

BREWER LAKE

WATERSHED MANAGEMENT PLAN

PREPARED FOR US ARMY
CORPS OF ENGINEERS &
CONWAY CORPORATION
JANUARY 2026

PREPARED BY:



BLACK & VEATCH



WOOLPERT

A BLACK & VEATCH AND WOOLPERT JOINT VENTURE

Executive Summary

Brewer Lake is a critical drinking water supply for approximately 90,000 residents spread across Conway and Faulkner Counties in central Arkansas. Increased nutrient and sediment inputs—driven by land use patterns, soil and slope conditions, rural wastewater systems, and expanding development—have heightened concerns about long-term water quality and reservoir sustainability. In response, Conway Corporation partnered with the U.S. Army Corps of Engineers (USACE), Black & Veatch, and Woolpert to develop a comprehensive, science-based Watershed Management Plan that identifies current watershed conditions, quantifies pollutant sources, and recommends targeted management actions to protect Brewer Lake as a multi-generational resource.

Watershed Setting and Key Drivers of Water Quality

The Brewer Lake watershed spans roughly 36 square miles within the Arkansas Valley physiographic province. Steep ridge-and-valley terrain, combined with hydrologic soil groups characterized by low infiltration (C, C/D, and D), predisposes the watershed to high runoff potential and erosion during storm events. Streamflow in Cypress Creek—the primary tributary—shows highly variable discharge, ranging from extended zero-flow periods to peak events exceeding 16,000 cubic feet per second. These natural dynamics contribute to sediment mobilization and rapid nutrient transport during stormflows.

Ecologically, much of the watershed remains forested, with riparian corridors maintaining 62% forest cover within 100 feet of streams. However, land use also includes 42% pasture, poultry operations, dispersed rural development, unpaved road networks, and localized energy extraction. Most households rely on septic systems, some of which are aging or failing. The 2020 cyanobacterial bloom in Brewer Lake underscores the increasing vulnerability to nutrient-driven water quality impairments.

Challenges and Management Objectives

Stakeholder engagement, including biweekly technical meetings and two public workshops, played a central role in identifying watershed priorities. Key concerns include rising nutrient levels, sediment delivery, increased water treatment costs, and the risk of recurring harmful algal blooms. Stakeholders also emphasized stewardship, ecological integrity, and property rights.

Conway Corporation established three primary quantitative objectives:

- Reduce nitrogen loading by 15%
- Reduce phosphorus loading by 15%
- Reduce sediment loading by 15%

These reductions are benchmarked against 2009–2023 conditions—years with minimal algal bloom activity—and are informed by watershed modeling, feasibility considerations, and analogous national programs.

Secondary objectives include enhancing drought resilience, supporting resident enjoyment, promoting biodiversity, and strengthening community stewardship.

Existing Conditions and Watershed Modeling

An HSPF (Hydrologic Simulation Program—Fortran) watershed model was developed to simulate hydrology, sediment, and nutrient dynamics. The model was calibrated using long-term USGS data for hydrology and historical monitoring data for nitrogen and phosphorus.

Key findings from the analysis include:

- Sediment: Highest contributions originate from steep slopes, eroding pasturelands, and hydrologically connected gravel roads.
- Nitrogen: Dominant sources include manure-amended pastureland and failing septic systems. Soluble nitrogen also moves via groundwater pathways.
- Phosphorus: Primarily transported with sediment, especially from disturbed soils, unpaved roads, and manure-enriched fields.

These processes collectively drive pollutant delivery to Brewer Lake during storm events and contribute to chronic nutrient enrichment during baseflow periods.

Management Measures and Pollutant Reduction Scenarios

A suite of Best Management Practices (BMPs) was evaluated using the EPA Pollutant Load Estimation Tool (PLET). Three BMP portfolios were assessed:

- Pasture Management
- Stream Corridor Management
- Combined Pasture + Stream BMPs

Combined portfolios provide the greatest efficiency, meeting all three 15% pollutant reduction goals with BMP implementation on ~40–50% of pasture lands in prioritized areas.

Priority Sub-Catchments

Using both ranking analysis and multi-criteria decision analysis (MCDA), eight sub-catchments (1, 9, 10, 13, 17, 19, 22, and 25) were identified as offering the greatest potential to achieve pollutant reductions. Sub-catchments 1 and 19 exhibit the highest pollutant loads, while others provide strong opportunities due to feasibility factors (e.g., proximity to lake, land values, riparian condition). Applying BMPs exclusively in these areas is sufficient to meet watershed-scale targets.

Implementation Framework

Implementation will occur over a 10-year horizon and involves coordinated efforts among Conway Corporation, Conway County Regional Water Distribution District (CCRWDD), the University of Central Arkansas, Garver, USACE, NRCS, the Faulkner County Conservation District, the Arkansas Department of Agriculture, and landowners. Some of the planned actions in the watershed include:

- Agricultural BMPs: Rotational grazing, livestock exclusion fencing, pasture planting, heavy-use area protection, nutrient management plans, and poultry litter management.

- Riparian/Stream BMPs: Forested buffers, grassed buffers, streambank stabilization, silvopasture.
- Wastewater BMPs: Septic system inspections, repairs, and replacements.
- Road/Stormwater BMPs: Upgrading unpaved roads, stabilizing ditches, installing sediment traps, updating stormwater pollution prevention plans.
- Stewardship & Education: Landowner training, community engagement, illicit discharge reporting.

Monitoring Strategy and Adaptive Management

A comprehensive monitoring framework will track nutrient concentrations, sediment loads, algal conditions, and ecological metrics. Data will inform adaptive management:

- Annual monitoring review to adjust implementation.
- Full program review every five years to evaluate progress and recalibrate strategies.
- Potential development of a linked watershed–reservoir model to predict lake responses to BMPs.

Conclusion

The Brewer Lake Watershed Management Plan provides a practical, science-based roadmap for protecting a vital drinking water supply. By focusing efforts on high-priority sub-catchments, implementing a balanced mix of pasture, stream, and wastewater improvements, and maintaining strong community engagement, Conway Corporation and its partners can significantly reduce nutrient and sediment inputs while enhancing long-term watershed resilience. This coordinated, multi-year approach positions Brewer Lake as a sustainable and resilient water source for decades to come.

1.0 Introduction

The Conway Corporation, the city-owned utility provider for Conway, Arkansas, identified water quality issues such as sedimentation and nutrient loading¹ in the Brewer Lake Watershed in Central Arkansas through routine testing and monitoring. To help address the watershed concerns, Conway Corporation has partnered with the U.S. Army Corps of Engineers (USACE) to develop a watershed management plan for the Watershed. The goals of this watershed study are to: (1) assess the status and trends of the Brewer Lake Watershed with an emphasis on water quality issues, (2) prioritize sub-catchments exhibiting signs of degradation, (3) compile potential management actions to address degradation and (4) to provide supporting information for EPA 319 proposals. Black & Veatch and Woolpert jointly conducted technical analyses for this study, which compiled diverse lines of evidence related to watershed condition based on geospatial analysis and watershed modeling. This report synthesizes findings of this watershed assessment along with associated recommendations for management actions. Technical appendices accompany this report describing the underlying analyses and detailing the process-specific findings.

A watershed is “the landscape that contributes surface water to a single location, such as a point on a stream or river, or a single wetland, lake or other waterbody” (Flotemersch et al. 2016). The catchment scale integrates physical, chemical, biological, and social processes and provides a fundamental unit for assessing the management of lands and waters. Watershed assessments capture the status and trends of different functional outcomes related to landscape condition, geomorphology, hydrology, water quality, habitat, and biological conditions (USEPA 2012). Ultimately, integrated assessment of these components facilitates understanding of the integrity of the system as a whole (Flotemersch et al. 2016). Watershed assessments also provide a crucial means of identifying stressors, guiding development of management strategies, prioritizing actions and funding, and fostering collaboration among stakeholders.

For the Brewer Watershed Management Plan, the six-step USACE Planning process (USACE 2023) was merged with the EPA’s elements of a successful watershed plan (USEPA 2008) to assess watershed integrity. This process links scientific outcomes to watershed management, developing a watershed restoration plan that aligns with specific agency policy.

Table 1 provides an overview of this report and the location of key aspects common in watershed management plans.

¹ Nutrient loading is the excessive influx of nutrients, primarily nitrogen and phosphorus, into aquatic ecosystems like lakes, rivers, and coastal waters, usually from human activities like farming, sewage, and stormwater runoff, which over-fertilizes the water, causing harmful algal blooms, depleting oxygen, and creating [dead zones](#), ultimately harming aquatic life.

Table 1 Report overview and alignment with elements of a successful watershed plan (USEPA 2008).

EPA's Elements of Successful Watershed Plans	Watershed History (2)	Challenges and objectives (3)	Existing conditions (4)	Management measures (5)	Assessing actions (6)	Executing the Plan (7)
Identify causes and sources of pollution	•	•	•			
Estimate load reductions expected			•		•	
Describe management measures & critical areas				•	•	
Estimate technical and financial assistance needed						•
Develop information & education components						•
Develop a project schedule						•
Describe interim, measurable milestones						•
Identify indicators to measure the progress		•				•
Develop a monitoring component						•

2.0 Watershed History

The physical, ecological, and human context of the Brewer Lake watershed that underpins current water quality conditions and management challenges are discussed below. This section describes the watershed's regional setting, climate, physiography, soils, and hydrologic regime, along with its ecological characteristics and patterns of human settlement and land use. Together, these factors shape how water, sediment, and nutrients move through the landscape and ultimately reach Brewer Lake. Understanding this historical and environmental context is essential for interpreting observed water quality conditions, diagnosing pollutant sources, and identifying management actions that are both effective and appropriate for the watershed. Additional background information on the geophysical data and watershed characteristics are included in Appendix A.

2.1 Regional Setting, Climate, and Physiography

Brewer Lake was completed in 1983 through a partnership between the U.S. Army Corps of Engineers and Conway Corporation to provide municipal water supply for the City of Conway and surrounding counties. The lake is located within the Arkansas Valley physiographic province and is fed by Cypress Creek and several smaller tributaries draining approximately 36 square miles. The watershed is characterized by pronounced ridge-and-valley topography that strongly influences runoff generation and sediment transport.

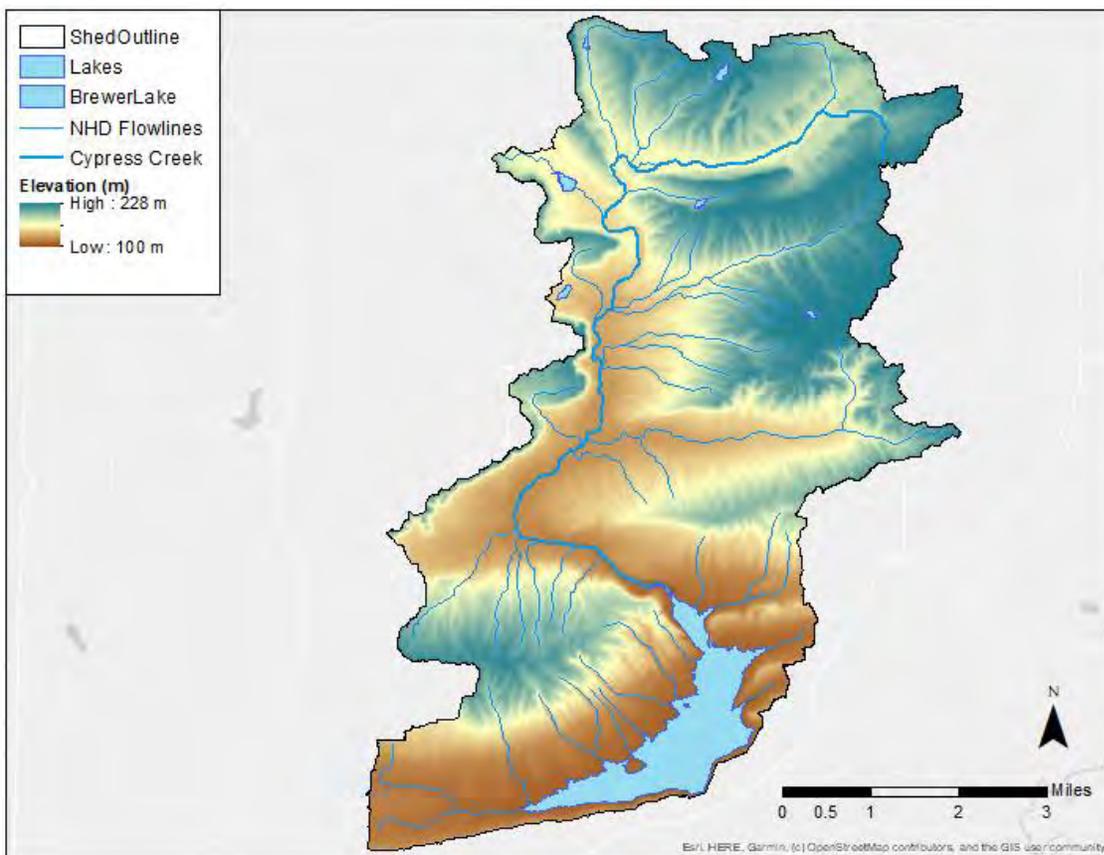


Figure 1 Brewer Lake Watershed boundary, elevation and major streams.

The climate of the watershed is humid subtropical, with hot summers and mild winters. Average annual precipitation is approximately 58 inches, with the greatest rainfall occurring during spring months. This climatic setting, combined with steep terrain, predisposes the watershed to flashy hydrologic responses during storm events.

2.2 Soils and Infiltration Capacity

Soils within the Brewer Lake watershed are dominated by sandy loam and silty loam textures, primarily classified as hydrologic soil groups C, C/D, and D. These soils exhibit moderate to low infiltration capacity and relatively high runoff potential. As a result, precipitation events often translate efficiently into surface runoff, particularly where soils are compacted or vegetation is disturbed. These soil characteristics play a key role in controlling erosion rates and nutrient transport to surface waters.

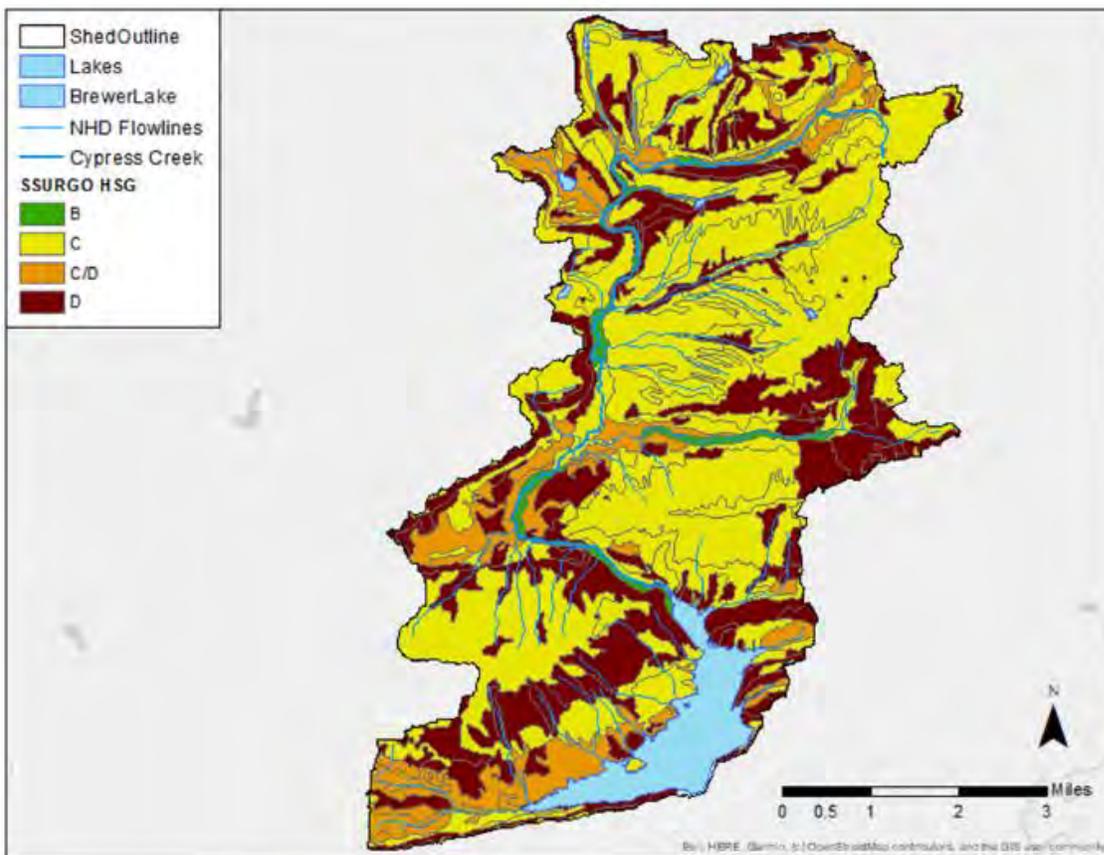


Figure 2 Hydrologic soil groups in the watershed show areas with higher infiltration rates (B soils) and lower rates (D soils).

2.3 Hydrologic Regime

Streamflow in Cypress Creek reflects the interaction between climate, topography, and soil conditions. Average annual discharge is approximately 32 cubic feet per second, although flows vary widely and include extended zero-flow periods as well as peak discharges exceeding 16,000 cubic feet per second during major storm events. These hydrologic patterns are characteristic of intermittent, runoff-dominated systems common in the region and strongly influence sediment mobilization and nutrient delivery to Brewer Lake.

2.4 Ecological Setting

The Brewer Lake watershed lies within the Arkansas Valley Hills Level IV ecoregion. Historically, the region supported oak-hickory and oak-hickory-pine forests. Much of the watershed remains forested today, although pasture and managed evergreen forest are also common. Riparian areas are relatively intact, with approximately 62 percent of land within 100 feet of streams remaining forested. These areas provide important ecological functions, including bank stabilization, nutrient uptake, and habitat connectivity.

2.5 Human Settlement and Socioeconomic Context

Human occupation of the Cypress Creek watershed spans thousands of years, with archeological evidence of both prehistoric and historic settlement. Contemporary population density remains low, reflecting the rural character of the watershed. Most residences rely on individual septic systems for wastewater treatment, and economic indicators show higher-than-average poverty and unemployment relative to statewide conditions. These factors influence both pollutant sources and the feasibility of voluntary watershed management actions.

2.6 Contemporary Land Use and Infrastructure

Current land use within the watershed is dominated by forest (approximately 45 percent) and pasture (approximately 42 percent). Agricultural activities include livestock grazing and poultry production, while urban development is limited and dispersed. Gravel roads and other unpaved infrastructure are prevalent and represent important sediment sources due to their direct hydrologic connectivity to streams. In recent decades, oil and gas extraction activities have expanded in the region, introducing additional areas of land disturbance.

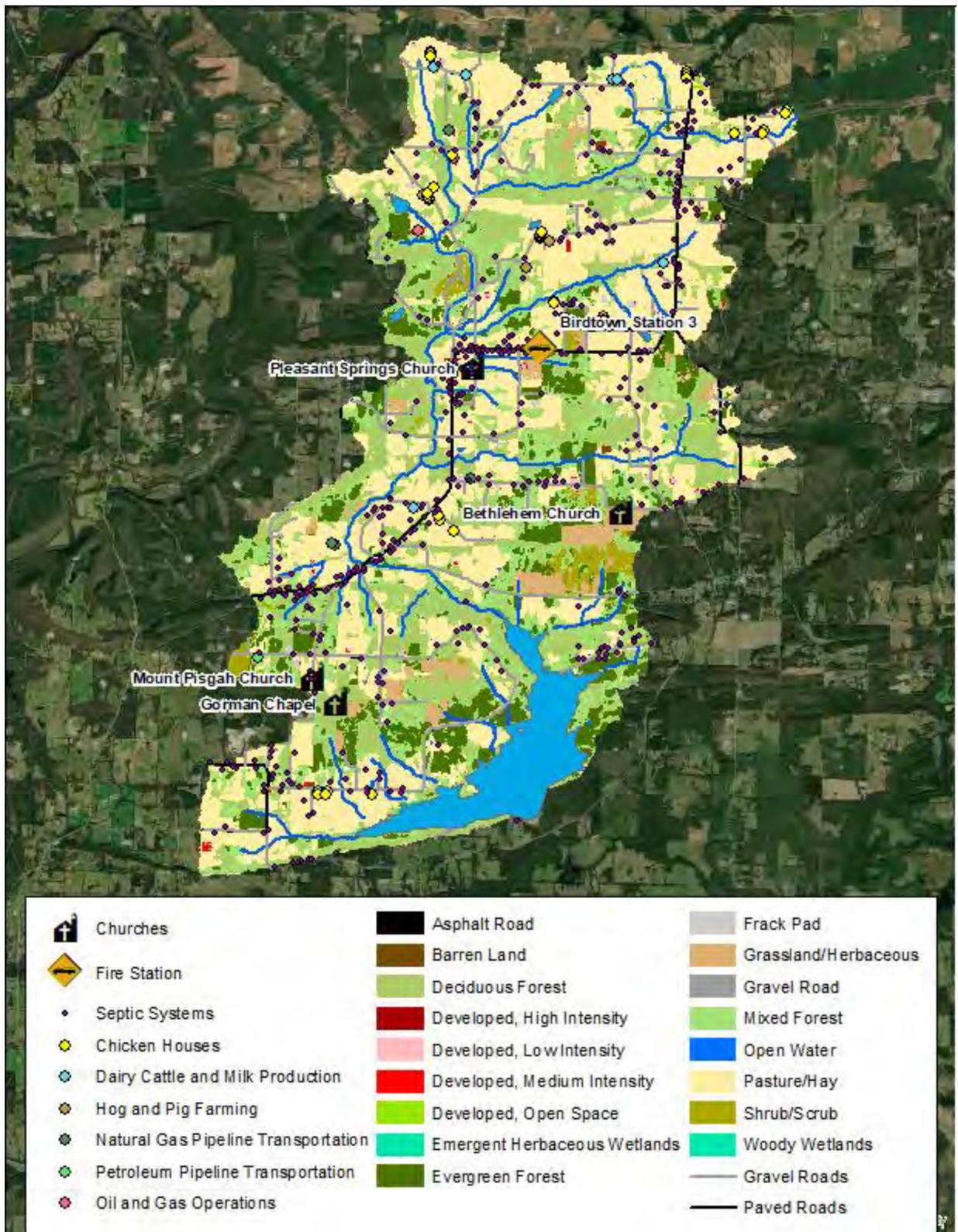


Figure 3 Summary of watershed land use alongside potential sources of water quality degradation (i.e., septic systems, poultry houses, and hydraulic fracturing extraction sites).

Beyond existing agricultural, residential, and extractive land uses, portions of the Brewer Lake watershed are subject to long-term forest management agreements that influence future land disturbance and vegetation cover. Portions of the Brewer Lake watershed are subject to long-term forest management agreements that influence future land disturbance and vegetation cover. In 2025, the City of Conway entered into a Carbon Agreement with NativState LLC covering approximately 2,374 acres of City-owned land. The agreement establishes a 40-year term for an Improved Forest Management carbon offset project, under which forest management activities are constrained to maintain forest stocking, limit harvesting intensity, and protect streamside areas. The agreement allows only selective or deferred harvesting under defined conditions, includes restrictions on tree removal near streams and waterbodies, and is designed to increase long-term forest carbon sequestration while maintaining sustainable forest management practices. This agreement provides additional context for long-term watershed conditions and helps explain the persistence of forest cover in portions of the watershed (Appendix B).

2.7 Implications for Water Quality

The interaction of steep terrain, low-infiltration soils, flashy hydrology, and land use practices creates efficient pathways for sediment and nutrient transport to Brewer Lake. Agricultural manure application, eroding road networks, and failing septic systems contribute nitrogen, phosphorus, and sediment loads to tributaries. These cumulative effects were highlighted by the occurrence of a cyanobacterial bloom in 2020 and provide the context for the challenges and management objectives described in Section 3.

2.8 Regulatory Context and Water Quality Standards

Management objectives for the Brewer Lake Watershed are grounded in the State of Arkansas's water quality standards established under the Clean Water Act and implemented through APC&EC Rule 2. Waters within the Brewer Lake watershed are designated for multiple uses, including secondary contact recreation, domestic and industrial water supply, agricultural water supply, and aquatic life. Because Brewer Lake serves as a municipal drinking water source, protection of these uses requires maintaining water quality conditions that support both human health and ecological integrity. A detailed summary of applicable designated uses, numeric and narrative criteria, and antidegradation requirements is provided in Appendix D (Water Quality Standards). Although Arkansas does not currently apply numeric total nitrogen or total phosphorus criteria to lakes within this ecoregion, narrative nutrient standards prohibit nutrient concentrations that cause excessive algal growth or otherwise impair designated uses.

In addition, numeric standards for parameters such as turbidity, dissolved oxygen, pH, and ammonia provide measurable benchmarks for evaluating impairment and overall watershed condition. The challenges identified in this section—namely elevated nutrient and sediment loading and the risk of recurring algal blooms—are therefore directly linked to regulatory requirements to prevent nuisance conditions and protect existing uses. The quantitative objectives established for nitrogen, phosphorus, and sediment reduction provide a practical framework for aligning watershed management actions with these standards while supporting long-term protection of Brewer Lake as a sustainable drinking water supply.

3.0 Challenges and Objectives

Effective watershed planning begins with a clear understanding of the issues that threaten watershed integrity and the community values at risk. For Brewer Lake, a series of scientific assessments, stakeholder discussions, and long-term monitoring results reveal that water quality conditions are being shaped by both natural watershed characteristics and evolving land-use pressures. While the watershed remains relatively undeveloped, increasing nutrient inputs, sediment delivery, and aging rural infrastructure have created emerging vulnerabilities for a drinking water supply that serves more than 70,000 people. The Conway Corporation partnered with other entities to gather data on water quality throughout the watershed. The analysis of the data lead to the identification of water quality issues, which were further analyzed as part of this study.

This section synthesizes the concerns expressed by technical partners, landowners, and local residents, and translates them into a structured set of planning challenges and management objectives to develop a Watershed Management Plan for Brewer Lake. These challenges reflect not only measurable water quality stressors—such as nitrogen, phosphorus, and sediment loading—but also broader community priorities related to resilience, ecological integrity, and long-term stewardship. Together, these elements define the core problems the watershed management plan must address and establish the foundation for evaluating feasible, locally appropriate solutions in the sections that follow.

VISION: The vision for the Brewer Lake watershed management plan is to identify a set of management actions and priority locations that help the community protect the watershed as a multi-generational asset and Conway Corporation secure a sustainable water supply.

The foundation of effective watershed planning is identifying the challenges and overarching management goals (USEPA 2008, USACE 2022). These qualitative descriptions guide data compilation, modeling analyses, and diagnosis of underlying stressors. As a project develops, these general concerns are articulated as a set of planning context and specific objectives, which guide the process toward meaningful management actions (USACE 2023). For the Brewer Lake watershed study, stakeholders were involved through outreach activities to ensure that their concerns and aspirations were understood, considered, and reflected in the watershed plan. Two stakeholder groups were engaged at multiple points in the watershed planning process. First, biweekly progress meetings of a technical advisory committee were conducted from October 2024 to December 2025 with technical stakeholders from Conway Corporation, federal agencies (USACE, NRCS, etc.), and the Arkansas Department of Agriculture. Second, the experiences of watershed residents, lake users, and other members of the public were incorporated through two facilitated public meetings held in May 2025 and January 2026, and a public website, hosted by Conway Corp. Additional detail regarding both technical and non-technical stakeholder groups is summarized in Appendix C, including meeting dates, locations, attendees, agendas, and minutes.

The following statements were synthesized from stakeholder input, subsequent technical analyses, and dialog with the USACE, Conway Corporation, and CCRWDD. These statements do not reflect a specific comment from any single group or a comprehensive list of watershed management challenges. Instead, these statements express a synthesis of ideas from many groups distilled into the primary issues degrading watershed integrity and hindering management.

- Brewer Lake provides municipal water supply for over 90,000 residents, and Conway Corporation, CCRWDD and local residents want to ensure the security, resilience, and sustainability of this resource.
- Water quality is a growing concern among both lake managers and residents. On short time scales, this manifests as increasing nutrient loads and associated increases in water treatment cost for Conway Corporation and CCRWDD. On longer time scales, sediment delivery to the reservoir has the potential to reduce storage volume. An algal bloom in November 2020 also raised awareness of the potential for increased frequency or duration of harmful algal blooms because of nutrient inputs.

Watershed residents also expressed a desire to preserve the ecological integrity and beauty of this minimally developed landscape as a legacy of opportunities for future generations.

Watershed challenges may then be translated into opportunities and constraints that are more closely tied to management actions (USACE 2023). The relatively unaltered watershed condition provides a unique opportunity in terms of preserving existing watershed functions and avoiding more severe outcomes (e.g., water supply threats from harmful algal blooms or increased water rates). However, the watershed management plan is constrained by a desire to avoid infringing on local property owners (e.g., through takings or regulation) in a watershed with almost exclusively private land ownership.

Given the challenges, opportunities, and constraints, an overarching goal for the watershed management plan was developed in conjunction with the technical advisory committee: *The vision for the Brewer Lake watershed management plan is to identify a set of management actions and priority locations that help the community protect the watershed as a multi-generational asset and Conway Corporation and CCRWDD secure a sustainable water supply.*

This vision sets the general trajectory for the watershed plan as a whole, but more refined objectives were needed to assess the relative merits of management activities. The specific objectives for the watershed management plan center on nitrogen, phosphorous, and sediment as indicators of riverine water quality and sustainability of the lake water supply.

The goals of the Brewer Lake watershed management plan are as follows:

- Reduce nitrogen loading to the Lake with the assumption that Brewer Lake algal blooms are nitrogen limited
- Reduce phosphorous loading to the Lake to Brewer Lake to minimize long-term nutrient storage and eutrophication
- Reduce sediment loading to the Lake with the implicit goals of minimizing riverine embeddedness, minimizing reservoir sedimentation, and reducing phosphorous delivery

Each of these water quality constituents integrates a variety of factors, which can indirectly be thought of as sub-objectives. Management of nitrogen inputs is supported by reducing loading to waterways (e.g., optimizing fertilizer use, managing animal waste) as well as increasing uptake capacity (e.g., through cover crops or riparian buffers). Phosphorus control focuses on managing animal waste and controlling erosion. Sedimentation issues in the basin are associated with minimizing soil disturbance, capturing runoff before entering rivers, and reducing streambank erosion. While not explicitly incorporated as sub-objectives, these processes guide development of effective watershed management actions (Section 5).

A numeric target or threshold for each metric helps judge the relative success of watershed management actions in achieving the objectives. The 2020 algal bloom in Brewer Lake was identified as an undesirable outcome by the technical stakeholder advisory group. As such, a general preference was identified for reducing watershed loading of nitrogen, phosphorous, and sediment to the reservoir. Reductions were judged relative to the 2009-2023 conditions, which represents a recent period in which algal blooms were infrequent, short duration, or low consequence. A 15% reduction from this baseline was identified based on preliminary modeling estimates of feasibility and the technical advisory group's understanding of what is normal and achievable. This level of reduction should be achievable since other long-term program tracking in other locations with water quality management programs like New York Harbor (HRF 2021) and Chesapeake Bay (Zhang et al. 2023) have had similar targets.

The primary objectives for this watershed management plan are related to nitrogen, phosphorous, and sediment. However, the community and Conway Corporation also expressed other areas of concern and interest in outcomes of watershed management. These secondary objectives are not the focus of the targeted watershed management practices but these outcomes are important to track and communicate in the context of the broader vision for the watershed. The following secondary goals are presented in Section 5 as part of the discussion of the relative merits of different management actions:

- Maximize drought resilience. Water quality is the primary focus of this watershed plan. However, management actions can have varying indirect benefits such as maintenance of base flows during prolonged droughts.

GOALS: Reduce nitrogen loading by 15% with the assumption that Brewer Lake algal blooms are nitrogen limited by

- Optimizing fertilizer use
- Managing animal waste
- Increasing uptake capacity (e.g., through cover crops or riparian buffers)

Reduce phosphorous loading by 15% to Brewer Lake to minimize long-term nutrient storage and eutrophication by

- Managing animal waste
- Controlling erosion

Reduce sediment loading by 15% with the implicit goals of minimizing riverine embeddedness, minimizing reservoir sedimentation, and reducing phosphorous delivery by

- Minimizing soil disturbance,
- Capturing runoff before entering rivers
- Reducing streambank erosion

- Facilitate resident enjoyment. Some management practices influence the beauty and recreational value of the watershed or lake (e.g., riparian buffers), whereas other actions may produce relatively neutral effects on these outcomes (e.g., septic maintenance).
- Foster watershed conditions that provide for regional biodiversity. Local aquatic and riparian ecosystems provide habitat for diverse and unique taxa, and healthy ecosystems contribute to resident enjoyment and use.
- Promote multi-generational watershed stewardship. To the degree feasible, management actions are preferred that facilitate education and bring community members together around collective management of their natural resources.

4.0 Existing Conditions

As stated in Section 3, the objectives for the Brewer Lake watershed management plan center on nitrogen, phosphorous, and sediment controls. The plan specifically needs to identify watershed sources of these pollutants, their ultimate fates within the watershed or lake, and management strategies to mitigate these inputs. Additional information on the assessment of pollutant sources can be found in Appendix E. This section uses watershed modeling to understand the current sources and fates of nitrogen, phosphorous, and sediment in the Brewer Lake watershed.

Spatially distributed watershed models are powerful tools for informing watershed planning. These tools provide a mechanism for linking hydrologic, water quality, and ecological outcomes (Freeman et al. 2013). When calibrated against historical data, watershed models can help reconstruct historical change in a basin (Yan and Edwards 2013) as well as forecast future conditions such as management (Davis 2012, Hart 2014), land use (McKay et al. 2019), or climate scenarios (Sharif et al. 2007). In this section, a watershed model was developed and applied to simulate hydrology, sediment, and nutrient dynamics in the Brewer Lake watershed. Sediment was calibrated over the five-year period from 2010-2015, and nutrients for 11 years (2013-2024).

A calibrated HSPF watershed model was applied to the Brewer Lake watershed to simulate hydrology, sediment, and nutrient dynamics over an extended period. The model effectively reproduced observed flow patterns, capturing both baseflow and storm-driven runoff, and provided a robust foundation for evaluating water quality processes. Results indicate that sediment and phosphorus loading are strongly linked to erosion from steep slopes, gravel roads, and disturbed land surfaces, while nitrogen transport is dominated by manure-amended pasturelands and failing septic systems with contributions from groundwater pathways. These findings highlight the interplay between land use, soil characteristics, and hydrologic variability in shaping pollutant delivery to Brewer Lake, underscoring the need for integrated management strategies targeting both natural and anthropogenic sources. Analysis of the watershed's existing conditions shows a direct link between land use and water quality degradation. As detailed in this section, pollutant loads from pastureland, residential lawns, and eroding streambanks are the primary drivers of the elevated nutrient and sediment levels observed in Brewer Lake. The following sections quantify these sources to establish a baseline for reduction efforts.

4.1 Watershed Modeling with HSPF

HSPF (Hydrologic Simulation Program – Fortran) (Bicknell et al. 2001) was used to simulate watershed hydrology and nutrient dynamics. The HSPF model is included in the EPA BASINS suite of tools (USEPA 2025) and is frequently used in watershed studies. The lumped parameter model simulates watershed hydrology as well as point and nonpoint source pollutant loadings, fate, and transport through the stream network. The model routes flows and pollutants through the stream network connecting each sub-catchment in the watershed. HSPF simulates the water cycle via precipitation, infiltration, and groundwater flows to the stream and deep aquifer. The model is time variable and simulates how conditions in the watershed vary through a day and across multiple years. Model results can be analyzed on hourly or greater time steps. HSPF model details are documented in Appendix E.

4.2 Watershed Hydrology

Hydrologic conditions in the Brewer Lake watershed were characterized using long-term flow records from the U.S. Geological Survey's gaging station on Cypress Creek (USGS 07261090). The station has collected continuous discharge data since 2009 and serves as the primary calibration point for the HSPF watershed model. This gauge captures the runoff response from nearly the entire watershed upstream of

Brewer Lake, providing a strong basis for evaluating seasonal flow variability, hydrologic processes, and the model's ability to reproduce observed hydrology.

Flow measurements at the gauge are generally reliable, with more than half of all observations rated “good,” indicating an accuracy within 5 percent of true streamflow. However, measurement uncertainty is greater under very low-flow conditions. Approximately 81 percent of flows below five cubic feet per second (cfs) were rated “poor,” reflecting the intermittent nature of Cypress Creek and the presence of shallow, slow-moving pools in summer. Despite this low-flow uncertainty, the gauge provides a robust record for characterizing watershed-scale hydrology.

Typical flows in Cypress Creek are modest. The median daily discharge is 9 cfs, while the mean flow is 40 cfs, reflecting the influence of occasional large storm events. Flow exceeds 5 cfs roughly 58 percent of the time and exceeds 100 cfs only about 8 percent of the time. Peak annual discharge from 2010–2023 averaged 1,100 cfs, with the highest recorded event reaching 3,060 cfs in February 2023. These statistics indicate a system dominated by low to moderate baseflow conditions but capable of producing substantial stormflow peaks.

Baseflow separation analysis using the retired Purdue University Web-based Hydrograph Analysis Tool (WHAT) tool shows that roughly half of the total flow volume in Cypress Creek originates from groundwater contributions, with the remainder generated by direct surface runoff. This balance reflects both the permeable sandy loam soils that dominate the watershed and the presence of hydrologic soil Group B losing reaches. These losing reaches, primarily in the northern watershed, allow streamflow to infiltrate into groundwater, reducing downstream discharge during dry periods and influencing the timing of water delivery to Brewer Lake.

Hydrologic model calibration performance further supports the understanding of watershed behavior. The HSPF model successfully reproduced measured flow patterns, including daily hydrographs, monthly averages, cumulative volumes, and flow duration distributions. Model performance metrics met all major calibration targets for storm peaks, storm volumes, seasonal runoff, recession rates, and total flow volume. Errors in high-flow ranges were low, and low-flow performance, while less precise, was within acceptable limits for watershed management purposes. These results indicate that the calibrated model accurately captures both baseflow and runoff processes and provides a dependable foundation for evaluating sediment and nutrient transport (Figure 4).

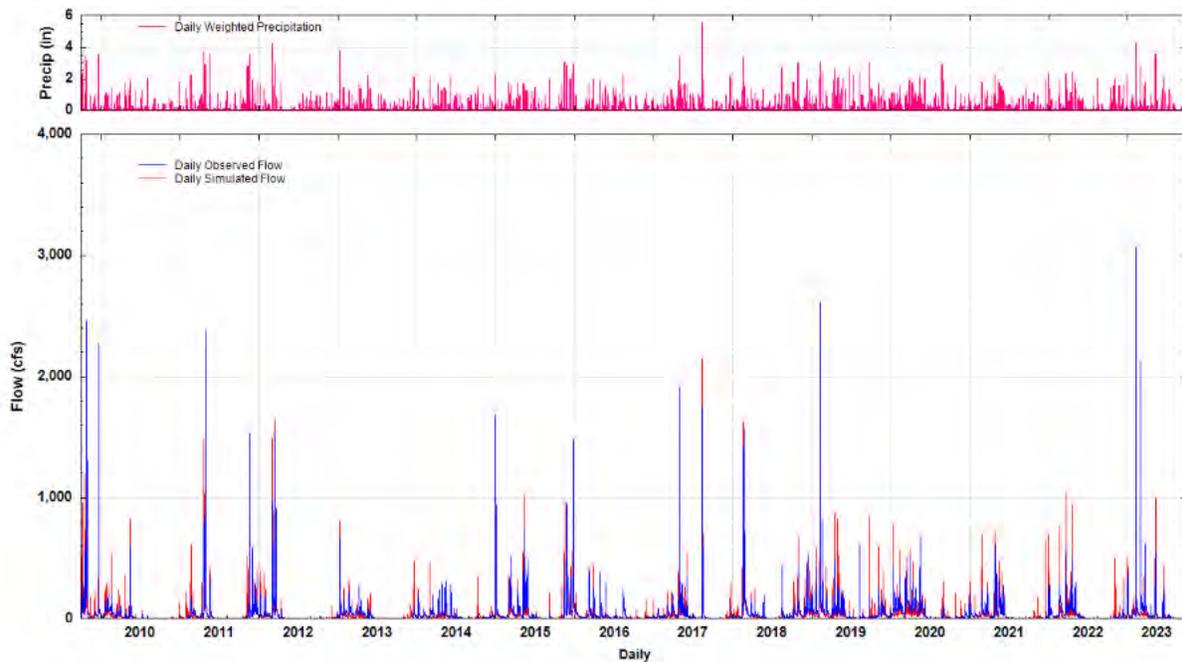


Figure 4 Modeled watershed hydrology compared well to the observed historic flows.

4.3 Sediment

Sediment is a major water quality concern in the Brewer Lake watershed as it impacts stream stability, aquatic habitat, and the transport of nutrients—particularly phosphorus, which binds strongly to fine sediment particles. The watershed contains a combination of natural forested uplands and more disturbed or intensively used areas, including pastureland, gravel road networks, fracking pads, and developed spaces, all of which contribute varying degrees of sediment to the stream system. Sediment loading to Cypress Creek and its tributaries is influenced by a mix of land use practices, geomorphic conditions, and hydrologic processes that collectively determine the amount of material that is mobilized and eventually delivered to the lake.

The watershed’s diverse topography and soil characteristics contribute to sediment generation and erosion patterns. The upper and western portions of the watershed contain steeper slopes (see Figure 1) that accelerate runoff during storm events, increasing the capacity of water to detach and transport soil particles. Many of these areas are underlain by hydrologic soil groups C, C/D, and D, which exhibit lower infiltration rates and higher runoff potential (Figure 2). As a result, the combination of slope and soil limitations creates natural hotspots for erosion where even modest land disturbance can produce measurable sediment loads.

Human activities amplify these natural tendencies. Gravel and unpaved roads can be among the most significant anthropogenic contributors of sediment. Their exposed soil surfaces, lack of pavement, and frequent connection to roadside ditches allow stormwater to pick up and deliver large amounts of sediment directly to nearby channels. During periods of heavy rainfall, these ditches act as efficient conduits, transporting sediment to tributaries with little opportunity for settling or infiltration. Fracking pads and other industrial or resource extraction sites create additional areas of disturbed and compacted soil that generate rapid runoff and increase sediment mobility.

Agricultural land, particularly pasture and hay fields, plays a crucial role in sediment dynamics. Although these areas are less disturbed than tilled croplands, the large acreage of pasture—much of which receives manure applications—means that soil is periodically exposed during grazing, management, or wet-weather conditions. Compaction from livestock and reduced vegetative cover in certain seasons increase the susceptibility of these soils to erosion. During storm events, runoff from these fields contributes fine sediment particles to creeks and tributaries, which then transport the material toward Brewer Lake.

Sediment behavior within the stream network reflects both hydrologic variability and channel processes. Monitoring data from the USGS gauge on Cypress Creek show that sediment concentrations rise sharply during storm flows, as high velocities mobilize material from the land surface, streambanks, and channel beds. During low-flow periods, Cypress Creek exhibits intermittent flow patterns that limit sediment conveyance, allowing some particles to settle within pools. The hydrologic simulation conducted through HSPF reflects these dynamics by calibrating sediment movement so that the stream network maintains a realistic balance between scour during high flows and deposition during low flows. This equilibrium is necessary for accurately representing long-term sediment transport to Brewer Lake.

The cumulative effect of these processes is that sediment loading originates primarily from diffuse, nonpoint sources, with certain portions of the watershed contributing more intensively than others. Steep, erosion-prone sub-catchments in the western watershed, road corridors with direct hydrologic connectivity, and pasturelands with recurring soil disturbance collectively account for much of the sediment delivered to Cypress Creek. Because sediment serves as both a physical and chemical pollutant—physically affecting habitat while also transporting attached nutrients—reducing sediment loads will require attention to both natural erosion processes and human activities that accelerate soil mobilization. The modeled flux (amount of sediment per acre per year) of sediment in the watershed is shown in Figure 5. The flux is used to normalize the sediment load to identify areas with higher proportional loading.

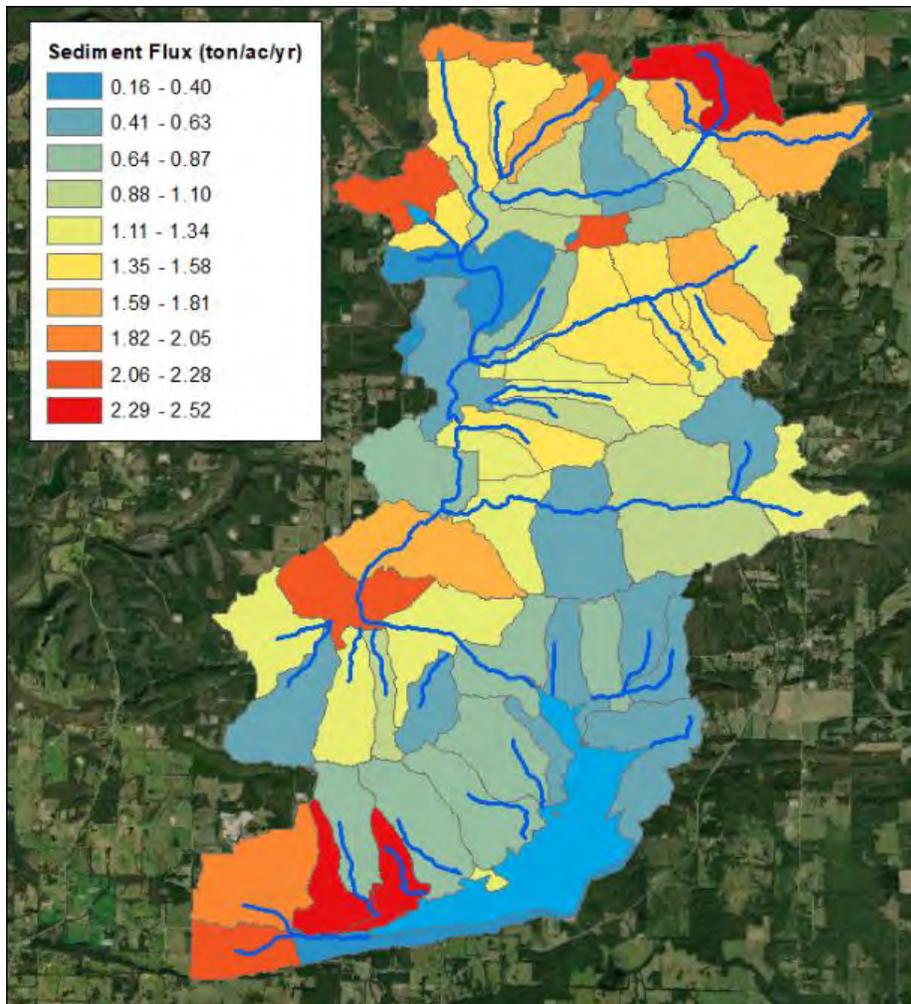


Figure 5 Median sediment flux (ton/ac/year) identified areas with higher proportional sediment inputs.

4.4 Nitrogen

Nitrogen (N) is a major nutrient of concern in the Brewer Lake watershed due to its mobility in both surface water and groundwater, as well as its influence on aquatic productivity and eutrophication. Monitoring data, which can be found in Appendix E indicates that total nitrogen (TN) concentrations typically range from approximately 0.43 to 2.01 mg/L, with the highest concentrations occurring during the winter and spring months, when rainfall and runoff are at their greatest. Nitrogen occurs in multiple forms within the watershed, including nitrate, nitrite, ammonia, and organic nitrogen. The relative proportions of these species vary seasonally, depending on hydrologic conditions, land use practices, and temperature. Note that Arkansas does not have a total nitrogen water quality limit but the recommended a total nitrogen limit of 0.31 mg/L in this ecoregion (USEPA, 2000).

The most significant controllable source of nitrogen in the watershed is agricultural manure. Livestock operations, including broiler and layer chicken houses along with cattle, horses, pigs, and other animals, collectively generate approximately 248,323 pounds of nitrogen per year based on animal population estimates. This manure is applied primarily to about 8,900 acres of pasture and hay land, where it enriches the soil and increases the potential for nitrogen transport during storm events or periods of high soil moisture. Because nitrogen is relatively soluble compared to phosphorus, it can move not only with

surface runoff but also through subsurface pathways, allowing nitrate and other nitrogen forms to reach streams through groundwater contributions.

Septic systems represent another important nitrogen source, particularly in residential areas near streams. There are 776 septic systems in the watershed, with 102 located within 250 feet of stream channels. These systems vary significantly in performance and age. The subset classified as failing contributes an estimated 458 pounds of nitrogen per year, while intermediate and well-functioning systems contribute additional loads at reduced rates due to partial nutrient attenuation in the soil. In areas with older systems, shallow soils, or low-permeability soil groups, nitrogen from wastewater can enter streams either through shallow groundwater or via direct seepage, contributing to elevated baseflow concentrations.

Nitrogen is also transported from developed and disturbed land surfaces, including gravel roads, fracking pads, and compacted soils in developed areas. These surfaces accumulate nitrogen-containing materials such as organic debris, vehicle-related pollutants, and atmospheric deposition, which are then washed off during storm events. Although these sources contribute smaller nitrogen loads compared to agriculture and septic systems, they can produce sharp increases in nitrogen concentrations during storms, especially in sub-catchments with limited vegetative cover or high connectivity between the road network and stream channels.

The assessment of nitrogen conditions in the watershed incorporated manure production estimates, septic system load calculations, water quality monitoring, and hydrologic simulation in the HSPF model. Manure-based nitrogen loading was determined from livestock inventories and manure nutrient content values. Septic contributions were estimated using standard effluent concentrations and adjusted for system performance. Modeled nitrogen movement reflected both surface and subsurface pathways and was calibrated against long-term monitoring data to capture seasonal variability and storm-driven loading.

Results show that nitrogen-related water quality issues are most pronounced in areas dominated by manure-amended pastureland (pasture lands that had chicken manure applied), particularly in the central and northern portions of the watershed. Residential areas with clusters of aging or poorly functioning septic systems also contribute to localized nitrogen enrichment, especially near streams. Hydrologic soil groups C, C/D, and D, which have reduced infiltration capacity, further increase nitrogen transport by promoting surface runoff during storm events. In addition, groundwater pathways contribute nitrogen to streams during baseflow, complicating mitigation because subsurface nitrogen transport is often slower to respond to management practices than surface runoff (Figure 6).

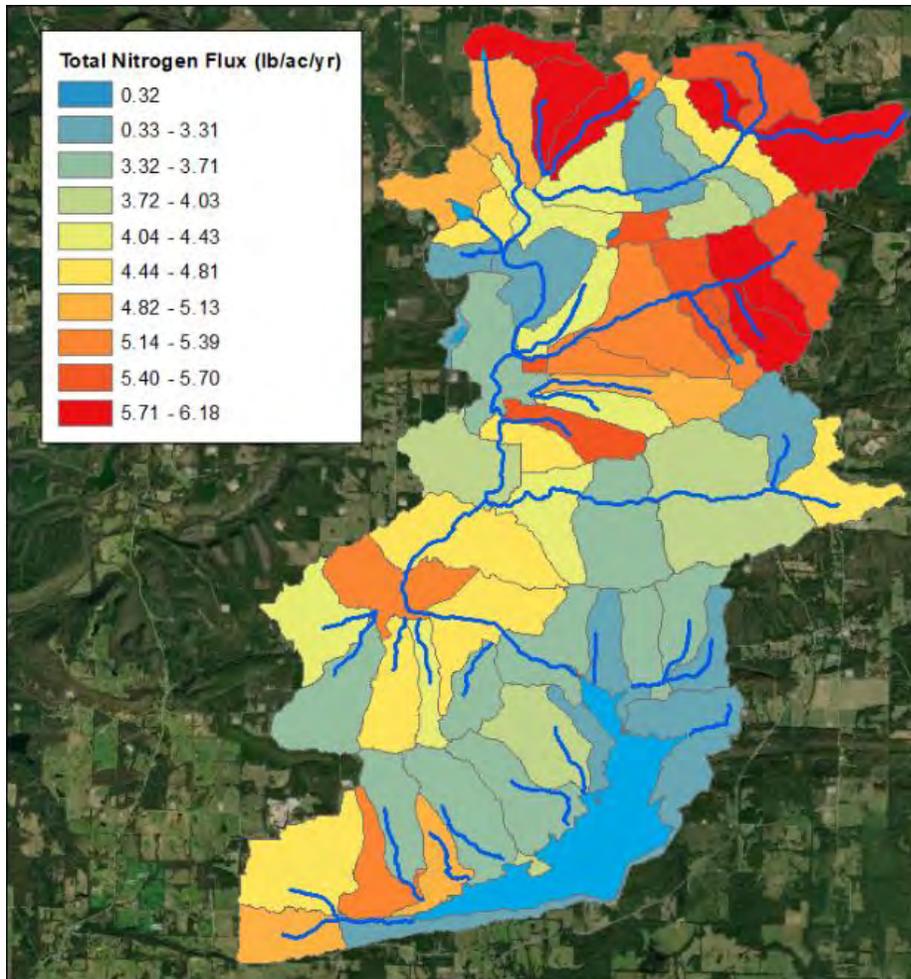


Figure 6 Median nitrogen flux (lb/ac/year) identified areas with higher proportional total nitrogen inputs.

4.5 Phosphorous

The primary source of phosphorus in the watershed is agricultural manure. Livestock operations—including chicken houses, cattle, horses, pigs, and other animals—produce an estimated 136,338 pounds of phosphorus each year. This material is applied mainly to the 8,900 acres of pasture and hay land throughout the watershed. Repeated application enriches soil over time, increasing the likelihood that phosphorus will be transported to streams during storm events. In addition to manure, a significant portion of watershed phosphorus is bound to soil and sediment. Erosion from gravel roads, roadside ditches, fracking pads, disturbed land surfaces, and steep tributary channels contributes to the mobilization of phosphorus-rich sediment. These areas are susceptible to erosion because exposed soil, low vegetation cover, and direct hydrologic connectivity to streams allow sediment-bound phosphorus to enter the drainage network rapidly during rainfall.

Septic systems represent an additional and more localized source of dissolved phosphorus. There are 776 septic systems in the watershed, with 102 located within 250 feet of streams—an area where phosphorus transport to surface water is most likely. Failing systems are estimated to contribute approximately 110 pounds of phosphorus per year, while intermediate and well-functioning systems contribute smaller but still meaningful loads. Dissolved phosphorus from septic effluent enters

groundwater or shallow subsurface flow paths. It can reach streams with minimal attenuation where soils have low infiltration capacity or where systems are aged, undersized, or improperly maintained.

Phosphorus conditions in the watershed were assessed using several types of data and modeling tools. Manure generation and application rates were estimated based on livestock numbers and the nutrient content of manure. Septic system contributions were calculated using accepted effluent concentration values, household size assumptions, and attenuation factors based on system performance. Suspended sediment monitoring was used to evaluate particulate phosphorus transport, and the HSPF model simulated sediment movement using assumed particle-size fractions of 10 percent sand, 40 percent silt, and 50 percent clay. Because most phosphorus is transported with sediment, an accurate representation of erosion was essential to calibrating phosphorus behavior in the model.

Assessment results show that phosphorus loads are most pronounced in areas where manure-amended pasturelands intersect with moderate slopes or hydrologically connected drainage routes. Gravel road corridors and disturbed surfaces such as fracking pads also create direct pathways for sediment-bound phosphorus to reach tributaries. Steeper slopes in the western watershed accelerate runoff and erosion, further enhancing phosphorus delivery during storm events. Residential clusters with aging septic systems near streams release dissolved phosphorus that bypasses sediment control measures entirely, creating localized hotspots. (Figure 7).

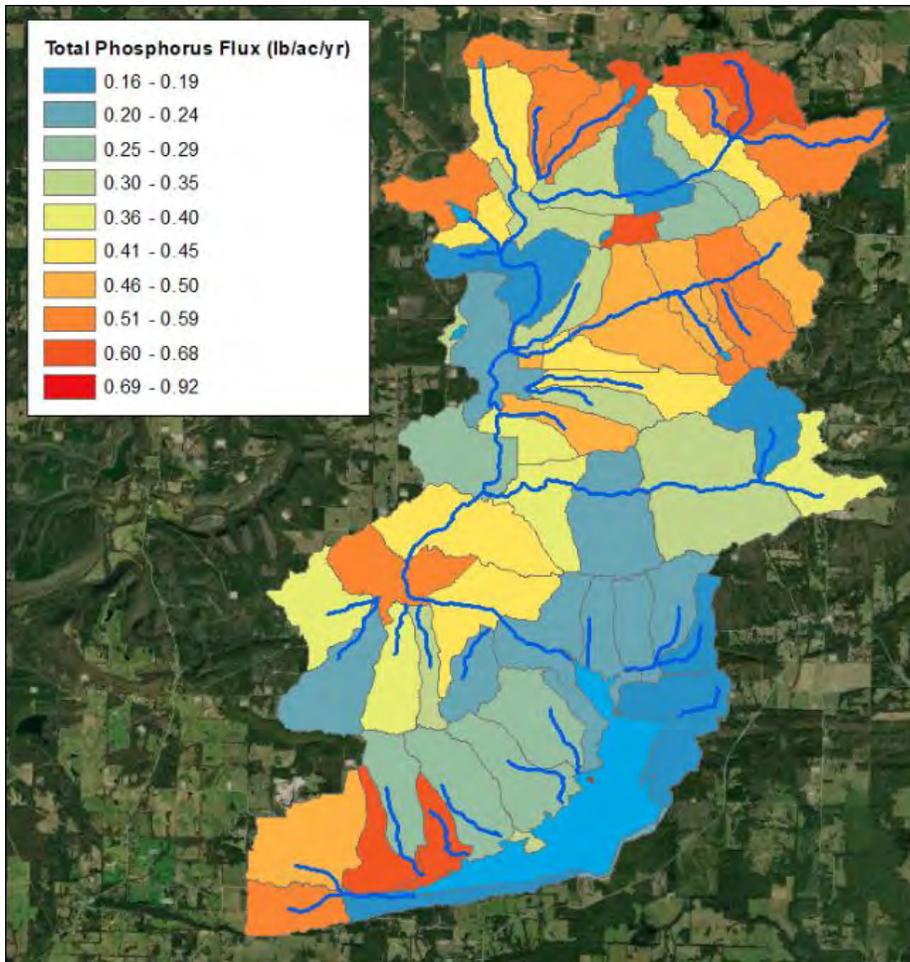


Figure 7 Median phosphorus flux (lb/ac/year) identified areas with higher proportional total phosphorus.

4.6 Summary

Analysis of existing conditions in the Brewer Lake watershed demonstrates that nutrient and sediment loading are closely linked to the interaction of natural watershed characteristics and current land-use practices. Steep slopes, low-infiltration soils, and flashy hydrology provide efficient transport pathways, while pastureland management, gravel road networks, and aging septic systems serve as the dominant controllable sources of nitrogen, phosphorus, and sediment. Modeling results show that pollutant delivery is highly variable across the watershed, with a limited number of sub-catchments contributing a disproportionate share of loads. These findings establish a clear technical basis for focusing management efforts in targeted areas and guide the prioritization of Best Management Practices evaluated in subsequent sections of the report.

5.0 Management Measures

Watershed management relies on diverse actions ranging from ecological restoration and engineering solutions to policy and regulatory methods. This family of management measures is referred to as Best Management Practices (BMPs). A broad suite of BMPs were considered for application in the Brewer Lake watershed, which were compiled from prior EPA documents (USEPA 2023) as well as other studies in Arkansas (GBMC & Associates 2015ab; FTN Associates 2016ab, 2018; Miller 2006). Table 2 qualitatively compares these actions based on their efficacy for addressing the primary goals of sediment, nitrogen, and phosphorous removal. The relative merits of BMPs were also assessed for accomplishing secondary goals related to drought resilience, resident use, biodiversity, and stewardship. Additional description of the BMPs and their efficacy is summarized in Appendix F.

The BMPs identified in Table 2 were selected because of their high effectiveness in reducing sediment, nitrogen, and phosphorous loads as independent activities, and the BMPs are capable of being implemented in the watershed and match the current land use.

Table 2 summarizes BMPs as independent activities; however, many of these actions are linked and dependent on each other. For instance, streambank stabilization may not yield the desired reduction in sediment or nitrogen unless livestock have also been excluded or riparian zones expanded. Furthermore, watershed management typically involves clustered activities at a smaller number of locations rather than uniform application of a single BMP across the entire watershed. To that end, the following scenarios combine these measures into logical portfolios of actions. These scenarios are intended to provide conceptually coherent groupings of BMPs that can be applied in conjunction with one another and easily aligned with watershed challenges at the catchment scale.

- **Pasture management.** This BMP scenario focuses primarily on pasture lands as a key source of sediment and nutrient inputs and includes actions like cattle exclusion, rotational grazing, pasture planting, and alternative water supplies.
- **Stream corridor management.** This BMP scenario focuses on actions within stream corridors such as addition of forested or grassed buffer zones and streambank stabilization. These actions assume that stream corridors may provide better alignment for real estate actions (e.g., voluntary programs, incentives, easements, acquisitions), given flooding potential and other regulatory limits (e.g., buffer ordinances).
- **Pasture and stream corridor management.** This BMP scenario combines the strategies above into a single scenario applying both practices, which has been shown more effective than using either alone.

While this section focused on BMPs that achieve the water quality goals set forth by this plan, selection of management actions also depends on a variety of additional factors. Overall cost and budget constrain all watershed management activities, and some actions may exceed project budgets or be incentivized by different funding or grant programs (e.g., NRCS's Conservation Reserve Program). Similarly, costs may also be considered relative to the efficacy of a given action at reducing pollutant inputs (e.g., \$/lb of nutrients) at a specific site. Space requirements also differ across BMPs, and real estate constraints are a common logistical factor in selecting the most appropriate action (e.g., a ditch in an existing right-of-way vs. a buffer requiring acquisition). Land-owners and nearby residents also likely have preferences regarding the aesthetics, construction windows, land use changes, or long-term maintenance of a given BMP. While efficacy is a tempting goal to maximize, BMP selection requires balance and trade-offs across these and other factors.

Table 2

Summary of management practices considered in the Brewer Lake Watershed and the associated qualitative effects on water quality of each.

Category	Management Practices	Sediment	Nitrogen	Phosphorous	Drought resilience	Resident use	Biodiversity	Stewardship
Stream	Riparian Buffers and Buffer Zones	++	++	++	+	+	++	+
	Livestock Stream Access Control and Exclusion Fencing	++	+	++	+	+	++	+
	Streambank Restoration and Stabilization	++	+	+	0	+	+	0
	Filter Strips of Native Plants	++	++	++	++	-	+	+
	Grassed Waterways	++	+	+	+	0	+	0
	Farm Pond/Sediment Basins	++	++	++	+	0	-	0
Pasture	Prescribed/Rotational Grazing	+	++	+	0	+	0	+
	Alternative Pasture Water Sources	++	+	++	0	0	0	0
	Silvopasture Establishment	+	+	+	+	0	+	0
	Pasture Planting and Management, Heavy Use Area Revegetation	++	+	++	+	+	0	+
	Nutrient Management Plans	0	+	++	0	0	0	++
	Farm, Water Quality, and Conservation Plans	0	+	++	0	0	0	++
Other	Fertilizer Application Technology	0	+	++	0	0	0	+
	Prescribed Forest Burns	0	0	+	0	-	++	0
	Dry Stacks, Composters, Incinerators for Poultry Houses	+	++	++	0	0	+	0
	No-Till Practices	++	+	++	++	0	0	+
	Cover Crops and Crop Rotation	+	+	+	+	0	0	+
	Wastewater System Management	0	0	+	0	0	0	+
	Incentivize low impact development (LID)	+	+	+	0	0	0	++
	Unpaved Roads Management	+	0	0	0	+	0	0
	Watershed Stewardship Education	+	+	+	+	+	0	++
	Encourage Good Neighbor Practices	+	+	+	0	+	0	++
Illicit Discharge Detection and Elimination	+	+	+	0	0	0	++	
Updating Fracking Pad Stormwater Pollution Prevention Plan	+	0	0	0	0	0	+	

Effects in Table 2 are described qualitatively as: ++ indicates a strong positive impact likely to be quantifiable using numerical modeling, + indicates a positive effect unlikely to be captured in numerical tools but likely to exist, 0 indicates a neutral effect, - indicates a negative effect unlikely to be captured in numerical tools, and -- indicates a strong negative effect likely to be quantifiable with modeling tools.

6.0 Prioritizing Management Actions

The Brewer Lake watershed management plan ultimately seeks to identify a suite of potential actions that align with local goals and challenges. This section examines which management actions would best achieve local water quality goals, identifies sub-catchments where actions are needed, and recommends locally appropriate BMPs in the priority sub-catchments. This analysis does not intend to identify specific BMPs at the parcel-scale, as this will require additional analysis of feasibility, logistics, and efficacy.

6.1 PLET Application to Brewer Lake Watershed

This watershed management plan has established primary objectives for reducing sediment, nitrogen, and phosphorous loading to Brewer Lake with a target of 15% reduction for each constituent. In this section, we analyze what type and extent of BMPs could be used to achieve this target. Specifically, the EPA’s Pollutant Load Estimation Tool (PLET) (USEPA 2025) is used to estimate removal efficiency of multiple BMPs applied simultaneously. Additional details about the PLET application and its use in this project may be found in Appendix G.

PLET is a spatially lumped calculator treating the entire watershed as one analytical domain. Land cover serves as the primary driver of removal efficiency in PLET. Land use and land cover were input based on area represented in the National Land Cover Data Set (NLCD) from 2021. Users may also specify the number and type of BMPs in PLET, which allows users to define whether practices are used in series or in parallel as well as the drainage area contributing to each practice. The three sets of BMPs described in Section 5 were executed in PLET based on the pasture, stream, and combined scenarios. The BMP calculator was configured such that similar practices were used in series, and dissimilar practices were used in parallel. It was assumed that all practices were used in series with either grassed or forested riparian buffers, since runoff flows through them before entering the stream. Area (in acres) treated by each practice was calculated by dividing the treated pasture area evenly into each set of practices. No BMP calculations were performed on developed areas due to its insignificant pollutant load contribution.

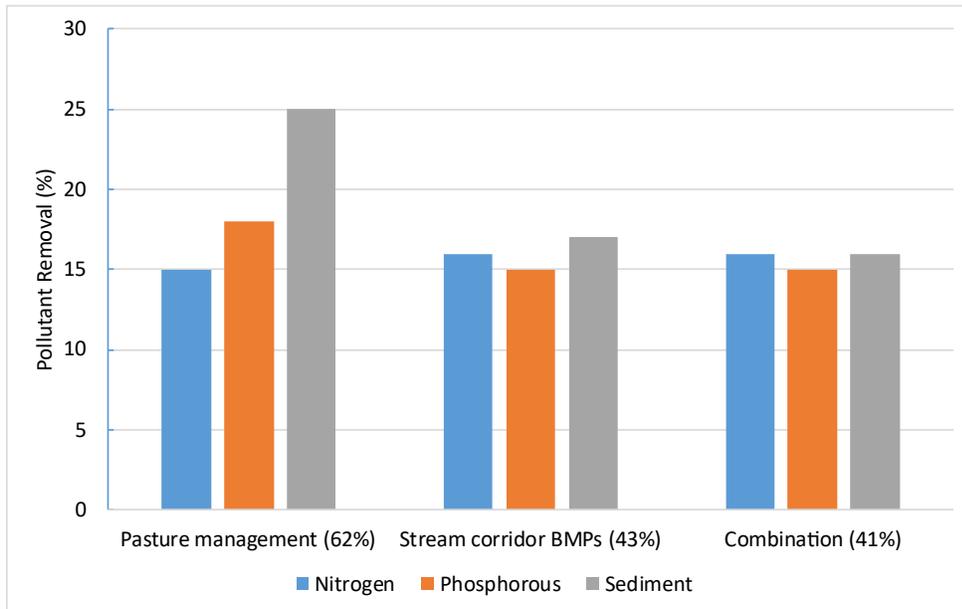


Figure 8 Pollutant removal rates for three scenarios of BMP application. Pasture management, stream corridor BMPs, and combined BMPs require 62%, 43%, and 41% of pasture areas to achieve pollutant removal goals, respectively.

The three BMP scenarios produced different pollutant removal rates and required different amounts of pasture area to achieve the 15% pollutant reduction targets (Figure 8). PLET analyses indicate that pasture-oriented practices are more effective for nitrogen removal, whereas stream-oriented practices more efficiently remove phosphorous and sediment. Using only pasture management practices, large pasture land areas would need to be converted to BMP application (i.e., 62% of existing pasture). Stream corridor BMPs achieve the load targets with significantly less pasture conversion (i.e., 43% of existing pasture), and combinations of practices further reduce land requirements (i.e., 41% of existing pasture). While ambitious in the scope and scale of BMP application, results indicate that the nutrient removal targets are feasible, particularly with an emphasis on stream corridor management.

6.2 Priority Sub-catchments

Sediment and nutrient runoff varies across the watershed due to factors like land use, slope, and soil type. The HSPF model split the watershed into 60 sub-catchments based on these factors with the goal of increasing predictive capability. These 60 sub-catchments were aggregated into 26 for prioritization purposes (Figure 9), grouping based on slope, soil type, land use, and proximity to Brewer Lake. These 26 sub-catchments were used in prioritization as a balance between detail from the HSPF model, efficiency from an analytical standpoint, and reasonableness from a watershed management perspective.

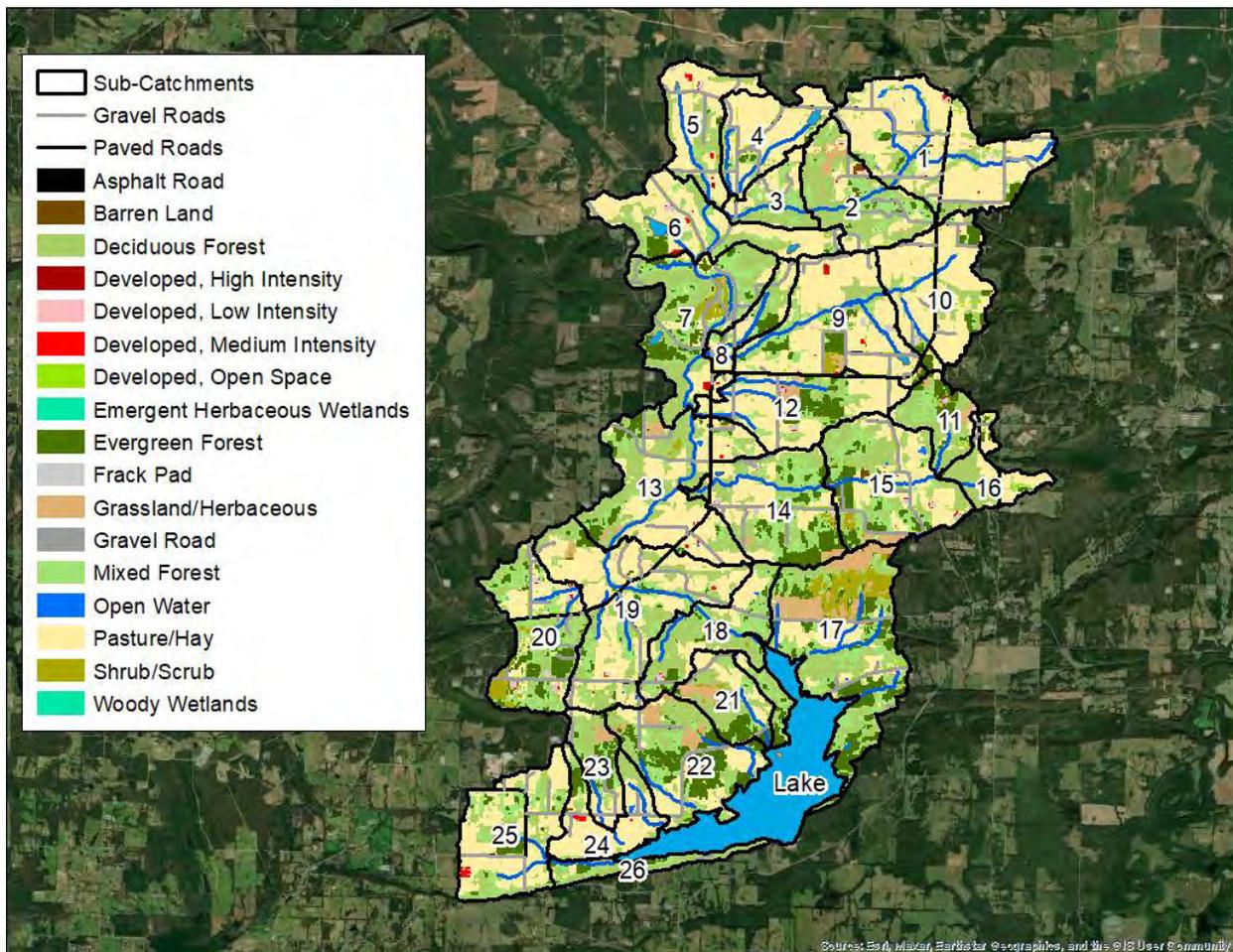


Figure 9 Brewer Lake sub-catchments (26) used in prioritization of management actions.

To identify high-reward areas, or areas in the watershed where BMPs would provide the greatest return-on-investment, the sub-catchments were prioritized using two different methods: ranking and multiple criteria decision analysis (MCDA). The ranking method identified sub-catchments with high pollutant loading and feasibility for management based on separate criteria. Conversely, the MCDA compared each sub-catchment based on a weighted average of multiple criteria summarized in a single score.

Using multiple methods provides insight into where in the Brewer Lake watershed there are: high load sub-catchments; sub-catchments where load-reducing practices can easily be applied; and areas where these factors overlap and become high-reward sub-catchments. Sub-catchments that emerge as high reward under different sets of assumptions reinforce that BMP application in these areas will see the greatest return-on-investment.

6.2.1 Prioritization Method 1 – Ranking

The ranking-based prioritization method evaluates the relationship between the feasibility of implementing best management practices (BMPs) and the relative pollutant loads generated by individual sub-catchments to identify areas of higher priority for BMP application. By integrating indicators of implementation feasibility with modeled estimates of sediment, nitrogen, and phosphorus loading, this approach provides a structured framework for comparing sub-catchments and highlighting locations where management actions may yield the greatest potential benefit.

The flux (pounds per acre) of sediment, nitrogen, and phosphorous was estimated using HSPF for each of the 26 sub-catchments (Section 4). The sub-catchments were then ranked from lowest to highest loading with increasing flux for each constituent. The average rank across all three constituents was used as a general proxy for identifying higher loading areas in the watershed. Additional information about the intermediate steps of prioritizing catchments is included in Appendix H.

Feasibility serves as a metric to evaluate the practicality of implementing BMPs within this sub-catchment. Ideally, the feasibility of an action could be assessed relative to the total project cost, stakeholder surveys, or other data. However, no direct metrics were available for the entirety of Brewer Lake watershed, and a suite of proxy metrics were used as a relative metric of feasibility. First, appraised land value from tax records was used as a general proxy for affordability. Second, the forested proportion of a 100-foot riparian area was used as a surrogate for the durability of BMPs with the assumption that all things equal, BMPs would perform better in sites with forested buffers. Third, time of travel from the catchment outlet to Brewer Lake (from HSPF) was used as a proxy for the nutrient consumption by plants along the stream and the eventual nutrient loading to Brewer Lake. The sub-catchments were then ranked from lowest to highest on these factors, and the average rank was used as a general proxy for the feasibility of actions.

The relative rankings of load and feasibility factors provide a mechanism for identifying priority sub-catchments (Figure 10). High priority sites could be identified based on either factor independently such as sub-catchment 1 as the most urgent location from a load reduction perspective or sub-catchment 22 from a feasibility perspective. However, the greatest utility lies in identifying sites that have high potential on both factors (i.e., Sub-catchments 17 and 19) and avoiding sites with the least potential (i.e., Sub-catchments 2 and 16).

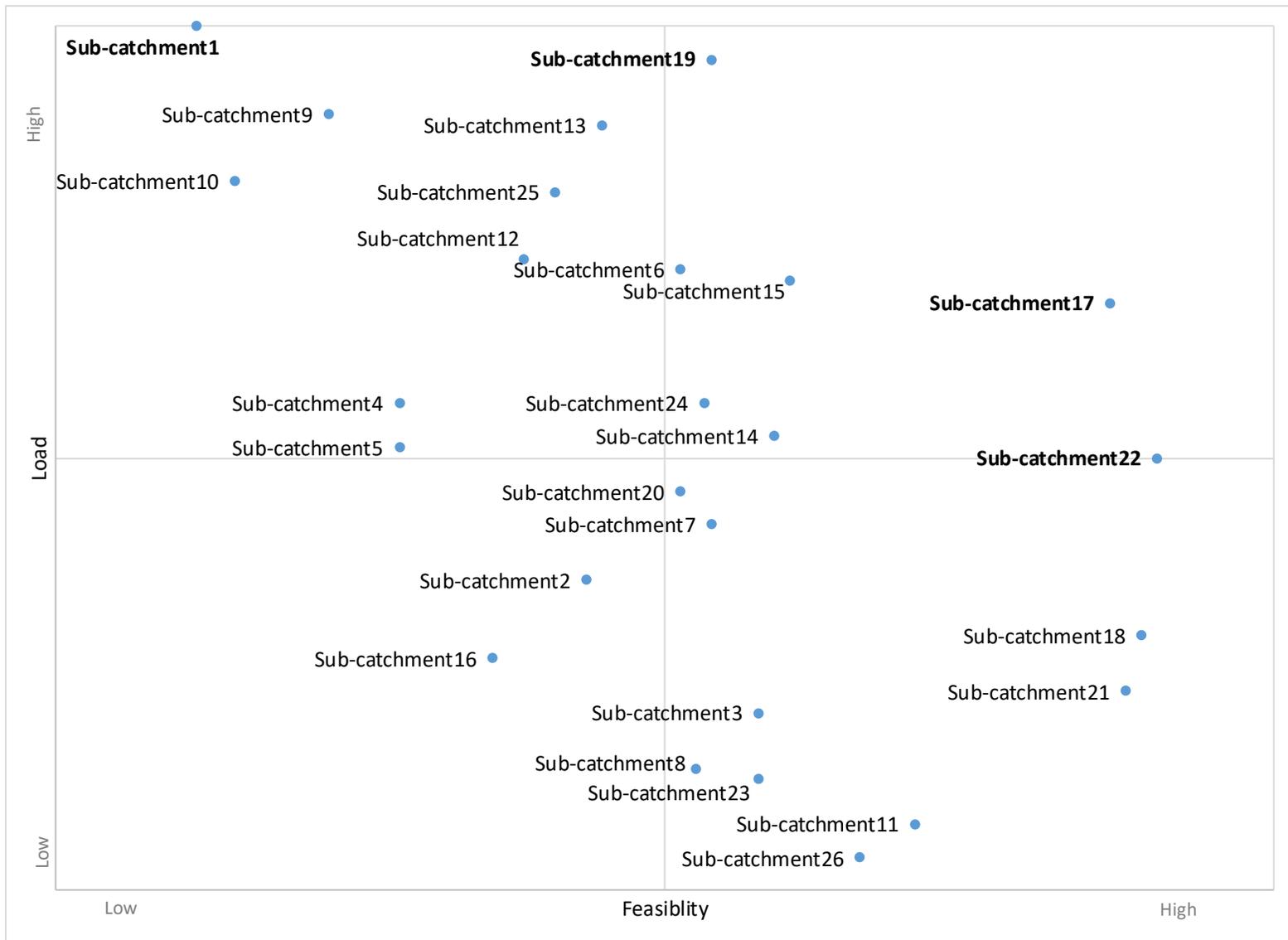


Figure 10 Prioritization based on average ranking relative to water quality loads (TN, TP, Sediment) and feasibility (appraised land value, riparian buffers, and time of travel to Brewer Lake).

Through this lens, sub-catchments with higher feasibility at the same level of water quality load would be identified as preferable (e.g., Sub-catchment 17 would be preferred over sub-catchment 15), and sites with higher load at the same level of feasibility would be identified as preferable (e.g., Sub-catchment 19 would be preferred over sub-catchment 6). **Based on this analysis, sub-catchments 1, 17, 19, and 22 were identified as key opportunities for watershed management actions balancing water quality loading (the project objectives) with feasibility (project constraints).** The reasoning for the selected sub-catchments are:

Sub-catchment 1: highest load score. Although feasibility for BMP implementation was comparatively low, the magnitude and consistency of pollutant loading justified prioritization from a load-reduction standpoint.

Sub-catchment 17: combination of high load with high feasibility

Sub-catchment 19: combination of high load with high feasibility

Sub-catchment 22: highest feasibility score and adjacent to Brewer Lake

Collectively, these four sub-catchments demonstrate how the prioritization framework identifies sites that either contribute disproportionately to pollutant loading, offer favorable conditions for BMP implementation, or represent an optimal balance of both. Their selection illustrates the flexibility of the ranking approach in supporting strategic, data-driven watershed management decisions.

6.2.2 Prioritization Method 2 – Multi-criteria decision analysis (MCDA)

Structured decision making is a broad field of study centered on increasing the transparency and repeatability of decisions across a variety of domains, including environmental science (Gregory and Keeney 2002, Hemming et al. 2022). Many methods have been developed within this field for comparing disparate metrics using a spectrum of qualitative to quantitative techniques (Linkov et al. 2009). Multi-criteria decision analysis (MCDA) provides a set of methods for normalizing metrics with different units and scales and combining those metrics into a single score for comparing alternatives, which has proven particularly useful for the multi-objective context of watershed planning (Yaryan Hall and Bledsoe 2023).

A form of MCDA was used to prioritize sub-catchments in the Brewer Lake watershed using a weighted score based on multiple criteria: flux of sediment, flux of total nitrogen, flux of total phosphorous, proportion of land use in pasture, and time of travel from the catchment outlet to Brewer Lake. The land use and time of travel metrics added to this analysis as indicators of load reduction potential from the sub-catchments to the lake.

6.2.2.1 Scoring Method:

- Each metric was converted to a 1–5 scale for consistency, where 1 = least preferred and 5 = most preferred.
- Flux scores were assigned based on data quantiles:
 - 0–20% = 1,
 - 20–40% = 2,
 - 40–60% = 3,
 - 60–80% = 4,
 - 80–100% = 5.

- Pasture land use was scored by percentage:
 - <30% = 1
 - 30–40% = 2
 - 40–50% = 3
 - 50–60% = 4
 - >60% = 5
- Time of Travel to the lake was normalized and scored:
 - 0 days = 5
 - >0-1.8 days = 4
 - >1.8-2.4 days = 3
 - >2.4-3.5 days = 2
 - >3.5-6.25 days = 1

6.2.2.2 Weighting:

Weights were determined through pairwise comparison of importance:

Phosphorus = 33%, Nitrogen = 27%, Sediment = 20%, Land use = 13%, Time of Travel = 7%.

Finally, all normalized scores were combined using a weighted average to produce an overall priority score (1–5) for each sub-catchment.

The MCDA produced an estimate of the potential for load reduction in each sub-catchment, which can be summarized relative to the individual criteria or the overall weighted score (Table 3). Sub-catchments 1 and 19 show the greatest potential benefit relative to these prioritization criteria. Sub-catchments 9, 10, 13, and 25 also show promise but with slightly lower scores. Based on the MCDA, sub-catchments 1, 9, 10, 13, 19, and 25 are identified as key opportunities for watershed management actions.

Table 3 Summary of MCDA metrics for prioritization. The highlighted rows indicate the top 6 watersheds based on this form of prioritization.

Watershed	Sediment Load	Nitrogen Load	Phosphorous Load	Land Use	Time of Travel	Weighted-score
1	5	5	5	5	1	4.7
2	1	2	2	1	1	1.6
3	1	1	1	2	1	1.1
4	2	3	3	5	1	2.9
5	2	2	2	4	1	2.2
6	3	3	3	4	1	3.0
7	1	3	2	1	2	1.9
8	1	1	1	2	2	1.2
9	3	5	4	4	2	3.9
10	3	4	4	5	2	3.8
11	1	1	1	1	3	1.1
12	3	4	3	3	2	3.2
13	4	4	4	2	3	3.7
14	2	3	2	1	3	2.2
15	3	3	3	1	3	2.7
16	1	1	1	3	3	1.4
17	2	4	3	1	5	2.9
18	1	2	1	1	5	1.5
19	5	5	5	3	4	4.7
20	2	3	2	1	4	2.3
21	1	2	1	1	5	1.5
22	2	3	2	1	5	2.3
23	1	1	1	2	4	1.3
24	3	2	3	5	5	3.1
25	4	3	3	4	4	3.4
26	1	1	1	1	5	1.3

6.3 Brewer Lake Watershed Management Priorities

Eight sub-catchments were identified based on the two different prioritization processes (i.e., 1, 9, 10, 13, 17, 19, 22, and 25) (Figure 11). Sub-catchments 1 and 19 were identified by both prioritization methods due to their high pollutant load and may be considered top priorities in the watershed. Sub-catchments 9, 10, and 13 were also identified by the MCDA as technically important opportunities for managing

pollutant loads in the central valley portions of the basin. Sub-catchments 17, 22, and 25 were identified as key sites for BMPs given their proximity to Brewer Lake.

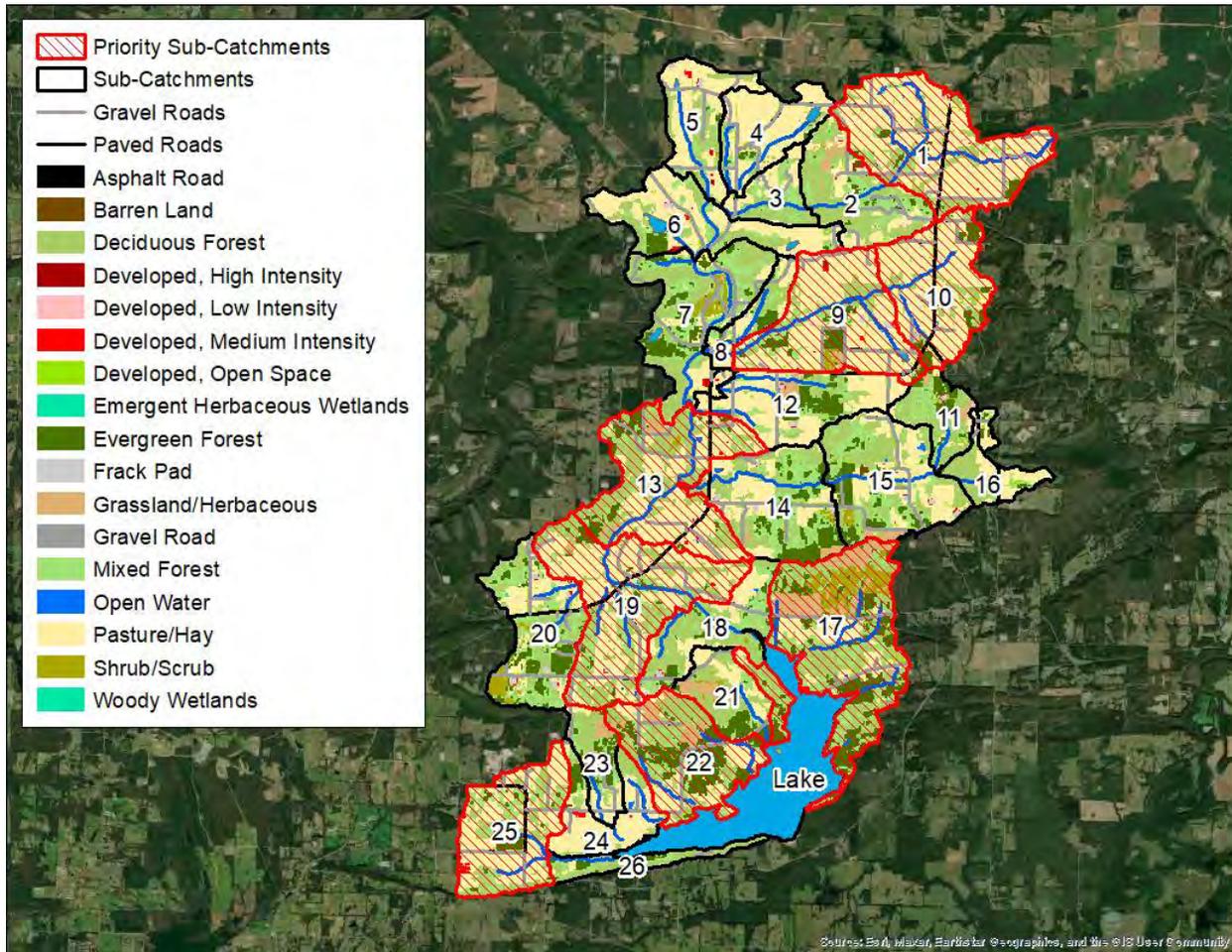


Figure 11 Prioritized Sub-Catchments for BMP Implementation

Table 4 summarizes the priority sub-catchments from both prioritization methods and identifies management actions likely to be appropriate in those basins. The actions were informed by the PLET analysis as well as a qualitative evaluation of local land uses in those areas. Generally, all practices in Section 5 have potential to meaningfully affect water quality outcomes, but Table 4 highlights those showing the greatest promise in light of current land uses.

