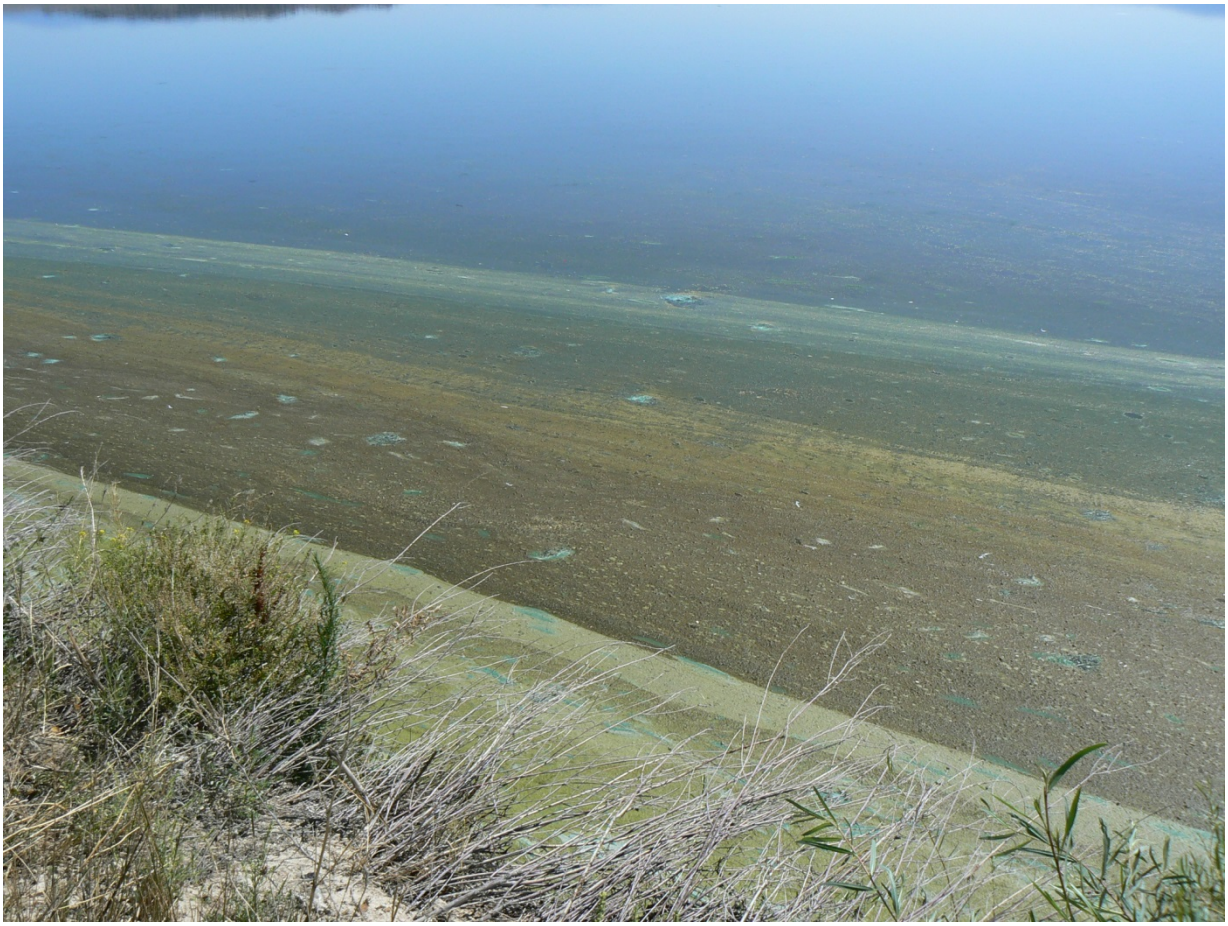
DEQ
Montana Department
of Environmental Quality

