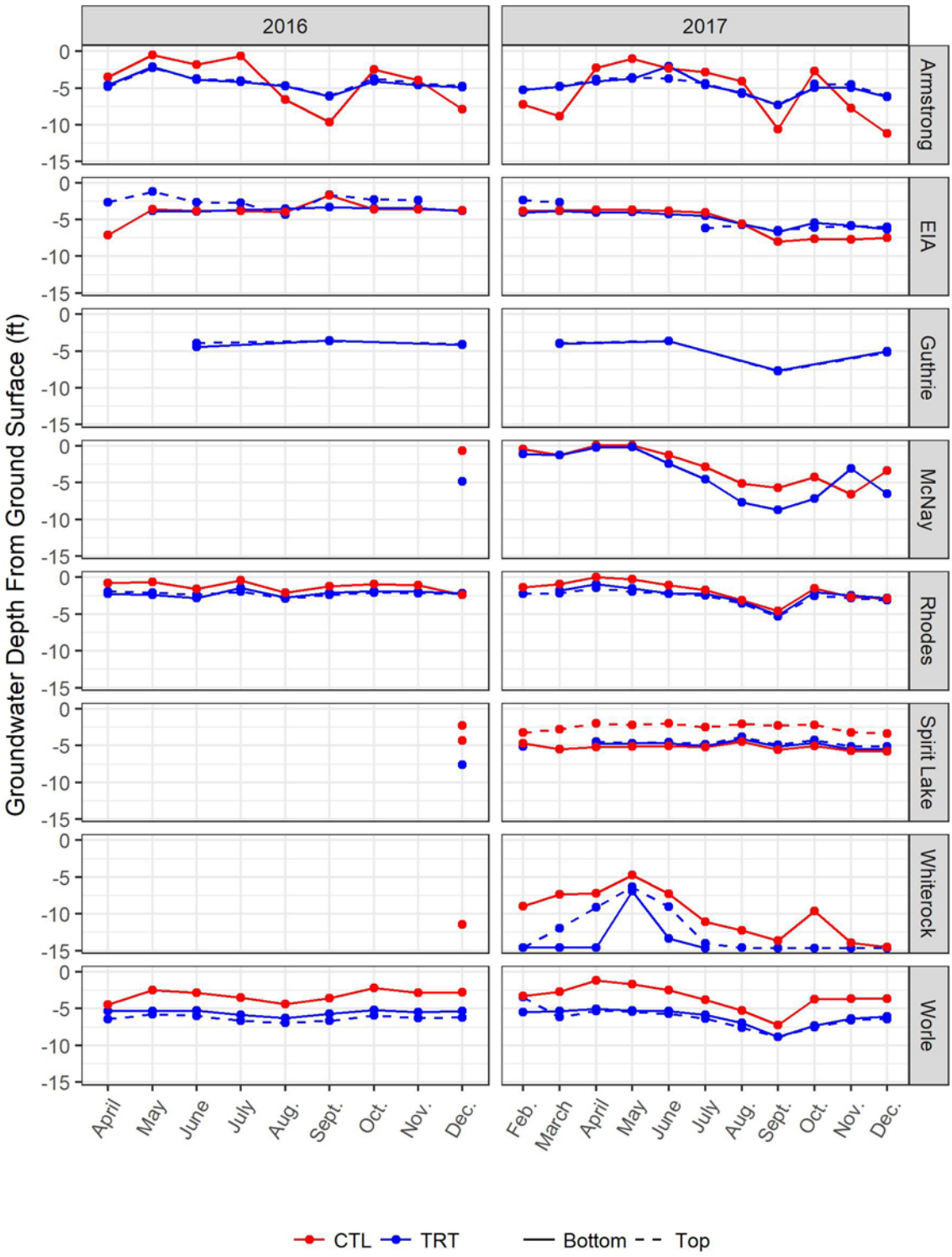

Figure 5: Groundwater depth from ground surface. Sites have 3 shallow groundwater wells, except for the Guthrie site, which has 2 since there is no control watershed at that site. There is a single well placed at the top (dotted lines) and bottom (solid lines) edges of the most downhill prairie strip in the treatment (TRT, blue lines) watersheds, and a well placed at the bottom of the control (CTL, red lines) watershed.