The priority watersheds represent a significantly reduced footprint (10,300 ac) compared with the watershed as a whole (22,000 ac). Pollutant removal rates from the prior PLET analysis (Figure 8) were applied in these sub-catchments to assess if the watershed-scale load reduction goals can be met in this much smaller areas. Figure 10 presents the pollutant removal loads for each of the three BMP scenarios. **All three BMP scenarios can meet the 15% reduction target for nitrogen, phosphorous, and sediment by taking action only in the priority sub-catchments.** The amount of land required to meet the target can vary substantially. For instance, the pasture-only BMPs would require more than 70% of pasture lands to meet the nitrogen target, whereas the combined BMP scenario would need less than 45% of pasture lands to meet the same goal. Across each scenario, PLET estimates indicate that water quality goals can be met with application of BMPs in 40-50% of pasture lands in these eight sub-catchments.

As discussed in Section 3.0, a primary constraint is the need to avoid impacts to private property rights. Consequently, site-specific management measures on individual parcels were not evaluated. Because this plan does not include parcel-level analysis, it cannot provide a definitive assessment of the feasibility of implementing particular measures within specific catchments. Such feasibility determinations would require detailed, site-specific information that lies beyond the scope and intent of this plan.

Table 4 Summary of sub-catchments prioritized for management intervention.

		Priority Sub-Catchments							
Category	BMPs	1	9	10	13	17	19	22	25
		Stream	Riparian buffers and buffer zones	●	●	●	●		●
Livestock stream access control and exclusion fencing	●			●	●		●		●
Streambank restoration and stabilization			●		●	●	●	●	●
Filter strips of native plants	●		●	●	●		●		●
Farm pond/sediment basins	●		●		●		●		●
Pasture	Prescribed/rotational grazing	●	●	●	●		●		●
	Alternative pasture water sources	●	●	●	●		●	●	●
	Silvopasture establishment	●	●	●					
	Pasture planting and management; heavy use area revegetation	●	●	●	●		●		●
	Nutrient management plans	●	●	●	●	●	●	●	●
	Farm, water quality, and conservation plans	●	●	●	●	●	●	●	●
Other	Prescribed forest burns		●	●	●	●	●	●	
	Dry stacks, composters, and incinerators for poultry houses	●	●						
	Wastewater system management – repair or replacement	●	●	●	●	●	●	●	●
	Unpaved roads management	●	●	●					
	Watershed stewardship education	●	●	●	●	●	●	●	●
	Encourage good neighbor practices	●	●	●	●	●	●	●	●
	Illicit Discharge Detection Elimination	●	●	●	●	●	●	●	●
	Fracking SWPPP		●						

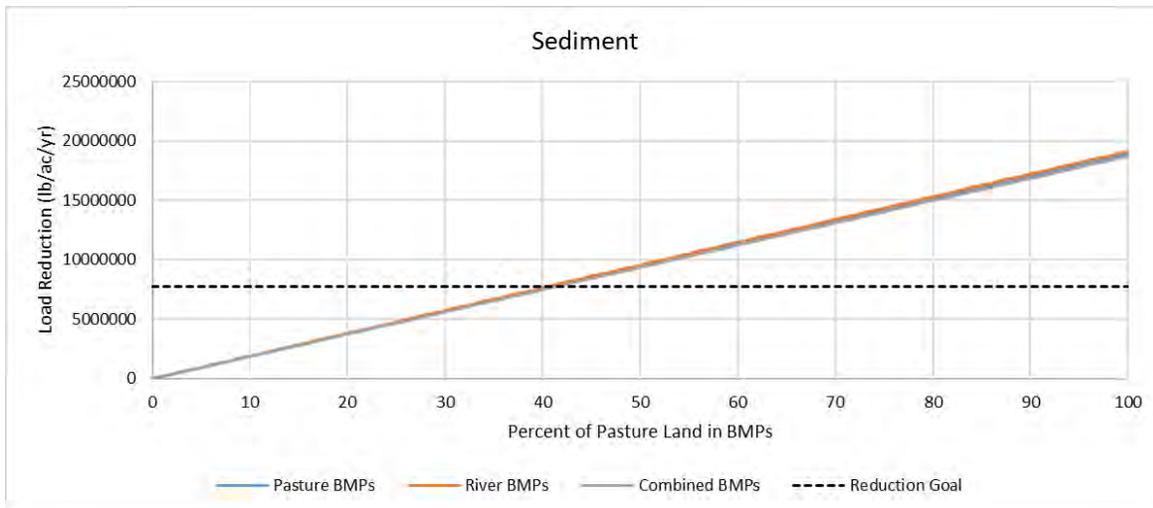
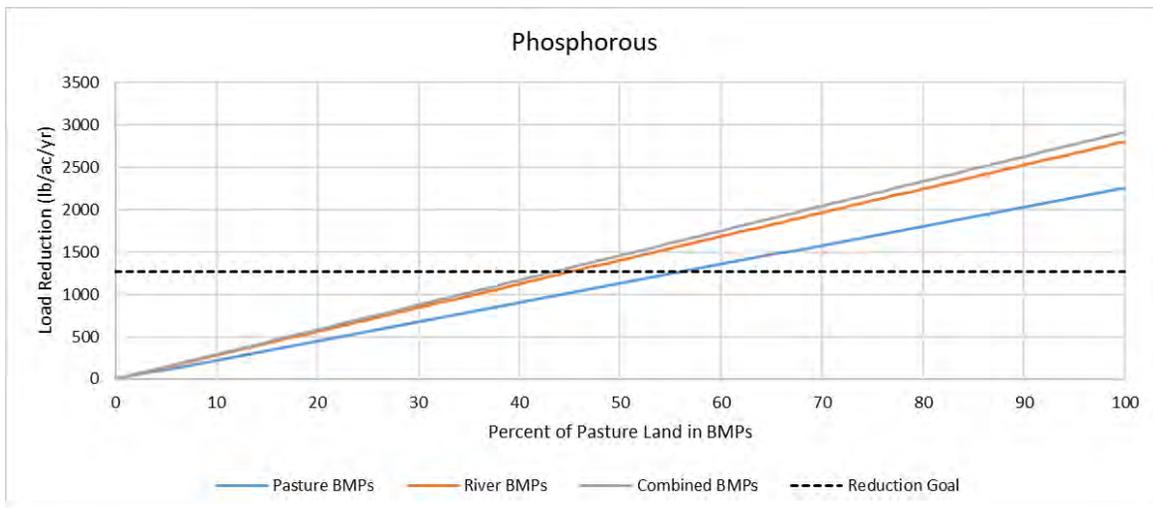
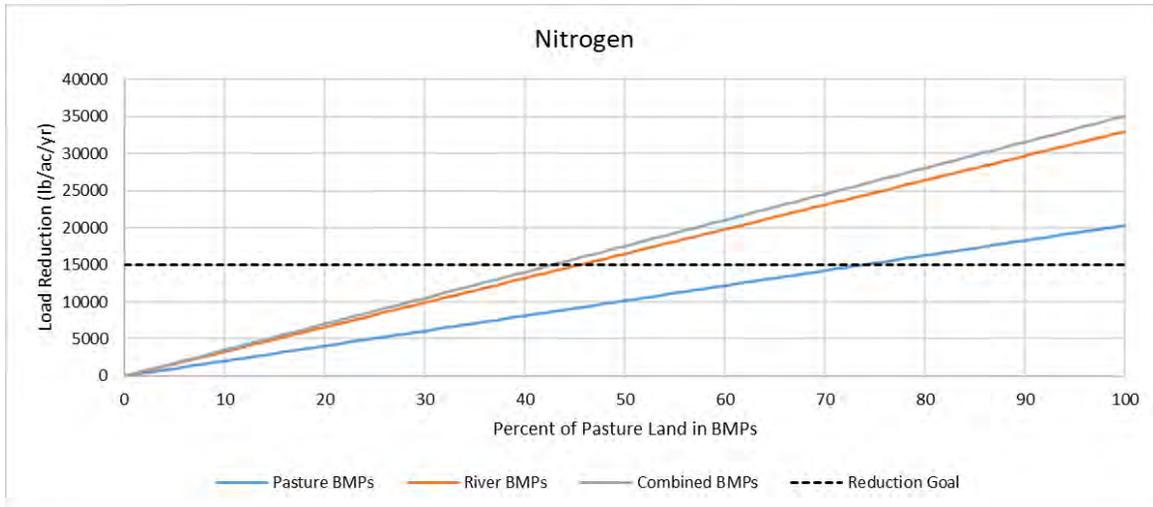


Figure 12 Examination of the extent of BMPs required to meet watershed goals by only taking action in the eight (8) priority sub-catchments. All three BMP scenarios can meet the 15% reduction target for nitrogen, phosphorous, and sediment by taking action only in the priority sub-catchments.

7.0 Executing the Plan

Successful implementation of the Brewer Lake Watershed Management Plan requires a coordinated, multi-year effort that integrates technical expertise, strategic investment, local partnerships, and adaptive management. The goal of implementing this plan is to achieve a 15% reduction in nitrogen, phosphorus, and sediment delivery to Brewer Lake, while strengthening watershed resilience, protecting the municipal water supply, and preserving the ecological integrity of the surrounding landscape. The following plan describes how to execute the management strategy, who will be responsible for individual actions, and how progress will be measured.

The watershed management initiative is designed as a phased, multi-year effort that gradually builds capacity, establishes monitoring programs, implements best management practices (BMPs), and evaluates long-term outcomes. The timeline from 2026 through 2036 highlights key activities, associated costs, and the progression from planning to implementation and review after five years.

7.1 Stakeholder Involvement and Outreach

The process begins with stakeholder involvement, a low-cost but critical first step. Outreach is conducted through the Conway Corp website and stakeholder meetings to ensure broad engagement and transparency. In parallel, efforts to establish funding opportunities take place, including budget development, identifying available funding sources for monitoring and BMP implementation, and exploring land acquisition if needed. A Watershed Coordinator position would benefit the implementation of the management plan. This role oversees grants, contracts, and the coordination of monitoring and implementation efforts throughout the project.

7.2 Coordination

Conway Corporation will serve as the central implementation coordinator, ensuring consistent oversight, budgeting, stakeholder engagement, and reporting. The U.S. Army Corps of Engineers will continue offering technical support and providing review of structural BMP designs and watershed-scale planning. Additional support will come from NRCS, Faulkner County Conservation District, and the Arkansas Department of Agriculture, particularly for agricultural BMPs such as nutrient management plans, rotational grazing systems, pasture planting, and riparian buffer establishment.

To ensure the success of the watershed management plan, coordination with landowners and clear communication with the public are critical. Beginning in 2027, efforts will include launching a new monitoring program to support both short-term and long-term assessments, while engaging residents in high-priority catchments through meetings and educational materials. These activities will help community members understand watershed goals and their role in achieving them. By 2028, as BMP implementation begins, outreach will continue alongside monitoring focused on nutrient and total suspended solids (TSS) analysis to evaluate effectiveness. Regular updates on progress, monitoring results, and any adjustments will be shared through community meetings, newsletters, and online platforms. This approach fosters transparency, builds trust, and ensures stakeholders remain informed and involved throughout the process.

7.3 Monitoring

Protecting Brewer Lake's water quality is essential for sustaining drinking water supplies, recreational opportunities, and ecological health. The monitoring plan provides a comprehensive, science-based framework to assess current conditions, track long-term trends, and evaluate the BMP effectiveness implemented under the watershed management plan.

Existing programs already contribute valuable data. ADEQ monitors lake conditions, USGS provides rainfall, stage, and flow measurements, Conway Corp and CCRWDD track source water quality, and the University of Central Arkansas (UCA) conducts additional monitoring through Dr. Halvorson's lab. These efforts form the foundation for understanding watershed health, but additional monitoring is needed before BMP implementation to strengthen baseline information on nutrient concentrations and sediment loads in both the lake and tributaries.

Additional lake sampling will focus on nutrients, chlorophyll, algal speciation and biomass, dissolved oxygen, cyanotoxin indicators, temperature, and periodic sediment samples to assess legacy nutrients. Tributary sites will be monitored for nutrient levels, sediment loads, seasonal patterns, and reductions to provide a complete picture of watershed conditions. These data will allow us to determine whether BMPs are reducing pollutants and stressors over time, using both qualitative and quantitative measures.

To enhance this framework, a more robust monitoring plan could incorporate continuous sensors for water quality, rainfall, and flow, providing real-time insight into storm events and daily changes that traditional grab samples cannot capture. All sampling will follow a Quality Assurance Project Plan to ensure data integrity and usability.

Beyond water chemistry, periodic biological and habitat assessments—such as macroinvertebrate surveys, streambank condition evaluations, and bank pin installations to measure erosion—could be conducted within the watershed. UCA or other colleges and universities may assist with these efforts. Biological and habitat data will document long-term ecological improvements and provide context that chemical data alone cannot capture, especially when evaluating riparian buffers, stabilization projects, or agricultural conservation practices.

Monitoring results will be reviewed annually by the watershed manager to guide adaptive management, adjust priorities, strengthen efforts, and address emerging issues before they threaten drinking water quality. A broader, multi-year assessment will be completed every five years to document progress across the entire watershed. Reductions in nutrient concentrations and loads, along with biological and ecological indicators, will serve as key measures of success.

7.4 Implementation

Implementation will begin in **eight priority sub-catchments**: 1, 9, 10, 13, 17, 19, 22, and 25. These areas were identified through model-based load rankings and multi-criteria prioritization and offer the greatest potential for reducing nutrient and sediment loading. An overview of the specific BMPs can be found in Appendix F: Management Measures, along with the associated cost for each BMP and the source from which the cost originated. The primary BMPs that were identified included:

Agricultural and Pasture BMPs

- Livestock exclusion fencing and off-stream watering systems
- Rotational grazing plans and pasture planting
- Heavy use area protection
- Nutrient management planning
- Poultry litter storage upgrades (dry stacks, composters, incinerators)

Riparian and Stream Corridor BMPs

- Forested and grassed buffer installation
- Streambank stabilization along active erosion reaches
- Silvopasture establishment at forest–pasture interfaces

Wastewater Management

- Septic system inspections, repairs, and targeted replacements

Watershed Education & Stewardship

- Landowner workshops and field demonstrations
- Good-neighbor BMP guidance
- Illicit discharge detection and community reporting mechanisms

The implementation framework in Table 5 outlines a coordinated set of agricultural, riparian, septic, and stormwater actions targeted across priority catchments in the Brewer Lake watershed. Spanning ten (10) years, these practices collectively aim to improve pasture condition, stabilize stream corridors, reduce sediment inputs into Brewer Lake, and lower TN/TP loads with clear metrics such as improved acres, feet of buffer installed, reduction in nutrient and sediment delivery to Brewer Lake, and reduced algal blooms in Brewer Lake.

Table 5 Implementation framework for the Brewer Lake watershed plan

Action Category	Specific Action	Lead Entity	Supporting Partners	Priority Catchments	Timeline	Expected Outcome/Metric
Pasture & Agricultural BMPs	Rotational grazing, pasture planting, heavy use area protection	NRCS, Conway Co. CD	Landowners, Conway Corp	1, 9, 10, 19, 25	Yrs 1-6	Acres improved; reduced TN/TP runoff, reduced algal blooms
	Livestock exclusion fencing & off-stream water	NRCS	Conway Corp, Landowners	1, 9, 10, 13, 19	Yrs 1-5	Linear feet fenced; livestock exclusion achieved
	Nutrient management plans	NRCS	Extension Service	1, 19, 25	Yrs 1-10	Acres under NMP; manure application efficiency, reduced algal blooms
	Poultry litter management (dry stack, composting)	Land owners	NRCS, Conway Corp	1, 9, 25	Yrs 2-7	Reduction in nutrient loss from poultry operations
Riparian & Stream Corridor BMPs	Riparian buffer installation	Conway Corp	NRCS, USACE	1, 13, 17, 19, 22	Yrs 2-8	Feet of buffer; improved bank stability, ecological improvement
	Streambank stabilization	USACE	Conway Corp, Contractors	13, 17, 19, 22	Yrs 3-8	Sediment reduction (tons); stable bank slopes
	Silvopasture establishment	NRCS	Landowners	1, 9, 10	Yrs 3-7	Acres converted; enhanced infiltration
Septic	Septic Inspections	Conway County EHS	Landowners	1, 9, 10, 19, 25	Yrs 1-10	Septic repaired/maintained, reduced TN/TP runoff, reduced algal blooms
Road & Stormwater BMPs	Upgrade unpaved roads (crowning, graveling)	County Road Dept.	Conway Corp	9, 10, 25	Yrs 1-6	Sediment reduction estimates, miles improved
	Ditch/culvert stabilization & sediment traps	County, NRCS	Conway Corp	9, 10	Yrs 2-6	Improved drainage; localized sediment control
	Update SWPPP for fracking pads	SEECO	ARDEP, Conway Corp	9	Yrs 5-7	Improved drainage; localized sediment control

7.5 Funding

Implementing a comprehensive watershed management plan for Brewer Lake will require a flexible funding strategy, as overall costs can vary significantly depending on the specific Best Management Practices (BMPs) selected. Structural practices such as streambank stabilization, livestock exclusion systems, and septic system upgrades typically involve higher upfront expenses, while educational programs, landowner outreach, and monitoring activities may require comparatively lower but recurring investments. The extent of landowner participation, site-specific conditions, availability of assistance, and long-term maintenance needs will also influence total project costs.

To address these challenges, the Brewer Lake Watershed Management Plan should leverage multiple funding sources, local match, and in-kind contributions. Examples of potential funding mechanisms include EPA Section 319 Nonpoint Source Grants, which have historically supported watershed projects in central Arkansas, as well as Arkansas Natural Resources Division cost-share programs, USDA NRCS Environmental Quality Incentives Program (EQIP) for agricultural BMPs, and state revolving funds for septic system upgrades. Aligning priority BMPs with the most appropriate funding programs will help manage financial uncertainty and maximize the effectiveness and sustainability of watershed improvements. BMP-specific costs are detailed in Appendix F, while available funding assistance and target programs are listed in Appendix I.

7.6 Watershed-Lake Water Quality Linking

The ultimate goal of this watershed management plan is to protect and maintain water quality in Brewer Lake. Historic monitoring data and the existing watershed model provide a strong foundation for understanding baseline conditions and identifying nutrient sources across the watershed. This model can be updated to reflect management actions and the nutrient reductions expected from each. Developing a dynamic lake model linked to watershed loading will allow us to evaluate the impact of reduced nutrient inputs on lake conditions. Ideally, the lake model should be a coupled two- or three-dimensional hydrodynamic and water quality model capable of simulating spatial and temporal changes in temperature, dissolved oxygen, nutrient concentrations, and algal communities. If a lake model is pursued, sampling in the lake should be coordinated with watershed monitoring so that both datasets integrate seamlessly into the models. By coupling watershed load reductions with reservoir response modeling, stakeholders can better predict outcomes under different management scenarios, optimize BMP placement, and ensure long-term protection of water supply and ecological health.

7.7 Summary

The successful execution of the Brewer Lake Watershed Management Plan will depend on maintaining momentum, transparent communication, and a long-term commitment from all participating partners. As implementation progresses, tracking outcomes, adapting strategies based on monitoring results, and continuously engaging landowners and local stakeholders will be essential to sustaining improvements in water quality and watershed health. By aligning additional monitoring, targeted investments in higher priority catchments, community stewardship, and science-based adaptive management, Conway Corporation, CCRWDD and its partners will position Brewer Lake for long-term protection as a reliable drinking water source and resilient ecological resource. This plan provides a clear framework for action, but its success will ultimately hinge on consistent follow-through, cooperative adaptive management, and a shared commitment to protecting the drinking water source and its watershed.

8.0 References Cited

ATTRA – National Center for Appropriate Technology. 2016. Rotational grazing.

ATTRA – National Center for Appropriate Technology. 2023. Planting and managing pastures.

Baker, L., Evans-White, M.A. and Entekin, S., 2018. Basin risk explains patterns of macroinvertebrate community differences across small streams in the Fayetteville Shale, AR. *Ecological Indicators*, 91, pp.478-489.

Center for Biological Diversity (CBD). 2025. Map: U.S. Threatened and Endangered Species by County. https://www.biologicaldiversity.org/programs/population_and_sustainability/T_and_E_map/#. Accessed November 14, 2025.

Cleaves, D. A., Martinez, J., & Haines, T. K. 2000. Influences on prescribed burning activity and costs in the National Forest System (General Technical Report SRS-37). U.S. Department of Agriculture, Forest Service, Southern Research Station.

Davis, C.A. 2012. Assessing the impacts of surface water removal for use in natural gas extraction on a watershed level. Master's Thesis. University of Arkansas.

Dillard M., Brooks C., Fisher H., Pietersen H., Nijhuis A., van Breda A., and Durden S. 2021. Engaging Communities and Stakeholders in Implementing NNBF. Chapter 3 in *International Guidelines on Natural and Nature-Based Features for Flood Risk Management*. Edited by T. S. Bridges, J. K. King, J. D. Simm, M. W. Beck, G. Collins, Q. Lodder, and R. K. Mohan. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Donald, J. 2023. Commercial poultry mortality management economics. Alabama Cooperative Extension System.

EJScreen. 2025. Environmental Justice Screening and Mapping Tool (Version 2.3). Public Environmental Data Partners. <https://pedp-ejscreen.azurewebsites.net/>. Accessed on November 14, 2025.

EPA. 2023. Best Management Practice Definitions Document for Pollutant Load Estimation Tool. U.S. Environmental Protection Agency.

EPA. 2007. Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments. U.S. Environmental Protection Agency.

Freeman, M.C., Buell, G.R., Hay, L.E., Hughes, W.B., Jacobson, R.B., Jones, J.W., Jones, S.A., LaFontaine, J.H., Odom, K.R., Peterson, J.T. and Riley, J.W., 2013. Linking river management to species conservation using dynamic landscape-scale models. *River Research and Applications*, 29(7), pp.906-918.

Flotemersch, J.E., Leibowitz, S.G., Hill, R.A., Stoddard, J.L., Thoms, M.C. and Tharme, R.E., 2016. A watershed integrity definition and assessment approach to support strategic management of watersheds. *River Research and Applications*, 32(7), pp.1654-1671. \ FTN Associates, Ltd. (2018, May 22). Buffalo River Watershed-Based Management Plan. Arkansas Natural Resources Commission.

FTN Associates, Ltd. 2012. Watershed-Based Management Plan for the Upper Illinois River Watershed, Northwest Arkansas. Arkansas Natural Resources Commission.

FTN Associates, Ltd. 2016a. Cache River Watershed-Based Management Plan. Arkansas Natural Resources Commission.

FTN Associates, Ltd. 2016b. Strawberry River Watershed-Based Management Plan. Arkansas Natural Resources Commission.

FTN Associates, Ltd. 2018. Buffalo River Watershed-Based Management Plan. Arkansas Natural Resources Commission.

GBMC & Associates. 2015a. Lee Creek Reservoir and Lee Creek Watershed Management Plan. Fort Smith Utility Department.

GBMC & Associates. 2015b. Upper Frog Bayou Watershed: Watershed Management Plan. Fort Smith Utility Department.

Gregory, R.S. and Keeney, R.L., 2002. Making smarter environmental management decisions. *Journal of the American Water Resources Association*, 38(6), pp.1601-1612.

Hamilton, J. (Ed.). 2008. *Silvopasture: Establishment & management principles for pine forests in the Southeastern United States*. USDA National Agroforestry Center.

Hart, R.M., 2014. Simulated effects of existing and proposed surface-water impoundments and gas-well pads on streamflow and suspended sediment in the Cypress Creek watershed, Arkansas. *Scientific Investigations Report 2014-5057*. US Geological Survey.

Hemming, V., Camaclang, A.E., Adams, M.S., Burgman, M., Carbeck, K., Carwardine, J., Chadès, I., Chalifour, L., Converse, S.J., Davidson, L.N. and Garrard, G.E., 2022. An introduction to decision science for conservation. *Conservation biology*, 36(1), p.e13868.

Hudson River Foundation (HRF). 2021. Harbor-wide water quality monitoring report 2021. New York / New Jersey Harbor & Estuary Program.

Hyde, C., & Oakes, P. 1998. *Pond building: A guide to planning, constructing & maintaining recreational ponds (ANR-1114)*. Alabama Cooperative Extension System.

International Association for Public Participation (IAP2). 2018. *Spectrum of public participation*. <https://www.iap2usa.org/cvs>. Accessed October 23, 2025.

Johnson, E., Austin, B.J., Inlander, E., Gallipeau, C., Evans-White, M.A. and Entekin, S., 2015. Stream macroinvertebrate communities across a gradient of natural gas development in the Fayetteville Shale. *Science of the Total Environment*, 530, pp.323-332.

Leasure, D.R., Magoulick, D.D. and Longing, S.D., 2016. Natural flow regimes of the Ozark–Ouachita interior highlands region. *River Research and Applications*, 32(1), pp.18-35.

Linkov, I., Loney, D., Cormier, S., Satterstrom, F.K. and Bridges, T., 2009. Weight-of-evidence evaluation in environmental assessment: review of qualitative and quantitative approaches. *Science of the Total Environment*, 407(19), pp.5199-5205.

McKay, S.K., Theiling, C.H. and Dougherty, M.P., 2019. Comparing outcomes from competing models assessing environmental flows in the Minnesota River Basin. *Ecological Engineering*, 142, p.100014.

Miller S. 2006. Watershed Management Plan For the Kings River Watershed Northwest Arkansas & Southwest Missouri HUC: 1101001. Kings River Watershed Partnership.

Montgomery, D.R., Grant, G.E. and Sullivan, K., 1995. Watershed analysis as a framework for implementing ecosystem management. *Journal of the American Water Resources Association*, 31(3), pp.369-386.

Mulhollem, J. 2021. Novel study looks at nitrogen credit trading to spur growth of riparian buffers. *Penn State News*.

National Land Cover Dataset (NLDC). 2025. <https://www.usgs.gov/centers/eros/science/national-land-cover-database>. Accessed January 8, 2025.

New Cost Report. (n.d.). Cost to replace a septic system: Budget guide. New Cost Report.

Newman, N. (2025, April 21). Iowa's average custom no-till rate increases by 65 cents in 2025. *No-Till Farmer*.

North American Land Data Assimilation System (NLDAS). 2025. <https://ldas.gsfc.nasa.gov/nldas>. Accessed November 14, 2025.

Pfost, D., Gerrish, J., Davis, M., & Kennedy, M. (n.d.). Pumps and watering systems for managed beef grazing (EQ380). University of Missouri Extension.

Rural Roads. (n.d.). Road maintenance realities. *Rural Roads*.

Santeford, L.G. and Martin., W. 1980. The Conway water supply: Results of archeological survey and testing and a historical survey of a proposed reservoir area in Conway County, Arkansas. Project Number 340, Arkansas Archeological Survey, Fayetteville, Arkansas.

SERA-17. (n.d.). Grassed waterways. SERA-17: Southern Extension and Research Activities Information Exchange Group. Ohio State University Extension. (n.d.). Grassed waterways (NRCS 412). Ohio State University Agricultural BMPs.

Sharif, H.O., Crow, W., Miller, N.L. and Wood, E.F., 2007. Multidecadal high-resolution hydrologic modeling of the Arkansas–Red River basin. *Journal of Hydrometeorology*, 8(5), pp.1111-1127.

Sustainable Agriculture Research and Education (SARE). (2019). Cover crop economics: Opportunities to improve your bottom line in row crops. SARE.

USDA-NRCS. 2005. Pasture and hayland planting: Conservation practice standard (CPS 512). U.S. Department of Agriculture, Natural Resources Conservation Service.

USDA-NRCS. 2006. Conservation practice standard: Fence (CPS 382). U.S. Department of Agriculture, Natural Resources Conservation Service.

USDA-NRCS. 2018. Heavy use area protection: Conservation practice standard (CPS 561). U.S. Department of Agriculture, Natural Resources Conservation Service.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2023. Arkansas conservation practice scenarios (Fiscal Year 2023). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2024. State cost list (Fiscal Year 2024). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. (n.d.). Arkansas EQIP. Environmental Quality Incentives Program. USDA NRCS.

USDA-NRCS. (n.d.). Field office technical guide (FOTG). U.S. Department of Agriculture, Natural Resources Conservation Service.

USDA-NRCS. (n.d.). Riparian forest buffer: Conservation practice standard (CPS 390). U.S. Department of Agriculture, Natural Resources Conservation Service.

U.S. Environmental Protection Agency (USEPA). 2008. Handbook for developing watershed plans to restore and protect our waters. EPA 841-B-08-002, Nonpoint Source Control Branch, Office of Water, United States Environmental Protection Agency, Washington, DC.

U.S. Environmental Protection Agency. 2008. Riparian buffer design and maintenance for water quality protection. EPA 841-B-07-006.

U.S. Environmental Protection Agency (USEPA). 2012. Identifying and protecting healthy watersheds: Concepts, assessments, and management approaches. EPA 841-B-11-002, Office of Wetlands, Oceans, and Watersheds, Office of Water, United States Environmental Protection Agency, Washington, DC.

U.S. Environmental Protection Agency (USEPA). 2012. Pollutant Load Estimation Tool (PLET). <https://www.epa.gov/nps/plet> Accessed February 11, 2025.

U.S. Environmental Protection Agency (USEPA). 2000. Ambient water quality criteria recommendations information supporting the development of state and tribal nutrient criteria for rivers and streams in nutrient Ecoregion XI. EPA 822-B-00-020. Office of Water, Office of Science and Technology, Health and Ecological Criteria Division Washington, D.C.

U.S. Army Corps of Engineers. 1993. *Engineering and design: Civil works cost engineering* (Engineer Regulation ER 1110-2-1302). Department of the Army.

U.S. Army Corps of Engineers (USACE). 2022. Water resource policies and authorities: Watershed studies. ER 1105-2-102, Headquarters, Washington, D.C.

U.S. Army Corps of Engineers (USACE). 2023. Planning: Policy for conducting Civil Works Planning studies. ER 1105-2-103, Headquarters, Washington, D.C.

URS Corporation, Ecological Services Group, & Thoma, R. 2009. Lower Black River Ecological Restoration Master Plan. Prepared for U.S. Environmental Protection Agency, Great Lakes National Program Office.

Woods A.J., Foti, T.L., Chapman, S.S., Omernik, J.M., Wise, J.A., Murray, E.O., Prior, W.L., Pagan, J.B., Jr., Comstock, J.A., and Radford, M., 2004, Ecoregions of Arkansas (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,000,000).

Yan, H. and Edwards, F.G., 2013. Effects of land use change on hydrologic response at a watershed scale, Arkansas. *Journal of Hydrologic Engineering*, 18(12), pp.1779-1785.

Yaryan Hall, H.R. and Bledsoe, B.P., 2023. Integrated urban riverscape planning: Spatial prioritization for environmental equity. *ASCE OPEN: Multidisciplinary Journal of Civil Engineering*, 1, p.04023004.

Zhang, Q., Blomquist, J.D., Fanelli, R.M., Keisman, J.L., Moyer, D.L. and Langland, M.J., 2023. Progress in reducing nutrient and sediment loads to Chesapeake Bay: Three decades of monitoring data and implications for restoring complex ecosystems. *Wiley Interdisciplinary Reviews: Water*, 10(5), p.e1671.

9.0 Acknowledgements

This project was supported by the Tulsa District of the U.S. Army Corps of Engineers and the Conway Corporation, under the direction of Sarah Austin, USACE's Project Manager. Other agencies and organizations advised on the development of the watershed management plan, including the USDA, Conway County Regional Water Distribution District, and the Arkansas Department of Agriculture. Additionally, watershed residents and stakeholders provided input through a series of public meetings, and their input is gratefully acknowledged. At Black & Veatch, Jeff Henson and Matt Scott were the project managers and Drew Ackerman and Todd Keniry led the development and application of the HSPF model. At Woolpert, Julianna Hunter and Michael Long led watershed planning, and Julia Ruff, Maya Burns, and Kyle McKay contributed to analyses and report preparation.

10.0 List of Appendices

Appendix A: Geospatial Data and Watershed Characteristics

Appendix B: Carbon Agreement

Appendix C: Stakeholders, Meeting Records, Public Involvement, & Website

Appendix D: Water Quality Standards

Appendix E: HSPF Model Development

Appendix F: Management Measures

Appendix G: PLET Model Application

Appendix H: Catchment Prioritization

Appendix I: Potential Funding Assistance Programs

Appendix A: Geospatial Data and Watershed Characteristics

Appendix A: Geospatial Data and Watershed Characteristics

Physical and Natural Features

The Brewer Lake watershed has generally moderate slopes and is characterized by mixed rural land uses, including undeveloped forests and agriculture. Forests are both deciduous and evergreen. Agriculture includes hay, pasture, and livestock farming.

The watershed is oriented north-south, with Brewer Lake on the south end of the watershed and Cypress Creek running from north to south. There are no population centers in the watershed, but isolated homes, agricultural buildings, roads, and fracking pads provide impervious cover.

Brewer Lake and its watershed are contained within the “Arkansas River Valley” EPA Level III ecoregion. Ecoregions are areas where ecosystems (and the type, quality, and quantity of environmental resources) are generally similar. These are identified by analyzing the patterns and composition of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity. These phenomena include geology, landforms, soils, vegetation, climate, land use, wildlife, and hydrology. The relative importance of each characteristic varies from one ecological region to another, regardless of the hierarchical level.

Watershed Boundaries

The Brewer Lake watershed is in central Arkansas, approximately 15 miles northwest of Conway, AR. The watershed encompasses the area draining to Brewer Lake and is defined by the HUC 12 boundary (111102050201) and is roughly 36 square miles in size, primarily Cypress Creek and its tributaries. Its upland boundaries follow ridgelines in northwestern Conway County, surrounding the headwaters of Cypress Creek and smaller feeder streams. The location of this watershed falls just outside (to the East) of a previously adopted Watershed Management Plan: the Lake Conway Point Remove Watershed Management Plan (2023).

Vegetation

The Brewer Lake watershed is 42% hay and pasture. The primary species present are bermudagrass and fescue. Shrub and grasslands make up 4%. 23% of the area is deciduous forests made up of oak and hickory. Evergreen forests make up 9% of the watershed. These are composed of shortleaf pine, longleaf pine, and loblolly pine. Mixed forests account for 13% of the watershed. Much of what was grassland has been converted to pasture. Being aware of native and present species is important, as many treatment measures rely on vegetation (e.g. buffer strips, grassed waterways) and it is important to use species that will thrive.

Table 1 Land Use Distribution in the Brewer Lake Watershed

Percent Area Developed	Percent Area Pasture	Percent Area Forest	Percent Area Other
6.7%	42.2%	45.4%	5.6%

Wildlife Resources—Endangered and Threatened Species and Fisheries

Projects that qualify for state or federal funding may be required to assess potential impacts on endangered species. Because some practices suggested in this report may qualify for government funding, it is important to be aware of endangered species that could be present in the Brewer Lake watershed. The Arkansas state endangered species list can be found on the Arkansas Game and Fish

Commission webpage. The entire federal list can be found on the U.S. Fish and Wildlife Services ECOS website alongside a non-exhaustive list of species believed or known to exist in Arkansas.

The Center for Biological Diversity: U.S. Threatened and Endangered Species by County website allows users to filter the federal endangered species list by county. According to this tool, ten species from the federal endangered species list are known to have ranges that overlap with Conway County. Species impact assessments will need to include, but may not be limited to:

- Alligator snapping turtle (*Macrochelys temminckii*)
- Gray bat (*Myotis grisescens*)
- Harperella (*Ptilimnum nodosum*)
- Indiana bat (*Myotis sodalist*)
- Monarch butterfly (*Danaus plexippus*)
- Northern long-eared bat (*Myotis septentrionalis*)
- Ozark big-eared bat (*Corynorhinus townsendii ingens*)
- Piping plover (*Charadrius melodus*)
- Scaleshell mussel (*Leptodea leptodon*)
- Tricolored bat (*Perimyotis subflavus*)

Sensitive Areas

Stream segments listed as sensitive areas or as 303(d) stream sections may require additional assessment or treatment if they are found within the watershed.

Owing to the cumulative effects of land uses in the watershed, Hill Creek in the southwest corner of the watershed contains a low priority site on the EPA's 303d list for the biological integrity of fish.

Cypress Creek, Stratton Creek, and Brindley Creek have no 303(d) listings.

No sensitive areas are contained within the Brewer Lake watershed

Agricultural Animal Numbers:

The amount of manure produced in the watershed and applied to pasture lands was a significant source of nutrients and a point of significant discussion with the Team during model development. There were a total of 19 chicken houses with broilers and 5 with layers with an estimated 25,000 chickens per house, using a combination of information from PLET (US EPA, 2025) and discussions and the Team. Other animal estimates were calculated from county population information (USDA, 2025) and scaled to watershed area.

Table 2 Estimated Animal Populations in the Brewer Lake Watershed

Animal	Count
Chickens, Broilers	475,000*
Chickens, Layers	125,000
Cows, Beef	3,042
Cows	2,000
Calves	1,042
Horses	88
Pigs/Hogs/Swine	4,000
Sheep	37

Socioeconomics:

Watershed restoration and protection efforts are most effective when environmental outcomes are aligned with the social and economic conditions of the communities they serve. Increasingly, federal and state funding programs recognize that water quality impairments often intersect with socioeconomic challenges such as limited household income, aging infrastructure, land-use constraints, and reduced capacity to implement best management practices (BMPs). Incorporating socioeconomic factors into watershed planning allows resource managers to prioritize investments where both environmental and community benefits can be maximized.

Socioeconomic indicators, including income levels, reliance on agriculture, and environmental justice considerations, can be leveraged to demonstrate need and feasibility in grant applications. These data help document barriers to voluntary BMP adoption, justify financial assistance or incentive-based approaches, and support cost-share structures that reflect local capacity. Table 3 shows the population statistics in the watershed along with other key demographic information.

The Brewer Lake watershed is contained within Conway County, Arkansas. During the 2020 US Census, Conway County had a population of 20,715 people and is a 0.97% decrease from the 2010 census. Figure 1 and Figure 2 show the population distribution within the watershed.

The median household income is \$51,212 and 20.6% of the population is below the federal poverty line. This is in comparison to a national average of \$77,719 and 12.5%. The unemployment rate of Conway County is 4.4% compared to the national average of 4.2%.

The median age of Conway County is 42.6 years, and it has an aging population. Conway County's residents primarily identify as white (79%). 11% of the population is black and 4.2% are Hispanic/Latino.

EJScreen was an EPA tool for visualizing regional environmental impacts. According to EJScreen, Conway County is in the 74th percentile for drinking-water quality noncompliance and in the 64th for toxic wastewater discharges.

Table 3 Socioeconomic Statistics of the Brewer Lake Watershed

	Conway County	Arkansas	USA
Total Population (2020)	20,715	3,011,524	331,449,281
Total Population (2010)	21,273	2,915,918	308,745,538
White Population	79.0%	70.2%	61.6%
Hispanic/Latino Population	4.2%	8.5%	18.7%
Black/African American Population	10.7%	15.1%	12.4%
Median Household Income	\$51,212	\$58,700	\$77,719
Population Below Poverty Line	20.6%	15.7%	12.5%
Education (Bachelor's or Higher)	18.2%	16.2%	36.2%
Employment	51.6%	56.1%	60.6%
Unemployment Rate	4.4%	3.6%	4.2%
Median Age	42.6 yrs	38.9 yrs	39.2 yrs
Disabled Population	24.4%	18.0%	13.6%

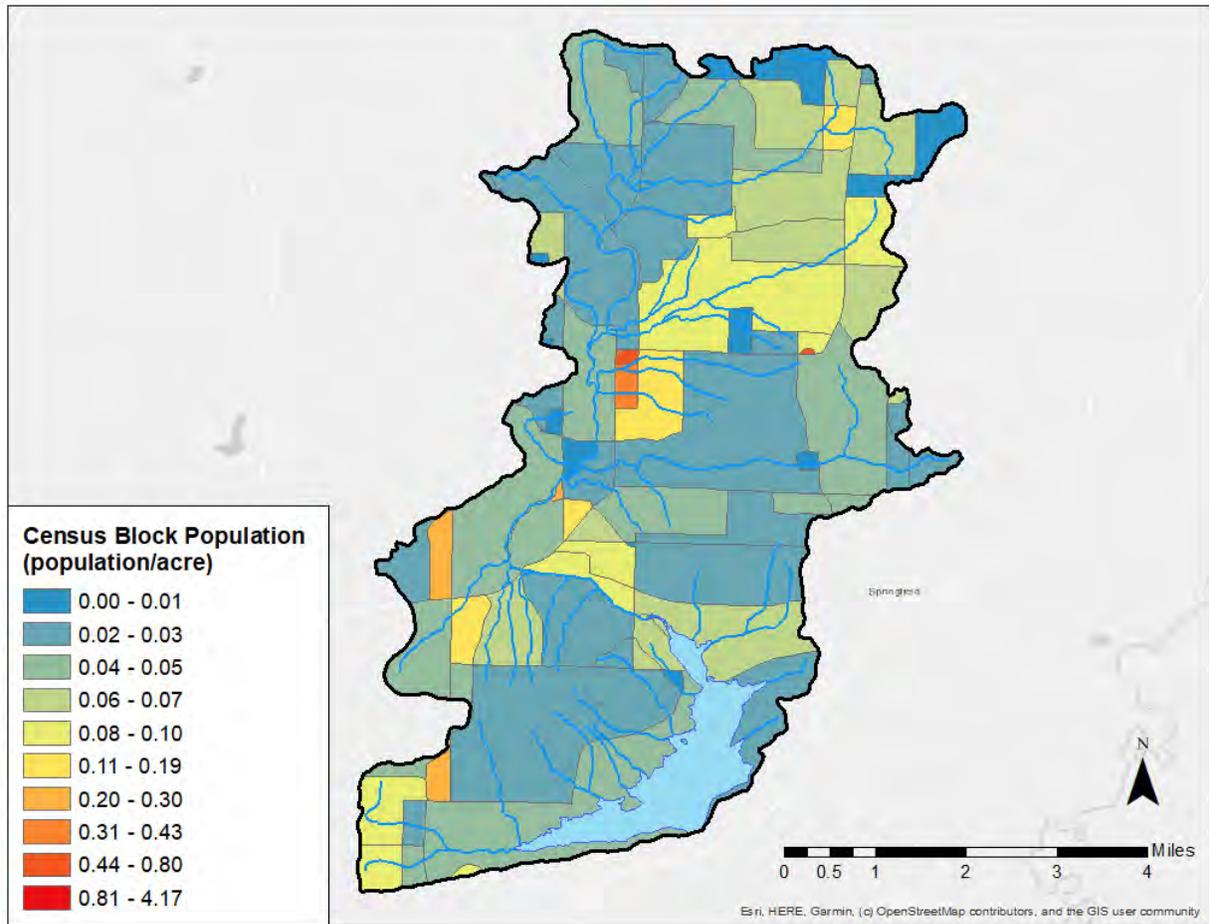


Figure 1 Watershed Population per Acre from 2020 Census

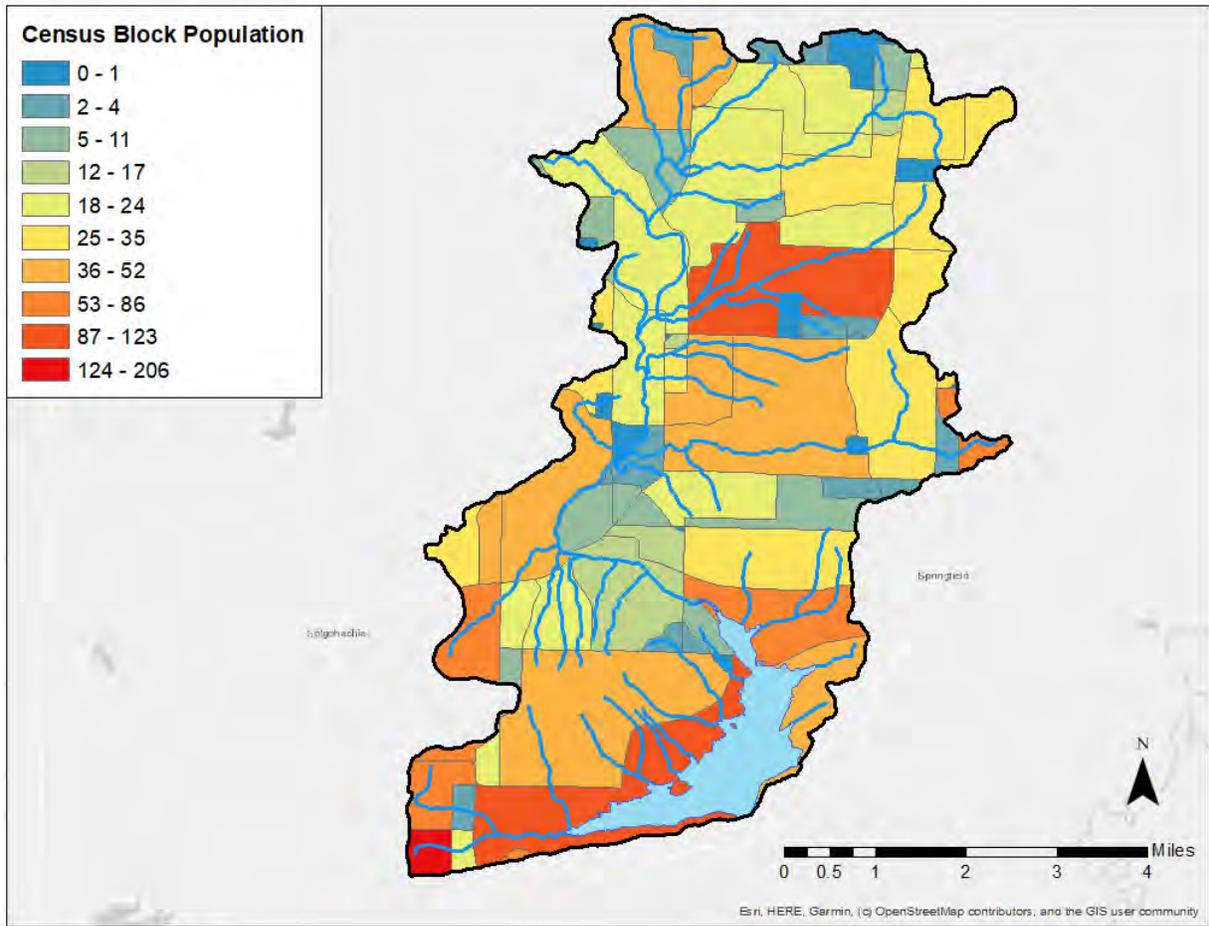


Figure 2 Watershed Area Weighted Population from 2020 Census

References

USEPA. 2025. Pollutant Load Estimation Tool (PLET). <https://www.epa.gov/nps/plet>

Appendix B: Carbon Agreement

**Upon Recording,
Please Return To:**
NativState LLC
1510 Mill Street
Conway, AR 72034

CARBON AGREEMENT

THIS CARBON AGREEMENT (this “Agreement”), dated effective as of 22nd day of September, 2025 (the “Effective Date”), is entered into between NativState LLC, a Delaware limited liability company (“NativState”), having an address of 1510 Mill Street, Conway, Arkansas 72034, and City of Conway, Faulkner County, Arkansas, a municipal corporation of Arkansas (“Owner”), having an address of 111 Main Street, Conway, AR 72032. NativState and Owner shall be referred to herein, individually, as a “Party,” and collectively, as the “Parties.” All capitalized terms shall have the meanings assigned to them in Schedule 1 attached hereto and incorporated by reference herein.

Recitals

A. Owner owns approximately 2,373.97 acres of land (the “Lands”), as described in Exhibit A attached hereto and incorporated by reference herein.

B. NativState is engaged in the development of carbon offset and other ecological credit offset and biodiversity projects.

C. The Parties desire to have NativState develop a carbon offset project (and potentially other ecological or biodiversity projects as available when feasible) on the Lands in accordance with the terms hereof.

Agreement

IN CONSIDERATION OF TEN DOLLARS (\$10.00), the mutual covenants contained herein, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereby agree:

1. ***Grant.*** Owner hereby grants, leases, lets and demises unto NativState the Lands exclusively and solely for the purpose of Improved Forest Management on the Lands, the Forest located upon the Lands, any and all Credits generated therefrom, and the right of access in, to, on, over and across the Lands.

2. ***Reservation.*** Except as provided in Section 1 above, and subject to the terms and conditions hereof, Owner hereby reserves all right, title and interest in, to and under the Lands, including: (a) the right of entry upon the Lands to engage in Selective Cut of the Forest located thereon, and to receive and retain the proceeds of sale thereof; (b) hunting, fishing, and other recreational uses of the Lands; and (c) all oil, gas, minerals, and geothermal resources in, to and under the Lands.

3. ***Term.*** The term (the “Term”) of this Agreement shall commence on the Effective Date and shall remain in full force and effect for forty (40) years from and after the Effective Date, and as long thereafter as Improved Forest Management continues upon the Lands. Notwithstanding the foregoing, if a Project for Improved Forest Management covering the Lands is not submitted by NativState for Listing by a Registry on or before the fifth anniversary of the Effective Date, this Agreement shall expire automatically. From and after forty (40) years after the Effective Date, if Owner determines that the value

of the merchantable timber on the Lands is greater than the value of the Royalty, Owner shall have the right, but not the obligation, to terminate this Agreement by written notice delivered to NativState.

4. **Royalty.** NativState shall pay Owner a royalty (the “Royalty”) on the gross proceeds received by NativState from the sale of Credits (attributable to Owner’s Lands) to a third party. The Royalty is structured as follows:

- a. **Fixed Portion.** Fifty percent (50%) of the royalty will be a fixed amount equal to a proportionate thirty percent (30%) of the gross proceeds from the sale of Credits to a third party.
- b. **Variable Portion.** The remaining fifty percent (50%) of the Royalty will be calculated using a tiered structure based on the gross proceeds from the sale of Credits to a third party:
 - i. **First Tier:** For that portion of the Credit price from \$0.00 up to and including \$20.00, the Royalty Rate will be thirty percent (30%) of such portion;
 - ii. **Second Tier:** For that portion of the Credit price above \$20.00 up to and including \$30.00, the Royalty Rate will be fifty percent (50%) of such portion; and
 - iii. **Third Tier:** For that portion of the Credit price above \$30.00, the Royalty Rate will be eighty percent (80%) of such portion.

All Credits shall be issued in the name of NativState, or NativState’s successors and assigns. In the event of the Retirement of any Credits prior to the sale thereof, NativState shall pay Owner the Royalty for such Credits based upon the fair market value of Credits of a similar type and vintage on the date of such Retirement. NativState shall pay Owner the Royalty on or before sixty (60) days after the earlier of the receipt by NativState of the proceeds of the sale of such Credits, or the Retirement of such Credits. In no event shall the Royalty be payable on any: (a) resale of Credits; (b) contribution, deposit or transfer of any Credits to a Registry; (c) Retirement of any Credits held by a Registry; or (d) Cancellation of any Credits by a Registry.

5. **Improved Forest Management.** As used in this Agreement, “Improved Forest Management” means the Plan proposed by NativState for the Project in accordance with ACR’s Improved Forest Management Methodology for Quantifying GHG Removals and Emission Reductions through Increased Forest Carbon Sequestration on Non-Federal U.S. Forestlands (version 2.0), or such other methodology as approved by a Registry. Owner acknowledges and agrees that NativState shall have the right, but not the obligation, as group manager of an IMG, to include the Lands with one or more other parcels of land pursuant to an aggregation or programmatic development approach in accordance with the terms of the Plan and this Agreement. NativState shall discuss and design with Owner or Owner representative a forest management plan to be incorporated within the Plan. NativState shall deliver to Owner a copy of the Plan on or before Certification thereof. Owner hereby commits to sustainable forest management as described in the Plan, and agrees to engage in, implement, practice, conduct and maintain Improved Forest Management upon the Lands as described in the Plan. Owner hereby designates and appoints NativState as Owner’s agent and attorney-in-fact to execute all documents, and take all action to develop, implement, administer and manage the Project pursuant to the Plan, including Listing, Certification, Verification, Validation, Registration, and issuance, marketing, sale and transfer of any and all Credits. The foregoing right shall be deemed conclusively to be a power coupled with an interest and shall be irrevocable during the Term hereof. NativState shall provide copies of all documents executed on behalf of owner. The Lands shall be subject to and burdened by the terms and conditions of the Plan.

6. ***Selective Cut.*** As used in this Agreement, “Selective Cut” (also known as: thinning’s, partial cuts, improvement cuts) means the identification, tree cutting and harvesting activities of individual trees or small groups of trees within a given timber management unit and/or stand upon the Lands; provided, during each consecutive five-year period commencing with the Effective Date, such activities shall neither reduce: (a) the Stocking of the total forested acreage to less than sixty percent (60%); nor (b) the original carbon inventory Merchantable Timber by more than seven and one half percent (7.5%), unless otherwise approved by NativState. Owner will follow the “Selective Harvest Guidelines for NativState Participants in the Southeastern U.S.” in Exhibit B. On or before Certification of the Plan, NativState shall deliver to Owner a Forest Carbon Inventory, including NativState’s determination of the Stocking and Merchantable Timber. Thereafter, NativState shall deliver to Owner a Forest Carbon Inventory, with NativState’s determination of the Stocking and Merchantable Timber as of commencement of each consecutive five-year period from and after the Effective Date. Owner shall not commence any tree cutting or harvesting activities on the Lands prior to the fifth anniversary of the Effective Date. On or before sixty (60) days before Owner commences any tree cutting or harvesting activities on the Lands, Owner shall deliver to NativState written notice of such activities with reasonable detail thereof, and NativState shall have the right, but not the obligation, to enter upon the Lands and witness such activities. All tree cutting and harvesting activities on the Lands shall be at Owner’s cost and expense. Owner shall provide NativState with copies of scale tickets or other documentation to verify the total tons of timber harvested in any given operation from the Land. In no event shall any commercial timber harvest result in any tree removal within fifty (50) feet of any intermittent or perennial streams with defined banks, spring seeps, lakes, ponds, or vernal pools, except to the extent permissible pursuant to Arkansas Best Management Practices for water quality and streamside stabilization.

7. ***Deferred Harvesting Option.*** Owner shall have the right, but not the obligation, to elect the following described Deferred Harvesting option by signing Owner’s Election to Exercise by delivering such written election to NativState on or before thirty (30) days after delivery of the Forest Carbon Inventory by NativState to Owner. If Owner delivers to NativState such Election to Exercise within said time period, then Owner shall be deemed to have expressly and irrevocably waived, released and disclaimed any and all rights to engage in any Selective Cut upon the Lands, and shall be deemed conclusively to be subject to and burdened by the terms of Deferred Harvesting under the Plan and this Agreement. In consideration of Owner’s timely delivery to NativState of the Election to Exercise hereunder, the Royalty shall be increased from thirty percent (30%) to forty percent (40%). Notwithstanding the foregoing, with respect to fifty percent (50%) of the Royalty payable by NativState to Owner hereunder, in lieu of the Royalty described above, the Royalty shall be indexed based upon the gross proceeds received by NativState from the sale of Credits to a third party as follows: (i) a proportionate forty percent (40%) of that portion of the gross proceeds per Credit equal to or less than Twenty Dollars (\$20.00) per Credit (50% x 40%); (ii) a proportionate fifty percent (50%) of that portion of the gross proceeds per Credit in excess of Twenty Dollars (\$20.00) per Credit, but less than or equal to Thirty Dollars (\$30.00) per Credit (50% x 50%); and (iii) a proportionate eighty percent (80%) of that portion of the gross proceeds per Credit greater than Thirty Dollars (\$30.00) per Credit (50% x 80%). As used in this Agreement, “Deferred Harvesting” means Owner shall not conduct any tree cutting or harvesting activities on the Lands, except: (a) the cutting of standing dead or dying trees for firewood. (b) the clearing of trees in small areas for use as food plots and hunt stands, borrow pits, turn arounds, short spur roads, small pasture areas or small cabin sites; provided that such clearing is limited to no more than two percent (2%) of the Lands with an overall limit of five (5) acres during the Term of this Agreement; and (c) the cutting of trees to mitigate pest and disease outbreaks, including salvage cutting and preventative silvicultural treatments; provided, in the case of more than two (2) acres or one percent (1%) of the Lands being impacted, Owner delivers to NativState a written management plan prepared by a qualified forestry professional describing the nature of the disturbance and the silvicultural methods employed to mitigate the impact. All such Deferred Harvesting shall be at Owner’s cost and expense. On or before Sixty (60) days before Owner commences any cutting, thinning, clearing, harvesting, logging or similar activities on the Lands, Owner shall deliver to NativState written notice of

such activities with reasonable detail thereof, and NativState shall have the right, but not the obligation, to enter upon the Lands and witness such activities.

Owner will be provided with an Election to Exercise, (as attached hereto as Exhibit C) at the time Owner is provided with the Forest Carbon Inventory.

8. **Access.** Owner hereby grants unto NativState, and NativState's employees, agents and representatives, the right of access in, to, on over and across the Lands for purposes of the Project in accordance with the terms hereof. NativState shall provide Owner a minimum of 24-hour notice before any entry upon the Lands. NativState shall leave all gates as they were found after entry upon the Lands. NativState, and its employees, agents and representatives, shall be prohibited from carrying any firearms on the Lands, and from hunting and fishing upon the Lands. NativState agrees to repair, at NativState's sole cost and expense, all damage caused by NativState to existing roads located upon the Lands.

9. **Ownership.** Owner warrants and agrees to defend title to the Lands, free and clear of all liens, encumbrances and defects of title. Owner represents and warrants that there are no existing liens, encumbrances, defects of title, or other burdens on or affecting the Lands that would prevent, impair, conflict or interfere with NativState's rights under this Agreement. NativState shall have the right, but not the obligation, to pay and discharge any and all liens or other encumbrances upon the Lands, including any mortgage, tax, mechanic's or materialman's liens, and in the event NativState does so, NativState shall be subrogated to such lien with the right to enforce the same and to apply the Royalty payable hereunder toward the satisfaction thereof. Without impairment of NativState's rights under the foregoing warranty of title, if this Agreement covers less than the entire and undivided fee simple estate, then the Royalty and other payments hereunder accruing from any part as to which this Agreement covers less than such full interest, shall be paid only in the proportion which Owner's interest covered by this Agreement bears to the whole and undivided fee simple estate therein.

10. **Surrender.** NativState shall have the right, but not the obligation, at any time, and from time to time, to surrender this Agreement, in whole or in part, to Owner by delivering a release thereof to Owner, or by placing a release thereof of record in the county in which the Lands are located. Upon any surrender of this Agreement, in whole or in part, the Parties shall be released, discharged and relieved from any and all duties, obligations and liabilities hereunder, express or implied, including the payment of Royalty, as to the acreage so surrendered; provided, however, NativState shall remain liable to Owner for any payments accruing hereunder prior to such surrender. No partial surrender, release or termination shall in any manner reduce or limit NativState's rights to use all of the Lands in connection with NativState's ownership of that portion of the Lands as to which the Agreement has not been surrendered, released or terminated.

11. **Assignment.** The rights of either Party hereunder may be assigned, in whole or in part, and the provisions hereof shall extend to their respective heirs, devisees, executors, administrators, personal representatives, successors and assigns; provided, however, any change or division in the ownership of the Land, or the ownership or right to receive the Royalty, shall not enlarge the obligations, nor diminish the rights of NativState, and such change or division shall not be binding upon NativState until thirty (30) days after NativState has received at NativState's principal place of business certified copies, or acceptable alternative documentation in lieu thereof, constituting the chain of title from the original Owner. Any assignment of this Agreement, in whole or in part, shall, to the extent of such assignment, relieve and discharge NativState of any obligations hereunder, and, if NativState or assignee of part or parts hereof shall fail or default in the payment of the proportionate part of the Royalty due from NativState or such assignee, or fail to comply with any of the provisions of this Agreement, such default shall not affect this Agreement insofar as it covers that portion of the Lands upon which NativState or any assignee thereof shall properly comply or make such payments.

12. **Force Majeure.** If NativState is prevented from complying with any express or implied covenant of this Agreement, including engaging in Improved Forest Management, by act of God, any Federal, state, local, municipal, tribal or governmental entity, or other organization, authority or governing body, including any Registry, ATFS, or similar organization, pursuant to any statute, law, rule, regulation, order, code, ordinance, judgment, decree, ruling, notice, standard, methodology, plan, policy, practice or program (including the time during which NativState is waiting on the issuance of any Listing, Certification, Validation, Verification, Registration, issuance, approval, consent, permit, license, hearing, judgment, award, ruling, order, appeal or policy in connection therewith or during the time for comments thereon), scarcity or inability to obtain or use equipment or material, or by other act, event, circumstance, cause or condition beyond NativState's reasonable control, then while so prevented, and for thirty (30) days thereafter, NativState's duty or obligation shall be suspended, and NativState shall not be liable for failure to comply therewith; and this Agreement shall be extended while and so long as NativState is prevented by any such cause from complying with any express or implied covenant of this Agreement, and for thirty (30) days thereafter, and that time shall not be counted against NativState, notwithstanding anything herein to the contrary.

13. **Termination.** In the event of a breach or the threatened breach of any of the terms of this Agreement, the non-defaulting Party shall deliver to the defaulting Party written notice thereof, along with a detailed description of the alleged breach. The defaulting Party shall have thirty (30) days to cure any default hereunder; provided, however, in the event such default cannot be cured with reasonable diligence within thirty (30) days, the defaulting Party shall have a reasonable period of time to cure such default. If the defaulting Party fails to cure the default within the above-described time period, the non-defaulting Party shall have the right, but not the obligation, to elect to terminate this Agreement by written notice delivered to the defaulting Party. Upon the termination of this Agreement hereunder, all liabilities incurred prior to such termination, and Sections 12 through 25 of this Agreement shall remain in full force and effect in accordance with their respective terms.

14. **Reversal.** Owner shall indemnify, defend, hold harmless and fully compensate NativState for any intentional or willful Reversal, discontinuation or termination by Owner of Improved Forest Management upon the Lands, including the fair market value of any Credits that are Cancelled or Retired in connection therewith or related thereto, based upon the fair market value of Credits of a similar type and vintage on the date of such Cancellation or Retirement, along with the then-applicable offset activation, Retirement and Cancellation fees imposed by the applicable Registry.

15. **Relationship.** This Agreement shall not be deemed or construed to create any partnership, agency, joint venture or other association whereby the Parties may be jointly liable or liable as agents, partners, co-venturers or fiduciaries. EACH PARTY HEREBY EXPRESSLY WAIVES, RELEASES AND DISCLAIMS ANY AND ALL FIDUCIARY DUTIES HEREUNDER TO THE OTHER PARTY.

16. **Exhibits.** All exhibits to this Agreement are hereby incorporated herein as if fully set forth in the body of this Agreement.

17. **Integration.** This Agreement and the exhibits hereto constitute the entire agreement between the Parties with respect to the subject matter hereof, and supersede and replace any and all prior discussions, offers, negotiations, understandings, representations and agreements, whether oral or written, relating to such subject matter.

18. **Amendments.** This Agreement may not be altered or amended, nor any rights hereunder waived, except by a written document signed by the Party to be charged with such amendment or waiver.

19. **Binding Effect.** This Agreement shall be binding upon and inure to the benefit of each of the Parties, and their respective heirs, devisees, executors, administrators, personal representatives, successors and assigns. This Agreement, and all of the terms and conditions hereof, shall be deemed to be covenants running with the Lands, and a burden upon Owner's interest in the Lands for the benefit of NativState's interest in the Lands.

20. **Remedies.** Upon the breach or threatened breach of any of the terms of this Agreement, the non-defaulting Party shall have all rights and remedies, at law and in equity, including the right to damages, and equitable remedies of injunction and specific performance, without the necessity of proving irreparable harm or an inadequate remedy at law, or the posting a bond. The filing of any particular cause of action shall not be deemed to be an election of remedies. In the event of any disputes related to this Agreement, the prevailing Party shall be entitled to recover its costs of investigation, court costs, out-of-pocket expenses, expert witness fees, reasonable attorneys' fees and costs of collection from the opposing Party. EACH PARTY HEREBY EXPRESSLY WAIVES, DISCLAIMS AND RELEASES ANY AND ALL RIGHTS TO TRIAL BY JURY WITH RESPECT TO ANY DISPUTE HEREUNDER.

21. **Severability.** If any of the terms of this Agreement are held by a court of competent jurisdiction to be in violation of any applicable law, such terms shall be deemed modified to the extent required to comply with applicable law, and as so modified such terms and this Agreement shall remain in full force and effect.

22. **Construction.** For purposes of this Agreement, the term "including" shall mean "including, but not limited to." Each Party hereby acknowledges, represents and agrees that the Parties have equal bargaining power, this Agreement is the result of arms-length negotiations, and this Agreement is drafted jointly by the Parties. EACH PARTY HEREBY EXPRESSLY WAIVES, RELEASES AND DISCLAIMS ANY RULE OF CONSTRUCTION THAT AMBIGUITIES ARE TO BE RESOLVED AGAINST THE DRAFTING PARTY IN THE INTERPRETATION OR CONSTRUCTION OF THIS AGREEMENT.

23. **Further Assurances.** Each Party shall execute, acknowledge and deliver such instruments and take such other action as may be reasonably necessary to consummate the transactions contemplated by this Agreement. NativState may record this Agreement, or a memorandum of this Agreement, in the county or counties in which the Lands are located. Upon termination or surrender of this Agreement, NativState shall file a release of record in the county or counties in which the Lands are located.

24. **Counterparts.** This Agreement may be executed in any number of counterparts, each of which shall be deemed to be an original, but all of which, taken together, shall constitute one and the same agreement.

EXECUTED by the Parties on the dates in their respective acknowledgements below to be effective for all purposes as of the Effective Date.

The Remainder of this Page Left Blank Intentionally, Signature Pages to follow.

NATIVSTATE:

NATIVSTATE LLC

By: _____
Travis Creed, General Counsel

Acknowledgment

STATE OF ARKANSAS §

§ss.

COUNTY OF FAULKNER §

The foregoing instrument was acknowledged before me this _____ day of _____, 2025 by Travis Creed, as General Counsel of NativState LLC, a Delaware limited liability company, on behalf of such company.

(Notary Seal)

Notary Public
Printed: Kristy Bonds
My commission expires: 9/19/2028

Schedule 1
Definitions

As used in this Agreement, the following terms shall have the meanings assigned to them below:

- a) “Above Ground Tree Biomass” means the total weight, expressed in tons, of all trees located on the Lands equal to or greater than one (1) inch DBH, including stumps, bark, tops, branches, and foliage.
- b) “ACR” means the American Carbon Registry.
- c) “Agreement” means this Carbon Agreement dated as of the Effective Date between NativState and Owner.
- d) “ATFS” means the American Tree Farm System.
- e) “Cancellation” or “Cancelled” means the permanent removal of any Credits from a Registry, so that they cannot be transferred, transacted, Retired or applied towards any reduction or removal of emissions.
- f) “Certified” or “Certification” means the certification by the ATFS or similar organization of a plan for sustainable forest management on the Lands.
- g) “Credits” mean all right, title and interest in, to and under any and all credits, offsets and allowances generated by a Project, as Registered and issued by a Registry, including greenhouse gas and carbon offsets and credits, emission reductions and removals, removal enhancements, emissions sequestrations, emissions allowances, and emission reduction tons.
- h) “DBH” means diameter at 4½ feet above the ground.
- i) “Deferred Harvesting” as defined in Section 7.
- j) “Effective Date” as defined in the preamble to this Agreement.
- k) “Election to Exercise” means Owner’s election to exercise the Deferred Harvesting option in accordance with the terms of Section 7.
- l) “Forest” means all timber, trees, wood, brush, plants and vegetation located on the Lands.
- m) “Forest Carbon Inventory” means NativState’s determination of the Stocking and Above Ground Tree Biomass on the Lands.
- n) “IMG” means independently managed group.
- o) “Improved Forest Management” as defined in Section 5.
- p) “Indexed Royalty Schedule” means an increase in the Owner’s Royalty based on the selling price of the carbon credits, as defined in Section 4, or if Owner delivers to NativState the Election to Exercise the Deferred Harvesting option, Section 7.
- q) “Lands” means the land described in Exhibit A hereto.

- r) “Listing” means the process by which NativState submits a Project to a Registry for review, the successful outcome of which results in the Project being approved for Listing on the Registry platform.
- s) “Merchantable Timber” means pine with a diameter equal to or greater than five (5”) inches at DBH or hardwood with a diameter equal to or greater than five (5”) inches at DBH.
- t) “NativState” as defined in the preamble to this Agreement.
- u) “Owner” as defined in the preamble to this Agreement.
- v) “Party” or “Parties” means NativState, and Owner, and their respective successors and assigns.
- w) “Plan” means the plans, forest management plan, policies, practices, operations and activities proposed by NativState for Improved Forest Management upon the Lands.
- x) “Project” means the carbon offset project on the Lands proposed by NativState in accordance with the Plan and the terms of this Agreement.
- y) “Registry” means a greenhouse gas or carbon offset registry, including ACR or similar organization.
- z) “Registration” means the acceptance of the Validation of a Project by a Registry, so that the Project is eligible for issuance of Credits.
- aa) “Retirement” or “Retired” means the permanent removal of any Credits from circulation as transactable units, so that it represents a permanent reduction or removal of emissions from the atmosphere.
- bb) “Reversal” means an intentional or unintentional event that results in the emissions into the atmosphere of stored or sequestered carbon dioxide for which Credits were issued pursuant to the Plan.
- cc) “Royalty” as defined in Section 4, or if Owner delivers to NativState the Election to Exercise the Deferred Harvesting option, Section 7.
- dd) “Selective Cut” as defined in Section 6.
- ee) “Stocking” means the density of each stand of trees located on the Lands, expressed as a percentage, of the aggregate of the basal area (cross-sectional area in sq. ft.) quadratic mean diameter and trees per acre, of all trees greater than five (5) inches DBH to the referenced optimal density for such stand, which shall be determined by the dominant tree species and site index for such stand.
- ff) “Term” as defined in Section 3.
- gg) “Validation” means the systematic, independent and documented process for the evaluation of the Project against the applicable requirements of a Registry.
- hh) “Verification” means the systematic, independent and documented assessment of the Project by a qualified and impartial third party of the quantification of carbon reductions or removals for a specific reporting period.

EXHIBIT A
The Lands

A tract of land situated in the County of Conway, State of Arkansas, being a part of the S 1/2 of the NW 1/4, a part of the SW 1/4 of the NE 1/4, a part of the NW 1/4 of the SW 1/4, a part of the E 1/2 of the SW 1/4, a part of the N 1/2 of the SE 1/4, a part of the SE 1/4 of the SE 1/4, the SW 1/4 of the SE 1/4 of Section 9, a part of the NW 1/4 of the SW 1/4, a part of the fractional S 1/2 of the fractional S 1/2 of Fractional Section 10, a part of the fractional NW 1/4, a part of the fractional N 1/2 of the fractional NE 1/4, a part of the SW 1/4, a part of the NW 1/4 of the SE 1/4 of Fractional Section 15, a part of the fractional NE 1/4, a part of the fractional SW 1/4, the fractional SE 1/4 of Fractional Section 16, a part of the SE 1/4 of the SE 1/4 of Section 17, a part of the SE 1/4, a part of the fractional S 1/2 of the fractional SW 1/4 of Fractional Section 19, a part of the fractional S 1/2, a part of the SE 1/4 of the NW 1/4, a part of the fractional NE 1/4 of the fractional NE 1/4, a part of the fractional S 1/2 of the Fractional NE 1/4 of Fractional Section 20, a part of the fractional N 1/2, a part of the S 1/2 of Fractional Section 21, a part of the NW 1/4 of Section 22, a part of the W 1/2 of the NW 1/4 of Section 27, a part of the E 1/2 of the NW 1/4, a part of the NE 1/4, a part of the N 1/2 of the SE 1/4 of Section 28, a part of the N 1/2 of the NW 1/4 of Section 29, and a part of the fractional N 1/2 of the fractional N 1/2 of Fractional Section 30, Township 7 North, Range 15 West of the Fifth Principal Meridian and being more particularly described as follows:

More particularly described in Quit Claim Deed, dated September 13, 1985, and recorded April 16, 1986, at Deed Book 151, Page 16, of the records of the Chancery Clerk of Conway County, Arkansas

EXHIBIT B

Selective Harvest Guidelines for NativState Participants in the Southeastern U.S.

The intention of these guidelines is to provide guidance to the Landowner and/or their forest management staff in the selective harvest of their timber resources so as not to create an intentional reversal of carbon credits for the duration of the carbon agreement.

Acknowledgment is made that it would be impractical to outline every possible harvest scenario, given the differences in acreage, stocking levels, topography, forest product specifications, local timber markets, growth rates and site productivity. Therefore, the following guidelines are for the maximum allowable harvest levels are provided.

- No harvest activity is allowed in the first 5 years of the Carbon Project. Notwithstanding the case of insect or disease outbreak, or salvage harvests due to natural disaster.
- As shown in the chart below, the landowner may elect to harvest up to a given percentage per year for pine plantation acres and another percentage per year of the remaining non-pine plantation acres, based on the initial inventoried merchantable timber over the course of the first 20-year crediting period. Harvests will continue to be allowed in the second 20-year crediting period, provided the allowable harvest guidelines are followed during the first 20-year crediting period.
- Under no circumstance will the amount harvested reduce the original initial inventoried merchantable volume.
- The allowable harvest will be calculated regionally, based on eco-region divisions done by the Climate Action Reserve. See attached map.

Allowable Harvest Area	Pine Plantation Allowable Harvest/Year	Hardwood, Pine/Hardwood/Other Allowable Harvest/Year
AR-1	1.5%	1.0%
AR-2	2.5%	1.5%

Under the terms of the agreement, the Landowner must contact NativState a minimum of 90 days prior to any harvest activity beginning. When the Landowner contacts NativState, NativState will evaluate the harvest request to align with the respective forest certification program (FSC, SFI, ATFS) and confirm with the Landowner the maximum allowable harvest volume in U.S. tons or thousand board feet (Mbf) that has accrued on their lands at the time of harvest, based upon the percentages previously described.

At the Landowner’s request, limited exceptions may be made on a case-by-case basis after a thorough review that will include, but will not be limited to, Landowner discussion, updated inventory, updated computer credit modeling, etc. The timing and acreage of any harvests will impact the amount the amount of carbon credits generated during the Project, but following these guidelines should be adequate to reduce the likelihood of an intentional reversal of carbon credits for this Landowner.

EXHIBIT C

ELECTION TO EXERCISE DEFERRED HARVESTING OPTION

Pursuant to that certain Carbon Agreement (the “Carbon Agreement”), dated effective as of _____, 2025 (the “Effective Date”), between NativState LLC, a Delaware limited liability company (“NativState”), _____ (“Owner”), having an address of _____, the parties agreed to develop a carbon offset project for Improved Forest Management upon the lands (the “Lands”), as described in Exhibit A attached hereto and by this reference incorporated herein. NativState and Owner shall be referred to herein, individually, as a “Party,” and collectively, as the “Parties.” Except as otherwise defined herein, all capitalized terms shall have the meanings assigned to them in the Carbon Agreement.

Numerical Section 7. Of the Carbon Agreement has the option to elect to the Deferred Harvest Option.

7. ***Deferred Harvesting Option.*** Owner shall have the right, but not the obligation, to elect the following described Deferred Harvesting option by signing Owner’s Election to Exercise below or by delivering such written election to NativState on or before thirty (30) days after delivery of the Forest Carbon Inventory by NativState to Owner. If Owner delivers to NativState such Election to Exercise within said time period, then Owner shall be deemed to have expressly and irrevocably waived, released and disclaimed any and all rights to engage in any Selective Cut upon the Lands, and shall be deemed conclusively to be subject to and burdened by the terms of Deferred Harvesting under the Plan and this Agreement. In consideration of Owner’s timely delivery to NativState of the Election to Exercise hereunder, the Royalty shall be increased from thirty percent (30%) to forty percent (40%). Notwithstanding the foregoing, with respect to fifty percent (50%) of the Royalty payable by NativState to Owner hereunder, in lieu of the Royalty described above, the Royalty shall be indexed based upon the gross proceeds received by NativState from the sale of Credits to a third party as follows: (i) a proportionate forty percent (40%) of that portion of the gross proceeds per Credit equal to or less than Twenty Dollars (\$20.00) per Credit (50% x 40%); (ii) a proportionate fifty percent (50%) of that portion of the gross proceeds per Credit in excess of Twenty Dollars (\$20.00) per Credit, but less than or equal to Thirty Dollars (\$30.00) per Credit (50% x 50%); and (iii) a proportionate eighty percent (80%) of that portion of the gross proceeds per Credit greater than Thirty Dollars (\$30.00) per Credit (50% x 80%). As used in this Agreement, “Deferred Harvesting” means Owner shall not conduct any tree cutting or harvesting activities on the Lands, except: (a) the cutting of standing dead or dying trees for firewood. (b) the clearing of trees in small areas for use as food plots and hunt stands, borrow pits, turn arounds, short spur roads, small pasture areas or small cabin sites; provided that such clearing is limited to no more than two percent (2%) of the Lands with an overall limit of five (5) acres during the Term of this Agreement; and (c) the cutting of trees to mitigate pest and disease outbreaks, including salvage cutting and preventative silvicultural treatments; provided, in the case of more than two (2) acres or one percent (1%) of the Lands being impacted, Owner delivers to NativState a written management plan prepared by a qualified forestry professional describing the nature of the disturbance and the silvicultural methods employed to mitigate the impact. All such Deferred Harvesting shall be at Owner’s cost and expense. On or before Sixty (60) days before Owner commences any cutting, thinning, clearing, harvesting, logging or similar activities on the Lands, Owner shall deliver to NativState written notice of such activities with reasonable detail thereof, and NativState shall have the right, but not the obligation, to enter upon the Lands and witness such activities.

Therefore, by this Notice Owner elects to exercise the Deferred Harvesting Option as to those lands described on Exhibit A-1;

If Owner does not want to exercise the Deferred Harvesting Option as to all the lands covered by the Carbon Agreement, the lands described on Exhibit A-2 will remain under the Selective Cut Option, as described in Numerical Section 6 of the Carbon Agreement.

Do Not Execute until provided with Forest Inventory- this exhibit is provided as an example.

OWNER:

By: _____

Date: _____

Exhibit A-1
Deferred Harvesting Option
The Lands

Exhibit A-2
Select Cut Option
The Lands

Appendix C: Stakeholders, Meeting Records, Public Involvement, & Website

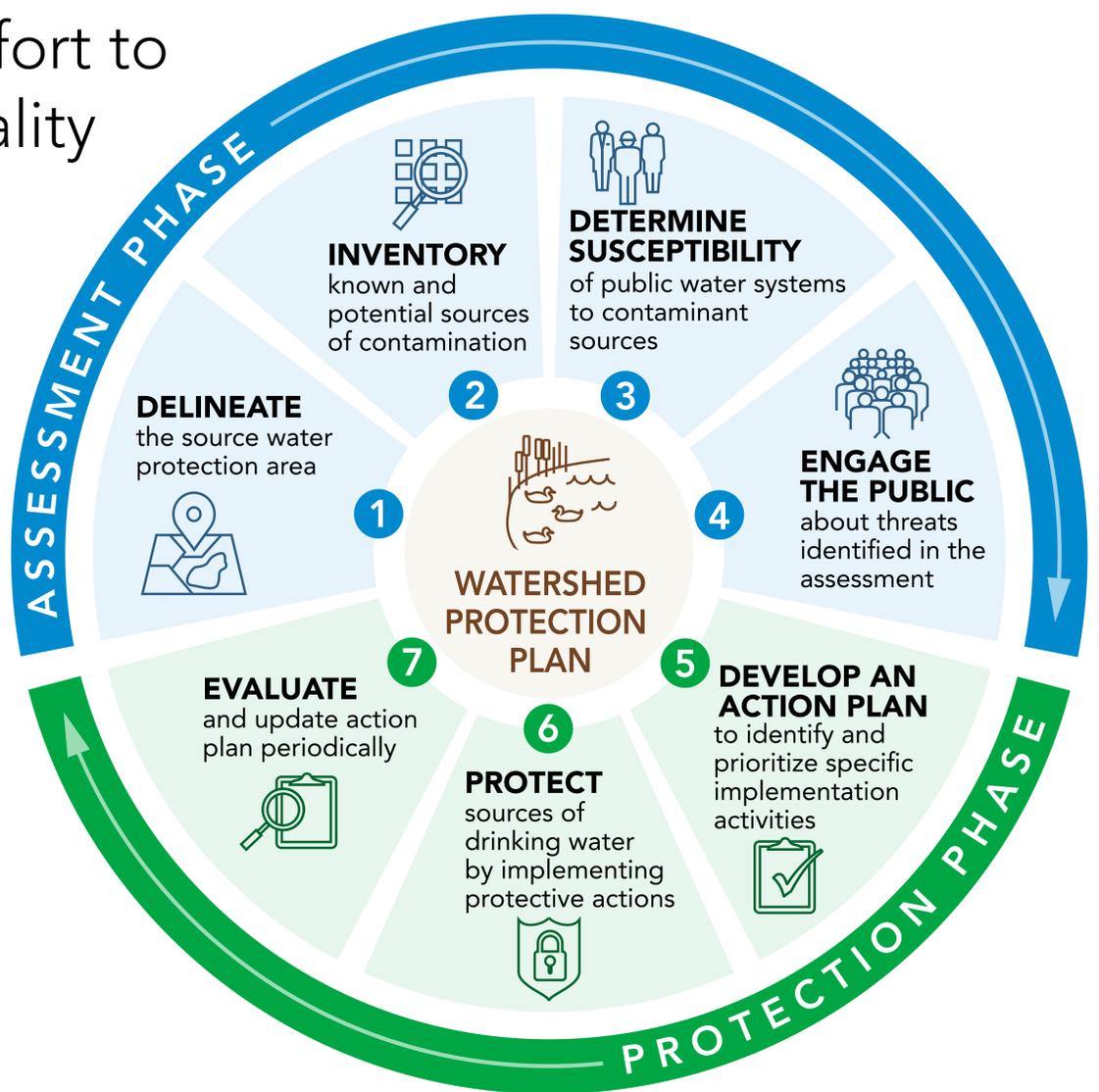
Boards and Handouts -
Public Meeting #1
May 22, 2025

What problem are we addressing?

Elevated nutrients in Brewer Lake are causing water treatment issues.

What is a Watershed Protection Plan?

- An iterative plan to protect and improve water quality.
- A collaborative effort to address water quality concerns.
- A path to identify funding for water quality projects and ways to cost-effectively reduce treatment inputs.



What the plan is NOT.

It is not a regulatory mandate to change land management practices or uses.



EPA's nine elements for plans:

-  Identify causes and sources of nutrients.
-  Estimate nutrient reduction goals and expectations.
-  Describe management measures and target critical areas.
-  Estimate technical and financial assistance needed.
-  Develop education component.
-  Develop project schedule.
-  Describe interim, measurable milestones.
-  Identify indicators to measure progress.
-  Develop a monitoring component.