Nutrient Pollution in the Lake Helena Watershed

A status update for the Water Policy Interim Committee – December 2017



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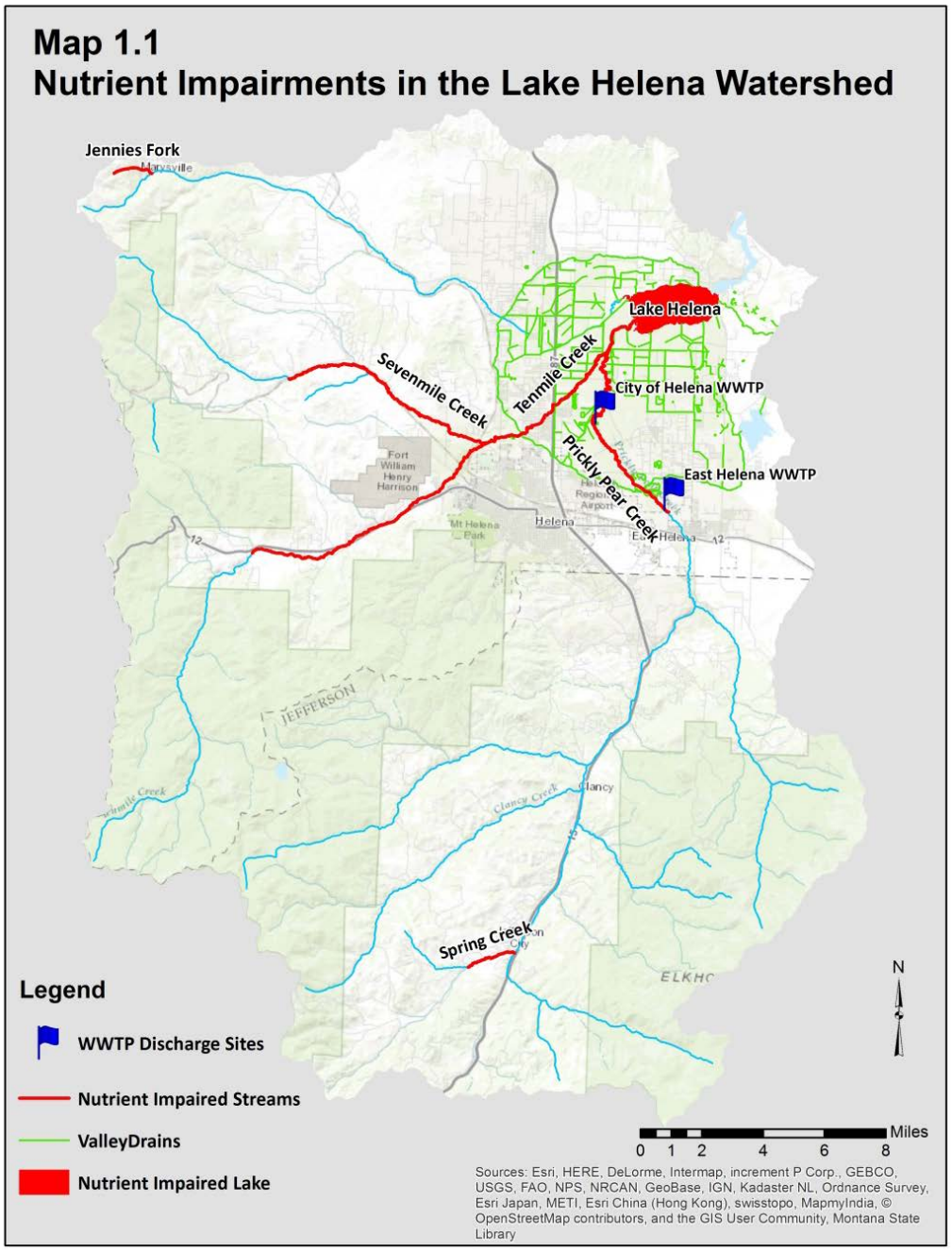
1.0 INTRODUCTION

This report summarizes nitrogen and phosphorus (nutrient) pollution in the lower valley of the Lake Helena watershed, including current conditions, recent pollutant reduction efforts, and recommendations for future actions to help achieve water quality standards. This report does not evaluate water quality issues from sources and causes other than nutrients (e.g., metals, sediment, habitat alteration, etc).

