2024-2025 Wastewater Treatment Plant Wetlands Testing

Figure 1: Aerial view of Town of Jackson Wastewater Treatment Plant lagoons

The Town of Jackson Wastewater Treatment Plant (WWTP) is located south of Town near the confluence of Flat Creek and the Snake River. It serves the Town of Jackson as well as many residences and businesses in Teton County that are connected to the Town's sewer system. The WWTP utilizes ten lagoons, and the microbes within them, to treat wastewater. After the effluent passes through all of the lagoons, it undergoes UV treatment that deactivates harmful viruses and bacteria. The Town of Jackson is required to test the final effluent at the UV treatment building and report the data to the Wyoming Department of Environmental Quality (WYDEQ). Water quality testing at the UV treatment building is the final testing location where the Town must comply with the Wyoming Pollution Discharge Elimination System (WYPDES) permit.

Treated effluent does not enter the Snake River directly after it passes through the final treatment in the UV treatment building. Instead, the treated effluent enters the Borrow Pond, where it is diluted with some freshwater from a small creek. It then passes through three existing small wetland ponds and a newly constructed (2023) wetland area, where natural processes further reduce concentrations of nutrients like nitrate, phosphorus, and ammonia. For several years, the Town has voluntarily tested treated effluent at the Borrow Pond and after the first three existing wetlands, before it entered the Snake River. Figure 1, below, shows the WWTP, Borrow Pond, the first three wetlands, and the pathway to the Snake River used prior to summer, 2023. Figure 2,

below, zooms out to show the greater area, the distance from the Snake River, and the other land surrounding the WWTP, with the area shown in Figure 1 highlighted within the red box.

Figure 2: Site Sketch of Wastewater Treatment Plant and first three wetlands

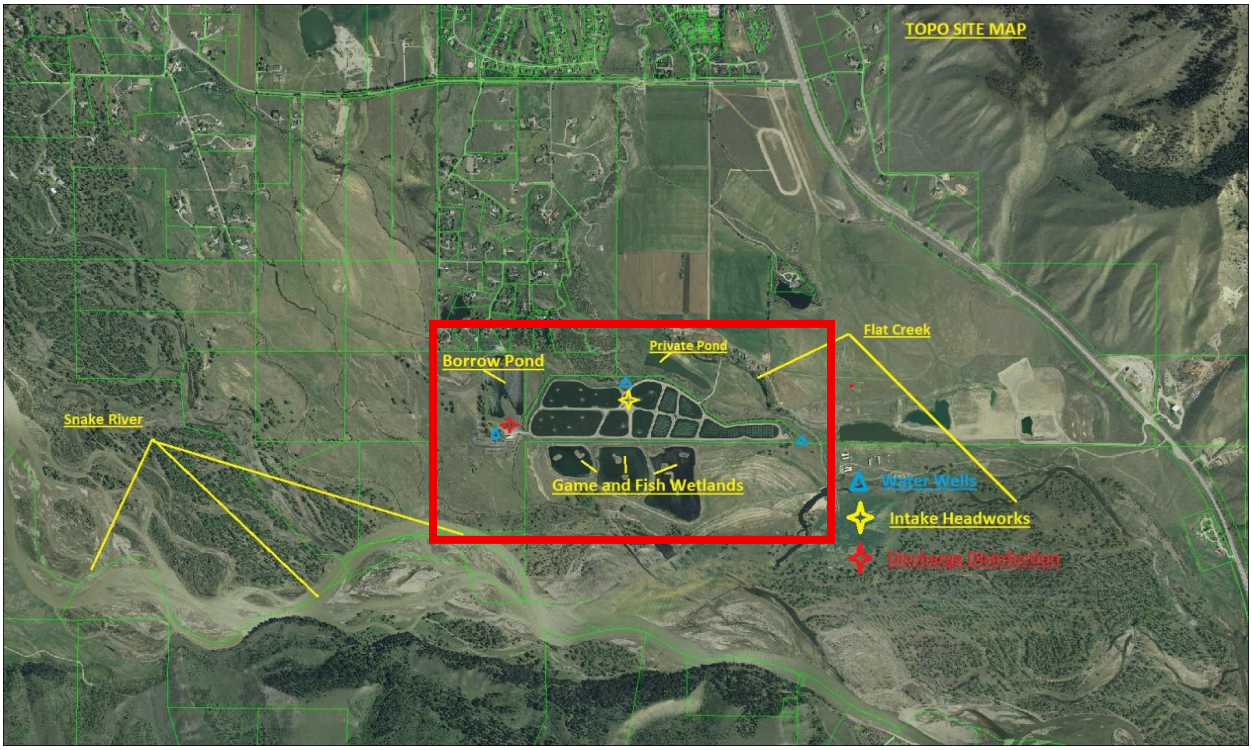

Figure 3: Wastewater Treatment Plant site view, including new wetland site.

In the spring of 2023, Ducks Unlimited completed the construction of additional wetlands adjacent to the Wastewater Treatment Plant. The wetlands provide habitat for waterfowl and other wildlife, support recreational opportunities for hunters and birdwatchers, and offer additional treatment for the effluent from the Wastewater Treatment Plant after it has passed through the Borrow Pond and the first three wetlands, and before it enters the Snake River. The new flow diagram, which is represented in Figure 4, extends the pathway the effluent takes after it completes treatment at the WWTP.