22

watershed protection plans
already exist with Arkansas
Department of Agriculture

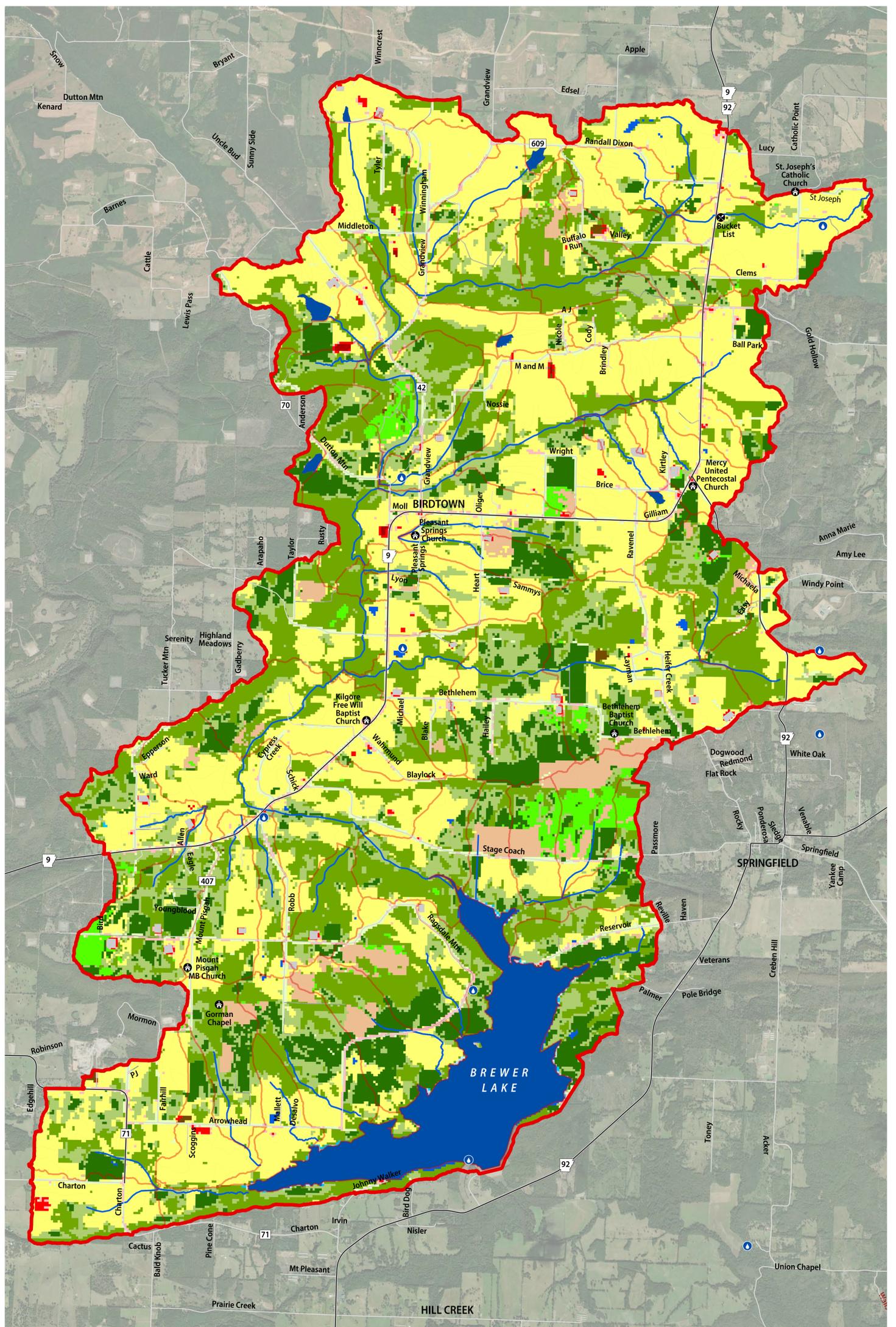


*Link to DOA's
22 watershed projects*

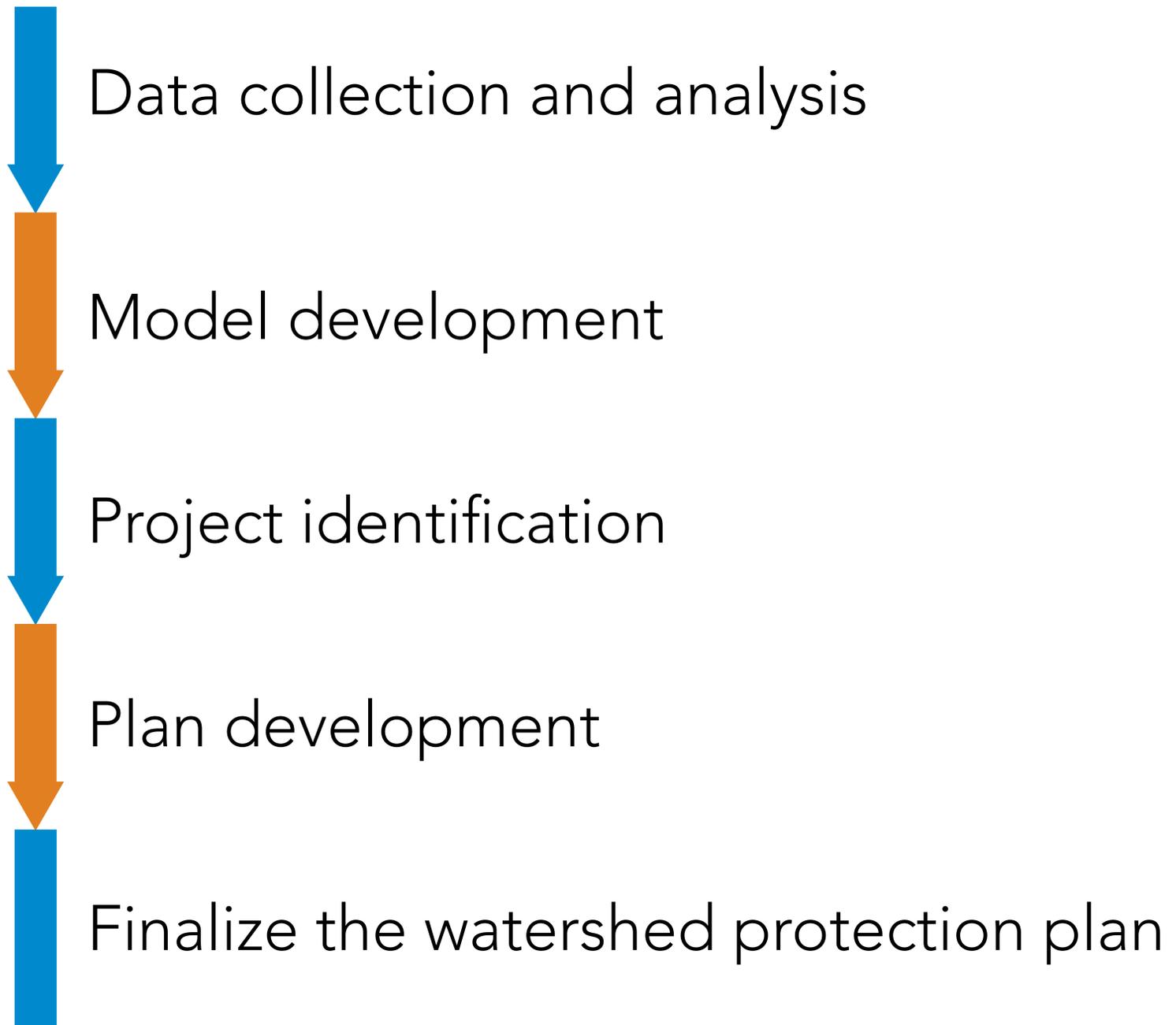


Brewer Lake Watershed land use

- Basin
 - Sub-basin
 - Conduits
 - Lakes
 - 🏠 Church
 - 🍴 Restaurant
 - 💧 Water quality monitoring station
 - Asphalt road
 - Gravel road
 - Frack pad
- LAND USE**
- Barren land
 - Developed:
 - High intensity
 - Medium intensity
 - Low intensity
 - Open space
 - Emergent herbaceous wetlands
 - Woody wetlands
 - Open water
 - Forest:
 - Evergreen
 - Deciduous
 - Mixed
 - Shrub/scrub
 - Grassland/herbaceous
 - Pasture/hay



Brewer Lake Watershed Protection Plan Next Steps



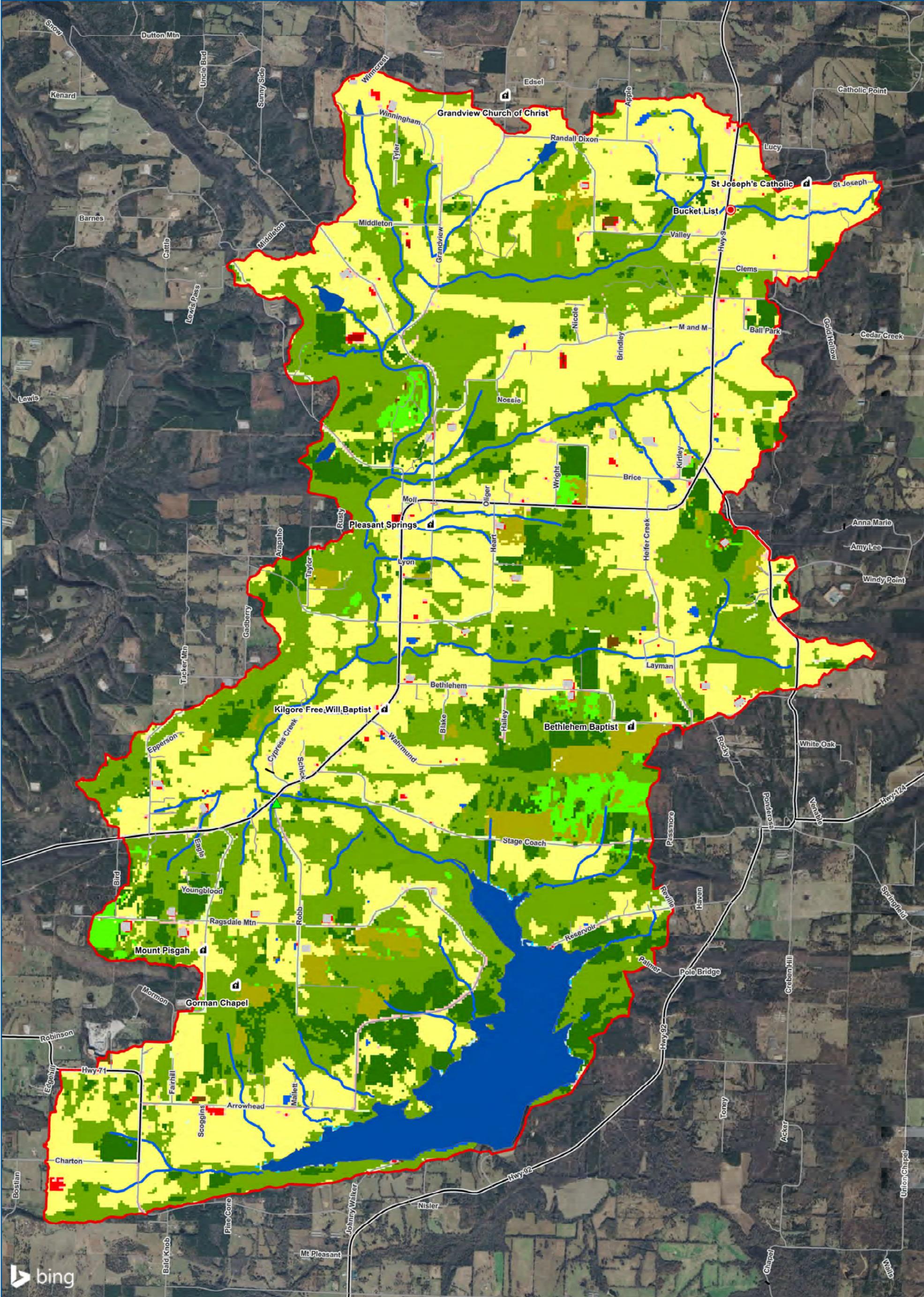
Next meeting:
Winter 2025

**SUBMIT YOUR FEEDBACK
ON THE WATERSHED PLAN**



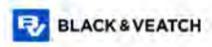
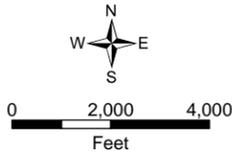
*Link to Conway Corp. website
on Brewer Lake Watershed Plan*

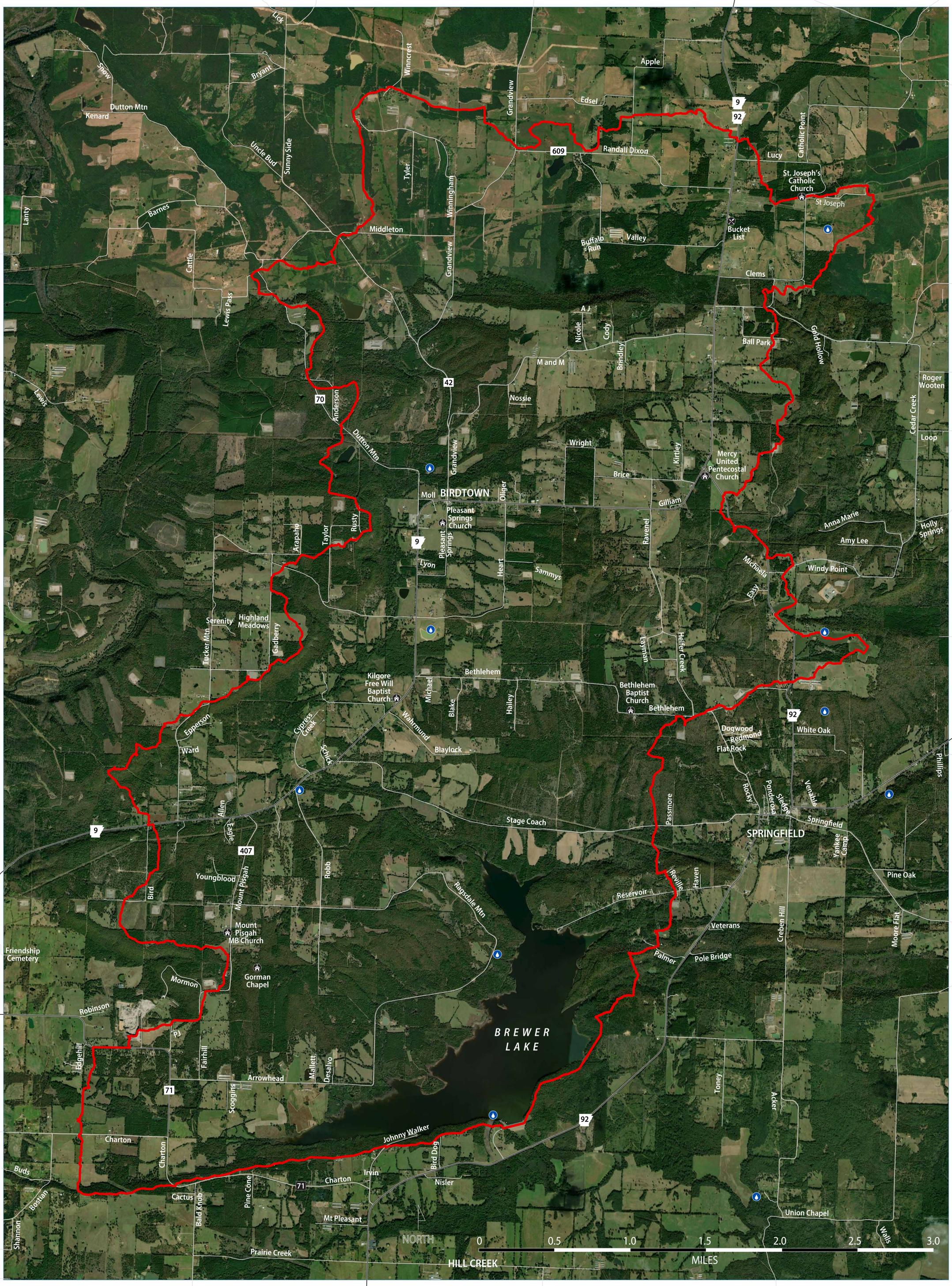




Lake Brewer Watershed Protection Plan Public Meeting

- ▲ Water Quality Monitoring Station
 - Church
 - Restaurant
 - Basin
- Roads (by Type)**
 - Highway
 - Others
 - Conduits
 - Lakes
 - Brewer Lake





0 0.5 1.0 1.5 2.0 2.5 3.0
MILES
HILL CREEK

NORTH

BREWER LAKE

SPRINGFIELD

BIRD TOWN

Dutton Mtn
Kenard

St. Joseph's
Catholic Church
St Joseph

Pleasant
Springs
Church

Mercy United
Pentecostal
Church

Kilgore
Free Will
Baptist
Church

Bethlehem
Baptist
Church

Mount
Pisgah
MB Church

Gorman
Chapel

Brewer Lake Watershed Protection Plan

What is a Watershed Protection Plan?

A watershed protection plan is a framework to preserve and enhance water quality. **It involves identifying sources of pollution, identifying potential best management practices, and engaging stakeholders.**

The iterative plan aims to protect water resources from contaminants, promote healthy ecosystems, and support the community's long-term environmental and economic health.

By fostering collaboration among local governments, businesses, and residents, a watershed protection plan helps maintain clean and safe water for drinking, agriculture, recreation, and wildlife.

What a Watershed Protection Plan is Not

A watershed protection plan is not a regulatory mandate that imposes strict controls or changes on land use practices.

It does not seek to disrupt or drastically alter the daily activities of landowners and their land uses, including agriculture. Instead, it focuses on voluntary, cooperative efforts to improve water quality through education, incentives, and shared responsibility.

The plan respects existing agricultural practices and aims to work alongside agricultural producers and other stakeholders to find mutually beneficial solutions that protect water resources while supporting productivity.

What are the goals?

The primary goals of the plan project are:

- Safeguard water quality
- Support agricultural productivity by empowering farmers with resources and practices that align with environmental conservation
- Reduce nutrient inputs to Brewer Lake
- Enhance the health of the watershed ecosystem
- Identify potential water quality improvement projects
- Identify cost efficient ways to improve water quality and unlock potential funding mechanisms

Path Forward

This meeting is the initial outreach to discuss water quality issues in the watershed. The path forward will include:

- Analyzing collected water quality data in the watershed
- Compiling other watershed information

- Developing a predictive model of nutrients in the watershed
- Creating a list of potential water quality improvement projects
- Participation in discussions with watershed stakeholders concerning project viability
- A second outreach meeting
- Composing the watershed protection plan

Contact Us

comments@ConwayCorp.net

Add to email distribution list

Name	Phone Number	Email	Add to email list?
Jeff DeSalvo	501-400-6302	jeff.desalvo@nabkale.com	
Julia Eichenberg	501-548-7394	jscoggins3@gmail.com	
SCOTT SCHROEDER	903-503-8335	SCOTTR.SCHROEDER@KOTMAIL.COM	
Richard Fitzgerald	977-3950		
Michael Pettigall	501-454-9955	Pettingall.michael@kthoo.com	
Jonathan Higgins	501-354-0101	higginslee.jonathan@gmail	
Tawna Hoelzman	501-208-2866	hoelzman@tawna tawna@lvp.com	
Terry Coleman	501- 208 ³³⁹ 7543	mayor@terrycoleman@tcwork.net	
Jason Kaufman	501-516-0779	jason.kaufman@artb.com	
Robert Carruthers	501-208-1610	crushcarruthers@hotmail.com	
Bruce Hawkins	501-208-2300	bruce@dbhmanagement.com	
Jonathan Trafford	501-208-3667	jtrafford5767@gmail.com	
Tiffany Williams	501-354-2000	tiffany.williams@usda.gov	yes.
EWAN TEAGUE	501-228-1335	ewan.teague@artb.com	y
CHARLES GROSE	501-354-2000	charles.grose@usda.gov	yes
Jacob Powell	501-354-2000	jacob.Powell@USDA.GOV	
Aimee Sudmeyer	501-354-2000 ext 3	conwaycoed@gmail.com	Yes
Cardace Baker	501-339-3860	cardace.a.baker@gmail.com	yes
Sarah Ryals	501-354-3503	Sarah@ecrwd.com	

Slide Deck & Boards
- Public Meeting #2
January 15th, 2026



Brewer Lake Watershed Management Plan



Watershed Management Plan

- Iterative plan to protect and improve water quality
- Collaborative effort to address water quality concerns
- Path to identify funding for water quality projects and ways to cost effectively reduce treatment inputs



Why are we developing a Plan?

- Elevated nutrients in Brewer Lake are causing water treatment issues
- Assess the status and trends of the Brewer Lake Watershed with an emphasis on water quality issues
- Prioritize sub-catchments exhibiting signs of degradation,
- Compile potential management actions to address degradation
- Provide supporting information for EPA 319 proposals
- Plan is available on Conway **Corp** web site



What the Plan is NOT

- Not something to require changes to your land
- Not going to force different management practices

What the Plan IS

- A plan to collaboratively reduce nutrients
- A path to cost effectively identify where to target reduction efforts
- A tool to help preserve the water quality in Brewer Lake



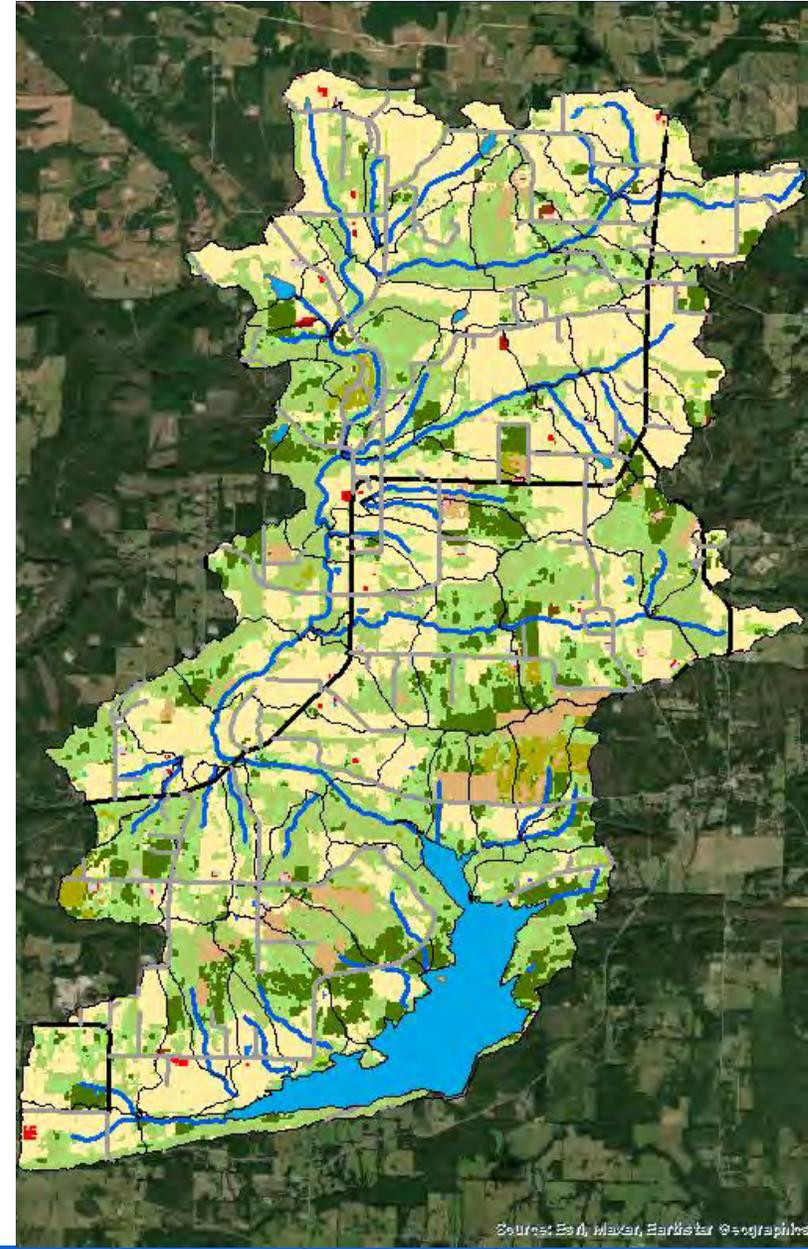
Regional Work

- This isn't a new type of planning work
- Work has been done nationally and in Arkansas
 - Buffalo River Watershed
 - Cache River
 - Kings River
 - Strawberry River
 - Frog Bayou
 - Lee Creek
 - Illinois River



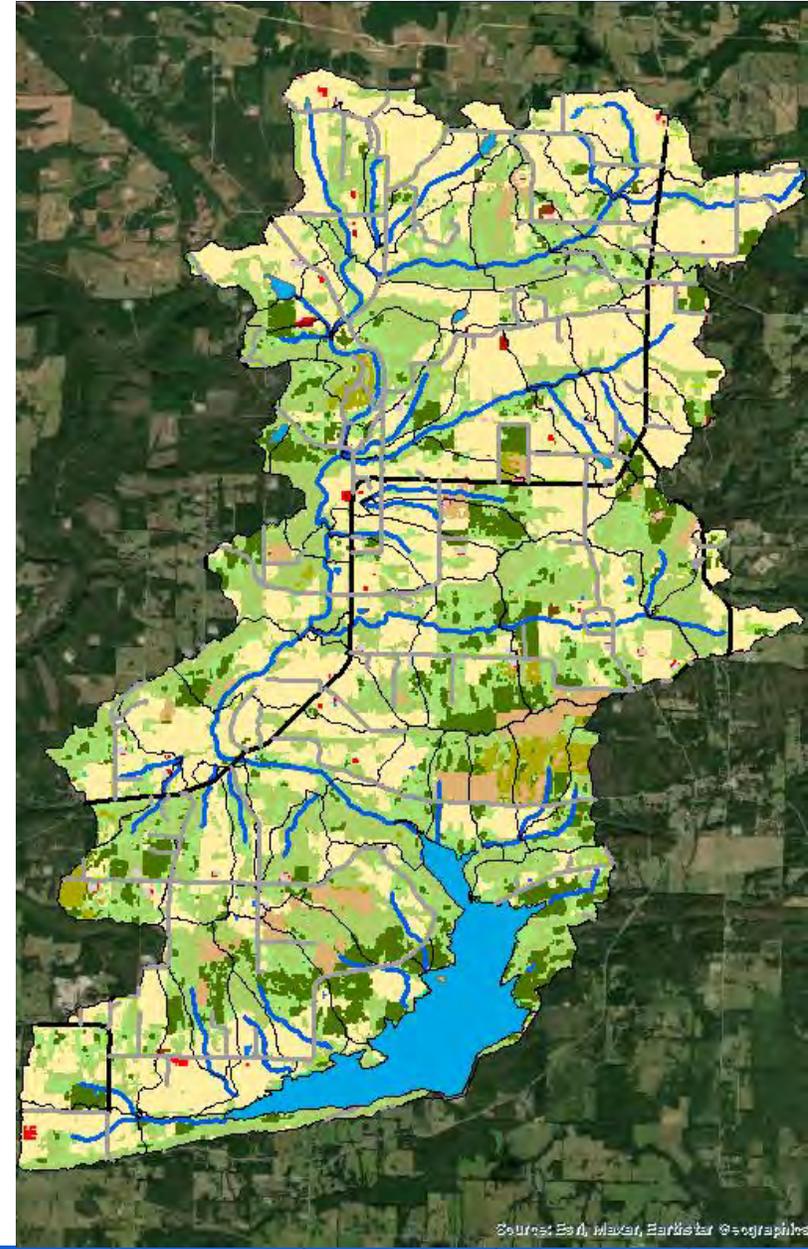
Watershed Background

- Brewer Lake formed in 1983
- Watershed is 36 square miles

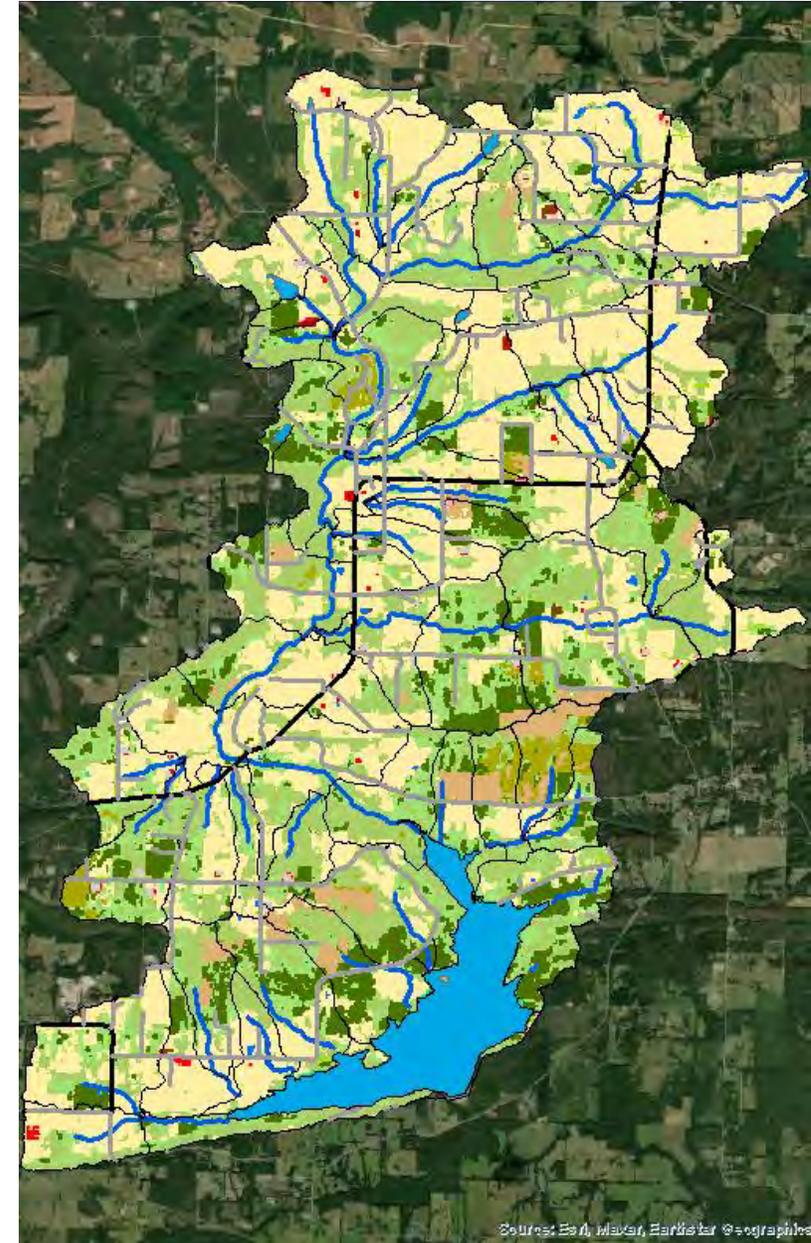
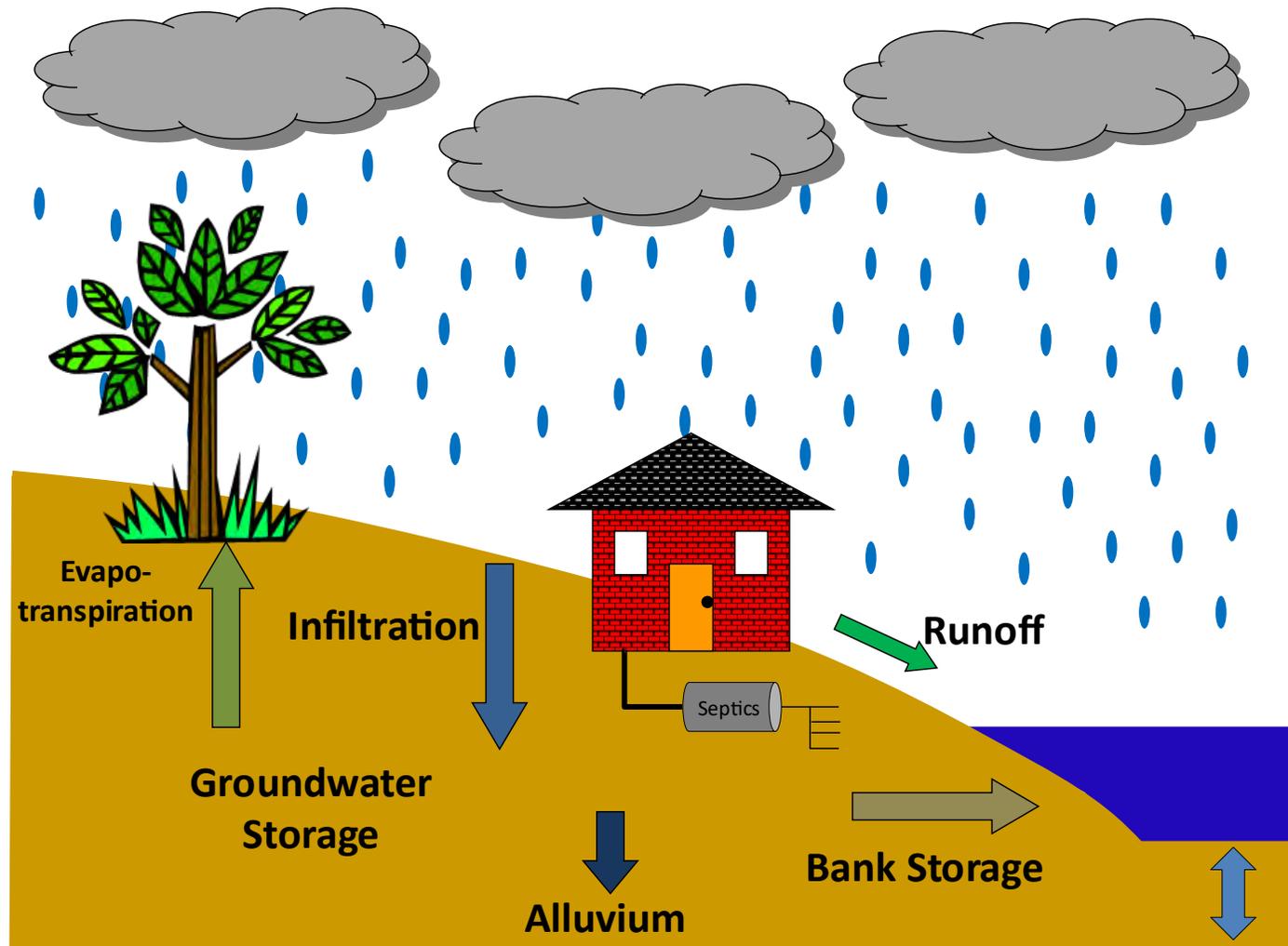


Modeling

- Watershed model developed using land use, soils, slope
- Divided watershed into sub-catchments
- Use meteorology data to predict runoff, infiltration and evaporation
- Nitrogen, phosphorus and sediment all simulated
- Model calibrated to past monitoring data

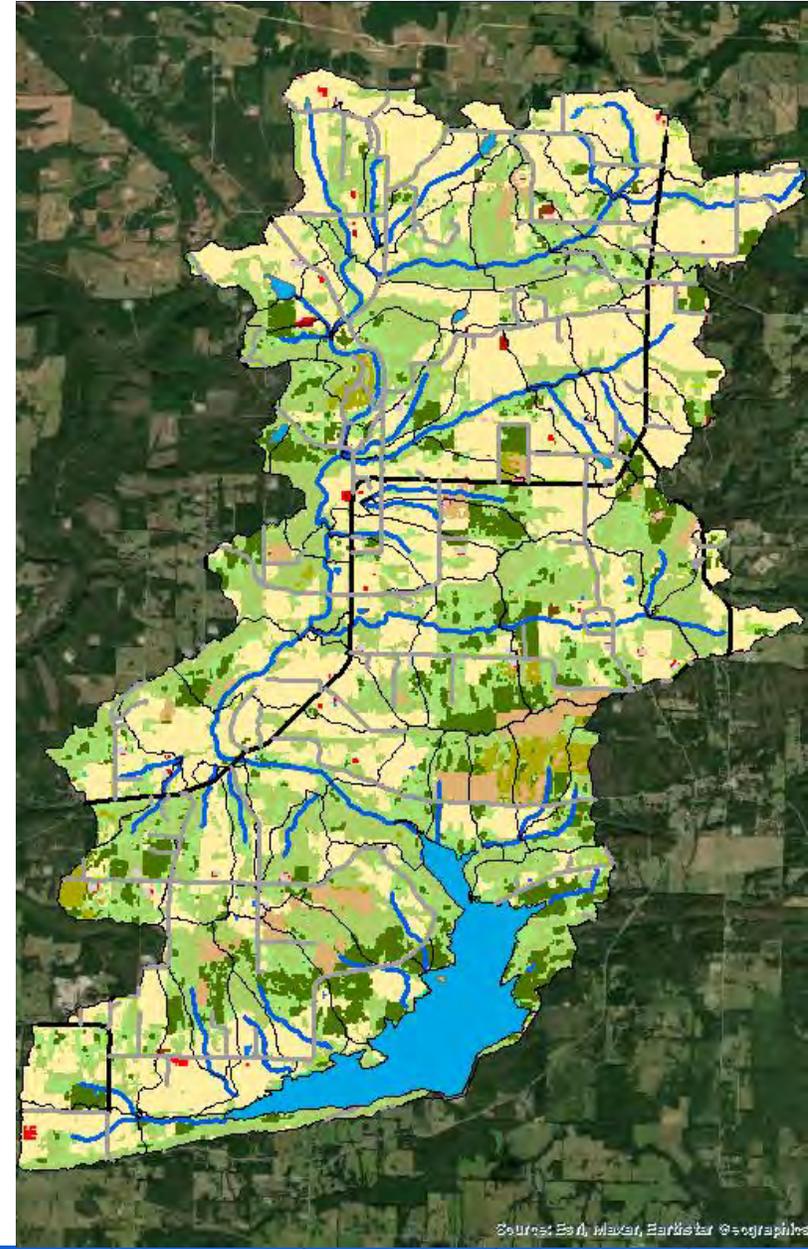


Modeling



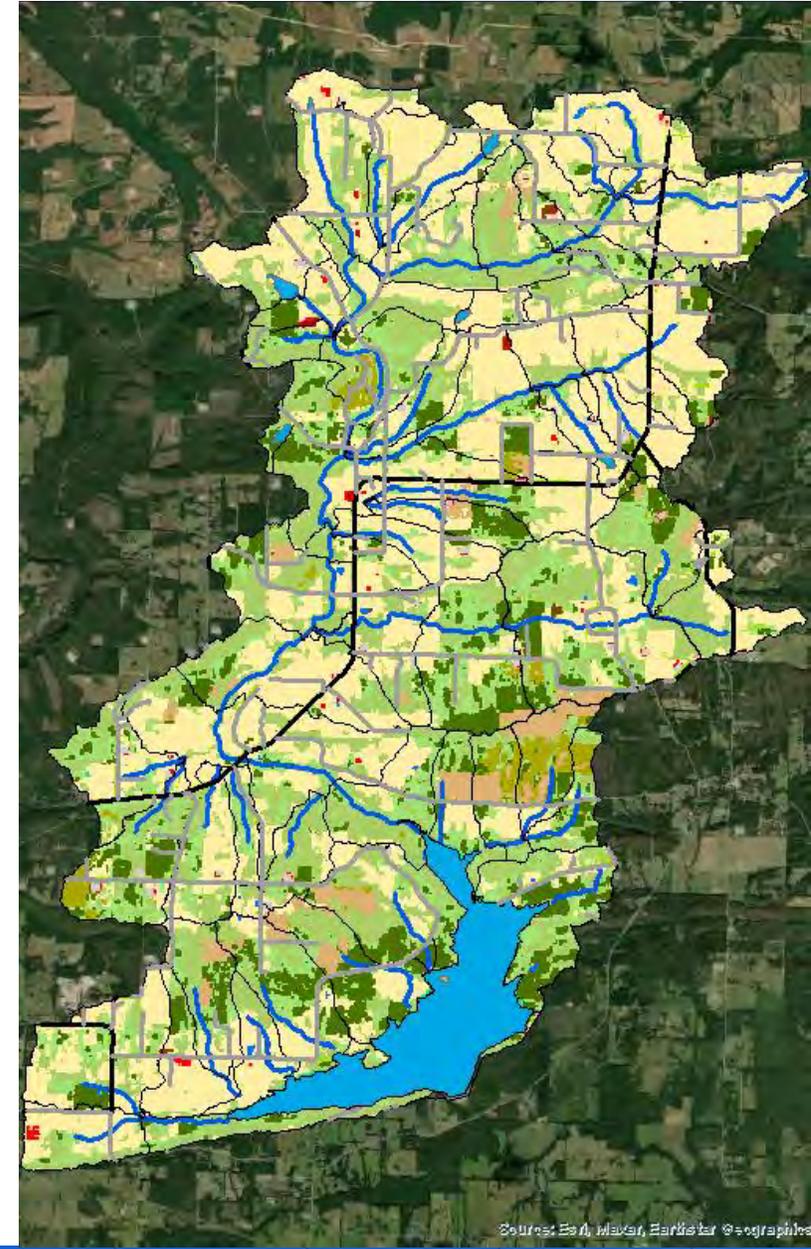
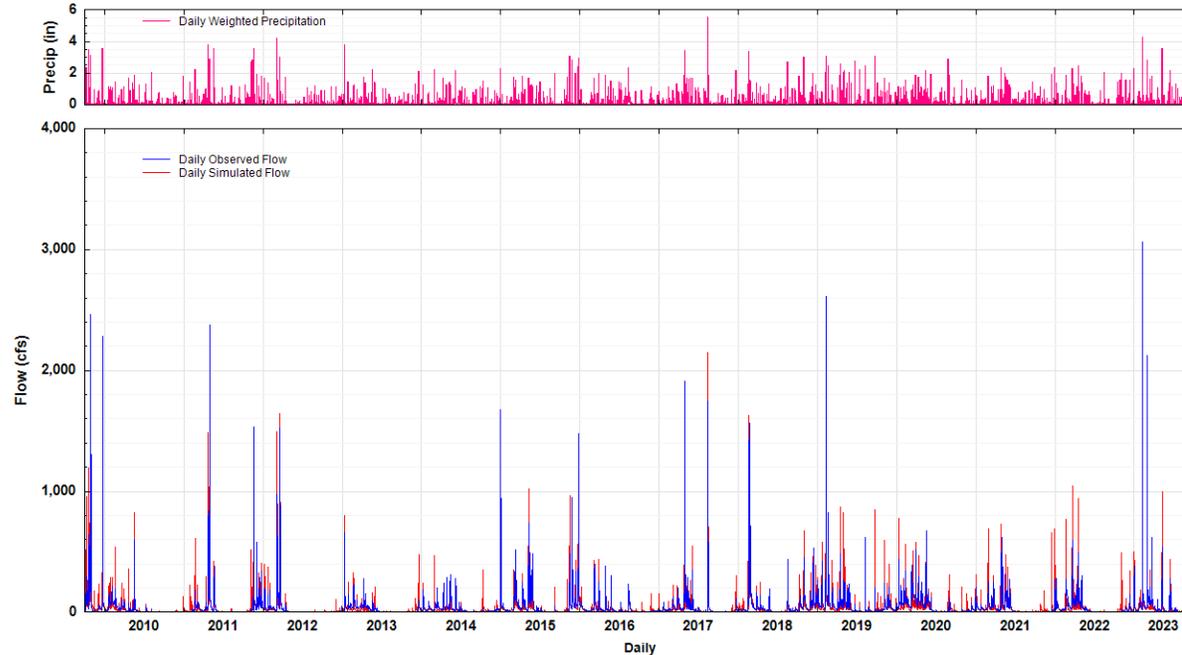
Modeling

- Watershed model developed using land use, soils, slope
- Use meteorology data to predict runoff, infiltration and evaporation
- Nitrogen, phosphorus and sediment all simulated
 - Different buildup/washoff on all land uses
 - Manure application
 - Septic systems
- Model calibrated to past monitoring data



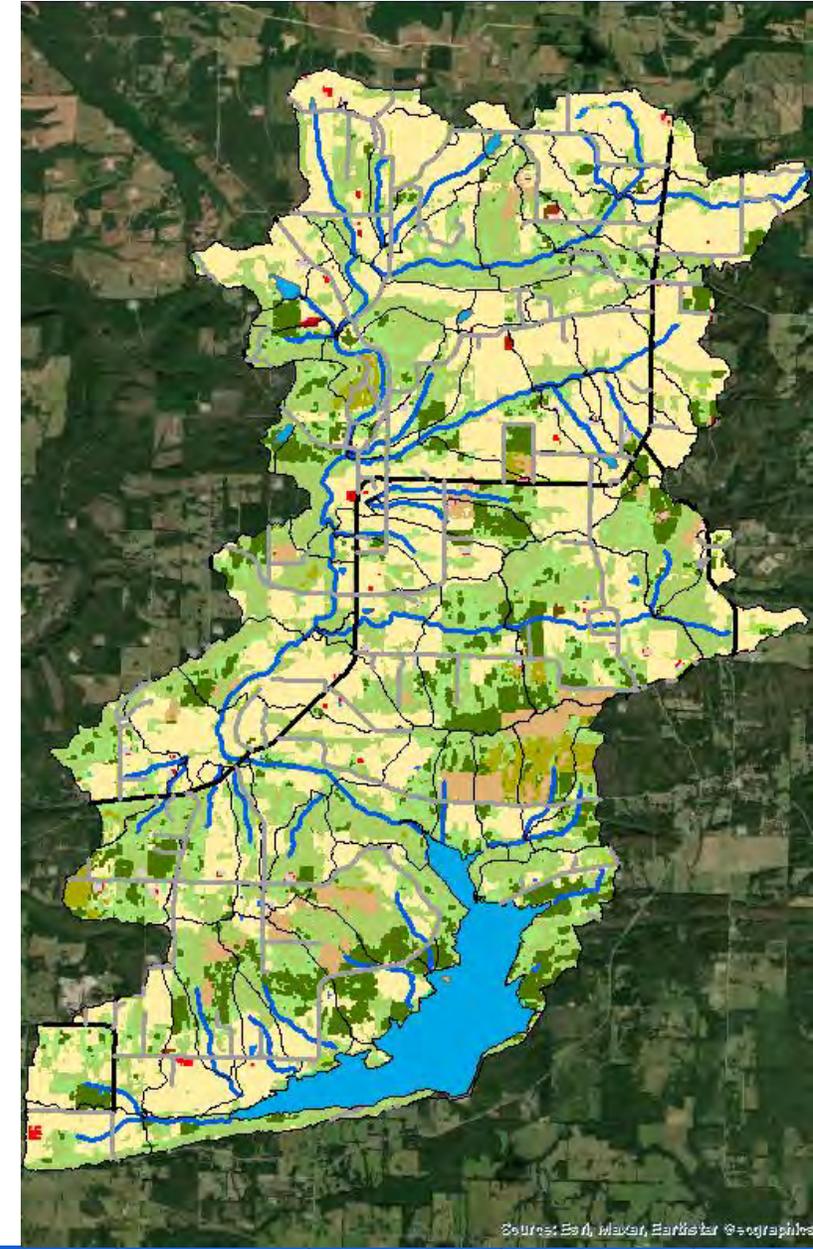
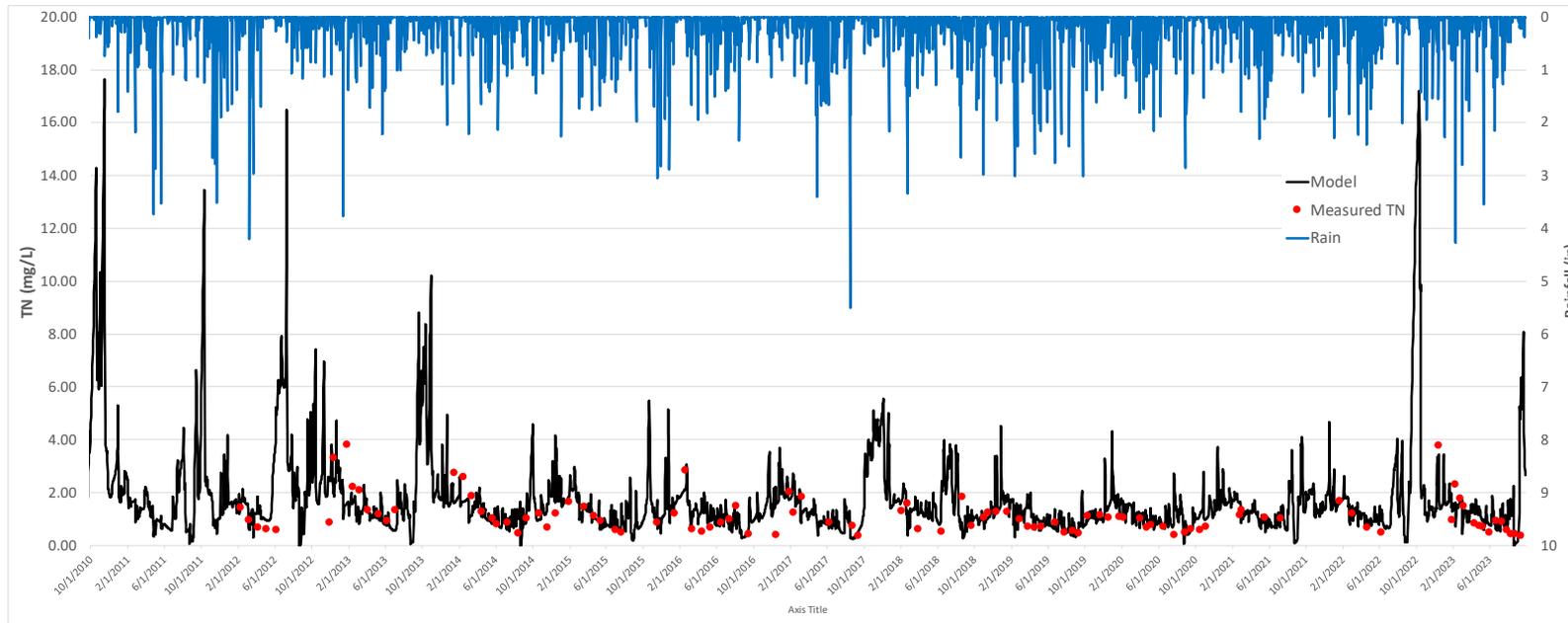
Hydrology Calibration

- Model calibrated to measured stream flows at USGS gage
- Model parameters adjusted to match flow conditions



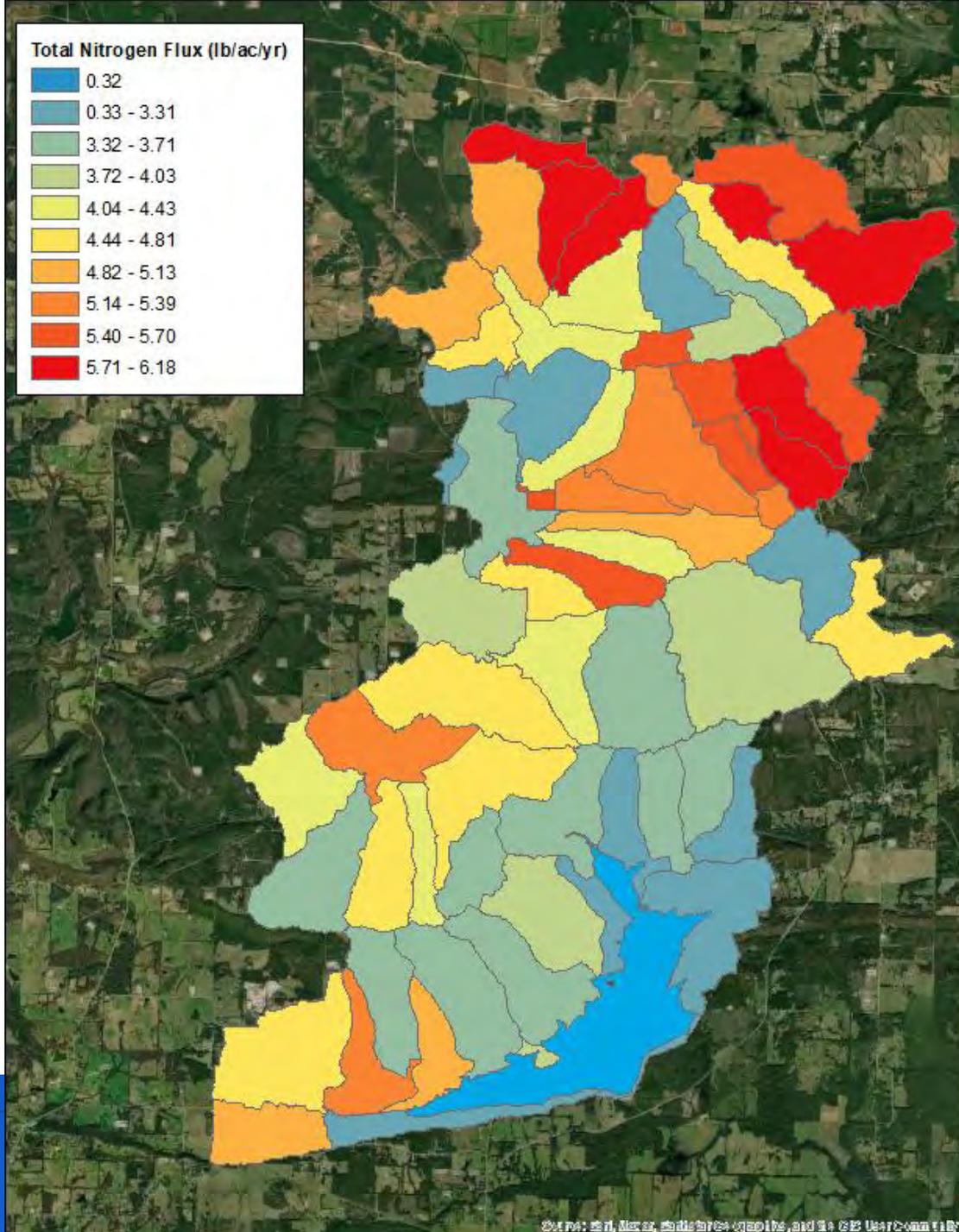
Nutrient Calibration

- Nutrient buildup/washoff adjusted by land use
 - Used literature data to make sure values made sense
- Compared with measurements **from** the USGS gage



Nutrient Results

- Modeled results show areas with higher nutrient load (lbs/year) or flux (lbs/acre/year)
 - Similar analyses were done for sediment and phosphorus
- Modeling results are used to focus management efforts
- Model results also provide information on how long it takes to flow to the lake from each catchment



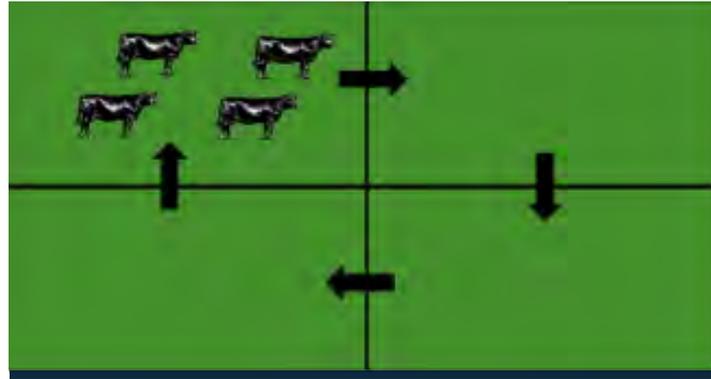
BMP Management

- Techniques and guidelines to protect water quality
- Overall – conserving valuable resources and protecting Brewer Lake (drinking water source), which reduces cost long-term
- Model indicated key pollutant sources:
 - Sediment – gravel roads, eroding streambanks, disturbed land
 - Nitrogen – manure-amended pastures, failing septic systems
 - Phosphorus – manure, sediment-bound erosion, septic systems
- BMP Categories
 - **Pasture Management** – Improves grazing and vegetation cover to reduce runoff of sediment & nutrients from pasture lands into nearby streams
 - **Stream Corridor Management** – Protects and restores vegetated areas along streams to filter pollutants, stabilize banks, and reduce erosion before runoff reaches the water.
 - **Pasture and Stream Corridor Management** – Combines improved grazing practices with stream buffers to provide the greatest reduction in pollution while maintaining productive agricultural land.



Pasture Management

- Prescribed and Rotational Grazing
- Alternative Pasture Water Sources
- Silvopasture Establishment
- Pasture Planting and Management/Heavy Use Area Revegetation
- Nutrient Management Plans
- Farm, Water Quality, and Conservation Plans
- Fertilizer Application Technology



Rotational Grazing



Alternative Pasture Water Sources



Silvopasture



Fertilizer Application Technology

Stream Corridor Management

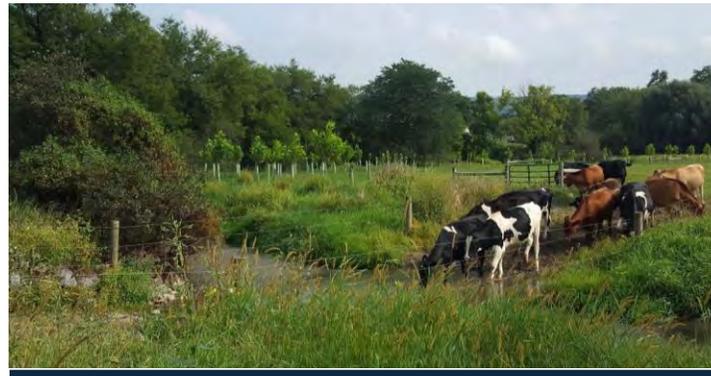
- Riparian Buffers and Buffer Zones
- Livestock Stream Access Control and Exclusion Fencing
- Streambank Restoration and Stabilization
- Filter Strips of Native Plants
- Grassed Waterways
- Farm Pond and Sediment Basins



Streambank Restoration and Buffer Zone



Grassed Waterway and Filter Strips



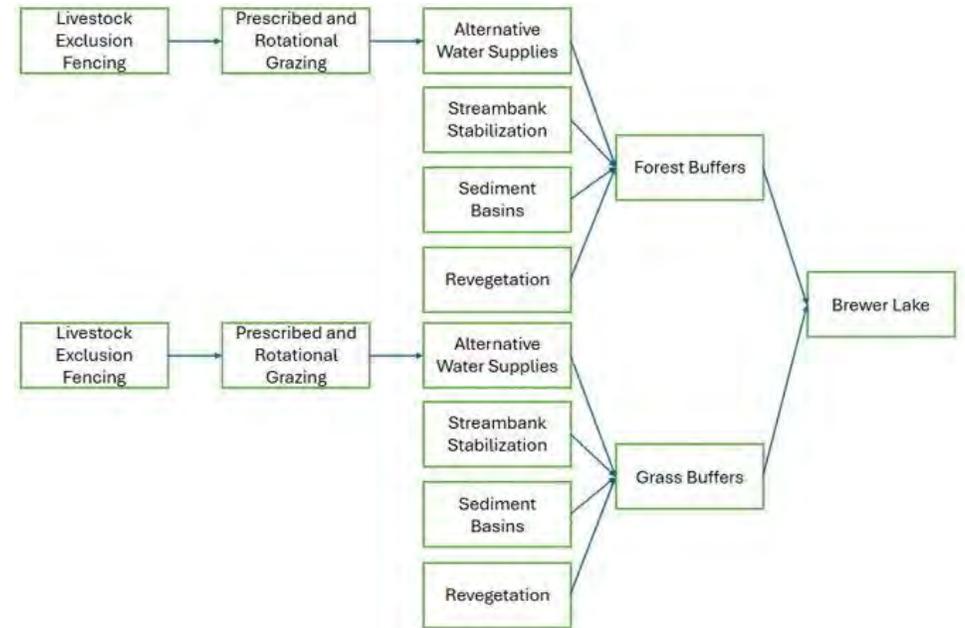
Livestock Exclusion Fencing



Sediment Basin

Pollutant Load Estimation Tool (PLET)

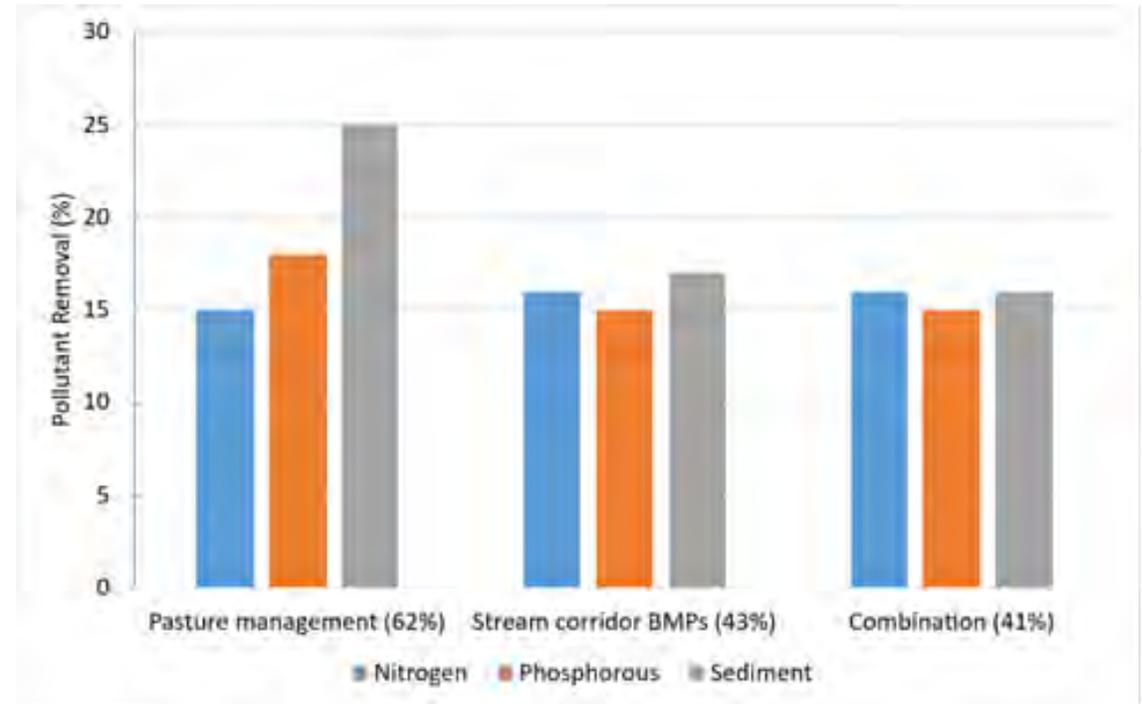
- EPA tool for estimating BMP impacts
- Users can input information about the watershed or use default values suggested by the EPA
 - Land use
 - Animal populations
 - Septic systems
 - Rainfall data
 - Soil types
- Users can create different scenarios with different extents of BMPs to estimate pollutant removal
- Goal for watershed = 15% reduction in sediment and nutrients



Relationship of Practices Used in All-Practices Scenario

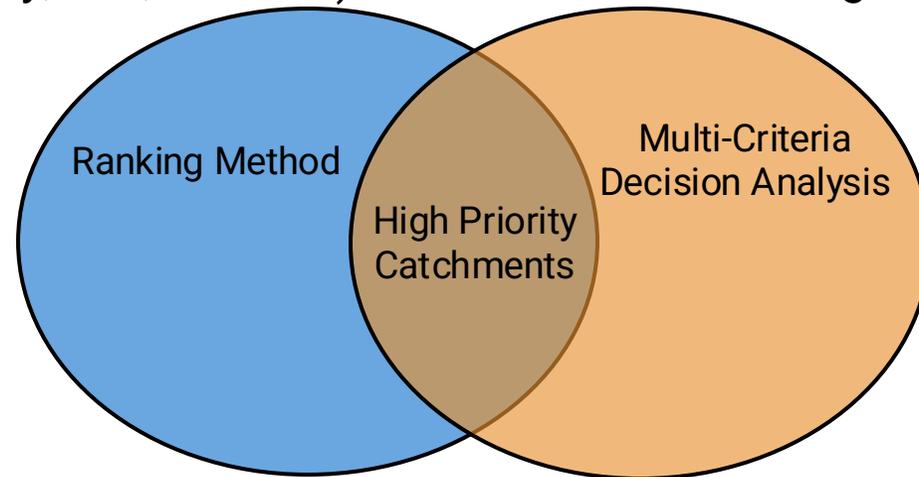
PLET Scenarios

- Three scenarios were created
 - Cattle-focused practices
 - Stream-focused practices
 - Combination scenario
- Extent of each scenario was adjusted until the desired 15% removal was achieved
 - "Area" does not refer to how large the practice is, just how many acres are treated by the practice
 - Cattle-focused practices required treating 62% of the watershed
 - Stream-focused practices required treating 43% of the watershed
 - Combination scenario required treating 41% of the watershed



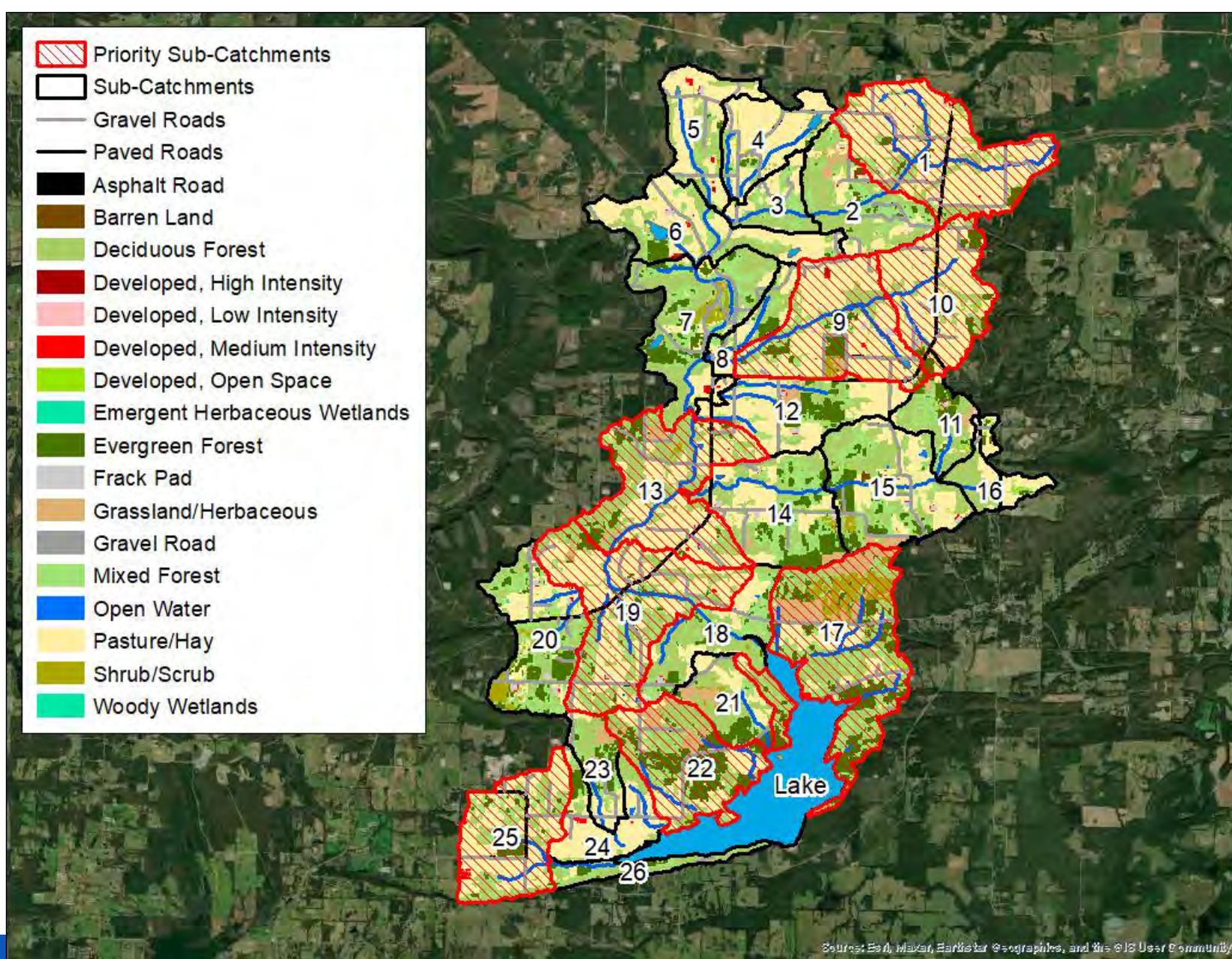
Catchment Prioritization

- Combine modeled load and feasibility of implementation to target high-return catchments
- Ranking Method
 - Separate ranks for Pollutant (TN, TP, Sediment) flux and BMP implementation feasibility
 - Subcatchments with high pollutant flux and feasibility identified to prioritize
- Multi-Criteria Decision Analysis
 - Systematic process in operations research for making complex choices by evaluating multiple conflicting criteria (quality, risk, benefits) to rank or select among alternatives



Catchment Prioritization

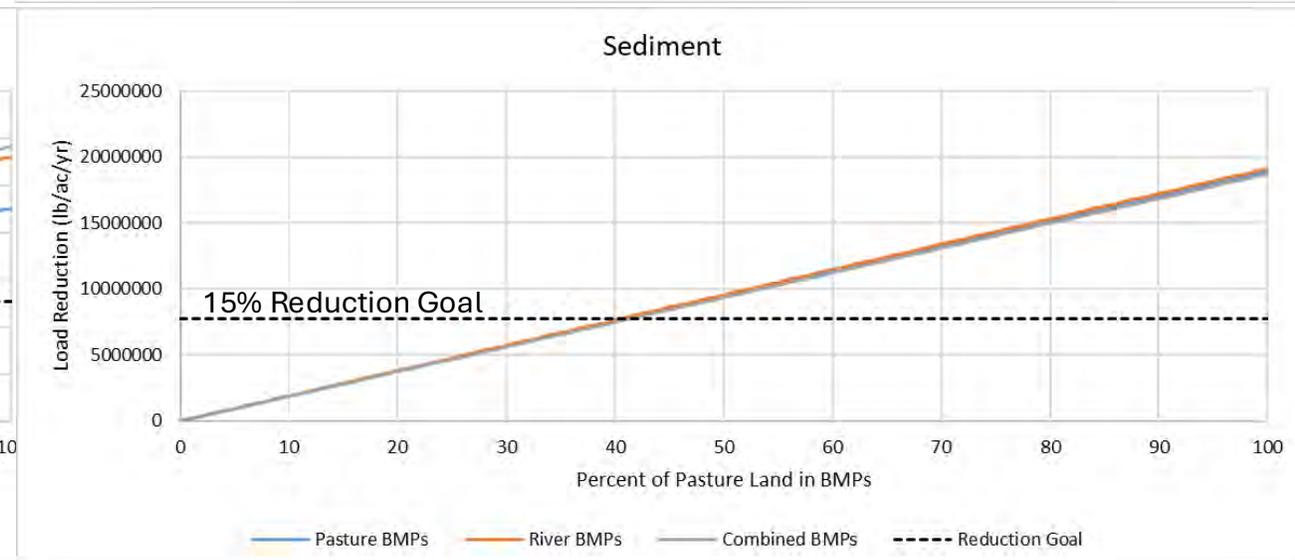
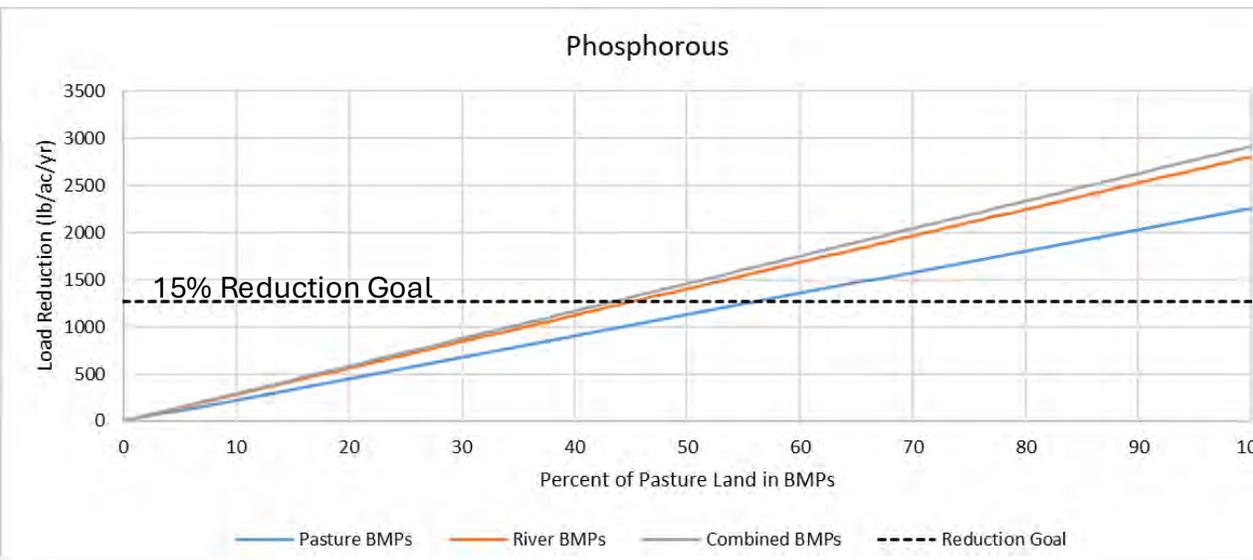
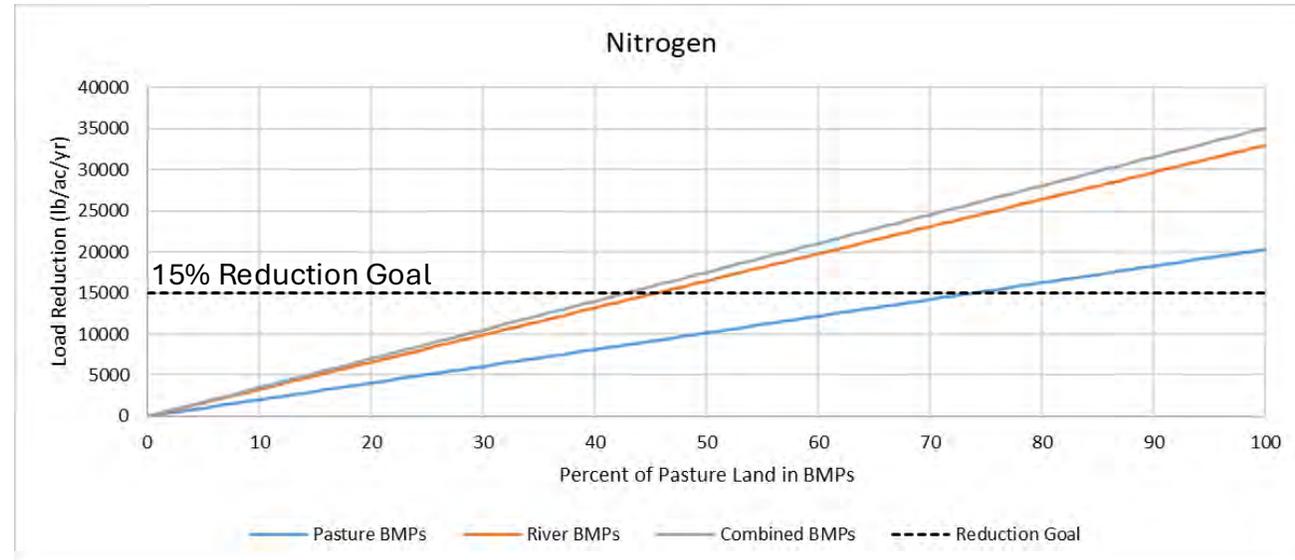
- Prioritized sub-catchments include:
 - 1 and 19: Highest loads
 - 9, 10, and 13: Higher loads with key land use
 - 17, 22, and 25: Proximity to Brewer Lake, higher loads and feasibility



High Priority Catchment

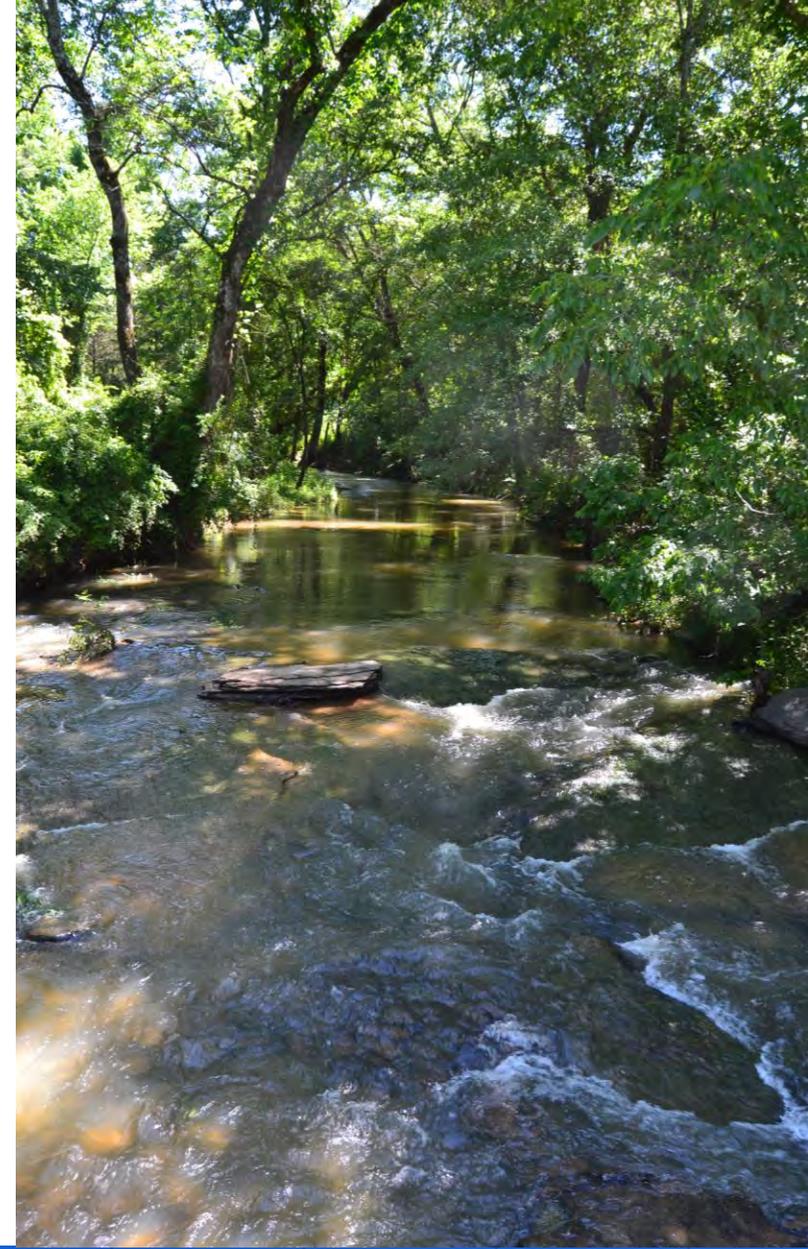
15% nutrient and sediment reduction is achievable

- Targeted BMPs reduce costs and land impacts
- Combined BMP strategies are most effective
- Focused action protects Brewer Lake long-term



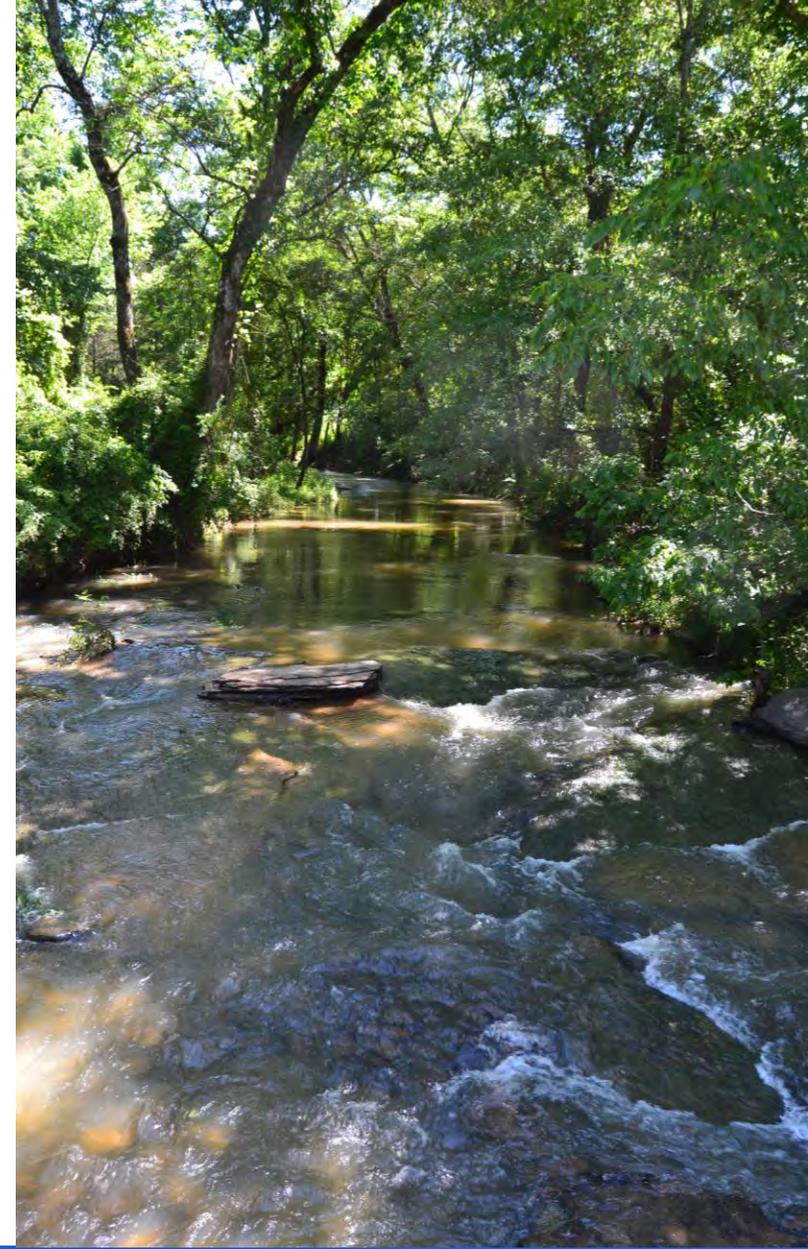
Executing the Management Plan

- The Brewer Lake Watershed Management Plan sets a goal of reducing nitrogen, phosphorus, and sediment delivery to Brewer Lake by 15%
- Implementation is structured as a phased, 10-year effort (2026–2036)
- A 5-year review will ensure progress and adaptability
- Success depends on
 - Technical expertise
 - Strategic investment
 - Local partnerships
 - Adaptive management



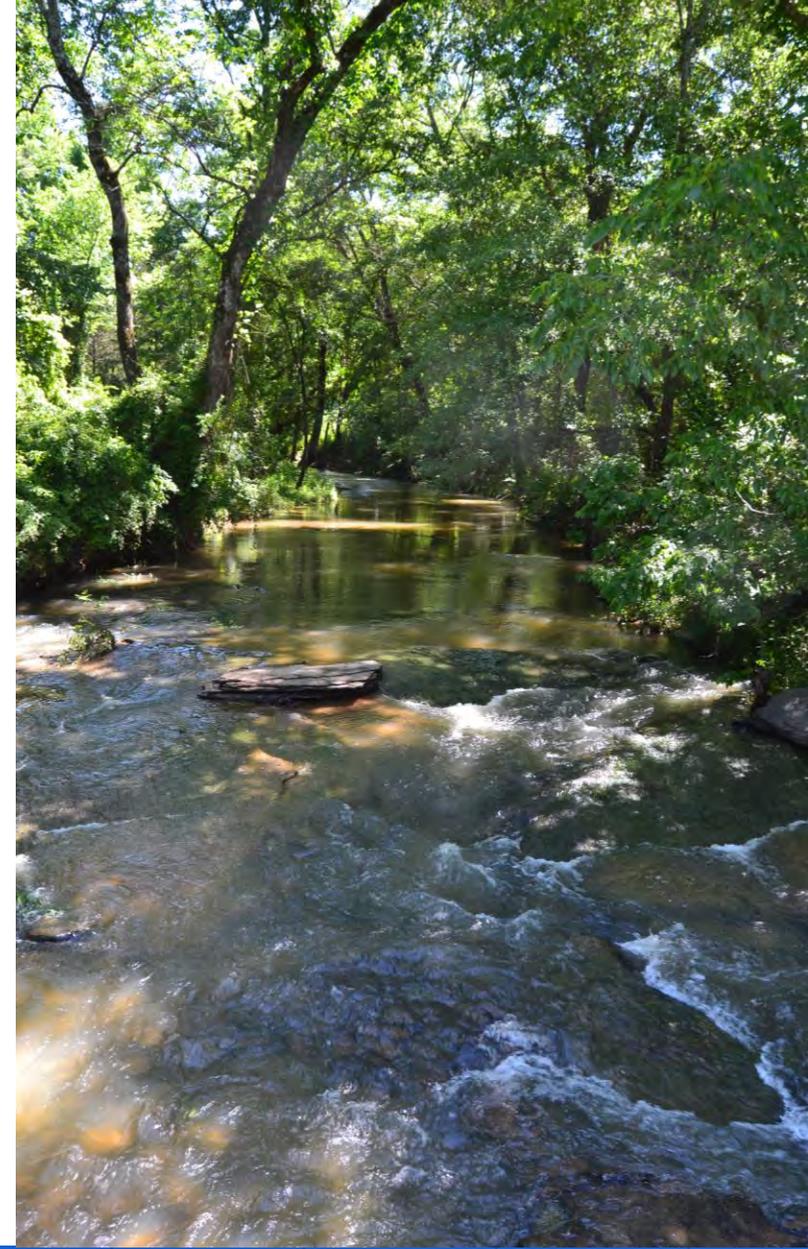
Stakeholder Involvement & Outreach

- Stakeholder engagement is the foundation of the plan
- Outreach is conducted through the
 - Conway Corp website
 - Public meetings
 - Ongoing, open communication
- Early and continuous involvement of landowners, agencies, and the public is critical for effective implementation



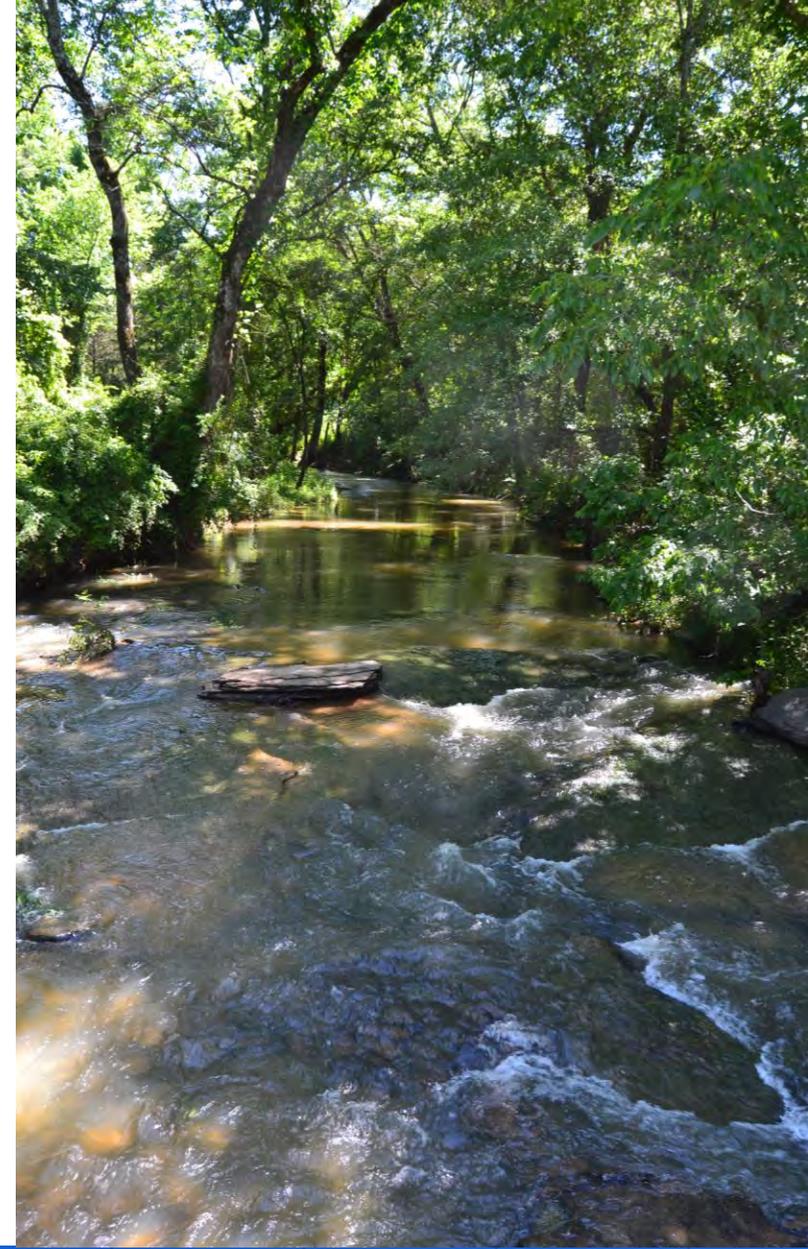
Project Coordination & Leadership

- Conway Corporation acts as the central coordinator, overseeing budgeting, stakeholder engagement, and reporting
- The U.S. Army Corps of Engineers provides technical support
- Additional partners may include
 - NRCS
 - Conservation District
 - University of Central Arkansas
 - Arkansas Department of Health
 - Arkansas Department of Agriculture



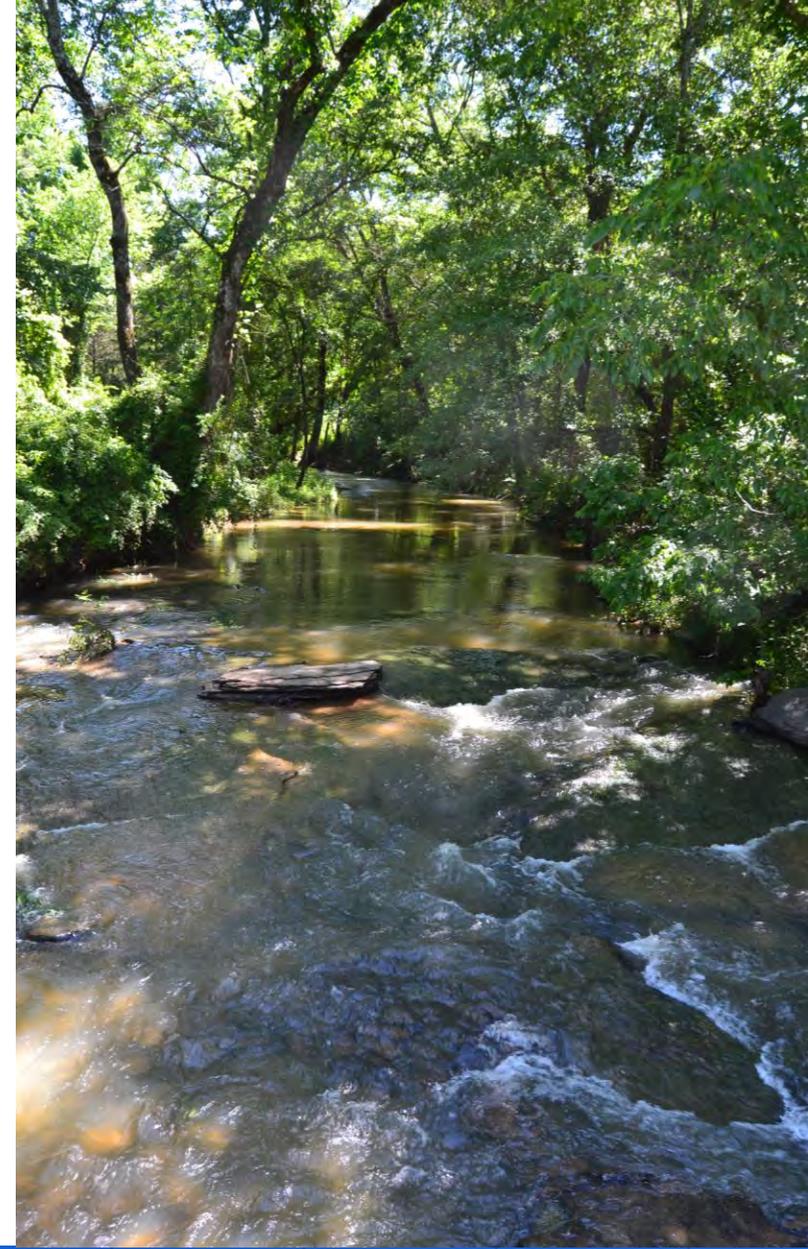
Monitoring & Adaptive Management

- Monitoring is essential for tracking water quality improvements and guiding adaptive management
- Existing programs provide baseline data
- Additional monitoring will focus on nutrients, sediment, and biological indicators
- Annual reviews and a comprehensive five-year assessment will evaluate BMP effectiveness and inform strategy adjustments