In 2006, DEQ published Total Maximum Daily Loads (TMDLs) for the Lake Helena Watershed, outlining nutrient load reduction recommendations for Lake Helena and several of its major tributaries. Prickly Pear Creek is the largest tributary to Lake Helena and is the receiving waterbody of the two largest point sources. Valley drains transport nonpoint source pollution from septic systems and agriculture. This report uses water quality in Prickly Pear Creek and the valley drain system as an indicator of progress toward achieving nutrient load reductions in Lake Helena. Based on current available information, the following may be said of nutrient pollution within the Lake Helena watershed:

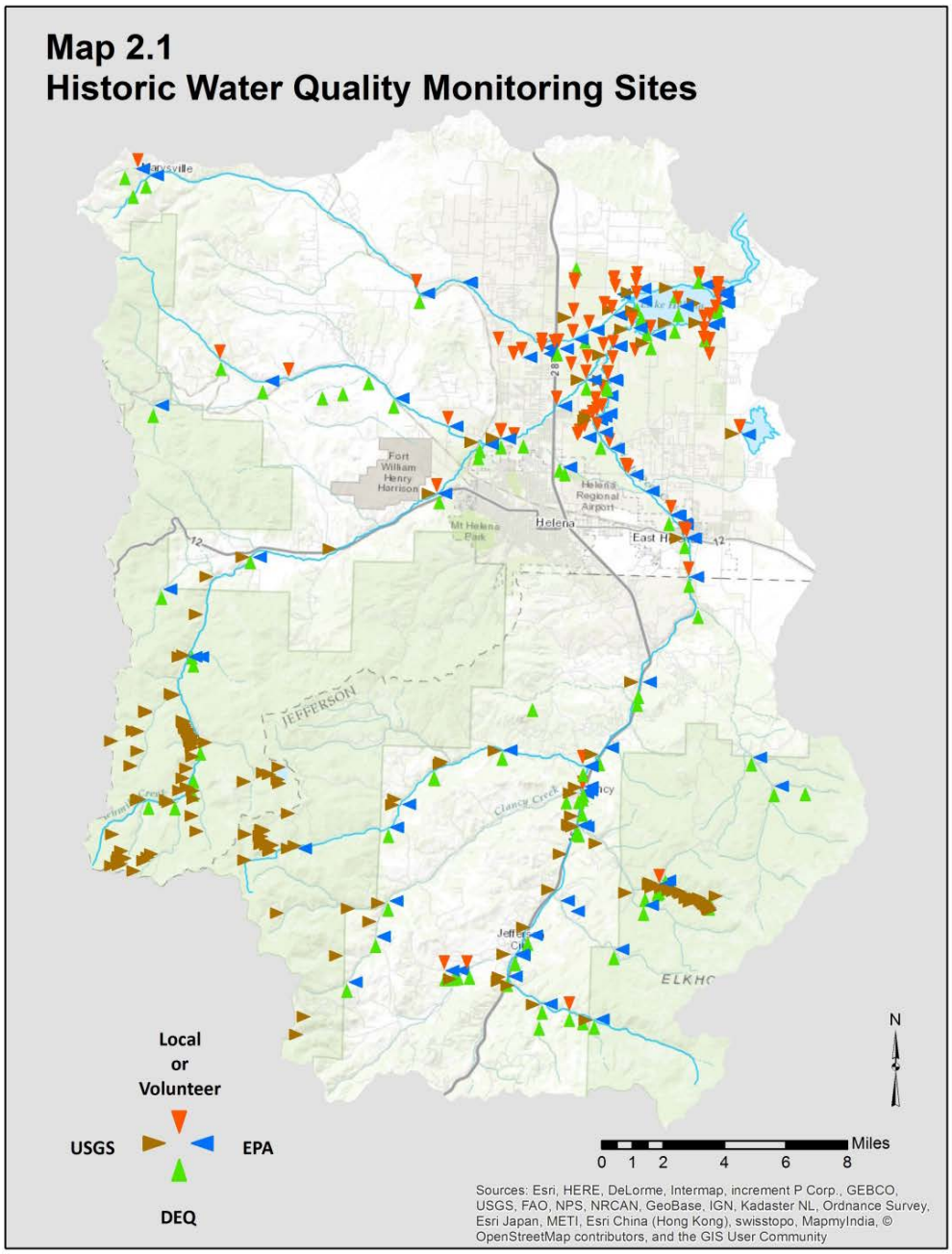
- **Existing Impaired Waterbodies** where at least one water quality standard is not met because of excess nutrient loading (Map 1.1):
    - Lake Helena
    - Lower Prickly Pear Creek (below East Helena)
    - Lower Tenmile Creek (below Helena Drinking Water Plant near Rimini Rd)
    - Sevenmile Creek
    - Jennies Fork
    - Spring Creek
- **Primary sources and contributing factors** of nutrient pollution include the following, in no particular order:
    - Household septic systems and subdivision wastewater treatment systems
    - Farmland
    - Livestock
    - City wastewater treatment plants (WWTPs), the two largest being the Helena WWTP and East Helena WWTP
    - Loss of floodplain, riparian, and wetland habitat for nutrient filtering and uptake
    - Loss of flow (dilution)
- **Actions taken** to reduce nutrient pollution in the Lake Helena Watershed include the following:
    - ~$13 million in wastewater treatment system upgrades
    - Creation of a septic maintenance district and subsequent efforts to repair failing septic systems
    - Repair and replacement of leaky sewage lagoons serving several major, rural subdivisions (e.g., Tenmile Estates, East Gate)
    - Wetland and floodplain restoration along Prickly Pear Creek
    - Livestock fencing along parts of Prickly Pear, Tenmile, and Merritt Creeks