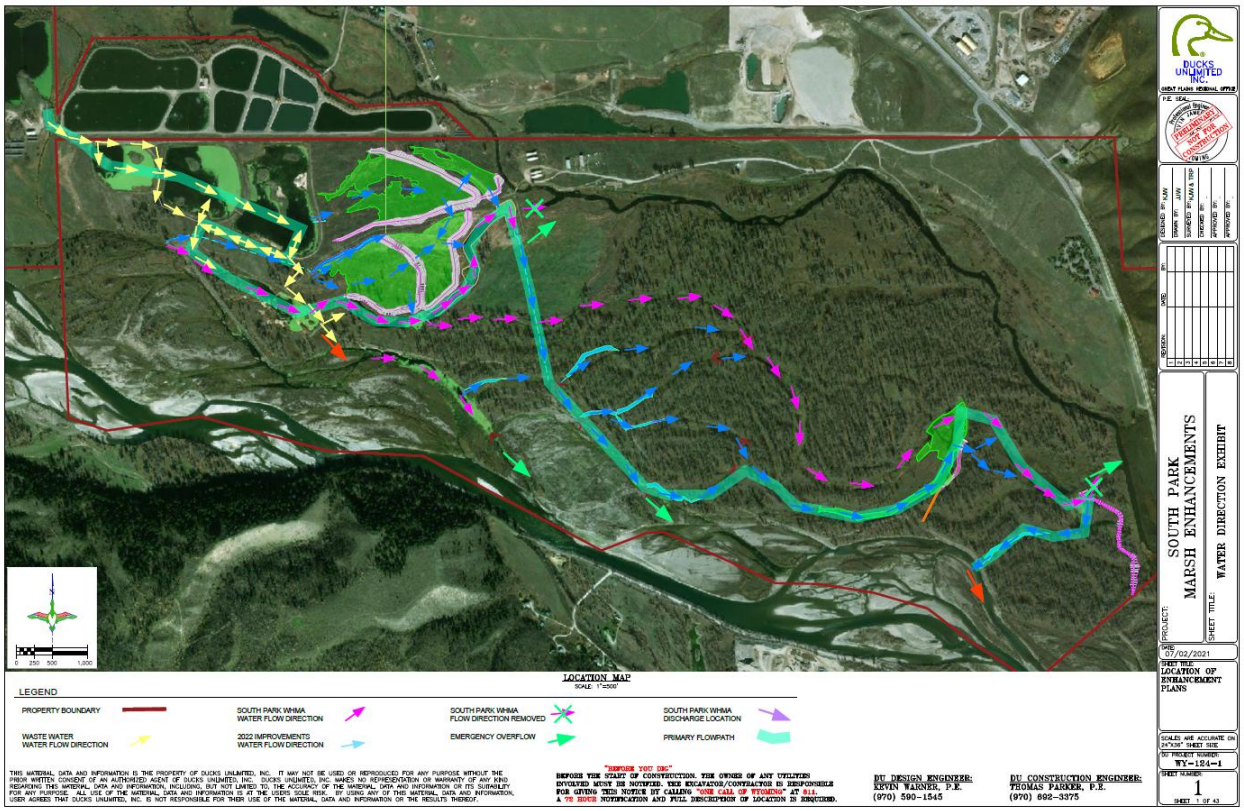

Figure 4: Simplified Flow Diagram with new wetlands.

Starting in August of 2023, with financial support from the Teton Conservation District, the Town of Jackson began testing the treated effluent after it passes through the new Ducks Unlimited wetlands, hereafter referred to as “Wetland 4”, to understand how the additional wetland influences the quality of the effluent before it enters the Snake River. Results may be attributed both to uptake by wetland plants and dilution from freshwater sources. Data from 2023 is not included in this report because the wetland was in its early stages. Data in this report is limited to surface water testing; groundwater testing has not occurred at this site since 2012.

In 2024 and 2025, the Town collected data downstream of Wetland 4 from May through November. Attempts to gather samples in winter were thwarted by the presence of elk close to

the sampling site. Preliminary results show a consistent decrease in ammonia, nitrate, and phosphorus when compared to data collected downstream of Wetland 3.

Nitrates

Nitrates are a byproduct of human waste that are also found in fertilizers, pet waste, livestock manure, and more. In freshwater, excessive nitrate concentrations can contribute to eutrophication, a process in which excess nutrients can lead to algal blooms that then deplete water bodies of oxygen and harm aquatic species. In drinking water, high nitrate levels can interfere with the body's ability to carry oxygen, especially in infants, and are associated with increased risk of some cancers, thyroid problems, and adverse pregnancy outcomes.

In Wyoming, the primary maximum contaminant level (MCL) for nitrates in *drinking water* is 10 mg/L. 10 mg/L is also the discharge limit for mechanical treatment plants regulated by the Wyoming Department of Environmental Quality (WYDEQ) Underground Injection Control program. The outflow from Wetland 4 is *not* drinking water; drinking water standards are used for comparison only. No effluent samples taken downstream of Wetland 3 or downstream of Wetland 4 exceeded 10 mg/L on the dates tested in 2024 or 2025. Wetland 4 appears to provide buffering capacity above and beyond that provided by the first three wetlands.

While the Wyoming DEQ MCL for nitrates in drinking water is 10 mg/L , the United States (US) Environmental Protection Agency (EPA) considers concentrations greater than 3 mg/L indicative of contamination in groundwater used for drinking. Some local organizations, including Protect Our Water Jackson Hole and the Teton Conservation District, consider drinking water with nitrate concentrations greater than 2 mg/L to be impacted by human activity and advise that water at or above this level should not be consumed.

In 2024, nitrate concentrations downstream of Wetland 4 were significantly lower than at the UV treatment building, never exceeded 3 mg/L, and only exceeded 2 mg/L on three occasions in late August and early September. In 2025, nitrate concentrations downstream of Wetland 4 averaged 0.95 mg/L and exceeded 2 mg/L three times. One of those samples exceeded 3 mg/L.

The United States Geological Survey (USGS) tests nitrate and nitrite concentrations in the Snake River downstream of the Wastewater Treatment Plant, near the intersection of Henry's Road and Highway 189. Between June 21, 2023, and August 6, 2025, these samples show nitrate concentrations ranging from 0.014 mg/L to 0.095 mg/L. Nitrate was not detected in more than half of the samples, indicating concentrations below 0.005 mg/L to 0.044 mg/L depending on the sample. Nitrite was detected in only 2 out of 33 samples. Nitrate concentrations of less than 1.0 mg/L in rivers are considered excellent.