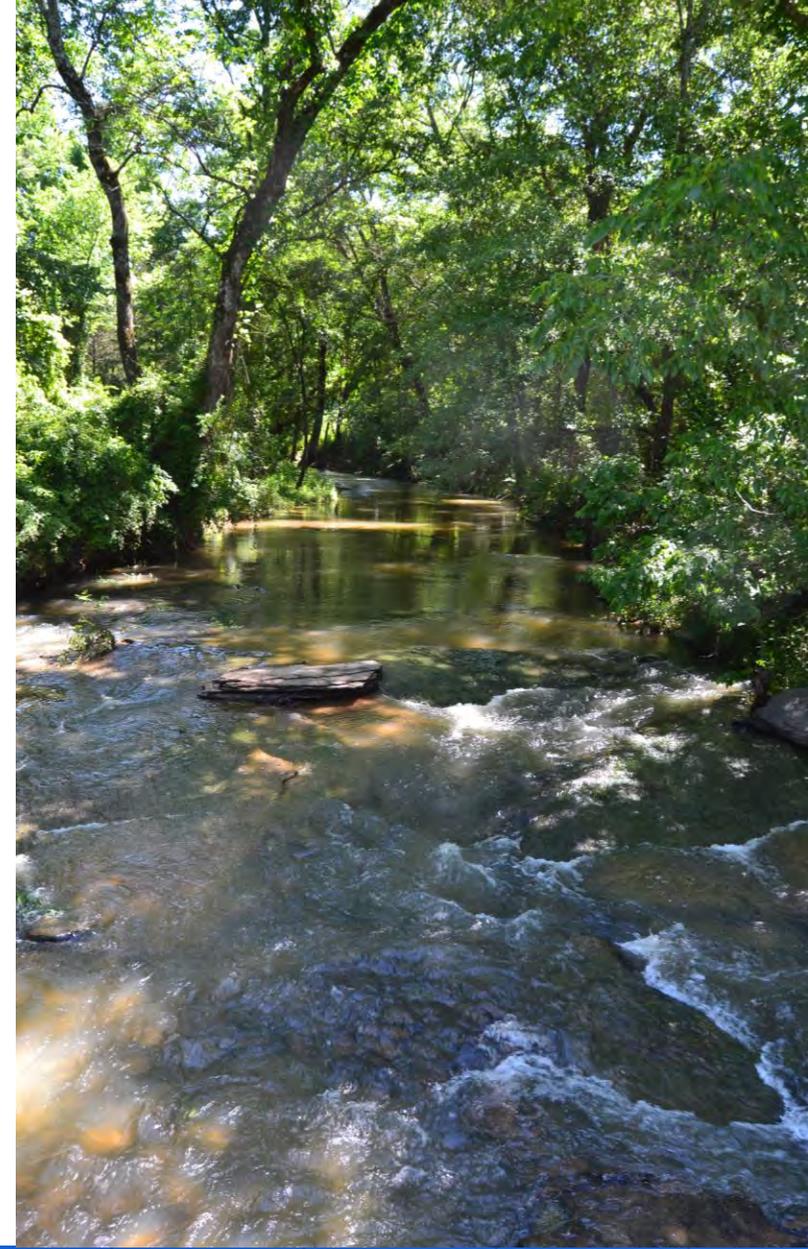
Implementation Priorities & Timeline

- Implementation begins in eight priority sub-catchments identified through modeling and multi-criteria analysis
- Actions are phased over 10 years, with early years focused on planning, outreach, and baseline monitoring, followed by BMP installation and ongoing evaluation
- Progress is measured by pollutant reductions, improved acres, and enhanced community engagement



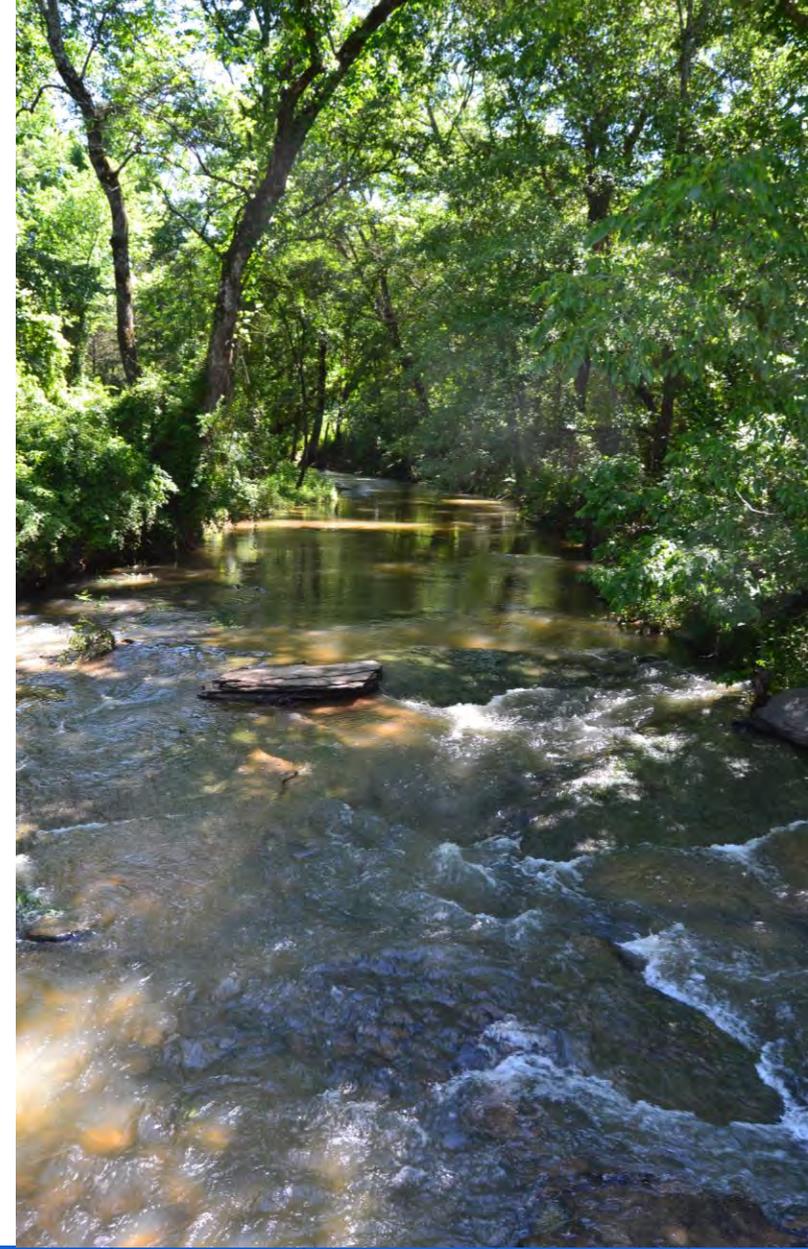
Best Management Practices (BMPs)

- Agricultural BMPs:
 - Rotational grazing
 - Livestock exclusion fencing
 - Pasture planting
 - Nutrient management
 - Poultry litter upgrades
- Riparian/stream BMPs:
 - Buffer installation
 - Streambank stabilization
 - Silvopasture establishment
- Septic system inspections, road and stormwater improvements, and watershed education programs are also included



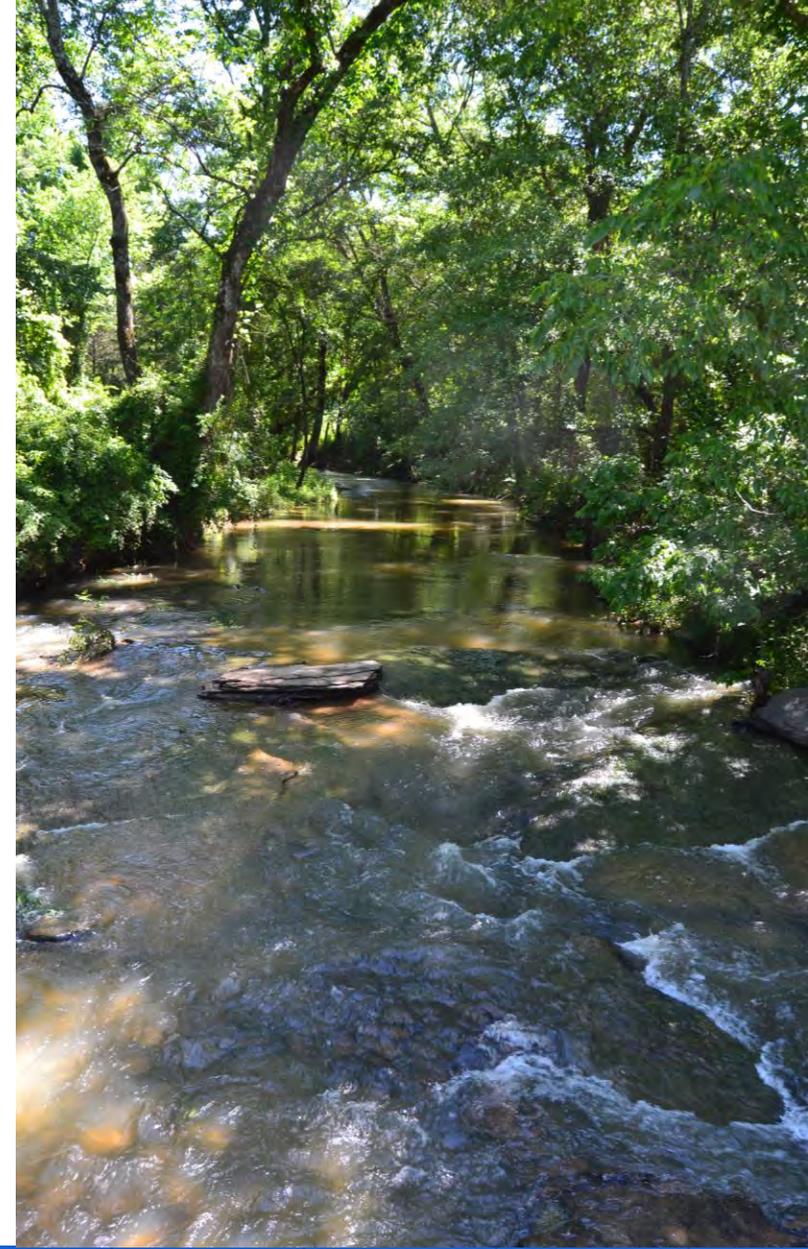
Funding & Resource Allocation

- Implementation relies on a flexible funding strategy,
- Potential funding sources include
 - EPA section 319 grants
 - State cost-share programs
 - USDA and NRCS
 - Local contributions
- Structural BMPs (e.g., streambank stabilization) require higher upfront investment, while education and monitoring need ongoing support
- Aligning BMPs with appropriate funding sources is key to long-term success



Long-Term Success & Adaptive Management

- The plan's success depends on sustained momentum, transparent communication, and adaptive management
- Regular monitoring, stakeholder engagement, and strategy adjustments ensure continued progress toward water quality goals
- The plan provides a clear framework for action
- Ongoing commitment and collaboration are essential for protecting Brewer Lake as a reliable water source and ecological resource

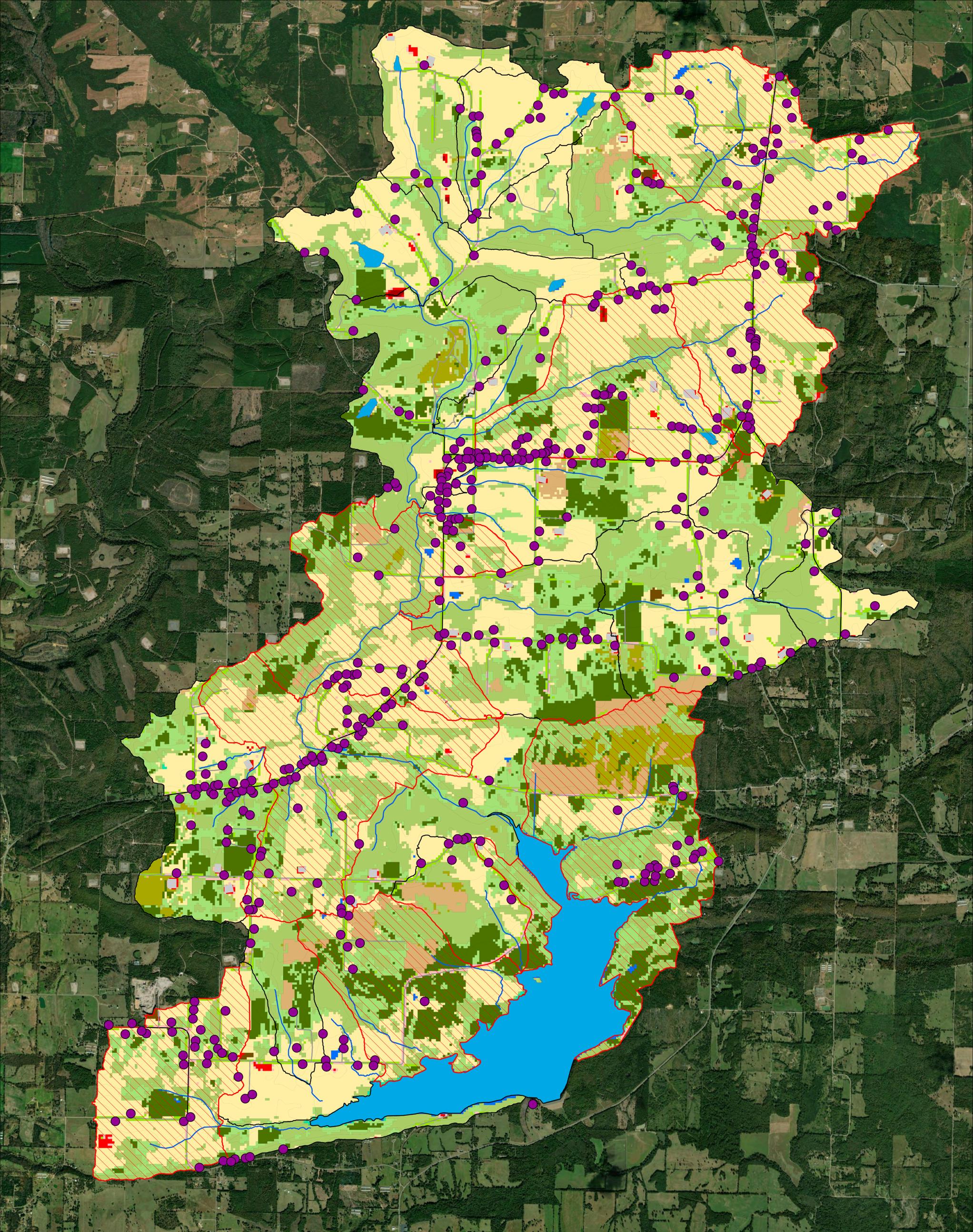




Thank You!

SUMMARY OF SUB-CATCHMENTS PRIORITIZED FOR MANAGEMENT INTERVENTION

		Priority Sub-catchments							
Category	BMPs	1	9	10	13	17	19	22	25
Stream	Riparian buffers and buffer zones	●	●	●	●		●	●	●
	Livestock stream access control and exclusion fencing	●		●	●		●		●
	Streambank restoration and stabilization		●		●	●	●	●	●
	Filter strips of native plants	●	●	●	●		●		●
	Farm pond/sediment basins	●	●		●		●		●
	Prescribed/rotational grazing	●	●	●	●		●		●
Pasture	Alternative pasture water sources	●	●	●	●		●	●	●
	Silvopasture establishment	●	●	●					
	Pasture planting and management; heavy use area revegetation	●	●	●	●		●		●
	Nutrient management plans	●	●	●	●	●	●	●	●
	Farm, water quality, and conservation plans	●	●	●	●	●	●	●	●
	Prescribed forest burns		●	●	●	●	●	●	
Other	Dry stacks, composters, and incinerators for poultry houses	●	●						
	Wastewater system management – repair or replacement	●	●	●	●	●	●	●	●
	Unpaved roads management	●	●	●					
	Watershed stewardship education	●	●	●	●	●	●	●	●
	Encourage good neighbor practices	●	●	●	●	●	●	●	●
	Illicit Discharge Detection and Elimination	●	●	●	●	●	●	●	●
	Fracking Stormwater Pollution Prevention Plan		●						



Brewer Lake Watershed Protection Plan

What is a Watershed Protection Plan?

A watershed protection plan is a framework to preserve and enhance water quality. **It involves identifying sources of pollution, identifying potential best management practices, and engaging stakeholders.**

The iterative plan aims to protect water resources from contaminants, promote healthy ecosystems, and support the community's long-term environmental and economic health.

By fostering collaboration among local governments, businesses, and residents, a watershed protection plan helps maintain clean and safe water for drinking, agriculture, recreation, and wildlife.

What a Watershed Protection Plan is Not

A watershed protection plan is not a regulatory mandate that imposes strict controls or changes on land use practices.

It does not seek to disrupt or drastically alter the daily activities of landowners and their land uses, including agriculture. Instead, it focuses on voluntary, cooperative efforts to improve water quality through education, incentives, and shared responsibility.

The plan respects existing agricultural practices and aims to work alongside agricultural producers and other stakeholders to find mutually beneficial solutions that protect water resources while supporting productivity.

What are the goals?

The primary goals of the plan project are:

- Safeguard water quality
- Support agricultural productivity by empowering farmers with resources and practices that align with environmental conservation
- Reduce nutrient inputs to Brewer Lake
- Enhance the health of the watershed ecosystem
- Identify potential water quality improvement projects
- Identify cost efficient ways to improve water quality and unlock potential funding mechanisms

Path Forward

This meeting is the initial outreach to discuss water quality issues in the watershed. The path forward will include:

- Analyzing collected water quality data in the watershed
- Compiling other watershed information

- Developing a predictive model of nutrients in the watershed
- Creating a list of potential water quality improvement projects
- Participation in discussions with watershed stakeholders concerning project viability
- A second outreach meeting
- Composing the watershed protection plan

Contact Us

comments@ConwayCorp.net

2ND Public Meeting

Brewer LAKE WATER SHED

<u>NAME</u>	<u>EMAIL</u>
Mark Ferguson	mark.ferguson@conwaycorp.com
Scott Zotti	zottis@bu.com
Blake Forrest	blake.forrest@arkansas.gov
JEANNIE GIBBY	jmgibby5779@gmail.com
Lee Tedford	lee.tedford@conwaycorp.com
Dale Gifford	dale dale@ccrwd.com
Patricia Scroggins	tricia@scroggins@hotmail.com
Robert Carruthers	crashcarruthers@hotmail.com
Jeff Resalvo	jeff.resalvo@nabholz.com
Connie Robinson	None
Zach Gardner	Zach.gardner@conwaycorp.com
Sarah Ryals	Sarah@ccrwd.com
Stephen Hogan	stephen.hogan@conwaycorp.com
Dale Gottsponer	dale.gottsponer@conwaycorp.com
Louise Fitzgerald	fitzgeraldlouise@ymail.com
Richard Fitzgerald	
Scott Keeton	Scott@ccrwd.com
J. AM	Judge @ Conway County, ORB
Donnie Crain	donnie@morriltonchamber.com
Barbara Wilson	sheepskinbarb@gmail.com
Tiffany Williams	tiffany.williams@usda.gov
Hal Halvorson	hhalvorson@uca.edu
Allen Brown	allen.brown@arkansas.gov

Appendix D: Water Quality Standards

Appendix D. Water Quality Standards

Water Quality Standards

The Federal Water Pollution Control Act (Clean Water Act) requires that all waters within the State's jurisdiction must have water quality standards that include goals (designated uses) and pollution limits for common contaminants. Standards also must include an anti-degradation policy. The Arkansas Department of Environmental Quality (ADEQ) developed and proposed water quality standards for Arkansas waters. The Arkansas Pollution Control and Ecology Commission (APC&EC) then approved, adopted, and submitted the standard for review by the U.S. Environmental Protection Agency (US EPA). Arkansas's water quality standards are published in APC&EC Rule 2, Section 4 (<https://www.adeq.state.ar.us/regs/>).

The water quality standards adopted by APC&EC apply to discharges into all surface waters of the State and therefore do not apply to natural background levels of various substances. In addition to the water quality, the biological integrity of waters should be closely monitored to ensure the aquatic biota is representative of reference waters and not affected by effluent concentrations or conditions. Section 5 of the APC&EC, Rule 2 document outlines specific standards for temperature, turbidity, pH, dissolved oxygen, bacteria, and nutrients. Many of these standards vary based on criteria such as the specific waterbody, the waterbody classification, ambient water quality parameters, flow rate, watershed, and use. Standards will be discussed more in depth in the numeric and narrative criteria section below.

Designated Uses

Most waters of the State are classified for Designated Uses, or the purpose for which water quality standards are developed for the specific waterbody. The protection of those uses is established with correlating Water Quality criteria. Waterbodies can have more than one Designated Use, with the most sensitive use setting the standards to be upheld for the waterbody.

Designated Uses of the Arkansas waters of the state are outlined by ecoregion in Appendix A (A-25) of Rule 2 of the APC&EC (2025) (Figure 1), with exceptions noted. The Brewer Lake watershed is contained in the Arkansas River Valley Ecoregion. Designated Uses of this ecoregion, including the 36 mi² Brewer Lake watershed, are described below:

- All streams with watersheds greater than 10 square miles and all lakes and reservoirs are Primary Contact Recreation. This use designates waterbodies that are swimmable, or where full body contact with the water is expected.
- All waters are Secondary Contact Recreation, or wadable. This use designates waters that involve secondary activities like boating, fishing, or wading.
- All waters are Domestic Water Supply. This use designates protection for public and private water supply.
- All waters are Industrial Water Supply. This use designates water used in industrial processes and water utilized as cooling water.
- All waters are Agricultural Water Supply. This use designates protection of water for crop irrigation and livestock consumption.
- Aquatic Life is a use designation that protects fish, shellfish, other aquatic life, and the propagation of these aquatic biota. All lakes and reservoirs in this ecoregion are classified for this Designated Use. Streams with watersheds less than 10 square miles are considered Seasonal Aquatic Life Use. Streams with watersheds 10 square miles or larger and with

discharge equal to or greater than 1 cubic foot per second (cfs) are classified as Perennial Aquatic Life Use.

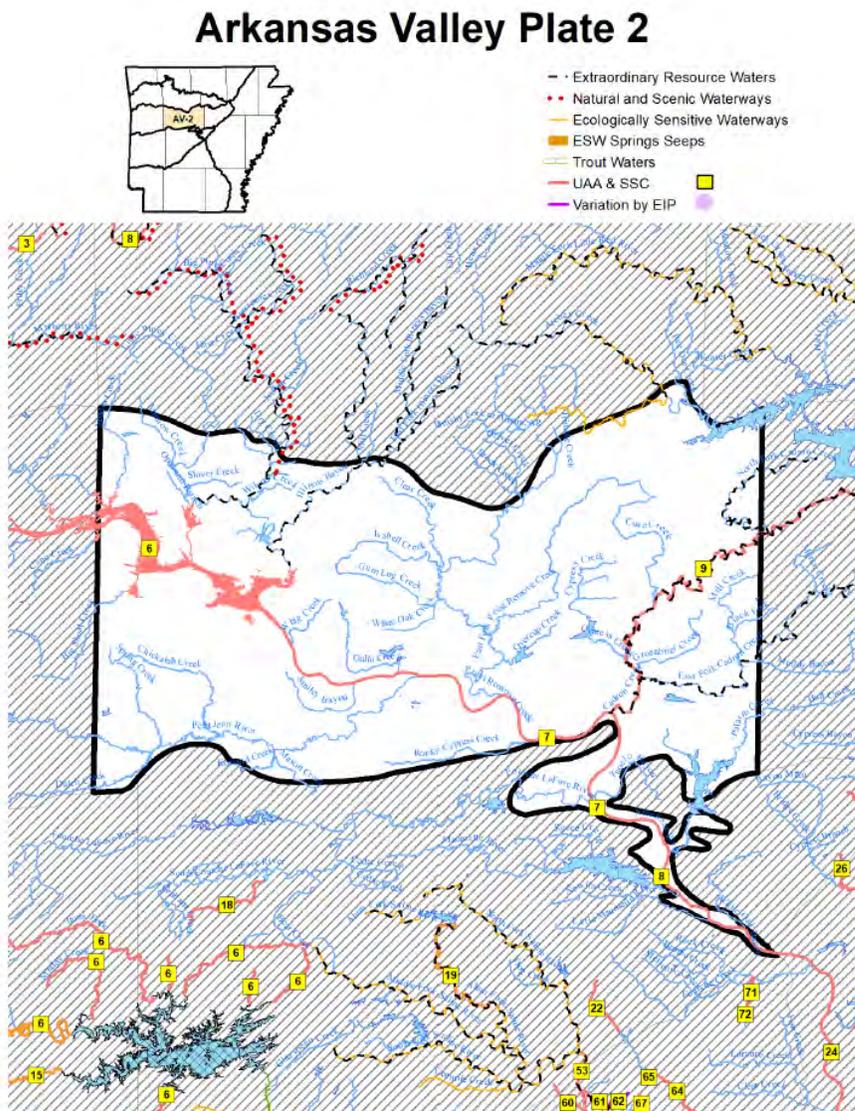


Figure 1 Arkansas Valley Plate 2 Ecoregion from Rule 2 (APC&EC, 2025)

Numeric and Narrative Criteria

Water quality criteria identify the characteristics of the waterbody that must be achieved and protected to ensure the ability of the waterbody to be used for its designated use. Criteria include chemical, physical, and biological conditions of the waterbodies and can be both quantitative and qualitative attributes. Numeric criteria are based on 304(a) guidance from the Clean Water Act or other scientifically defensible methods(8 CAR § 21-308 (3)). Narrative nutrient criteria are qualitative, descriptive water quality standards that prohibit nutrient levels (nitrogen/phosphorus) from causing undesirable conditions like

excessive algae or weeds that impair water use. Unlike numeric standards, they provide flexible, subjective guidelines for managing water quality on a case-by-case basis rather than using a specific concentration threshold. Narrative criteria can both support these numeric criteria and fill needs where numeric criteria cannot be used.

Section 4 of APC&EC, Rule 2 covers surface water general standards. These general standards are primarily narrative, covering man-caused sources of substances rather than naturally occurring nutrients and characteristics.

Section 5 of APC&EC, Rule 2 includes specific standards for water quality that apply to all surface waters of the State, except when stated otherwise, such as when flows are under applicable critical flow, in mixing zones, and where background levels of a substance may occur naturally. These numeric standards cover many water quality metrics, with specifics relating to ecoregions, waterbodies, and connection to other water quality metrics.

High concentrations of nutrients in waterbodies can lead to conditions that enable excessive algal growth. The general standards section Rule 2.402 describes the nuisance species standard, stating that waters shall be free of man-caused substances from both point and nonpoint source discharges that result in the adverse proliferation of nuisance aquatic life. Rule 2.509 specifies that nutrient concentrations shall not reach levels that cause algal growth that impairs the designated uses of a waterbody. There are a multitude of natural factors within a waterbody that can contribute to an overabundance of nutrients, and high amounts of nutrients do not always lead to adverse algal growth. Therefore, other water quality metrics, including pH, dissolved oxygen, and periphyton or phytoplankton production, will be assessed for a combination that reflects impairment in the waterbody. Still, when excess nutrients result in an impairment, based upon Department assessment methodology, by any Arkansas established numeric water quality standard, the waterbody will be determined to be impaired by nutrients.

Within the Brewer Lake Watershed, algal growth in the lake is attributed to nutrient runoff throughout the watershed. Reducing nutrient runoff will likely reduce the amount of algal growth and/or frequency of larger blooms in Brewer Lake, bringing Brewer Lake into compliance with Rules 2.402 and 2.509. To meet the criteria of Rule 2.405, the conditions of the Brewer Lake Watershed should have no impact on the aquatic biota residing in the waters. Aquatic life observed in streams should be representative of a healthy, well-supported fishery. The key species of this ecoregion's fish community include bluntnose minnow, golden redhorse, yellow bullhead, longear sunfish, redbfin darter, and spotted bass. Indicator species, or species that reflect the health of the ecosystem with their presence or response to changes in the ecosystem, include orange-spotted sunfish, blackside darter, and madtoms.

Turbidity is a measure of cloudiness in water and is often used as an indicator of the presence of nutrients or microorganisms linked to diseases. Receiving waterbodies shall not distinctly increase in visible turbidity from discharges in the waters or activity happening within the waters. Rule 2.503 outlines turbidity values for streams, lakes, and reservoirs. During base flow conditions in streams, turbidity shall not exceed 21 NTU. Base flow is defined as flow occurring from natural storage sources like groundwater and not caused by rainfall. Storm flow shall not see a turbidity of 40 NTU exceeded in more than 20% of the monthly samples taken over at least 24 months. Lakes and reservoirs shall not see turbidity exceed 25 NTU during base flow and 45 NTU during storm flow.

Total ammonia nitrogen criteria are pH- and temperature-dependent. Tables for acute criterion and chronic criterion, with and without the presence of fish in their early stage of life, can be found in the corresponding section of APC&EC, Rule 2.

Brewer Lake serves as a drinking water reservoir for Conway Corporation and CCRWDD and thus must comply with federal Safe Drinking Water Act (SDWA) regulations put forth by the U.S. EPA (2025). Nitrates, which are harmful to children six months and younger, can enter waterways through agricultural runoff and septic tank leakage. The maximum contaminant goal for nitrates to reduce the risk of harm is 10 mg/L.

Currently, none of the ADEQ water quality monitoring stations within the Brewer Lake Watershed have resulted in streams to be listed on the EPA 303(d) 2022 Final List or 2024 Draft List. In Arkansas Code Annotated § 15-20-1104 (2003), a section of the state code identifying County and watersheds of surplus nutrients, neither the County nor the Brewer Lake Watershed are declared to be nutrient surplus areas.

Antidegradation Policy

Arkansas's Antidegradation Policy, found in Rule 2 Section 2 of the Regulation Establishing Water Quality Standards for Surface Waters of the State of Arkansas by the Arkansas Pollution Control and Ecology Commission, is a set of regulations that protects the State's water quality by ensuring that water is used in a way that maintains or increases its current quality. The ADEQ implements and enforces the policy, using monitoring data to assess the State's waters. The policy is a demonstration of Arkansas's commitment to compliance with the Clean Water Act.

The policy protects the current uses and water quality condition of all waters in Arkansas. It also provides extra protection for waters that are high quality or have unique ecological or aesthetic features, except in cases where lower water quality is necessary for economic or social development. In cases where a lower quality standard is deemed necessary, the existing use remains fully protected. The policy protects designated Outstanding Resource Waters by recommending water quality controls, maintenance of the natural flow regime, protection of instream habitat, and encouraging land management practices that are protective of the watershed. These practices are all alternatives that would cause less or no degradation. It also addresses impairments caused by thermal discharges by citing Section 316 of the Clean Water Act.

References

Arkansas Code Annotated. 2003. § 15-20-1104 – Declared Nutrient Surplus Areas.

Arkansas Department of Environmental Quality (ADEQ). n.d. Aquaview.

<https://experience.arcgis.com/experience/57e4fa8751524d54bd69ab58a7296e3e/page/Page> Accessed January 27, 2026.

Arkansas Pollution Control and Ecology Commission (APC&EC). 2025. 8 CAR § 21: Rule Establishing Water Quality Standards for Surface Waters of the State of Arkansas.

United States Congress. 2001. Federal Water Pollution Control Act.

U.S. Environmental Protection Agency. 2025. Summary of the Safe Drinking Water Act. 42 U.S.C. §§ 300f–300j-9

Appendix E: HSPF Model Development

HSPF Model Development

1. HSPF Model Background

The goal of this project was to understand the nutrient sources in the Brewer Lake watershed and the loading to the lake. Incorporating the variable watershed loadings across a range of years provided a good understanding of those impacts on the reservoir.

A HSPF (Hydrologic Simulation Program – Fortran) (Bicknell et al., 2001) was used to simulate watershed hydrology and nutrient dynamics. The HSPF model is included in the EPA BASINS suite of tools (US EPA, 2025) and is frequently used in watershed studies. The model is a lumped parameter model that simulates watershed hydrology and point and nonpoint source pollutant loadings, fate and transport through the watershed streams. The model routes flows and pollutants through the stream network connecting each sub-catchment in the watershed. HSPF simulates the water cycle via precipitation, infiltration, and groundwater flows to the stream and deep aquifer. The model is a time variable model that simulates hourly variable conditions in the watershed. Model results can be output on hourly or greater time steps.

1.1 Topography

Elevation in the Brewer Lake watershed ranges from 329 feet above sea level near the lake to 746 feet above sea level in the headwaters (Figure 1-1) (Arkansas GIS Office, 2025). Stream slopes are generally mild with steeper slopes in the western part of the watershed and along the tributaries (Figure 1-2).

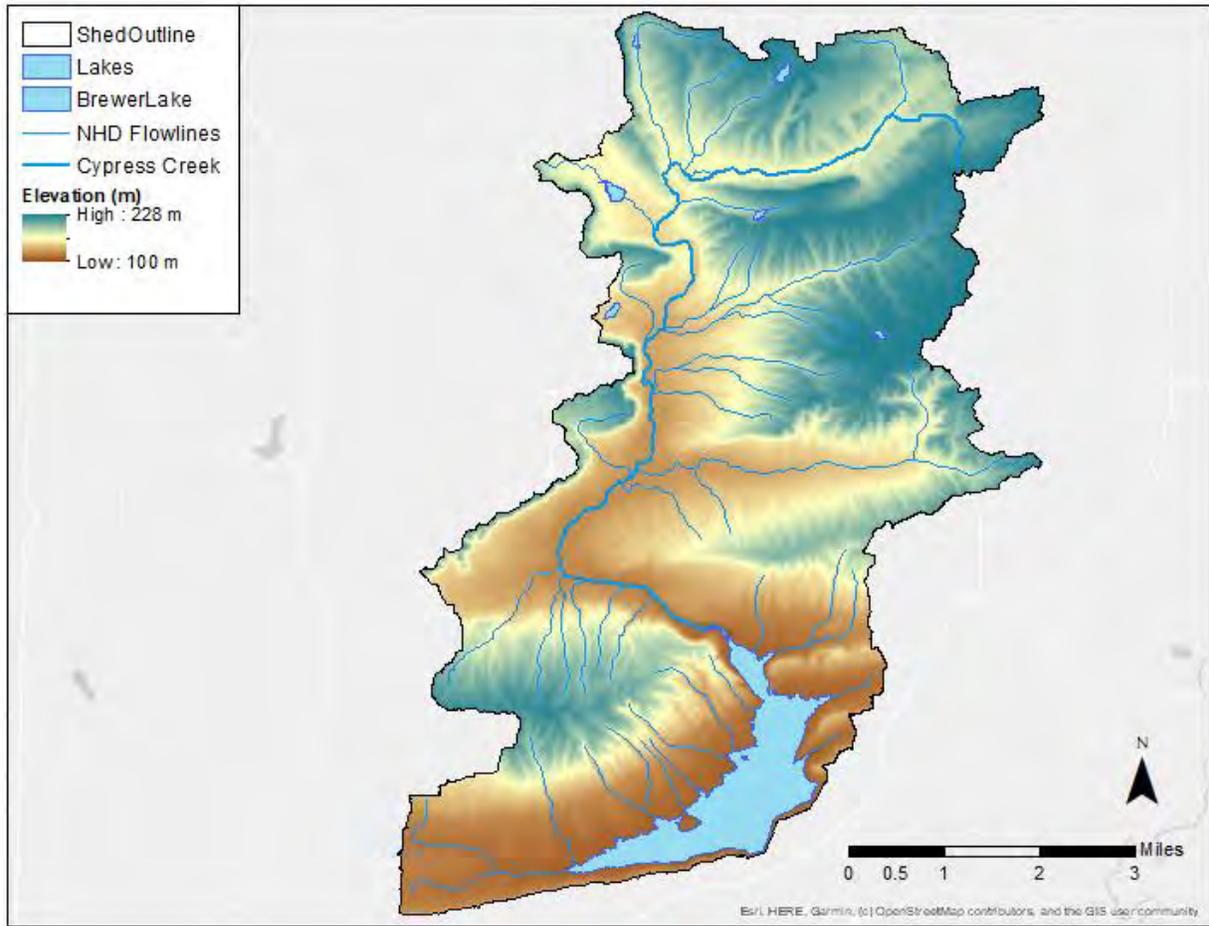


Figure 1-1 Watershed Elevation

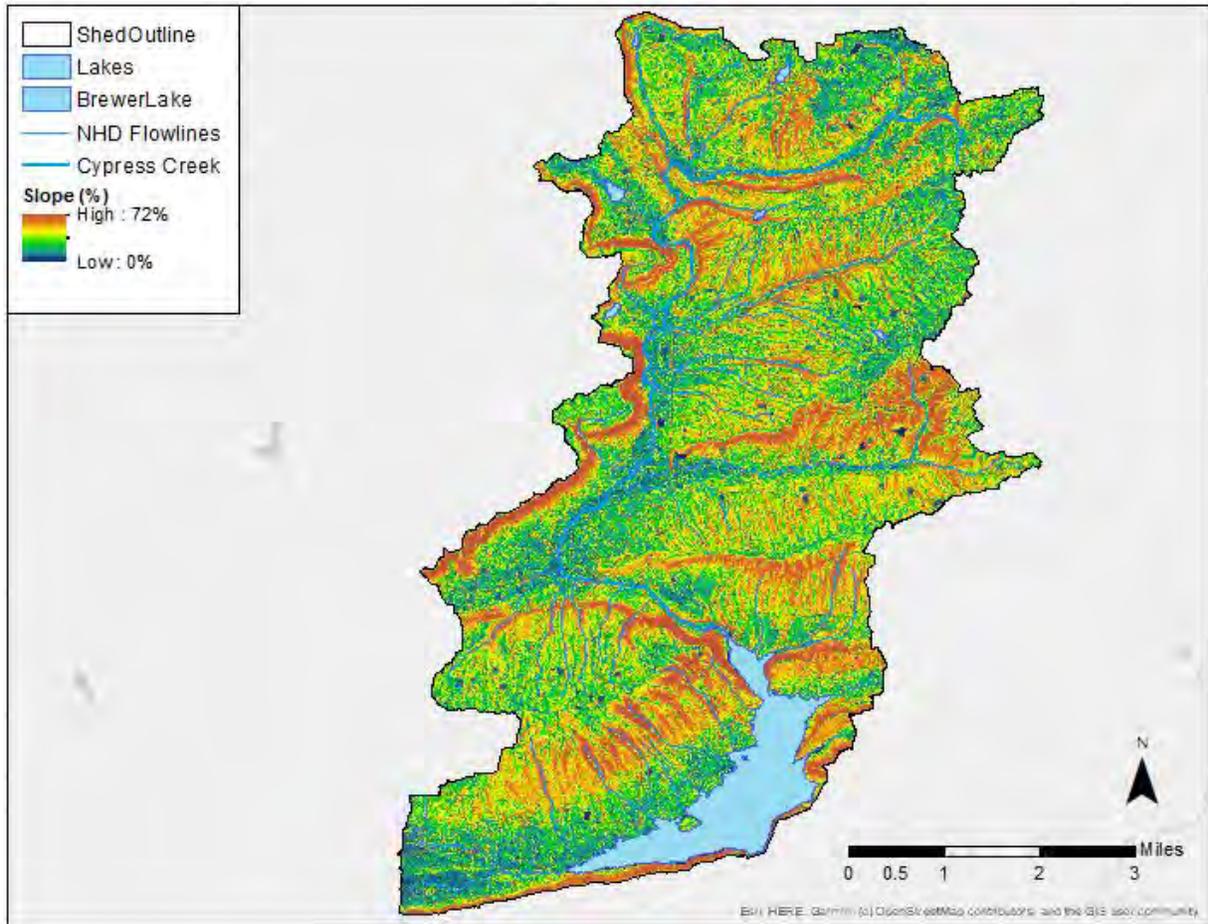


Figure 1-2 Watershed Slopes

1.2 Soils

Soils in the watershed were identified using the NRCS Web Soil Survey data interface and the SSURGO data (USDA, 2025). The predominant soil type is fine sandy loam and has good drainage. There are also some silt loams scattered throughout the watershed. The sandy soils in the Brewer Lake watershed generally provide good drainage. Most soils are Hydrologic Soil Group (HSG) C but C/D and D soils are also common. Isolated locations along Cypress Creek have HSG B soils (Figure 1-3). Exceptional drainage occurs in HSG B soils which are scattered throughout the watershed along river reaches. These reaches are likely losing reaches where runoff in the stream infiltrates to groundwater. Losing reaches over HSG B soils are an important hydrologic feature that results in loss of runoff between subcatchments in the northern portion of the watershed and Brewer Lake.

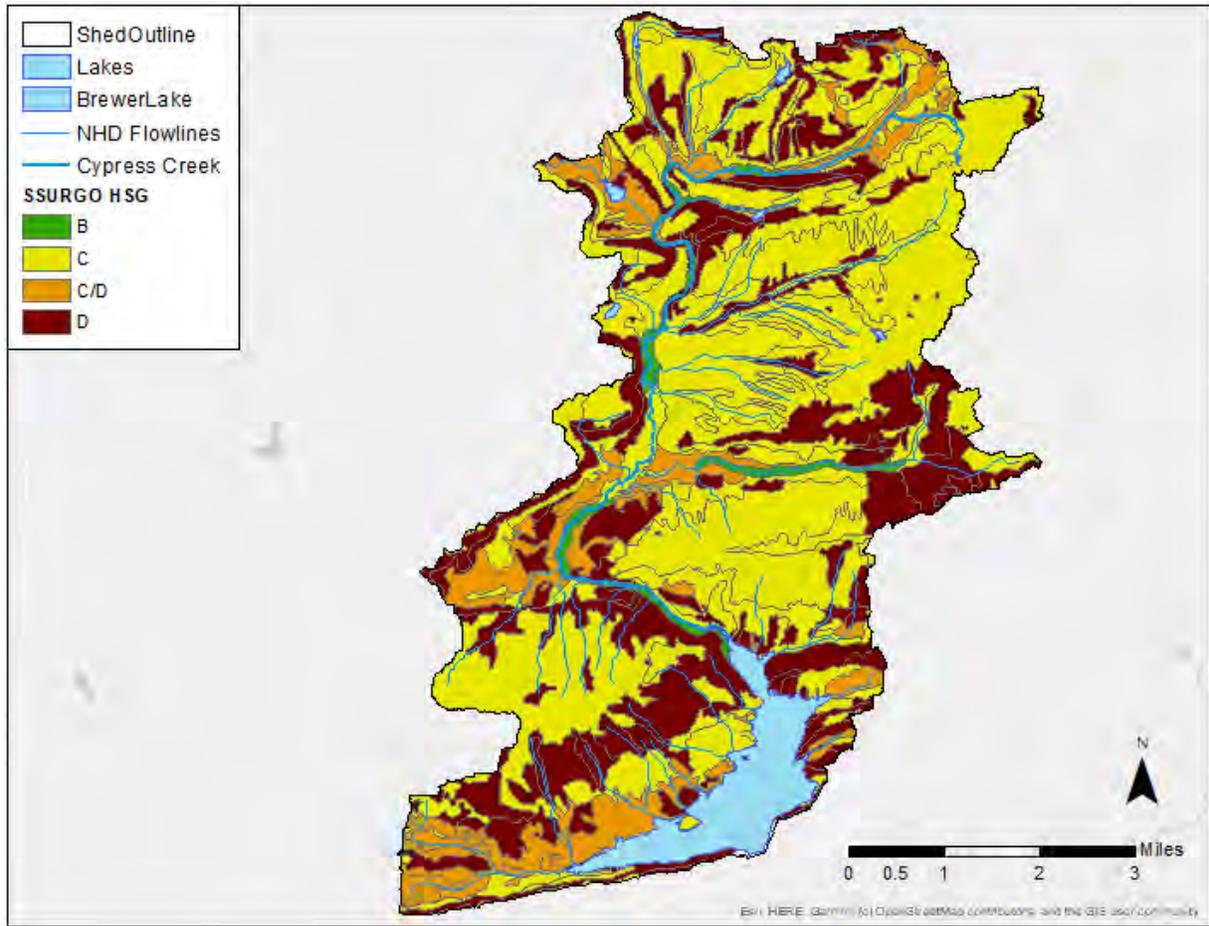


Figure 1-3 Watershed hydrologic soil groups

1.3 Land Cover

Accurately quantifying land cover is critical for modeling both water quantity and water quality. Land cover has a significant impact on soil infiltration properties, sediment calculations, and nutrient cycles. Each landcover type in the watershed was assigned infiltration and sediment properties based on scientific literature.

Three datasets were used to categorize the landcover in the Brewer Lake watershed; the National Land Cover Database (NCLD), county roads data, and fracking pad locations. The NLCD (USGS, 2025) is a dataset published by the United States Geological Survey (USGS) and developed in collaboration with the Multi-Resolution Land Characteristics (MRLC) Consortium that classifies the landcover over the conterminous United States. The NCLD provides land cover data at 30 meter spatial resolution as an annual snapshot in time. The 2021 release of the NLCD was used for this study as it is the most recent edition of the NLCD that classifies landcover during the same time as stream flow calibration data measured at USGS stream gage 07261090. Figure 1-5 shows the 2021 NLCD in the Brewer Lake watershed in combination with road and fracking pad data.

Fracking for oil and gas extraction is a new and impactful land use for hydrologic and water quality modeling in the Brewer Lake watershed. Throughout the Brewer Lake watershed, fracking pads affect rainfall-runoff processes and sediment loading. Fracking pads also have different runoff properties which affect the buildup and washoff properties of nutrients preceding and during rainstorms. Fracking pads were mapped based on point locations with their aerial extent determined via an examination of aerial imagery in the watershed (Hart, 2014).

Roads in the Cypress Creek watershed are predominantly unpaved county roads (Arkansas GIS Office, 2025), however, Highway 9 as well as several other major paved roads do pass through the watershed. Roads impact both the hydrology and water quality of the watershed by increasing the amount of runoff relative to natural pervious area and introducing sediments and other pollutants to the runoff. Often roadside ditches carry water to waterways. Because of these impacts, correctly accounting for the roadways in the hydrologic model is critical.

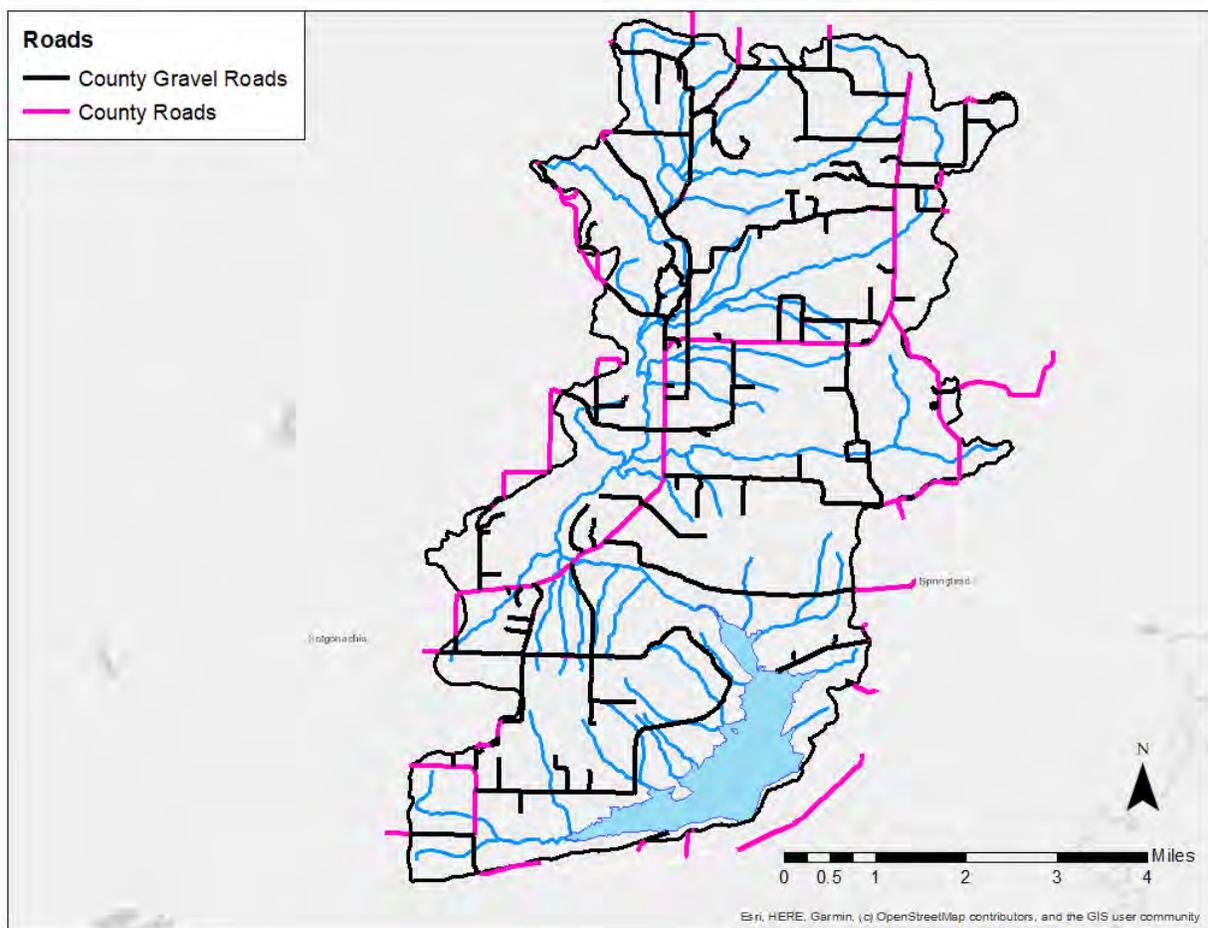


Figure 1-4 Gravel and paved roads in the watershed

The three datasets were combined to have a comprehensive picture of the land use throughout the watershed. Figure 1-5 shows the combined land use data in the watershed.

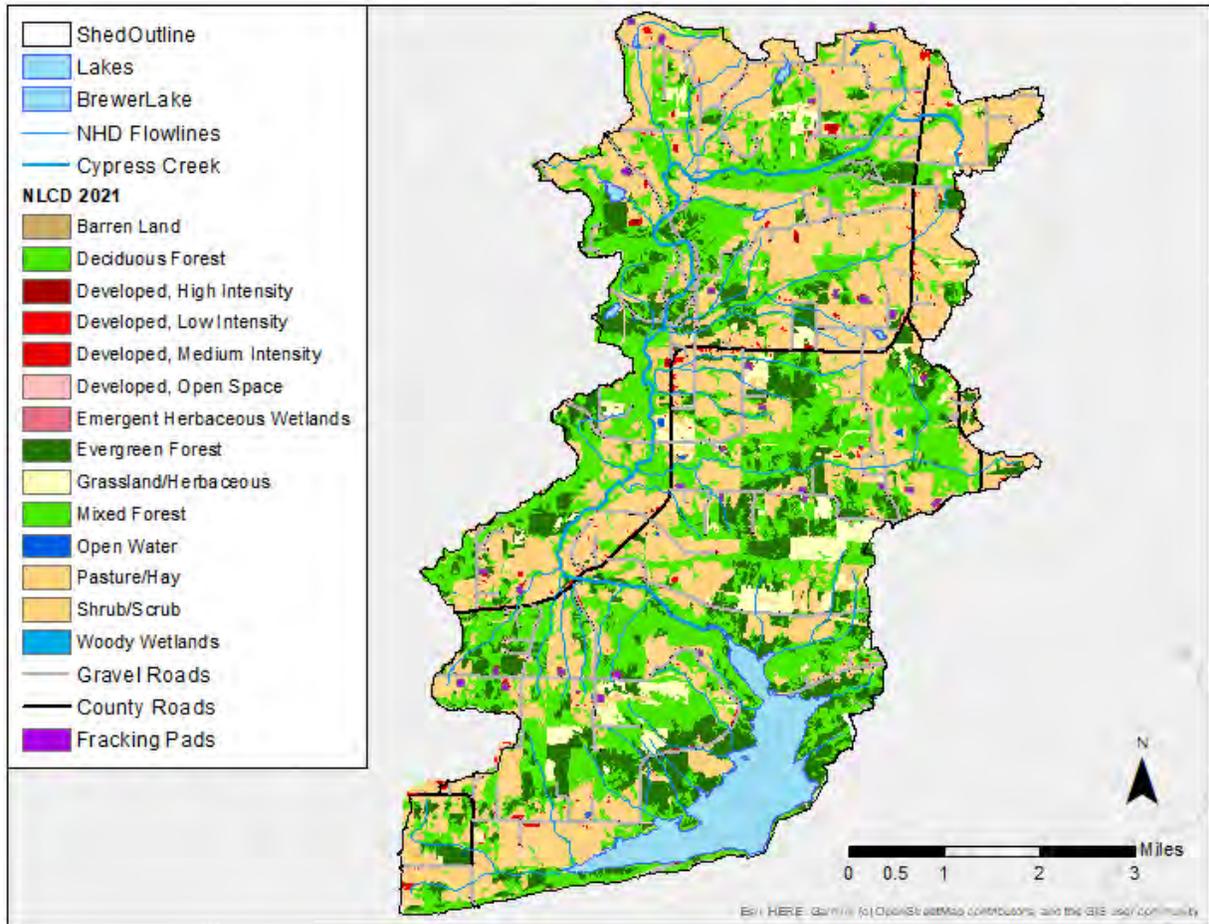


Figure 1-5 Watershed National Land Cover Dataset (2021), county paved roads, gravel roads and fracking pads

Table 1-1 Modeled land use, HSG soils, slope and area

Land Use	HSG Soil	Slope(%)	Imperviousness	Area (ac)
Deciduous Forest	B			214
Deciduous Forest	C	0-5		506
Deciduous Forest	C	5-10		1,210
Deciduous Forest	C	>10		335
Deciduous Forest	D	0-5		409
Deciduous Forest	D	5-10		1,793
Deciduous Forest	D	>10		911
Evergreen Forest	C	0-5		1,029
Evergreen Forest	C	5-10		408
Evergreen Forest	D	0-5		376
Evergreen Forest	D	5-10		291
Mixed Forest	C	0-5		595
Mixed Forest	C	5-10		1,093
Mixed Forest	D	0-5		341
Mixed Forest	D	5-10		956
Herbaceous				607
Shrub/Scrub				353
Barren Land				28
Pasture/Hay	C	0-5		5,470
Pasture/Hay	C	5-10		455
Pasture/Hay	D			2,983
Gravel Road			80%	323
Fracking			80%	69
Paved Road			95%	59
Developed, Open Space			20%	730
Developed, Low Intensity			40%	256
Developed, Medium Intensity			60%	73
Developed, High Intensity			80%	10
Water				1,145
Wetlands				73

1.4 Climate and Precipitation

Conway County, Arkansas, experiences a humid subtropical climate with hot, humid summers and mild winters. There isn't an available long term meteorological station within the watershed. Rainfall estimates from the North American Land Data Assimilation System (NLDAS) were obtained via the BASINS interface, which is an hourly estimate of climate conditions across the United States, and were used to characterize the rainfall in the watershed. The watershed receives an average of 58 inches of rainfall annually, with the highest average monthly rain totals in spring (Figure 1-6).

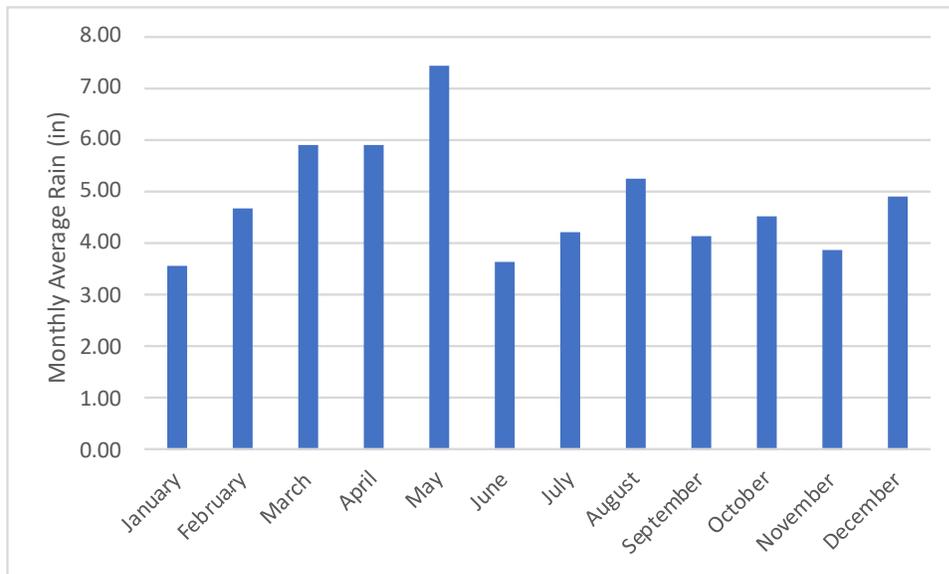


Figure 1-6 NLDAS monthly average rainfall (in/month)

The pollutant source assessment identifies sources of phosphorous, nitrogen, and sediments in the Brewer Lake watershed. Identification of pollutant sources is critical to accurately represent nutrient and sediment loading in the HSPF model and inform watershed prioritization efforts. Pollutants in the watershed come from point sources, nonpoint sources, and contributions of hazardous waste that is improperly stored. Quantifying each source of pollution is critical to understanding pollutant dynamics in the watershed and selecting stormwater BMPs to address water quality issues.

The pollutant source assessment combined data from state and federal sources to identify potential sources of point, nonpoint, and hazardous waste pollutant sources. Pollutant sources were represented in the HSPF model to understand their contribution to water quality in Brewer Lake. Each source of pollution is discussed in detail in sections 1.5, 1.6,

1.5 Nonpoint Sources

Nonpoint sources of pollution include roadway runoff, agricultural runoff, natural soil erosion, streambank erosion, and stream bed erosion. Specific nutrients on the land surface can be either bound to sediments or dissolved in storm water runoff.

Roadways are also an important source of nonpoint source pollution. Gravel roadways in particular are unique in that they have exposed soils that are susceptible to erosion during rainstorms. Roadways are also unique because they are frequently paralleled by drainage ditches that offer a direct route for runoff to transport sediment and nutrients from the roadway to nearby streams.

Similar to roadways, developed spaces are a potential nonpoint source of pollution. Developed areas runoff quickly during storm events owing to their high percentage of impermeable area. Dust, nutrients, and heavy metals accumulate on impervious areas from vehicle traffic, atmospheric deposition, and erosion during dry periods and are transported to streams with runoff events.

Agricultural runoff is a unique source of nonpoint pollution because the soil has been modified and may contain amendments and fertilizers in addition to being disturbed by management practices. Seasonal planting and harvest can disturb sediments and increase susceptibility to soil erosion. Soil amendments

and fertilizers also impact the quantity of nutrients in the soil. Manure application is an example of an important management practice that improves crop growth and can impact nutrient loading during runoff.

The amount of manure produced in the watershed and applied to pasture lands was a significant source of nutrients and a point of significant discussion during model development. There were a total of 19 chicken houses with broilers and 5 with layers with an estimated 25,000 chickens per house, using a combination of information from PLET (US EPA, 2025b) and discussions with the Team. Other animal estimates were calculated from county population information (USDA, 2025b) and scaled to watershed area. That information was paired with manure production rates from Miller (2021) to estimate the total manure production and of that, the total nitrogen and total phosphorus production which was applied to the 8,900 acres of pasture in the watershed per year (Table 1-2).

Table 1-2 Manure and nutrient production in the watershed

Animals	Count	Dry Production (lb/animal/yr)	Total Production (lb/yr)	Percent		Nutrient Load	
				TN	TP	TN (lb/yr)	TP (lb/yr)
Chickens, Broilers	475,000	48	22,995,700	0.6%	0.4%	145,236	96,824
Chickens, Layers	125,000	18	2,281,250	1.7%	0.5%	39,534	12,159
Cow	2,000	3,385	6,769,533	0.6%	0.2%	41,320	16,706
Calf	1,042	1,314	1,369,188	0.4%	0.2%	6,102	2,096
Horses	88	2,785	245,076	0.3%	0.1%	809	270
Pigs/Hogs/Swine	4,000	424	1,696,033	0.9%	0.5%	15,187	8,215
Sheep	37	374	13,843	1.0%	0.5%	135	68
Total			35,370,623			248,323	136,338
Applied acres			8,900			8,900	8,900
Load per acre per year			3,974			27.9	15.3

1.6 Point Sources

Point sources of pollution include any pollutant source where a single source of pollution is released into the environment. Point sources of pollution include wastewater treatment facilities, septic systems, and any NPDES permit locations. In the Brewer Lake watershed, point sources of pollution include septic systems and agricultural discharges.

Septic systems are a common method of treating domestic wastewater in the Brewer Lake watershed. When located in appropriate soils far from streams, operated appropriately, and well maintained, septic systems are effective at reducing nutrient loading to waterbodies. In practice some portions of septic systems discharge a non-negligible quantity of nutrients.

The Arkansas GIS Office has locations of individual sewage disposal systems (septics) (Arkansas GIS Office, 2025) and other potential sources of contamination in the watershed (Figure 1-7). Discussions with the working group indicated that there are no consistently active permitted direct discharges in the watershed. The septic systems were a potential source of nutrients in the watershed.

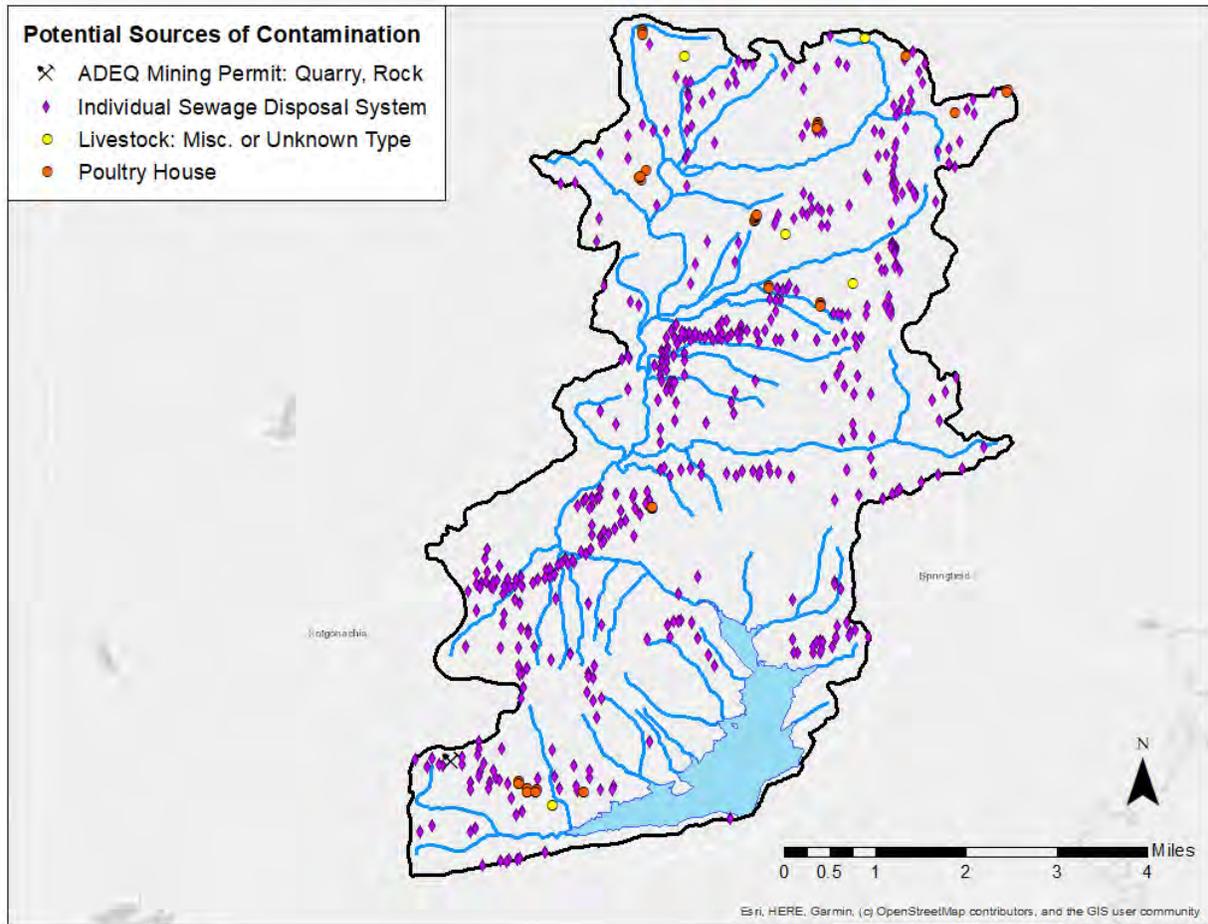


Figure 1-7 **Locations of historic potential sources of contamination**

Individual sewage disposal systems, especially septic systems, are an important potential source of phosphorus and nitrogen into streams. Septic systems work through a combination of processes but are prone to failure if not well constructed, maintained, or located. Proximity to streams is a predictor of potential contribution of nutrients to the stream. Septic systems located further from streams have greater distance through which nutrient rich discharge has to travel and increases both the time nutrients have to decay and sorb to soils. There were 776 total septic systems in the watershed with 228 within a 500 ft buffer of the streams and 102 within a 250 ft buffer. Discussions with the working group estimated that the 250 ft buffer was most appropriate in the watershed based on septic age and soil characteristics.

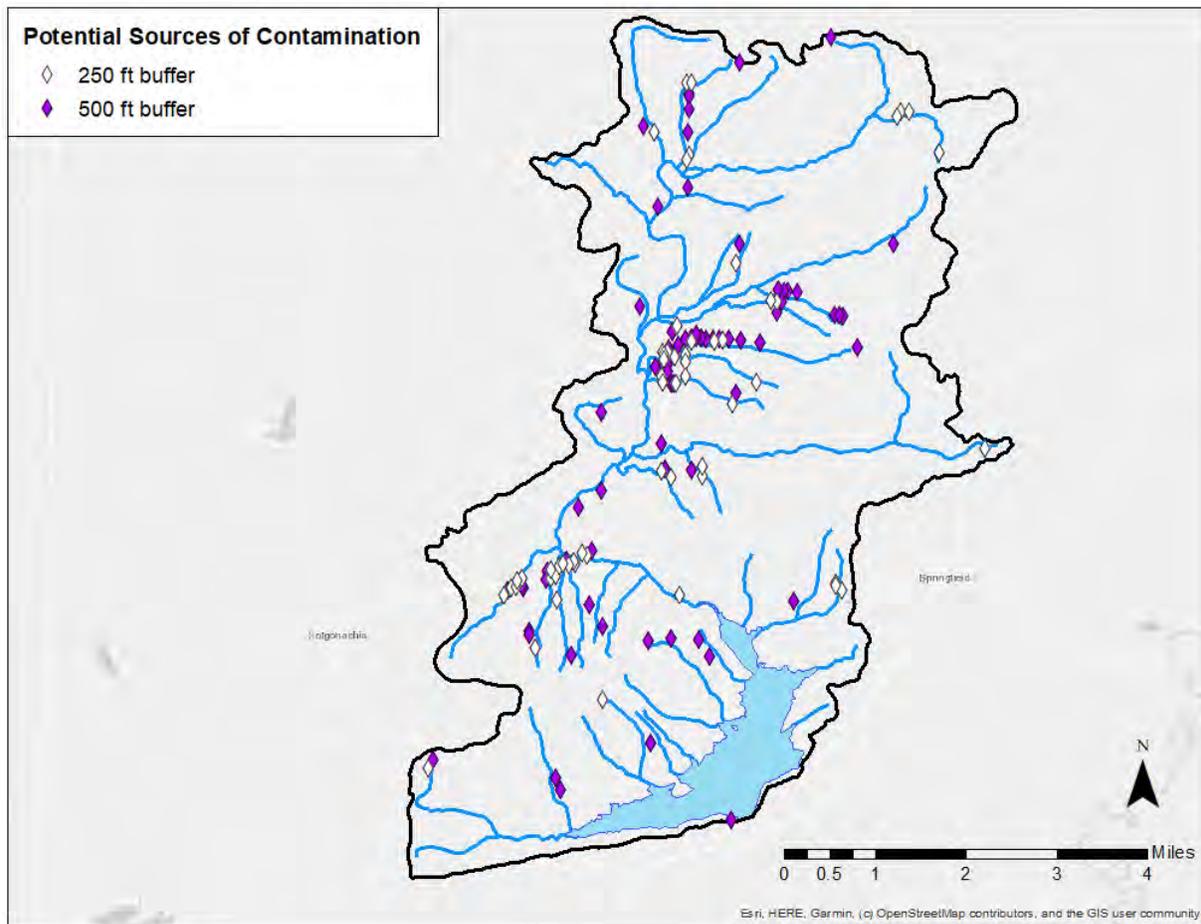


Figure 1-8 Locations of individual sewage disposal systems within 250 and 500 ft of NHD streams

Total nitrogen and total phosphorus loads to each septic system were calculated. According to the study by Lusk, Toor, and Obreza (2015), the average TN concentration in septic tank effluent is around 60 mg/L, and one person typically discharges 11.2 grams of TN per day. Assuming a household size of 2.5 people (a common average used in such studies) and a flow of 75 gal/day/person, this translates to:

$$11.2 \text{ grams/person/day} * 2.5 \text{ people} * 365 \text{ days} = 10,200 \text{ grams or } 10.2 \text{ kg (22.48 pounds) per year per septic system.}$$

The average TP concentration in septic tank effluent can be around 6-10 mg/L, with an assumption of 6 mg/L for this calculation. With the same household size assumption, and considering that each person contributes about 2.7 grams of phosphorus per day:

$$2.7 \text{ grams/person/day} * 2.5 \text{ people} * 365 \text{ days} = 2,456.25 \text{ grams or } 2.456 \text{ kg (5.41 pounds) per year per septic system.}$$

Within the 102 septic systems included in the nutrient loading assessment, it was further determined that splitting those loads into systems which were failing, intermediately functioning and well functioning

would help to further refine the septic loadings, following methodology similar to the PLET (USEPA. 2025b) septic modeling approach (Table 1-3).

Table 1-3 Septic loading estimates in the watershed

Septic Class	Rate	TN Attenuation	TN Load (lb/yr)	TP Attenuation	TP Load (lb/yr)
Failing	20%	0%	458.6	0%	110.4
Intermediate	20%	30%	321.0	85%	16.6
Well functioning	60%	30%	963.0	85%	49.7

2 Hydrology

Cypress Creek has one USGS flow gaging station (USGS gage 07261090) (Figure 2-1) which was used to calibrate the model hydrology. Measured flow data (Figure 2-2) has been collected since July 7, 2009, through the present. USGS gage 07261090 collects data automatically and converts measurements to discharge values. Additional flow measurements are taken periodically when USGS makes a site visit. The automated measurement taken at the time of the site visit measurement is then given a measurement accuracy rating that can be used to infer information about the accuracy of other flow measurements taken at the gage site.



Figure 2-1 USGS monitoring station 07261090

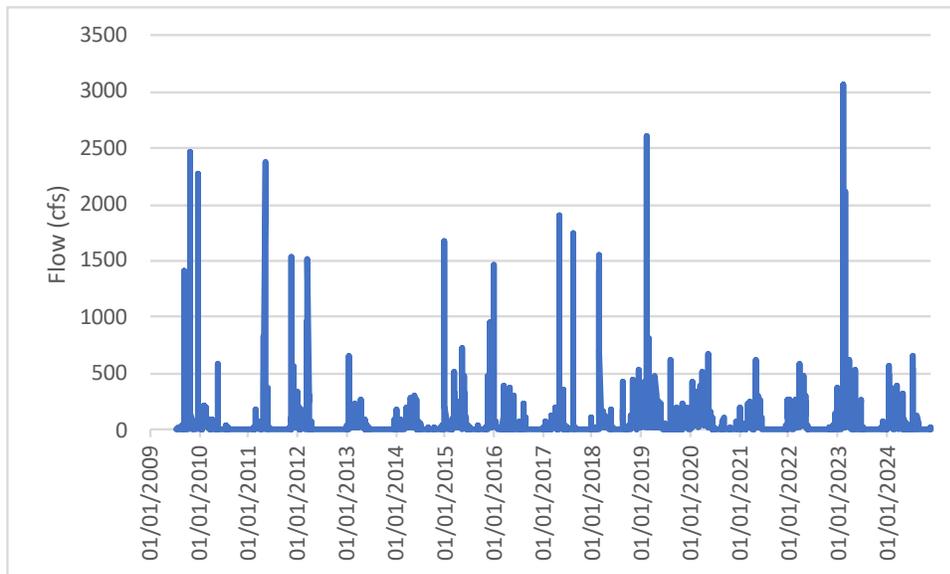


Figure 2-2 Historic stream flows at USGS 07261090 Cypress Creek near Birdtown, AR

Streamflow measurement accuracy at USGS gage 07261090 was most often rated as “good” indicating that the reported values are within 5% of the true value (Table 2-1). 11% of the data was rated as “poor” quality indicating measurement error greater than 8%. Poor data quality disproportionately affects low flow readings. 81% of flow values less than 5 cfs were assigned a rating of “poor”. This indicates that flow measurements greater than 5 cfs are less affected by poor data quality than measurements below 5 cfs. Cypress Creek is an intermittent stream at the USGS gaging station with slow moving pools forming during low flow summer months. During low flow periods, flow uncertainty is greater than when Cypress Creek is flowing freely.

Table 2-1 USGS flow rating measurements at 07261090

	Measurement Accuracy	Count	Percent
Excellent	2%	4	4%
Good	5%	54	56%
Fair	8%	27	28%
Poor	>8%	11	11%
Unspecified		2	

The median flow in Cypress Creek at the USGS gaging station is 9 cfs. Flow is greater than 5 cfs approximately 58% of the time. Flow exceeds 100 cfs approximately 8% of the time. The median peak annual discharge between 2010 and 2023 was 1,100 cfs. The maximum discharge recorded between 2009 and 2023 was 3,060 cfs on February 8, 2023.

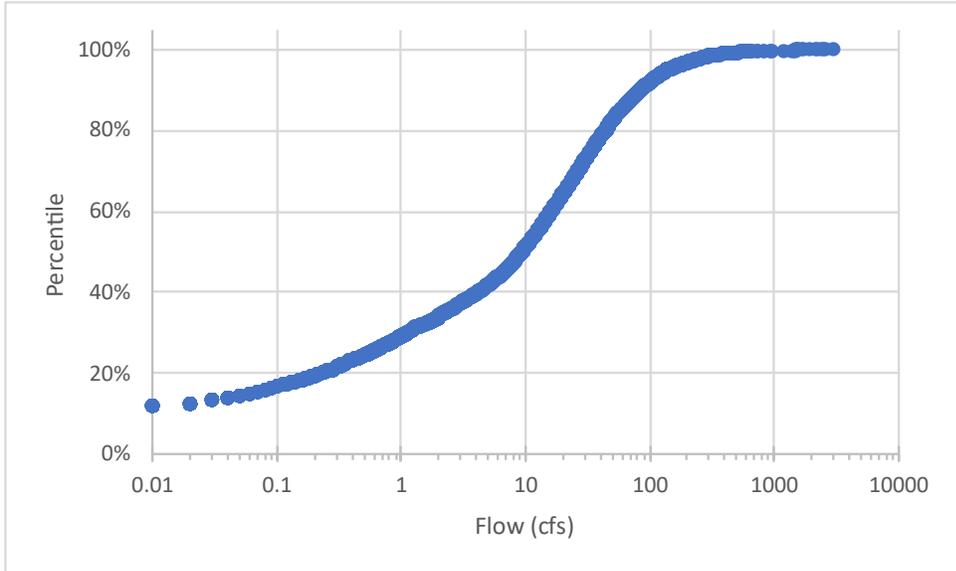


Figure 2-3 Flow duration curve at USGS 07261090 Cypress Creek near Birdtown, AR

Flow in Cypress Creek is a combination of baseflow and direct surface runoff depending on the time of year and hydrologic conditions upstream of the USGS gaging station (Figure 2-4). A baseflow algorithm (WHAT, 2025) was used to determine the proportion of the monitored flow which was attributable to surface runoff or base flow.

The average flow rate at the USGS gaging station is 40 cfs while the median flow rate is 9 cfs. By volume on an average daily basis for the period of record reviewed, approximately half of the flow in Cypress Creek is baseflow.

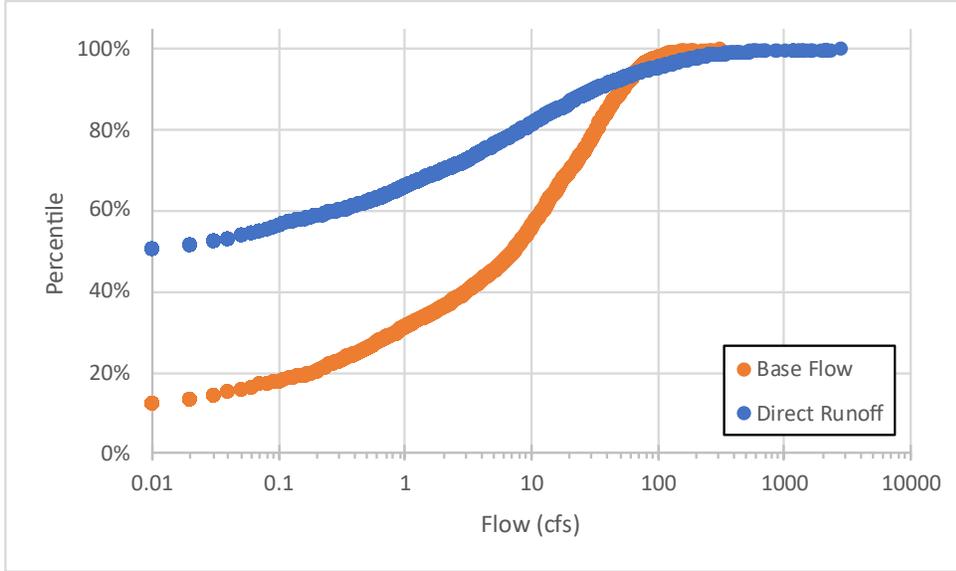


Figure 2-4 Base flow and runoff duration curves at USGS 07261090 using baseflow separation

3 Background Water Quality Data

Water quality data in the watershed was obtained from the Arkansas Department of Energy and Environment, Division of Environmental Quality (ADEQ, 2025). The primary nutrient calibration station (ARK135) in the watershed was co-located with the USGS monitoring station (USGS 07261090). Data for the nitrogen species were obtained (2013 – 2024) and total nitrogen calculated and total phosphorus were compiled from the ADEQ data. Sampling methods in the ADEQ dataset did not capture the full range of sediment transport, so the USGS suspended sediment concentration data (USGS, 2025b) was used for calibration and spanned 2010 through 2015.

Table 3-1 shows the monthly median concentrations which were used to provide insight into the seasonality of the instream concentrations. Additionally, the baseflow concentrations were calculated using the baseflow separation where baseflow was assumed to be more than half of the flow and a range of those values is shown in Table 3-2.

Table 3-1 Monthly median concentrations

Month	Temperature (°F)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	Organic nitrogen (mg/L)	Total nitrogen (mg/L)	Total Phosphorus (mg/L)	SSC (mg/L)
1	43.2	0.015	1.455	0.260	2.01	0.500	156.0
2	47.3	0.015	1.350	0.205	1.67	0.500	17.0
3	53.4	0.015	0.970	0.285	1.40	0.343	80.5
4	57.9	0.015	0.560	0.269	1.10	0.392	80.5
5	65.7	0.047	0.510	0.210	0.92	0.500	27.8
6	74.1	0.040	0.500	0.290	0.86	0.155	8.0
7	75.9	0.030	0.380	0.267	0.58	0.500	-
8	78.1	0.015	0.165	0.275	0.49	0.500	10.5
9	74.9	0.023	0.172	0.240	0.43	0.500	10.5
10	60.4	0.030	0.675	0.265	1.08	0.297	5.0
11	52.3	0.015	0.603	0.290	0.95	0.248	43.0
12	49.3	0.015	1.050	0.283	1.50	0.312	12.0

Table 3-2 Baseflow concentrations with a 50 percent threshold

Percentile	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	Organic nitrogen (mg/L)	Total nitrogen (mg/L)	Total Phosphorus (mg/L)
10%	0.015	0.157	0.140	0.443	0.057
25%	0.015	0.355	0.170	0.605	0.109
50%	0.015	0.565	0.238	0.960	0.500

4 Watershed Delineation

The first step in developing the HSPF model of the watershed was to use the elevation information (see Figure 1-1) to determine the extent of the drainage area to the lake and further divide the watershed into sub-catchments. The model was divided into smaller areas to allow the water, sediment and nutrients to be routed through the watershed and allow the travel time of each to impact the amount delivered to the lake and the timing of those inputs.

Many different approaches can be utilized to delineate the watershed. A separate software (PCSWMM) was used to delineate the watershed. That software has a tool that has two key advantages over other approaches. The first was simplicity. Frequently, many steps are needed in a typical ArcMap watershed delineation which can be cumbersome. PCSWMM provides an automated delineation process which delineates subcatchments of a target drainage area easily. The second benefit is that PCSWMM easily extracts elevation data to provide a representative stream cross section for each modeled reach. In the BASINS interface, a trapezoidal cross section is assumed. By using a varying cross section representative of the stream in each subcatchment, the modeled shear stresses and sediment transport are more accurate. The watershed was delineated into 67 subcatchments (Figure 4-1) with an average size of 345 acres.



Figure 4-1 Delineated subcatchments in the Brewer Lake watershed

5 HSPF Hydrology Calibration

The watershed model is a simplified mathematical representation of the hydrologic cycle. The model includes precipitation (as rainfall or snow), accumulation of snow pack, runoff, infiltration and evapotranspiration. The model uses many different parameters to represent how water moves through soils and streams. Model calibration involves modifying those parameters so the predicted stream flows are reflective of the observations.

Model performance is measured against how well it mimics observed flows. The model's performance was evaluated using the USGS's HSPF Expert System. Model performance was evaluated using recommended performance metrics (Donigian, 2000) (Table 5-1).

Table 5-1 HSPF model calibration metrics

Error in total volume	
Error in 10% highest flows	Error in the mean of the highest 10 percent of the daily mean flows
Error in 25% highest flows	Error in the mean of the highest 25 percent of the daily mean flows
Error in 50% highest flows	Error in the mean of the highest 50 percent of the daily mean flows
Error in 50% lowest flows	Error in the mean of the lowest 50 percent of the daily mean flows
Error in 25% lowest flows	Error in the mean of the lowest 25 percent of the daily mean flows
Error in 10% lowest flows	Error in the mean of the lowest 10 percent of the daily mean flows
Error in low-flow recession	Error in the mean of the low-flow-recession rates based on the computed ratios of daily mean flow today divided by the daily mean flow yesterday for each day
Error in storm volumes	Error in storm runoff volume for the calibration period
Seasonal volume error	Error in seasonal runoff volume for the calibration period
Error in average storm peak	Error in storm peak flows for the calibration period
Summer volume error	Error in summer runoff volume for the calibration period
Winter volume error	Error in winter runoff volume for the calibration period
Summer storm volume error	Error in summer storms for the calibration period
Winter storm volume error	Error in winter storms for the calibration period

Figure 5-1 through Figure 5-4 present a graphical representation of the model performance versus measured flows for the entire simulation period, cumulative flows, the distribution of flows, and monthly average flows. The graphical comparisons and the model performance statistics (Figure 5-1 through Figure 5-4 and Table 5-2) demonstrate that the model reproduces the observed flows and mimics the hydrologic cycle in the upper watershed. The model metrics were within the suggested criteria for calibration targets with the exception of the 50th percentile lowest flows but the other 13 criteria were all met. Considerable effort was made to meet all criteria and the final model calibration was the optimal balance across all model metrics.