- **Future actions** should focus primarily on reducing nutrient contributions from sources within the Helena valley. Addressing nutrient sources upstream of the Helena valley will not have much of an impact on overall nutrient levels in the valley and would only minimally create more capacity for Lake Helena to take nutrients from wastewater treatment facilities. Reducing nutrients in Lake Helena and its major tributaries will require efforts by point and nonpoint sources.



2.0 Water Quality Data Collection Activities

- From 1990 to 2017, federal agencies, DEQ, Lewis and Clark County Water Quality Protection District, and watershed group volunteers have collected watershed-wide monitoring data (Map 2.1).
- DEQ's Section 319 grant program helped fund groundwater monitoring of drains beginning in 2009 (Map 2.1).
- The Helena and East Helena WWTPs perform weekly discharge monitoring of nutrients.



3.0 WATER QUALITY IMPROVEMENT ACTIVITIES

Septic Systems and Subdivision Wastewater Treatment Facilities

- Subdivision wastewater systems in the Helena valley typically require a higher level of nitrogen removal than individual septic systems, resulting in less nutrient loading to ground water.
- In 2011 the Pleasant Valley/Tenmile subdivision replaced a sewage lagoon system that had been leaking nutrients into a ditch that discharged to Prickly Pear Creek.
- In 2011 a septic maintenance program was established by the City-County Board of Health.

Other Nonpoint Source Activities

- These include: streamside erosion control and habitat restoration, improved land management practices on private and government land, and remediation of abandoned mines and industrial sites.

Wastewater Treatment Plant Upgrades

- Helena WWTP upgrades in 2001 reduced nutrients. DEQ helped Helena further optimize the wastewater plant for nutrient removal in 2012 and 2017 (Fig. 1). While the figure shows the annual average phosphorus concentrations since 2014, optimizations in 2017 could reduce phosphorus concentrations to as low as 0.2 mg/L.
- East Helena WWTP upgrades and DEQ-assisted optimization in 2014 reduced phosphorus (Fig. 1). While the figure shows the average nitrogen concentrations since 2001, optimizations in 2014 further reduced nitrogen concentrations to 13 mg/L.
- WWTP improvements removed up to 70% of summer nutrient loads from Prickly Pear Creek and up to 24% of annual nutrient loads from Lake Helena. Although the improvements are substantial, the WWTPs still represent a major source of nutrient loading to Prickly Pear Creek and Lake Helena, particularly during the summer season.