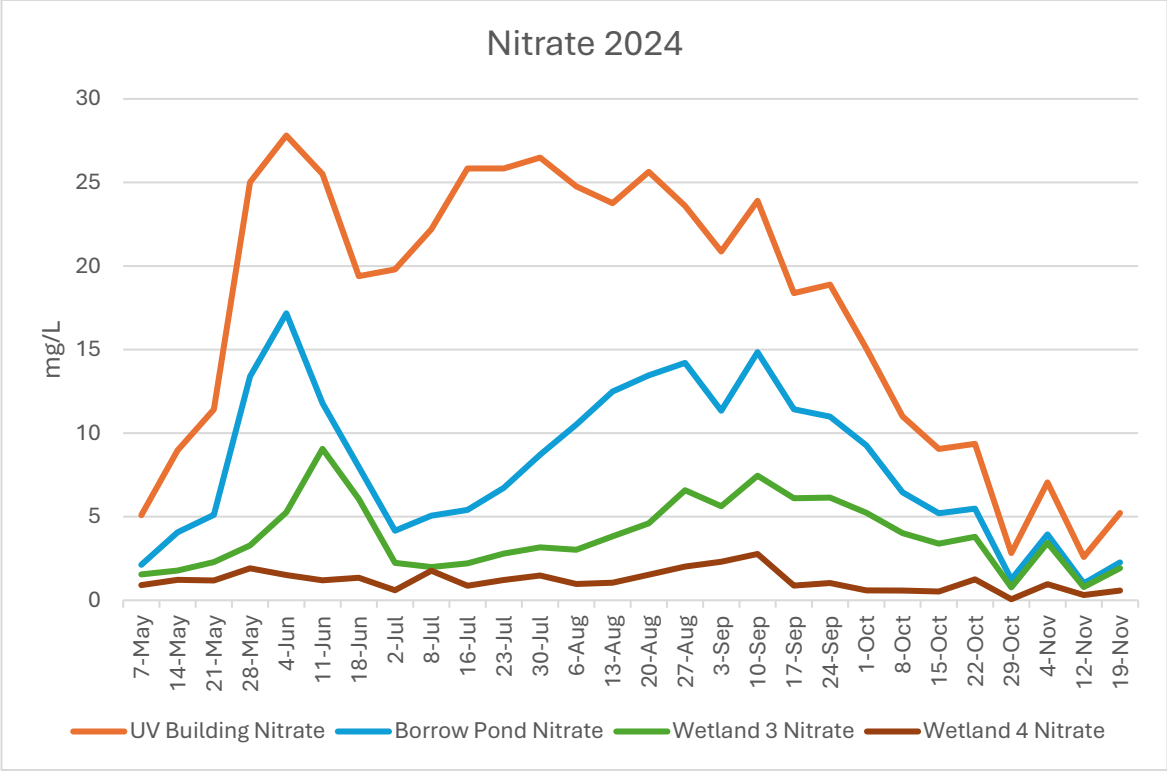

Figure 5: 2024 Nitrate concentration at the UV Building, Borrow Pond, Wetland 3, and Wetland 4.

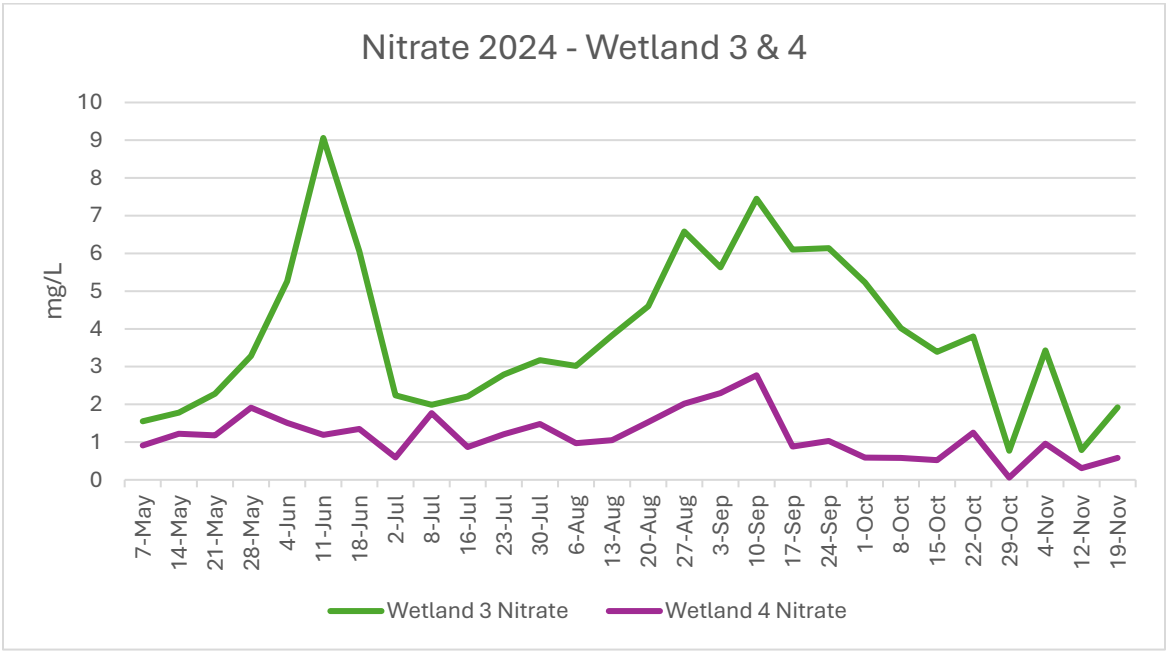

Figure 6: 2024 Nitrate concentration at Wetland 3 and Wetland 4.