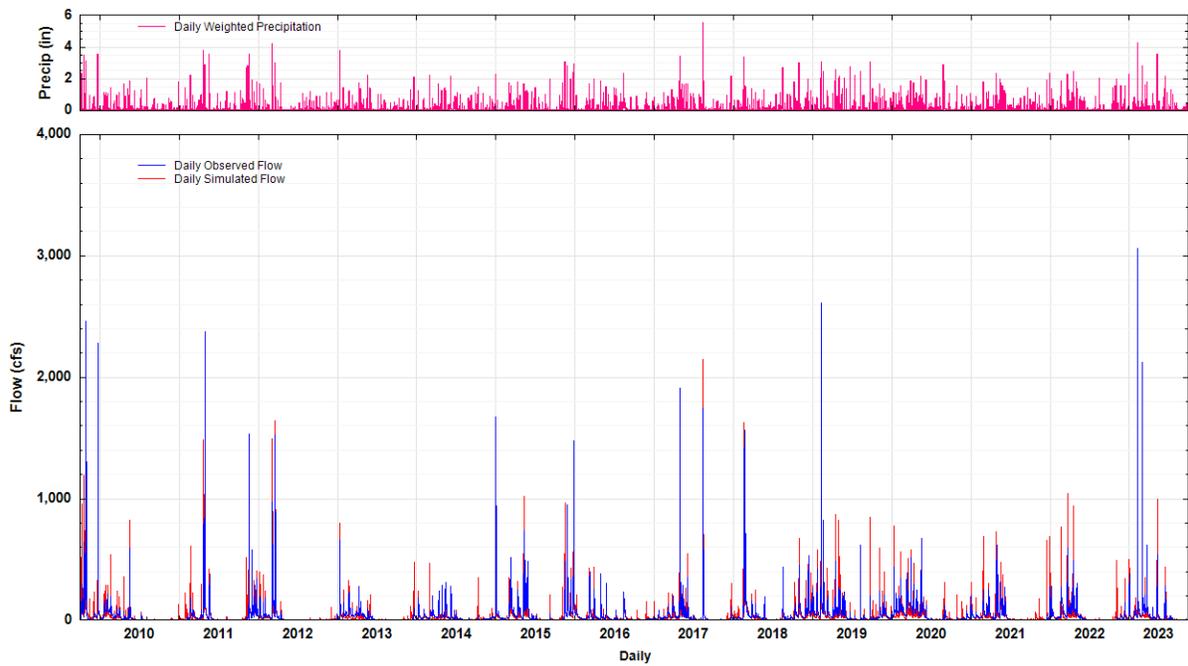


Figure 5-1 Comparison of daily measured and modeled flows

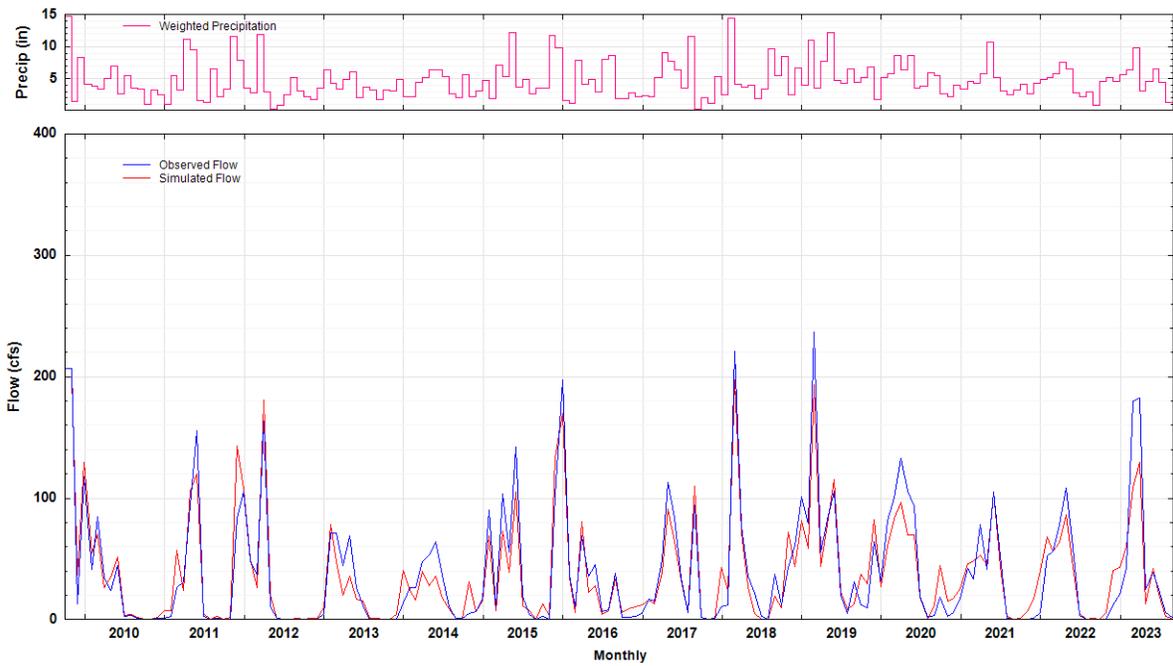


Figure 5-2 Comparison of daily measured and modeled monthly average flows

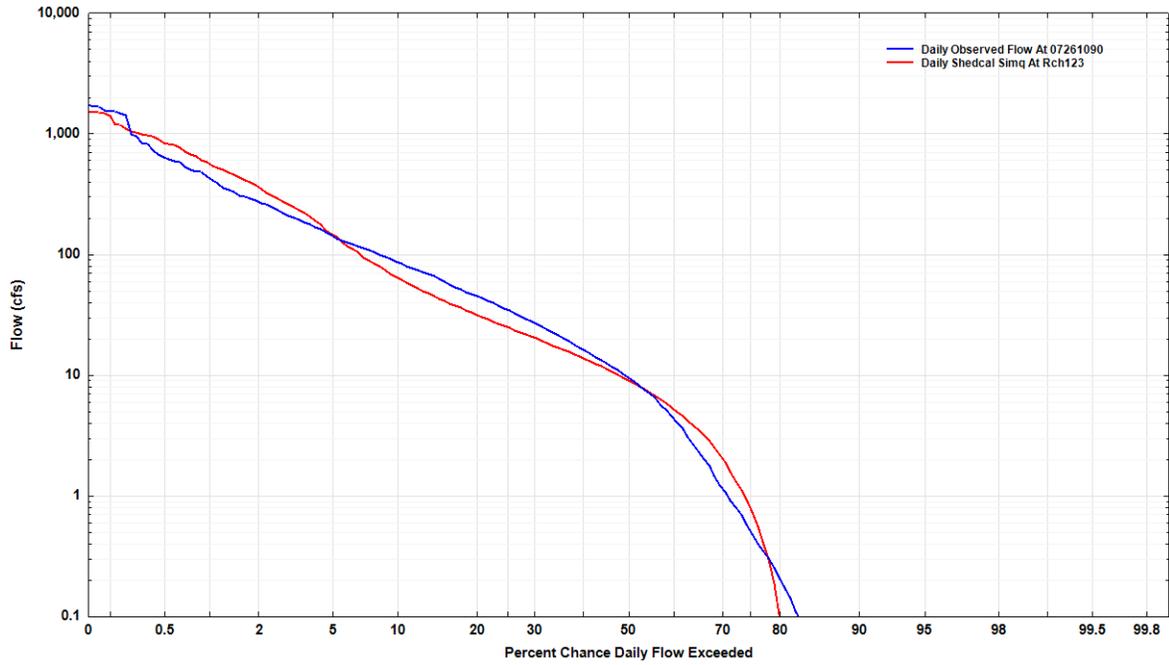


Figure 5-3 Comparison of daily measured and modeled flow distributions

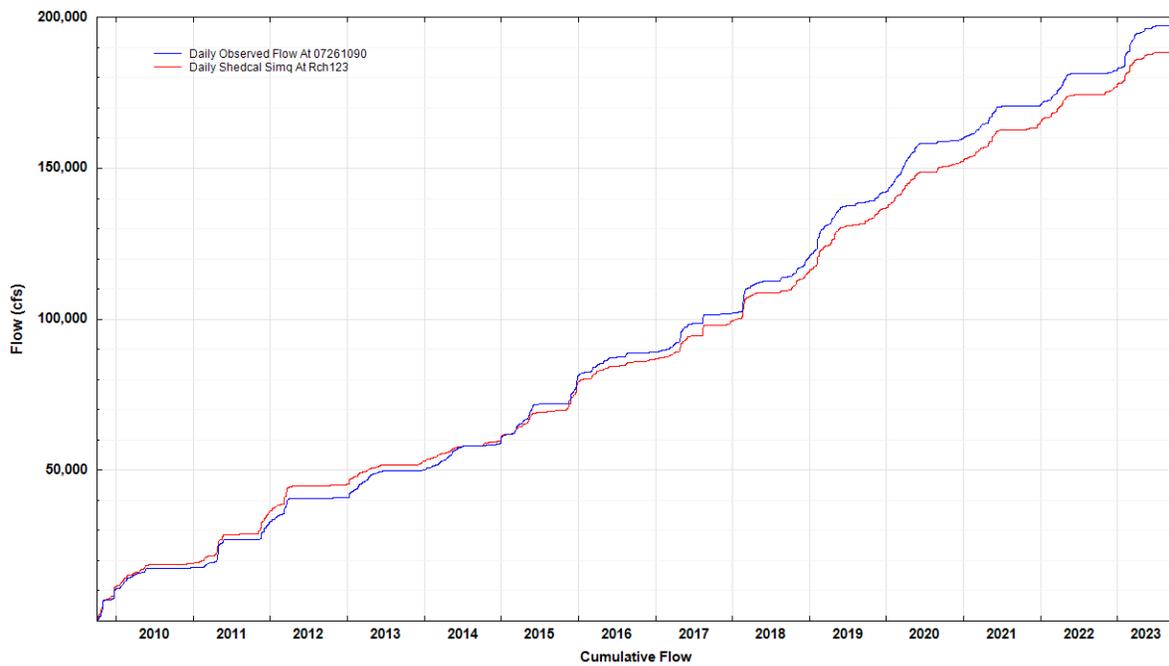


Figure 5-4 Comparison of cumulative measured and modeled flow

Table 5-2 Model performance metrics

Criteria	Units	Error	Target	Check
Error in total volume	(%)	-4.6	10	OK
Error in 10% highest flows	(%)	6.1	15	OK
Error in 25% highest flows	(%)	-2.8	10	OK
Error in 50% highest flows	(%)	-5.1	10	OK
Error in 50% lowest flows	(%)	15.0	10	High
Error in 25% lowest flows	(%)	-12.5	15	
Error in 10% lowest flows	(%)	NaN	20	
Error in low-flow recession		0.0	0.03	OK
Error in storm volumes	(%)	-8.3	15	OK
Seasonal volume error	(%)	-6.6	20	OK
Error in average storm peak	(%)	0.2	15	OK
Summer volume error	(%)	-8.8	20	OK
Winter volume error	(%)	-2.2	15	OK
Summer storm volume error	(%)	1.7	15	OK
Winter storm volume error	(%)	-12.6	NA	NA

6 Estimation of Pollutant Loads for the Brewer Lake Watershed

The primary nutrients considered were phosphorus and nitrogen. Both phosphorus and nitrogen are essential nutrients for life and in different systems can be growth limiting in aquatic environments. Furthermore, both phosphorus and nitrogen can have impacts on drinking water quality and treatment. Since Brewer Lake is a source of drinking water, accurate quantification of nitrogen and phosphorus were essential for this study.

The HSPF watershed model was calibrated for sediment, total nitrogen and total phosphorus. The model was calibrated to the monitoring data at the USGS station near the bottom of the watershed. Model calibration compares model predictions to measured values. Donigian (2002) provides a range of calibration targets to evaluate the performance of a predictive model (Figure 6-1). Model median differences were calculated for the calibration stations. Model medians were used for both the watershed and reservoir calibrations because the median comparisons are a better representation of the general observed and modeled conditions and not as biased by outliers.

	% Difference Between Simulated and Recorded Values		
	Very Good	Good	Fair
Hydrology/Flow	< 10	10 - 15	15 - 25
Sediment	< 20	20 - 30	30 - 45
Water Temperature	< 7	8 - 12	13 - 18
Water Quality/Nutrients	< 15	15 - 25	25 - 35
Pesticides/Toxics	< 20	20 - 30	30 - 40

CAVEATS: Relevant to monthly and annual values; storm peaks may differ more
 Quality and detail of input and calibration data
 Purpose of model application
 Availability of alternative assessment procedures
 Resource availability (i.e. time, money, personnel)

Figure 6-1 Model calibration performance targets (Donigian, 2000)

The HSPF model simulates nutrient transport off the land either using a buildup/washoff relationship or by assuming nutrients are bound to particles and washoff proportionally with sediments. Total nitrogen was simulated using a buildup-washoff relationship. The model simulated 16 land use categories which were further broken down into flat or steep land areas and soil groups of high infiltration or low infiltration rates for a total of 30 modeled land uses. The model breaks each of those land use categories (Table 1-1) into pervious and impervious areas. The impervious areas are assumed to be directly connected imperviousness which results in flow and nutrients directly entering a stream. Literature search was performed to determine a range of appropriate land use fluxes from each modeled land use. Note that not all modeled land uses had values to target, and in those cases, professional judgement of similar land uses was used to ensure a reasonable input.

Sediment loads were also quantified. Sediment load is important for two reasons; first it affects water quality and stream health, and second phosphorus can bind to sediments. Identification of areas that contribute sediment to the watershed allows better tailored solutions to improve water quality in Brewer Lake.

6.1 Sediment

Sediments were loaded into HSPF based on an assumed fractionation of sediment in runoff of 10% sand, 40% silt, and 50% clay. Creek sediment calibration and fractionation data was not available in the Brewer Lake watershed. Modeled fractionation of sediments in runoff was chosen based on typical fractionation and intended to account for the increased mobility of clays in runoff relative to silt and sand.

Beyond fractionation of sediments in runoff, the quantity of sediment delivered to Cypress Creek was based on upstream land uses from the NLCD and a literature review of sediment loading from various land uses and monitoring data from Arkansas Water Quality Monitoring Program (ADEQ, 2025).

Reach sediment scour and deposition were calculated in the model and calibrated so that reaches did not have significant net accumulation or scour of sediment over the course of the simulation period. In other words, a dynamic equilibrium between scour and deposition was assumed so that bed depth increased and decreased over the course of the simulation based on the flow regime in each reach.

Model results were compared to the measured concentrations to ensure that the model was a good representation of the watershed dynamics. Figure 6-2 shows a time series of the comparison of the modeled and measured suspended sediment concentrations. Model parameters were modified to ensure that the model performance was comparable to literature values in similar studies (Table 6-1) Table 6-2 shows the statistical comparison of the model with the measured values during baseflow, storm flow and all flow conditions. The mapped catchment median sediment flux (Figure 6-3) and load (Figure 6-4) help to identify areas in the watershed with higher loading rates and inputs.

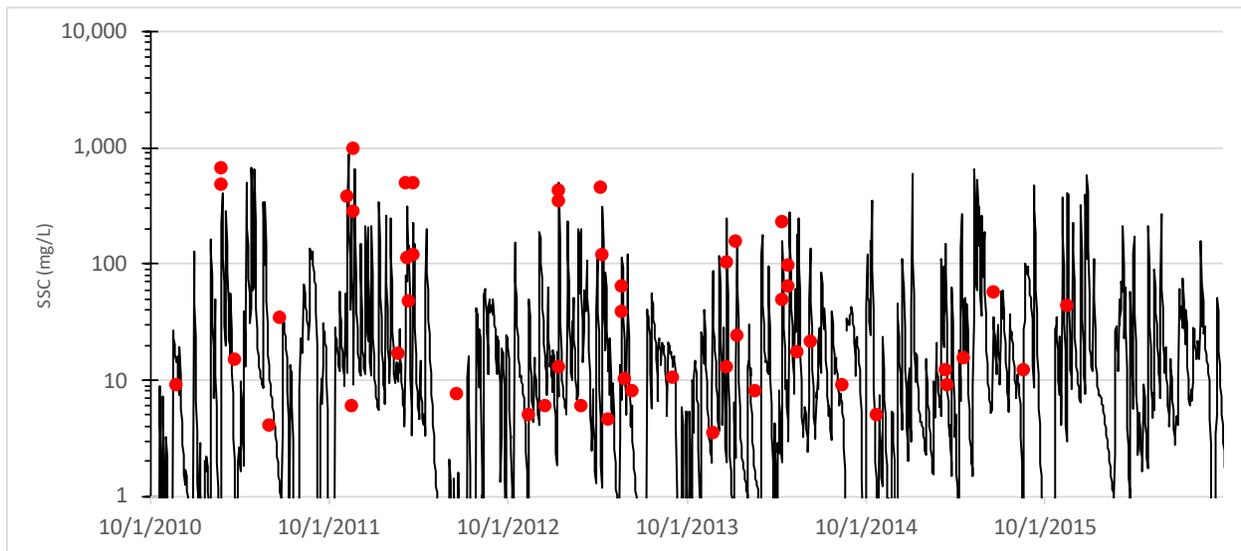


Figure 6-2 Comparison of cumulative measured and modeled sediment concentrations (red dots are measured concentrations and black line is model output)

Table 6-1 Modeled sediment land use flux (ton/ac/yr) compared with literature ranges

Modeled Land Use	Low End	Model	Upper End	Range
Deciduous Forest	0.01	0.11	0.4	EPA BASINS Tech Note 8, Diaz-Ramirez et al. (2008), MPCA-HSPF-Water-Quality-Tech-Note_FINAL_8.31.18,
Evergreen Forest	0.01	0.11	0.15	
Mixed Forest	0.01	0.11	0.18	
Herbaceous		0.48		
Shrub-Scrub		0.50		
Barren Land	0.3	0.69	1.8	EPA BASINS Tech Note 8,
Pasture-Hay	0.2	1.41	2	MPCA-HSPF-Water-Quality-Tech-Note_FINAL_8.31.18, EPA BASINS Tech Note 8
Gravel Road	0.5	0.68	5	Wemple (2014)
Frack	0.5	0.68	8	Williams et al. (2008)2
Paved Road	0.01	0.05	0.1	MPCA-HSPF-Water-Quality-Tech-Note_FINAL_8.31.18
Developed-OpenSpace	0.1	0.10	1	EPA BASINS Tech Note 8, MPCA-HSPF-Water-Quality-Tech-Note_FINAL_8.31.18,
Developed-Low Intensity	0.05	0.13	5	
Developed-Medium Intensity	0.03	0.16	0.3	
Developed-High Intensity	0.01	0.20	0.2	
Wetlands		0.56		

Table 6-2 Sediment model performance metrics

		Storm Flow (mg/L)	Base Flow (mg/L)	All (mg/L)
Average	Measured	214.1	16.5	124.6
	Modeled	229.6	26.6	151.8
Median	Measured	101.0	9.5	38.0
	Modeled	162.7	9.6	93.6
	Median Error	54.2	3.0	6.2
	T test	0.7	0.3	0.7
	RMSE	236.4	26.5	186.4
	Mean abs error	15.5	7.1	12.2
	Nash			0.5
	Pct Bias	0.0%	1.0%	0.5%

Equations that were used to compare the simulated model concentrations against the observed water quality data are shown below.

Nash-Sutcliffe Efficiency

$$NSE = 1 - \frac{\sum_{i=1}^n (O_i - P_i)^2}{\sum_{i=1}^n (O_i - \bar{O})^2}$$

O_i observed (measured) value

P_i predicted (model) value

\bar{O} mean of observed values

n number of data points

NSE ranges from $-\infty$ to 1. A value of 1 indicates perfect model performance.

Root Mean Square Error

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^n (O_i - P_i)^2}$$

Measures the average magnitude of the error.

Sensitive to large errors due to squaring.

Mean Absolute Error

$$MAE = \frac{1}{n} \sum_{i=1}^n |O_i - P_i|$$

Measures the average absolute difference between observed and predicted values.

Less sensitive to outliers than RMSE.

Bias

$$Bias = \frac{1}{n} \sum_{i=1}^n (P_i - O_i)$$

Indicates whether the model tends to overestimate (positive bias) or underestimate (negative bias).

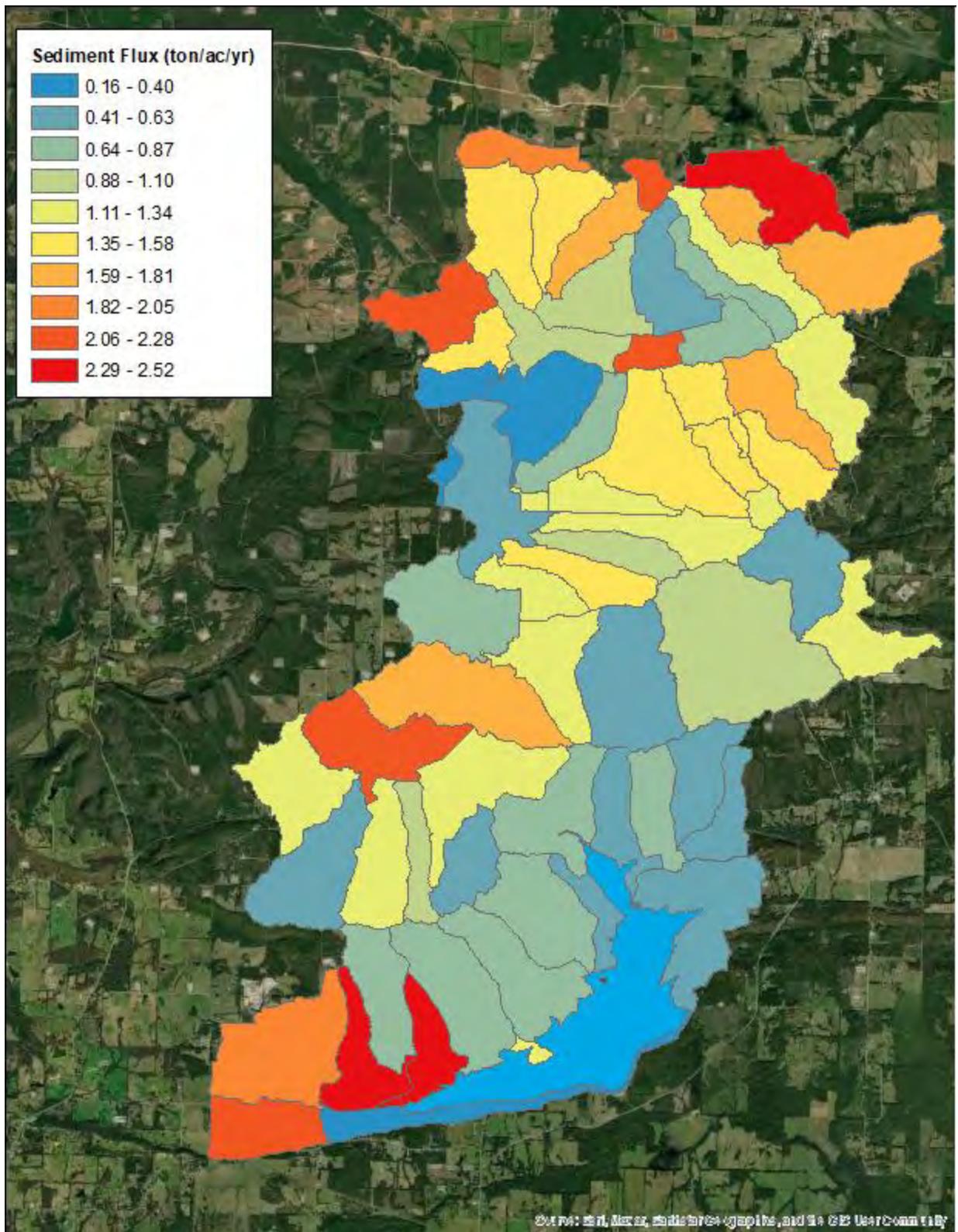


Figure 6-3 Median sediment flux (ton/ac/year) identified areas with higher proportional inputs.

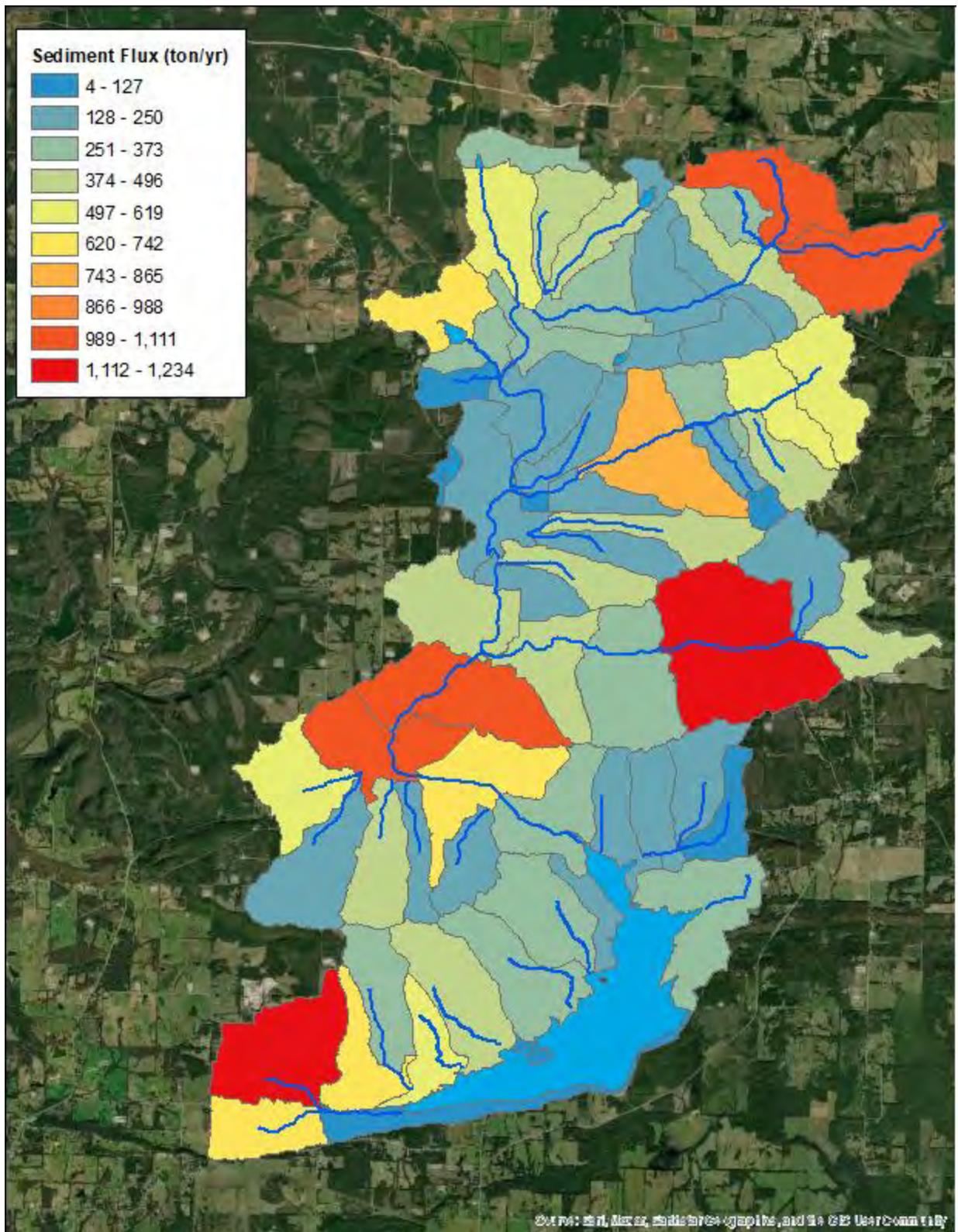


Figure 6-4 Median sediment annual load (ton /year) identified areas with inputs.

6.2 Nitrogen Loads

Nitrogen was simulated with buildup-washoff processes in the model. Only total nitrogen was simulated without speciation and all nitrogen delivered to the stream was assumed to be dissolved. Nitrogen loads applied in the model vary by land use type and treatment. Three sources of nitrogen were considered for the modelling; natural buildup from nutrient cycling, septic systems, and manure application.

Nitrogen cycles naturally in the environment and accumulates on land surfaces and active groundwater from atmospheric deposition, plant decay, livestock, wildlife, and fertilizer application. Nitrogen is removed from the land surface by plant uptake, chemical decay, and washoff processes. Of primary concern in the model is the net available nitrogen load on the surface and the amount of nitrogen transported during runoff.

The quantity of nitrogen that washes off the surface (without fertilizer application) was calibrated in the model to match literature values for each land surface (Table 6-3). Nitrogen in storage on the land surface was calibrated so that a dynamic equilibrium was attained in the model where nitrogen accumulated and dispersed over the course of the simulation.

Nitrogen concentrations in baseflow and interflow that enter the stream were assumed constant since water beneath the surface is more isolated from environmental variables. Nitrogen concentration in septic systems discharge was also assumed constant, however, the quantity of septic system water entering the streams was varied throughout the year to account for evapotranspiration. Concentrations were set so that the load from each land use type and source was consistent with literature values and instream measurements taken by the USGS and Arkansas Division of Environmental Quality.

Instream measurements of nitrogen taken by the USGS and through the Arkansas Water Quality Monitoring Program (ADEQ, 2025) were used as a calibration dataset. Nitrogen measurements taken during low flows were used to set interflow and active groundwater concentrations. Nitrogen measurements taken during storm flows were used to set surface washoff parameters.

Model results were compared to the measured concentrations to ensure that the model was a good representation of the watershed dynamics. Figure 6-5 shows a time series of the comparison of the modeled and measured suspended sediment concentrations. Model parameters were modified to ensure that the model performance was comparable to literature values in similar studies (Figure 6-5) and Table 6-4 shows the statistical comparison of the model with the measured values during baseflow, storm flow and all flow conditions. The mapped catchment total nitrogen flux (Figure 6-6) and load (Figure 6-7) help to identify areas in the watershed with higher loading rates and inputs.

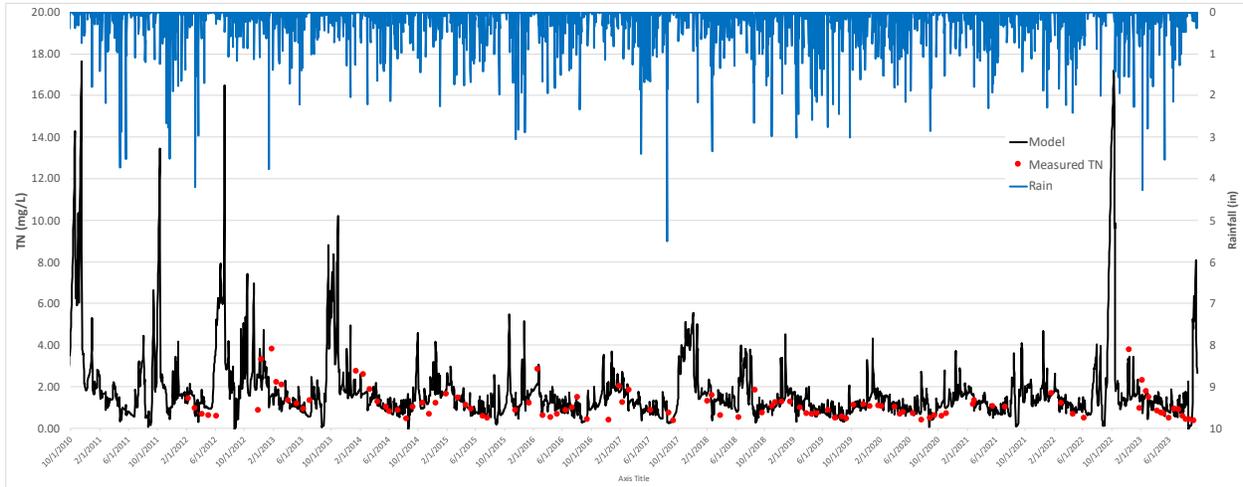


Figure 6-5 Comparison of cumulative measured and modeled total nitrogen concentrations (red dots are measured concentrations and black line is model output)

Table 6-3 Modeled total nitrogen land use flux (lb/ac/yr) compared with literature ranges

Modeled Land Use	Low End	Model	Upper End	Source
Deciduous Forest	2	2.1	5	MPCA-HSPF-Water-Quality-Tech-Note_FINAL_8.31.18, Beaulac and Reckhow (1982)
Evergreen Forest	1	2.1	4	
Mixed Forest	1.5	2.1	4.5	
Herbaceous		7.1		
Shrub-Scrub		6.3		
Barren Land		4.5		
Pasture-Hay	2	5.0	30	MPCA-HSPF-Water-Quality-Tech-Note_FINAL_8.31.18, Beaulac and Reckhow (1982)
Gravel Road	2	5.8	10	
Frack		5.8		
Paved Road	3	6.6	15	MPCA-HSPF-Water-Quality-Tech-Note_FINAL_8.31.18
Developed-OpenSpace	5	10.5	20	Beaulac and Reckhow (1982), MPCA-HSPF-Water-Quality-Tech-Note_FINAL_8.31.18,
Developed-Low Intensity	10	18.7	30	
Developed-Medium Intensity	20	28.1	50	
Developed-High Intensity	30	53.3	70	
Wetlands		6.07		

Table 6-4 Total nitrogen model performance metrics

		Storm Flow (mg/L)	Base Flow (mg/L)	All (mg/L)
Average	Measured	1.2	1.1	1.1
	Modeled	1.3	1.2	1.2
Median	Measured	1.0	0.9	0.9
	Modeled	1.1	1.1	1.1
	Median Error	0.0	0.1	0.1
	T test	0.8	0.4	0.3
	RMSE	0.7	0.6	0.6
	Mean abs error	0.1	0.1	0.1
	Nash			0.2
	Pct Bias	2.7%	14.8%	16.3%

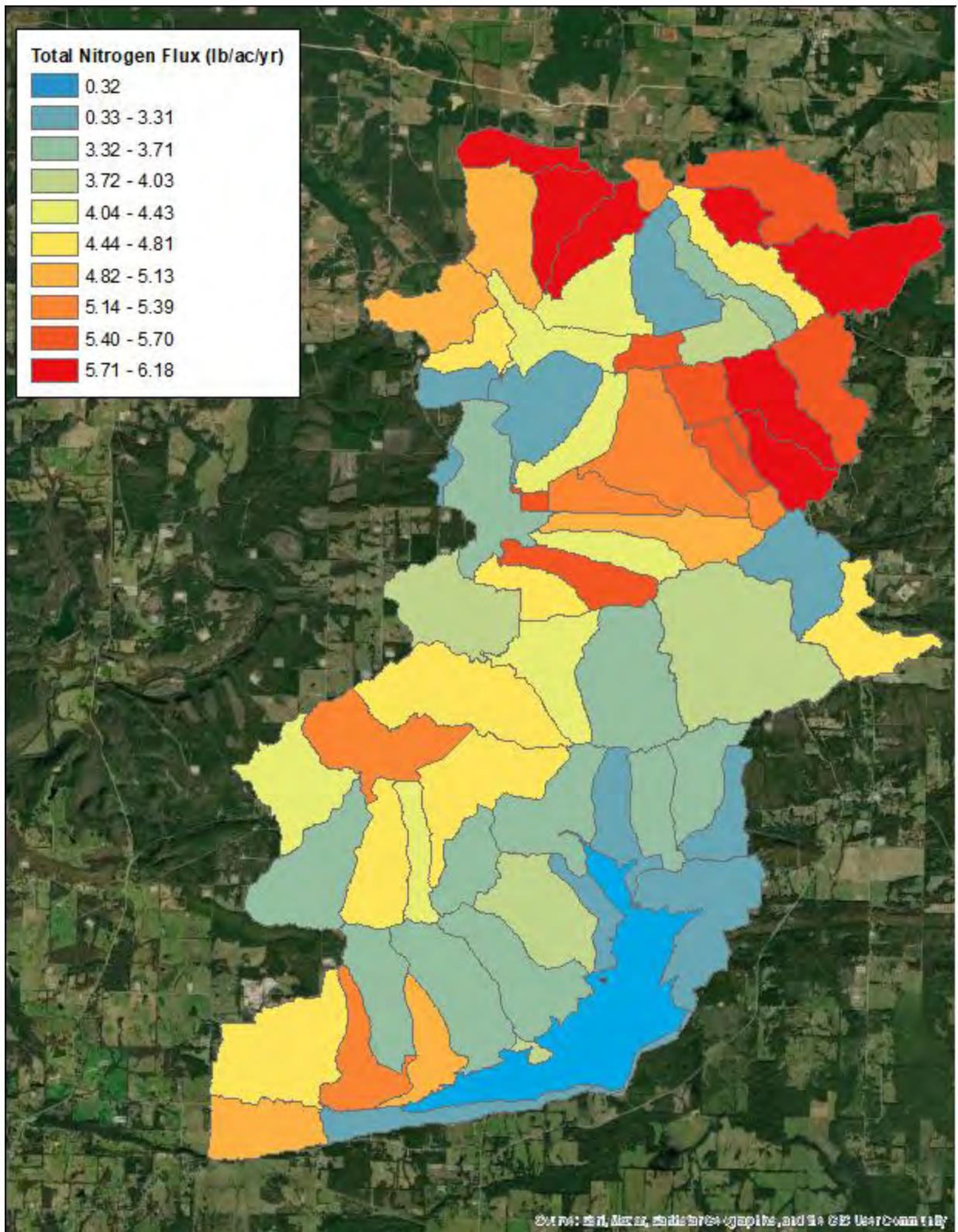


Figure 6-6 Median nitrogen flux (lb/ac/year) identified areas with higher proportional inputs.

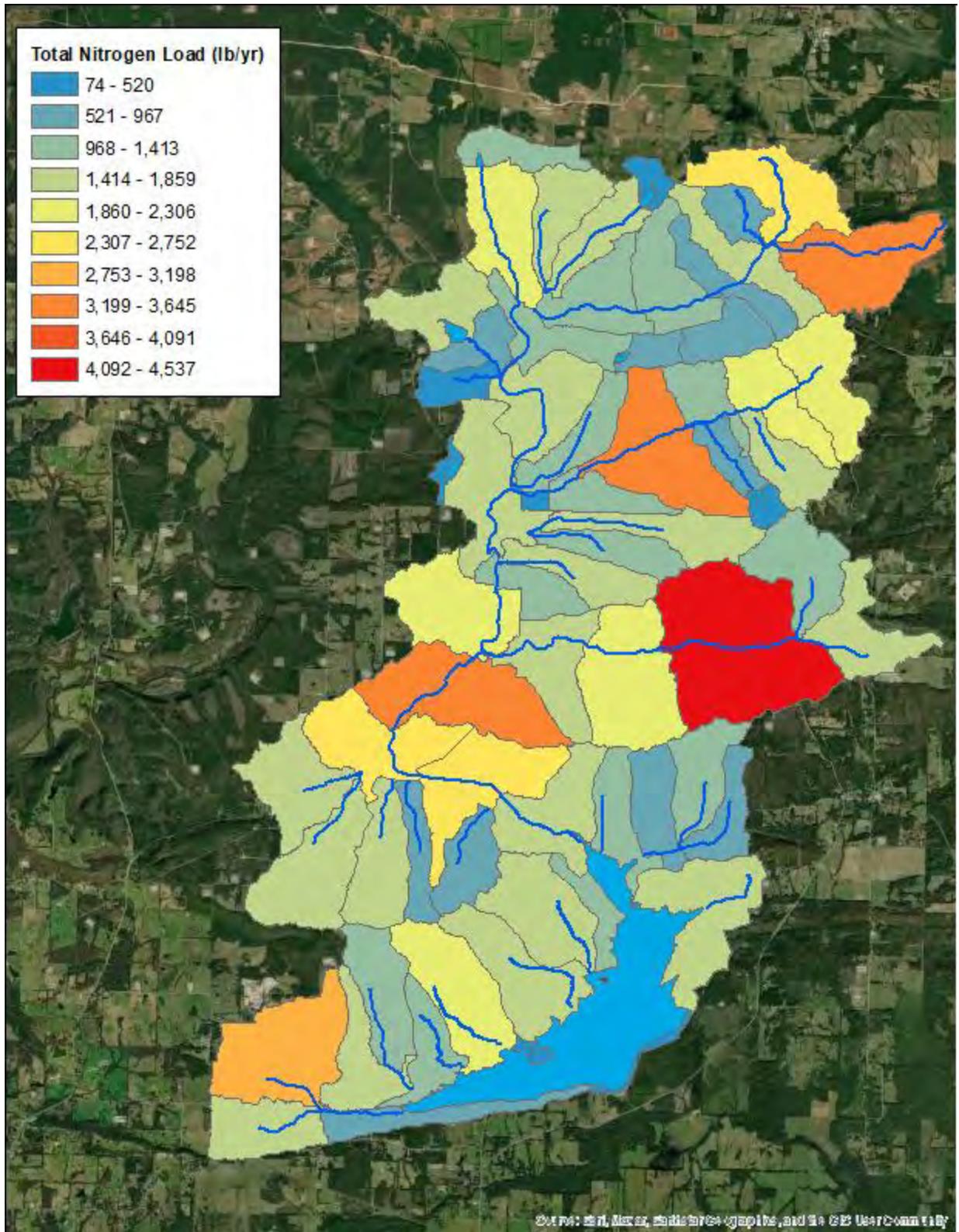


Figure 6-7 Median nitrogen annual load (lb /year) identified areas with higher inputs.

6.3 Phosphorus Loads

Phosphorous was modeled using buildup-washoff processes and a potency factor that simulates phosphorous adhesion to sediments. Only total phosphorous was simulated without speciation. Phosphorus loads applied in the model vary by land use type and treatment. Four sources of phosphorous were considered for the modeling; natural buildup from nutrient cycling, phosphorus loading associated with sediments, septic systems, and manure application.

Phosphorous cycles naturally in the environment and accumulates on land surfaces and in groundwater from organic and inorganic sources including fertilizers, livestock, wildlife, and erosion of sediments. Phosphorous is removed from the land surface by plant uptake, chemical decay, washoff, and sediment transport. Of primary concern in the model is the amount of phosphorous on the surface, dissolved phosphorous transport, and transport of sediments with bound phosphorus into waterways.

The quantity of phosphorous that washes off (without fertilizer application) was calibrated in the model to match literature values for each land surface (Table 6-5). Phosphorous in storage on the land surface was calibrated so that a dynamic equilibrium was achieved in the model with accumulation and washoff over the course of the simulation.

Phosphorous concentrations in baseflow and interflow that enter the stream were assumed constant since water beneath the surface is isolated from environmental variables. Total phosphorus load from interflow and groundwater was varied based on the quantity of water from each reservoir that reached the streams during the simulation. Likewise, the concentration of phosphorus in septic system discharge was assumed constant but the load of phosphorus to the streams varied with evapotranspiration throughout the year. Concentrations were set so that the load from each land use type and source was consistent with literature values and instream measurements taken by the USGS and Arkansas department of Arkansas Division of Environmental Quality.

Instream measurements of phosphorus taken by the USGS and Arkansas Water Quality Monitoring Program (ADEQ, 2025) were used as a calibration dataset. Phosphorus measurements taken during low flows were used to set interflow and active groundwater concentrations. Phosphorus measurements taken during and after storm events were used to set surface washoff parameters.

Model results were compared to the measured concentrations to ensure that the model was a good representation of the watershed dynamics. Figure 6-8 shows a time series of the comparison of the modeled and measured total phosphorus concentrations. Model parameters were modified to ensure that the model performance was comparable to literature values in similar studies (Table 6-5). Table 6-6 shows the statistical comparison of the model with the measured values during baseflow, storm flow and all flow conditions. The mapped catchment total phosphorus flux (Figure 6-9) and load (Figure 6-10) help to identify areas in the watershed with higher loading rates and inputs.

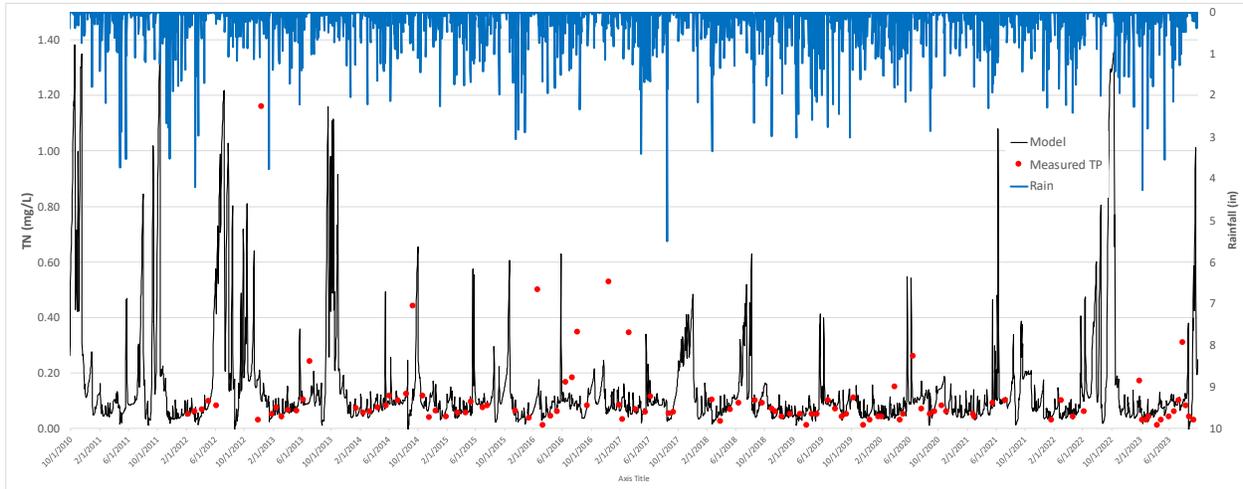


Figure 6-8 Comparison of measured and modeled total phosphorus concentrations (red dots are measured concentrations and black line is model output)

Table 6-5 Modeled total phosphorus land use flux (lb/ac/yr) compared with literature ranges

Modeled Land Use	Low End	Model	Upper End	Reference
Deciduous Forest	0.05	0.08	0.5	MPCA-HSPF-Water-Quality-Tech-Note_FINAL_8.31.18
Evergreen Forest	0.05	0.09	0.5	
Mixed Forest	0.05	0.09	0.5	
Herbaceous		0.17		
Shrub-Scrub		0.17		
Barren Land		0.10		
Pasture-Hay				MPCA-HSPF-Water-Quality-Tech-Note_FINAL_8.31.18, Beaulac and Reckhow (1982)
	0.5	0.51	2.5	
Gravel Road	0.23	0.53	0.99	Wemple (2014)
Frack		0.53		
Paved Road				MPCA-HSPF-Water-Quality-Tech-Note_FINAL_8.31.18
	0.2	0.53	1.5	
Developed-OpenSpace	0.2	0.37	1.5	Beaulac and Reckhow (1982), MPCA-HSPF-Water-Quality-Tech-Note_FINAL_8.31.18,
Developed-Low Intensity	0.2	0.45	1.5	
Developed-Medium Intensity	0.2	0.53	1.5	
Developed-High Intensity	0.2	0.61	1.5	
Wetlands		0.13		

Table 6-6 Total phosphorus model performance metrics

		Storm Flow (mg/L)	Base Flow (mg/L)	All (mg/L)
Average	Measured	0.085	0.090	0.089
	Modeled	0.085	0.086	0.076
Median	Measured	0.066	0.060	0.060
	Modeled	0.076	0.076	0.076
	Median Error	0.007	0.003	0.005
	T test	0.998	0.114	0.099
	RMSE	0.073	0.115	0.110
	Mean abs error	0.000	0.004	0.003
	Nash			-0.417
	Pct Bias	12.1%	6.3%	8.2%

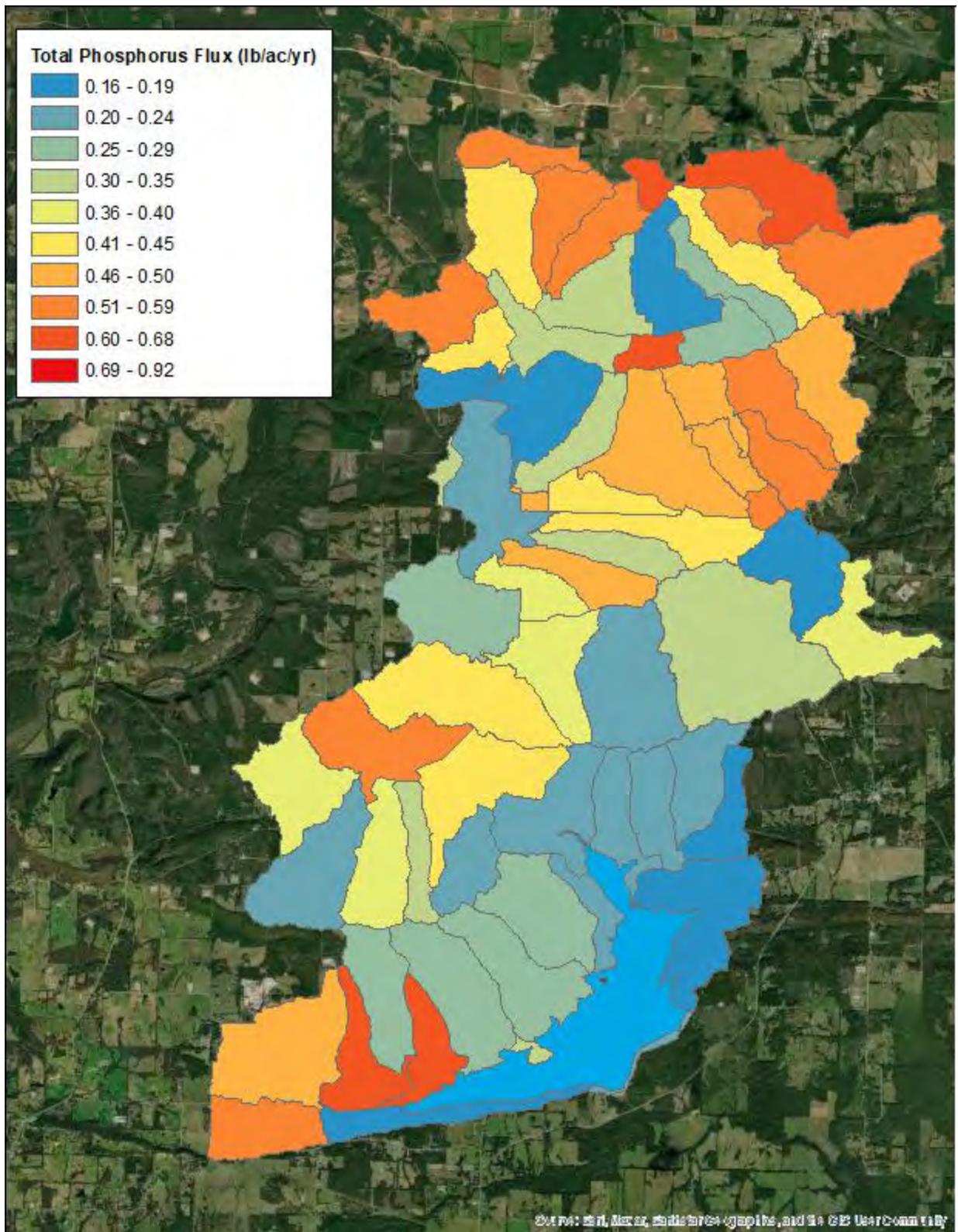


Figure 6-9 Median phosphorus flux (lb/ac/year) identified areas with higher proportional inputs.

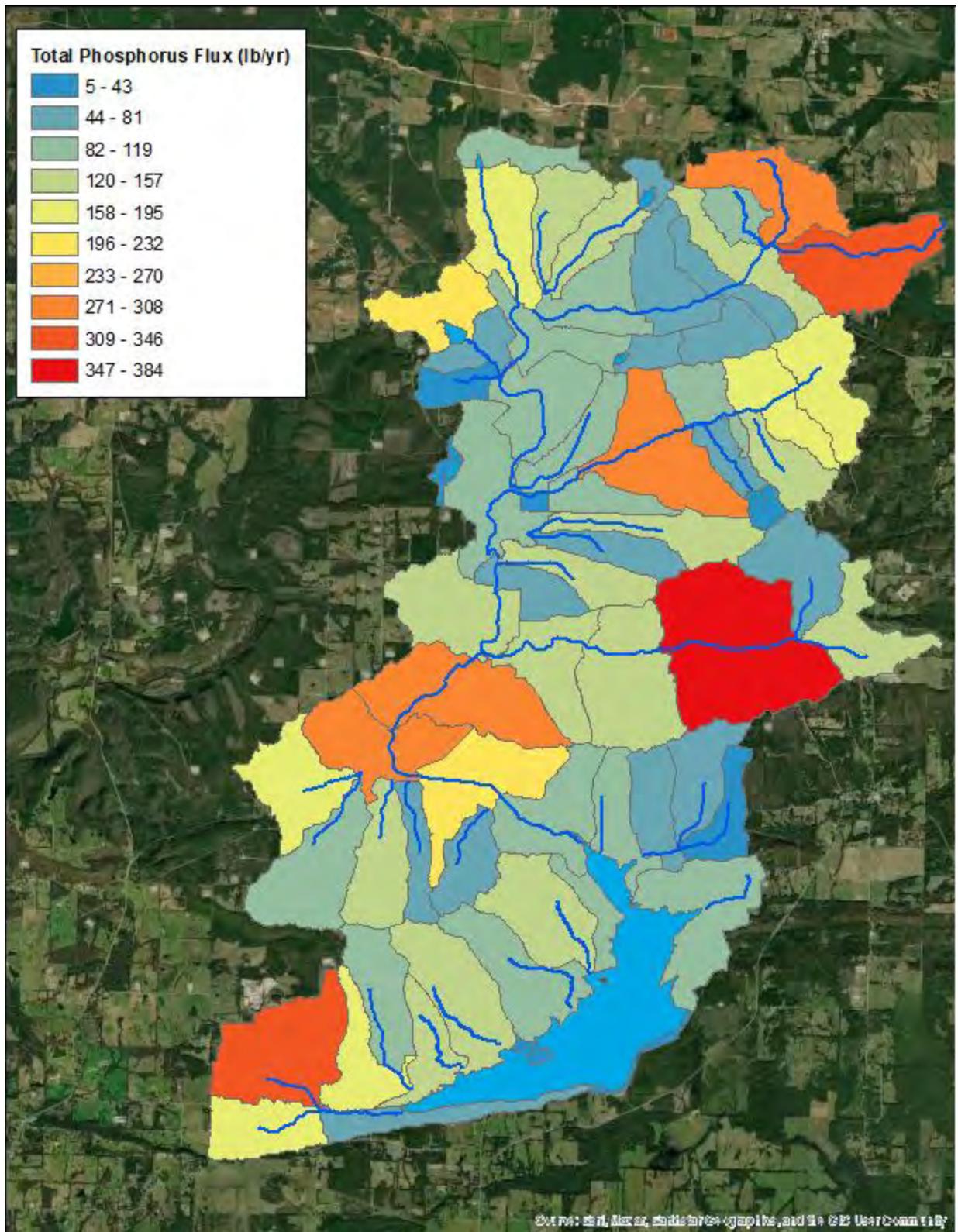


Figure 6-10 Median total phosphorus annual load (lb /year) identified areas with higher inputs.

7 References

ADEQ. 2025. Arkansas Energy and Environment, Environmental Quality. <https://www.adeq.state.ar.us/water/planning/surface/>

Arkansas GIS Office. 2025. GIS data. [ht 1024tps://gis.arkansas.gov](https://gis.arkansas.gov)

Beaulac, M.N. and K.H. Reckhow. 1982. An examination of land use – nutrient export relationships. *Water Resources Bulletin*, Vol 16, No. 6, 1013.

Diaz-Ramirez, J.N., V. J. Alarcon, Z. Duan, M. L. Tagert, W. H. McAnally, J. L. Martin, C. G. O'Hara. 2007. Impacts of land use characterization in modeling hydrology and sediments for the Luxapallila creek watershed, Alabama and Mississippi. *Transactions of the ASABE*, Vol. 51(1): 139-151.

Hart, R.M. 2014. Simulated effects of existing and proposed surface-water impoundments and gas-well pads on streamflow and suspended sediment in the Cypress Creek watershed, Arkansas (ver. 1.1, April 2016): U.S. Geological Survey Scientific Investigations Report 2014–5057, 36 p., <http://dx.doi.org/10.3133/sir20145057>.

Jarvie, H.P. P.J.A. Withers, M.J. Bowes, E.J. Palmer-Felgate, D.M. Harper, K. Wasiak, P. Wasiak, R.A. Hodgkinson, A. Bates, C. Stoate, M. Neal, H.D. Wickham, S.A. Harman, L.K. Armstrong. 2010. Streamwater phosphorus and nitrogen across a gradient in rural–agricultural land use intensity. *Agriculture, Ecosystems and Environment* 135 (2010) 238–252.

Lusk, M., Toor, G.S., Obreza, T. (2015). "Onsite Sewage Treatment and Disposal Systems: Nitrogen." University of Florida. (edis.ifas.ufl.edu/ss550)

Miller, Rhonda. 2021. How much manure will my animals produce. Utah State University Extension. [chrome-extension://efaidnbmnnnibpajpcgplefindmkaj/https://extension.usu.edu/smallfarms/files/How_Much_Manure.pdf](https://extension.usu.edu/smallfarms/files/How_Much_Manure.pdf)

MPCA. 2018. Water Quality Parameter and Calibration Guidance for HSPF. Minnesota Pollution Control Agency.

USDA. 2025. Soil Survey Geographic Database (SSURGO). <https://www.nrcs.usda.gov/resources/data-and-reports/soil-survey-geographic-database-ssurgo>

USDA. 2025b. National Agricultural Statistics Service. https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_2_County_Level/Arkansas/

US EPA. 2025. Better Assessment Science Integrating Point and Non-point Sources (BASINS). <https://www.epa.gov/hydrowq/better-assessment-science-integrating-point-and-non-point-sources-basins>

USEPA. 2025b. Pollutant Load Estimation Tool (PLET). <https://www.epa.gov/nps/plet>

USEPA. 2006. EPA BASINS Technical Note 8: Sediment Parameter and Calibration Guidance for HSPF. USEPA Office of Water, January 2006.

USGS. 2025. National Land Cover Database. <https://www.usgs.gov/centers/eros/science/national-land-cover-database>

USGS. 2025b. USGS Water-Quality Data for the Nation. <https://waterdata.usgs.gov/nwis/qw>

Wepel, B.C. 2013. Assessing the Effects of Unpaved Roads on Lake Champlain Water Quality. The Lake Champlain Basin Program and New England Interstate Water Pollution Control Commission.

WHAT, 2025. WHAT: Hydrograph Analysis Tool.
<https://engineering.purdue.edu/mapserve/WHAT/main.cgi#bottom>

Williams, H.F.L., D. L. Havens, K. E. Banks, D. J. Wachal. 2008. Field-based monitoring of sediment runoff from natural gas well sites in Denton County, Texas, USA. *Environmental Geology*. Vol 55: 1463-1471.

HSPF Model (UCI) File

RUN

GLOBAL

```
UCI Cypress Creek watershed model
START      2007/10/01 00:00  END    2023/09/28 24:00
RUN INTERP OUTPT LEVELS    4    0
RESUME     0 RUN           1                UNITS    1
END GLOBAL
```

FILES

```
<FILE> <UN#>***<----FILE NAME----->
MESSU    24  WaterQuality.ech
          91  WaterQuality.out
WDM1     26  HydroCal.wdm
          30  Output\WaterQuality.plt
BIN0     92  WaterQuality10.hbn
```

END FILES

OPN SEQUENCE

INGRP INDELT 00:30

```
PERLND 101
PERLND 102
PERLND 103
PERLND 104
PERLND 105
PERLND 106
PERLND 107
PERLND 111
PERLND 112
PERLND 113
PERLND 114
PERLND 121
PERLND 122
PERLND 123
PERLND 124
PERLND 201
PERLND 211
PERLND 221
PERLND 301
PERLND 302
PERLND 303
PERLND 401
PERLND 402
PERLND 501
PERLND 601
PERLND 611
PERLND 621
PERLND 631
PERLND 711
```

```
PERLND 901
PERLND 902
PERLND 903
PERLND 904
PERLND 905
PERLND 906
PERLND 907
PERLND 908
PERLND 909
PERLND 910
PERLND 911
PERLND 912
PERLND 913
PERLND 914
PERLND 915
PERLND 916
```

PERLND 917
PERLND 918
PERLND 919
PERLND 920
PERLND 921
PERLND 922
PERLND 923
PERLND 924
PERLND 925
PERLND 926
PERLND 927
PERLND 928
PERLND 929
PERLND 930
PERLND 931
PERLND 932
PERLND 933
PERLND 934
PERLND 935
PERLND 936
PERLND 937
PERLND 938
PERLND 939
PERLND 940
PERLND 941
PERLND 942
PERLND 943
PERLND 944
PERLND 945
PERLND 946
PERLND 947
PERLND 948
PERLND 949
PERLND 950
PERLND 951
PERLND 952
PERLND 953
PERLND 954
PERLND 955
PERLND 956
PERLND 957
PERLND 958
PERLND 959
PERLND 960
PERLND 961
PERLND 962
PERLND 963
PERLND 964
PERLND 965
PERLND 966
PERLND 967

IMPLND 401
IMPLND 402
IMPLND 501
IMPLND 601
IMPLND 611
IMPLND 621
IMPLND 631
IMPLND 701
IMPLND 711

RCHRES 100
RCHRES 101
RCHRES 102
RCHRES 103
RCHRES 104
RCHRES 105

RCHRES 1
RCHRES 2

```

RCHRES      3
RCHRES      4
RCHRES      5
RCHRES      6
RCHRES      7
RCHRES      8
RCHRES      9
RCHRES     10
RCHRES     11
RCHRES     13
RCHRES     14
RCHRES     15
RCHRES     16
RCHRES     17
RCHRES     18
RCHRES     19
RCHRES     20
RCHRES     21
RCHRES     22
RCHRES     23
RCHRES     24
RCHRES     25
RCHRES     27
RCHRES     28
RCHRES     26
RCHRES     29
RCHRES     30
RCHRES     31
RCHRES     32
RCHRES     33
RCHRES     34
RCHRES     35
RCHRES     36
RCHRES     37
RCHRES     39
RCHRES     40
RCHRES     41
RCHRES     42
RCHRES     38
RCHRES     43
RCHRES     44
RCHRES     45
RCHRES     46
RCHRES     47
RCHRES     48
RCHRES     49
RCHRES     50
***      RCHRES      51
RCHRES     52
RCHRES     53
RCHRES     54
***      RCHRES      55
RCHRES     56
RCHRES     57
RCHRES     58
RCHRES     59
RCHRES     60
RCHRES     61
RCHRES     999

      PLTGEN      1
      END INGRP
      END OPN SEQUENCE

      PERLND
      ACTIVITY
      *** <PLS >           Active Sections           ***
      *** x - x ATMP SNOW PWAT  SED  PST  PWG  PQAL MSTL  PEST  NITR  PHOS  TRAC ***
      101 999  0  0  1  1  0  0  1  0  0  0  0  0
      END ACTIVITY

```

```

PRINT-INFO
*** < PLS>
Print-flags
*** x - x ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC PIVL PYR
101 999 5 5 5 5 5 5 5 5 5 5 5 5 1 9
END PRINT-INFO

```

```

BINARY-INFO
*** < PLS>
Binary Output Flags
*** x - x ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC PIVL PYR
101 899 6 6 6 4 6 6 4 6 6 6 6 6 1 9
900 999 6 6 6 4 6 6 4 6 6 6 6 6 1 9
END BINARY-INFO

```

```

GEN-INFO
***
Name Unit-systems Printer BinaryOut
*** <PLS > t-series Enгл Metr Enгл Metr
*** x - x in out
101 DeciduousForest_B 1 1 0 0 92 0
102 DeciduousForest_C_0 1 1 0 0 92 0
103 DeciduousForest_C_5 1 1 0 0 92 0
104 DeciduousForest_C_10 1 1 0 0 92 0
105 DeciduousForest_D_0 1 1 0 0 92 0
106 DeciduousForest_D_5 1 1 0 0 92 0
107 DeciduousForest_D_> 1 1 0 0 92 0
111 EvergreenForest_C_0 1 1 0 0 92 0
112 EvergreenForest_C_5 1 1 0 0 92 0
113 EvergreenForest_D_0 1 1 0 0 92 0
114 EvergreenForest_D_5 1 1 0 0 92 0
121 MixedForest_C_0-5 1 1 0 0 92 0
122 MixedForest_C_5-10 1 1 0 0 92 0
123 MixedForest_D_0-5 1 1 0 0 92 0
124 MixedForest_D_5-10 1 1 0 0 92 0
201 Herbaceous 1 1 0 0 92 0
211 Shrub-Scrub 1 1 0 0 92 0
221 BarrenLand 1 1 0 0 92 0
301 Pasture-Hay_C_0-5 1 1 0 0 92 0
302 Pasture-Hay_C_5-10 1 1 0 0 92 0
303 Pasture-Hay_D 1 1 0 0 92 0
401 GravelRoad 1 1 0 0 92 0
402 Fracking 1 1 0 0 92 0
501 PavedRoad 1 1 0 0 92 0
601 Developed-OpenSpace 1 1 0 0 92 0
611 Developed-LowIntensity 1 1 0 0 92 0
621 Developed-MediumIntensity 1 1 0 0 92 0
631 Developed-HighIntensity 1 1 0 0 92 0
711 Wetlands 1 1 0 0 92 0
900 999Septic 1 1 0 0 92 0
END GEN-INFO

```

```

ATEMP-DAT
*** <ILS > ELDAT AIRTEMP
*** x - x (ft) (deg F)
1 999 0.0 40.0
END ATEMP-DAT

```

```

PWAT-PARM1
*** <PLS >
Flags
*** x - x CSNO RTOP UZFG VCS VUZ VNN VIFW VIRC VLE IFFC HWT IRRG IFRD
101 711 0 0 0 1 1 0 0 0 1 0 0 0 0
END PWAT-PARM1

```

```

PWAT-PARM2
*** < PLS> FOREST LZSN INFILT LRSUR SLSUR KVARV AGWRC
*** x - x (in) (in/hr) (ft) (1/in) (1/day)
***Deciduous Forest_B
101 0.8 11.08 0.10 250 0.050 3. 0.996
***Deciduous Forest_C
102 0.8 9.23 0.05 250 0.025 3. 0.996
103 0.8 8.31 0.05 250 0.075 3. 0.996
104 0.8 7.38 0.05 250 0.100 3. 0.996
***Deciduous Forest_D

```

105	0.8	7.38	0.01	250	0.025	3.	0.996
106	0.8	6.46	0.01	250	0.075	3.	0.996
107	0.8	5.54	0.01	250	0.100	3.	0.996
***Evergreen Forest_C							
111	0.8	9.78	0.05	250	0.025	3.	0.996
112	0.8	8.89	0.05	250	0.075	3.	0.996
***Evergreen Forest_D							
113	0.8	8.00	0.01	250	0.025	3.	0.996
114	0.8	7.11	0.01	250	0.075	3.	0.996
***Mixed Forest_C							
121	0.8	9.72	0.05	250	0.025	3.	0.996
122	0.8	8.97	0.05	250	0.075	3.	0.996
***Mixed Forest_D							
123	0.8	7.72	0.01	250	0.025	3.	0.996
124	0.8	6.97	0.01	250	0.075	3.	0.996
***Herbaceous							
201	0.0	8.00	0.05	250	0.050	3.	0.996
***Shrub/Scrub and Barren							
211	0.0	7.88	0.05	250	0.050	3.	0.996
221	0.0	7.00	0.05	250	0.050	3.	0.996
***Pasture/Hay							
301	0.0	8.38	0.05	250	0.025	3.	0.996
302	0.0	7.45	0.05	250	0.075	3.	0.996
303	0.0	7.45	0.01	250	0.050	3.	0.996
401	0.0	8.00	0.05	250	0.050	3.	0.996
402	0.0	8.00	0.05	250	0.050	3.	0.996
501	0.0	8.00	0.05	250	0.050	3.	0.996
601	0.0	8.00	0.05	250	0.050	3.	0.996
611	0.0	8.00	0.05	250	0.050	3.	0.996
621	0.0	8.00	0.05	250	0.050	3.	0.996
631	0.0	8.00	0.05	250	0.050	3.	0.996
711	0.0	7.00	0.40	100	0.001	3.	0.996
900 999	0.0	8.00	0.05	250	0.050	3.	0.996
END PWAT-PARM2							

PWAT-PARM3							
*** < PLS>	PETMAX	PETMIN	INFEXP	INFILD	DEEPFR	BASETP	AGWETP
*** x - x	(deg F)	(deg F)					
***Deciduous Forest_B							
101	40.	35.	4.	1.5	0.500	0.270	0.125
***Deciduous Forest_C							
102	40.	35.	4.	1.5	0.500	0.270	0.125
103	40.	35.	4.	1.5	0.500	0.270	0.125
104	40.	35.	4.	1.5	0.500	0.270	0.125
***Deciduous Forest_D							
105	40.	35.	4.	1.5	0.500	0.270	0.125
106	40.	35.	4.	1.5	0.500	0.270	0.125
107	40.	35.	4.	1.5	0.500	0.270	0.125
***Evergreen Forest_C							
111	40.	35.	4.	1.5	0.500	0.210	0.125
112	40.	35.	4.	1.5	0.500	0.210	0.125
***Evergreen Forest_D							
113	40.	35.	4.	1.5	0.500	0.210	0.125
114	40.	35.	4.	1.5	0.500	0.210	0.125
***Mixed Forest_C							
121	40.	35.	4.	1.5	0.500	0.240	0.125
122	40.	35.	4.	1.5	0.500	0.240	0.125
***Mixed Forest_D							
123	40.	35.	4.	1.5	0.500	0.240	0.125
124	40.	35.	4.	1.5	0.500	0.240	0.125
***Herbaceous							
201	40.	35.	4.	1.5	0.500	0.150	0.125
***Shrub/Scrub and Barren							
211	40.	35.	4.	1.5	0.500	0.150	0.125
221	40.	35.	4.	1.5	0.500	0.150	0.019
***Pasture/Hay							
301	40.	35.	4.	1.5	0.500	0.150	0.125
302	40.	35.	4.	1.5	0.500	0.150	0.125
303	40.	35.	4.	1.5	0.500	0.150	0.125

401	40.	35.	4.	1.5	0.500	0.150	0.125
402	40.	35.	4.	1.5	0.500	0.150	0.125
501	40.	35.	4.	1.5	0.500	0.150	0.125
601	40.	35.	4.	1.5	0.500	0.150	0.125
611	40.	35.	4.	1.5	0.500	0.150	0.125
621	40.	35.	4.	1.5	0.500	0.150	0.125
631	40.	35.	4.	1.5	0.500	0.150	0.125
711	40.	35.	4.	1.5	0.500	0.150	0.019
900 999	40.	35.	4.	1.5	0.500	0.150	0.125

END PWAT-PARM3

PWAT-PARM4

*** <PLS >	CEPSC	UZSN	NSUR	INTFW	IRC	LZETP
*** x - x	(in)	(in)			(1/day)	
***Deciduous Forest_B						
101	0.00	0.08	0.40	1.00	0.89	0.0
***Deciduous Forest_C						
102	0.00	0.08	0.40	1.40	0.89	0.0
103	0.00	0.08	0.40	1.40	0.89	0.0
104	0.00	0.08	0.40	1.40	0.89	0.0
***Deciduous Forest_D						
105	0.00	0.08	0.40	1.80	0.89	0.0
106	0.00	0.08	0.40	1.80	0.89	0.0
107	0.00	0.08	0.40	1.80	0.89	0.0
***Evergreen Forest_C						
111	0.00	0.08	0.35	1.20	0.89	0.0
112	0.00	0.08	0.35	1.20	0.89	0.0
***Evergreen Forest_D						
113	0.00	0.08	0.35	1.60	0.89	0.0
114	0.00	0.08	0.35	1.60	0.89	0.0
***Mixed Forest_C						
121	0.00	0.08	0.40	1.31	0.89	0.0
122	0.00	0.08	0.40	1.31	0.89	0.0
***Mixed Forest_D						
123	0.00	0.08	0.40	1.70	0.89	0.0
124	0.00	0.08	0.40	1.70	0.89	0.0
***Herbaceous						
201	0.00	0.08	0.25	1.33	0.89	0.0
***Shrub/Scrub and Barren						
211	0.00	0.08	0.25	1.23	0.89	0.0
221	0.00	0.08	0.25	1.25	0.89	0.0
***Pasture/Hay_C						
301	0.00	0.08	0.30	1.30	0.89	0.0
302	0.00	0.08	0.30	1.30	0.89	0.0
303	0.00	0.08	0.30	1.30	0.89	0.0
401	0.00	0.08	0.25	1.33	0.89	0.0
402	0.00	0.08	0.25	1.33	0.89	0.0
501	0.00	0.08	0.25	1.33	0.89	0.0
601	0.00	0.08	0.25	1.33	0.89	0.0
611	0.00	0.08	0.25	1.33	0.89	0.0
621	0.00	0.08	0.25	1.33	0.89	0.0
631	0.00	0.08	0.25	1.33	0.89	0.0
711	0.00	0.08	0.30	1.00	0.89	0.0
900 999	0.00	0.08	0.25	1.33	0.89	0.0

END PWAT-PARM4

PWAT-STATE1

*** < PLS>	PWATER	state	variables	(in)				
*** x - x	CEPS	SURS	UZS	IFWS	LZS	AGWS	GWWS	
*** 101 999	0.00	0.00	0.0	0.00	00.	0.00	0.00	
101 899	0.00	0.00	0.00	0.12	9.5	1.15	0.39	
900 999	0.00	0.00	0.00	0.12	9.5	1.15	0.39	

END PWAT-STATE1

MON-UZSN

*** <PLS >	Interception storage capacity at start of each month (in)											
*** x - x	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
***Deciduous Forest_B												
101	0.25	0.25	0.25	0.38	0.75	1.25	1.25	1.25	0.88	0.25	0.25	0.25

```

***Deciduous Forest_C
102    0.20 0.20 0.20 0.30 0.60 1.00 1.00 1.00 0.70 0.20 0.20 0.20
103    0.20 0.20 0.20 0.30 0.60 1.00 1.00 1.00 0.70 0.20 0.20 0.20
104    0.20 0.20 0.20 0.30 0.60 1.00 1.00 1.00 0.70 0.20 0.20 0.20
***Deciduous Forest_D
105    0.15 0.15 0.15 0.23 0.45 0.75 0.75 0.75 0.53 0.15 0.15 0.15
106    0.15 0.15 0.15 0.23 0.45 0.75 0.75 0.75 0.53 0.15 0.15 0.15
107    0.15 0.15 0.15 0.23 0.45 0.75 0.75 0.75 0.53 0.15 0.15 0.15
***Evergreen Forest_C
111    0.23 0.23 0.23 0.34 0.68 1.13 1.13 1.13 0.79 0.23 0.23 0.23
112    0.23 0.23 0.23 0.34 0.68 1.13 1.13 1.13 0.79 0.23 0.23 0.23
***Evergreen Forest_D
113    0.18 0.18 0.18 0.26 0.53 0.88 0.88 0.88 0.61 0.18 0.18 0.18
114    0.18 0.18 0.18 0.26 0.53 0.88 0.88 0.88 0.61 0.18 0.18 0.18
***Mixed Forest_C
121    0.21 0.21 0.21 0.32 0.63 1.05 1.05 1.05 0.74 0.21 0.21 0.21
122    0.21 0.21 0.21 0.32 0.63 1.05 1.05 1.05 0.74 0.21 0.21 0.21
***Mixed Forest_D
123    0.16 0.16 0.16 0.24 0.48 0.80 0.80 0.80 0.56 0.16 0.16 0.16
124    0.16 0.16 0.16 0.24 0.48 0.80 0.80 0.80 0.56 0.16 0.16 0.16
***Herbaceous
201    0.25 0.25 0.25 0.38 0.75 1.25 1.25 1.25 0.88 0.25 0.25 0.25
***Shrub/Scrub and Barren
211    0.25 0.25 0.25 0.38 0.75 1.25 1.25 1.25 0.88 0.25 0.25 0.25
221    0.05 0.05 0.05 0.08 0.15 0.25 0.25 0.25 0.18 0.05 0.05 0.05
***Pasture/Hay_C
301    0.25 0.25 0.25 0.38 0.75 1.25 1.25 1.25 0.88 0.25 0.25 0.25
302    0.25 0.25 0.25 0.38 0.75 1.25 1.25 1.25 0.88 0.25 0.25 0.25
303    0.20 0.20 0.20 0.30 0.60 1.00 1.00 1.00 0.70 0.20 0.20 0.20

401    0.25 0.25 0.25 0.38 0.75 1.25 1.25 1.25 0.88 0.25 0.25 0.25
402    0.25 0.25 0.25 0.38 0.75 1.25 1.25 1.25 0.88 0.25 0.25 0.25
501    0.25 0.25 0.25 0.38 0.75 1.25 1.25 1.25 0.88 0.25 0.25 0.25
601    0.25 0.25 0.25 0.38 0.75 1.25 1.25 1.25 0.88 0.25 0.25 0.25
611    0.25 0.25 0.25 0.38 0.75 1.25 1.25 1.25 0.88 0.25 0.25 0.25
621    0.25 0.25 0.25 0.38 0.75 1.25 1.25 1.25 0.88 0.25 0.25 0.25
631    0.25 0.25 0.25 0.38 0.75 1.25 1.25 1.25 0.88 0.25 0.25 0.25
711    0.10 0.10 0.10 0.15 0.30 0.50 0.50 0.50 0.35 0.10 0.10 0.10
800 999 0.25 0.25 0.25 0.38 0.75 1.25 1.25 1.25 0.88 0.25 0.25 0.25
END MON-UZSN

```

MON-INTERCEP

```

*** <PLS > Interception storage capacity at start of each month (in)
*** x - x JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
***Deciduous Forest_B
101    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
***Deciduous Forest_C
102    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
103    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
104    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
***Deciduous Forest_D
105    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
106    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
107    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
***Evergreen Forest_C
111    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
112    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
***Evergreen Forest_D
113    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
114    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
***Mixed Forest_C
121    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
122    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
***Mixed Forest_D
123    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
124    .030 .030 .060 .113 .150 .263 .300 .300 .225 .113 .060 .030
***Herbaceous
201    .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
***Shrub/Scrub and Barren
211    .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
221    .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020

```

```

***Pasture/Hay_C
301      .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
302      .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
303      .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020

401      .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
402      .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
501      .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
601      .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
611      .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
621      .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
631      .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
711      .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
800 999 .020 .020 .040 .075 .100 .175 .200 .200 .150 .075 .040 .020
END MON-INTERCEP

```

```

MON-LZETPARM
*** <PLS > Interception storage capacity at start of each month (in)
*** x - x JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
***Deciduous Forest_B
101      0.08 0.08 0.16 0.23 0.47 0.62 0.70 0.70 0.47 0.23 0.16 0.08
***Deciduous Forest_C
102      0.09 0.09 0.19 0.28 0.56 0.75 0.84 0.84 0.56 0.28 0.19 0.09
103      0.09 0.09 0.19 0.28 0.56 0.75 0.84 0.84 0.56 0.28 0.19 0.09
104      0.09 0.09 0.19 0.28 0.56 0.75 0.84 0.84 0.56 0.28 0.19 0.09
***Deciduous Forest_D
105      0.11 0.11 0.22 0.33 0.66 0.87 0.98 0.98 0.66 0.33 0.22 0.11
106      0.11 0.11 0.22 0.33 0.66 0.87 0.98 0.98 0.66 0.33 0.22 0.11
107      0.11 0.11 0.22 0.33 0.66 0.87 0.98 0.98 0.66 0.33 0.22 0.11
***Evergreen Forest_C
111      0.10 0.10 0.20 0.29 0.59 0.78 0.88 0.88 0.59 0.29 0.20 0.10
112      0.10 0.10 0.20 0.29 0.59 0.78 0.88 0.88 0.59 0.29 0.20 0.10
***Evergreen Forest_D
113      0.10 0.10 0.20 0.29 0.59 0.78 0.88 0.88 0.59 0.29 0.20 0.10
114      0.10 0.10 0.20 0.29 0.59 0.78 0.88 0.88 0.59 0.29 0.20 0.10
***Mixed Forest_C
121      0.09 0.09 0.18 0.27 0.54 0.72 0.81 0.81 0.54 0.27 0.18 0.09
122      0.09 0.09 0.18 0.27 0.54 0.72 0.81 0.81 0.54 0.27 0.18 0.09
***Mixed Forest_D
123      0.11 0.11 0.21 0.31 0.63 0.83 0.93 0.93 0.63 0.31 0.21 0.11
124      0.11 0.11 0.21 0.31 0.63 0.83 0.93 0.93 0.63 0.31 0.21 0.11
***Herbaceous
201      0.06 0.06 0.13 0.19 0.39 0.51 0.58 0.58 0.39 0.19 0.13 0.06
***Shrub/Scrub and Barren
211      0.07 0.07 0.14 0.20 0.41 0.54 0.61 0.61 0.41 0.20 0.14 0.07
221      0.08 0.08 0.15 0.23 0.45 0.60 0.68 0.68 0.45 0.23 0.15 0.08
***Pasture/Hay_C
301      0.06 0.06 0.12 0.17 0.35 0.46 0.52 0.52 0.35 0.17 0.12 0.06
302      0.06 0.06 0.12 0.17 0.35 0.46 0.52 0.52 0.35 0.17 0.12 0.06
303      0.06 0.06 0.12 0.17 0.35 0.46 0.52 0.52 0.35 0.17 0.12 0.06

401      0.06 0.06 0.13 0.19 0.39 0.51 0.58 0.58 0.39 0.19 0.13 0.06
402      0.06 0.06 0.13 0.19 0.39 0.51 0.58 0.58 0.39 0.19 0.13 0.06
501      0.06 0.06 0.13 0.19 0.39 0.51 0.58 0.58 0.39 0.19 0.13 0.06
601      0.06 0.06 0.13 0.19 0.39 0.51 0.58 0.58 0.39 0.19 0.13 0.06
611      0.06 0.06 0.13 0.19 0.39 0.51 0.58 0.58 0.39 0.19 0.13 0.06
621      0.06 0.06 0.13 0.19 0.39 0.51 0.58 0.58 0.39 0.19 0.13 0.06
631      0.06 0.06 0.13 0.19 0.39 0.51 0.58 0.58 0.39 0.19 0.13 0.06
711      0.12 0.12 0.24 0.36 0.72 0.96 1.08 1.08 0.72 0.36 0.24 0.12
800 999 0.06 0.06 0.13 0.19 0.39 0.51 0.58 0.58 0.39 0.19 0.13 0.06
END MON-LZETPARM

```

```

SED-PARM1
*** <PLS > Sediment parameters 1
*** x - x CRV VSIV SDOP
101 999 1 0 0
END SED-PARM1

```

```

SED-PARM2
*** <PLS > SMPF KRER JRER AFFIX COVER NVSI

```

*** x - x		(/day)				lb/ac-day	
101	109	1.	0.13	1.9	0.14	0.0	0.0
110	119	1.	0.14	1.9	0.14	0.0	0.0
120	199	1.	0.12	1.9	0.14	0.0	0.0
200	220	1.	0.18	1.9	0.14	0.0	0.0
221	299	1.	0.40	1.9	0.14	0.0	0.0
300	399	1.	0.32	1.9	0.14	0.0	0.0
400	499	1.	0.80	1.9	0.14	0.0	0.0
500	599	1.	0.20	1.9	0.14	0.0	0.0
600	699	1.	0.24	1.9	0.14	0.0	0.0
711		1.	0.32	1.9	0.14	0.0	0.0
900	999	1.	0.30	1.9	0.14	0.0	0.0

*** Jan 30, 2025 - KRER values set based on soil erodibility (K) values from Web Soil Survey.
 *** Jan 31, 2025 - Gravel and Paved landcover type KRER increased by 2.5times

*** 101 109 Deciduous Forest
 *** 110 119 Evergreen Forest
 *** 120 199 Mixed Forest
 *** 200 299 Herbaceous, Shrub, & Barren
 *** 300 399 Hay/Pasture
 *** 400 499 Gravel & Fracking
 *** 500 599 Paved
 *** 600 699 Developed
 *** 711 Wetlands
 *** 900 999 Septic

END SED-PARM2

SED-PARM3

*** <PLS > Sediment parameter 3
 *** x - x KSER JSER KGER JGER

101	109	0.05	2.0	0.00	2.0
110	119	0.05	2.0	0.00	2.0
120	199	0.05	2.0	0.00	2.0
200	299	0.25	2.0	0.00	2.0
300	399	0.65	2.0	0.10	2.0
400	499	0.06	2.0	0.10	2.0
500	599	0.03	2.0	0.10	2.0
600	699	0.03	2.0	0.00	2.0
711		0.01	2.0	0.00	2.0
900	999	0.0	2.0	0.00	2.0

*** 101 109 Deciduous Forest
 *** 110 119 Evergreen Forest
 *** 120 199 Mixed Forest
 *** 200 299 Herbaceous, Shrub, & Barren
 *** 300 399 Hay/Pasture
 *** 400 499 Gravel & Fracking
 *** 500 599 Paved
 *** 600 699 Developed
 *** 711 Wetlands
 *** 900 999 Septic

END SED-PARM3

MON-COVER

*** <PLS > Monthly values for erosion related cover
 *** x - x JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

101	109	.50	.50	.70	.85	.85	.85	.85	.85	.85	.85	.70	.50
110	119	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85
120	199	.60	.60	.75	.85	.85	.85	.85	.85	.85	.85	.75	.60
200	299	.40	.40	.50	.60	.60	.60	.60	.60	.60	.60	.40	.40
300	399	.40	.50	.75	.85	.25	.50	.80	.80	.25	.40	.40	.40
400	599	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
600	699	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
711		.98	.98	.98	.98	.98	.98	.98	.98	.98	.98	.98	.98
900	999	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

```

*** 101 109 Deciduous Forest
*** 110 119 Evergreen Forest
*** 120 199 Mixed Forest
*** 200 299 Herbaceous, Shrub, & Barren
*** 300 399 Hay/Pasture, assume two harvests, plus cover crop during the winter
*** 400 599 Gravel, Fracking, & Paved
*** 600 699 Developed
*** 711 Wetlands
*** 900 999 Septic

```

END MON-COVER

SED-STOR

```

*** <PLS > Detached sediment storage (tons/acre)
*** x - x DETS
101 999 0.0
END SED-STOR

```

NQUALS

```

*** <PLS >
*** x - xNQUAL
101 999 4
END NQUALS

```

```

*****
***** Nitrogen Water Quality
*****

```

QUAL-PROPS

```

*** <PLS > Identifiers and Flags
*** x - x QUALID QTID QSD VPFW VPFS QSO VQO QIFW VIQC QAGW VAQC
101 299TN LBS 0 0 0 1 0 1 3 1 3
300 399TN LBS 0 0 0 1 0 1 3 1 3
401 999TN LBS 0 0 0 1 0 1 3 1 3
END QUAL-PROPS

```

QUAL-INPUT

```

*** Storage on surface and nonseasonal parameters
*** SQO POTFW POTFS ACQOP SQOLIM WSQOP IOQC AOQC
*** <PLS > qty/ac qty/ton qty/ton qty/ ac.day qty/ac in/hr qty/ft3 qty/ft3
*** x - x
*** FOREST
101 199 0.0 0.00 0.0 0.03 0.30 2.50 0.0 0.0
*** HERBACEOUS, SHRUB, & BARREN
201 0.0 0.00 0.0 0.05 0.50 2.50 0.0 0.0
211 0.0 0.00 0.0 0.05 0.50 2.50 0.0 0.0
221 0.0 0.00 0.0 0.02 0.20 2.50 0.0 0.0
*** HAY/PASTURE
300 399 0.0 0.00 0.0 0.05 0.50 2.00 0.0 0.0
*** GRAVEL, FRACKING, & PAVED
400 599 0.0 0.00 0.0 0.06 0.60 1.00 0.0 0.0
*** DEVELOPED
601 0.0 0.00 0.0 0.06 0.60 1.50 0.0 0.0
611 0.0 0.00 0.0 0.06 0.60 1.50 0.0 0.0
621 0.0 0.00 0.0 0.08 0.80 1.00 0.0 0.0
631 0.0 0.00 0.0 0.08 0.80 1.00 0.0 0.0
*** WETLANDS
700 799 0.0 0.00 0.0 0.01 0.10 2.00 0.0 0.0
*** SEPTIC
900 999 0.0 0.00 0.0 0.00 0.00 1.00 0.0 0.0
END QUAL-INPUT

```

MON-IFLW-CONC

```

*** <PLS > Monthly values for interflow TN concentrations
*** x - x JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
*** FOREST
101 199 .72 .66 .54 .42 .36 .30 .24 .16 .12 .30 .30 .54
*** HERBACEOUS, SHRUB
200 220 0.6 0.6 0.6 0.6 0.5 0.4 0.3 0.2 0.2 0.4 0.4 0.6
*** BARREN
221 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1

```

```

*** HAY/PASTURE
300 399 2.5 3.0 1.0 1.0 1.0 1.0 0.9 0.7 1.8 1.8 1.8
*** GRAVEL, FRACKING, & PAVED
400 599 1.0 0.9 0.7 0.6 0.5 0.4 0.3 0.2 0.2 0.4 0.4 0.7
*** DEVELOPED
600 699 1.0 0.9 0.7 0.6 0.5 0.4 0.3 0.2 0.2 0.4 0.4 0.7
*** WETLANDS
700 799 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10
*** SEPTIC
900 999 23.0 23.0 23.0 23.0 23.0 23.0 23.0 23.0 23.0 23.0 23.0
END MON-IFLW-CONC

```

```

MON-GRND-CONC
*** <PLS > Monthly values for groundwater TN concentrations
*** x - x JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
*** FOREST
101 199 .72 .66 .54 .42 .36 .30 .24 .16 .12 .30 .30 .54
*** HERBACEOUS, SHRUB
200 220 0.6 0.6 0.6 0.6 0.5 0.4 0.3 0.2 0.2 0.4 0.4 0.6
*** BARREN
221 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1
*** HAY/PASTURE
300 399 2.5 3.0 3.0 1.0 1.0 1.0 0.9 0.7 1.8 1.8 1.8
*** GRAVEL, FRACKING, & PAVED
400 599 1.0 0.9 0.7 0.6 0.5 0.4 0.3 0.2 0.2 0.4 0.4 0.7
*** DEVELOPED
600 699 1.0 0.9 0.7 0.6 0.5 0.4 0.3 0.2 0.2 0.4 0.4 0.7
*** WETLANDS
700 799 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10
*** SEPTIC
900 999 23.0 23.0 23.0 23.0 23.0 23.0 23.0 23.0 23.0 23.0 23.0
END MON-GRND-CONC

```

```

QUAL-PROPS
*** <PLS > Identifiers and Flags
*** x - x QUALID QTID QSD VPFW VPFS QSO VQO QIFW VIQC QAGW VAQC
300 399TN-Manure LBS 0 0 0 1 0 0 0 0 0 0
END QUAL-PROPS

```

```

QUAL-INPUT
*** Storage on surface and nonseasonal parameters
*** SQO POTFW POTFS ACQOP SQOLIM WSQOP IOQC AOQC
*** <PLS > qty/ac qty/ton qty/ton qty/ qty/ qty/ in/hr qty/ft3 qty/ft3
*** x - x ac.day
*** HAY/PASTURE
300 399 0.0 0.00 0.0 0.00 0.00 20. 0.0 0.0
END QUAL-INPUT

```

```

*****
***** Phosphorus Water Quality
*****

```

```

QUAL-PROPS
*** <PLS > Identifiers and Flags
*** x - x QUALID QTID QSD VPFW VPFS QSO VQO QIFW VIQC QAGW VAQC
101 999TP LBS 0 0 0 1 0 1 3 1 3
END QUAL-PROPS

```

```

QUAL-INPUT
*** Storage on surface and nonseasonal parameters
*** SQO POTFW POTFS ACQOP SQOLIM WSQOP IOQC AOQC
*** <PLS > qty/ac qty/ton qty/ton qty/ qty/ qty/ in/hr qty/ft3 qty/ft3
*** x - x ac.day
*** FOREST
101 199 0.0 0.000 0.000 .001 0.01 1.00 0.0 0.0
*** HERBACEOUS, SHRUB, & BARREN
200 220 0.0 0.000 0.000 .002 0.02 1.00 0.0 0.0
221 0.0 0.000 0.000 .001 0.01 1.00 0.0 0.0
*** HAY/PASTURE
300 399 0.0 0.000 0.000 .004 0.04 1.00 0.0 0.0

```

```

*** GRAVEL, FRACKING, & PAVED
400 599 0.0 0.000 0.000 .006 0.06 1.00 0.0 0.0
*** DEVELOPED
601 0.0 0.000 0.000 .004 0.04 1.00 0.0 0.0
611 0.0 0.000 0.000 .005 0.05 1.00 0.0 0.0
621 0.0 0.000 0.000 .006 0.06 1.00 0.0 0.0
631 0.0 0.000 0.000 .007 0.07 1.00 0.0 0.0
*** WETLANDS
700 799 0.0 0.000 0.000 .002 0.02 1.00 0.0 0.0
*** SEPTIC
900 999 0.0 0.00 0.0 0.00 0.00 1.00 0.0 0.0
END QUAL-INPUT