Tracking Water Quality Improvements

- It is difficult to confirm nonpoint source improvements due to the natural variability of nutrient levels in the environment, variability of nutrient loading sources, and population growth which could offset improvements. Nonpoint source projects can be quantified, but substantial cumulative nonpoint source actions must be take place before they are detected in water quality monitoring data.
- Where sufficient data is available, point source improvements from the WWTPs are evident within the existing data from Prickly Pear Creek.

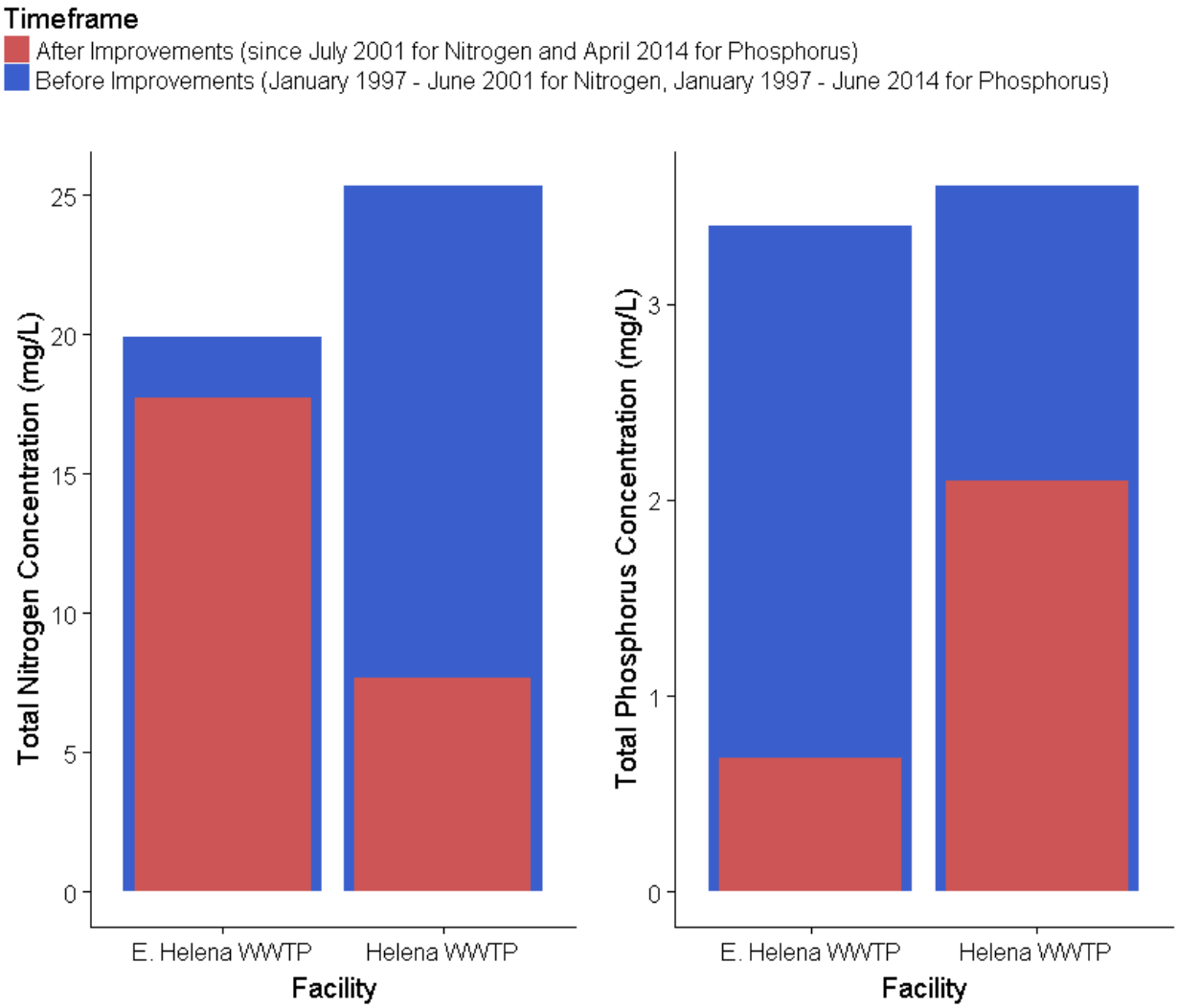


Figure 1 Monthly Average Nutrient Concentrations Showing Reductions Achieved by Facility Improvements in 2014 at the East Helena WWTP and in 2001, 2012, and 2017 at the Helena WWTP

4.0 Point Source, Nonpoint Source, and Background Nutrients

Total maximum daily loads (TMDLs) establish the maximum pollutant load a waterbody can contain while still achieving water quality standards, and TMDLs allocate this load amongst sources of pollution. TMDL implementation is based predominately on voluntary actions for non-point sources, and the TMDL can be used to inform requirements for permitted surface water dischargers (point sources). Often, permitted dischargers are allowed to meet their allocation through a phased implementation which takes economics, technology, and upstream conditions into account. TMDL targets reflect the applicable water quality standards, and nutrient targets typically only apply during summer months when the potential for nuisance algal growth is greatest. Figure 2 below identifies summer nutrient concentrations and loadings from significant sources in the valley and compares these to the TMDL targets and loads derived from TMDL targets (gold lines). Figure 3 displays the summer load contributions to Lake Helena in a pie chart, including an estimate of natural background loading.