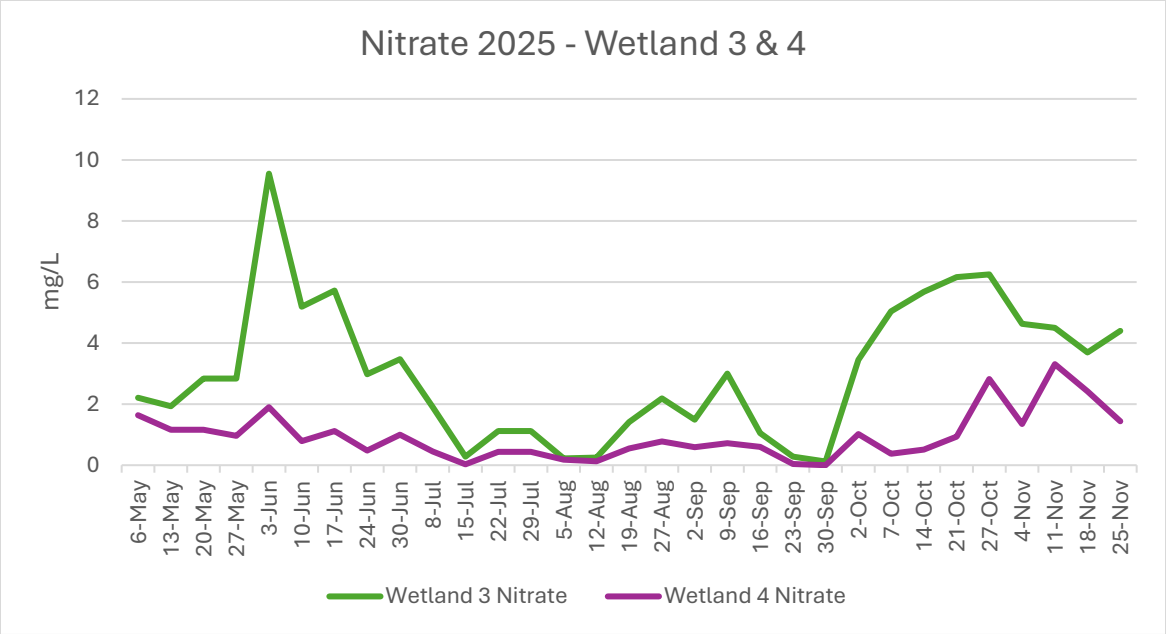

Figure 7: 2025 Nitrate concentrations at Wetland 3 and Wetland 4.

In Figure 8, below, the maximum nitrate concentration each season is recorded. For comparison, the red, black, green, and blue lines indicate, respectively, WYDEQ thresholds for nitrate in drinking water, US EPA thresholds indicating contamination in groundwater, local thresholds indicating water impacted by human activity, and concentrations considered "excellent" in rivers.

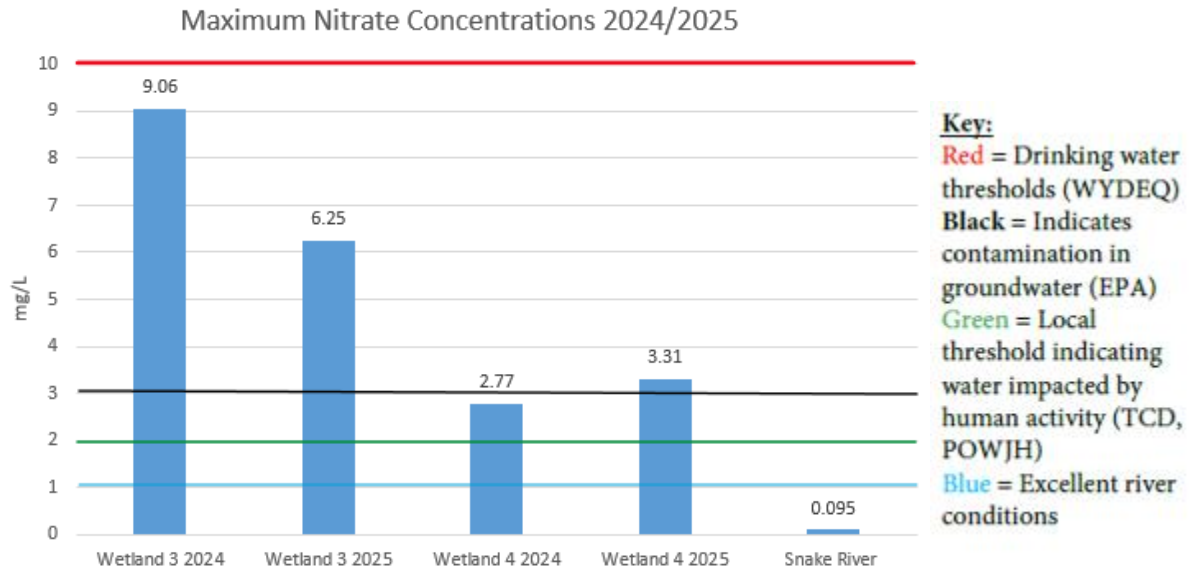

Figure 8: Maximum Nitrate Concentrations at different locations in 2024 and 2025

Figure 9, below, shows the average nitrate concentrations at sampling locations at Wetland 3 and Wetland 4. Samples were collected between May and November both years.