```

```

MON-IFLW-CONC
*** <PLS > Monthly values for interflow TN concentrations
*** x - x JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
*** FOREST
101 199 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001
*** HERBACEOUS, SHRUB, & BARREN
200 220 .003 .003 .003 .003 .008 .013 .013 .010 .006 .010 .003 .003
221 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001
*** HAY/PASTURE
300 399 .05 .06 .05 .12 .30 .45 .53 .38 .11 .30 .05 .06
300 399 .06 .06 .06 .08 .10 .20 .20 .17 .07 .30 .06 .06
*** GRAVEL, FRACKING, & PAVED
400 599 .02 .02 .02 .02 .03 .05 .05 .03 .03 .04 .02 .02
*** DEVELOPED
600 699 .02 .02 .02 .02 .03 .05 .05 .03 .03 .04 .02 .02
*** WETLANDS
700 799 .02 .02 .02 .02 .03 .05 .05 .03 .03 .04 .02 .02
*** SEPTIC
900 999 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6
END MON-IFLW-CONC

```

```

MON-GRND-CONC
*** <PLS > Monthly values for groundwater TN concentrations
*** x - x JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
*** FOREST
101 199 .003 .003 .003 .003 .004 .004 .004 .004 .005 .003 .003
*** HERBACEOUS, SHRUB, & BARREN
200 220 .003 .003 .003 .003 .008 .013 .013 .010 .006 .010 .003 .003
221 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001 .001
*** HAY/PASTURE
300 399 .06 .06 .06 .08 .10 .20 .20 .17 .07 .30 .06 .06
*** GRAVEL, FRACKING, & PAVED
400 599 .02 .02 .02 .02 .03 .05 .05 .03 .03 .04 .02 .02
*** DEVELOPED
600 699 .02 .02 .02 .02 .03 .05 .05 .03 .03 .04 .02 .02
*** WETLANDS
700 799 .02 .02 .02 .02 .03 .05 .05 .03 .03 .04 .02 .02
*** SEPTIC
900 999 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6
END MON-GRND-CONC

```

```

QUAL-PROPS
*** <PLS > Identifiers and Flags
*** x - x QUALID QTID QSD VPFW VPFS QSO VQO QIFW VIQC QAGW VAQC
300 399TP-Manure LBS 0 0 0 1 0 0 0 0 0 0
END QUAL-PROPS

```

```

QUAL-INPUT
*** Storage on surface and nonseasonal parameters
*** SQO POTFW POTFS ACQOP SQOLIM WSQOP IOQC AOQC
*** <PLS > qty/ac qty/ton qty/ton qty/ ac.day
*** x - x

```

```

*** HAY/PASTURE
300 399 0.0 0.000 0.000 .000 0.00 6.00 0.0 0.0
END QUAL-INPUT

```

END PERLND

IMPLND

ACTIVITY
*** <ILS > Active Sections
*** x - x ATMP SNOW IWAT SLD IWG IQAL
401 711 0 0 1 1 0 1
END ACTIVITY

PRINT-INFO
*** <ILS > ***** Print-flags ***** PIVL PYR
*** x - x ATMP SNOW IWAT SLD IWG IQAL *****
401 711 5 5 5 5 5 5 1 9
END PRINT-INFO

BINARY-INFO
*** <ILS > **** Binary-Output-flags **** PIVL PYR
*** x - x ATMP SNOW IWAT SLD IWG IQAL *****
401 711 6 6 4 4 6 4 1 9
END BINARY-INFO

GEN-INFO
*** Name Unit-systems Printer BinaryOut
*** <ILS > t-series Engl Metr Engl Metr
*** x - x in out
401 imp, GravelRoad 1 1 0 0 92 0
402 imp, Fracking 1 1 0 0 92 0
501 imp, PavedRoad 1 1 0 0 92 0
601 imp, Dev-OpenSpace 1 1 0 0 92 0
611 imp, Dev-LowIntensity 1 1 0 0 92 0
621 imp, Dev-MediumIntensity 1 1 0 0 92 0
631 imp, Dev-HighIntensity 1 1 0 0 92 0
701 imp, Water 1 1 0 0 92 0
711 imp, Wetlands 1 1 0 0 92 0
END GEN-INFO

ATEMP-DAT
*** <ILS > ELDAT AIRTEMP
*** x - x (ft) (deg F)
1 999 0.0 40.0
END ATEMP-DAT

IWAT-PARM1
*** <ILS > Flags
*** x - x CSNO RTOP VRS VNN RTLI
401 711 0 0 0 0 0
END IWAT-PARM1

IWAT-PARM2
*** <ILS > LSUR SLSUR NSUR RETSC
*** x - x (ft) (in)
401 150 0.050 0.20 0.15
402 150 0.050 0.20 0.15
501 150 0.005 0.05 0.05
601 150 0.050 0.10 0.10
611 150 0.050 0.10 0.10
621 150 0.050 0.10 0.10
631 150 0.050 0.10 0.10
701 150 0.001 0.01 0.00
711 150 0.001 0.01 0.00
END IWAT-PARM2

IWAT-PARM3
*** <ILS > PETMAX PETMIN
*** x - x (deg F) (deg F)
401 711 40. 35.
END IWAT-PARM3

IWAT-STATE1
*** <ILS > IWATER state variables (inches)
*** x - x RETS SURS

401 711 0.01 0.01
END IWAT-STATE1

SLD-PARM1
*** <ILS > Flags
*** x - x VASD VRSD SDOF
401 631 0 0 0
701 711 0 0 0
END SLD-PARM1

SLD-PARM2
*** KEIM JEIM ACCSDP REMSDP
*** <ILS > tons/ /day
*** x - x ac.day
401 0.10 1.8 0.01 0.10
402 0.10 1.8 0.01 0.10
501 0.001 1.1 0.008 0.08
601 0.012 1.5 0.01 0.10
611 0.012 1.5 0.01 0.10
621 0.012 1.5 0.01 0.10
631 0.012 1.5 0.01 0.10
701 0.05 1.8 0.01 0.10
711 0.01 1.8 0.01 0.10
END SLD-PARM2

SLD-STOR
*** <ILS > Solids storage (tons/acre)
*** x - x
401 711 0.0
END SLD-STOR

NQUALS
*** <ILS >
*** x - xNQUAL
401 711 2
END NQUALS

***** Nitrogen Water Quality

QUAL-PROPS
*** <ILS > Identifiers and Flags
*** x - x QUALID QTID QSD VPFW QSO VQO
401 999TN LBS 0 0 1 0
END QUAL-PROPS

QUAL-INPUT
*** Storage on surface and nonseasonal parameters
*** SQO POTFW ACQOP SQOLIM WSQOP
*** <ILS > qty/ac qty/ton qty/ qty/ac in/hr
*** x - x ac.day
401 0.0 0.0 0.04 0.4 1.5
402 0.0 0.0 0.04 0.4 1.5
501 0.0 0.0 0.04 0.4 1.5
601 0.0 0.0 0.03 0.3 1.5
611 0.0 0.0 0.04 0.4 1.5
621 0.0 0.0 0.05 0.5 1.5
631 0.0 0.0 0.05 0.5 1.5
701 0.0 0.0 0.0 0.0 1.0
711 0.0 0.0 0.03 0.3 1.5
END QUAL-INPUT

***** Phosphorus Water Quality

QUAL-PROPS
*** <ILS > Identifiers and Flags
*** x - x QUALID QTID QSD VPFW QSO VQO
401 999TP LBS 0 0 1 0

END QUAL-PROPS

QUAL-INPUT

```

*** Storage on surface and nonseasonal parameters
*** SQO POTFW ACQOP SQOLIM WSQOP
*** <ILS > qty/ac qty/ton qty/ qty/ in/hr
*** x - x ac.day
401 0.0 0.0 .003 0.03 0.50
402 0.0 0.0 .003 0.03 0.50
501 0.0 0.0 .003 0.03 0.25
601 0.0 0.0 .003 0.03 0.50
611 0.0 0.0 .0035 .035 0.50
621 0.0 0.0 .004 0.04 0.50
631 0.0 0.0 .004 0.04 0.50
701 0.0 0.0 .000 0.00 0.50
711 0.0 0.0 .003 0.03 0.50
END QUAL-INPUT

```

END IMPLND

RCHRES

```

ACTIVITY
*** RCHRES Active sections
*** x - x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUGF PKFG PHFG
1 999 1 1 0 0 1 1 0 0 0 0
END ACTIVITY

```

PRINT-INFO

```

*** RCHRES Printout level flags
*** x - x HYDR ADCA CONS HEAT SED GQL OXRX NUTR PLNK PHCB PIVL PYR
1 999 5 5 5 5 5 5 5 5 5 5 1 9
END PRINT-INFO

```

BINARY-INFO

```

*** RCHRES Binary Output level flags
*** x - x HYDR ADCA CONS HEAT SED GQL OXRX NUTR PLNK PHCB PIVL PYR
1 999 6 6 6 6 6 6 6 6 6 6 1 9
END BINARY-INFO

```

GEN-INFO

```

*** Name Nexits Unit Systems Printer
*** RCHRES t-series Engr Metr LKFG
*** x - x in out
1 Stream 1 1 1 1 91 0 0 92 0
2 Stream 2 1 1 1 91 0 0 92 0
3 Stream 3 1 1 1 91 0 0 92 0
4 Stream 4 1 1 1 91 0 0 92 0
5 Stream 5 1 1 1 91 0 0 92 0
6 Stream 6 1 1 1 91 0 0 92 0
7 Stream 7 1 1 1 91 0 0 92 0
*** Infiltration
8 Stream 8 2 1 1 91 0 0 92 0
9 Stream 9 1 1 1 91 0 0 92 0
10 Stream 10 1 1 1 91 0 0 92 0
11 Stream 11 1 1 1 91 0 0 92 0
*** Infiltration
13 Stream 13 2 1 1 91 0 0 92 0
14 Stream 14 1 1 1 91 0 0 92 0
15 Stream 15 1 1 1 91 0 0 92 0
*** Infiltration
16 Stream 16 2 1 1 91 0 0 92 0
17 Stream 17 1 1 1 91 0 0 92 0
18 Stream 18 1 1 1 91 0 0 92 0
19 Stream 19 1 1 1 91 0 0 92 0
20 Stream 20 1 1 1 91 0 0 92 0
21 Stream 21 1 1 1 91 0 0 92 0
22 Stream 22 1 1 1 91 0 0 92 0
23 Stream 23 1 1 1 91 0 0 92 0
24 Stream 24 1 1 1 91 0 0 92 0
25 Stream 25 1 1 1 91 0 0 92 0
*** Fracking WD *** Infiltration

```

```

26 Stream 26 2 1 1 91 0 0 92 0
27 Stream 27 1 1 1 91 0 0 92 0
28 Stream 28 1 1 1 91 0 0 92 0
29 Stream 29 1 1 1 91 0 0 92 0
30 Stream 30 1 1 1 91 0 0 92 0
31 Stream 31 1 1 1 91 0 0 92 0
32 Stream 32 1 1 1 91 0 0 92 0
33 Stream 33 1 1 1 91 0 0 92 0
34 Stream 34 1 1 1 91 0 0 92 0
35 Stream 35 1 1 1 91 0 0 92 0
36 Stream 36 1 1 1 91 0 0 92 0
*** Infiltration
37 Stream 37 2 1 1 91 0 0 92 0
*** Fracking WD *** Infiltration
38 Stream 38 2 1 1 91 0 0 92 0
39 Stream 39 1 1 1 91 0 0 92 0
40 Stream 40 1 1 1 91 0 0 92 0
41 Stream 41 1 1 1 91 0 0 92 0
42 Stream 42 1 1 1 91 0 0 92 0
*** Fracking WD *** Infiltration
43 Stream 43 2 1 1 91 0 0 92 0
44 Stream 44 1 1 1 91 0 0 92 0
*** Fracking WD *** Infiltration
45 Stream 45 2 1 1 91 0 0 92 0
46 Stream 46 1 1 1 91 0 0 92 0
47 Stream 47 1 1 1 91 0 0 92 0
48 Stream 48 1 1 1 91 0 0 92 0
49 Stream 49 1 1 1 91 0 0 92 0
50 Stream 50 1 1 1 91 0 0 92 0
*** 51 Stream 51 1 1 1 91 0 0 92 0
52 Stream 52 1 1 1 91 0 0 92 0
53 Stream 53 1 1 1 91 0 0 92 0
54 Stream 54 1 1 1 91 0 0 92 0
*** 55 Stream 55 1 1 1 91 0 0 92 0
56 Stream 56 1 1 1 91 0 0 92 0
57 Stream 57 1 1 1 91 0 0 92 0
58 Stream 58 1 1 1 91 0 0 92 0
59 Stream 59 1 1 1 91 0 0 92 0
60 Stream 60 1 1 1 91 0 0 92 0
61 Stream 61 1 1 1 91 0 0 92 0
*** Fracking WD
100 Stream 100 2 1 1 91 0 0 92 0
101 Stream 101 2 1 1 91 0 0 92 0
102 Stream 102 2 1 1 91 0 0 92 0
103 Stream 103 2 1 1 91 0 0 92 0
104 Stream 104 2 1 1 91 0 0 92 0
105 Stream 105 2 1 1 91 0 0 92 0
999 Stream 999 1 1 1 91 0 1 92 0
END GEN-INFO

```

```

HYDR-PARM1
*** Flags for HYDR section
***RC HRES VC A1 A2 A3 ODFVFG for each *** ODGTFG for each FUNCT for each
*** x - x FG FG FG FG possible exit *** possible exit possible exit
1 0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
2 0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
3 0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
4 0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
5 0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
6 0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
7 0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** Infiltration
8 0 1 1 1 4 5 0 0 0 0 0 0 0 0 0 3 3 3 3 3
9 0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
10 0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
11 0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** Infiltration
13 0 1 1 1 4 5 0 0 0 0 0 0 0 0 0 3 3 3 3 3
14 0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
15 0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** Infiltration

```

```

16      0 1 1 1 4 5 0 0 0 0 0 0 0 0 0 3 3 3 3 3
17      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
18      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
19      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
20      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
21      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
22      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
23      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
24      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
25      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** Fracking WD *** Infiltration
26      0 1 1 1 4 5 0 0 0 0 1 0 0 0 0 3 3 3 3 3
27      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
28      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
29      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** Infiltration -- not included
30      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** Infiltration -- not included
31      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
32      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
33      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** infiltration - straton creek-- not included
34      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** infiltration - straton creek-- not included
35      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** infiltration - straton creek-- not included
36      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** Infiltration
37      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** Fracking WD *** Infiltration
38      0 1 1 1 4 5 0 0 0 0 1 0 0 0 0 3 3 3 3 3
39      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
40      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
41      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
42      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** Fracking WD *** Infiltration
43      0 1 1 1 4 5 0 0 0 0 1 0 0 0 0 3 3 3 3 3
44      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** Fracking WD *** Infiltration
45      0 1 1 1 4 5 0 0 0 0 1 0 0 0 0 3 3 3 3 3
46      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
47      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
48      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
49      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
50      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
52      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
53      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
54      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
56      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
57      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
58      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
59      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
60      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
61      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
100     0 1 1 1 4 0 0 0 0 0 1 0 0 0 0 3 3 3 3 3
101     0 1 1 1 4 0 0 0 0 0 1 0 0 0 0 3 3 3 3 3
102     0 1 1 1 4 0 0 0 0 0 1 0 0 0 0 3 3 3 3 3
103     0 1 1 1 4 0 0 0 0 0 1 0 0 0 0 3 3 3 3 3
104     0 1 1 1 4 0 0 0 0 0 1 0 0 0 0 3 3 3 3 3
105     0 1 1 1 4 0 0 0 0 0 1 0 0 0 0 3 3 3 3 3
999     0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3
*** 51      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1
*** 55      0 1 1 1 4 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1

```

END HYDR-PARM1

```

HYDR-PARM2
*** RCHRES FTBW FTBU      LEN      DELTH      STCOR      KS      DB50
*** x - x      (miles)      (ft)      (ft)      (in)
1      0.      1      1.052      42.12      0.0      0.5      0.01

```

2	0.	2	1.992	156.35	0.0	0.5	0.01	
3	0.	3	0.439	34.44	0.0	0.5	0.01	
4	0.	4	0.431	12.11	0.0	0.5	0.01	
5	0.	5	0.314	5.98	0.0	0.5	0.01	
6	0.	6	0.682	65.59	0.0	0.5	0.01	
7	0.	7	0.659	14.22	0.0	0.5	0.01	
8	0.	8	1.075	17.49	0.0	0.5	0.01	
9	0.	9	1.248	146.16	0.0	0.5	0.01	
10	0.	10	0.798	81.99	0.0	0.5	0.01	
11	0.	11	1.344	77.54	0.0	0.5	0.01	
13	0.	13	0.863	24.83	0.0	0.5	0.01	
14	0.	14	0.521	31.87	0.0	0.5	0.01	
15	0.	15	0.582	43.61	0.0	0.5	0.01	
16	0.	16	1.462	60.33	0.0	0.5	0.01	
17	0.	17	0.300	24.40	0.0	0.5	0.01	
18	0.	18	0.664	46.71	0.0	0.5	0.01	
19	0.	19	0.616	57.04	0.0	0.5	0.01	
20	0.	20	0.502	35.78	0.0	0.5	0.01	
21	0.	21	1.036	123.96	0.0	0.5	0.01	
22	0.	22	1.111	79.63	0.0	0.5	0.01	
23	0.	23	0.317	26.47	0.0	0.5	0.01	
24	0.	24	0.361	30.86	0.0	0.5	0.01	
25	0.	25	1.159	167.14	0.0	0.5	0.01	
26	0.	26	0.896	18.33	0.0	0.5	0.01	
27	0.	27	1.284	147.70	0.0	0.5	0.01	
28	0.	28	0.766	102.92	0.0	0.5	0.01	
29	0.	29	0.769	91.36	0.0	0.5	0.01	
30	0.	30	0.246	3.19	0.0	0.5	0.01	
31	0.	31	0.848	2.83	0.0	0.5	0.01	
32	0.	32	0.697	88.19	0.0	0.5	0.01	
33	0.	33	0.612	47.46	0.0	0.5	0.01	
34	0.	34	1.329	61.76	0.0	0.5	0.01	
35	0.	35	0.727	28.93	0.0	0.5	0.01	
36	0.	36	1.128	18.66	0.0	0.5	0.01	
37	0.	38	1.008	5.60	0.0	0.5	0.01	
38	0.	38	0.662	8.99	0.0	0.5	0.01	
39	0.	39	0.654	32.73	0.0	0.5	0.01	
40	0.	40	0.835	138.37	0.0	0.5	0.01	
41	0.	41	0.590	150.74	0.0	0.5	0.01	
42	0.	42	0.714	182.65	0.0	0.5	0.01	
43	0.	43	0.796	32.43	0.0	0.5	0.01	
44	0.	44	0.658	204.22	0.0	0.5	0.01	
45	0.	45	0.907	24.18	0.0	0.5	0.01	
46	0.	46	0.515	105.76	0.0	0.5	0.01	
47	0.	47	0.730	138.77	0.0	0.5	0.01	
48	0.	48	0.793	112.21	0.0	0.5	0.01	
49	0.	49	0.328	22.10	0.0	0.5	0.01	
50	0.	50	0.651	60.70	0.0	0.5	0.01	
52	0.	52	0.821	93.21	0.0	0.5	0.01	
53	0.	53	0.975	108.17	0.0	0.5	0.01	
54	0.	54	0.936	144.06	0.0	0.5	0.01	
56	0.	56	0.854	103.83	0.0	0.5	0.01	
57	0.	57	0.892	220.52	0.0	0.5	0.01	
58	0.	58	0.195	4.40	0.0	0.5	0.01	
59	0.	59	0.612	16.78	0.0	0.5	0.01	
60	0.	60	0.653	17.29	0.0	0.5	0.01	
61	0.	61	0.797	8.60	0.0	0.5	0.01	
100	0.	100	0.2	0.01	0.0	0.5	0.01	
101	0.	101	0.2	0.01	0.0	0.5	0.01	
102	0.	102	0.2	0.01	0.0	0.5	0.01	
103	0.	103	0.2	0.01	0.0	0.5	0.01	
104	0.	104	0.2	0.01	0.0	0.5	0.01	
105	0.	105	0.2	0.01	0.0	0.5	0.01	
999	0.	999	0.2	0.01	0.0	0.5	0.01	
***	51	0.	51	#N/A	#N/A	3.2	0.5	0.01
***	55	0.	55	0.936	101.	3.2	0.5	0.01

END HYDR-PARM2

HYDR-INIT

*** Initial conditions for HYDR section

```

***RCHRES      VOL CAT Initial value of COLIND      initial value of OUTDGT
*** x  - x    ac-ft      for each possible exit  for each possible exit,ft3
  1          0.549
  2          0.854
  3          0.956
  4          0.197
  5          0.143
  6          0.312
  7          0.303
  8          0.465
  9          0.670
 10          0.424
 11          0.592
 13          0.487
 14          0.232
 15          0.315
 16          0.802
 17          0.167
 18          0.269
 19          0.301
 20          0.223
 21          0.620
 22          0.540
 23          0.191
 24          0.196
 25          0.798
 26          1.113
 27          0.528
 28          0.388
 29          0.304
 30          0.187
 31          0.461
 32          0.313
 33          0.256
 34          0.575
 35          0.393
 36          0.490
 37          1.122
 38          0.623
 39          0.300
 40          0.363
 41          0.258
 42          0.338
 43          0.536
 44          0.225
 45          0.727
 46          0.328
 47          0.386
 48          0.434
 49          0.142
 50          0.359
 52          0.345
 53          0.501
 54          0.503
 56          1.976
 57          0.361
 58          0.063
 59          0.341
 60          0.340
 61          0.438
 100         5.0
 101         69.0
 102         134.0
 103         55.0
 104         29.0
 105         23.0
 999         10.0
*** 51      DIV/0      4.2 4.5 4.5 4.5 4.2      2.1 1.2 0.5 1.2 1.8
*** 55      DIV/0      4.2 4.5 4.5 4.5 4.2      2.1 1.2 0.5 1.2 1.8

```

END HYDR-INIT

```

ADCALC-DATA
*** RCHRES Data for section ADCALC
*** x - x      CRRAT      VOL (ac-ft)
    1 999      1.7      0.1
END ADCALC-DATA

```

```

SANDFG
*** RCHRES
*** 1: Toffaleti 2: Colby 3: User power
*** x - x SDFG
    1 999      3
END SANDFG

```

```

SED-GENPARM
*** RCHRES      BEDWID      BEDWRN      POR
*** x - x      (ft)      (ft)
    1          24.8      5.0      0.4
    2          17.2      5.0      0.4
    3         105.0      5.0      0.4
    4          17.8      5.0      0.4
    5          17.8      5.0      0.4
    6          18.9      5.0      0.4
    7          19.1      5.0      0.4
    8          18.3      5.0      0.4
    9          23.2      5.0      0.4
   10          11.8      5.0      0.4
   11          18.1      5.0      0.4
   13          21.9      5.0      0.4
   14          19.2      5.0      0.4
   15          24.7      5.0      0.4
   16          22.5      5.0      0.4
   17          24.6      5.0      0.4
   18          17.9      5.0      0.4
   19          21.3      5.0      0.4
   20          18.2      5.0      0.4
   21          26.8      5.0      0.4
   22          20.1      5.0      0.4
   23          25.0      5.0      0.4
   24          22.1      5.0      0.4
   25          31.3      5.0      0.4
   26          42.2      5.0      0.4
   27          17.4      5.0      0.4
   28          22.1      5.0      0.4
   29           9.4      5.0      0.4
   30          30.2      5.0      0.4
   31          22.1      5.0      0.4
   32          19.4      5.0      0.4
   33          18.3      5.0      0.4
   34          17.1      5.0      0.4
   35          21.7      5.0      0.4
   36          16.9      5.0      0.4
   37          31.2      5.0      0.4
   38          35.1      5.0      0.4
   39          19.6      5.0      0.4
   40          17.7      5.0      0.4
   41          18.0      5.0      0.4
   42          19.1      5.0      0.4
   43          26.2      5.0      0.4
   44          12.9      5.0      0.4
   45          31.1      5.0      0.4
   46          27.0      5.0      0.4
   47          22.8      5.0      0.4
   48          24.7      5.0      0.4
   49          17.6      5.0      0.4
   50          33.0      5.0      0.4
   52          17.4      5.0      0.4
   53          20.9      5.0      0.4
   54          21.0      5.0      0.4
   56          118.0     5.0      0.4
   57          16.4      5.0      0.4

```

58	15.0	5.0	0.4
59	24.8	5.0	0.4
60	23.6	5.0	0.4
61	23.3	5.0	0.4
100	280.0	5.0	0.4
101	400.0	5.0	0.4
102	600.0	5.0	0.4
103	1000.0	5.0	0.4
104	400.0	5.0	0.4
105	350.0	5.0	0.4
999	10500.0	5.0	0.4

END SED-GENPARM

*** 0.002 to 0.079 inches

SAND-PM					
*** RCHRES	D	W	RHO	KSAND	EXPSND
*** x - x	(in)	(in/sec)	(gm/cm3)		
1	0.01	6.0	2.65	2.70	2.50
2	0.01	6.0	2.65	2.70	2.50
3	0.01	6.0	2.65	2.70	2.50
4	0.01	6.0	2.65	2.70	2.50
5	0.01	6.0	2.65	2.70	2.50
6	0.01	6.0	2.65	2.70	2.50
7	0.01	6.0	2.65	2.70	2.50
8	0.01	6.0	2.65	2.70	2.50
9	0.01	6.0	2.65	2.70	2.50
10	0.01	6.0	2.65	2.70	2.50
11	0.01	6.0	2.65	2.70	2.50
13	0.01	6.0	2.65	2.70	2.50
14	0.01	6.0	2.65	2.70	2.50
15	0.01	6.0	2.65	2.70	2.50
16	0.01	6.0	2.65	2.70	2.50
17	0.01	6.0	2.65	2.70	2.50
18	0.01	6.0	2.65	2.70	2.50
19	0.01	6.0	2.65	2.70	2.50
20	0.01	6.0	2.65	2.70	2.50
21	0.01	6.0	2.65	2.70	2.50
22	0.01	6.0	2.65	2.50	2.00
23	0.01	6.0	2.65	2.70	2.50
24	0.01	6.0	2.65	2.70	2.50
25	0.01	6.0	2.65	2.70	2.50
26	0.01	6.0	2.65	2.70	2.50
27	0.01	6.0	2.65	2.70	2.50
28	0.01	6.0	2.65	2.70	2.50
29	0.01	6.0	2.65	2.70	2.50
30	0.01	6.0	2.65	2.70	2.50
31	0.01	6.0	2.65	5.00	3.50
32	0.01	6.0	2.65	2.70	2.50
33	0.01	6.0	2.65	2.70	2.50
34	0.01	6.0	2.65	2.70	2.50
35	0.01	6.0	2.65	2.70	2.50
36	0.01	6.0	2.65	2.70	2.50
37	0.01	6.0	2.65	2.50	1.50
38	0.01	6.0	2.65	2.70	2.50
39	0.01	6.0	2.65	2.70	2.50
40	0.01	6.0	2.65	2.50	2.00
41	0.01	6.0	2.65	2.50	1.50
42	0.01	6.0	2.65	2.70	2.50
43	0.01	6.0	2.65	2.50	1.20
44	0.01	6.0	2.65	2.50	1.50

45	0.01	6.0	2.65	2.50	1.50
46	0.01	6.0	2.65	2.70	2.50
47	0.01	6.0	2.65	2.70	2.50
48	0.01	6.0	2.65	2.70	2.50
49	0.01	6.0	2.65	2.70	2.50
50	0.01	6.0	2.65	2.70	2.50
52	0.01	6.0	2.65	2.70	2.50
53	0.01	6.0	2.65	2.70	2.50
54	0.01	6.0	2.65	2.70	2.50
56	0.01	6.0	2.65	2.70	2.50
57	0.01	6.0	2.65	2.50	1.50
58	0.01	6.0	2.65	10.50	5.50
59	0.01	6.0	2.65	2.70	2.50
60	0.01	6.0	2.65	2.70	2.50
61	0.01	6.0	2.65	2.70	2.50
100	0.01	6.0	2.65	2.70	2.50
101	0.01	6.0	2.65	2.70	2.50
102	0.01	6.0	2.65	2.70	2.50
103	0.01	6.0	2.65	2.70	2.50
104	0.01	6.0	2.65	2.70	2.50
105	0.01	6.0	2.65	2.70	2.50
999	0.01	6.0	2.65	2.70	2.50

END SAND-PM

*** SILT
 *** SILT
 *** 0.00008 to 0.002 inches, settling 0.0004 to 0.24 in/sec

SILT-CLAY-PM

*** RCHRES	D	W	RHO	TAUCD	TAUCS	M
*** x - x	(in)	(in/sec)	gm/cm3	lb/ft2	lb/ft2	lb/ft2.d
1	0.0010	0.100	2.65	0.0639	0.1146	0.01
2	0.0010	0.100	2.65	0.1340	0.2518	0.01
3	0.0010	0.100	2.65	0.0737	0.0886	0.01
4	0.0010	0.100	2.65	0.1033	0.1384	0.01
5	0.0010	0.100	2.65	0.0752	0.1120	0.01
6	0.0010	0.100	2.65	0.0924	0.1526	0.01
7	0.0010	0.100	2.65	0.0933	0.1520	0.01
8	0.0010	0.100	2.65	0.1913	0.3475	0.01
9	0.0010	0.100	2.65	0.1465	0.2293	0.01
10	0.0010	0.100	2.65	0.1062	0.2007	0.01
11	0.0010	0.100	2.65	0.1053	0.1905	0.01
13	0.0010	0.100	2.65	0.6590	0.6730	0.05
14	0.0010	0.100	2.65	0.0949	0.2781	0.01
15	0.0010	0.100	2.65	0.0689	0.0908	0.01
16	0.0010	0.100	2.65	0.8239	0.8539	0.01
17	0.0010	0.100	2.65	0.1053	0.1795	0.01
18	0.0010	0.100	2.65	0.1481	0.2671	0.01
19	0.0010	0.100	2.65	0.1283	0.1784	0.01
20	0.0010	0.100	2.65	0.1959	0.3075	0.01
21	0.0010	0.100	2.65	0.1281	0.2032	0.01
22	0.0010	0.100	2.65	0.2351	0.3657	0.01
23	0.0010	0.100	2.65	0.2624	0.3793	0.01
24	0.0010	0.100	2.65	0.2633	0.4097	0.01
25	0.0010	0.100	2.65	0.1748	0.2533	0.01
26	0.0010	0.100	2.65	0.5100	0.5325	0.01
27	0.0010	0.100	2.65	0.1414	0.2633	0.01
28	0.0010	0.100	2.65	0.1757	0.2262	0.01
29	0.0010	0.100	2.65	0.1282	0.2361	0.01
30	0.0010	0.100	2.65	0.0866	0.1617	0.01
31	0.0010	0.100	2.65	0.0289	0.0589	0.01
32	0.0010	0.100	2.65	0.1352	0.2207	0.01
33	0.0010	0.100	2.65	0.0908	0.1678	0.01
34	0.0010	0.100	2.65	0.1625	0.2518	0.01
35	0.0010	0.100	2.65	0.1327	0.2278	0.01
36	0.0010	0.100	2.65	0.0852	0.1306	0.01
37	0.0010	0.100	2.65	0.1552	0.1250	0.40
38	0.0010	0.100	2.65	0.3160	0.3492	0.05
39	0.0010	0.100	2.65	0.0679	0.1168	0.02

40	0.0010	0.100	2.65	0.2323	0.4016	0.01
41	0.0010	0.100	2.65	0.3294	0.4786	0.01
42	0.0010	0.100	2.65	0.2888	0.3456	0.01
43	0.0010	0.100	2.65	0.9157	0.9672	0.01
44	0.0010	0.100	2.65	0.2714	0.1721	0.01
45	0.0010	0.100	2.65	0.6168	0.6786	0.01
46	0.0010	0.100	2.65	0.2283	0.3476	0.01
47	0.0010	0.100	2.65	0.2332	0.3370	0.01
48	0.0010	0.100	2.65	0.1749	0.2101	0.01
49	0.0010	0.100	2.65	0.1442	0.2595	0.01
50	0.0010	0.100	2.65	0.1327	0.2227	0.01
52	0.0010	0.100	2.65	0.1469	0.2531	0.01
53	0.0010	0.100	2.65	0.1423	0.2549	0.01
54	0.0010	0.100	2.65	0.1226	0.1532	0.01
56	0.0010	0.100	2.65	0.0894	0.0984	0.01
57	0.0010	0.100	2.65	0.2128	0.3885	0.01
58	0.0010	0.100	2.65	0.0538	0.0771	0.01
59	0.0010	0.100	2.65	0.0642	0.0834	0.01
60	0.0010	0.100	2.65	0.0380	0.0652	0.01
61	0.0010	0.100	2.65	0.0335	0.0460	0.01
100	0.0010	0.100	2.65	0.0008	0.0008	0.01
101	0.0010	0.100	2.65	0.0039	0.0039	0.01
102	0.0010	0.100	2.65	0.0047	0.0049	0.01
103	0.0010	0.100	2.65	0.0039	0.0039	0.01
104	0.0010	0.100	2.65	0.0031	0.0031	0.01
105	0.0010	0.100	2.65	0.0027	0.0028	0.01
999	0.0010	0.100	2.65	0.0000	0.0000	0.01

END SILT-CLAY-PM

*** CLAY
 *** CLAY
 *** 0.00008 inches

SILT-CLAY-PM

*** RCHRES	D	W	RHO	TAUCD	TAUCS	M
*** x - x	(in)	(in/sec)	gm/cm3	lb/ft2	lb/ft2	lb/ft2.d
1	0.00006	0.00020	2.6	0.0584	0.0906	0.001
2	0.00006	0.00020	2.6	0.1255	0.2021	0.001
3	0.00006	0.00020	2.6	0.0727	0.0817	0.001
4	0.00006	0.00020	2.6	0.0972	0.1261	0.001
5	0.00006	0.00020	2.6	0.0736	0.0902	0.001
6	0.00006	0.00020	2.6	0.0888	0.1209	0.001
7	0.00006	0.00020	2.6	0.0880	0.1211	0.001
8	0.00006	0.00020	2.6	0.1819	0.2640	0.001
9	0.00006	0.00020	2.6	0.1423	0.1856	0.001
10	0.00006	0.00020	2.6	0.0993	0.1580	0.001
11	0.00006	0.00020	2.6	0.0994	0.1521	0.001
13	0.00006	0.00020	2.6	0.6586	0.6628	0.001
14	0.00006	0.00020	2.6	0.0849	0.1717	0.001
15	0.00006	0.00020	2.6	0.0672	0.0802	0.001
16	0.00006	0.00020	2.6	0.8232	0.8324	0.001
17	0.00006	0.00020	2.6	0.0974	0.1434	0.001
18	0.00006	0.00020	2.6	0.1336	0.2194	0.001
19	0.00006	0.00020	2.6	0.1256	0.1479	0.001
20	0.00006	0.00020	2.6	0.1833	0.2479	0.001
21	0.00006	0.00020	2.6	0.1248	0.1590	0.001
22	0.00006	0.00020	2.6	0.2346	0.2851	0.001
23	0.00006	0.00020	2.6	0.2434	0.3363	0.001
24	0.00006	0.00020	2.6	0.2449	0.3472	0.001
25	0.00006	0.00020	2.6	0.1705	0.2064	0.001
26	0.00006	0.00020	2.6	0.5092	0.5178	0.001
27	0.00006	0.00020	2.6	0.1342	0.2063	0.001
28	0.00006	0.00020	2.6	0.1730	0.2010	0.001
29	0.00006	0.00020	2.6	0.1201	0.1869	0.001
30	0.00006	0.00020	2.6	0.0773	0.1172	0.001
31	0.00006	0.00020	2.6	0.0263	0.0396	0.001
32	0.00006	0.00020	2.6	0.1255	0.1755	0.001
33	0.00006	0.00020	2.6	0.0847	0.1343	0.001
34	0.00006	0.00020	2.6	0.1490	0.2326	0.001
35	0.00006	0.00020	2.6	0.1292	0.1880	0.001
36	0.00006	0.00020	2.6	0.0847	0.1083	0.001

37	0.00006	0.00020	2.6	0.1547	0.1550	0.060
38	0.00006	0.00020	2.6	0.3145	0.3303	0.001
39	0.00006	0.00020	2.6	0.0639	0.0995	0.001
40	0.00006	0.00020	2.6	0.2220	0.3252	0.001
41	0.00006	0.00020	2.6	0.3209	0.4018	0.001
42	0.00006	0.00020	2.6	0.2851	0.3179	0.001
43	0.00006	0.00020	2.6	0.9135	0.9359	0.001
44	0.00006	0.00020	2.6	0.2627	0.1409	0.001
45	0.00006	0.00020	2.6	0.6138	0.6434	0.001
46	0.00006	0.00020	2.6	0.2214	0.2790	0.001
47	0.00006	0.00020	2.6	0.2280	0.2767	0.001
48	0.00006	0.00020	2.6	0.1723	0.1920	0.001
49	0.00006	0.00020	2.6	0.1359	0.2176	0.001
50	0.00006	0.00020	2.6	0.1215	0.1840	0.001
52	0.00006	0.00020	2.6	0.1357	0.2047	0.001
53	0.00006	0.00020	2.6	0.1308	0.2072	0.001
54	0.00006	0.00020	2.6	0.1148	0.1429	0.001
56	0.00006	0.00020	2.6	0.0888	0.0939	0.001
57	0.00006	0.00020	2.6	0.1967	0.3013	0.001
58	0.00006	0.00020	2.6	0.0515	0.0670	0.001
59	0.00006	0.00020	2.6	0.0594	0.0740	0.001
60	0.00006	0.00020	2.6	0.0363	0.0522	0.001
61	0.00006	0.00020	2.6	0.0305	0.0411	0.001
100	0.00006	0.00020	2.6	0.0008	0.0008	0.001
101	0.00006	0.00020	2.6	0.0039	0.0039	0.001
102	0.00006	0.00020	2.6	0.0047	0.0047	0.001
103	0.00006	0.00020	2.6	0.0039	0.0039	0.001
104	0.00006	0.00020	2.6	0.0031	0.0031	0.001
105	0.00006	0.00020	2.6	0.0027	0.0028	0.001
999	0.00006	0.00020	2.6	0.0000	0.0000	0.001

END SILT-CLAY-PM

SSED-INIT

```

*** RCHRES      Suspended sed concs (mg/l)
*** x - x      Sand      Silt      Clay
1 999          0.1      1      2
END SSED-INIT

```

BED-INIT

```

*** RCHRES      BEDDEP      Initial bed composition
*** x - x      (ft)      Sand      Silt      Clay
1 999          2.00      0.05      0.40      0.55
END BED-INIT

```

GQ-GENDATA

```

*** RCHRES      NGQL      TPFQ      PHFG      ROFG      CDFG      SDFG      PYFG      LAT
*** x - x      deg
1 999          2      3      2      2      2      2      2      0
END GQ-GENDATA

```

GQ-QALDATA

```

*** RCHRES      GQID      DQAL      CONCID      CONV      QTYID
*** x - x      concid
1 999TN          0.0      mg      16018.5      LBS
END GQ-QALDATA

```

GQ-QALFG

```

*** RCHRES      HDRL      OXID      PHOT      VOLT      BIOD      GEN      SDAS
*** x - x
1 999          0      0      0      0      0      1      0
END GQ-QALFG

```

GQ-GENDECAY

```

*** RCHRES      FSTDEC      THFST
*** x - x      (/day)
1 999          0.12      1.07
END GQ-GENDECAY

```

GQ-QALDATA

```

*** RCHRES      GQID      DQAL      CONCID      CONV      QTYID
*** x - x      concid

```

1 999TP 0.0 mg 16018.5 LBS
 END GQ-QALDATA

GQ-QALFG
 *** RCHRES HDRL OXID PHOT VOLT BIOD GEN SDAS
 *** x - x
 1 999 0 0 0 0 0 1 0
 END GQ-QALFG

GQ-GENDECAY
 *** RCHRES FSTDEC THFST
 *** x - x (/day)
 1 999 0.08 1.07
 END GQ-GENDECAY

MON-WATEMP
 *** RCHRES Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec
 *** x - x
 1 999 43 47 53 57 66 73 76 78 75 60 50 48
 END MON-WATEMP

END RCHRES

*** Stream infiltration assumed 1.0 in/hr range of 0.1 to 1.0 in/hr
 *** see <https://www.usgs.gov/publications/ground-water-recharge-humid-areas-united-states-a-summary-ground-water-resources>

FTABLES

FTABLE 1
 rows cols ***
 42 4

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.84	0.05	0.00	
0.15	0.84	0.09	0.20	
0.20	0.84	0.13	0.38	
0.25	0.84	0.17	0.61	
0.30	0.84	0.21	0.87	
0.35	0.84	0.26	1.18	
0.40	0.84	0.30	1.51	
0.45	1.67	0.53	2.47	
0.50	1.67	0.61	3.16	
0.55	1.67	0.69	3.91	
0.60	1.67	0.78	4.73	
0.65	1.67	0.86	5.61	
0.70	1.67	0.94	6.55	
0.75	2.09	1.11	7.36	
0.80	2.09	1.21	8.55	
0.85	2.09	1.32	9.81	
0.90	2.09	1.42	11.15	
0.95	2.93	1.70	11.94	
1.00	2.93	1.84	17.14	
1.25	12.13	3.81	22.40	
1.50	15.90	7.30	55.21	
1.75	23.43	12.74	107.92	
2.00	26.78	19.10	193.80	
2.25	28.45	26.02	311.59	
2.50	30.13	33.43	455.34	
2.75	31.80	41.26	623.71	
3.00	34.31	49.68	808.20	
3.25	38.91	58.80	983.93	
3.50	41.84	68.99	1223.89	
3.75	46.03	80.10	1472.78	
4.00	47.70	91.89	1808.13	
4.25	49.79	104.12	2163.87	
4.50	51.89	116.89	2553.19	
4.75	53.14	130.09	3003.25	
5.00	55.65	143.83	3442.74	
6.00	63.60	204.15	5646.13	

7.00	71.97	272.24	8400.16
8.00	78.67	348.21	11931.12
9.00	89.55	431.42	15641.44
10.00	93.73	524.02	20979.95

END FTABLE 1

FTABLE 2

rows	cols			***
36	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	1.58	0.06	0.00	
0.10	1.58	0.14	0.00	
0.15	1.58	0.22	0.44	
0.20	1.58	0.30	0.74	
0.25	1.58	0.38	1.09	
0.30	1.58	0.46	1.50	
0.35	1.58	0.54	1.96	
0.40	1.58	0.61	2.46	
0.45	1.58	0.69	3.01	
0.50	1.58	0.77	3.61	
0.55	1.58	0.85	4.24	
0.60	2.38	1.18	5.53	
0.65	2.38	1.30	6.49	
0.70	2.38	1.41	7.51	
0.75	2.38	1.53	8.59	
0.80	2.38	1.65	9.73	
0.85	2.38	1.77	10.92	
0.90	2.38	1.89	12.17	
0.95	2.38	2.01	13.47	
1.00	2.38	2.13	18.53	
1.25	4.75	4.00	33.25	
1.50	4.75	5.19	51.30	
1.75	6.34	6.81	66.76	
2.00	6.34	8.40	94.59	
2.25	8.71	10.60	112.90	
2.50	11.09	13.14	137.70	
2.75	14.26	16.45	169.42	
3.00	18.22	20.69	211.07	
3.25	19.57	25.64	287.84	
3.50	19.57	30.53	385.08	
3.75	19.57	35.42	493.33	
4.00	19.57	40.32	612.03	
4.25	19.57	45.21	740.76	
4.50	19.57	50.10	879.13	
4.75	19.57	54.99	1026.82	

END FTABLE 2

FTABLE 3

rows	cols			***
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.52	0.01	0.00	
0.10	0.70	0.05	0.00	
0.15	0.87	0.10	0.78	
0.20	1.40	0.16	1.27	
0.25	1.57	0.24	2.28	
0.30	1.92	0.35	3.77	
0.35	2.27	0.46	5.38	
0.40	2.62	0.59	7.47	
0.45	2.79	0.73	10.19	
0.50	3.14	0.89	13.16	
0.55	3.49	1.07	16.62	
0.60	3.84	1.26	20.61	
0.65	4.19	1.47	25.11	
0.70	4.19	1.68	31.33	
0.75	4.36	1.91	37.52	
0.80	4.88	2.16	42.78	
0.85	4.88	2.40	51.15	
0.90	5.23	2.67	58.43	

0.95	5.23	2.94	68.26
1.00	5.41	3.21	97.00
1.25	6.28	4.75	168.29
1.50	6.80	6.43	264.37
1.75	7.15	8.23	386.23
2.00	7.85	10.20	518.72
2.25	8.02	12.19	688.05
2.50	8.37	14.31	873.99
2.75	8.72	16.49	1077.10
3.00	8.89	18.72	1313.30
3.25	9.24	21.06	1556.58
3.50	9.42	23.41	1833.67
3.75	9.59	25.84	2135.90
4.00	9.77	28.30	2455.09
4.25	10.29	30.93	2750.02
4.50	10.46	33.55	3114.12
4.75	10.99	36.31	3437.55
5.00	11.34	39.11	3811.19
6.00	12.38	51.05	5601.45
7.00	13.43	64.12	7755.36
8.00	14.65	78.26	10201.79
9.00	15.87	93.56	13023.17
10.00	16.92	110.06	16359.09
11.00	18.14	127.70	20005.27
12.00	19.36	146.50	24078.79
13.00	20.75	166.62	28486.26
14.00	22.15	188.27	33437.98
15.00	23.54	211.29	38907.60
16.00	25.46	235.89	44372.48
17.00	27.21	262.42	50710.03
18.00	28.78	290.68	57930.18
19.00	31.22	320.70	64639.33
20.00	32.96	353.22	73226.37

END FTABLE 3

FTABLE 4				
rows	cols			
46	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.34	0.01	0.00	
0.10	0.34	0.03	0.00	
0.15	0.34	0.04	0.23	
0.20	0.34	0.06	0.40	
0.25	0.34	0.08	0.61	
0.30	0.34	0.10	0.84	
0.35	0.34	0.11	1.11	
0.40	0.34	0.13	1.41	
0.45	0.51	0.19	1.95	
0.50	0.51	0.21	2.42	
0.55	0.69	0.29	3.31	
0.60	0.69	0.32	3.99	
0.65	0.69	0.35	4.73	
0.70	0.69	0.39	5.52	
0.75	0.69	0.42	6.36	
0.80	0.69	0.46	7.24	
0.85	0.69	0.49	8.16	
0.90	0.69	0.53	9.13	
0.95	0.69	0.56	10.15	
1.00	0.69	0.59	14.01	
1.25	0.86	0.85	21.96	
1.50	1.03	1.16	32.65	
1.75	1.03	1.42	45.53	
2.00	1.20	1.76	58.85	
2.25	1.37	2.16	75.13	
2.50	1.37	2.50	96.06	
2.75	1.71	2.99	111.46	
3.00	1.71	3.42	139.33	
3.25	1.71	3.85	169.64	
3.50	2.06	4.45	191.77	
3.75	2.40	5.05	213.77	

4.00	3.08	5.75	225.03
4.25	5.48	7.00	213.43
4.50	8.91	8.87	229.27
4.75	10.96	11.42	304.37
5.00	16.28	15.14	374.67
6.00	21.93	34.38	1205.43
7.00	24.84	58.06	2657.40
8.00	26.90	84.07	4670.89
9.00	29.12	112.33	7180.11
10.00	30.67	142.34	10294.44
11.00	32.21	173.92	13913.37
12.00	33.41	206.85	18129.27
13.00	34.43	240.85	22894.75
14.00	34.93	275.65	28397.30

END FTABLE 4

FTABLE 5

rows cols ***

52 4

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.25	0.02	0.00	
0.15	0.25	0.03	0.18	
0.20	0.25	0.04	0.31	
0.25	0.25	0.06	0.48	
0.30	0.25	0.07	0.67	
0.35	0.25	0.08	0.89	
0.40	0.25	0.09	1.13	
0.45	0.37	0.14	1.61	
0.50	0.37	0.15	1.99	
0.55	0.50	0.21	2.68	
0.60	0.50	0.23	3.24	
0.65	0.50	0.26	3.85	
0.70	0.50	0.28	4.49	
0.75	0.50	0.31	5.18	
0.80	0.50	0.33	5.90	
0.85	0.50	0.36	6.66	
0.90	0.50	0.38	7.46	
0.95	0.50	0.41	8.29	
1.00	0.50	0.43	11.44	
1.25	0.75	0.66	17.74	
1.50	0.75	0.85	26.88	
1.75	0.75	1.04	37.47	
2.00	0.87	1.27	47.55	
2.25	1.00	1.57	61.61	
2.50	1.00	1.82	78.80	
2.75	1.12	2.13	94.23	
3.00	1.25	2.47	112.38	
3.25	1.25	2.78	137.11	
3.50	1.50	3.20	153.40	
3.75	1.62	3.61	178.00	
4.00	2.12	4.12	186.51	
4.25	4.00	4.81	158.58	
4.50	8.37	6.31	153.08	
4.75	9.87	8.73	235.64	
5.00	12.25	11.85	339.51	
6.00	15.00	25.64	1073.99	
7.00	16.62	41.60	2246.48	
8.00	18.25	59.19	3800.85	
9.00	20.12	78.51	5702.11	
10.00	21.37	99.37	8111.39	
11.00	22.25	121.23	11001.90	
12.00	22.87	143.90	14372.45	
13.00	23.62	167.28	18078.11	
14.00	24.25	191.28	22215.35	
15.00	24.87	215.91	26726.35	
16.00	25.62	241.25	31526.32	
17.00	26.24	267.22	36786.54	
18.00	26.87	293.86	42428.99	
19.00	27.49	321.10	48436.02	

20.00 28.24 349.06 54678.82
 END FTABLE 5

FTABLE 6
 rows cols ***
 52 4
 depth area volume outflow1 ***
 0.00 0.00 0.00 0.00
 0.05 0.00 0.00 0.00
 0.10 0.54 0.03 0.00
 0.15 0.54 0.06 0.35
 0.20 0.54 0.09 0.65
 0.25 0.54 0.12 1.01
 0.30 0.54 0.14 1.43
 0.35 0.54 0.17 1.91
 0.40 0.81 0.26 2.90
 0.45 0.81 0.30 3.71
 0.50 0.81 0.34 4.59
 0.55 0.81 0.38 5.54
 0.60 0.81 0.42 6.57
 0.65 0.81 0.46 7.66
 0.70 1.08 0.59 9.57
 0.75 1.08 0.65 11.07
 0.80 1.08 0.70 12.67
 0.85 1.08 0.75 14.34
 0.90 1.36 0.89 16.18
 0.95 1.36 0.95 18.30
 1.00 1.36 1.02 25.64
 1.25 1.63 1.42 39.26
 1.50 1.90 1.95 59.92
 1.75 1.90 2.42 86.17
 2.00 2.17 3.04 114.95
 2.25 2.71 3.78 142.63
 2.50 2.98 4.51 179.36
 2.75 3.25 5.30 221.96
 3.00 3.53 6.17 270.70
 3.25 3.80 7.10 325.66
 3.50 4.34 8.31 387.12
 3.75 4.34 9.40 474.91
 4.00 4.61 10.58 556.07
 4.25 5.15 11.97 633.82
 4.50 5.42 13.33 732.46
 4.75 5.69 14.79 843.66
 5.00 6.24 16.37 941.04
 6.00 7.59 23.41 1497.65
 7.00 9.76 32.22 2158.71
 8.00 11.66 43.09 3115.61
 9.00 13.02 55.67 4437.20
 10.00 14.64 69.70 5966.74
 11.00 16.54 85.51 7736.57
 12.00 22.78 104.23 8705.77
 13.00 27.39 130.35 11182.52
 14.00 29.02 158.95 14975.60
 15.00 31.19 189.36 19109.48
 16.00 33.63 222.09 23707.18
 17.00 35.79 257.04 29013.34
 18.00 38.51 294.40 34651.28
 19.00 40.40 334.05 41424.68
 20.00 43.12 376.10 48343.03
 END FTABLE 6

FTABLE 7
 rows cols ***
 52 4
 depth area volume outflow1 ***
 0.00 0.00 0.00 0.00
 0.05 0.00 0.00 0.00
 0.10 0.52 0.03 0.00
 0.15 0.52 0.06 0.14
 0.20 0.52 0.08 0.26
 0.25 0.52 0.11 0.40

0.30	0.52	0.14	0.58
0.35	0.52	0.16	0.77
0.40	0.79	0.24	1.16
0.45	0.79	0.28	1.48
0.50	0.79	0.32	1.84
0.55	0.79	0.36	2.24
0.60	1.05	0.47	2.85
0.65	1.05	0.52	3.40
0.70	1.05	0.57	3.99
0.75	1.05	0.63	4.61
0.80	1.05	0.68	5.27
0.85	1.05	0.73	5.97
0.90	1.05	0.78	6.70
0.95	1.05	0.84	7.47
1.00	1.31	0.97	10.36
1.25	1.57	1.41	16.95
1.50	1.57	1.80	25.55
1.75	1.83	2.32	34.99
2.00	2.10	2.92	47.18
2.25	2.10	3.45	62.10
2.50	2.36	4.10	76.54
2.75	2.62	4.83	93.69
3.00	2.88	5.58	111.71
3.25	3.15	6.36	131.25
3.50	3.93	7.38	144.94
3.75	4.98	8.57	159.35
4.00	5.50	9.95	191.08
4.25	7.86	11.81	200.74
4.50	9.44	14.06	238.11
4.75	11.27	16.72	282.39
5.00	13.11	19.86	340.17
6.00	17.04	35.67	758.69
7.00	20.97	55.15	1365.65
8.00	24.38	78.14	2208.33
9.00	27.00	104.05	3325.19
10.00	29.36	132.56	4707.97
11.00	31.72	163.44	6339.32
12.00	34.34	196.71	8187.51
13.00	36.17	232.14	10421.48
14.00	38.01	269.49	12929.82
15.00	40.10	308.90	15661.31
16.00	41.94	350.10	18726.66
17.00	43.51	392.88	22143.84
18.00	45.35	437.61	25781.69
19.00	47.18	484.11	29710.32
20.00	48.75	532.43	34061.37

END FTABLE 7

FTABLE 8

rows cols				***
52	5			
depth	area	volume	outflow1	Infilt ***
0.00	0.00	0.00	0.00	0.00
0.05	0.00	0.00	0.00	0.00
0.10	0.00	0.00	0.00	0.00
0.15	0.86	0.07	0.01	0.00
0.20	0.86	0.11	0.02	0.00
0.25	0.86	0.16	0.03	0.00
0.30	0.86	0.20	0.04	0.00
0.35	0.86	0.24	0.05	0.00
0.40	0.86	0.28	0.07	0.00
0.45	0.86	0.33	0.09	0.00
0.50	1.28	0.49	0.13	0.60
0.55	1.28	0.55	0.16	0.60
0.60	1.28	0.62	0.19	0.60
0.65	1.28	0.68	0.23	0.60
0.70	1.71	0.81	0.25	0.60
0.75	1.71	0.89	0.29	0.60
0.80	1.71	0.98	0.34	0.60
0.85	1.71	1.06	0.39	0.60
0.90	2.14	1.32	0.48	0.60

0.95	2.14	1.42	0.55	0.60
1.00	2.14	1.53	0.78	0.60
1.25	2.14	2.06	1.28	0.60
1.50	2.57	2.75	1.83	0.60
1.75	2.99	3.68	2.67	0.60
2.00	2.99	4.42	3.64	0.60
2.25	3.42	5.36	4.58	0.60
2.50	3.42	6.22	5.86	0.60
2.75	3.42	7.07	7.27	0.60
3.00	3.85	8.29	8.72	0.60
3.25	4.28	9.50	10.19	0.60
3.50	4.70	10.76	11.76	0.60
3.75	4.70	11.93	13.98	0.60
4.00	5.56	13.34	15.09	0.60
4.25	6.41	15.08	16.83	0.60
4.50	7.70	16.90	18.05	0.60
4.75	10.69	19.34	18.21	0.60
5.00	18.38	23.26	17.31	0.60
6.00	23.09	43.87	42.84	0.60
7.00	33.78	72.43	76.73	0.60
8.00	39.76	110.23	138.63	0.60
9.00	44.04	152.32	222.05	0.60
10.00	48.74	199.44	325.26	0.60
11.00	52.59	250.72	452.76	0.60
12.00	55.58	305.28	605.84	0.60
13.00	59.43	363.15	773.84	0.60
14.00	62.85	424.72	967.87	0.60
15.00	65.84	489.57	1189.03	0.60
16.00	67.55	556.53	1447.12	0.60
17.00	70.55	626.66	1713.37	0.60
18.00	73.11	699.19	2008.04	0.60
19.00	75.25	773.68	2331.63	0.60
20.00	77.82	850.77	2671.25	0.60

END FTABLE 8

FTABLE 9

rows	cols	***				
52	4	depth	area	volume	outflow1	***
		0.00	0.00	0.00	0.00	
		0.05	0.99	0.03	0.00	
		0.10	0.99	0.08	0.00	
		0.15	0.99	0.13	0.51	
		0.20	0.99	0.18	0.87	
		0.25	0.99	0.23	1.30	
		0.30	0.99	0.28	1.79	
		0.35	1.49	0.42	2.68	
		0.40	1.98	0.59	3.87	
		0.45	1.98	0.69	5.01	
		0.50	1.98	0.79	6.26	
		0.55	1.98	0.89	7.63	
		0.60	1.98	0.99	9.10	
		0.65	1.98	1.09	10.67	
		0.70	1.98	1.19	12.34	
		0.75	1.98	1.29	14.11	
		0.80	2.48	1.50	15.73	
		0.85	2.98	1.75	17.96	
		0.90	2.98	1.90	20.58	
		0.95	2.98	2.05	23.34	
		1.00	2.98	2.20	32.79	
		1.25	3.97	3.22	51.17	
		1.50	4.96	4.45	75.75	
		1.75	6.95	6.12	102.88	
		2.00	8.93	8.31	145.15	
		2.25	11.91	11.20	196.82	
		2.50	14.39	14.59	269.73	
		2.75	16.37	18.49	367.26	
		3.00	17.86	22.82	492.43	
		3.25	19.35	27.59	640.27	
		3.50	20.84	32.76	811.76	
		3.75	21.83	38.24	1018.15	

4.00	23.32	44.06	1233.90
4.25	24.31	50.12	1487.21
4.50	25.31	56.40	1763.34
4.75	26.30	62.96	2064.44
5.00	27.79	69.86	2366.74
6.00	32.25	100.18	3907.54
7.00	36.22	134.95	5941.44
8.00	40.69	173.98	8396.03
9.00	44.16	216.78	11469.90
10.00	48.13	263.45	14987.65
11.00	51.11	313.57	19247.90
12.00	55.08	367.26	23828.27
13.00	59.05	424.70	28982.00
14.00	62.52	485.98	34923.81
15.00	66.99	551.49	41179.71
16.00	70.96	621.04	48302.98
17.00	75.92	695.04	55705.16
18.00	80.39	773.80	64128.99
19.00	85.84	857.45	72835.30
20.00	91.80	946.46	82117.67

END FTABLE 9

FTABLE	10			
rows cols				***
49	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.00	0.00	0.00	
0.15	0.63	0.05	0.20	
0.20	0.63	0.08	0.46	
0.25	0.63	0.11	0.78	
0.30	0.63	0.15	1.18	
0.35	0.95	0.24	2.07	
0.40	0.95	0.29	2.80	
0.45	0.95	0.34	3.61	
0.50	0.95	0.38	4.50	
0.55	1.59	0.54	5.67	
0.60	1.59	0.62	7.12	
0.65	1.59	0.70	8.70	
0.70	1.59	0.78	10.40	
0.75	1.59	0.86	12.23	
0.80	1.59	0.94	14.17	
0.85	1.59	1.02	16.22	
0.90	1.90	1.15	17.73	
0.95	1.90	1.25	20.23	
1.00	2.22	1.42	28.26	
1.25	2.54	2.05	47.67	
1.50	3.17	2.89	72.90	
1.75	4.44	3.99	99.73	
2.00	6.66	5.50	129.99	
2.25	7.93	7.40	189.78	
2.50	8.88	9.59	270.99	
2.75	9.83	12.03	369.33	
3.00	10.79	14.71	485.50	
3.25	12.05	17.62	609.08	
3.50	12.69	20.75	773.00	
3.75	13.96	24.20	937.39	
4.00	15.23	27.91	1122.21	
4.25	15.86	31.84	1360.28	
4.50	16.50	35.98	1624.68	
4.75	17.13	40.31	1914.46	
5.00	18.08	44.85	2206.66	
6.00	20.94	64.80	3694.13	
7.00	23.79	87.37	5581.78	
8.00	26.65	112.61	7900.19	
9.00	29.50	140.78	10710.20	
10.00	32.36	172.04	14065.78	
11.00	35.21	206.18	17975.41	
12.00	38.38	243.13	22336.66	
13.00	40.92	283.06	27574.56	

14.00	43.78	325.74	33315.50
15.00	48.22	372.01	38977.47
16.00	55.52	424.60	44236.59
17.00	56.15	480.75	53993.96

END FTABLE 10

FTABLE 11

rows	cols			***
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	1.07	0.05	0.00	
0.10	1.07	0.10	0.00	
0.15	1.07	0.16	0.42	
0.20	1.07	0.21	0.68	
0.25	1.07	0.26	1.00	
0.30	1.07	0.32	1.36	
0.35	1.07	0.37	1.76	
0.40	1.07	0.42	2.20	
0.45	1.07	0.48	2.68	
0.50	1.07	0.53	3.19	
0.55	1.07	0.59	3.75	
0.60	1.60	0.80	4.84	
0.65	2.14	1.07	6.40	
0.70	2.14	1.18	7.50	
0.75	2.14	1.28	8.68	
0.80	2.14	1.39	9.91	
0.85	2.14	1.50	11.22	
0.90	2.14	1.60	12.59	
0.95	2.14	1.71	14.01	
1.00	2.14	1.82	19.38	
1.25	3.21	2.77	29.90	
1.50	3.21	3.57	45.65	
1.75	5.34	4.93	55.57	
2.00	9.62	7.06	68.42	
2.25	13.36	10.14	100.63	
2.50	19.24	14.24	139.00	
2.75	21.91	19.56	216.40	
3.00	24.58	25.59	313.77	
3.25	27.26	32.22	430.01	
3.50	29.39	39.41	572.18	
3.75	32.07	47.22	729.78	
4.00	34.20	55.58	917.37	
4.25	35.81	64.37	1136.55	
4.50	36.88	73.55	1391.55	
4.75	39.01	83.37	1651.61	
5.00	40.62	93.46	1945.31	
6.00	47.03	137.85	3371.36	
7.00	52.38	187.99	5262.78	
8.00	58.25	243.93	7566.98	
9.00	63.06	305.00	10415.28	
10.00	66.81	370.76	13877.72	
11.00	72.15	441.82	17657.08	
12.00	77.49	517.23	21891.91	
13.00	81.77	597.07	26829.90	
14.00	85.51	681.09	32430.24	
15.00	89.79	769.42	38464.57	
16.00	94.06	861.80	45047.74	
17.00	97.80	958.65	52412.90	
18.00	103.15	1060.24	59833.14	
19.00	107.42	1165.75	68208.27	
20.00	110.63	1275.46	77697.49	

END FTABLE 11

FTABLE 13

rows	cols			***
52	5			
depth	area	volume	outflow1	Infilt ***
0.00	0.00	0.00	0.0	0
0.05	0.69	0.03	0.0	0.0
0.10	0.69	0.07	0.0	0.0

0.15	0.69	0.10	0.0	0.0
0.20	0.69	0.14	0.0	0.0
0.25	1.03	0.22	0.0	0.0
0.30	1.37	0.32	0.0	0.0
0.35	1.37	0.39	0.0	0.0
0.40	1.37	0.46	0.0	0.0
0.45	1.37	0.53	0.0	0.0
0.50	1.37	0.60	0.0	0.72
0.55	1.37	0.67	0.0	0.72
0.60	1.37	0.74	0.0	0.72
0.65	1.37	0.81	0.0	0.72
0.70	1.37	0.87	0.0	0.72
0.75	1.72	1.03	0.0	0.72
0.80	1.72	1.12	0.0	0.72
0.85	1.72	1.20	0.0	0.72
0.90	2.06	1.40	0.0	0.72
0.95	2.06	1.51	0.0	0.72
1.00	2.06	1.61	0.0	0.72
1.25	2.06	2.12	0.0	0.72
1.50	2.75	2.93	0.0	0.72
1.75	2.75	3.62	0.0	0.72
2.00	2.75	4.30	0.0	0.72
2.25	3.43	5.36	0.0	0.72
2.50	3.43	6.22	0.0	0.72
2.75	3.77	7.21	0.0	0.72
3.00	3.77	8.15	0.0	0.72
3.25	4.12	9.23	28.6	0.72
3.50	4.46	10.35	58.9	0.72
3.75	5.15	12.12	101.9	0.72
4.00	6.52	13.77	118.3	0.72
4.25	7.89	15.72	147.3	0.72
4.50	8.58	17.81	201.1	0.72
4.75	8.92	20.03	271.3	0.72
5.00	9.95	22.57	331.6	0.72
6.00	13.73	34.56	659.4	0.72
7.00	15.44	49.55	1233.0	0.72
8.00	16.81	66.08	1975.9	0.72
9.00	18.19	84.03	2872.9	0.72
10.00	20.25	104.29	3892.5	0.72
11.00	22.65	126.31	5020.4	0.72
12.00	24.71	150.32	6378.8	0.72
13.00	27.11	176.62	7885.2	0.72
14.00	29.51	205.10	9598.9	0.72
15.00	31.91	236.06	11553.5	0.72
16.00	34.66	270.07	13720.0	0.72
17.00	37.06	306.57	16240.5	0.72
18.00	39.46	345.36	19026.7	0.72
19.00	42.21	386.66	21990.0	0.72
20.00	42.89	429.41	25939.5	0.72

END FTABLE 13

FTABLE		14		
rows	cols			***
43	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.00	0.00	0.00	
0.15	0.41	0.03	0.16	
0.20	0.41	0.05	0.36	
0.25	0.41	0.08	0.62	
0.30	0.41	0.10	0.92	
0.35	0.62	0.16	1.56	
0.40	0.62	0.19	2.12	
0.45	0.62	0.22	2.74	
0.50	0.62	0.25	3.42	
0.55	0.62	0.28	4.16	
0.60	0.62	0.31	4.96	
0.65	0.62	0.34	5.82	
0.70	0.62	0.37	6.72	
0.75	0.62	0.40	7.69	

0.80	0.83	0.51	9.27
0.85	1.04	0.61	10.72
0.90	1.04	0.66	12.29
0.95	1.04	0.71	13.95
1.00	1.04	0.76	19.60
1.25	1.24	1.07	30.51
1.50	1.66	1.52	45.21
1.75	2.07	2.02	62.95
2.00	2.69	2.63	81.89
2.25	3.73	3.51	106.55
2.50	4.77	4.63	144.03
2.75	6.22	6.03	187.17
3.00	9.74	8.21	232.35
3.25	12.85	11.08	318.67
3.50	14.30	14.49	463.93
3.75	15.33	18.23	648.90
4.00	16.78	22.31	855.62
4.25	18.23	26.73	1094.54
4.50	19.27	31.46	1384.10
4.75	20.93	36.60	1685.77
5.00	21.96	42.02	2054.87
6.00	25.49	66.02	3951.58
7.00	30.87	94.69	6342.79
8.00	37.71	129.35	9336.49
9.00	42.56	169.61	13531.46
10.00	47.32	214.72	18677.70
11.00	54.78	265.56	24140.94

END FTABLE 14

FTABLE 15				***
rows cols				***
45	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.46	0.03	0.00	
0.15	0.46	0.05	0.33	
0.20	0.46	0.08	0.60	
0.25	0.46	0.10	0.92	
0.30	0.46	0.12	1.30	
0.35	0.46	0.15	1.73	
0.40	0.69	0.21	2.43	
0.45	0.93	0.31	3.66	
0.50	0.93	0.35	4.63	
0.55	0.93	0.40	5.69	
0.60	0.93	0.44	6.84	
0.65	0.93	0.49	8.07	
0.70	1.16	0.57	8.98	
0.75	1.16	0.63	10.54	
0.80	1.16	0.69	12.21	
0.85	1.16	0.75	13.97	
0.90	1.39	0.83	14.86	
0.95	1.62	0.97	17.33	
1.00	1.62	1.05	24.75	
1.25	1.85	1.51	41.60	
1.50	1.85	1.98	64.87	
1.75	2.31	2.62	89.08	
2.00	2.54	3.25	119.64	
2.25	2.54	3.88	161.21	
2.50	2.54	4.52	207.60	
2.75	3.24	5.44	240.53	
3.00	3.24	6.25	303.10	
3.25	3.24	7.06	371.32	
3.50	3.24	7.87	444.97	
3.75	3.70	8.98	505.76	
4.00	6.01	10.16	451.25	
4.25	6.48	11.72	545.27	
4.50	6.94	13.48	657.65	
4.75	9.95	15.58	658.80	
5.00	17.12	18.74	625.44	
6.00	19.20	37.18	1814.63	

7.00	21.28	57.64	3518.81
8.00	24.75	80.45	5546.18
9.00	29.84	107.79	7975.03
10.00	35.16	140.36	11102.18
11.00	40.02	178.54	15211.62
12.00	42.10	220.18	20855.01
13.00	42.33	262.40	27835.87

END FTABLE 15

FTABLE 16

rows cols ***

52 5

depth	area	volume	outflow1	Infilt ***
0.00	0.00	0.00	0.0	0.0
0.05	1.16	0.05	0.0	0.0
0.10	1.16	0.11	0.0	0.0
0.15	1.16	0.17	0.0	0.0
0.20	1.16	0.22	0.0	0.0
0.25	1.16	0.28	0.0	0.0
0.30	1.16	0.34	0.0	0.0
0.35	1.74	0.50	0.0	0.0
0.40	2.33	0.72	0.0	0.0
0.45	2.33	0.83	0.0	0.0
0.50	2.33	0.95	0.0	1.21
0.55	2.33	1.07	0.0	1.21
0.60	2.33	1.18	0.0	1.21
0.65	2.33	1.30	0.0	1.21
0.70	2.33	1.41	0.0	1.21
0.75	2.91	1.65	0.0	1.21
0.80	3.49	1.93	0.0	1.21
0.85	3.49	2.11	0.0	1.21
0.90	3.49	2.28	0.0	1.21
0.95	3.49	2.45	0.0	1.21
1.00	3.49	2.63	0.0	1.21
1.25	4.07	3.66	0.0	1.21
1.50	4.65	4.92	0.0	1.21
1.75	5.23	6.24	0.0	1.21
2.00	5.23	7.55	0.0	1.21
2.25	5.82	9.11	0.0	1.21
2.50	6.40	10.85	0.0	1.21
2.75	6.98	12.63	0.0	1.21
3.00	8.14	14.75	0.0	1.21
3.25	8.72	16.87	39.4	1.21
3.50	9.31	19.15	83.9	1.21
3.75	10.47	21.85	127.1	1.21
4.00	11.05	24.56	183.9	1.21
4.25	11.63	27.45	246.9	1.21
4.50	12.80	30.60	303.2	1.21
4.75	14.54	34.39	361.6	1.21
5.00	15.12	38.14	450.6	1.21
6.00	19.77	56.15	838.0	1.21
7.00	23.85	78.72	1410.0	1.21
8.00	28.50	105.46	2129.7	1.21
9.00	33.73	137.28	3032.7	1.21
10.00	38.97	174.43	4177.9	1.21
11.00	43.62	216.11	5605.2	1.21
12.00	47.11	262.07	7405.2	1.21
13.00	49.44	310.79	9584.1	1.21
14.00	52.34	362.19	11954.3	1.21
15.00	55.25	416.47	14597.1	1.21
16.00	59.32	474.61	17343.5	1.21
17.00	61.65	535.53	20710.2	1.21
18.00	63.39	598.58	24505.4	1.21
19.00	65.72	663.91	28459.9	1.21
20.00	68.05	731.51	32707.8	1.21

END FTABLE 16

FTABLE 17

rows cols ***

51 4

depth	area	volume	outflow1 ***
-------	------	--------	--------------

0.00	0.00	0.00	0.00
0.05	0.00	0.00	0.00
0.10	0.00	0.00	0.00
0.15	0.24	0.02	0.22
0.20	0.24	0.03	0.45
0.25	0.36	0.06	0.95
0.30	0.36	0.08	1.46
0.35	0.36	0.10	2.06
0.40	0.36	0.11	2.73
0.45	0.48	0.15	3.71
0.50	0.48	0.18	4.71
0.55	0.48	0.20	5.81
0.60	0.48	0.23	7.00
0.65	0.60	0.28	8.44
0.70	0.60	0.31	10.01
0.75	0.60	0.34	11.68
0.80	0.60	0.37	13.46
0.85	0.71	0.42	15.18
0.90	0.71	0.46	17.37
0.95	0.83	0.52	19.09
1.00	0.83	0.56	27.16
1.25	0.83	0.77	46.08
1.50	1.07	1.07	67.84
1.75	1.31	1.39	91.95
2.00	1.43	1.74	125.98
2.25	1.67	2.17	163.86
2.50	2.14	2.67	196.14
2.75	2.50	3.26	247.08
3.00	2.86	3.95	311.53
3.25	3.10	4.71	396.23
3.50	3.34	5.55	494.66
3.75	3.57	6.45	607.53
4.00	3.81	7.41	733.98
4.25	4.05	8.44	874.27
4.50	4.29	9.52	1029.87
4.75	4.65	10.69	1183.35
5.00	4.89	11.90	1369.81
6.00	5.84	17.39	2286.91
7.00	7.27	24.12	3410.94
8.00	8.46	32.09	4961.63
9.00	9.53	41.20	6948.82
10.00	10.84	51.55	9265.24
11.00	12.39	63.28	11932.81
12.00	13.94	76.62	15175.07
13.00	15.73	91.51	18826.86
14.00	17.40	108.14	23251.84
15.00	19.06	126.47	28400.64
16.00	21.57	146.77	33527.37
17.00	23.83	169.56	39903.88
18.00	26.33	194.73	47024.59
19.00	27.64	221.85	56577.33

END FTABLE 17

FTABLE		18		
rows	cols			***
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.00	0.00	0.00	
0.15	0.00	0.00	0.00	
0.20	0.53	0.06	0.27	
0.25	0.53	0.08	0.52	
0.30	0.53	0.11	0.82	
0.35	0.53	0.14	1.18	
0.40	0.53	0.16	1.58	
0.45	0.53	0.19	2.03	
0.50	0.79	0.28	3.05	
0.55	0.79	0.32	3.79	
0.60	0.79	0.36	4.60	
0.65	0.79	0.40	5.46	

0.70	0.79	0.44	6.39
0.75	1.06	0.56	7.82
0.80	1.06	0.61	9.08
0.85	1.06	0.67	10.42
0.90	1.06	0.72	11.84
0.95	1.06	0.77	13.32
1.00	1.06	0.82	18.59
1.25	1.58	1.30	30.06
1.50	1.58	1.69	46.90
1.75	1.85	2.17	64.11
2.00	2.11	2.78	88.37
2.25	2.38	3.38	113.34
2.50	2.91	4.11	137.53
2.75	3.17	4.88	172.78
3.00	3.70	5.78	206.73
3.25	4.75	6.96	238.47
3.50	5.55	8.30	288.38
3.75	6.34	9.82	349.77
4.00	7.13	11.55	423.40
4.25	7.39	13.38	528.39
4.50	8.45	15.48	616.30
4.75	9.24	17.71	727.23
5.00	9.51	20.08	879.28
6.00	11.62	31.04	1590.52
7.00	13.47	43.91	2569.37
8.00	15.05	58.36	3833.47
9.00	16.37	74.35	5425.91
10.00	17.96	91.94	7267.94
11.00	19.81	111.15	9339.63
12.00	21.39	131.85	11793.94
13.00	22.45	153.99	14792.13
14.00	23.77	177.60	18059.07
15.00	25.35	202.60	21542.36
16.00	26.94	228.99	25371.51
17.00	28.26	256.86	29761.39
18.00	30.11	286.41	34207.47
19.00	31.96	317.63	39061.87
20.00	33.81	350.71	44383.68

END FTABLE 18

FTABLE	19			
rows cols				***
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.49	0.02	0.00	
0.10	0.49	0.05	0.00	
0.15	0.49	0.07	0.50	
0.20	0.49	0.09	0.83	
0.25	0.49	0.12	1.22	
0.30	0.49	0.14	1.66	
0.35	0.49	0.17	2.17	
0.40	0.49	0.19	2.72	
0.45	0.74	0.27	3.65	
0.50	0.74	0.31	4.52	
0.55	0.98	0.41	6.06	
0.60	0.98	0.46	7.32	
0.65	0.98	0.51	8.66	
0.70	0.98	0.56	10.09	
0.75	0.98	0.61	11.61	
0.80	0.98	0.66	13.22	
0.85	1.23	0.76	14.50	
0.90	1.23	0.82	16.50	
0.95	1.23	0.88	18.61	
1.00	1.47	1.00	25.51	
1.25	1.72	1.43	41.75	
1.50	1.96	1.91	61.74	
1.75	2.70	2.60	83.75	
2.00	4.17	3.53	104.05	
2.25	4.66	4.66	153.38	
2.50	5.39	6.01	213.16	

2.75	5.88	7.49	289.90
3.00	6.37	9.09	379.84
3.25	6.86	10.83	483.49
3.50	7.60	12.73	591.63
3.75	8.33	14.79	714.51
4.00	8.82	16.98	866.45
4.25	9.56	19.36	1021.54
4.50	10.05	21.84	1208.36
4.75	10.54	24.47	1414.30
5.00	11.03	27.22	1639.12
6.00	12.74	39.37	2752.76
7.00	14.46	53.11	4167.85
8.00	16.17	68.62	5927.02
9.00	17.89	85.89	8056.82
10.00	19.60	104.97	10589.93
11.00	21.81	126.39	13442.99
12.00	24.50	150.05	16555.89
13.00	26.46	175.80	20480.27
14.00	28.42	203.59	24938.41
15.00	30.63	233.50	29816.64
16.00	33.08	265.67	35124.99
17.00	35.77	300.34	40903.66
18.00	38.71	337.85	47218.02
19.00	41.90	378.32	54093.74
20.00	46.06	422.54	61059.31

END FTABLE 19

FTABLE 20

rows cols ***
52 4

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.40	0.02	0.00	
0.15	0.40	0.04	0.25	
0.20	0.40	0.06	0.49	
0.25	0.40	0.08	0.78	
0.30	0.40	0.10	1.13	
0.35	0.60	0.16	1.81	
0.40	0.60	0.19	2.42	
0.45	0.60	0.22	3.11	
0.50	0.60	0.25	3.86	
0.55	0.60	0.28	4.67	
0.60	0.60	0.31	5.55	
0.65	0.60	0.34	6.48	
0.70	0.60	0.37	7.48	
0.75	0.80	0.46	9.20	
0.80	0.80	0.50	10.55	
0.85	0.80	0.54	11.98	
0.90	0.80	0.58	13.47	
0.95	0.80	0.62	15.04	
1.00	1.00	0.73	21.22	
1.25	1.00	0.98	34.53	
1.50	1.40	1.39	49.04	
1.75	1.40	1.74	71.24	
2.00	1.40	2.09	96.63	
2.25	1.80	2.64	120.25	
2.50	1.80	3.09	156.27	
2.75	2.19	3.69	184.41	
3.00	2.39	4.30	224.62	
3.25	3.39	5.10	236.88	
3.50	4.19	6.11	278.63	
3.75	6.38	7.44	292.31	
4.00	7.38	9.21	379.21	
4.25	8.38	11.28	488.41	
4.50	9.18	13.51	621.38	
4.75	9.97	15.96	775.39	
5.00	10.57	18.57	960.62	
6.00	13.76	31.03	1896.48	
7.00	15.96	46.15	3329.59	
8.00	17.55	63.16	5270.95	

9.00	18.95	81.64	7682.44
10.00	20.15	101.36	10576.16
11.00	21.35	122.26	13908.15
12.00	22.54	144.38	17693.22
13.00	23.34	167.52	22144.96
14.00	24.34	191.63	26941.90
15.00	24.94	216.45	32468.72
16.00	25.73	242.10	38310.67
17.00	26.33	268.34	44778.88
18.00	26.93	295.27	51726.10
19.00	27.93	323.07	58638.22
20.00	28.53	351.42	66509.66

END FTABLE 20

FTABLE 21

rows cols ***

52 4

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.82	0.02	0.00	
0.10	0.82	0.06	0.00	
0.15	0.82	0.10	0.46	
0.20	1.24	0.19	0.94	
0.25	1.24	0.25	1.52	
0.30	1.24	0.31	2.20	
0.35	1.24	0.37	2.98	
0.40	1.65	0.51	4.11	
0.45	1.65	0.59	5.29	
0.50	1.65	0.67	6.58	
0.55	2.06	0.83	8.08	
0.60	2.06	0.93	9.82	
0.65	2.06	1.04	11.69	
0.70	2.06	1.14	13.69	
0.75	2.06	1.24	15.81	
0.80	2.06	1.35	18.06	
0.85	2.47	1.52	19.65	
0.90	2.89	1.75	22.39	
0.95	2.89	1.90	25.54	
1.00	2.89	2.04	36.07	
1.25	3.71	2.97	56.98	
1.50	4.53	4.18	88.10	
1.75	5.77	5.62	122.96	
2.00	6.18	7.16	175.68	
2.25	7.42	9.03	228.99	
2.50	7.83	11.00	307.32	
2.75	8.66	13.22	390.48	
3.00	9.48	15.61	484.68	
3.25	10.30	18.15	589.12	
3.50	10.72	20.79	719.85	
3.75	11.13	23.60	866.80	
4.00	11.54	26.52	1027.49	
4.25	12.37	29.64	1180.76	
4.50	12.37	32.73	1393.11	
4.75	13.19	36.14	1574.52	
5.00	13.60	39.59	1795.13	
6.00	16.08	55.02	2778.87	
7.00	18.55	72.68	4016.97	
8.00	20.20	92.37	5659.04	
9.00	22.67	114.32	7473.67	
10.00	24.32	138.16	9778.87	
11.00	26.79	164.21	12224.45	
12.00	28.85	192.44	15155.50	
13.00	31.33	223.05	18348.99	
14.00	33.80	256.07	21956.40	
15.00	36.68	291.76	25840.85	
16.00	39.98	330.46	30032.79	
17.00	43.28	372.42	34772.38	
18.00	46.58	417.69	40091.63	
19.00	50.29	466.56	45816.05	
20.00	54.41	519.37	51986.45	

END FTABLE 21

```

FTABLE      22
rows cols
52      4
depth      area      volume      outflow1 ***
0.00      0.00      0.00      0.00
0.05      0.00      0.00      0.00
0.10      0.88      0.05      0.00
0.15      0.88      0.09      0.26
0.20      0.88      0.13      0.50
0.25      0.88      0.18      0.80
0.30      0.88      0.22      1.15
0.35      0.88      0.27      1.55
0.40      1.33      0.40      2.34
0.45      1.77      0.55      3.27
0.50      1.77      0.64      4.18
0.55      1.77      0.73      5.19
0.60      1.77      0.82      6.28
0.65      1.77      0.91      7.45
0.70      1.77      0.99      8.71
0.75      1.77      1.08      10.03
0.80      1.77      1.17      11.44
0.85      1.77      1.26      12.91
0.90      1.77      1.35      14.46
0.95      2.21      1.57      16.07
1.00      2.65      1.81      22.49
1.25      2.65      2.47      37.84
1.50      2.65      3.14      56.22
1.75      3.54      4.23      76.26
2.00      3.54      5.11      104.64
2.25      4.42      6.37      130.01
2.50      4.42      7.47      169.74
2.75      4.86      8.77      207.84
3.00      5.75      10.34     244.70
3.25      6.63      11.97     284.09
3.50      7.51      13.78     330.60
3.75      8.84      15.88     375.80
4.00      11.05     18.52     418.88
4.25      12.82     21.61     490.93
4.50      14.59     25.15     580.38
4.75      15.03     28.89     716.89
5.00      17.68     33.42     820.23
6.00      23.43     54.56     1540.28
7.00      29.17     81.61     2603.78
8.00      32.71     112.82    4139.49
9.00      36.24     147.75    6059.97
10.00     39.78     186.22    8375.15
11.00     42.43     227.58    11206.73
12.00     45.97     272.23    14320.69
13.00     49.06     320.20    17971.10
14.00     52.16     371.25    22076.30
15.00     54.37     424.91    26890.78
16.00     57.02     481.35    32067.48
17.00     59.67     540.24    37705.60
18.00     61.88     601.43    44005.14
19.00     64.09     664.91    50807.87
20.00     65.86     730.44    58352.94
END FTABLE 22

```

```

FTABLE      23
rows cols
41      4
depth      area      volume      outflow1 ***
0.00      0.00      0.00      0.00
0.05      0.00      0.00      0.00
0.10      0.25      0.02      0.00
0.15      0.25      0.03      0.37
0.20      0.38      0.06      0.83
0.25      0.38      0.08      1.32
0.30      0.38      0.10      1.90
0.35      0.38      0.12      2.56

```

0.40	0.38	0.13	3.29
0.45	0.50	0.18	4.47
0.50	0.63	0.23	5.73
0.55	0.63	0.26	7.10
0.60	0.63	0.29	8.58
0.65	0.63	0.33	10.17
0.70	0.63	0.36	11.86
0.75	0.63	0.39	13.66
0.80	0.63	0.42	15.56
0.85	0.76	0.48	17.36
0.90	0.76	0.52	19.69
0.95	0.88	0.59	21.95
1.00	0.88	0.64	30.94
1.25	1.01	0.89	49.23
1.50	1.14	1.19	74.36
1.75	1.39	1.54	100.55
2.00	1.51	1.93	137.59
2.25	1.77	2.39	176.73
2.50	2.15	2.90	215.72
2.75	2.52	3.50	264.78
3.00	4.67	4.36	252.67
3.25	5.55	5.67	349.51
3.50	6.44	7.21	472.90
3.75	8.20	9.18	601.84
4.00	8.58	11.30	825.10
4.25	9.46	13.61	1054.17
4.50	10.60	16.15	1300.22
4.75	11.23	18.94	1631.30
5.00	11.48	21.82	2035.30
6.00	13.12	34.17	3932.62
7.00	15.65	48.83	6342.15
8.00	17.79	65.75	9558.25
9.00	17.92	83.66	14213.33

END FTABLE 23

FTABLE		24			***
rows	cols				
41	4				***
depth	area	volume	outflow1		***
0.00	0.00	0.00	0.00		
0.05	0.29	0.01	0.00		
0.10	0.29	0.02	0.00		
0.15	0.29	0.04	0.39		
0.20	0.29	0.05	0.68		
0.25	0.29	0.06	1.04		
0.30	0.43	0.10	1.58		
0.35	0.43	0.12	2.20		
0.40	0.43	0.14	2.90		
0.45	0.57	0.20	4.15		
0.50	0.57	0.22	5.22		
0.55	0.57	0.25	6.37		
0.60	0.72	0.30	7.45		
0.65	0.72	0.34	8.97		
0.70	0.72	0.38	10.60		
0.75	0.72	0.41	12.34		
0.80	0.72	0.45	14.18		
0.85	0.72	0.48	16.12		
0.90	0.72	0.52	18.16		
0.95	0.86	0.60	20.14		
1.00	0.86	0.64	28.28		
1.25	0.86	0.85	45.89		
1.50	1.15	1.20	67.16		
1.75	1.29	1.53	92.65		
2.00	1.29	1.86	127.42		
2.25	1.58	2.32	161.26		
2.50	1.87	2.78	195.86		
2.75	2.30	3.36	233.62		
3.00	4.02	4.12	226.52		
3.25	4.30	5.19	317.66		
3.50	4.74	6.35	417.78		
3.75	12.77	8.71	365.31		

