Appendix D. Data Inventory and Evaluation

Methods and Assumptions

Phosphorus

As part of the data inventory and evaluation of phosphorus data, AWQMS data were downloaded for all sites in the watershed boundary in 20 years of record (2001–2021). Table 7 in Section 3.3.2 of the report summarizes the average phosphorus concentration at each site with data in the AWQMS database in the 20 years of record as well as the water quality assessment from the 2022 Integrated Report (UDWQ 2022b). The following list summarizes the quality control review processes of AWMQS phosphorus data evaluated in this watershed plan:

- Monitoring points in Table 7 have ≥ five collection events in the 20 years and are either a river/stream or canal site.
- Sample results reported as "non-detect" in the AWQMS database were represented with 0.5 times the lowest reporting limit.
- Before summarizing the data in Table 7, a statistical analysis was performed for phosphorus results to identify outliers that may not represent the data set. For each river/stream site and canal site, the average value and standard deviation were calculated by season, irrigation season (May–October), and non-irrigation season. There were 70 outliers (1.4% of the total number of samples for TP) in the data set that were removed from the analysis, with outliers defined as three times the standard deviation from the mean.

TP results were further broken down by irrigation season to assess the time of year when concentrations are highest and identify if irrigation is driving high phosphorus concentrations throughout the watershed. The same data QAQC was completed, except that sites with fewer than five collection events were included in the analysis. Instead of summarizing the data to calculate site averages, the data was aggregated to output average values per season. A summary of the irrigation season for TP is provided in Appendix G.

E. coli

As part of the data inventory and evaluation of *E. coli* data, data analysis was completed to assess the current achievement of the target endpoints for *E. coli* as defined in the Spring Creek *E. coli* TMDL (UDWQ 2021a). AWQMS data was downloaded for all sites in the watershed boundary in 20 years of record (2001–2021), and three different data analyses and corresponding QAQC steps were completed. Table 8 and Tables I-1 and I-2 in Appendix I summarize all three data analyses.

1. *E. coli* data was summarized to determine what percentage of samples exceeded 668 MPN/100 mL in the recreation season.
    a. Recreation season was defined as May 1 through October 30.
    b. Sites with less than five collection events in all recreation seasons were excluded from the analysis. Only sites with five or more collection events in any recreation season were summarized.

2. *E. coli* data was further analyzed to determine if any site with more than five collection events in the recreation season had a 30-day geometric mean that exceeded 206 MPN/100 mL.
    a. Recreation season was defined as May 1 through October 30.
    b. Sites with less than five collection events in any recreation season were excluded from the analysis. Only sites with five or more collection events in any recreation season were summarized.
    c. *E. coli* 30-day geometric means were reported as NA in Table I-1 if there were too few samples within 30 days to calculate the geometric mean.
3. *E. coli* was analyzed to determine if sites with ten or more collection events had a geometric mean of 206 MPN/100 mL or higher.
    a. Sites with less than ten collection events during the recreation season were removed from the analysis.

Although each data analysis had specific data QAQC steps completed on the data, some QAQC steps were taken for all *E. coli* data. The following list summarizes the quality control review processes of AWMQS *E. coli* data summarized for numbers 1–3, as stated above.

- For this assessment, sample results reported as "non-detect" in the AWQMS database were represented with 0.5 times the lowest reporting limit.
- The minimum detection limit (1 MPN/100 ml) was used for *E. coli* results reported as "less than detection." Likewise, the maximum detection limit (2,419.6 MPN/100 ml) was used for results reported as "greater than the detection limit."
- A statistical data analysis was performed for *E. coli* results to identify outliers that may not represent the data set.

Mann-Kendall Trend Test

In cases where the assumptions for linear regression are not met, a nonparametric statistical test, such as the Mann-Kendall Trend Test, is preferred. The Mann-Kendall test is a nonparametric statistical test commonly used in environmental time-series data to determine whether a significant upward or downward trend has occurred throughout the record analyzed (Helsel et al. 2020).

For each river/stream and canal PRWC monitoring location, a Mann-Kendall test for trend was performed using summertime mean TP concentrations. Two periods were assessed: 11 years (2010 to 2021) and 31 years (1990 to 2021). The confidence interval was 95%, and the null hypothesis for each test was that there was no trend.

Trends in phosphorus concentrations in lakes were assessed by aggregating mean TP at each monitoring location by year. At each monitoring location, concentrations for all depths were aggregated together, consistent with how the TMDL target for phosphorus concentrations in lakes is described. A Mann-Kendall test for trends was performed over 31 years (1990 to 2021) and 11 years (2010 to 2021). Figure 16 in the report summarizes this data analysis completed as part of the PRWC story map (PRWC 2022).

TSI Analysis

For Jordanelle and Deer Creek Reservoirs, Chl-a TSI was calculated from 1996 to 2021. The following list summarizes the QC review processes of AWMQS Chl-a data evaluated in this analysis.

- Chl-a, Chl-a uncorrected, and Chl-a corrected were all included in the analysis.
- Chl-a samples missing both relative depth and measured sample depth were assumed to have been sampled from the surface and were included in the data analysis.
- Where the result was blank for chlorophyll and listed as non-detectable, values were replaced with one-half the detection limit.
- Where MDL was zero for Chl-a, values were flagged and rejected from the analysis.
- There was no Chl-a data for Deer Creek or Jordanelle Reservoirs for 2013 or 2014. The PRWC annual water quality implementation report data for TSI was used instead of TSI-Chl-a calculated values for 2013 and 2014.
- Where there were multiple measurements from various monitoring locations or depths within the reservoir, all values were averaged, and a single reservoir-wide value was obtained for the year.

PLET Model

Model Description

The EPA's Pollutant Load Estimation Tool (PLET) is an open-access, online model that calculates nutrient and sediment loads from different land uses and load reductions from BMP scenarios. This tool and description can be found on the EPA's website and the PLET user guide is available for download for more detailed information on the PLET mode.

Methodology

The EPA's PLET was used to independently establish an estimate of the existing pollutant loads from phosphorus for each HUC 12 watershed in the Heber Valley watershed summarized in Table 11 of the report.

Input variables of the PLET model used in the Heber Valley Watershed Plan consist of the following:

- Watershed land use
- Agricultural animals and animal weight
- Septic and illegal wastewater
- Nutrient and *E. coli* content
- Universal soil loss equation
- Reference runoff curve
- Detailed urban reference
- Nutrient concentration
- Urban land use distribution
- Irrigation area and amount
- Wildlife in cropland
- Soil infiltration
- Feedlots reference
- Septic overcharge
- Wastewater per capita
- Gullies
- Streambanks
- Urban pollutant concentration
- Urban land use distribution

For more information on the PLET model, see Appendix. J.

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