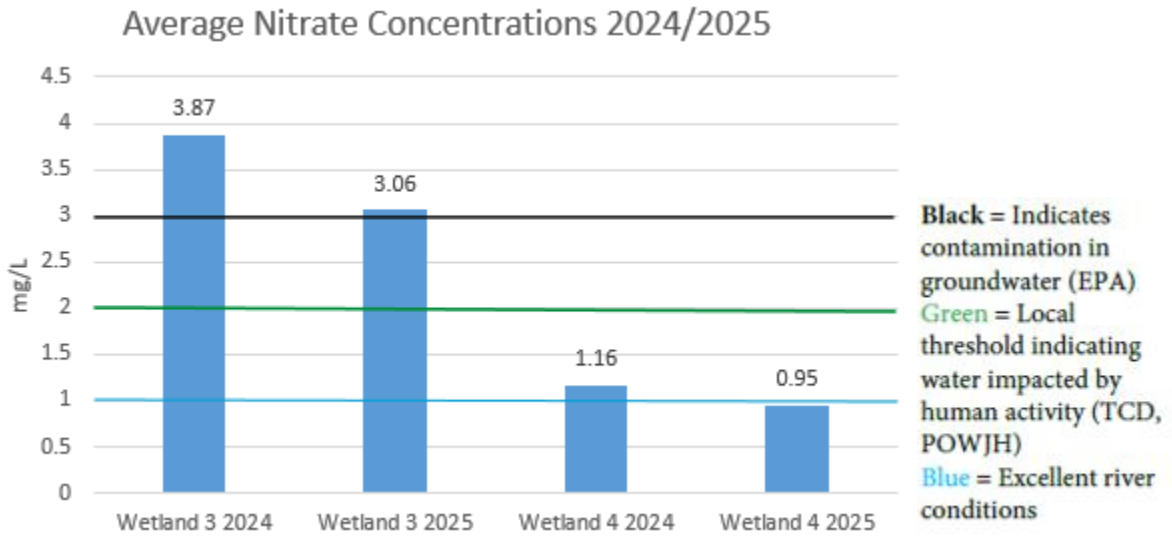

Figure 9: Average Nitrate Concentrations at Wetland 3 and 4 in 2024 and 2025

Phosphorus

Phosphorus is another nutrient present in wastewater that can contribute to eutrophication. In 2024, total phosphorus remained lower downstream of Wetland 3 than at the UV treatment building throughout the season and never exceeded 4 mg/L. In 2025, total phosphorus exceeded 4 mg/L on one date, June 3, with a concentration of 4.18 mg/L.

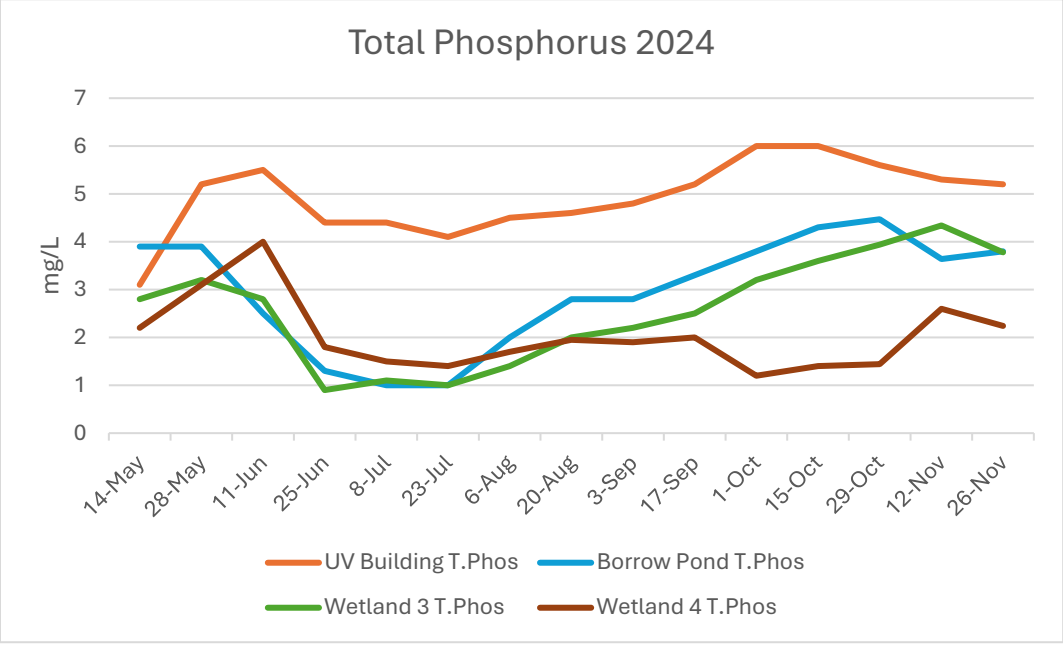

Figure 10: 2024 Phosphorus concentration (mg/L) at the UV Building, Borrow Pond, Wetland 3, and Wetland 4.

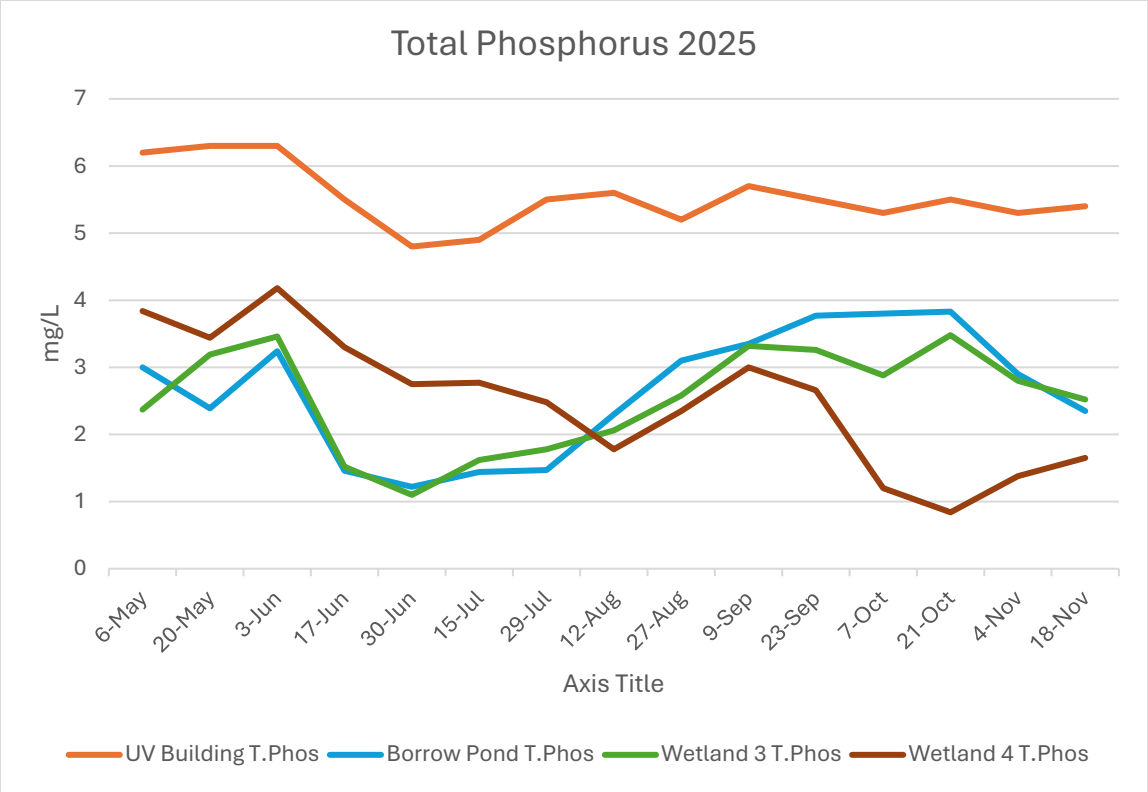

Figure 11: 2025 Phosphorus concentration (mg/L) at the UV Building, Borrow Pond, Wetland 3, and Wetland 4.

pH

In 2024, effluent pH at the UV treatment building consistently ranged between 7.35 and 7.84, increased at the borrow ponds and the first three wetlands, and then decreased downstream of Wetland 4. In 2024, Wetland 4 pH samples ranged from 7.11 to 8.31. In 2025, Wetland 4 pH samples ranged from 7.18 to 7.83. The new wetland appears to provide some buffering capacity before the treated effluent enters the Snake River.