4.00	13.92	12.11	597.78
4.25	15.21	15.77	874.59
4.50	16.79	19.87	1204.27
4.75	18.22	24.28	1592.68
5.00	19.23	28.97	2061.97
6.00	22.10	49.89	4651.07
7.00	24.54	73.17	8212.67
8.00	27.55	99.24	12632.76
9.00	29.13	128.01	18604.78

END FTABLE 24

FTABLE 25
rows cols ***
52 4

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.92	0.03	0.00	
0.10	0.92	0.08	0.00	
0.15	0.92	0.12	0.56	
0.20	0.92	0.17	0.95	
0.25	1.84	0.33	1.85	
0.30	1.84	0.42	2.79	
0.35	1.84	0.52	3.87	
0.40	1.84	0.61	5.09	
0.45	1.84	0.70	6.44	
0.50	1.84	0.79	7.91	
0.55	2.30	0.96	9.45	
0.60	2.30	1.08	11.40	
0.65	2.30	1.19	13.50	
0.70	2.30	1.31	15.74	
0.75	2.76	1.48	17.18	
0.80	2.76	1.62	19.92	
0.85	2.76	1.76	22.83	
0.90	3.69	2.23	27.91	
0.95	4.15	2.47	30.55	
1.00	4.15	2.67	43.68	
1.25	5.07	3.90	71.65	
1.50	5.99	5.35	108.57	
1.75	6.91	7.01	154.86	
2.00	8.76	9.23	209.15	
2.25	9.68	11.68	289.72	
2.50	10.14	14.24	390.95	
2.75	11.06	17.12	501.36	
3.00	11.52	20.04	634.16	
3.25	12.44	23.24	770.68	
3.50	13.36	26.55	917.51	
3.75	13.36	29.89	1117.91	
4.00	14.28	33.55	1296.47	
4.25	15.21	37.37	1487.97	
4.50	15.67	41.27	1720.83	
4.75	16.13	45.37	1976.58	
5.00	17.05	49.70	2216.97	
6.00	18.89	68.14	3502.88	
7.00	21.66	89.06	4994.78	
8.00	23.96	112.30	6871.64	
9.00	27.19	138.30	8937.64	
10.00	29.49	167.02	11593.43	
11.00	32.26	198.50	14563.27	
12.00	35.02	232.51	17941.69	
13.00	37.32	268.97	21920.17	
14.00	40.09	308.29	26236.96	
15.00	42.85	350.38	31062.98	
16.00	45.62	395.27	36424.62	
17.00	48.84	443.10	42101.95	
18.00	52.53	494.18	48112.56	
19.00	56.22	548.89	54786.85	
20.00	60.82	608.09	61665.48	

END FTABLE 25

FTABLE 26
rows cols ***

depth	area	volume	outflow1	infiltr ***
0.00	0.00	0.00	0.0	0.0
0.05	0.71	0.03	0.0	0.0
0.10	1.07	0.09	0.0	0.0
0.15	1.07	0.14	0.0	0.0
0.20	1.07	0.19	0.0	0.0
0.25	1.78	0.33	0.0	0.0
0.30	1.78	0.42	0.0	0.0
0.35	1.78	0.51	0.0	0.0
0.40	2.14	0.63	0.0	0.0
0.45	2.14	0.74	0.0	0.0
0.50	2.14	0.85	0.0	1.39
0.55	2.49	1.01	0.0	1.39
0.60	2.49	1.14	0.0	1.39
0.65	2.49	1.26	0.0	1.39
0.70	2.85	1.46	0.0	1.39
0.75	2.85	1.60	0.0	1.39
0.80	2.85	1.74	0.0	1.39
0.85	2.85	1.88	0.0	1.39
0.90	2.85	2.03	0.0	1.39
0.95	2.85	2.17	0.0	1.39
1.00	2.85	2.31	0.0	1.39
1.25	3.56	3.33	0.0	1.39
1.50	3.56	4.23	0.0	1.39
1.75	4.28	5.42	0.0	1.39
2.00	4.28	6.48	0.0	1.39
2.25	4.28	7.55	0.0	1.39
2.50	4.99	8.97	0.0	1.39
2.75	4.99	10.22	0.0	1.39
3.00	4.99	11.46	0.0	1.39
3.25	5.35	12.90	34.2	1.39
3.50	5.70	14.45	72.8	1.39
3.75	5.70	15.88	121.1	1.39
4.00	5.70	17.30	172.3	1.39
4.25	6.41	19.15	207.8	1.39
4.50	6.41	20.75	268.0	1.39
4.75	6.41	22.36	331.3	1.39
5.00	6.41	23.96	397.8	1.39
6.00	7.84	31.69	636.4	1.39
7.00	13.19	42.63	775.3	1.39
8.00	28.51	69.61	1129.6	1.39
9.00	31.36	100.09	2093.4	1.39
10.00	33.85	132.62	3290.4	1.39
11.00	37.42	168.86	4687.7	1.39
12.00	39.91	207.91	6427.4	1.39
13.00	42.77	249.79	8396.4	1.39
14.00	43.84	293.32	10854.9	1.39
15.00	44.20	337.39	13686.9	1.39

END FTABLE 26

depth	area	volume	outflow1	infiltr ***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	1.02	0.06	0.00	
0.15	1.02	0.11	0.36	
0.20	1.02	0.16	0.67	
0.25	1.02	0.21	1.06	
0.30	1.02	0.26	1.52	
0.35	1.02	0.32	2.04	
0.40	1.02	0.37	2.62	
0.45	1.02	0.42	3.25	
0.50	1.02	0.47	3.94	
0.55	1.02	0.52	4.68	
0.60	1.53	0.73	6.21	
0.65	1.53	0.80	7.34	
0.70	1.53	0.88	8.55	
0.75	2.04	1.14	10.84	

0.80	2.04	1.24	12.51
0.85	2.04	1.34	14.27
0.90	2.04	1.44	16.12
0.95	2.04	1.55	18.07
1.00	2.04	1.65	25.12
1.25	3.06	2.51	38.60
1.50	3.06	3.28	60.15
1.75	3.57	4.21	82.51
2.00	4.08	5.37	112.97
2.25	4.08	6.39	151.01
2.50	5.10	7.86	183.66
2.75	5.62	9.27	227.06
3.00	6.64	10.94	267.87
3.25	7.75	12.82	314.60
3.50	8.26	14.95	389.76
3.75	8.77	17.16	471.61
4.00	9.28	19.48	561.00
4.25	9.79	21.94	659.97
4.50	10.30	24.53	768.70
4.75	10.30	27.11	907.87
5.00	11.32	30.09	1014.99
6.00	11.83	41.94	1713.89

END FTABLE 27

FTABLE	28			***
rows cols				
43	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.61	0.03	0.00	
0.10	0.61	0.06	0.00	
0.15	0.61	0.09	0.66	
0.20	0.61	0.12	1.06	
0.25	0.61	0.15	1.54	
0.30	0.61	0.18	2.09	
0.35	0.61	0.21	2.70	
0.40	0.61	0.24	3.38	
0.45	0.91	0.34	4.58	
0.50	1.22	0.47	6.37	
0.55	1.22	0.53	7.80	
0.60	1.22	0.59	9.35	
0.65	1.22	0.65	11.00	
0.70	1.22	0.71	12.76	
0.75	1.22	0.78	14.63	
0.80	1.22	0.84	16.60	
0.85	1.52	0.96	18.10	
0.90	1.52	1.04	20.55	
0.95	1.83	1.20	22.97	
1.00	1.83	1.29	32.46	
1.25	2.13	1.83	52.49	
1.50	2.74	2.53	76.35	
1.75	3.66	3.45	105.78	
2.00	5.18	4.64	137.55	
2.25	7.31	6.29	181.61	
2.50	8.83	8.39	258.99	
2.75	11.27	11.02	346.93	
3.00	12.79	14.08	479.53	
3.25	14.62	17.61	637.20	
3.50	16.45	21.62	829.39	
3.75	17.67	25.98	1074.41	
4.00	19.19	30.69	1341.96	
4.25	20.11	35.67	1671.34	
4.50	20.71	40.84	2053.12	
4.75	21.63	46.26	2455.58	
5.00	22.54	51.89	2892.79	
6.00	25.59	76.43	5068.72	
7.00	29.55	104.36	7738.56	
8.00	33.51	136.06	11071.98	
9.00	37.77	171.80	15079.73	
10.00	43.26	212.37	19616.74	
11.00	44.78	257.03	26348.20	

END FTABLE 28

FTABLE 29

rows cols ***

52 4

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.00	0.00	0.00	
0.15	0.61	0.05	0.20	
0.20	0.61	0.08	0.46	
0.25	0.61	0.11	0.81	
0.30	0.61	0.14	1.23	
0.35	0.61	0.17	1.72	
0.40	0.61	0.20	2.26	
0.45	0.61	0.23	2.87	
0.50	0.61	0.26	3.54	
0.55	0.61	0.29	4.26	
0.60	0.92	0.42	5.98	
0.65	0.92	0.47	7.10	
0.70	0.92	0.51	8.31	
0.75	0.92	0.56	9.58	
0.80	0.92	0.60	10.93	
0.85	0.92	0.65	12.35	
0.90	0.92	0.70	13.83	
0.95	0.92	0.74	15.39	
1.00	0.92	0.79	21.26	
1.25	1.22	1.16	33.41	
1.50	1.84	1.89	57.26	
1.75	2.14	2.48	81.53	
2.00	2.45	3.11	108.86	
2.25	2.75	3.85	143.38	
2.50	3.06	4.66	183.71	
2.75	4.28	5.74	208.20	
3.00	4.89	6.91	259.57	
3.25	6.12	8.47	314.22	
3.50	7.34	10.31	385.90	
3.75	8.26	12.31	479.56	
4.00	8.87	14.48	600.08	
4.25	9.79	16.89	726.18	
4.50	10.40	19.49	885.57	
4.75	11.93	22.48	1025.11	
5.00	12.54	25.57	1229.44	
6.00	15.90	40.38	2247.96	
7.00	18.35	57.84	3718.63	
8.00	20.49	77.59	5637.63	
9.00	22.94	99.77	7951.25	
10.00	25.38	124.30	10721.08	
11.00	28.14	151.50	13920.78	
12.00	30.28	181.21	17866.78	
13.00	33.03	213.63	22183.25	
14.00	35.78	248.51	27059.75	
15.00	38.23	285.75	32677.12	
16.00	40.67	325.44	38942.39	
17.00	43.12	367.66	45898.96	
18.00	46.48	413.08	53015.38	
19.00	49.54	461.28	61074.53	
20.00	52.91	512.64	69705.04	

END FTABLE 29

FTABLE 30

rows cols ***

52 4

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.00	0.00	0.00	
0.15	0.29	0.03	0.13	
0.20	0.29	0.04	0.28	
0.25	0.29	0.06	0.46	
0.30	0.29	0.07	0.68	

0.35	0.39	0.10	0.98
0.40	0.39	0.12	1.32
0.45	0.39	0.14	1.71
0.50	0.59	0.20	2.31
0.55	0.69	0.24	2.90
0.60	0.69	0.27	3.63
0.65	0.69	0.31	4.42
0.70	0.69	0.34	5.28
0.75	0.69	0.37	6.19
0.80	0.69	0.41	7.16
0.85	0.69	0.44	8.19
0.90	0.78	0.50	9.13
0.95	0.78	0.54	10.36
1.00	0.78	0.58	14.55
1.25	0.88	0.81	23.70
1.50	0.98	1.07	35.09
1.75	1.08	1.35	48.17
2.00	1.08	1.62	65.26
2.25	1.17	1.95	84.03
2.50	1.27	2.29	104.18
2.75	1.27	2.61	129.39
3.00	1.37	2.98	153.68
3.25	1.37	3.33	184.21
3.50	1.47	3.73	212.91
3.75	1.66	4.17	235.95
4.00	1.66	4.59	276.45
4.25	1.66	5.00	319.48
4.50	1.66	5.42	364.97
4.75	1.76	5.89	402.78
5.00	1.86	6.41	446.23
6.00	2.25	8.49	627.93
7.00	5.58	12.11	624.39
8.00	7.64	19.18	1090.78
9.00	13.71	29.93	1553.50
10.00	16.45	45.26	2741.42
11.00	22.52	64.30	3993.05
12.00	24.57	87.87	6340.80
13.00	26.92	113.51	9142.65
14.00	28.59	141.59	12697.51
15.00	30.74	171.19	16600.29
16.00	32.60	203.26	21251.16
17.00	33.97	236.37	26588.56
18.00	34.36	270.38	33012.64
19.00	34.66	305.11	40149.64
20.00	34.95	339.85	47782.88

END FTABLE 30

FTABLE 31

rows cols ***

52 4

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	1.01	0.05	0.00	
0.15	1.35	0.11	0.08	
0.20	2.70	0.28	0.23	
0.25	2.70	0.42	0.44	
0.30	2.70	0.55	0.70	
0.35	2.70	0.69	1.01	
0.40	2.70	0.82	1.36	
0.45	2.70	0.96	1.75	
0.50	2.70	1.09	2.18	
0.55	2.70	1.23	2.65	
0.60	3.03	1.44	3.20	
0.65	3.03	1.60	3.78	
0.70	3.03	1.75	4.40	
0.75	3.03	1.90	5.05	
0.80	3.03	2.05	5.74	
0.85	3.03	2.20	6.47	
0.90	3.03	2.35	7.23	
0.95	3.03	2.51	8.02	

1.00	3.37	2.74	10.82
1.25	3.71	3.79	17.42
1.50	3.71	4.71	25.09
1.75	3.71	5.64	33.84
2.00	3.71	6.57	43.61
2.25	3.71	7.49	54.34
2.50	3.71	8.42	66.00
2.75	3.71	9.35	78.54
3.00	4.04	10.60	90.68
3.25	4.38	12.03	105.14
3.50	4.72	13.22	117.35
3.75	5.06	14.54	131.47
4.00	5.39	15.89	146.16
4.25	5.39	17.24	167.40
4.50	6.07	18.86	180.02
4.75	7.08	20.72	190.43
5.00	7.08	22.49	218.30
6.00	9.77	32.08	318.37
7.00	10.79	42.81	482.44
8.00	12.81	55.42	661.80
9.00	13.82	69.11	908.90
10.00	99.43	122.31	638.16
11.00	104.49	225.50	1711.65
12.00	115.95	336.59	3113.48
13.00	127.41	459.22	4907.36
14.00	136.51	591.02	7137.53
15.00	139.54	730.11	10002.88
16.00	142.91	872.58	13251.24
17.00	146.28	1017.30	16848.95
18.00	148.98	1165.59	20880.97
19.00	151.34	1316.93	25324.72
20.00	154.37	1468.34	29962.97

END FTABLE 31

rows	cols	***		
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.00	0.00	0.00	
0.15	0.55	0.05	0.25	
0.20	0.55	0.07	0.53	
0.25	0.55	0.10	0.90	
0.30	0.55	0.13	1.35	
0.35	0.83	0.21	2.26	
0.40	0.83	0.25	3.06	
0.45	0.83	0.29	3.95	
0.50	0.83	0.33	4.94	
0.55	0.83	0.37	6.01	
0.60	0.83	0.42	7.16	
0.65	0.83	0.46	8.39	
0.70	0.83	0.50	9.70	
0.75	0.83	0.54	11.08	
0.80	1.39	0.74	13.37	
0.85	1.39	0.81	15.51	
0.90	1.39	0.88	17.77	
0.95	1.39	0.95	20.15	
1.00	1.39	1.02	28.32	
1.25	1.66	1.44	44.56	
1.50	1.94	1.99	68.73	
1.75	2.77	2.69	89.75	
2.00	3.05	3.44	126.49	
2.25	4.16	4.43	157.36	
2.50	4.71	5.61	214.43	
2.75	5.82	7.11	276.37	
3.00	6.65	8.76	358.16	
3.25	7.76	10.64	447.31	
3.50	8.87	12.80	556.40	
3.75	9.15	15.06	715.34	
4.00	10.25	17.66	863.93	

4.25	10.81	20.35	1056.98
4.50	11.36	23.18	1269.81
4.75	11.92	26.14	1502.76
5.00	12.20	29.22	1781.68
6.00	14.69	43.01	2998.06
7.00	16.35	58.64	4679.01
8.00	18.02	76.08	6768.70
9.00	19.68	95.21	9272.70
10.00	21.62	116.07	12115.27
11.00	23.28	138.68	15513.32
12.00	24.94	163.15	19423.76
13.00	27.16	189.56	23565.17
14.00	29.38	218.02	28235.78
15.00	31.32	248.61	33677.80
16.00	33.26	281.31	39754.41
17.00	35.48	316.00	46223.65
18.00	37.42	352.69	53573.39
19.00	39.08	391.26	61870.30
20.00	41.02	431.74	70584.60

END FTABLE 32

FTABLE 33

rows	cols			***
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.00	0.00	0.00	
0.15	0.49	0.04	0.18	
0.20	0.49	0.06	0.40	
0.25	0.49	0.09	0.68	
0.30	0.49	0.11	1.02	
0.35	0.49	0.14	1.42	
0.40	0.49	0.16	1.87	
0.45	0.49	0.18	2.36	
0.50	0.49	0.21	2.90	
0.55	0.49	0.23	3.49	
0.60	0.73	0.32	4.44	
0.65	0.97	0.44	6.25	
0.70	0.97	0.49	7.45	
0.75	0.97	0.54	8.74	
0.80	0.97	0.58	10.10	
0.85	0.97	0.63	11.54	
0.90	0.97	0.68	13.05	
0.95	0.97	0.73	14.64	
1.00	0.97	0.78	20.37	
1.25	1.46	1.22	32.95	
1.50	1.46	1.59	50.91	
1.75	1.70	2.06	70.88	
2.00	2.19	2.69	93.42	
2.25	3.41	3.41	103.61	
2.50	6.32	4.70	117.27	
2.75	7.78	6.54	176.96	
3.00	9.00	8.68	257.54	
3.25	9.97	11.08	361.32	
3.50	10.70	13.70	491.01	
3.75	11.43	16.53	642.65	
4.00	12.89	19.68	793.17	
4.25	14.11	23.14	979.13	
4.50	14.84	26.84	1211.81	
4.75	15.81	30.73	1455.57	
5.00	16.30	34.78	1753.48	
6.00	18.24	52.28	3208.28	
7.00	19.95	71.72	5119.46	
8.00	21.65	92.80	7446.07	
9.00	23.11	115.41	10253.30	
10.00	24.57	139.49	13496.36	
11.00	25.79	164.87	17266.71	
12.00	27.00	191.54	21495.07	
13.00	28.22	219.49	26188.85	
14.00	29.43	248.63	31337.33	

15.00	30.41	278.83	37118.35
16.00	31.87	310.52	43040.97
17.00	33.08	343.28	49610.75
18.00	34.30	377.25	56674.52
19.00	35.52	412.29	64201.25
20.00	36.49	448.42	72523.80

END FTABLE 33

FTABLE	34			
rows cols				***
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	1.06	0.05	0.00	
0.10	1.06	0.10	0.00	
0.15	1.06	0.15	0.36	
0.20	1.06	0.21	0.60	
0.25	1.06	0.26	0.88	
0.30	1.06	0.31	1.20	
0.35	1.06	0.36	1.55	
0.40	1.06	0.42	1.95	
0.45	1.06	0.47	2.37	
0.50	1.06	0.52	2.84	
0.55	1.06	0.58	3.33	
0.60	1.59	0.80	4.36	
0.65	2.11	1.05	5.72	
0.70	2.11	1.16	6.70	
0.75	2.11	1.26	7.75	
0.80	2.11	1.37	8.86	
0.85	2.11	1.48	10.03	
0.90	2.11	1.58	11.26	
0.95	2.11	1.69	12.54	
1.00	2.11	1.79	17.34	
1.25	2.64	2.51	26.19	
1.50	3.17	3.46	39.57	
1.75	3.17	4.26	55.78	
2.00	3.17	5.05	74.14	
2.25	4.23	6.50	93.01	
2.50	4.23	7.56	119.55	
2.75	4.75	8.82	142.76	
3.00	5.28	10.31	172.51	
3.25	5.28	11.63	210.91	
3.50	5.81	13.21	244.95	
3.75	6.87	15.12	274.63	
4.00	8.45	17.16	295.68	
4.25	18.49	21.28	252.52	
4.50	27.47	26.97	288.22	
4.75	32.23	34.62	393.02	
5.00	36.45	43.31	525.86	
6.00	47.55	85.99	1382.46	
7.00	56.53	138.76	2735.26	
8.00	64.98	200.04	4586.36	
9.00	72.91	269.80	6994.02	
10.00	78.72	346.63	10090.56	
11.00	80.83	426.91	14029.23	
12.00	84.53	510.56	18349.31	
13.00	88.76	597.67	23095.21	
14.00	91.93	688.46	28558.70	
15.00	95.10	782.22	34541.74	
16.00	97.74	878.98	41194.14	
17.00	100.38	978.55	48392.66	
18.00	103.55	1080.99	55954.58	
19.00	107.78	1187.16	63693.06	
20.00	112.01	1297.24	71968.46	

END FTABLE 34

FTABLE	35			
rows cols				***
48	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	

0.05	0.58	0.02	0.00
0.10	0.58	0.05	0.00
0.15	0.58	0.08	0.31
0.20	0.58	0.11	0.53
0.25	0.58	0.14	0.78
0.30	0.58	0.17	1.07
0.35	0.87	0.25	1.63
0.40	1.16	0.36	2.39
0.45	1.16	0.41	3.07
0.50	1.16	0.47	3.82
0.55	1.16	0.53	4.63
0.60	1.16	0.59	5.50
0.65	1.16	0.65	6.43
0.70	1.16	0.70	7.41
0.75	1.45	0.83	8.39
0.80	1.45	0.90	9.64
0.85	1.45	0.97	10.96
0.90	1.74	1.13	12.33
0.95	1.74	1.21	13.95
1.00	1.74	1.30	19.57
1.25	1.74	1.73	31.64
1.50	2.02	2.31	46.19
1.75	2.31	2.98	64.30
2.00	2.60	3.68	84.55
2.25	2.60	4.33	110.91
2.50	3.18	5.24	133.04
2.75	3.18	6.03	168.37
3.00	3.76	7.01	193.35
3.25	3.76	7.95	238.45
3.50	4.34	9.11	272.00
3.75	4.92	10.36	310.14
4.00	8.96	12.62	289.59
4.25	10.70	15.09	346.96
4.50	13.01	18.14	414.25
4.75	17.64	22.12	471.00
5.00	20.24	26.94	597.12
6.00	28.92	51.41	1382.44
7.00	36.73	85.17	2735.05
8.00	39.33	123.36	4845.61
9.00	42.51	164.42	7427.03
10.00	44.82	208.25	10629.77
11.00	47.42	254.60	14310.40
12.00	49.45	303.11	18612.29
13.00	52.34	354.08	23219.92
14.00	54.65	407.73	28540.45
15.00	56.97	463.62	34391.35
16.00	57.09	520.69	41671.23

END FTABLE 35

FTABLE	36			
rows cols				***
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.90	0.05	0.00	
0.15	0.90	0.10	0.14	
0.20	0.90	0.14	0.26	
0.25	0.90	0.19	0.41	
0.30	0.90	0.23	0.58	
0.35	0.90	0.28	0.78	
0.40	0.90	0.32	1.00	
0.45	0.90	0.37	1.24	
0.50	0.90	0.41	1.50	
0.55	0.90	0.46	1.78	
0.60	0.90	0.50	2.08	
0.65	1.79	0.84	3.07	
0.70	1.79	0.93	3.63	
0.75	1.79	1.02	4.23	
0.80	1.79	1.11	4.87	
0.85	1.79	1.20	5.55	

0.90	1.79	1.29	6.26
0.95	1.79	1.38	7.00
1.00	1.79	1.47	9.72
1.25	1.79	1.92	15.17
1.50	2.69	2.84	22.30
1.75	2.69	3.52	31.77
2.00	2.69	4.19	42.54
2.25	2.69	4.86	54.52
2.50	3.14	5.83	66.36
2.75	3.14	6.62	81.91
3.00	3.59	7.83	98.46
3.25	3.59	8.72	117.99
3.50	4.04	9.88	134.04
3.75	4.04	10.89	157.63
4.00	4.04	11.90	182.72
4.25	4.49	13.24	202.67
4.50	4.93	14.62	224.13
4.75	4.93	15.85	256.55
5.00	5.38	17.22	278.46
6.00	7.63	24.02	385.78
7.00	16.60	34.38	421.66
8.00	36.79	63.55	694.16
9.00	55.63	109.28	1302.51
10.00	71.33	171.99	2351.23
11.00	82.10	249.10	3970.41
12.00	85.08	333.57	6308.18
13.00	86.88	420.12	9136.72
14.00	89.12	508.51	12349.39
15.00	93.61	600.05	15750.29
16.00	96.30	695.44	19764.25
17.00	99.44	793.51	24104.80
18.00	101.68	894.72	29008.42
19.00	104.37	997.93	34198.17
20.00	106.62	1103.85	39889.37

END FTABLE 36

FTABLE 37

rows cols ***

52 5

depth	area	volume	outflow1	infiltr ***
0.00	0.00	0.00	0.0	0.0
0.05	0.00	0.00	0.0	0.0
0.10	0.40	0.02	0.0	0.0
0.15	0.40	0.04	0.0	0.0
0.20	3.21	0.40	0.0	0.0
0.25	3.61	0.58	0.0	0.0
0.30	3.61	0.76	0.0	0.0
0.35	3.61	0.94	0.0	0.0
0.40	3.61	1.12	0.0	0.0
0.45	3.61	1.30	0.0	0.0
0.50	3.61	1.48	0.0	1.15
0.55	3.61	1.66	0.0	1.15
0.60	3.61	1.84	0.0	1.15
0.65	3.61	2.02	0.0	1.15
0.70	4.01	2.33	0.0	1.15
0.75	4.01	2.53	0.0	1.15
0.80	4.01	2.73	0.0	1.15
0.85	4.01	2.93	0.0	1.15
0.90	4.01	3.13	0.0	1.15
0.95	4.41	3.39	0.0	1.15
1.00	4.41	3.61	0.0	1.15
1.25	4.81	4.96	0.0	1.15
1.50	4.81	6.16	0.0	1.15
1.75	4.81	7.36	0.0	1.15
2.00	4.81	8.56	0.0	1.15
2.25	5.21	10.04	0.0	1.15
2.50	5.61	11.66	0.0	1.15
2.75	5.61	13.06	0.0	1.15
3.00	5.61	14.47	0.0	1.15
3.25	6.01	16.05	18.0	1.15
3.50	6.01	17.55	42.3	1.15

3.75	6.41	19.39	64.5	1.15
4.00	6.41	21.00	92.5	1.15
4.25	6.41	22.60	121.9	1.15
4.50	6.81	24.38	144.7	1.15
4.75	6.81	26.08	177.8	1.15
5.00	7.62	28.56	202.5	1.15
6.00	7.62	36.18	364.5	1.15
7.00	8.02	44.25	536.7	1.15
8.00	8.82	53.54	724.2	1.15
9.00	23.25	64.77	493.6	1.15
10.00	121.44	163.38	848.8	1.15
11.00	137.48	293.43	2266.1	1.15
12.00	145.49	434.16	4305.8	1.15
13.00	161.92	588.76	6735.4	1.15
14.00	168.74	755.87	10001.4	1.15
15.00	181.96	931.81	13527.7	1.15
16.00	187.58	1115.25	17926.3	1.15
17.00	192.79	1306.71	22961.4	1.15
18.00	202.81	1506.17	28159.1	1.15
19.00	209.62	1712.77	34154.0	1.15
20.00	212.43	1924.30	41128.8	1.15

END FTABLE 37

FTABLE 38

rows	cols				***
48	5				
depth	area	volume	outflow1	infiltr ***	
0.00	0.00	0.00	0.0	0.0	
0.05	0.53	0.02	0.0	0.0	
0.10	0.79	0.06	0.0	0.0	
0.15	1.32	0.13	0.0	0.0	
0.20	1.58	0.21	0.0	0.0	
0.25	1.58	0.29	0.0	0.0	
0.30	1.58	0.37	0.0	0.0	
0.35	1.58	0.45	0.0	0.0	
0.40	2.11	0.60	0.0	0.0	
0.45	2.11	0.70	0.0	0.0	
0.50	2.11	0.81	0.0	0.85	
0.55	2.11	0.91	0.0	0.85	
0.60	2.11	1.02	0.0	0.85	
0.65	2.11	1.12	0.0	0.85	
0.70	2.11	1.23	0.0	0.85	
0.75	2.11	1.33	0.0	0.85	
0.80	2.11	1.44	0.0	0.85	
0.85	2.37	1.62	0.0	0.85	
0.90	2.63	1.81	0.0	0.85	
0.95	2.63	1.94	0.0	0.85	
1.00	2.63	2.07	0.0	0.85	
1.25	2.90	2.79	0.0	0.85	
1.50	3.16	3.62	0.0	0.85	
1.75	3.16	4.41	0.0	0.85	
2.00	3.68	5.43	0.0	0.85	
2.25	3.68	6.35	0.0	0.85	
2.50	3.68	7.27	0.0	0.85	
2.75	4.21	8.48	0.0	0.85	
3.00	4.74	9.68	0.0	0.85	
3.25	4.74	10.87	38.7	0.85	
3.50	5.00	12.14	74.3	0.85	
3.75	5.00	13.39	119.9	0.85	
4.00	5.26	14.73	159.9	0.85	
4.25	6.05	16.47	193.1	0.85	
4.50	6.32	18.06	243.2	0.85	
4.75	6.58	19.72	297.4	0.85	
5.00	7.11	21.51	344.3	0.85	
6.00	10.00	30.12	553.5	0.85	
7.00	15.79	43.22	809.8	0.85	
8.00	18.69	60.64	1377.4	0.85	
9.00	21.32	80.92	2128.7	0.85	
10.00	24.48	104.05	3023.1	0.85	
11.00	28.69	130.93	4048.2	0.85	
12.00	36.59	163.22	5014.8	0.85	

13.00	47.90	206.89	6266.9	0.85
14.00	54.48	257.58	8347.0	0.85
15.00	99.23	354.10	9543.2	0.85
16.00	101.60	455.17	14366.5	0.85

END FTABLE 38

FTABLE 39

rows	cols			***
44	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.52	0.03	0.00	
0.15	0.52	0.06	0.27	
0.20	0.52	0.09	0.48	
0.25	0.52	0.11	0.75	
0.30	0.52	0.14	1.05	
0.35	0.52	0.16	1.40	
0.40	0.52	0.19	1.79	
0.45	0.52	0.22	2.22	
0.50	0.52	0.24	2.68	
0.55	0.52	0.27	3.17	
0.60	0.78	0.37	4.10	
0.65	0.78	0.41	4.85	
0.70	0.78	0.45	5.64	
0.75	0.78	0.49	6.49	
0.80	0.78	0.53	7.38	
0.85	0.78	0.56	8.31	
0.90	0.78	0.60	9.29	
0.95	1.30	0.89	12.71	
1.00	1.30	0.96	17.85	
1.25	1.56	1.40	29.56	
1.50	2.08	1.94	42.36	
1.75	2.60	2.57	58.24	
2.00	4.94	3.66	68.60	
2.25	8.06	5.23	89.79	
2.50	9.36	7.48	147.42	
2.75	11.44	10.23	217.28	
3.00	12.48	13.29	317.17	
3.25	13.25	16.59	440.87	
3.50	14.81	20.24	570.33	
3.75	15.59	24.07	735.39	
4.00	16.89	28.20	908.25	
4.25	18.45	32.69	1095.22	
4.50	19.49	37.46	1325.28	
4.75	20.79	42.55	1569.60	
5.00	21.83	47.94	1853.70	
6.00	28.33	73.04	3143.26	
7.00	33.27	104.12	5099.50	
8.00	39.50	140.65	7506.27	
9.00	47.30	184.12	10429.25	
10.00	53.28	235.28	14497.09	
11.00	57.44	290.30	19572.48	
12.00	57.70	347.93	26389.05	

END FTABLE 39

FTABLE 40

rows	cols			***
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.66	0.05	0.00	
0.15	0.66	0.08	0.49	
0.20	0.66	0.11	0.89	
0.25	0.66	0.14	1.37	
0.30	0.66	0.18	1.93	
0.35	0.66	0.21	2.57	
0.40	0.66	0.24	3.27	
0.45	0.66	0.28	4.05	
0.50	0.66	0.31	4.89	

0.55	1.00	0.43	6.31
0.60	1.33	0.58	8.72
0.65	1.33	0.65	10.44
0.70	1.33	0.71	12.28
0.75	1.33	0.78	14.24
0.80	1.33	0.85	16.31
0.85	1.33	0.91	18.50
0.90	1.33	0.98	20.79
0.95	1.33	1.05	23.20
1.00	1.33	1.11	32.12
1.25	1.99	1.70	49.63
1.50	1.99	2.20	76.12
1.75	1.99	2.70	106.96
2.00	2.32	3.35	137.94
2.25	2.66	4.14	179.29
2.50	2.66	4.80	229.79
2.75	2.99	5.60	274.76
3.00	2.99	6.35	338.48
3.25	2.99	7.10	407.42
3.50	3.32	7.98	461.75
3.75	3.32	8.81	544.51
4.00	3.32	9.64	632.65
4.25	3.32	10.47	725.99
4.50	4.65	12.81	809.26
4.75	4.65	13.97	935.33
5.00	4.65	15.13	1068.61
6.00	5.65	20.81	1595.89
7.00	6.97	27.72	2236.12
8.00	7.64	35.32	3152.07
9.00	8.97	44.31	4133.99
10.00	10.29	54.31	5295.57
11.00	11.29	65.41	6791.79
12.00	12.95	78.04	8324.02
13.00	14.28	91.95	10256.06
14.00	15.94	107.37	12347.71
15.00	17.27	124.26	14938.86
16.00	19.26	142.83	17529.87
17.00	20.59	162.97	20898.47
18.00	22.58	185.08	24302.30
19.00	24.57	209.18	28182.23
20.00	27.23	235.50	32084.30

END FTABLE 40

FTABLE	41			***
rows cols				
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.47	0.02	0.00	
0.10	0.47	0.04	0.00	
0.15	0.47	0.07	0.82	
0.20	0.47	0.09	1.36	
0.25	0.47	0.11	2.00	
0.30	0.47	0.14	2.74	
0.35	0.47	0.16	3.57	
0.40	0.47	0.18	4.49	
0.45	0.47	0.21	5.48	
0.50	0.47	0.23	6.56	
0.55	0.47	0.25	7.71	
0.60	0.70	0.35	9.93	
0.65	0.94	0.47	13.27	
0.70	0.94	0.51	15.58	
0.75	0.94	0.56	18.03	
0.80	0.94	0.61	20.63	
0.85	0.94	0.65	23.36	
0.90	0.94	0.70	26.22	
0.95	0.94	0.75	29.22	
1.00	0.94	0.79	40.43	
1.25	1.41	1.21	62.16	
1.50	1.41	1.56	95.16	
1.75	1.64	2.02	131.74	

2.00	1.88	2.49	170.71
2.25	1.88	2.96	227.71
2.50	2.11	3.50	278.35
2.75	2.11	4.03	351.88
3.00	2.35	4.63	414.39
3.25	2.82	5.72	520.14
3.50	3.05	6.52	613.33
3.75	3.05	7.28	737.55
4.00	3.52	8.25	825.29
4.25	3.52	9.13	977.14
4.50	3.76	10.12	1110.66
4.75	3.99	11.16	1255.19
5.00	4.22	12.26	1413.58
6.00	5.16	17.11	2154.50
7.00	5.87	22.74	3180.25
8.00	6.81	29.34	4406.66
9.00	7.75	36.90	5925.49
10.00	8.92	45.49	7649.22
11.00	10.33	55.29	9608.26
12.00	11.50	66.28	12100.80
13.00	12.91	78.58	14886.24
14.00	13.85	92.10	18511.99
15.00	15.26	107.03	22302.16
16.00	17.13	123.56	26237.57
17.00	19.01	141.87	30832.89
18.00	20.89	162.01	36138.21
19.00	23.00	184.19	41991.12
20.00	25.35	208.73	48498.11

END FTABLE 41

FTABLE		42		
rows	cols			***
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.57	0.02	0.00	
0.10	0.57	0.05	0.00	
0.15	0.57	0.08	0.84	
0.20	0.57	0.11	1.39	
0.25	0.57	0.14	2.04	
0.30	0.57	0.17	2.78	
0.35	0.57	0.19	3.62	
0.40	0.57	0.22	4.54	
0.45	0.85	0.32	6.23	
0.50	0.85	0.36	7.68	
0.55	1.14	0.48	10.25	
0.60	1.14	0.54	12.34	
0.65	1.14	0.60	14.59	
0.70	1.14	0.65	16.99	
0.75	1.14	0.71	19.52	
0.80	1.14	0.77	22.20	
0.85	1.14	0.82	25.01	
0.90	1.14	0.88	27.96	
0.95	1.42	1.02	30.58	
1.00	1.42	1.09	42.79	
1.25	1.70	1.55	68.73	
1.50	1.70	1.98	102.94	
1.75	2.27	2.66	138.80	
2.00	2.27	3.23	191.68	
2.25	2.56	3.91	244.30	
2.50	2.84	4.70	308.48	
2.75	3.13	5.52	378.36	
3.00	3.41	6.40	457.14	
3.25	3.69	7.37	548.63	
3.50	3.98	8.41	650.73	
3.75	4.26	9.53	765.41	
4.00	4.83	10.81	869.30	
4.25	5.11	12.10	1009.31	
4.50	5.40	13.48	1166.38	
4.75	5.68	14.95	1338.38	
5.00	5.97	16.49	1526.25	

6.00	7.39	23.54	2395.75
7.00	8.52	31.74	3584.83
8.00	9.66	41.22	5096.88
9.00	11.08	51.96	6841.82
10.00	11.93	63.69	9141.83
11.00	13.35	76.75	11574.28
12.00	15.06	91.26	14259.55
13.00	16.48	107.26	17579.88
14.00	17.90	124.71	21392.42
15.00	19.32	143.63	25731.36
16.00	21.02	164.12	30378.75
17.00	22.45	185.95	35813.69
18.00	23.58	209.11	42145.43
19.00	25.86	234.44	47973.10
20.00	28.41	261.82	54173.52

END FTABLE 42

FTABLE 43

rows cols

52 5

depth	area	volume	outflow1	infiltr ***
0.00	0.00	0.00	0.0	0.0
0.05	0.63	0.02	0.0	0.0
0.10	0.63	0.05	0.0	0.0
0.15	0.95	0.11	0.0	0.0
0.20	0.95	0.16	0.0	0.0
0.25	0.95	0.20	0.0	0.0
0.30	1.27	0.30	0.0	0.0
0.35	1.58	0.40	0.0	0.0
0.40	1.58	0.48	0.0	0.0
0.45	1.58	0.56	0.0	0.0
0.50	1.58	0.63	0.0	0.76
0.55	1.58	0.71	0.0	0.76
0.60	1.58	0.79	0.0	0.76
0.65	1.90	0.94	0.0	0.76
0.70	1.90	1.03	0.0	0.76
0.75	2.22	1.19	0.0	0.76
0.80	2.22	1.30	0.0	0.76
0.85	2.22	1.41	0.0	0.76
0.90	2.22	1.53	0.0	0.76
0.95	2.22	1.64	0.0	0.76
1.00	2.22	1.75	0.0	0.76
1.25	2.22	2.30	0.0	0.76
1.50	2.85	3.18	0.0	0.76
1.75	3.17	3.96	0.0	0.76
2.00	3.48	4.88	0.0	0.76
2.25	3.48	5.75	0.0	0.76
2.50	3.80	6.78	0.0	0.76
2.75	4.12	7.81	0.0	0.76
3.00	4.43	9.04	0.0	0.76
3.25	4.75	10.26	44.1	0.76
3.50	5.07	11.53	91.5	0.76
3.75	5.70	13.02	135.7	0.76
4.00	5.70	14.45	207.5	0.76
4.25	6.02	15.99	272.0	0.76
4.50	6.65	17.73	329.0	0.76
4.75	6.65	19.39	421.4	0.76
5.00	6.97	21.16	502.1	0.76
6.00	8.23	29.11	890.9	0.76
7.00	12.98	39.65	1161.7	0.76
8.00	18.05	56.16	1774.6	0.76
9.00	22.48	76.90	2701.8	0.76
10.00	26.92	102.65	3986.4	0.76
11.00	30.40	131.41	5645.4	0.76
12.00	34.83	164.60	7585.8	0.76
13.00	38.32	201.47	10048.6	0.76
14.00	42.12	242.13	12886.8	0.76
15.00	46.24	286.44	16086.1	0.76
16.00	50.04	335.12	19883.7	0.76
17.00	53.84	387.35	24161.6	0.76
18.00	58.27	443.92	28816.3	0.76

```

19.00    59.54    502.94    35028.1    0.76
20.00    60.49    563.03    41879.9    0.76
END FTABLE 43

```

```

FTABLE      44
rows cols
52      4
depth      area      volume  outflow1 ***
0.00      0.00      0.00    0.00
0.05      0.00      0.00    0.00
0.10      0.52      0.03    0.00
0.15      0.52      0.06    0.64
0.20      0.52      0.09    1.16
0.25      0.52      0.11    1.81
0.30      0.52      0.14    2.58
0.35      0.52      0.16    3.44
0.40      0.52      0.19    4.40
0.45      0.52      0.22    5.45
0.50      0.52      0.24    6.59
0.55      0.52      0.27    7.82
0.60      0.52      0.30    9.13
0.65      0.52      0.32    10.51
0.70      0.52      0.35    11.98
0.75      0.52      0.37    13.52
0.80      0.52      0.40    15.13
0.85      0.52      0.43    16.82
0.90      0.52      0.45    18.58
0.95      0.79      0.60    22.29
1.00      0.79      0.64    30.99
1.25      1.05      1.01    55.39
1.50      1.05      1.28    81.21
1.75      1.05      1.54    110.83
2.00      1.31      1.95    141.31
2.25      1.57      2.44    182.29
2.50      1.57      2.84    233.65
2.75      1.57      3.23    289.97
3.00      1.57      3.62    351.06
3.25      1.83      4.21    405.23
3.50      2.09      4.85    468.15
3.75      2.09      5.37    555.34
4.00      2.09      5.90    648.39
4.25      2.36      6.57    717.08
4.50      2.36      7.16    827.33
4.75      2.36      7.75    943.79
5.00      2.36      8.34    1066.32
6.00      2.88     11.40    1558.63
7.00      3.40     14.80    2152.19
8.00      3.66     18.47    2963.15
9.00      4.19     22.83    3860.91
10.00     4.71     27.60    4889.84
11.00     5.23     32.86    6104.58
12.00     5.50     38.33    7628.53
13.00     5.76     44.26    9377.28
14.00     6.28     50.63   11046.19
15.00     6.54     57.13   13133.40
16.00     7.07     64.18   15135.68
17.00     7.07     71.25   18013.56
18.00     7.59     79.04   20354.51
19.00     7.85     86.91   23303.76
20.00     8.11     95.16   26525.06
END FTABLE 44

```

```

FTABLE      45
rows cols
52      5
depth      area      volume  outflow1  infilt ***
0.00      0.00      0.00    0.0    0.0
0.05      0.72      0.03    0.0    0.0
0.10      0.72      0.06    0.0    0.0
0.15      1.44      0.16    0.0    0.0
0.20      1.44      0.24    0.0    0.0

```

0.25	1.44	0.31	0.0	0.0
0.30	1.80	0.42	0.0	0.0
0.35	1.80	0.51	0.0	0.0
0.40	1.80	0.60	0.0	0.0
0.45	2.16	0.76	0.0	0.0
0.50	2.52	0.92	0.0	1.03
0.55	2.52	1.04	0.0	1.03
0.60	2.52	1.17	0.0	1.03
0.65	2.52	1.30	0.0	1.03
0.70	2.52	1.42	0.0	1.03
0.75	2.52	1.55	0.0	1.03
0.80	2.52	1.67	0.0	1.03
0.85	2.89	1.87	0.0	1.03
0.90	3.25	2.10	0.0	1.03
0.95	3.25	2.26	0.0	1.03
1.00	3.25	2.43	0.0	1.03
1.25	3.25	3.24	0.0	1.03
1.50	3.25	4.05	0.0	1.03
1.75	3.61	5.06	0.0	1.03
2.00	4.33	6.47	0.0	1.03
2.25	4.69	7.70	0.0	1.03
2.50	4.69	8.87	0.0	1.03
2.75	4.69	10.04	0.0	1.03
3.00	5.77	11.84	0.0	1.03
3.25	5.77	13.28	43.2	1.03
3.50	6.13	14.85	81.8	1.03
3.75	6.13	16.38	132.7	1.03
4.00	6.85	18.24	170.0	1.03
4.25	6.85	19.96	230.4	1.03
4.50	6.85	21.67	294.3	1.03
4.75	7.57	23.76	339.1	1.03
5.00	7.57	25.65	413.2	1.03
6.00	9.02	34.38	690.6	1.03
7.00	10.46	44.46	1039.6	1.03
8.00	11.54	55.69	1491.9	1.03
9.00	14.07	69.24	1933.5	1.03
10.00	15.87	84.51	2546.3	1.03
11.00	18.03	101.78	3240.6	1.03
12.00	20.56	121.21	4022.0	1.03
13.00	23.44	143.54	4930.8	1.03
14.00	25.97	168.62	6071.5	1.03
15.00	28.13	196.03	7444.5	1.03
16.00	31.02	225.95	8879.4	1.03
17.00	33.18	258.23	10646.4	1.03
18.00	35.35	292.78	12622.1	1.03
19.00	37.51	329.64	14819.5	1.03
20.00	39.32	368.36	17317.1	1.03

END FTABLE 45

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.41	0.01	0.00	
0.10	0.41	0.03	0.00	
0.15	0.41	0.05	0.66	
0.20	0.41	0.07	1.12	
0.25	0.61	0.12	1.96	
0.30	0.61	0.15	2.85	
0.35	0.61	0.18	3.87	
0.40	0.61	0.21	5.00	
0.45	0.82	0.29	6.92	
0.50	0.82	0.33	8.61	
0.55	0.82	0.37	10.44	
0.60	1.02	0.44	11.73	
0.65	1.02	0.49	14.10	
0.70	1.02	0.54	16.64	
0.75	1.43	0.70	20.33	
0.80	1.43	0.77	23.93	
0.85	1.43	0.84	27.76	

0.90	1.43	0.91	31.81
0.95	1.43	0.98	36.07
1.00	1.43	1.06	50.69
1.25	1.84	1.55	81.20
1.50	1.84	2.01	125.24
1.75	2.25	2.60	167.44
2.00	2.66	3.22	214.70
2.25	2.66	3.89	293.58
2.50	3.07	4.67	362.65
2.75	3.07	5.44	467.29
3.00	3.48	6.35	556.94
3.25	3.89	7.34	658.62
3.50	4.30	8.42	774.01
3.75	4.50	9.55	924.90
4.00	4.91	10.79	1070.86
4.25	5.52	12.17	1209.73
4.50	5.93	13.66	1398.06
4.75	6.34	15.25	1606.69
5.00	6.96	16.97	1806.83
6.00	8.80	25.07	2960.34
7.00	10.84	35.08	4509.96
8.00	12.69	47.06	6630.43
9.00	14.53	61.06	9348.26
10.00	16.78	77.06	12518.47
11.00	18.82	95.24	16507.21
12.00	19.23	114.41	22088.35

END FTABLE 46

FTABLE 47				***		
rows	cols			***		
50	4	depth	area	volume	outflow1	***
		0.00	0.00	0.00	0.00	
		0.05	0.58	0.02	0.00	
		0.10	0.58	0.05	0.00	
		0.15	0.58	0.08	0.66	
		0.20	0.58	0.11	1.12	
		0.25	0.58	0.14	1.67	
		0.30	0.58	0.17	2.30	
		0.35	0.58	0.19	3.01	
		0.40	0.58	0.22	3.79	
		0.45	1.16	0.39	5.97	
		0.50	1.16	0.45	7.53	
		0.55	1.16	0.50	9.23	
		0.60	1.16	0.56	11.07	
		0.65	1.16	0.62	13.03	
		0.70	1.16	0.68	15.13	
		0.75	1.45	0.79	16.69	
		0.80	1.45	0.86	19.33	
		0.85	1.74	1.00	22.03	
		0.90	1.74	1.09	25.32	
		0.95	1.74	1.17	28.78	
		1.00	1.74	1.26	40.53	
		1.25	2.03	1.79	65.31	
		1.50	2.32	2.43	99.43	
		1.75	2.90	3.21	136.49	
		2.00	3.48	4.07	179.97	
		2.25	4.06	5.07	233.59	
		2.50	4.35	6.16	309.16	
		2.75	5.22	7.47	377.58	
		3.00	5.80	8.92	472.77	
		3.25	6.39	10.51	584.09	
		3.50	6.97	12.25	711.47	
		3.75	7.55	14.11	853.46	
		4.00	7.84	16.06	1032.80	
		4.25	8.13	18.13	1233.62	
		4.50	9.00	20.47	1411.08	
		4.75	9.58	22.87	1627.82	
		5.00	10.16	25.39	1863.29	
		6.00	11.90	36.49	3068.89	
		7.00	13.64	49.39	4639.56	

8.00	15.67	64.28	6561.23
9.00	17.70	81.19	8929.04
10.00	19.45	100.08	11886.13
11.00	21.48	120.99	15261.25
12.00	23.80	143.90	19027.25
13.00	25.54	168.85	23696.05
14.00	28.15	196.05	28485.71
15.00	30.47	225.78	34192.47
16.00	33.09	258.24	40492.35
17.00	35.99	293.39	47362.53
18.00	36.28	329.67	57215.51

END FTABLE 47

FTABLE 48

rows cols ***

49 4

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.63	0.03	0.00	
0.10	0.63	0.06	0.00	
0.15	0.63	0.09	0.67	
0.20	0.63	0.13	1.09	
0.25	0.63	0.16	1.58	
0.30	0.63	0.19	2.15	
0.35	0.63	0.22	2.77	
0.40	0.95	0.32	3.89	
0.45	1.26	0.44	5.53	
0.50	1.26	0.50	6.91	
0.55	1.26	0.57	8.41	
0.60	1.26	0.63	10.03	
0.65	1.26	0.69	11.76	
0.70	1.26	0.76	13.60	
0.75	1.58	0.88	14.98	
0.80	1.58	0.96	17.29	
0.85	1.89	1.11	19.78	
0.90	1.89	1.21	22.66	
0.95	1.89	1.30	25.70	
1.00	1.89	1.40	36.10	
1.25	2.52	2.09	58.18	
1.50	3.47	2.97	84.72	
1.75	4.42	4.02	119.21	
2.00	5.68	5.29	159.48	
2.25	6.31	6.84	228.21	
2.50	7.57	8.68	300.52	
2.75	8.20	10.65	400.83	
3.00	8.84	12.88	523.71	
3.25	9.78	15.32	653.51	
3.50	10.41	17.94	815.50	
3.75	11.04	20.72	997.49	
4.00	12.62	23.79	1148.74	
4.25	13.25	27.05	1377.32	
4.50	14.20	30.55	1611.08	
4.75	14.83	34.26	1894.25	
5.00	15.78	38.18	2178.09	
6.00	18.93	55.76	3625.52	
7.00	21.46	76.29	5622.88	
8.00	23.35	99.01	8206.02	
9.00	25.56	123.78	11207.87	
10.00	27.77	150.70	14720.67	
11.00	30.29	179.83	18648.31	
12.00	32.82	211.43	23154.68	
13.00	35.03	245.46	28430.85	
14.00	37.55	282.08	34221.56	
15.00	40.71	321.51	40333.92	
16.00	45.75	365.35	46174.03	
17.00	46.38	411.71	55835.66	

END FTABLE 48

FTABLE 49

rows cols ***

52 4

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.26	0.01	0.00	
0.10	0.26	0.02	0.00	
0.15	0.26	0.04	0.41	
0.20	0.26	0.05	0.68	
0.25	0.26	0.06	1.01	
0.30	0.26	0.08	1.39	
0.35	0.26	0.09	1.81	
0.40	0.26	0.10	2.28	
0.45	0.26	0.11	2.79	
0.50	0.26	0.13	3.34	
0.55	0.39	0.18	4.48	
0.60	0.39	0.20	5.32	
0.65	0.39	0.22	6.22	
0.70	0.39	0.24	7.18	
0.75	0.52	0.31	9.07	
0.80	0.52	0.33	10.39	
0.85	0.52	0.36	11.78	
0.90	0.52	0.39	13.24	
0.95	0.52	0.41	14.77	
1.00	0.52	0.44	20.45	
1.25	0.65	0.63	32.29	
1.50	0.91	0.89	46.01	
1.75	1.04	1.15	64.42	
2.00	1.17	1.46	88.70	
2.25	1.70	1.86	104.16	
2.50	2.22	2.36	129.71	
2.75	2.87	3.05	167.63	
3.00	3.13	3.82	230.29	
3.25	3.52	4.69	299.26	
3.50	3.92	5.67	382.27	
3.75	4.31	6.72	477.12	
4.00	4.57	7.86	595.27	
4.25	4.96	9.11	720.52	
4.50	5.35	10.45	861.42	
4.75	5.61	11.86	1030.62	
5.00	6.00	13.36	1201.62	
6.00	7.18	20.09	2104.85	
7.00	8.48	27.99	3272.41	
8.00	9.40	37.11	4890.88	
9.00	10.31	47.16	6856.03	
10.00	11.23	58.04	9155.43	
11.00	12.01	69.77	11893.00	
12.00	12.92	82.38	14939.88	
13.00	13.84	95.90	18388.12	
14.00	15.01	110.47	22046.76	
15.00	16.45	126.41	25971.87	
16.00	17.36	143.46	30933.17	
17.00	18.27	161.40	36376.58	
18.00	19.97	180.64	41370.62	
19.00	25.58	203.10	42654.67	
20.00	27.93	230.18	49564.81	

END FTABLE 49

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.00	0.00	0.00	
0.15	0.52	0.05	0.27	
0.20	0.52	0.08	0.53	
0.25	0.52	0.10	0.87	
0.30	0.52	0.13	1.27	
0.35	0.52	0.15	1.72	
0.40	0.78	0.23	2.64	
0.45	0.78	0.27	3.41	
0.50	1.04	0.37	4.58	
0.55	1.04	0.42	5.71	

0.60	1.04	0.47	6.94
0.65	1.04	0.52	8.26
0.70	1.04	0.57	9.67
0.75	1.29	0.68	11.03
0.80	1.55	0.79	12.60
0.85	1.55	0.87	14.74
0.90	1.55	0.95	17.00
0.95	2.07	1.09	17.70
1.00	2.59	1.22	23.07
1.25	4.14	2.06	40.41
1.50	6.21	3.40	71.19
1.75	7.25	5.11	126.96
2.00	10.10	7.26	182.77
2.25	11.13	10.02	292.82
2.50	12.94	13.21	419.55
2.75	15.53	16.81	555.28
3.00	18.12	21.14	734.62
3.25	19.68	25.93	977.24
3.50	20.97	31.06	1265.33
3.75	22.26	36.50	1591.44
4.00	23.30	42.27	1971.75
4.25	23.82	48.22	2419.37
4.50	25.11	54.53	2866.76
4.75	26.92	61.14	3312.03
5.00	28.22	68.08	3839.34
6.00	32.10	98.55	6526.74
7.00	36.50	133.29	9909.59
8.00	40.13	172.12	14246.32
9.00	45.56	215.77	19077.53
10.00	49.71	263.65	25142.07
11.00	54.11	316.14	32154.68
12.00	57.21	371.88	40608.96
13.00	59.55	430.34	50435.76

END FTABLE 50

FTABLE		52		
rows	cols			***
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.00	0.00	0.00	
0.15	0.65	0.06	0.24	
0.20	0.65	0.09	0.51	
0.25	0.65	0.12	0.86	
0.30	0.65	0.15	1.29	
0.35	0.65	0.19	1.77	
0.40	0.65	0.22	2.32	
0.45	0.65	0.25	2.93	
0.50	0.98	0.35	3.82	
0.55	0.98	0.40	4.76	
0.60	0.98	0.45	5.78	
0.65	1.31	0.60	7.82	
0.70	1.31	0.67	9.29	
0.75	1.31	0.73	10.86	
0.80	1.31	0.80	12.52	
0.85	1.31	0.86	14.28	
0.90	1.31	0.93	16.13	
0.95	1.31	0.99	18.07	
1.00	1.31	1.06	25.11	
1.25	1.63	1.54	40.33	
1.50	1.96	2.10	60.02	
1.75	2.29	2.73	83.74	
2.00	2.61	3.39	110.03	
2.25	2.61	4.05	147.55	
2.50	2.94	4.84	183.70	
2.75	3.92	6.12	224.17	
3.00	4.25	7.17	277.06	
3.25	4.57	8.32	337.59	
3.50	5.23	9.67	396.96	
3.75	5.55	11.04	475.27	

4.00	5.55	12.42	579.02
4.25	6.21	14.11	664.48
4.50	7.19	15.89	735.41
4.75	7.51	17.74	857.42
5.00	7.84	19.66	989.39
6.00	10.45	29.16	1576.82
7.00	12.08	40.74	2499.48
8.00	14.70	54.73	3590.23
9.00	16.33	70.59	5114.68
10.00	17.96	88.17	6952.15
11.00	19.60	107.40	9112.90
12.00	20.90	127.98	11691.76
13.00	22.21	149.85	14600.45
14.00	23.52	172.88	17832.05
15.00	24.50	197.02	21574.31
16.00	25.80	222.43	25504.32
17.00	26.78	248.95	30009.82
18.00	28.09	276.58	34636.67
19.00	28.74	305.15	40178.77
20.00	29.72	334.83	45854.46

END FTABLE 52

FTABLE		53		
rows	cols			***
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.78	0.04	0.00	
0.15	0.78	0.08	0.31	
0.20	0.78	0.12	0.61	
0.25	0.78	0.16	0.98	
0.30	0.78	0.19	1.42	
0.35	0.78	0.23	1.92	
0.40	1.16	0.36	2.98	
0.45	1.55	0.49	4.20	
0.50	1.55	0.57	5.36	
0.55	1.55	0.65	6.62	
0.60	1.55	0.73	7.99	
0.65	1.55	0.80	9.46	
0.70	1.94	0.96	10.90	
0.75	1.94	1.05	12.80	
0.80	1.94	1.15	14.82	
0.85	1.94	1.25	16.96	
0.90	1.94	1.34	19.22	
0.95	1.94	1.44	21.58	
1.00	1.94	1.54	30.07	
1.25	2.33	2.23	49.50	
1.50	3.10	3.09	70.11	
1.75	3.10	3.87	101.79	
2.00	3.49	4.79	134.43	
2.25	3.88	5.87	175.61	
2.50	4.27	6.96	218.91	
2.75	4.65	8.25	274.40	
3.00	5.43	9.69	323.89	
3.25	5.43	11.05	402.94	
3.50	6.20	12.65	461.59	
3.75	7.37	14.51	517.86	
4.00	7.76	16.41	614.51	
4.25	8.92	18.58	688.47	
4.50	9.31	20.86	811.66	
4.75	10.08	23.37	930.18	
5.00	10.86	26.07	1062.85	
6.00	15.51	40.10	1719.25	
7.00	18.22	57.59	2822.93	
8.00	20.94	77.59	4228.73	
9.00	23.27	100.05	6022.19	
10.00	25.98	124.95	8104.30	
11.00	29.86	153.17	10374.54	
12.00	34.90	185.48	12866.88	
13.00	46.53	226.49	14825.75	

14.00	50.80	275.52	19386.73
15.00	52.74	327.72	25246.02
16.00	54.29	381.52	31897.08
17.00	55.84	436.89	39232.56
18.00	57.39	494.12	47291.05
19.00	60.10	553.49	55397.32
20.00	62.82	615.56	64213.04

END FTABLE 53

FTABLE 54

rows	cols			***
52	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.74	0.03	0.00	
0.10	0.74	0.07	0.00	
0.15	0.74	0.11	0.68	
0.20	0.74	0.15	1.10	
0.25	0.74	0.18	1.61	
0.30	0.74	0.22	2.19	
0.35	1.49	0.40	3.70	
0.40	1.49	0.47	4.92	
0.45	1.49	0.55	6.28	
0.50	1.49	0.62	7.77	
0.55	1.49	0.70	9.38	
0.60	1.49	0.77	11.11	
0.65	1.49	0.84	12.96	
0.70	1.49	0.92	14.92	
0.75	1.49	0.99	16.99	
0.80	1.49	1.07	19.16	
0.85	1.86	1.24	21.27	
0.90	2.23	1.45	24.37	
0.95	2.23	1.56	27.57	
1.00	2.23	1.68	38.66	
1.25	2.23	2.23	62.42	
1.50	2.61	2.92	87.93	
1.75	2.98	3.76	122.38	
2.00	2.98	4.51	165.35	
2.25	3.72	5.55	201.76	
2.50	3.72	6.48	261.19	
2.75	4.09	7.56	316.82	
3.00	4.09	8.59	391.45	
3.25	4.47	9.73	454.59	
3.50	4.84	11.10	535.69	
3.75	5.21	12.41	613.82	
4.00	5.21	13.71	724.93	
4.25	5.21	15.01	843.31	
4.50	5.58	16.54	944.92	
4.75	5.96	18.17	1058.14	
5.00	6.33	19.79	1172.32	
6.00	7.82	27.24	1734.02	
7.00	8.56	35.64	2554.64	
8.00	9.68	45.32	3514.18	
9.00	11.17	56.29	4583.08	
10.00	11.91	68.12	6031.99	
11.00	13.40	81.29	7486.92	
12.00	14.52	95.52	9286.10	
13.00	15.63	110.92	11339.01	
14.00	16.75	127.55	13667.23	
15.00	18.24	145.36	16058.89	
16.00	19.35	164.55	18979.14	
17.00	20.47	184.86	22195.28	
18.00	21.96	206.52	25480.29	
19.00	23.08	229.32	29355.10	
20.00	24.19	253.39	33596.01	

END FTABLE 54

FTABLE 56

rows	cols			***
51	4			
depth	area	volume	outflow1	***

0.00	0.00	0.00	0.00
0.05	0.68	0.03	0.00
0.10	1.36	0.08	0.00
0.15	2.38	0.19	0.79
0.20	2.72	0.33	1.74
0.25	3.06	0.51	3.35
0.30	3.06	0.66	5.19
0.35	4.08	0.88	6.94
0.40	4.42	1.10	9.49
0.45	4.42	1.32	12.87
0.50	4.42	1.54	16.66
0.55	5.43	1.87	20.02
0.60	6.11	2.17	23.84
0.65	9.17	2.64	25.17
0.70	9.51	3.13	32.61
0.75	10.87	3.71	39.49
0.80	11.55	4.28	48.24
0.85	11.55	4.86	59.56
0.90	11.55	5.44	71.82
0.95	11.89	6.04	84.10
1.00	11.89	6.64	122.91
1.25	12.91	9.83	223.86
1.50	13.25	13.14	356.56
1.75	13.92	16.65	512.11
2.00	14.26	20.22	696.55
2.25	15.28	24.06	888.36
2.50	16.98	28.15	1075.72
2.75	17.66	32.51	1332.07
3.00	19.02	37.19	1586.71
3.25	20.38	42.09	1862.33
3.50	23.43	47.73	2092.79
3.75	24.11	53.83	2508.44
4.00	24.79	60.06	2955.04
4.25	25.47	66.39	3430.01
4.50	26.15	72.93	3941.39
4.75	28.87	79.88	4295.19
5.00	31.25	87.48	4740.38
6.00	40.76	125.38	7235.30
7.00	43.81	168.00	11226.76
8.00	46.53	213.35	16061.46
9.00	51.96	262.34	21058.61
10.00	66.57	326.77	25750.17
11.00	69.96	395.29	34209.66
12.00	75.74	467.51	42919.12
13.00	78.45	545.00	54130.55
14.00	79.81	624.15	67084.98
15.00	81.51	704.86	81010.96
16.00	84.91	788.06	94951.46
17.00	85.93	873.83	111897.81
18.00	86.95	960.54	129977.90
19.00	87.28	1047.57	149802.11

END FTABLE 56

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.00	0.00	0.00	
0.15	0.71	0.06	0.35	
0.20	0.71	0.10	0.75	
0.25	0.71	0.13	1.27	
0.30	0.71	0.17	1.89	
0.35	0.71	0.20	2.61	
0.40	0.71	0.24	3.42	
0.45	0.71	0.27	4.31	
0.50	0.71	0.31	5.28	
0.55	1.06	0.45	7.53	
0.60	1.06	0.50	9.08	
0.65	1.06	0.56	10.73	

0.70	1.06	0.61	12.50
0.75	1.42	0.78	15.54
0.80	1.42	0.85	17.97
0.85	1.42	0.92	20.53
0.90	1.42	0.99	23.23
0.95	1.42	1.06	26.06
1.00	1.42	1.13	36.28
1.25	1.77	1.63	56.98
1.50	1.77	2.07	85.11
1.75	2.13	2.73	118.72
2.00	2.13	3.26	159.80
2.25	2.13	3.79	205.62
2.50	2.48	4.59	254.32
2.75	2.84	5.43	307.19
3.00	2.84	6.14	376.95
3.25	3.19	7.05	438.10
3.50	3.55	8.00	504.16
3.75	3.55	8.88	600.74
4.00	3.55	9.77	703.98
4.25	3.55	10.66	813.66
4.50	3.90	11.82	904.97
4.75	4.26	13.03	1003.36
5.00	4.26	14.10	1143.58
6.00	5.32	19.25	1656.58
7.00	6.03	25.14	2375.84
8.00	6.74	31.79	3260.71
9.00	7.45	39.20	4322.83
10.00	8.16	47.29	5556.02
11.00	8.87	56.08	6979.65
12.00	9.58	65.58	8601.90
13.00	10.29	75.80	10438.34
14.00	10.64	86.53	12729.65
15.00	12.06	98.59	14542.33
16.00	12.77	111.15	17104.55
17.00	13.48	124.54	19942.05
18.00	14.54	138.86	22738.28
19.00	15.25	153.99	26177.02
20.00	16.32	170.11	29555.54

END FTABLE 57

FTABLE 58

rows cols ***

28 4

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.35	0.15	0.03	0.36	
0.70	0.23	0.11	2.74	
0.95	0.23	0.17	5.56	
1.00	0.31	0.21	8.04	
1.50	0.39	0.40	21.19	
1.75	1.39	0.57	16.06	
2.00	2.09	1.03	33.05	
2.25	2.32	1.63	66.12	
2.50	2.55	2.26	107.40	
2.75	2.63	2.92	161.31	
3.00	2.94	3.65	217.68	
3.25	3.25	4.44	282.27	
3.50	5.03	5.63	313.11	
3.75	5.49	6.96	421.30	
4.00	5.96	8.42	548.03	
4.25	6.58	10.03	686.37	
4.50	7.04	11.77	855.98	
4.75	7.51	13.61	1045.30	
5.00	8.13	15.59	1244.49	
6.00	9.67	24.55	2361.41	
7.00	11.04	35.04	3911.08	
8.00	11.66	46.47	6038.48	
9.00	12.36	58.56	8539.76	
10.00	13.13	71.35	11399.17	
11.00	15.53	85.66	13822.73	

```

12.00    16.77    101.89    17540.97
13.00    18.08    119.52    21761.51
END FTABLE 58

```

```

FTABLE      59
rows cols
39      4
depth      area      volume      outflow1 ***
0.00      0.00      0.00      0.00
0.05      0.49      0.02      0.00
0.10      0.49      0.05      0.00
0.15      0.49      0.07      0.28
0.20      0.49      0.10      0.46
0.25      0.49      0.12      0.68
0.30      0.73      0.18      1.02
0.35      0.73      0.22      1.39
0.40      0.73      0.25      1.80
0.45      0.73      0.29      2.25
0.50      0.97      0.39      3.09
0.55      0.97      0.44      3.75
0.60      0.97      0.49      4.47
0.65      0.97      0.54      5.23
0.70      1.22      0.64      6.04
0.75      1.22      0.70      7.02
0.80      1.22      0.76      8.07
0.85      1.22      0.82      9.17
0.90      1.46      0.94      10.15
0.95      1.70      1.05      11.05
1.00      1.70      1.14      15.72
1.25      2.19      1.66      24.99
1.50      2.68      2.31      37.86
1.75      3.89      3.20      50.87
2.00      5.11      4.34      70.47
2.25      9.24      6.35      89.50
2.50     10.70      8.95     143.70
2.75     12.65     12.00     209.77
3.00     14.84     15.48     288.35
3.25     16.30     19.41     394.71
3.50     17.52     23.70     524.98
3.75     19.46     28.43     662.50
4.00     22.14     33.68     806.71
4.25     24.08     39.55     996.81
4.50     27.98     46.44    1178.87
4.75     29.92     53.76    1438.47
5.00     31.14     61.47    1751.49
6.00     37.95     96.07    3231.20
7.00     44.27    138.23    5347.20
END FTABLE 59

```

```

FTABLE      60
rows cols
40      4
depth      area      volume      outflow1 ***
0.00      0.00      0.00      0.00
0.05      0.00      0.00      0.00
0.10      0.52      0.03      0.00
0.15      0.52      0.06      0.17
0.20      0.52      0.08      0.32
0.25      0.52      0.11      0.50
0.30      0.52      0.13      0.72
0.35      0.52      0.16      0.97
0.40      0.52      0.19      1.24
0.45      0.78      0.28      1.83
0.50      0.78      0.31      2.28
0.55      0.78      0.35      2.77
0.60      0.78      0.39      3.30
0.65      0.78      0.43      3.87
0.70      0.78      0.47      4.47
0.75      0.78      0.51      5.10
0.80      1.56      0.80      6.75
0.85      1.56      0.87      7.88

```

0.90	1.56	0.95	9.09
0.95	1.56	1.03	10.37
1.00	1.56	1.11	14.63
1.25	2.08	1.65	23.51
1.50	7.27	2.53	20.76
1.75	12.73	5.10	46.20
2.00	15.84	8.83	99.55
2.25	18.96	13.39	176.80
2.50	22.08	18.66	277.60
2.75	26.75	24.93	395.99
3.00	30.39	32.23	558.05
3.25	32.47	40.15	770.11
3.50	34.54	48.59	1015.66
3.75	36.10	57.50	1305.44
4.00	37.66	66.79	1629.24
4.25	41.04	76.75	1939.72
4.50	42.85	87.37	2339.04
4.75	45.45	98.55	2748.80
5.00	48.83	110.45	3168.99
6.00	58.70	164.39	5438.28
7.00	62.59	225.44	8819.63
8.00	62.81	288.31	13257.73

END FTABLE 60

*** SET TO SAME FTABLE AS 60

FTABLE 61

rows cols ***

40 4

depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.05	0.00	0.00	0.00	
0.10	0.52	0.03	0.00	
0.15	0.52	0.06	0.17	
0.20	0.52	0.08	0.32	
0.25	0.52	0.11	0.50	
0.30	0.52	0.13	0.72	
0.35	0.52	0.16	0.97	
0.40	0.52	0.19	1.24	
0.45	0.78	0.28	1.83	
0.50	0.78	0.31	2.28	
0.55	0.78	0.35	2.77	
0.60	0.78	0.39	3.30	
0.65	0.78	0.43	3.87	
0.70	0.78	0.47	4.47	
0.75	0.78	0.51	5.10	
0.80	1.56	0.80	6.75	
0.85	1.56	0.87	7.88	
0.90	1.56	0.95	9.09	
0.95	1.56	1.03	10.37	
1.00	1.56	1.11	14.63	
1.25	2.08	1.65	23.51	
1.50	7.27	2.53	20.76	
1.75	12.73	5.10	46.20	
2.00	15.84	8.83	99.55	
2.25	18.96	13.39	176.80	
2.50	22.08	18.66	277.60	
2.75	26.75	24.93	395.99	
3.00	30.39	32.23	558.05	
3.25	32.47	40.15	770.11	
3.50	34.54	48.59	1015.66	
3.75	36.10	57.50	1305.44	
4.00	37.66	66.79	1629.24	
4.25	41.04	76.75	1939.72	
4.50	42.85	87.37	2339.04	
4.75	45.45	98.55	2748.80	
5.00	48.83	110.45	3168.99	
6.00	58.70	164.39	5438.28	
7.00	62.59	225.44	8819.63	
8.00	62.81	288.31	13257.73	

END FTABLE61

```

*** lakes
FTABLE 100
rows cols
26 4
depth area volume outflow1 ***
0.00 0.00 0.00 0.00
0.1 3.46 0.46 0.00
1 3.47 4.58 0.00
1.5 3.48 6.89 119.5
2 3.49 9.2 577.88
2.5 3.5 11.52 1088.95
3 3.51 13.85 1762.73
3.5 3.52 16.18 2575.51
4 3.53 18.53 3573.82
4.5 3.54 20.88 4813.07
5 3.55 23.24 6230.65
5.6 3.56 26.08 15643.7
6.8 3.57 105.48 34114.59
7.4 3.58 114.82 84136.03
8 3.59 124.17 136439.6
8.6 3.6 133.53 195604.63
9.2 3.61 142.89 286988.54
9.9 3.62 153.81 318304.04
10.5 3.63 163.19 334114.59
11.1 3.64 172.57 384136.03
11.7 3.65 181.95 4136439.6
12.3 3.66 191.34 495604.63
13 3.67 202.3 586988.54
13.6 3.68 211.7 618304.04
14.2 3.69 221.11 695604.63
14.8 3.7 230.53 786988.54
END FTABLE100

```

```

FTABLE 101
rows cols
26 4
depth area volume outflow1 ***
0.00 0.00 0.00 0.00
0.1 9.71 0.97 0.00
1 9.76 9.74 0.00
2 9.82 19.53 0.00
3 9.87 29.37 0.00
4 9.93 39.27 0.00
5 9.98 49.23 0.00
6 10.04 59.24 0.00
7 10.09 69.31 0.00
8 10.15 79.43 147.16
9 10.2 89.61 467.16
10 10.26 99.84 918.1
11 10.31 110.13 1186.97
12 10.37 120.47 1482.74
13 10.43 130.87 1804.22
14 10.48 141.32 2278.8
15 10.54 151.83 3401.4
16 10.59 162.39 5004.63
17 10.65 173.01 6758.03
18 10.7 183.68 9310.43
19 10.76 194.41 12202.28
20 10.81 205.19 15406.78
21 10.87 216.03 18912.11
22 10.92 226.93 23524.98
23 10.98 237.88 59701.12
23.9 11.03 247.78 67312.54
END FTABLE101

```

```

FTABLE 102
rows cols
20 4
depth area volume outflow1 ***
0.00 0.00 0.00 0.00

```

0.1	16.39	3.34	0.00
1	16.47	33.42	0.00
2	16.55	66.93	0.00
3	16.64	100.53	0.00
4	16.73	134.22	0.00
5	16.82	167.99	10.13
6	16.9	201.85	1111.67
7	16.99	235.8	1568.21
8	17.08	269.83	3165.31
9	17.17	303.96	31878.43
10	17.25	338.17	80952.6
11	17.34	372.46	146586.56
12	17.43	406.85	226837.83
13	17.52	441.32	287817.99
14	17.6	475.88	320440.46
15	17.69	510.52	354442.77
16	17.78	545.26	389796.83
17	17.87	580.08	420440.46
18	17.95	614.99	454442.77

END FTABLE102

FTABLE 103

rows cols				***
22	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.1	7.93	1.09	0.00	
1	7.96	10.94	0.00	
2	7.99	21.91	0.00	
3	8.02	32.92	0.00	
4	8.06	43.96	0.00	
5	8.09	55.03	0.00	
6	8.12	66.14	3.18	
7	8.15	77.27	97.76	
8	8.19	88.44	1429.13	
9	8.22	99.64	4536.42	
10	8.25	110.88	8915.09	
11	8.28	122.14	16875.04	
12	8.32	133.44	26736.55	
13	8.35	144.78	38328.03	
14	8.38	156.14	51526.65	
15	8.41	167.54	66238.2	
16	8.45	178.97	82387.08	
17	8.48	190.43	89732.15	
18	8.51	201.93	94766.92	
19	8.54	213.46	102523.1	
19.9	8.57	223.86	124376.51	

END FTABLE103

FTABLE 104

rows cols				***
22	4			
depth	area	volume	outflow1	***
0.00	0.00	0.00	0.00	
0.1	5.22	0.72	0.00	
1	5.25	7.23	0.00	
2	5.28	14.5	0.00	
3	5.31	21.79	0.00	
4	5.34	29.11	0.00	
5	5.36	36.46	8.62	
6	5.39	43.84	265.59	
7	5.42	51.25	2142.37	
8	5.45	58.68	5259.42	
9	5.48	66.15	9396.32	
10	5.51	73.64	14437.42	
11	5.54	81.16	21574.51	
12	5.57	88.71	26947.84	
13	5.59	96.29	35876.47	
14	5.62	103.9	45795.58	
15	5.65	111.54	58555.92	
16	5.68	119.21	64007.76	

```

17      5.71      126.9  70347.18
18      5.74      134.62 102425.58
19      5.77      142.38 185422.17
19.9    5.79      149.38 324510.76
END FTABLE104

```

```

FTABLE      105
rows cols                                     ***
17      4
depth      area      volume  outflow1 ***
0.00      0.00      0.00    0.00
0.1       4.67      0.77    0.00
1         4.7       7.68    0.00
2         4.73     15.4    0.00
3         4.76     23.14   0.00
4         4.79     30.92   4.84
5         4.82     38.73  153.87
6         4.85     46.57  488.46
7         4.88     54.44  708.48
8         4.92     62.34 1241.18
9         4.95     70.27 1886.72
10        4.98     78.23 2635.85
11        5.01     86.22 6552.09
12        5.04     94.25 9669.16
13        5.07    102.3 13251.99
14        5.1     110.39 17271.57
15        5.13    118.51 22068.03
END FTABLE105

```

```

FTABLE      999
rows cols                                     ***
16      4
depth      area      volume  outflow1  outflow2 ***
(ft)      (acres) (acre-ft) ( ft3/s)  ( ft3/s) ***
0.00      0.00      0.00    0.00      0.00
3         234.02   351.04   803.41
6         422.05  1335.15  5936.4
9         658.08  2955.36 18193.74
12        767.02  5093.01 40358.66
15        830.61  7489.46 71989.83
18        864.28 10031.8 113552.05
21         894  12669.22 162764.73
24        950.58 15436.1 216545.07
27       1013.49 18382.21 277057.51
30       1043.94 21468.36 350441.1
33       1065.09 24631.91 433298.51
36       1090.57 27865.39 522297.52
39       1137.46 31207.43 611292.89
42       1177.66 34680.1 711515.42
45       1195.28 38239.51 827500.65
END FTABLE999

```

END FTABLES

```

PLTGEN
PLOTINFO
Plot-opn***
*** x - x FILE  NPT  NMN  LABL  PYR  PIVL  TYP
1         30    0   19   0    9   48   1
END PLOTINFO

```

```

GEN-LABELS
Plot -opn***
*** x - x General title          Y-axis label
1         FLOW
END GEN-LABELS

```

```

SCALING
Plot-opn***  YMIN      YMAX      IVLIN      THRESH
*** x - x
1             0        2000      6          -500

```

```

END SCALING

*** TS #1
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      USGS FLOW        0    0    0 AVER
END CURV-DATA

*** TS #2
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      ARK 135 FLOW    0    0    0 AVER
END CURV-DATA

*** TS #3
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      ARK 134 FLOW    0    0    0 AVER
END CURV-DATA

*** TS #4
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      USGS SAND       0    0    0 AVER
END CURV-DATA

*** TS #5
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      USGS SILT       0    0    0 AVER
END CURV-DATA

*** TS #6
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      USGS CLAY       0    0    0 AVER
END CURV-DATA

*** TS #7
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      ARK 135 SAND    0    0    0 AVER
END CURV-DATA

*** TS #8
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      ARK 135 SILT    0    0    0 AVER
END CURV-DATA

*** TS #9
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      ARK 135 CLAY    0    0    0 AVER
END CURV-DATA

*** TS #10
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      ARK 134 SAND    0    0    0 AVER
END CURV-DATA

```

```

*** TS #11
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      ARK 134 SILT      0    0    0 AVER
END CURV-DATA

*** TS #12
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      ARK 134 CLAY      0    0    0 AVER
END CURV-DATA

*** TS #13
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      USGS TN           0    0    0 AVER
END CURV-DATA

*** TS #14
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      USGS TP           0    0    0 AVER
END CURV-DATA

*** TS #15
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      ARK 135 TN        0    0    0 AVER
END CURV-DATA

*** TS #16
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      ARK 135 TP        0    0    0 AVER
END CURV-DATA

*** TS #17
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      ARK 134 TN        0    0    0 AVER
END CURV-DATA

*** TS #18
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      ARK 134 TP        0    0    0 AVER
END CURV-DATA

*** TS #19
CURV-DATA
Plot-opn*** Curve label      Line Intg  Col Tran
*** x - x                    type  eqv  code code
      1      RAINFALL          0    0    0 SUM
END CURV-DATA

END PLTGEN

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name>    x <Name> x tem strg<-factor->strg <Name>    x x      <Name> x x ***
*** Met Seg X259Y082
WDM1  101 PREC      ENGL                      DIV  PERLND 101 799 EXTNL  PREC

```

WDM1	114	PEVT	ENGL		DIV	PERLND	101	799	EXTNL	PETINP
WDM1	105	ATEM	ENGL		SAME	PERLND	101	799	EXTNL	GATMP

*** dummy septic drain field area 1/2 ac/site

WDM1	101	PREC	ENGL	0.0	DIV	PERLND	900	999	EXTNL	PREC
WDM1	114	PEVT	ENGL		DIV	PERLND	900	999	EXTNL	PETINP
WDM1	105	ATEM	ENGL		SAME	PERLND	900	999	EXTNL	GATMP

*** Met Seg X259Y082

WDM1	101	PREC	ENGL		DIV	IMPLND	101	799	EXTNL	PREC
WDM1	114	PEVT	ENGL		DIV	IMPLND	101	799	EXTNL	PETINP
WDM1	105	ATEM	ENGL		SAME	IMPLND	101	799	EXTNL	GATMP

WDM1	105	ATEM	ENGL		SAME	RCHRES	1	999	EXTNL	GATMP
WDM1	115	EVAP	ENGL		DIV	RCHRES	1	999	EXTNL	POTEV
WDM1	110	SOLR	ENGL		SAME	RCHRES	1	999	EXTNL	SOLRAD
WDM1	111	CLOU	ENGL		SAME	RCHRES	1	999	EXTNL	CLOUD
WDM1	113	DEWP	ENGL		SAME	RCHRES	1	999	EXTNL	DEWTMP
WDM1	108	WIND	ENGL		SAME	RCHRES	1	999	EXTNL	WIND

***** Fracking Withdrawals

***WDM1	500	OFLOW	ENGL	1.0	SAME	RCHRES	100		EXTNL	OUTDGT 1
WDM1	501	OFLOW	ENGL	1.0	SAME	RCHRES	101		EXTNL	OUTDGT 1
WDM1	502	OFLOW	ENGL	1.0	SAME	RCHRES	102		EXTNL	OUTDGT 1
WDM1	504	OFLOW	ENGL	1.0	SAME	RCHRES	104		EXTNL	OUTDGT 1
WDM1	505	OFLOW	ENGL	1.0	SAME	RCHRES	105		EXTNL	OUTDGT 1
WDM1	503	OFLOW	ENGL	1.0	SAME	RCHRES	103		EXTNL	OUTDGT 1
WDM1	510	OFLOW	ENGL	1.0	SAME	RCHRES	26		EXTNL	OUTDGT 1
WDM1	510	OFLOW	ENGL	1.0	SAME	RCHRES	38		EXTNL	OUTDGT 1
WDM1	510	OFLOW	ENGL	1.0	SAME	RCHRES	43		EXTNL	OUTDGT 1
WDM1	510	OFLOW	ENGL	1.0	SAME	RCHRES	45		EXTNL	OUTDGT 1

*** septic lateral inflows @ 75 gal/d/person

*** flows converted to ac-ft/d

*** flows go into a dummy 1/2 acre parcel (with no rain) to allow for

*** evapotranspiration

WDM1	999	FLOW		0.00000	SAME	PERLND	901		EXTNL	LZLI
WDM1	999	FLOW		0.00206	SAME	PERLND	902		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	903		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	904		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	905		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	906		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	907		EXTNL	LZLI
WDM1	999	FLOW		0.00103	SAME	PERLND	908		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	909		EXTNL	LZLI
WDM1	999	FLOW		0.00103	SAME	PERLND	910		EXTNL	LZLI
WDM1	999	FLOW		0.00052	SAME	PERLND	911		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	912		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	913		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	914		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	915		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	916		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	917		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	918		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	919		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	920		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	921		EXTNL	LZLI
WDM1	999	FLOW		0.00103	SAME	PERLND	922		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	923		EXTNL	LZLI
WDM1	999	FLOW		0.00103	SAME	PERLND	924		EXTNL	LZLI
WDM1	999	FLOW		0.00052	SAME	PERLND	925		EXTNL	LZLI
WDM1	999	FLOW		0.00516	SAME	PERLND	926		EXTNL	LZLI
WDM1	999	FLOW		0.00309	SAME	PERLND	927		EXTNL	LZLI
WDM1	999	FLOW		0.00309	SAME	PERLND	928		EXTNL	LZLI
WDM1	999	FLOW		0.00309	SAME	PERLND	929		EXTNL	LZLI
WDM1	999	FLOW		0.00206	SAME	PERLND	930		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	931		EXTNL	LZLI
WDM1	999	FLOW		0.00103	SAME	PERLND	932		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	933		EXTNL	LZLI
WDM1	999	FLOW		0.00000	SAME	PERLND	934		EXTNL	LZLI

WDM1	999	FLOW	0.00000	SAME	PERLND	935	EXTNL	LZLI
WDM1	999	FLOW	0.00412	SAME	PERLND	936	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	937	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	938	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	939	EXTNL	LZLI
WDM1	999	FLOW	0.00516	SAME	PERLND	940	EXTNL	LZLI
WDM1	999	FLOW	0.00516	SAME	PERLND	941	EXTNL	LZLI
WDM1	999	FLOW	0.00516	SAME	PERLND	942	EXTNL	LZLI
WDM1	999	FLOW	0.00206	SAME	PERLND	943	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	944	EXTNL	LZLI
WDM1	999	FLOW	0.00103	SAME	PERLND	945	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	946	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	947	EXTNL	LZLI
WDM1	999	FLOW	0.00309	SAME	PERLND	948	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	949	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	950	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	951	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	952	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	953	EXTNL	LZLI
WDM1	999	FLOW	0.00103	SAME	PERLND	954	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	955	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	956	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	957	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	958	EXTNL	LZLI
WDM1	999	FLOW	0.00103	SAME	PERLND	959	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	960	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	961	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	962	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	963	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	964	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	965	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	966	EXTNL	LZLI
WDM1	999	FLOW	0.00000	SAME	PERLND	967	EXTNL	LZLI