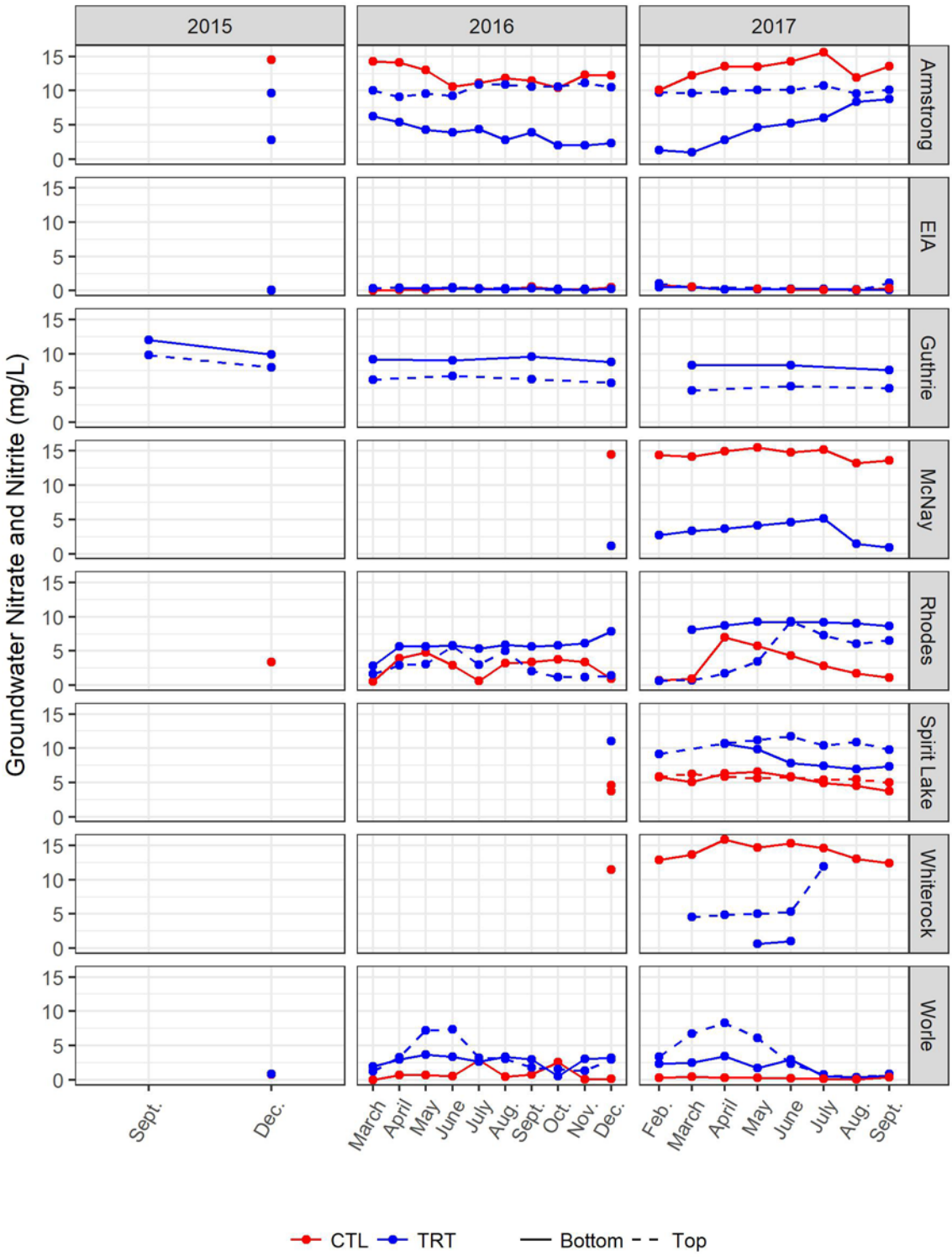

Figure 6: Groundwater dissolved nitrogen (nitrate and nitrite) concentrations. Sites have 3 shallow groundwater wells, except for the Guthrie site, which has 2 since there is no control watershed at that site. There is a single well placed at the top (dotted lines) and bottom (solid lines) edges of the most downhill prairie strip in the treatment (TRT, blue lines) watersheds, and a well placed at the bottom of the control (CTL, red lines) watershed.