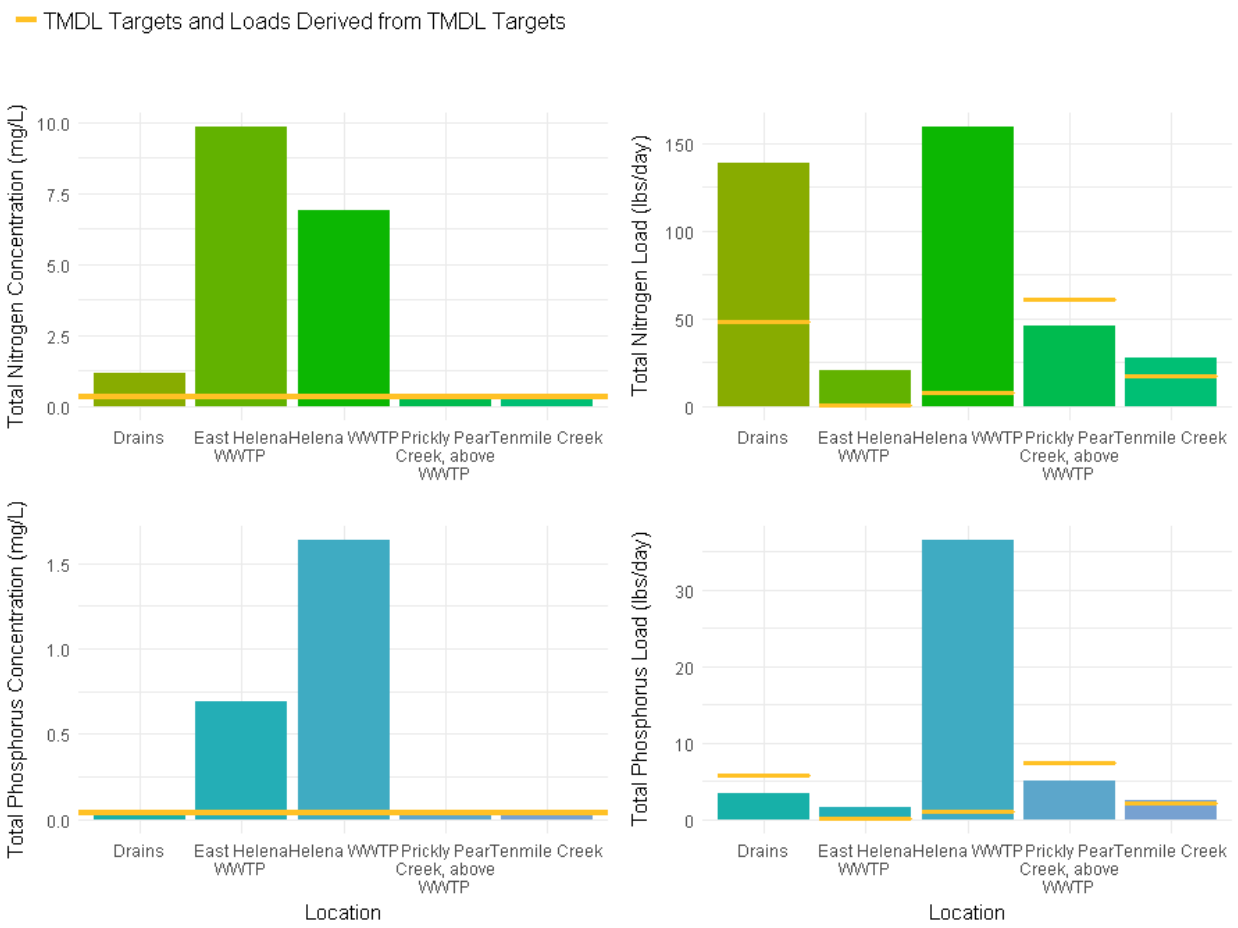