Wyoming DEQ limits pollution in surface waters to amounts that will not cause the pH to be less than 6.5 or greater than 9.0. A pH between 6.5 and 8.5 is considered safe for aquatic life. In 2024 and 2025, treated effluent was within that range when it entered the Snake River. A lower pH also raises the acute toxicity threshold for ammonia, reducing the impact of ammonia on fish.

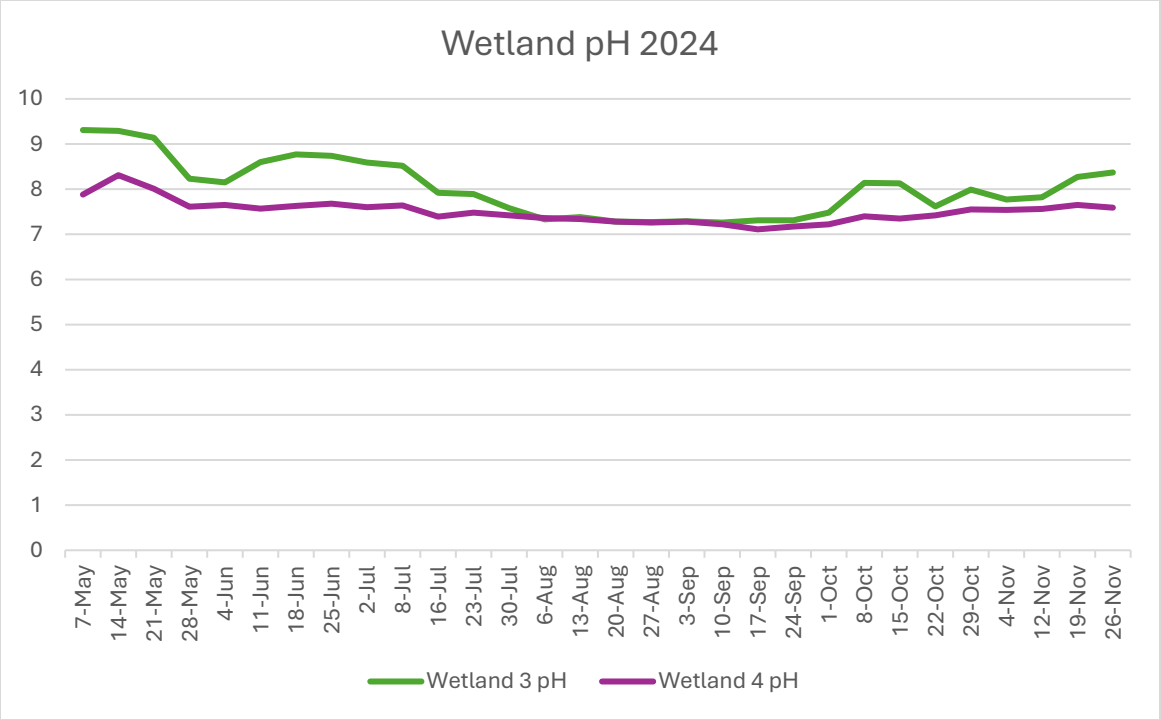

Figure 12: 2024 pH at Wetland 3 and Wetland 4.