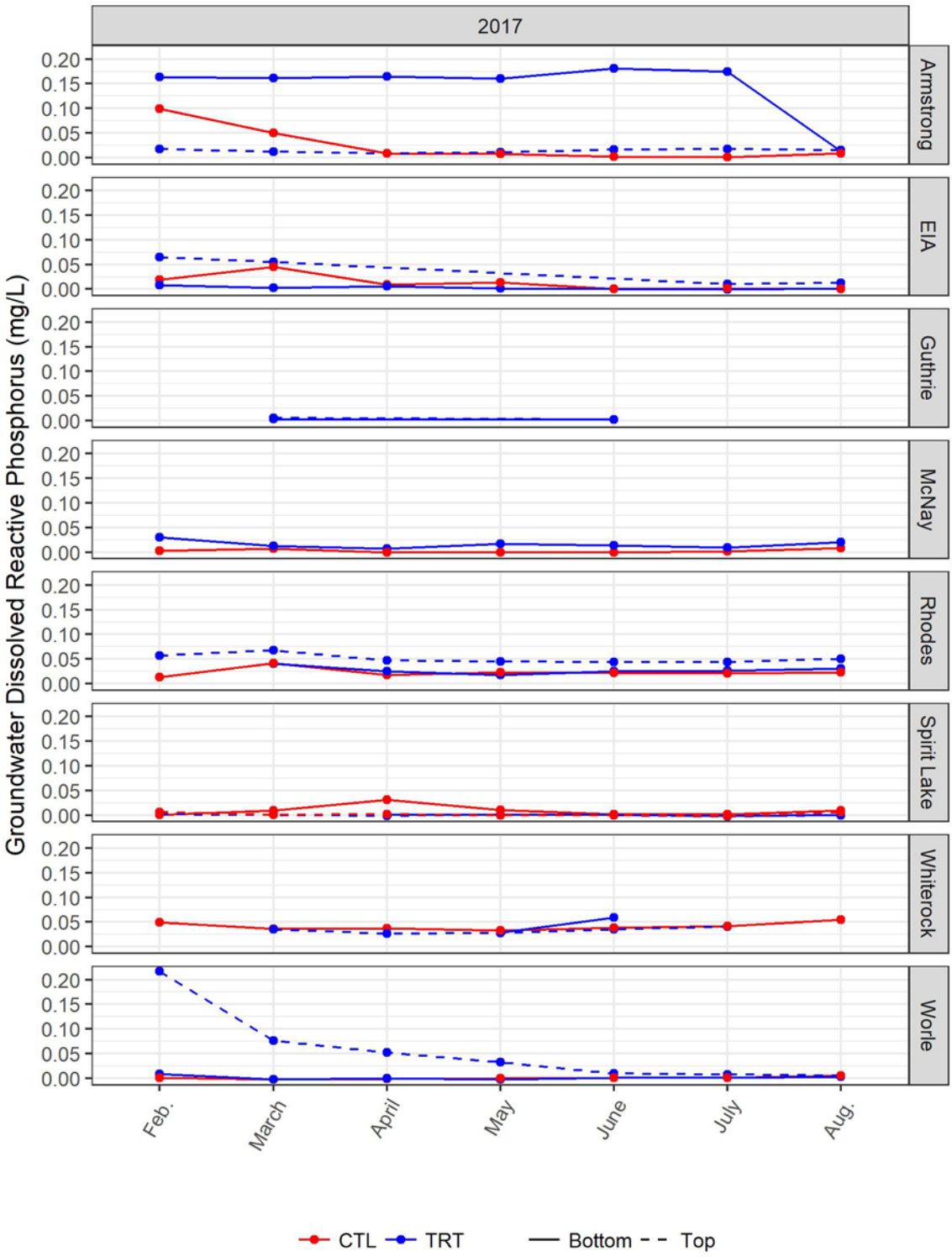

Figure 7: Groundwater dissolved phosphorus concentrations. Sites have 3 shallow groundwater wells, except for the Guthrie site, which has 2 since there is no control watershed at that site. There is a single well placed at the top (dotted lines) and bottom (solid lines) edges of the most downhill prairie strip in the treatment (TRT, blue lines) watersheds, and a well placed at the bottom of the control (CTL, red lines) watershed.