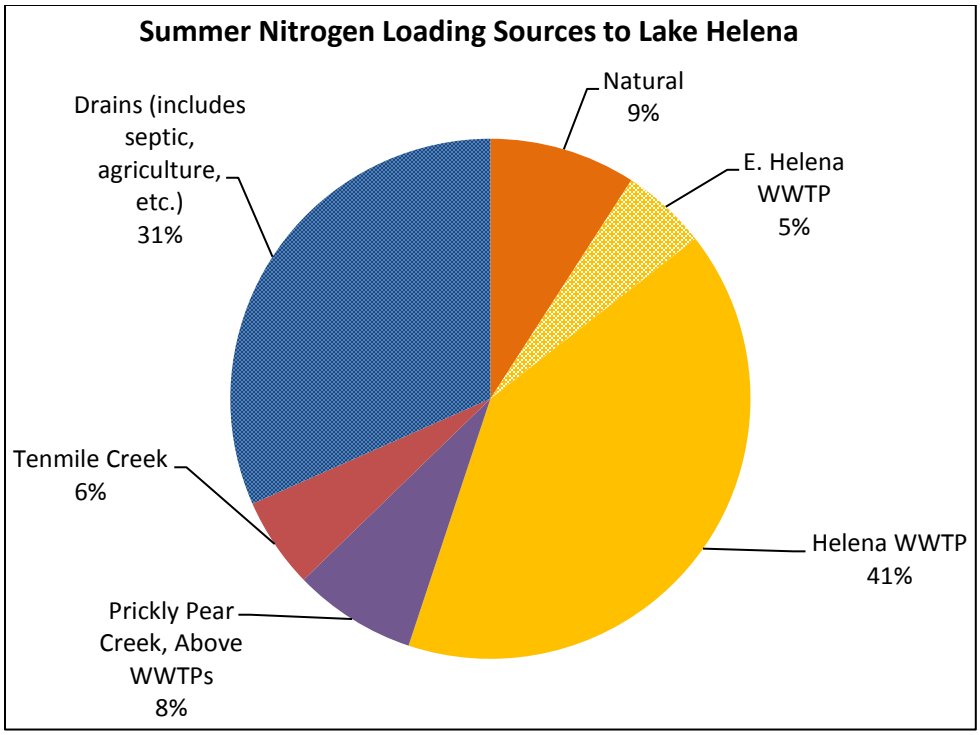