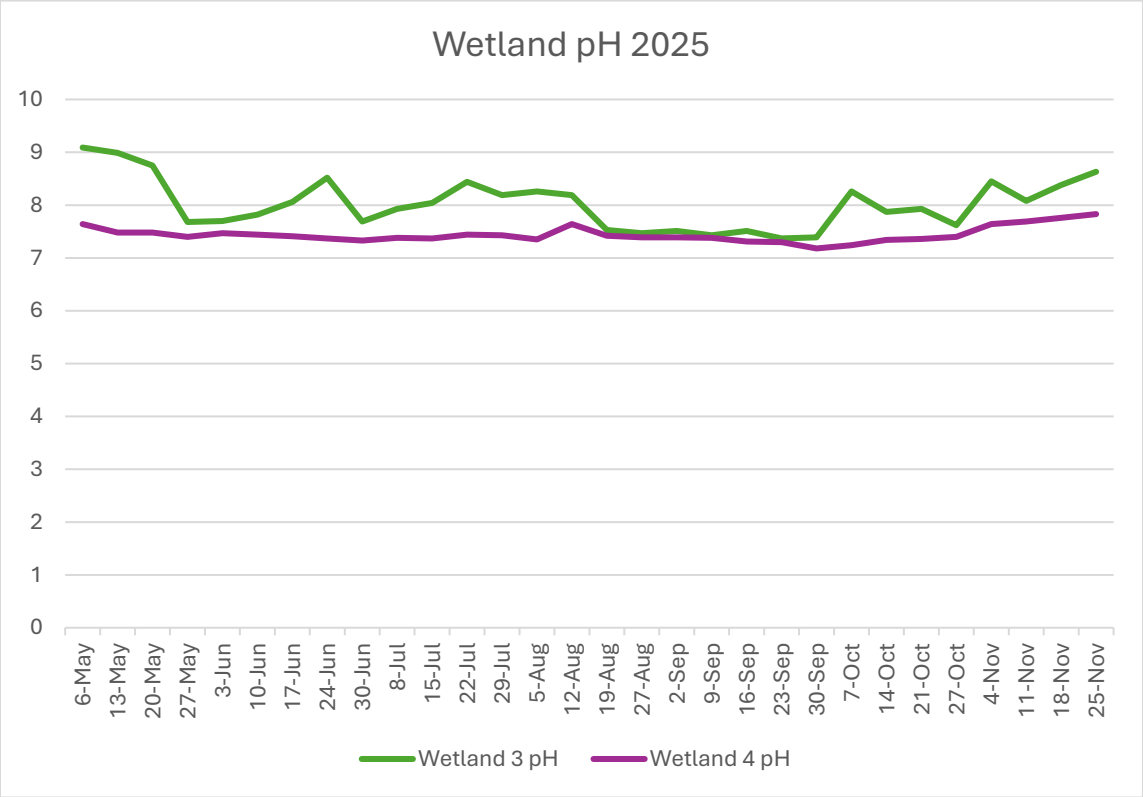

Figure 13: 2025 pH at Wetland 3 and Wetland 4.

Ammonia

Ammonia is a byproduct of wastewater that is present in effluent. It is toxic to fish in high concentrations. Ammonia concentrations at the UV treatment building are highest in late winter and early spring. Sampling at Wetland 3 and Wetland 4 in May is most representative of winter ammonia concentrations. In 2024, the ammonia concentration downstream of Wetland 4 were significantly lower than at the UV treatment building in the spring, averaging 2.225 milligrams per liter (mg/L) in early May downstream of Wetland 4 compared to 32.5 mg/L at the UV treatment building. Ammonia concentrations remained below 5 mg/L downstream of Wetland 4 during both the 2024 and the 2025 sampling seasons.

Ammonia toxicity is calculated based on temperature and/or pH, fish species, and fish life stage. Cutthroat Trout are present in the Snake River in various life stages. Thus, staff compared data collected to the most stringent short-term exposure toxicity criteria. Ammonia concentrations downstream of Wetland 4 did not reach acute criterion on any sampling day in 2024 or 2025. Ammonia levels downstream of Wetland 3 occasionally exceeded acute values in the spring when concentrations are highest. There are both decreased ammonia concentrations and a lower pH of the treated effluent in Wetland 4 when compared to other sampling locations. The lower pH increases the threshold for acute toxicity. Thus, the buffering capacity of the wetlands reduces the impact of ammonia in treated effluent in two ways.

Total ammonia concentrations at the USGS sampling location in the Snake River downstream of the WWTP between June 21, 2023, and August 6, 2025, ranged from 0.015 to 0.05 mg/L, well under toxicity levels for fish in any temperature or pH. Ammonia was not detected in 30 out of 35 samples, indicating concentrations below 0.026 mg/L or less.

The wetlands appear to provide the greatest benefit in the spring and the fall, providing a buffer when ammonia concentrations start to increase at the UV treatment building in November, as well as in early spring when ammonia concentrations are near their highest.

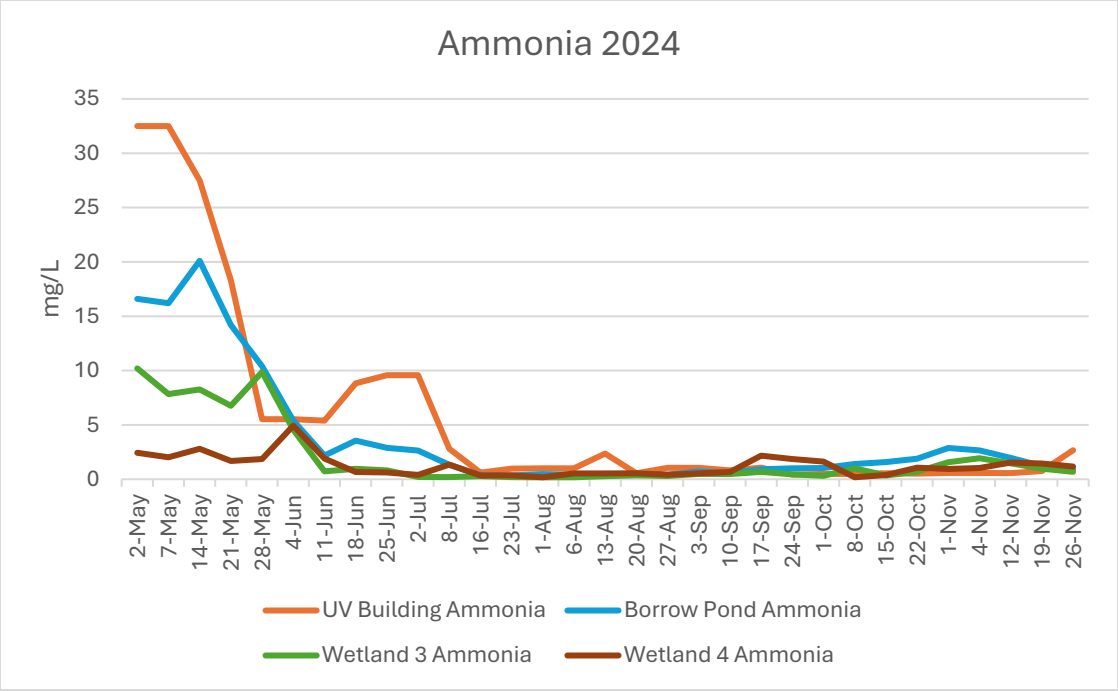

Figure 14: 2024 Ammonia concentrations (mg/L) at the UV Building, Borrow Pond, Wetland 3, and Wetland 4.