Figure 2 Current Concentrations and Summer Loads of Nurient Sources in the Lake Helena Valley



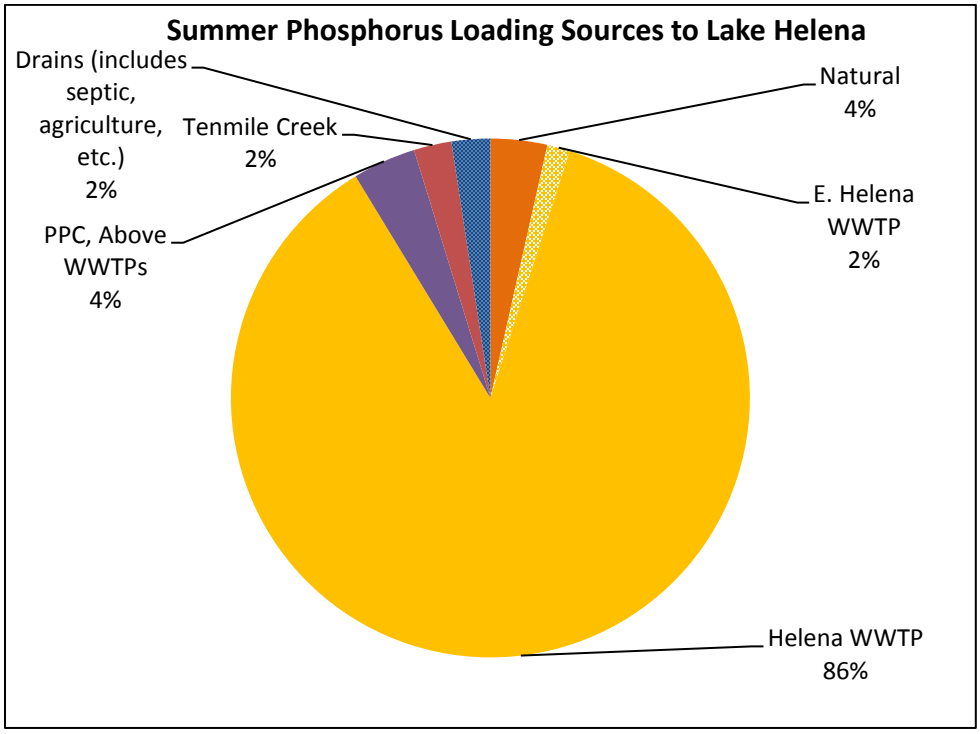


Figure 3 Current Summer Nutrient Load Sources Based on Available Water Quality Data.

5.0 Conclusions

- **RECENT NUTRIENT REDUCTION.** To date, millions of public and private dollars spent on point sources and nonpoint sources have reduced nutrients in the watershed.
- **MONITORING.** Water quality monitoring has provided good baseline data, but constantly evolving land uses, discharge concentrations, stream flow, and other factors make it very difficult to detect change and attribute it to specific pollution reduction efforts.
- **PRICKLY PEAR CREEK.** Wastewater treatment plant upgrades and optimization efforts have reduced nutrient loading to Prickly Pear Creek by up to 70%, but continue to be the primary cause of nutrient impairment.
- **LAKE HELENA.** The two major wastewater treatment plants contribute about 46% of the summer nitrogen load to Lake Helena, and the valley drains contribute about 31%. In addition to focusing on improving treatment plant operations, more work needs to address pollution from septic systems and agriculture because the drains capture much of the nitrogen load from these sources. Past WWTP improvements reduced annual nutrient loading to Lake Helena by 24% for nitrogen and 6% for phosphorus. However, the wastewater treatment plants still contribute the majority of the summer phosphorus load (about 88%).
- **FUTURE NUTRIENT REDUCTION.** Future efforts should focus primarily on reducing nutrient contributions from sources within the lower Helena valley. Reducing nutrients in Lake Helena and its major tributaries will require efforts by point and nonpoint sources.