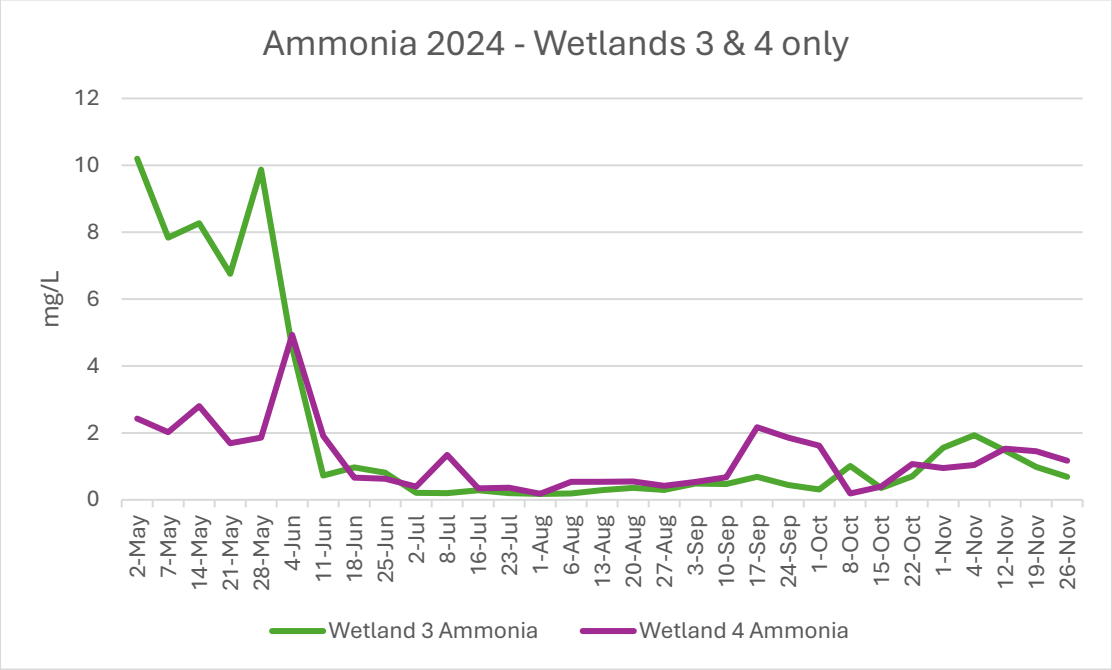

Figure 15: 2024 Ammonia concentrations (mg/L) downstream of Wetland 3 and Wetland 4.

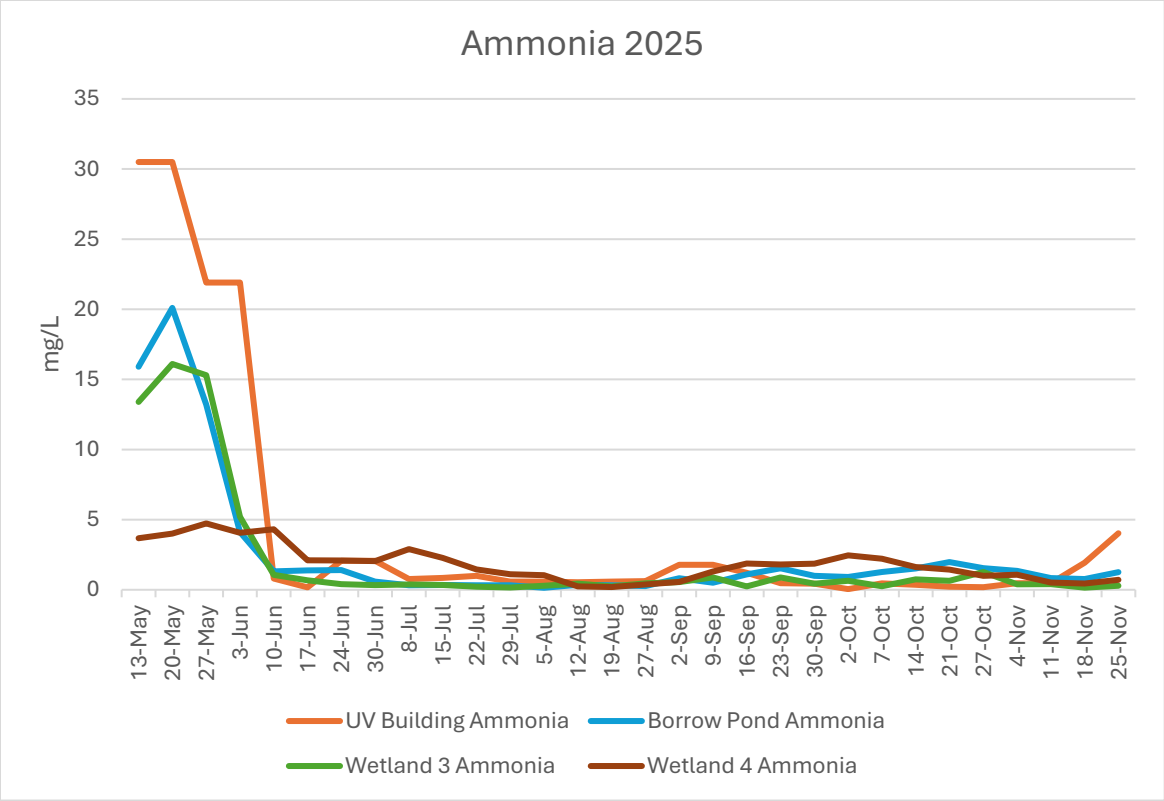

Figure 16: 2025 Ammonia concentrations (mg/L) at the UV Building, Borrow Pond, Wetland 3, and Wetland 4.

Summary

Preliminary results suggest that the quality of treated effluent downstream of Wetland 4 is within a healthier range than the effluent samples taken in the UV treatment building and is also within a healthier range than the samples taken at the end of the first three wetlands. The new wetlands appear to have a positive impact on water quality, such that the treated effluent entering the Snake River could meet drinking water standards for nitrate and does not exceed acute toxicity criterion for ammonia in bodies of water in which salmonids are present. The USGS data suggest that once the treated effluent enters the Snake River and is further diluted, nitrate and ammonia concentrations are very low and are not considered to be harmful to aquatic life.

These results suggest that the additional wetlands improve the quality of the treated effluent from the wastewater treatment plant before it enters the Snake River. However, it can take several years for a new wetland system to be established, and the results could change over time. Additionally, data has not yet been collected during mid-winter, and groundwater is not currently being monitored. It is important to continue monitoring downstream of Wetland 4 for at least 3 to 5 years and to get winter samples during at least one winter season to better understand the benefits of the additional wetlands.