END EXT SOURCES

NETWORK

<-Volume->	<-Grp>	<-Member->	<--Mult-->	Tran	<-Target vols>	<-Grp>	<-Member->	***
<Name>	x	<Name>	x	<-factor->	strg	<Name>	x	x
*** USGS 07261090		and ARK 132	-	flow				***
RCHRES	38	HYDR	O	1	PLTGEN	1	INPUT	MEAN 1
*** ARK 135		Cypress Creek	-	flow				***
RCHRES	16	HYDR	O	1	PLTGEN	1	INPUT	MEAN 2
*** ARK 134		Brindley Creek	-	flow				***
RCHRES	25	HYDR	RO	1	PLTGEN	1	INPUT	MEAN 3
*** USGS 07261090		and ARK 132	--	sand silt clay				***
RCHRES	38	SEDTRN	SSED	1	PLTGEN	1	INPUT	MEAN 4
RCHRES	38	SEDTRN	SSED	2	PLTGEN	1	INPUT	MEAN 5
RCHRES	38	SEDTRN	SSED	3	PLTGEN	1	INPUT	MEAN 6
*** ARK 135		Cypress Creek	--	sand silt clay				***
RCHRES	16	SEDTRN	SSED	1	PLTGEN	1	INPUT	MEAN 7
RCHRES	16	SEDTRN	SSED	2	PLTGEN	1	INPUT	MEAN 8
RCHRES	16	SEDTRN	SSED	3	PLTGEN	1	INPUT	MEAN 9
*** ARK 134		Brindley Creek	--	sand silt clay				***
RCHRES	25	SEDTRN	SSED	1	PLTGEN	1	INPUT	MEAN 10
RCHRES	25	SEDTRN	SSED	2	PLTGEN	1	INPUT	MEAN 11
RCHRES	25	SEDTRN	SSED	3	PLTGEN	1	INPUT	MEAN 12
*** USGS 07261090		and ARK 132	--	TN TP				***
RCHRES	38	GQUAL	DQAL	1	PLTGEN	1	INPUT	MEAN 13
RCHRES	38	GQUAL	DQAL	2	PLTGEN	1	INPUT	MEAN 14
*** ARK 135		Cypress Creek	--	TN TP				***
RCHRES	16	GQUAL	DQAL	1	PLTGEN	1	INPUT	MEAN 15
RCHRES	16	GQUAL	DQAL	2	PLTGEN	1	INPUT	MEAN 16
*** ARK 134		Brindley Creek	--	TN TP				***
RCHRES	25	GQUAL	DQAL	1	PLTGEN	1	INPUT	MEAN 17
RCHRES	25	GQUAL	DQAL	2	PLTGEN	1	INPUT	MEAN 18
*** USGS 07261090		and ARK 132	-	flow				***
PERLND	101	PWATER	SUPY		PLTGEN	1	INPUT	MEAN 19

END NETWORK

SCHEMATIC

BLACK & VEATCH | WOOLPERT

Brewer Lake Watershed Management Plan

<-Volume-> <Name> x	<--Area--> <-factor-->	<-Volume-> <Name> x	<ML#> *** ***	<sb> x x
*** septic field area = # systems x 1/2 acre				
PERLND 901	0.0	RCHRES 1	2	
PERLND 902	2.0	RCHRES 2	2	
PERLND 903	0.0	RCHRES 3	2	
PERLND 904	0.0	RCHRES 4	2	
PERLND 905	0.0	RCHRES 5	2	
PERLND 906	0.0	RCHRES 6	2	
PERLND 907	0.0	RCHRES 7	2	
PERLND 908	1.0	RCHRES 8	2	
PERLND 909	0.0	RCHRES 9	2	
PERLND 910	1.0	RCHRES 10	2	
PERLND 911	0.5	RCHRES 11	2	
PERLND 912	0.0	RCHRES 12	2	
PERLND 913	0.0	RCHRES 13	2	
PERLND 914	0.0	RCHRES 14	2	
PERLND 915	0.0	RCHRES 15	2	
PERLND 916	0.0	RCHRES 16	2	
PERLND 917	0.0	RCHRES 17	2	
PERLND 918	0.0	RCHRES 18	2	
PERLND 919	0.0	RCHRES 19	2	
PERLND 920	0.0	RCHRES 20	2	
PERLND 921	0.0	RCHRES 21	2	
PERLND 922	1.0	RCHRES 22	2	
PERLND 923	0.0	RCHRES 23	2	
PERLND 924	1.0	RCHRES 24	2	
PERLND 925	0.5	RCHRES 25	2	
PERLND 926	5.0	RCHRES 26	2	
PERLND 927	3.0	RCHRES 27	2	
PERLND 928	3.0	RCHRES 28	2	
PERLND 929	3.0	RCHRES 29	2	
PERLND 930	2.0	RCHRES 30	2	
PERLND 931	0.0	RCHRES 31	2	
PERLND 932	1.0	RCHRES 32	2	
PERLND 933	0.0	RCHRES 33	2	
PERLND 934	0.0	RCHRES 34	2	
PERLND 935	0.0	RCHRES 35	2	
PERLND 936	4.0	RCHRES 36	2	
PERLND 937	0.0	RCHRES 37	2	
PERLND 938	0.0	RCHRES 38	2	
PERLND 939	0.0	RCHRES 39	2	
PERLND 940	5.0	RCHRES 40	2	
PERLND 941	5.0	RCHRES 41	2	
PERLND 942	5.0	RCHRES 42	2	
PERLND 943	2.0	RCHRES 43	2	
PERLND 944	0.0	RCHRES 44	2	
PERLND 945	1.0	RCHRES 45	2	
PERLND 946	0.0	RCHRES 46	2	
PERLND 947	0.0	RCHRES 47	2	
PERLND 948	3.0	RCHRES 48	2	
PERLND 949	0.0	RCHRES 49	2	
PERLND 950	0.0	RCHRES 50	2	
PERLND 951	0.0	RCHRES 51	2	
PERLND 952	0.0	RCHRES 52	2	
PERLND 953	0.0	RCHRES 53	2	
PERLND 954	1.0	RCHRES 54	2	
PERLND 955	0.0	RCHRES 55	2	
PERLND 956	0.0	RCHRES 56	2	
PERLND 957	0.0	RCHRES 57	2	
PERLND 958	0.0	RCHRES 58	2	
PERLND 959	1.0	RCHRES 59	2	
PERLND 960	0.0	RCHRES 60	2	
PERLND 961	0.0	RCHRES 61	2	
PERLND 962	0.0	RCHRES 100	2	
PERLND 963	0.0	RCHRES 101	2	
PERLND 964	0.0	RCHRES 102	2	
PERLND 965	0.0	RCHRES 103	2	
PERLND 966	0.0	RCHRES 104	2	
PERLND 967	0.0	RCHRES 105	2	

PERLND 102	2.35	RCHRES	1	2
PERLND 103	8.46	RCHRES	1	2
PERLND 105	17.39	RCHRES	1	2
PERLND 106	28.20	RCHRES	1	2
PERLND 111	3.76	RCHRES	1	2
PERLND 113	6.11	RCHRES	1	2
PERLND 114	1.88	RCHRES	1	2
PERLND 121	1.41	RCHRES	1	2
PERLND 122	0.47	RCHRES	1	2
PERLND 123	1.41	RCHRES	1	2
PERLND 124	2.82	RCHRES	1	2
PERLND 201	0.47	RCHRES	1	2
PERLND 301	139.12	RCHRES	1	2
PERLND 302	3.29	RCHRES	1	2
PERLND 303	203.51	RCHRES	1	2
PERLND 401	1.32	RCHRES	1	2
PERLND 501	0.09	RCHRES	1	2
PERLND 601	6.39	RCHRES	1	2
PERLND 611	6.77	RCHRES	1	2
PERLND 621	0.75	RCHRES	1	2
IMPLND 401	5.26	RCHRES	1	1
IMPLND 501	1.79	RCHRES	1	1
IMPLND 601	1.60	RCHRES	1	1
IMPLND 611	4.51	RCHRES	1	1
IMPLND 621	1.13	RCHRES	1	1
IMPLND 701	3.29	RCHRES	1	1
PERLND 102	15.51	RCHRES	2	2
PERLND 103	26.79	RCHRES	2	2
PERLND 105	0.94	RCHRES	2	2
PERLND 106	10.34	RCHRES	2	2
PERLND 111	18.80	RCHRES	2	2
PERLND 112	0.47	RCHRES	2	2
PERLND 121	12.69	RCHRES	2	2
PERLND 122	5.64	RCHRES	2	2
PERLND 211	0.47	RCHRES	2	2
PERLND 301	372.23	RCHRES	2	2
PERLND 302	0.47	RCHRES	2	2
PERLND 303	61.10	RCHRES	2	2
PERLND 401	1.60	RCHRES	2	2
PERLND 501	0.16	RCHRES	2	2
PERLND 601	16.17	RCHRES	2	2
PERLND 611	3.38	RCHRES	2	2
PERLND 621	0.19	RCHRES	2	2
IMPLND 401	6.39	RCHRES	2	1
IMPLND 501	3.13	RCHRES	2	1
IMPLND 601	4.04	RCHRES	2	1
IMPLND 611	2.26	RCHRES	2	1
IMPLND 621	0.28	RCHRES	2	1
PERLND 102	6.11	RCHRES	3	2
PERLND 103	1.41	RCHRES	3	2
PERLND 105	0.94	RCHRES	3	2
PERLND 106	0.47	RCHRES	3	2
PERLND 111	5.64	RCHRES	3	2
PERLND 121	6.11	RCHRES	3	2
PERLND 301	104.81	RCHRES	3	2
PERLND 303	10.34	RCHRES	3	2
PERLND 401	0.56	RCHRES	3	2
PERLND 601	8.27	RCHRES	3	2
PERLND 611	0.28	RCHRES	3	2
IMPLND 401	2.26	RCHRES	3	1
IMPLND 601	2.07	RCHRES	3	1
IMPLND 611	0.19	RCHRES	3	1
IMPLND 701	0.47	RCHRES	3	1
PERLND 102	19.27	RCHRES	4	2
PERLND 103	26.32	RCHRES	4	2
PERLND 105	15.51	RCHRES	4	2
PERLND 106	32.90	RCHRES	4	2
PERLND 111	2.82	RCHRES	4	2
PERLND 112	1.88	RCHRES	4	2
PERLND 113	5.64	RCHRES	4	2

PERLND 114	0.47	RCHRES	4	2
PERLND 121	7.05	RCHRES	4	2
PERLND 122	7.99	RCHRES	4	2
PERLND 123	11.28	RCHRES	4	2
PERLND 124	0.94	RCHRES	4	2
PERLND 201	0.47	RCHRES	4	2
PERLND 301	95.41	RCHRES	4	2
PERLND 302	0.47	RCHRES	4	2
PERLND 303	52.17	RCHRES	4	2
PERLND 401	0.94	RCHRES	4	2
PERLND 501	0.05	RCHRES	4	2
PERLND 601	15.04	RCHRES	4	2
PERLND 611	4.23	RCHRES	4	2
IMPLND 401	3.76	RCHRES	4	1
IMPLND 501	0.89	RCHRES	4	1
IMPLND 601	3.76	RCHRES	4	1
IMPLND 611	2.82	RCHRES	4	1
IMPLND 701	0.47	RCHRES	4	1
PERLND 102	0.47	RCHRES	5	2
PERLND 103	13.16	RCHRES	5	2
PERLND 105	0.47	RCHRES	5	2
PERLND 106	51.70	RCHRES	5	2
PERLND 111	8.46	RCHRES	5	2
PERLND 112	0.47	RCHRES	5	2
PERLND 113	2.82	RCHRES	5	2
PERLND 114	0.47	RCHRES	5	2
PERLND 121	1.88	RCHRES	5	2
PERLND 122	23.50	RCHRES	5	2
PERLND 123	1.41	RCHRES	5	2
PERLND 124	31.02	RCHRES	5	2
PERLND 201	12.69	RCHRES	5	2
PERLND 211	0.94	RCHRES	5	2
PERLND 221	3.76	RCHRES	5	2
PERLND 301	21.15	RCHRES	5	2
PERLND 302	1.88	RCHRES	5	2
PERLND 303	18.80	RCHRES	5	2
PERLND 401	1.41	RCHRES	5	2
PERLND 402	0.19	RCHRES	5	2
PERLND 601	6.77	RCHRES	5	2
PERLND 611	1.97	RCHRES	5	2
PERLND 621	0.94	RCHRES	5	2
IMPLND 401	5.64	RCHRES	5	1
IMPLND 402	0.75	RCHRES	5	1
IMPLND 601	1.69	RCHRES	5	1
IMPLND 611	1.32	RCHRES	5	1
IMPLND 621	1.41	RCHRES	5	1
PERLND 102	0.47	RCHRES	6	2
PERLND 103	52.17	RCHRES	6	2
PERLND 105	1.41	RCHRES	6	2
PERLND 106	23.97	RCHRES	6	2
PERLND 111	1.41	RCHRES	6	2
PERLND 112	0.47	RCHRES	6	2
PERLND 113	1.88	RCHRES	6	2
PERLND 114	0.94	RCHRES	6	2
PERLND 121	5.17	RCHRES	6	2
PERLND 122	16.92	RCHRES	6	2
PERLND 124	25.85	RCHRES	6	2
PERLND 201	2.82	RCHRES	6	2
PERLND 301	34.31	RCHRES	6	2
PERLND 302	12.69	RCHRES	6	2
PERLND 303	13.16	RCHRES	6	2
PERLND 401	1.79	RCHRES	6	2
PERLND 601	4.89	RCHRES	6	2
PERLND 611	0.56	RCHRES	6	2
IMPLND 401	7.14	RCHRES	6	1
IMPLND 601	1.22	RCHRES	6	1
IMPLND 611	0.38	RCHRES	6	1
PERLND 103	56.40	RCHRES	7	2
PERLND 105	0.47	RCHRES	7	2
PERLND 106	156.51	RCHRES	7	2
PERLND 111	4.70	RCHRES	7	2

PERLND 112	0.47	RCHRES	7	2
PERLND 113	3.29	RCHRES	7	2
PERLND 114	1.88	RCHRES	7	2
PERLND 121	0.94	RCHRES	7	2
PERLND 122	23.03	RCHRES	7	2
PERLND 123	0.94	RCHRES	7	2
PERLND 124	27.73	RCHRES	7	2
PERLND 201	23.50	RCHRES	7	2
PERLND 211	0.47	RCHRES	7	2
PERLND 301	14.57	RCHRES	7	2
PERLND 302	9.40	RCHRES	7	2
PERLND 303	25.38	RCHRES	7	2
PERLND 401	0.56	RCHRES	7	2
PERLND 621	0.19	RCHRES	7	2
IMPLND 401	2.26	RCHRES	7	1
IMPLND 621	0.28	RCHRES	7	1
PERLND 101	18.80	RCHRES	8	2
PERLND 102	4.70	RCHRES	8	2
PERLND 103	25.85	RCHRES	8	2
PERLND 104	0.47	RCHRES	8	2
PERLND 105	4.23	RCHRES	8	2
PERLND 106	91.65	RCHRES	8	2
PERLND 107	1.41	RCHRES	8	2
PERLND 111	0.47	RCHRES	8	2
PERLND 114	0.47	RCHRES	8	2
PERLND 121	5.17	RCHRES	8	2
PERLND 122	20.21	RCHRES	8	2
PERLND 123	0.47	RCHRES	8	2
PERLND 124	28.67	RCHRES	8	2
PERLND 201	0.94	RCHRES	8	2
PERLND 301	86.95	RCHRES	8	2
PERLND 302	1.88	RCHRES	8	2
PERLND 303	35.72	RCHRES	8	2
PERLND 401	1.79	RCHRES	8	2
PERLND 601	1.88	RCHRES	8	2
PERLND 611	0.56	RCHRES	8	2
IMPLND 401	7.14	RCHRES	8	1
IMPLND 601	0.47	RCHRES	8	1
IMPLND 611	0.38	RCHRES	8	1
PERLND 102	0.94	RCHRES	9	2
PERLND 103	6.58	RCHRES	9	2
PERLND 105	4.70	RCHRES	9	2
PERLND 106	5.64	RCHRES	9	2
PERLND 111	7.99	RCHRES	9	2
PERLND 113	0.47	RCHRES	9	2
PERLND 121	6.58	RCHRES	9	2
PERLND 122	7.05	RCHRES	9	2
PERLND 123	1.41	RCHRES	9	2
PERLND 124	4.23	RCHRES	9	2
PERLND 201	0.47	RCHRES	9	2
PERLND 211	0.94	RCHRES	9	2
PERLND 301	164.03	RCHRES	9	2
PERLND 302	0.47	RCHRES	9	2
PERLND 303	24.91	RCHRES	9	2
PERLND 401	0.75	RCHRES	9	2
PERLND 601	6.02	RCHRES	9	2
PERLND 611	0.85	RCHRES	9	2
IMPLND 401	3.01	RCHRES	9	1
IMPLND 601	1.50	RCHRES	9	1
IMPLND 611	0.56	RCHRES	9	1
IMPLND 701	0.47	RCHRES	9	1
PERLND 102	0.94	RCHRES	10	2
PERLND 103	6.11	RCHRES	10	2
PERLND 106	15.04	RCHRES	10	2
PERLND 111	1.88	RCHRES	10	2
PERLND 113	0.47	RCHRES	10	2
PERLND 121	15.98	RCHRES	10	2
PERLND 122	1.41	RCHRES	10	2
PERLND 123	2.35	RCHRES	10	2
PERLND 124	2.82	RCHRES	10	2
PERLND 201	0.94	RCHRES	10	2

PERLND 211	0.94	RCHRES 10	2
PERLND 301	185.18	RCHRES 10	2
PERLND 303	13.16	RCHRES 10	2
PERLND 401	1.88	RCHRES 10	2
PERLND 601	18.42	RCHRES 10	2
PERLND 611	1.13	RCHRES 10	2
IMPLND 401	7.52	RCHRES 10	1
IMPLND 601	4.61	RCHRES 10	1
IMPLND 611	0.75	RCHRES 10	1
PERLND 102	11.28	RCHRES 11	2
PERLND 103	31.49	RCHRES 11	2
PERLND 104	8.46	RCHRES 11	2
PERLND 105	1.88	RCHRES 11	2
PERLND 106	70.97	RCHRES 11	2
PERLND 107	15.98	RCHRES 11	2
PERLND 111	4.70	RCHRES 11	2
PERLND 113	0.47	RCHRES 11	2
PERLND 121	8.46	RCHRES 11	2
PERLND 122	3.29	RCHRES 11	2
PERLND 123	8.46	RCHRES 11	2
PERLND 124	3.29	RCHRES 11	2
PERLND 201	0.47	RCHRES 11	2
PERLND 211	1.88	RCHRES 11	2
PERLND 301	151.81	RCHRES 11	2
PERLND 303	65.80	RCHRES 11	2
PERLND 401	2.44	RCHRES 11	2
PERLND 402	0.09	RCHRES 11	2
PERLND 601	11.28	RCHRES 11	2
PERLND 611	2.54	RCHRES 11	2
PERLND 621	1.50	RCHRES 11	2
PERLND 631	0.28	RCHRES 11	2
IMPLND 401	9.78	RCHRES 11	1
IMPLND 402	0.38	RCHRES 11	1
IMPLND 601	2.82	RCHRES 11	1
IMPLND 611	1.69	RCHRES 11	1
IMPLND 621	2.26	RCHRES 11	1
IMPLND 631	1.13	RCHRES 11	1
PERLND 101	23.50	RCHRES 13	2
PERLND 102	0.47	RCHRES 13	2
PERLND 103	28.20	RCHRES 13	2
PERLND 106	48.41	RCHRES 13	2
PERLND 107	0.94	RCHRES 13	2
PERLND 112	0.94	RCHRES 13	2
PERLND 121	1.88	RCHRES 13	2
PERLND 122	28.67	RCHRES 13	2
PERLND 123	1.41	RCHRES 13	2
PERLND 124	7.52	RCHRES 13	2
PERLND 201	0.47	RCHRES 13	2
PERLND 301	91.65	RCHRES 13	2
PERLND 302	10.34	RCHRES 13	2
PERLND 303	15.98	RCHRES 13	2
PERLND 401	0.66	RCHRES 13	2
PERLND 601	6.39	RCHRES 13	2
PERLND 611	1.41	RCHRES 13	2
IMPLND 401	2.63	RCHRES 13	1
IMPLND 601	1.60	RCHRES 13	1
IMPLND 611	0.94	RCHRES 13	1
PERLND 101	0.47	RCHRES 14	2
PERLND 104	7.99	RCHRES 14	2
PERLND 105	15.98	RCHRES 14	2
PERLND 106	1.88	RCHRES 14	2
PERLND 107	6.11	RCHRES 14	2
PERLND 111	11.75	RCHRES 14	2
PERLND 113	19.27	RCHRES 14	2
PERLND 121	3.29	RCHRES 14	2
PERLND 122	0.47	RCHRES 14	2
PERLND 123	8.93	RCHRES 14	2
PERLND 124	1.88	RCHRES 14	2
PERLND 301	1.41	RCHRES 14	2
PERLND 302	18.80	RCHRES 14	2
PERLND 303	51.70	RCHRES 14	2

PERLND 401	0.75	RCHRES 14	2
PERLND 601	5.64	RCHRES 14	2
PERLND 611	1.13	RCHRES 14	2
PERLND 621	1.88	RCHRES 14	2
PERLND 631	0.56	RCHRES 14	2
IMPLND 401	3.01	RCHRES 14	1
IMPLND 601	1.41	RCHRES 14	1
IMPLND 611	0.75	RCHRES 14	1
IMPLND 621	2.82	RCHRES 14	1
IMPLND 631	2.26	RCHRES 14	1
PERLND 101	0.47	RCHRES 15	2
PERLND 102	5.64	RCHRES 15	2
PERLND 104	32.90	RCHRES 15	2
PERLND 105	3.29	RCHRES 15	2
PERLND 107	25.38	RCHRES 15	2
PERLND 111	5.17	RCHRES 15	2
PERLND 112	0.94	RCHRES 15	2
PERLND 113	11.75	RCHRES 15	2
PERLND 121	18.80	RCHRES 15	2
PERLND 122	0.94	RCHRES 15	2
PERLND 123	13.16	RCHRES 15	2
PERLND 124	0.47	RCHRES 15	2
PERLND 211	0.47	RCHRES 15	2
PERLND 302	0.94	RCHRES 15	2
PERLND 303	5.64	RCHRES 15	2
PERLND 401	0.56	RCHRES 15	2
PERLND 601	2.26	RCHRES 15	2
PERLND 611	1.97	RCHRES 15	2
PERLND 621	0.56	RCHRES 15	2
PERLND 631	0.19	RCHRES 15	2
IMPLND 401	2.26	RCHRES 15	1
IMPLND 601	0.56	RCHRES 15	1
IMPLND 611	1.32	RCHRES 15	1
IMPLND 621	0.85	RCHRES 15	1
IMPLND 631	0.75	RCHRES 15	1
PERLND 101	11.75	RCHRES 16	2
PERLND 102	8.93	RCHRES 16	2
PERLND 103	15.98	RCHRES 16	2
PERLND 104	3.76	RCHRES 16	2
PERLND 105	3.76	RCHRES 16	2
PERLND 106	79.43	RCHRES 16	2
PERLND 107	50.29	RCHRES 16	2
PERLND 111	11.75	RCHRES 16	2
PERLND 112	4.23	RCHRES 16	2
PERLND 113	1.88	RCHRES 16	2
PERLND 114	0.47	RCHRES 16	2
PERLND 121	7.05	RCHRES 16	2
PERLND 122	39.01	RCHRES 16	2
PERLND 123	3.76	RCHRES 16	2
PERLND 124	66.74	RCHRES 16	2
PERLND 201	1.88	RCHRES 16	2
PERLND 211	45.12	RCHRES 16	2
PERLND 221	1.88	RCHRES 16	2
PERLND 301	31.96	RCHRES 16	2
PERLND 302	0.47	RCHRES 16	2
PERLND 303	5.64	RCHRES 16	2
PERLND 401	3.38	RCHRES 16	2
PERLND 402	0.19	RCHRES 16	2
PERLND 601	14.29	RCHRES 16	2
PERLND 611	1.69	RCHRES 16	2
IMPLND 401	13.54	RCHRES 16	1
IMPLND 402	0.75	RCHRES 16	1
IMPLND 601	3.57	RCHRES 16	1
IMPLND 611	1.13	RCHRES 16	1
PERLND 102	53.11	RCHRES 17	2
PERLND 103	0.47	RCHRES 17	2
PERLND 111	51.70	RCHRES 17	2
PERLND 113	0.47	RCHRES 17	2
PERLND 121	8.93	RCHRES 17	2
PERLND 201	0.47	RCHRES 17	2
PERLND 301	256.14	RCHRES 17	2

PERLND 401	0.75	RCHRES 17	2
PERLND 501	0.38	RCHRES 17	2
PERLND 601	7.52	RCHRES 17	2
PERLND 611	7.05	RCHRES 17	2
PERLND 621	0.75	RCHRES 17	2
IMPLND 401	3.01	RCHRES 17	1
IMPLND 501	7.14	RCHRES 17	1
IMPLND 601	1.88	RCHRES 17	1
IMPLND 611	4.70	RCHRES 17	1
IMPLND 621	1.13	RCHRES 17	1
PERLND 102	10.81	RCHRES 18	2
PERLND 103	21.15	RCHRES 18	2
PERLND 106	7.52	RCHRES 18	2
PERLND 121	0.94	RCHRES 18	2
PERLND 301	268.36	RCHRES 18	2
PERLND 303	2.82	RCHRES 18	2
PERLND 401	0.28	RCHRES 18	2
PERLND 501	0.02	RCHRES 18	2
PERLND 601	6.39	RCHRES 18	2
PERLND 611	2.26	RCHRES 18	2
PERLND 621	0.38	RCHRES 18	2
IMPLND 401	1.13	RCHRES 18	1
IMPLND 501	0.45	RCHRES 18	1
IMPLND 601	1.60	RCHRES 18	1
IMPLND 611	1.50	RCHRES 18	1
IMPLND 621	0.56	RCHRES 18	1
PERLND 102	4.23	RCHRES 19	2
PERLND 103	8.93	RCHRES 19	2
PERLND 111	21.15	RCHRES 19	2
PERLND 121	1.88	RCHRES 19	2
PERLND 122	1.88	RCHRES 19	2
PERLND 201	0.47	RCHRES 19	2
PERLND 211	0.94	RCHRES 19	2
PERLND 301	183.30	RCHRES 19	2
PERLND 302	0.94	RCHRES 19	2
PERLND 303	1.41	RCHRES 19	2
PERLND 401	0.19	RCHRES 19	2
PERLND 402	0.56	RCHRES 19	2
PERLND 501	0.12	RCHRES 19	2
PERLND 601	9.40	RCHRES 19	2
PERLND 611	3.38	RCHRES 19	2
PERLND 621	0.94	RCHRES 19	2
IMPLND 401	0.75	RCHRES 19	1
IMPLND 402	2.26	RCHRES 19	1
IMPLND 501	2.23	RCHRES 19	1
IMPLND 601	2.35	RCHRES 19	1
IMPLND 611	2.26	RCHRES 19	1
IMPLND 621	1.41	RCHRES 19	1
IMPLND 701	0.47	RCHRES 19	1
PERLND 103	42.30	RCHRES 20	2
PERLND 106	6.58	RCHRES 20	2
PERLND 122	4.70	RCHRES 20	2
PERLND 201	0.47	RCHRES 20	2
PERLND 211	0.47	RCHRES 20	2
PERLND 221	0.47	RCHRES 20	2
PERLND 301	141.00	RCHRES 20	2
PERLND 401	1.13	RCHRES 20	2
PERLND 402	0.38	RCHRES 20	2
PERLND 601	3.76	RCHRES 20	2
PERLND 611	0.56	RCHRES 20	2
IMPLND 401	4.51	RCHRES 20	1
IMPLND 402	1.50	RCHRES 20	1
IMPLND 601	0.94	RCHRES 20	1
IMPLND 611	0.38	RCHRES 20	1
PERLND 103	11.28	RCHRES 21	2
PERLND 106	10.81	RCHRES 21	2
PERLND 107	0.94	RCHRES 21	2
PERLND 112	3.29	RCHRES 21	2
PERLND 121	0.47	RCHRES 21	2
PERLND 122	6.58	RCHRES 21	2
PERLND 124	7.99	RCHRES 21	2

PERLND 201	0.47	RCHRES 21	2
PERLND 301	89.77	RCHRES 21	2
PERLND 303	1.41	RCHRES 21	2
PERLND 401	0.09	RCHRES 21	2
PERLND 402	1.03	RCHRES 21	2
PERLND 601	3.76	RCHRES 21	2
PERLND 611	1.13	RCHRES 21	2
IMPLND 401	0.38	RCHRES 21	1
IMPLND 402	4.14	RCHRES 21	1
IMPLND 601	0.94	RCHRES 21	1
IMPLND 611	0.75	RCHRES 21	1
IMPLND 701	0.94	RCHRES 21	1
PERLND 103	26.32	RCHRES 22	2
PERLND 104	0.47	RCHRES 22	2
PERLND 105	0.47	RCHRES 22	2
PERLND 106	21.62	RCHRES 22	2
PERLND 107	0.47	RCHRES 22	2
PERLND 111	2.35	RCHRES 22	2
PERLND 112	52.64	RCHRES 22	2
PERLND 113	0.47	RCHRES 22	2
PERLND 114	1.41	RCHRES 22	2
PERLND 121	5.64	RCHRES 22	2
PERLND 122	35.25	RCHRES 22	2
PERLND 124	29.14	RCHRES 22	2
PERLND 201	14.10	RCHRES 22	2
PERLND 211	13.16	RCHRES 22	2
PERLND 221	1.41	RCHRES 22	2
PERLND 301	360.01	RCHRES 22	2
PERLND 302	5.17	RCHRES 22	2
PERLND 303	17.86	RCHRES 22	2
PERLND 401	1.60	RCHRES 22	2
PERLND 402	0.38	RCHRES 22	2
PERLND 601	16.92	RCHRES 22	2
PERLND 611	1.41	RCHRES 22	2
PERLND 621	1.69	RCHRES 22	2
PERLND 631	0.19	RCHRES 22	2
IMPLND 401	6.39	RCHRES 22	1
IMPLND 402	1.50	RCHRES 22	1
IMPLND 601	4.23	RCHRES 22	1
IMPLND 611	0.94	RCHRES 22	1
IMPLND 621	2.54	RCHRES 22	1
IMPLND 631	0.75	RCHRES 22	1
PERLND 103	4.70	RCHRES 23	2
PERLND 105	0.47	RCHRES 23	2
PERLND 106	1.88	RCHRES 23	2
PERLND 111	2.35	RCHRES 23	2
PERLND 112	11.28	RCHRES 23	2
PERLND 114	0.94	RCHRES 23	2
PERLND 121	4.23	RCHRES 23	2
PERLND 122	20.68	RCHRES 23	2
PERLND 123	2.82	RCHRES 23	2
PERLND 124	7.52	RCHRES 23	2
PERLND 201	1.41	RCHRES 23	2
PERLND 211	4.70	RCHRES 23	2
PERLND 301	104.34	RCHRES 23	2
PERLND 303	1.88	RCHRES 23	2
PERLND 401	0.56	RCHRES 23	2
PERLND 501	0.12	RCHRES 23	2
PERLND 601	3.76	RCHRES 23	2
PERLND 611	2.82	RCHRES 23	2
PERLND 621	0.75	RCHRES 23	2
IMPLND 401	2.26	RCHRES 23	1
IMPLND 501	2.23	RCHRES 23	1
IMPLND 601	0.94	RCHRES 23	1
IMPLND 611	1.88	RCHRES 23	1
IMPLND 621	1.13	RCHRES 23	1
PERLND 101	0.47	RCHRES 24	2
PERLND 102	0.47	RCHRES 24	2
PERLND 103	0.94	RCHRES 24	2
PERLND 121	2.35	RCHRES 24	2
PERLND 123	4.70	RCHRES 24	2

PERLND 301	19.27	RCHRES 24	2
PERLND 401	0.66	RCHRES 24	2
PERLND 601	1.13	RCHRES 24	2
IMPLND 401	2.63	RCHRES 24	1
IMPLND 601	0.28	RCHRES 24	1
PERLND 101	0.47	RCHRES 25	2
PERLND 102	2.35	RCHRES 25	2
PERLND 103	57.81	RCHRES 25	2
PERLND 106	3.29	RCHRES 25	2
PERLND 111	27.26	RCHRES 25	2
PERLND 112	0.94	RCHRES 25	2
PERLND 113	2.35	RCHRES 25	2
PERLND 121	11.75	RCHRES 25	2
PERLND 122	25.85	RCHRES 25	2
PERLND 123	5.17	RCHRES 25	2
PERLND 124	8.93	RCHRES 25	2
PERLND 301	83.19	RCHRES 25	2
PERLND 302	2.82	RCHRES 25	2
PERLND 303	7.05	RCHRES 25	2
PERLND 401	2.07	RCHRES 25	2
PERLND 402	0.47	RCHRES 25	2
PERLND 601	6.77	RCHRES 25	2
PERLND 611	1.69	RCHRES 25	2
IMPLND 401	8.27	RCHRES 25	1
IMPLND 402	1.88	RCHRES 25	1
IMPLND 601	1.69	RCHRES 25	1
IMPLND 611	1.13	RCHRES 25	1
PERLND 101	41.36	RCHRES 26	2
PERLND 102	6.58	RCHRES 26	2
PERLND 103	17.39	RCHRES 26	2
PERLND 104	40.42	RCHRES 26	2
PERLND 105	2.82	RCHRES 26	2
PERLND 106	78.02	RCHRES 26	2
PERLND 107	20.68	RCHRES 26	2
PERLND 111	71.44	RCHRES 26	2
PERLND 112	3.29	RCHRES 26	2
PERLND 113	3.29	RCHRES 26	2
PERLND 121	58.28	RCHRES 26	2
PERLND 122	12.22	RCHRES 26	2
PERLND 123	4.23	RCHRES 26	2
PERLND 124	4.23	RCHRES 26	2
PERLND 211	7.99	RCHRES 26	2
PERLND 301	92.59	RCHRES 26	2
PERLND 302	1.88	RCHRES 26	2
PERLND 303	1.41	RCHRES 26	2
PERLND 401	1.13	RCHRES 26	2
PERLND 501	0.07	RCHRES 26	2
PERLND 601	10.15	RCHRES 26	2
PERLND 611	4.51	RCHRES 26	2
PERLND 621	1.50	RCHRES 26	2
PERLND 631	0.38	RCHRES 26	2
IMPLND 401	4.51	RCHRES 26	1
IMPLND 501	1.34	RCHRES 26	1
IMPLND 601	2.54	RCHRES 26	1
IMPLND 611	3.01	RCHRES 26	1
IMPLND 621	2.26	RCHRES 26	1
IMPLND 631	1.50	RCHRES 26	1
PERLND 102	0.94	RCHRES 27	2
PERLND 103	42.77	RCHRES 27	2
PERLND 104	3.76	RCHRES 27	2
PERLND 111	12.22	RCHRES 27	2
PERLND 112	13.16	RCHRES 27	2
PERLND 121	12.22	RCHRES 27	2
PERLND 122	31.02	RCHRES 27	2
PERLND 201	12.22	RCHRES 27	2
PERLND 211	0.94	RCHRES 27	2
PERLND 301	145.70	RCHRES 27	2
PERLND 302	37.60	RCHRES 27	2
PERLND 401	0.09	RCHRES 27	2
PERLND 402	0.09	RCHRES 27	2
PERLND 501	0.38	RCHRES 27	2

PERLND 601	17.67	RCHRES 27	2
PERLND 611	4.79	RCHRES 27	2
PERLND 621	0.19	RCHRES 27	2
IMPLND 401	0.38	RCHRES 27	1
IMPLND 402	0.38	RCHRES 27	1
IMPLND 501	7.14	RCHRES 27	1
IMPLND 601	4.42	RCHRES 27	1
IMPLND 611	3.20	RCHRES 27	1
IMPLND 621	0.28	RCHRES 27	1
PERLND 102	8.46	RCHRES 28	2
PERLND 103	8.46	RCHRES 28	2
PERLND 104	2.35	RCHRES 28	2
PERLND 111	63.92	RCHRES 28	2
PERLND 112	5.64	RCHRES 28	2
PERLND 121	9.40	RCHRES 28	2
PERLND 122	12.22	RCHRES 28	2
PERLND 201	18.33	RCHRES 28	2
PERLND 301	80.37	RCHRES 28	2
PERLND 302	7.99	RCHRES 28	2
PERLND 402	0.38	RCHRES 28	2
PERLND 601	5.26	RCHRES 28	2
PERLND 611	0.28	RCHRES 28	2
PERLND 631	0.09	RCHRES 28	2
IMPLND 402	1.50	RCHRES 28	1
IMPLND 601	1.32	RCHRES 28	1
IMPLND 611	0.19	RCHRES 28	1
IMPLND 631	0.38	RCHRES 28	1
PERLND 102	0.94	RCHRES 29	2
PERLND 103	15.51	RCHRES 29	2
PERLND 104	0.47	RCHRES 29	2
PERLND 111	1.41	RCHRES 29	2
PERLND 112	8.46	RCHRES 29	2
PERLND 121	0.47	RCHRES 29	2
PERLND 122	36.19	RCHRES 29	2
PERLND 201	0.47	RCHRES 29	2
PERLND 301	117.50	RCHRES 29	2
PERLND 302	67.21	RCHRES 29	2
PERLND 303	0.94	RCHRES 29	2
PERLND 401	0.66	RCHRES 29	2
PERLND 402	0.38	RCHRES 29	2
PERLND 601	7.90	RCHRES 29	2
PERLND 611	0.28	RCHRES 29	2
PERLND 621	0.19	RCHRES 29	2
PERLND 631	0.09	RCHRES 29	2
IMPLND 401	2.63	RCHRES 29	1
IMPLND 402	1.50	RCHRES 29	1
IMPLND 601	1.97	RCHRES 29	1
IMPLND 611	0.19	RCHRES 29	1
IMPLND 621	0.28	RCHRES 29	1
IMPLND 631	0.38	RCHRES 29	1
PERLND 101	1.88	RCHRES 30	2
PERLND 102	2.82	RCHRES 30	2
PERLND 103	36.66	RCHRES 30	2
PERLND 106	17.86	RCHRES 30	2
PERLND 111	8.93	RCHRES 30	2
PERLND 121	13.16	RCHRES 30	2
PERLND 122	4.70	RCHRES 30	2
PERLND 123	0.47	RCHRES 30	2
PERLND 201	5.17	RCHRES 30	2
PERLND 301	101.05	RCHRES 30	2
PERLND 303	5.64	RCHRES 30	2
PERLND 401	0.28	RCHRES 30	2
PERLND 601	1.50	RCHRES 30	2
PERLND 611	0.85	RCHRES 30	2
PERLND 621	0.38	RCHRES 30	2
IMPLND 401	1.13	RCHRES 30	1
IMPLND 601	0.38	RCHRES 30	1
IMPLND 611	0.56	RCHRES 30	1
IMPLND 621	0.56	RCHRES 30	1
PERLND 102	10.34	RCHRES 31	2
PERLND 103	77.08	RCHRES 31	2

PERLND 104	14.10	RCHRES 31	2
PERLND 105	1.41	RCHRES 31	2
PERLND 106	61.57	RCHRES 31	2
PERLND 107	41.36	RCHRES 31	2
PERLND 111	47.00	RCHRES 31	2
PERLND 113	0.47	RCHRES 31	2
PERLND 121	23.50	RCHRES 31	2
PERLND 122	9.40	RCHRES 31	2
PERLND 123	4.23	RCHRES 31	2
PERLND 124	11.28	RCHRES 31	2
PERLND 201	18.80	RCHRES 31	2
PERLND 211	6.11	RCHRES 31	2
PERLND 301	109.51	RCHRES 31	2
PERLND 303	37.13	RCHRES 31	2
PERLND 401	1.03	RCHRES 31	2
PERLND 601	12.78	RCHRES 31	2
PERLND 611	1.13	RCHRES 31	2
PERLND 631	0.09	RCHRES 31	2
IMPLND 401	4.14	RCHRES 31	1
IMPLND 601	3.20	RCHRES 31	1
IMPLND 611	0.75	RCHRES 31	1
IMPLND 631	0.38	RCHRES 31	1
IMPLND 701	3.29	RCHRES 31	1
PERLND 103	6.11	RCHRES 32	2
PERLND 106	120.32	RCHRES 32	2
PERLND 111	6.58	RCHRES 32	2
PERLND 112	4.23	RCHRES 32	2
PERLND 114	4.70	RCHRES 32	2
PERLND 121	1.88	RCHRES 32	2
PERLND 122	6.58	RCHRES 32	2
PERLND 123	1.88	RCHRES 32	2
PERLND 124	8.93	RCHRES 32	2
PERLND 201	0.47	RCHRES 32	2
PERLND 301	92.59	RCHRES 32	2
PERLND 302	16.45	RCHRES 32	2
PERLND 303	46.53	RCHRES 32	2
PERLND 401	0.85	RCHRES 32	2
PERLND 501	0.28	RCHRES 32	2
PERLND 601	13.91	RCHRES 32	2
PERLND 611	0.85	RCHRES 32	2
IMPLND 401	3.38	RCHRES 32	1
IMPLND 501	5.36	RCHRES 32	1
IMPLND 601	3.48	RCHRES 32	1
IMPLND 611	0.56	RCHRES 32	1
PERLND 102	1.88	RCHRES 33	2
PERLND 103	28.20	RCHRES 33	2
PERLND 106	126.43	RCHRES 33	2
PERLND 107	11.28	RCHRES 33	2
PERLND 111	14.10	RCHRES 33	2
PERLND 112	25.38	RCHRES 33	2
PERLND 113	0.94	RCHRES 33	2
PERLND 114	27.73	RCHRES 33	2
PERLND 121	2.35	RCHRES 33	2
PERLND 122	15.98	RCHRES 33	2
PERLND 124	51.70	RCHRES 33	2
PERLND 201	22.56	RCHRES 33	2
PERLND 211	4.70	RCHRES 33	2
PERLND 221	0.94	RCHRES 33	2
PERLND 301	13.63	RCHRES 33	2
PERLND 302	17.86	RCHRES 33	2
PERLND 303	12.22	RCHRES 33	2
PERLND 401	0.09	RCHRES 33	2
PERLND 402	0.28	RCHRES 33	2
PERLND 501	0.02	RCHRES 33	2
PERLND 601	5.26	RCHRES 33	2
PERLND 611	1.69	RCHRES 33	2
PERLND 621	0.38	RCHRES 33	2
IMPLND 401	0.38	RCHRES 33	1
IMPLND 402	1.13	RCHRES 33	1
IMPLND 501	0.45	RCHRES 33	1
IMPLND 601	1.32	RCHRES 33	1

IMPLND 611	1.13	RCHRES 33	1
IMPLND 621	0.56	RCHRES 33	1
PERLND 101	7.99	RCHRES 34	2
PERLND 102	25.85	RCHRES 34	2
PERLND 103	56.40	RCHRES 34	2
PERLND 104	4.23	RCHRES 34	2
PERLND 105	15.04	RCHRES 34	2
PERLND 106	128.31	RCHRES 34	2
PERLND 107	62.98	RCHRES 34	2
PERLND 111	99.17	RCHRES 34	2
PERLND 112	9.87	RCHRES 34	2
PERLND 113	15.98	RCHRES 34	2
PERLND 114	11.75	RCHRES 34	2
PERLND 121	11.75	RCHRES 34	2
PERLND 122	79.90	RCHRES 34	2
PERLND 123	30.08	RCHRES 34	2
PERLND 124	58.28	RCHRES 34	2
PERLND 201	36.19	RCHRES 34	2
PERLND 211	12.22	RCHRES 34	2
PERLND 221	7.05	RCHRES 34	2
PERLND 301	97.76	RCHRES 34	2
PERLND 302	48.88	RCHRES 34	2
PERLND 303	214.79	RCHRES 34	2
PERLND 401	3.01	RCHRES 34	2
PERLND 402	1.60	RCHRES 34	2
PERLND 601	39.86	RCHRES 34	2
PERLND 611	6.49	RCHRES 34	2
PERLND 621	1.50	RCHRES 34	2
IMPLND 401	12.03	RCHRES 34	1
IMPLND 402	6.39	RCHRES 34	1
IMPLND 601	9.96	RCHRES 34	1
IMPLND 611	4.32	RCHRES 34	1
IMPLND 621	2.26	RCHRES 34	1
IMPLND 701	4.23	RCHRES 34	1
PERLND 101	20.21	RCHRES 35	2
PERLND 102	19.27	RCHRES 35	2
PERLND 103	18.80	RCHRES 35	2
PERLND 104	11.28	RCHRES 35	2
PERLND 105	5.64	RCHRES 35	2
PERLND 106	0.94	RCHRES 35	2
PERLND 107	23.50	RCHRES 35	2
PERLND 111	125.49	RCHRES 35	2
PERLND 112	27.26	RCHRES 35	2
PERLND 113	16.45	RCHRES 35	2
PERLND 121	44.18	RCHRES 35	2
PERLND 122	128.31	RCHRES 35	2
PERLND 123	9.87	RCHRES 35	2
PERLND 124	18.33	RCHRES 35	2
PERLND 201	15.98	RCHRES 35	2
PERLND 211	7.52	RCHRES 35	2
PERLND 301	77.55	RCHRES 35	2
PERLND 302	7.52	RCHRES 35	2
PERLND 303	30.08	RCHRES 35	2
PERLND 401	1.50	RCHRES 35	2
PERLND 402	0.85	RCHRES 35	2
PERLND 601	18.42	RCHRES 35	2
PERLND 611	2.54	RCHRES 35	2
PERLND 621	0.56	RCHRES 35	2
PERLND 631	0.09	RCHRES 35	2
IMPLND 401	6.02	RCHRES 35	1
IMPLND 402	3.38	RCHRES 35	1
IMPLND 601	4.61	RCHRES 35	1
IMPLND 611	1.69	RCHRES 35	1
IMPLND 621	0.85	RCHRES 35	1
IMPLND 631	0.38	RCHRES 35	1
PERLND 101	14.10	RCHRES 36	2
PERLND 102	46.06	RCHRES 36	2
PERLND 103	22.09	RCHRES 36	2
PERLND 104	3.76	RCHRES 36	2
PERLND 105	7.05	RCHRES 36	2
PERLND 106	59.22	RCHRES 36	2

PERLND 107	7.52	RCHRES 36	2
PERLND 112	5.17	RCHRES 36	2
PERLND 121	15.51	RCHRES 36	2
PERLND 122	2.35	RCHRES 36	2
PERLND 123	5.17	RCHRES 36	2
PERLND 124	0.47	RCHRES 36	2
PERLND 201	6.11	RCHRES 36	2
PERLND 301	64.86	RCHRES 36	2
PERLND 302	16.45	RCHRES 36	2
PERLND 303	69.09	RCHRES 36	2
PERLND 401	1.97	RCHRES 36	2
PERLND 402	0.75	RCHRES 36	2
PERLND 501	0.07	RCHRES 36	2
PERLND 601	13.91	RCHRES 36	2
PERLND 611	3.10	RCHRES 36	2
PERLND 621	0.75	RCHRES 36	2
IMPLND 401	7.90	RCHRES 36	1
IMPLND 402	3.01	RCHRES 36	1
IMPLND 501	1.34	RCHRES 36	1
IMPLND 601	3.48	RCHRES 36	1
IMPLND 611	2.07	RCHRES 36	1
IMPLND 621	1.13	RCHRES 36	1
IMPLND 701	2.35	RCHRES 36	1
PERLND 101	23.03	RCHRES 37	2
PERLND 102	37.13	RCHRES 37	2
PERLND 103	20.21	RCHRES 37	2
PERLND 104	33.37	RCHRES 37	2
PERLND 105	23.03	RCHRES 37	2
PERLND 106	22.09	RCHRES 37	2
PERLND 107	42.30	RCHRES 37	2
PERLND 111	4.70	RCHRES 37	2
PERLND 112	0.47	RCHRES 37	2
PERLND 113	17.86	RCHRES 37	2
PERLND 114	11.75	RCHRES 37	2
PERLND 121	14.10	RCHRES 37	2
PERLND 122	13.63	RCHRES 37	2
PERLND 123	9.87	RCHRES 37	2
PERLND 124	10.81	RCHRES 37	2
PERLND 201	13.16	RCHRES 37	2
PERLND 301	145.70	RCHRES 37	2
PERLND 303	200.22	RCHRES 37	2
PERLND 401	1.50	RCHRES 37	2
PERLND 501	0.21	RCHRES 37	2
PERLND 601	11.66	RCHRES 37	2
PERLND 611	5.08	RCHRES 37	2
PERLND 621	1.69	RCHRES 37	2
IMPLND 401	6.02	RCHRES 37	1
IMPLND 501	4.02	RCHRES 37	1
IMPLND 601	2.91	RCHRES 37	1
IMPLND 611	3.38	RCHRES 37	1
IMPLND 621	2.54	RCHRES 37	1
IMPLND 701	0.47	RCHRES 37	1
PERLND 101	12.22	RCHRES 38	2
PERLND 102	4.70	RCHRES 38	2
PERLND 104	10.34	RCHRES 38	2
PERLND 105	15.51	RCHRES 38	2
PERLND 106	7.99	RCHRES 38	2
PERLND 107	29.61	RCHRES 38	2
PERLND 111	0.47	RCHRES 38	2
PERLND 112	1.88	RCHRES 38	2
PERLND 113	18.80	RCHRES 38	2
PERLND 121	8.46	RCHRES 38	2
PERLND 122	5.64	RCHRES 38	2
PERLND 123	5.17	RCHRES 38	2
PERLND 124	2.82	RCHRES 38	2
PERLND 201	7.99	RCHRES 38	2
PERLND 211	1.41	RCHRES 38	2
PERLND 301	69.56	RCHRES 38	2
PERLND 302	0.47	RCHRES 38	2
PERLND 303	234.99	RCHRES 38	2
PERLND 401	1.13	RCHRES 38	2

PERLND 501	0.12	RCHRES 38	2
PERLND 601	20.30	RCHRES 38	2
PERLND 611	3.10	RCHRES 38	2
PERLND 621	0.19	RCHRES 38	2
IMPLND 401	4.51	RCHRES 38	1
IMPLND 501	2.23	RCHRES 38	1
IMPLND 601	5.08	RCHRES 38	1
IMPLND 611	2.07	RCHRES 38	1
IMPLND 621	0.28	RCHRES 38	1
PERLND 102	5.64	RCHRES 39	2
PERLND 103	12.69	RCHRES 39	2
PERLND 104	3.29	RCHRES 39	2
PERLND 105	17.39	RCHRES 39	2
PERLND 106	7.99	RCHRES 39	2
PERLND 107	32.90	RCHRES 39	2
PERLND 111	3.29	RCHRES 39	2
PERLND 113	6.11	RCHRES 39	2
PERLND 114	14.10	RCHRES 39	2
PERLND 121	10.34	RCHRES 39	2
PERLND 122	11.75	RCHRES 39	2
PERLND 123	29.61	RCHRES 39	2
PERLND 124	72.85	RCHRES 39	2
PERLND 201	1.41	RCHRES 39	2
PERLND 211	5.64	RCHRES 39	2
PERLND 221	0.47	RCHRES 39	2
PERLND 301	25.38	RCHRES 39	2
PERLND 303	116.09	RCHRES 39	2
PERLND 401	1.13	RCHRES 39	2
PERLND 402	0.94	RCHRES 39	2
PERLND 501	0.14	RCHRES 39	2
PERLND 601	12.78	RCHRES 39	2
PERLND 611	5.64	RCHRES 39	2
PERLND 621	1.32	RCHRES 39	2
PERLND 711	0.05	RCHRES 39	2
IMPLND 401	4.51	RCHRES 39	1
IMPLND 402	3.76	RCHRES 39	1
IMPLND 501	2.68	RCHRES 39	1
IMPLND 601	3.20	RCHRES 39	1
IMPLND 611	3.76	RCHRES 39	1
IMPLND 621	1.97	RCHRES 39	1
IMPLND 711	0.43	RCHRES 39	1
PERLND 102	40.42	RCHRES 40	2
PERLND 103	22.09	RCHRES 40	2
PERLND 105	14.57	RCHRES 40	2
PERLND 106	22.09	RCHRES 40	2
PERLND 111	104.34	RCHRES 40	2
PERLND 112	1.88	RCHRES 40	2
PERLND 113	3.76	RCHRES 40	2
PERLND 114	1.41	RCHRES 40	2
PERLND 121	66.27	RCHRES 40	2
PERLND 122	39.48	RCHRES 40	2
PERLND 123	3.29	RCHRES 40	2
PERLND 124	31.02	RCHRES 40	2
PERLND 201	2.35	RCHRES 40	2
PERLND 211	44.65	RCHRES 40	2
PERLND 301	46.53	RCHRES 40	2
PERLND 303	14.57	RCHRES 40	2
PERLND 401	1.97	RCHRES 40	2
PERLND 402	1.60	RCHRES 40	2
PERLND 501	0.07	RCHRES 40	2
PERLND 601	17.30	RCHRES 40	2
PERLND 611	6.49	RCHRES 40	2
PERLND 621	1.50	RCHRES 40	2
IMPLND 401	7.90	RCHRES 40	1
IMPLND 402	6.39	RCHRES 40	1
IMPLND 501	1.34	RCHRES 40	1
IMPLND 601	4.32	RCHRES 40	1
IMPLND 611	4.32	RCHRES 40	1
IMPLND 621	2.26	RCHRES 40	1
PERLND 102	27.73	RCHRES 41	2
PERLND 103	51.70	RCHRES 41	2

PERLND 104	0.94	RCHRES 41	2
PERLND 106	12.69	RCHRES 41	2
PERLND 107	2.35	RCHRES 41	2
PERLND 111	13.63	RCHRES 41	2
PERLND 121	15.98	RCHRES 41	2
PERLND 122	28.67	RCHRES 41	2
PERLND 124	11.28	RCHRES 41	2
PERLND 211	0.94	RCHRES 41	2
PERLND 221	0.47	RCHRES 41	2
PERLND 301	148.05	RCHRES 41	2
PERLND 303	25.38	RCHRES 41	2
PERLND 401	0.85	RCHRES 41	2
PERLND 402	0.38	RCHRES 41	2
PERLND 501	0.07	RCHRES 41	2
PERLND 601	14.29	RCHRES 41	2
PERLND 611	2.54	RCHRES 41	2
PERLND 621	0.19	RCHRES 41	2
IMPLND 401	3.38	RCHRES 41	1
IMPLND 402	1.50	RCHRES 41	1
IMPLND 501	1.34	RCHRES 41	1
IMPLND 601	3.57	RCHRES 41	1
IMPLND 611	1.69	RCHRES 41	1
IMPLND 621	0.28	RCHRES 41	1
PERLND 102	29.61	RCHRES 42	2
PERLND 103	1.41	RCHRES 42	2
PERLND 104	0.47	RCHRES 42	2
PERLND 105	1.41	RCHRES 42	2
PERLND 107	8.46	RCHRES 42	2
PERLND 111	1.41	RCHRES 42	2
PERLND 112	0.47	RCHRES 42	2
PERLND 121	2.82	RCHRES 42	2
PERLND 122	26.79	RCHRES 42	2
PERLND 124	16.92	RCHRES 42	2
PERLND 201	0.47	RCHRES 42	2
PERLND 301	63.45	RCHRES 42	2
PERLND 303	2.82	RCHRES 42	2
PERLND 401	1.13	RCHRES 42	2
PERLND 402	0.28	RCHRES 42	2
PERLND 501	0.02	RCHRES 42	2
PERLND 601	7.90	RCHRES 42	2
PERLND 611	2.54	RCHRES 42	2
IMPLND 401	4.51	RCHRES 42	1
IMPLND 402	1.13	RCHRES 42	1
IMPLND 501	0.45	RCHRES 42	1
IMPLND 601	1.97	RCHRES 42	1
IMPLND 611	1.69	RCHRES 42	1
IMPLND 701	1.41	RCHRES 42	1
PERLND 101	8.93	RCHRES 43	2
PERLND 102	7.52	RCHRES 43	2
PERLND 103	54.05	RCHRES 43	2
PERLND 104	15.04	RCHRES 43	2
PERLND 105	6.58	RCHRES 43	2
PERLND 106	2.82	RCHRES 43	2
PERLND 107	39.48	RCHRES 43	2
PERLND 111	7.52	RCHRES 43	2
PERLND 112	1.88	RCHRES 43	2
PERLND 113	3.29	RCHRES 43	2
PERLND 114	0.94	RCHRES 43	2
PERLND 121	3.76	RCHRES 43	2
PERLND 122	31.49	RCHRES 43	2
PERLND 123	2.82	RCHRES 43	2
PERLND 124	30.08	RCHRES 43	2
PERLND 211	0.47	RCHRES 43	2
PERLND 301	180.01	RCHRES 43	2
PERLND 302	0.47	RCHRES 43	2
PERLND 303	71.91	RCHRES 43	2
PERLND 401	2.26	RCHRES 43	2
PERLND 501	0.05	RCHRES 43	2
PERLND 601	21.06	RCHRES 43	2
PERLND 611	5.08	RCHRES 43	2
PERLND 621	0.38	RCHRES 43	2

IMPLND 401	9.02	RCHRES 43	1
IMPLND 501	0.89	RCHRES 43	1
IMPLND 601	5.26	RCHRES 43	1
IMPLND 611	3.38	RCHRES 43	1
IMPLND 621	0.56	RCHRES 43	1
IMPLND 701	0.47	RCHRES 43	1
PERLND 102	7.52	RCHRES 44	2
PERLND 104	59.69	RCHRES 44	2
PERLND 107	66.27	RCHRES 44	2
PERLND 111	16.45	RCHRES 44	2
PERLND 113	0.94	RCHRES 44	2
PERLND 114	0.47	RCHRES 44	2
PERLND 121	20.68	RCHRES 44	2
PERLND 123	0.94	RCHRES 44	2
PERLND 124	4.23	RCHRES 44	2
PERLND 201	1.41	RCHRES 44	2
PERLND 301	42.30	RCHRES 44	2
PERLND 303	7.52	RCHRES 44	2
PERLND 401	0.19	RCHRES 44	2
PERLND 402	0.75	RCHRES 44	2
PERLND 601	7.14	RCHRES 44	2
PERLND 611	1.97	RCHRES 44	2
PERLND 621	0.75	RCHRES 44	2
IMPLND 401	0.75	RCHRES 44	1
IMPLND 402	3.01	RCHRES 44	1
IMPLND 601	1.79	RCHRES 44	1
IMPLND 611	1.32	RCHRES 44	1
IMPLND 621	1.13	RCHRES 44	1
IMPLND 701	0.47	RCHRES 44	1
PERLND 101	27.26	RCHRES 45	2
PERLND 102	9.40	RCHRES 45	2
PERLND 103	15.98	RCHRES 45	2
PERLND 104	27.26	RCHRES 45	2
PERLND 105	2.82	RCHRES 45	2
PERLND 106	0.47	RCHRES 45	2
PERLND 107	95.41	RCHRES 45	2
PERLND 111	7.99	RCHRES 45	2
PERLND 112	8.93	RCHRES 45	2
PERLND 113	2.82	RCHRES 45	2
PERLND 114	2.35	RCHRES 45	2
PERLND 121	3.76	RCHRES 45	2
PERLND 122	87.89	RCHRES 45	2
PERLND 123	1.41	RCHRES 45	2
PERLND 124	17.39	RCHRES 45	2
PERLND 201	0.94	RCHRES 45	2
PERLND 211	1.88	RCHRES 45	2
PERLND 221	0.47	RCHRES 45	2
PERLND 301	79.90	RCHRES 45	2
PERLND 302	1.41	RCHRES 45	2
PERLND 303	23.03	RCHRES 45	2
PERLND 401	0.28	RCHRES 45	2
PERLND 601	4.89	RCHRES 45	2
PERLND 611	0.85	RCHRES 45	2
PERLND 621	0.19	RCHRES 45	2
IMPLND 401	1.13	RCHRES 45	1
IMPLND 601	1.22	RCHRES 45	1
IMPLND 611	0.56	RCHRES 45	1
IMPLND 621	0.28	RCHRES 45	1
IMPLND 701	1.41	RCHRES 45	1
PERLND 102	7.52	RCHRES 46	2
PERLND 103	23.03	RCHRES 46	2
PERLND 104	6.11	RCHRES 46	2
PERLND 105	1.88	RCHRES 46	2
PERLND 106	25.38	RCHRES 46	2
PERLND 107	36.19	RCHRES 46	2
PERLND 111	29.14	RCHRES 46	2
PERLND 112	21.62	RCHRES 46	2
PERLND 113	16.92	RCHRES 46	2
PERLND 114	1.88	RCHRES 46	2
PERLND 121	17.39	RCHRES 46	2
PERLND 122	40.89	RCHRES 46	2

PERLND 123	2.82	RCHRES 46	2
PERLND 124	48.41	RCHRES 46	2
PERLND 201	41.36	RCHRES 46	2
PERLND 211	1.41	RCHRES 46	2
PERLND 301	33.84	RCHRES 46	2
PERLND 302	2.82	RCHRES 46	2
PERLND 303	17.39	RCHRES 46	2
PERLND 401	0.75	RCHRES 46	2
PERLND 402	0.56	RCHRES 46	2
PERLND 601	6.02	RCHRES 46	2
PERLND 611	0.85	RCHRES 46	2
PERLND 711	0.47	RCHRES 46	2
IMPLND 401	3.01	RCHRES 46	1
IMPLND 402	2.26	RCHRES 46	1
IMPLND 601	1.50	RCHRES 46	1
IMPLND 611	0.56	RCHRES 46	1
IMPLND 701	5.64	RCHRES 46	1
IMPLND 711	4.28	RCHRES 46	1
PERLND 102	2.35	RCHRES 47	2
PERLND 103	3.76	RCHRES 47	2
PERLND 104	9.87	RCHRES 47	2
PERLND 111	2.82	RCHRES 47	2
PERLND 112	29.61	RCHRES 47	2
PERLND 114	4.70	RCHRES 47	2
PERLND 121	0.94	RCHRES 47	2
PERLND 122	9.40	RCHRES 47	2
PERLND 124	0.94	RCHRES 47	2
PERLND 201	105.75	RCHRES 47	2
PERLND 211	93.53	RCHRES 47	2
PERLND 301	15.51	RCHRES 47	2
PERLND 303	12.22	RCHRES 47	2
PERLND 401	0.09	RCHRES 47	2
PERLND 601	3.76	RCHRES 47	2
PERLND 611	1.97	RCHRES 47	2
IMPLND 401	0.38	RCHRES 47	1
IMPLND 601	0.94	RCHRES 47	1
IMPLND 611	1.32	RCHRES 47	1
PERLND 102	0.47	RCHRES 48	2
PERLND 103	23.03	RCHRES 48	2
PERLND 105	0.47	RCHRES 48	2
PERLND 106	28.20	RCHRES 48	2
PERLND 107	0.47	RCHRES 48	2
PERLND 111	11.75	RCHRES 48	2
PERLND 112	2.82	RCHRES 48	2
PERLND 113	22.09	RCHRES 48	2
PERLND 114	6.58	RCHRES 48	2
PERLND 121	9.40	RCHRES 48	2
PERLND 122	8.93	RCHRES 48	2
PERLND 123	13.16	RCHRES 48	2
PERLND 124	26.79	RCHRES 48	2
PERLND 201	2.35	RCHRES 48	2
PERLND 211	31.49	RCHRES 48	2
PERLND 301	17.39	RCHRES 48	2
PERLND 302	0.47	RCHRES 48	2
PERLND 303	5.17	RCHRES 48	2
PERLND 401	0.19	RCHRES 48	2
PERLND 601	2.26	RCHRES 48	2
PERLND 611	1.41	RCHRES 48	2
IMPLND 401	0.75	RCHRES 48	1
IMPLND 601	0.56	RCHRES 48	1
IMPLND 611	0.94	RCHRES 48	1
PERLND 102	0.47	RCHRES 49	2
PERLND 103	34.31	RCHRES 49	2
PERLND 106	12.22	RCHRES 49	2
PERLND 111	5.64	RCHRES 49	2
PERLND 112	17.86	RCHRES 49	2
PERLND 113	4.23	RCHRES 49	2
PERLND 121	0.94	RCHRES 49	2
PERLND 122	23.97	RCHRES 49	2
PERLND 123	0.47	RCHRES 49	2
PERLND 124	12.22	RCHRES 49	2

PERLND 201	46.53	RCHRES 49	2
PERLND 211	49.82	RCHRES 49	2
PERLND 301	31.02	RCHRES 49	2
PERLND 303	14.10	RCHRES 49	2
PERLND 401	0.28	RCHRES 49	2
PERLND 601	2.63	RCHRES 49	2
IMPLND 401	1.13	RCHRES 49	1
IMPLND 601	0.66	RCHRES 49	1
PERLND 102	3.29	RCHRES 50	2
PERLND 103	13.16	RCHRES 50	2
PERLND 105	22.09	RCHRES 50	2
PERLND 106	109.98	RCHRES 50	2
PERLND 107	6.11	RCHRES 50	2
PERLND 111	41.83	RCHRES 50	2
PERLND 112	15.04	RCHRES 50	2
PERLND 113	37.60	RCHRES 50	2
PERLND 114	59.69	RCHRES 50	2
PERLND 121	11.28	RCHRES 50	2
PERLND 122	23.03	RCHRES 50	2
PERLND 123	26.32	RCHRES 50	2
PERLND 124	92.12	RCHRES 50	2
PERLND 201	2.35	RCHRES 50	2
PERLND 221	1.88	RCHRES 50	2
PERLND 301	2.35	RCHRES 50	2
PERLND 302	15.04	RCHRES 50	2
PERLND 303	39.95	RCHRES 50	2
PERLND 401	1.50	RCHRES 50	2
PERLND 601	15.04	RCHRES 50	2
PERLND 611	3.38	RCHRES 50	2
PERLND 711	0.89	RCHRES 50	2
IMPLND 401	6.02	RCHRES 50	1
IMPLND 601	3.76	RCHRES 50	1
IMPLND 611	2.26	RCHRES 50	1
IMPLND 701	4.70	RCHRES 50	1
IMPLND 711	8.13	RCHRES 50	1
*** direct lake drainage			
PERLND 103	0.47	RCHRES 999	2
PERLND 106	9.87	RCHRES 999	2
PERLND 112	1.41	RCHRES 999	2
PERLND 114	2.82	RCHRES 999	2
PERLND 122	0.94	RCHRES 999	2
PERLND 123	0.47	RCHRES 999	2
PERLND 124	0.47	RCHRES 999	2
PERLND 601	1.13	RCHRES 999	2
PERLND 611	1.41	RCHRES 999	2
PERLND 711	0.19	RCHRES 999	2
IMPLND 601	0.28	RCHRES 999	1
IMPLND 611	0.94	RCHRES 999	1
IMPLND 701	1.41	RCHRES 999	1
IMPLND 711	1.71	RCHRES 999	1
PERLND 102	0.47	RCHRES 52	2
PERLND 103	5.17	RCHRES 52	2
PERLND 104	14.57	RCHRES 52	2
PERLND 106	2.35	RCHRES 52	2
PERLND 107	126.43	RCHRES 52	2
PERLND 111	18.80	RCHRES 52	2
PERLND 112	48.88	RCHRES 52	2
PERLND 114	6.58	RCHRES 52	2
PERLND 121	5.64	RCHRES 52	2
PERLND 122	17.39	RCHRES 52	2
PERLND 124	14.57	RCHRES 52	2
PERLND 201	54.52	RCHRES 52	2
PERLND 211	7.99	RCHRES 52	2
PERLND 301	30.08	RCHRES 52	2
PERLND 302	37.13	RCHRES 52	2
PERLND 303	37.60	RCHRES 52	2
PERLND 401	1.97	RCHRES 52	2
PERLND 601	15.42	RCHRES 52	2
PERLND 611	7.05	RCHRES 52	2
IMPLND 401	7.90	RCHRES 52	1
IMPLND 601	3.85	RCHRES 52	1

IMPLND 611	4.70	RCHRES 52	1
PERLND 102	7.52	RCHRES 53	2
PERLND 104	3.29	RCHRES 53	2
PERLND 105	22.56	RCHRES 53	2
PERLND 106	0.94	RCHRES 53	2
PERLND 107	66.74	RCHRES 53	2
PERLND 111	39.01	RCHRES 53	2
PERLND 112	19.74	RCHRES 53	2
PERLND 113	71.91	RCHRES 53	2
PERLND 114	10.81	RCHRES 53	2
PERLND 121	7.05	RCHRES 53	2
PERLND 122	4.70	RCHRES 53	2
PERLND 123	13.63	RCHRES 53	2
PERLND 124	12.69	RCHRES 53	2
PERLND 201	59.69	RCHRES 53	2
PERLND 211	2.82	RCHRES 53	2
PERLND 221	0.47	RCHRES 53	2
PERLND 301	61.10	RCHRES 53	2
PERLND 303	39.48	RCHRES 53	2
PERLND 401	1.13	RCHRES 53	2
PERLND 601	1.50	RCHRES 53	2
PERLND 611	3.95	RCHRES 53	2
PERLND 711	0.23	RCHRES 53	2
IMPLND 401	4.51	RCHRES 53	1
IMPLND 601	0.38	RCHRES 53	1
IMPLND 611	2.63	RCHRES 53	1
IMPLND 701	0.47	RCHRES 53	1
IMPLND 711	2.14	RCHRES 53	1
*** direct lake drainage			
PERLND 102	7.52	RCHRES 999	2
PERLND 103	27.26	RCHRES 999	2
PERLND 104	2.35	RCHRES 999	2
PERLND 105	24.91	RCHRES 999	2
PERLND 106	23.97	RCHRES 999	2
PERLND 107	30.55	RCHRES 999	2
PERLND 111	15.04	RCHRES 999	2
PERLND 112	40.42	RCHRES 999	2
PERLND 113	22.09	RCHRES 999	2
PERLND 114	40.42	RCHRES 999	2
PERLND 121	6.58	RCHRES 999	2
PERLND 122	30.55	RCHRES 999	2
PERLND 123	12.22	RCHRES 999	2
PERLND 124	51.23	RCHRES 999	2
PERLND 201	24.91	RCHRES 999	2
PERLND 301	52.64	RCHRES 999	2
PERLND 303	68.15	RCHRES 999	2
PERLND 401	0.75	RCHRES 999	2
PERLND 601	9.02	RCHRES 999	2
PERLND 611	7.05	RCHRES 999	2
PERLND 711	0.38	RCHRES 999	2
IMPLND 401	3.01	RCHRES 999	1
IMPLND 601	2.26	RCHRES 999	1
IMPLND 611	4.70	RCHRES 999	1
IMPLND 701	2.35	RCHRES 999	1
IMPLND 711	3.42	RCHRES 999	1
PERLND 102	6.11	RCHRES 55	2
PERLND 105	5.64	RCHRES 55	2
PERLND 111	0.47	RCHRES 55	2
PERLND 113	0.94	RCHRES 55	2
PERLND 121	3.76	RCHRES 55	2
PERLND 123	0.94	RCHRES 55	2
PERLND 201	0.47	RCHRES 55	2
PERLND 301	3.76	RCHRES 55	2
PERLND 303	6.58	RCHRES 55	2
IMPLND 701	0.47	RCHRES 55	1
PERLND 103	4.70	RCHRES 56	2
PERLND 105	12.22	RCHRES 56	2
PERLND 106	43.71	RCHRES 56	2
PERLND 122	1.41	RCHRES 56	2
PERLND 123	1.41	RCHRES 56	2
PERLND 124	1.41	RCHRES 56	2

PERLND 301	20.21	RCHRES 56	2
PERLND 303	135.83	RCHRES 56	2
PERLND 401	0.85	RCHRES 56	2
PERLND 601	4.14	RCHRES 56	2
PERLND 611	2.26	RCHRES 56	2
PERLND 711	0.14	RCHRES 56	2
IMPLND 401	3.38	RCHRES 56	1
IMPLND 601	1.03	RCHRES 56	1
IMPLND 611	1.50	RCHRES 56	1
IMPLND 701	3.29	RCHRES 56	1
IMPLND 711	1.28	RCHRES 56	1
PERLND 103	39.95	RCHRES 57	2
PERLND 106	52.64	RCHRES 57	2
PERLND 107	0.47	RCHRES 57	2
PERLND 111	1.41	RCHRES 57	2
PERLND 112	5.64	RCHRES 57	2
PERLND 114	48.88	RCHRES 57	2
PERLND 121	4.23	RCHRES 57	2
PERLND 122	18.80	RCHRES 57	2
PERLND 123	2.35	RCHRES 57	2
PERLND 124	44.65	RCHRES 57	2
PERLND 201	34.78	RCHRES 57	2
PERLND 211	1.41	RCHRES 57	2
PERLND 301	36.19	RCHRES 57	2
PERLND 302	1.88	RCHRES 57	2
PERLND 303	36.19	RCHRES 57	2
PERLND 401	0.28	RCHRES 57	2
PERLND 601	15.42	RCHRES 57	2
PERLND 611	1.13	RCHRES 57	2
IMPLND 401	1.13	RCHRES 57	1
IMPLND 601	3.85	RCHRES 57	1
IMPLND 611	0.75	RCHRES 57	1
PERLND 103	6.58	RCHRES 58	2
PERLND 105	6.58	RCHRES 58	2
PERLND 106	11.75	RCHRES 58	2
PERLND 112	6.11	RCHRES 58	2
PERLND 114	19.74	RCHRES 58	2
PERLND 122	8.93	RCHRES 58	2
PERLND 123	1.41	RCHRES 58	2
PERLND 124	6.58	RCHRES 58	2
PERLND 201	0.47	RCHRES 58	2
PERLND 211	0.47	RCHRES 58	2
PERLND 221	3.29	RCHRES 58	2
PERLND 301	4.70	RCHRES 58	2
PERLND 302	9.87	RCHRES 58	2
PERLND 303	184.24	RCHRES 58	2
PERLND 401	1.32	RCHRES 58	2
PERLND 601	5.26	RCHRES 58	2
PERLND 611	1.97	RCHRES 58	2
PERLND 621	1.88	RCHRES 58	2
IMPLND 401	5.26	RCHRES 58	1
IMPLND 601	1.32	RCHRES 58	1
IMPLND 611	1.32	RCHRES 58	1
IMPLND 621	2.82	RCHRES 58	1
PERLND 102	3.76	RCHRES 59	2
PERLND 103	0.94	RCHRES 59	2
PERLND 105	70.50	RCHRES 59	2
PERLND 106	20.21	RCHRES 59	2
PERLND 111	8.46	RCHRES 59	2
PERLND 112	1.41	RCHRES 59	2
PERLND 113	39.01	RCHRES 59	2
PERLND 114	1.88	RCHRES 59	2
PERLND 121	29.14	RCHRES 59	2
PERLND 122	0.94	RCHRES 59	2
PERLND 123	54.99	RCHRES 59	2
PERLND 124	21.62	RCHRES 59	2
PERLND 201	0.47	RCHRES 59	2
PERLND 221	3.76	RCHRES 59	2
PERLND 301	62.51	RCHRES 59	2
PERLND 302	42.30	RCHRES 59	2
PERLND 303	243.45	RCHRES 59	2

PERLND 401	2.16	RCHRES 59	2
PERLND 501	0.42	RCHRES 59	2
PERLND 601	12.03	RCHRES 59	2
PERLND 611	3.67	RCHRES 59	2
PERLND 621	0.19	RCHRES 59	2
IMPLND 401	8.65	RCHRES 59	1
IMPLND 501	8.04	RCHRES 59	1
IMPLND 601	3.01	RCHRES 59	1
IMPLND 611	2.44	RCHRES 59	1
IMPLND 621	0.28	RCHRES 59	1
PERLND 102	3.76	RCHRES 60	2
PERLND 103	7.05	RCHRES 60	2
PERLND 105	2.82	RCHRES 60	2
PERLND 106	49.35	RCHRES 60	2
PERLND 111	5.17	RCHRES 60	2
PERLND 113	6.11	RCHRES 60	2
PERLND 121	4.23	RCHRES 60	2
PERLND 122	5.17	RCHRES 60	2
PERLND 123	18.33	RCHRES 60	2
PERLND 124	3.29	RCHRES 60	2
PERLND 301	31.49	RCHRES 60	2
PERLND 303	156.98	RCHRES 60	2
PERLND 401	1.60	RCHRES 60	2
PERLND 601	11.66	RCHRES 60	2
PERLND 611	1.69	RCHRES 60	2
PERLND 621	3.01	RCHRES 60	2
IMPLND 401	6.39	RCHRES 60	1
IMPLND 601	2.91	RCHRES 60	1
IMPLND 611	1.13	RCHRES 60	1
IMPLND 621	4.51	RCHRES 60	1
PERLND 102	7.99	RCHRES 61	2
PERLND 103	34.31	RCHRES 61	2
PERLND 104	5.17	RCHRES 61	2
PERLND 105	4.70	RCHRES 61	2
PERLND 106	40.42	RCHRES 61	2
PERLND 107	34.78	RCHRES 61	2
PERLND 111	24.91	RCHRES 61	2
PERLND 113	1.88	RCHRES 61	2
PERLND 114	1.88	RCHRES 61	2
PERLND 121	5.64	RCHRES 61	2
PERLND 122	21.15	RCHRES 61	2
PERLND 123	7.52	RCHRES 61	2
PERLND 124	13.16	RCHRES 61	2
PERLND 301	8.93	RCHRES 61	2
PERLND 302	1.88	RCHRES 61	2
PERLND 303	7.05	RCHRES 61	2
PERLND 401	0.38	RCHRES 61	2
PERLND 601	3.01	RCHRES 61	2
PERLND 611	1.13	RCHRES 61	2
PERLND 711	0.33	RCHRES 61	2
IMPLND 401	1.50	RCHRES 61	1
IMPLND 601	0.75	RCHRES 61	1
IMPLND 611	0.75	RCHRES 61	1
IMPLND 701	8.93	RCHRES 61	1
IMPLND 711	2.99	RCHRES 61	1
PERLND 102	0.47	RCHRES 100	2
PERLND 103	1.88	RCHRES 100	2
PERLND 104	0.47	RCHRES 100	2
PERLND 105	12.22	RCHRES 100	2
PERLND 106	13.63	RCHRES 100	2
PERLND 107	0.94	RCHRES 100	2
PERLND 301	113.27	RCHRES 100	2
PERLND 303	29.61	RCHRES 100	2
PERLND 401	0.56	RCHRES 100	2
PERLND 402	0.66	RCHRES 100	2
PERLND 601	3.01	RCHRES 100	2
PERLND 611	0.85	RCHRES 100	2
PERLND 621	1.88	RCHRES 100	2
IMPLND 401	2.26	RCHRES 100	1
IMPLND 402	2.63	RCHRES 100	1
IMPLND 601	0.75	RCHRES 100	1

IMPLND 611	0.56	RCHRES 100	1
IMPLND 621	2.82	RCHRES 100	1
IMPLND 701	4.23	RCHRES 100	1
PERLND 103	1.41	RCHRES 101	2
PERLND 106	5.64	RCHRES 101	2
PERLND 122	0.47	RCHRES 101	2
PERLND 201	0.47	RCHRES 101	2
PERLND 301	42.30	RCHRES 101	2
PERLND 303	23.97	RCHRES 101	2
PERLND 401	0.09	RCHRES 101	2
PERLND 601	0.75	RCHRES 101	2
PERLND 621	0.19	RCHRES 101	2
IMPLND 401	0.38	RCHRES 101	1
IMPLND 601	0.19	RCHRES 101	1
IMPLND 621	0.28	RCHRES 101	1
IMPLND 701	10.34	RCHRES 101	1
PERLND 102	4.70	RCHRES 102	2
PERLND 103	2.82	RCHRES 102	2
PERLND 104	8.46	RCHRES 102	2
PERLND 105	23.03	RCHRES 102	2
PERLND 106	0.47	RCHRES 102	2
PERLND 107	20.68	RCHRES 102	2
PERLND 112	0.94	RCHRES 102	2
PERLND 113	0.94	RCHRES 102	2
PERLND 121	3.76	RCHRES 102	2
PERLND 122	11.75	RCHRES 102	2
PERLND 123	4.23	RCHRES 102	2
PERLND 124	0.47	RCHRES 102	2
PERLND 301	36.19	RCHRES 102	2
PERLND 302	39.01	RCHRES 102	2
PERLND 303	136.30	RCHRES 102	2
PERLND 401	1.03	RCHRES 102	2
PERLND 402	0.75	RCHRES 102	2
PERLND 601	11.66	RCHRES 102	2
PERLND 611	0.56	RCHRES 102	2
IMPLND 401	4.14	RCHRES 102	1
IMPLND 402	3.01	RCHRES 102	1
IMPLND 601	2.91	RCHRES 102	1
IMPLND 611	0.38	RCHRES 102	1
IMPLND 701	17.39	RCHRES 102	1
PERLND 103	7.99	RCHRES 103	2
PERLND 106	3.76	RCHRES 103	2
PERLND 111	11.75	RCHRES 103	2
PERLND 121	3.76	RCHRES 103	2
PERLND 122	3.29	RCHRES 103	2
PERLND 302	0.94	RCHRES 103	2
PERLND 401	0.28	RCHRES 103	2
PERLND 601	1.88	RCHRES 103	2
PERLND 611	0.28	RCHRES 103	2
IMPLND 401	1.13	RCHRES 103	1
IMPLND 601	0.47	RCHRES 103	1
IMPLND 611	0.19	RCHRES 103	1
IMPLND 701	8.93	RCHRES 103	1
PERLND 102	7.52	RCHRES 104	2
PERLND 105	0.94	RCHRES 104	2
PERLND 112	0.47	RCHRES 104	2
PERLND 113	0.47	RCHRES 104	2
PERLND 114	0.94	RCHRES 104	2
PERLND 121	2.35	RCHRES 104	2
PERLND 122	0.47	RCHRES 104	2
PERLND 123	2.35	RCHRES 104	2
PERLND 301	40.42	RCHRES 104	2
PERLND 303	37.60	RCHRES 104	2
PERLND 401	0.47	RCHRES 104	2
PERLND 601	2.26	RCHRES 104	2
PERLND 611	1.41	RCHRES 104	2
PERLND 621	0.19	RCHRES 104	2
IMPLND 401	1.88	RCHRES 104	1
IMPLND 601	0.56	RCHRES 104	1
IMPLND 611	0.94	RCHRES 104	1
IMPLND 621	0.28	RCHRES 104	1

IMPLND 701	5.64	RCHRES 104	1
PERLND 105	0.47	RCHRES 105	2
PERLND 111	8.93	RCHRES 105	2
PERLND 121	0.47	RCHRES 105	2
PERLND 201	2.82	RCHRES 105	2
PERLND 211	0.94	RCHRES 105	2
PERLND 301	25.85	RCHRES 105	2
PERLND 302	9.87	RCHRES 105	2
PERLND 303	0.94	RCHRES 105	2
PERLND 401	0.28	RCHRES 105	2
PERLND 501	0.07	RCHRES 105	2
PERLND 601	1.88	RCHRES 105	2
PERLND 611	2.82	RCHRES 105	2
PERLND 621	0.19	RCHRES 105	2
IMPLND 401	1.13	RCHRES 105	1
IMPLND 501	1.34	RCHRES 105	1
IMPLND 601	0.47	RCHRES 105	1
IMPLND 611	1.88	RCHRES 105	1
IMPLND 621	0.28	RCHRES 105	1
IMPLND 701	5.64	RCHRES 105	1
PERLND 101	0.94	RCHRES 999	2
PERLND 102	1.41	RCHRES 999	2
PERLND 104	0.47	RCHRES 999	2
PERLND 105	15.51	RCHRES 999	2
PERLND 107	0.94	RCHRES 999	2
PERLND 113	2.82	RCHRES 999	2
PERLND 121	0.94	RCHRES 999	2
PERLND 122	2.82	RCHRES 999	2
PERLND 123	1.88	RCHRES 999	2
PERLND 124	0.47	RCHRES 999	2
PERLND 201	2.35	RCHRES 999	2
PERLND 221	2.35	RCHRES 999	2
PERLND 303	3.29	RCHRES 999	2
PERLND 711	4.65	RCHRES 999	2
IMPLND 701	1045.26	RCHRES 999	1
IMPLND 711	42.34	RCHRES 999	1
RCHRES 1		RCHRES 4	3
RCHRES 2		RCHRES 4	3
RCHRES 3		RCHRES 4	3
RCHRES 4		RCHRES 5	3
RCHRES 5		RCHRES 7	3
RCHRES 6		RCHRES 7	3
RCHRES 7		RCHRES 8	3
RCHRES 8		RCHRES 13	3
RCHRES 101		RCHRES 9	3
RCHRES 9		RCHRES 13	3
RCHRES 10		RCHRES 13	3
RCHRES 100		RCHRES 11	3
RCHRES 11		RCHRES 13	3
RCHRES 104		RCHRES 13	3
RCHRES 102		RCHRES 14	3
RCHRES 13		RCHRES 16	3
RCHRES 14		RCHRES 16	3
RCHRES 15		RCHRES 16	3
RCHRES 16		RCHRES 26	3
RCHRES 17		RCHRES 18	3
RCHRES 18		RCHRES 20	3
RCHRES 19		RCHRES 20	3
RCHRES 20		RCHRES 22	3
RCHRES 105		RCHRES 21	3
RCHRES 21		RCHRES 22	3
RCHRES 22		RCHRES 23	3
RCHRES 23		RCHRES 24	3
RCHRES 24		RCHRES 26	3
RCHRES 25		RCHRES 26	3
RCHRES 27		RCHRES 26	3
RCHRES 28		RCHRES 26	3
RCHRES 103		RCHRES 26	3
RCHRES 26		RCHRES 30	4
RCHRES 29		RCHRES 30	3

RCHRES	30			RCHRES	31	3	
RCHRES	31			RCHRES	37	3	
RCHRES	32			RCHRES	34	3	
RCHRES	33			RCHRES	34	3	
RCHRES	34			RCHRES	35	3	
RCHRES	35			RCHRES	36	3	
RCHRES	36			RCHRES	37	3	
RCHRES	37			RCHRES	38	3	
RCHRES	39			RCHRES	38	3	
RCHRES	40			RCHRES	38	3	
RCHRES	41			RCHRES	38	3	
RCHRES	38			RCHRES	43	4	
RCHRES	42			RCHRES	43	3	
RCHRES	44			RCHRES	45	3	
RCHRES	43			RCHRES	45	4	
RCHRES	45			RCHRES	999	4	
RCHRES	46			RCHRES	999	3	
RCHRES	47			RCHRES	49	3	
RCHRES	48			RCHRES	49	3	
RCHRES	49			RCHRES	999	3	
RCHRES	50			RCHRES	999	3	
*** RCHRES	51			RCHRES	999	3	<-- direct runoff
RCHRES	52			RCHRES	999	3	
RCHRES	53			RCHRES	999	3	
RCHRES	54			RCHRES	999	3	
*** RCHRES	55			RCHRES	999	3	<-- direct runoff
RCHRES	56			RCHRES	999	3	
RCHRES	57			RCHRES	58	3	
RCHRES	58			RCHRES	999	3	
RCHRES	59			RCHRES	61	3	
RCHRES	60			RCHRES	61	3	
RCHRES	61			RCHRES	999	3	

END SCHEMATIC

MASS-LINK

MASS-LINK	1			<-Target vols>	<-Grp>	<-Member->	***	
<-Volume->	<-Grp>	<-Member->	<--Mult-->	<Name>		<Name> x x	***	
<Name>		<Name>	x x<-factor->					
IMPLND	IWATER	SURO	0.0833333	RCHRES	INFLOW	IVOL		
IMPLND	IQUAL	SOQUAL	1	RCHRES	INFLOW	IDQAL	1	
IMPLND	IQUAL	SOQUAL	2	RCHRES	INFLOW	IDQAL	2	
IMPLND	SOLIDS	SOSLD	1	0.10	RCHRES	INFLOW	ISED	1
IMPLND	SOLIDS	SOSLD	1	0.40	RCHRES	INFLOW	ISED	2
IMPLND	SOLIDS	SOSLD	1	0.50	RCHRES	INFLOW	ISED	3
END MASS-LINK	1							

MASS-LINK	2			<-Target vols>	<-Grp>	<-Member->	***	
<-Volume->	<-Grp>	<-Member->	<--Mult-->	<Name>		<Name> x x	***	
<Name>		<Name>	x x<-factor->					
PERLND	PWATER	PERO	0.0833333	RCHRES	INFLOW	IVOL		
PERLND	PQUAL	POQUAL	1	RCHRES	INFLOW	IDQAL	1	
PERLND	PQUAL	POQUAL	2	RCHRES	INFLOW	IDQAL	1	
PERLND	PQUAL	POQUAL	3	RCHRES	INFLOW	IDQAL	2	
PERLND	PQUAL	POQUAL	4	RCHRES	INFLOW	IDQAL	2	
PERLND	SEDMNT	SOSED	1	0.10	RCHRES	INFLOW	ISED	1
PERLND	SEDMNT	SOSED	1	0.40	RCHRES	INFLOW	ISED	2
PERLND	SEDMNT	SOSED	1	0.50	RCHRES	INFLOW	ISED	3
END MASS-LINK	2							

MASS-LINK	3			<-Target vols>	<-Grp>	<-Member->	***
<-Volume->	<-Grp>	<-Member->	<--Mult-->	<Name>		<Name> x x	***
<Name>		<Name>	x x<-factor->				
RCHRES	ROFLOW			RCHRES	INFLOW		
END MASS-LINK	3						

MASS-LINK	4			<-Target vols>	<-Grp>	<-Member->	***
<-Volume->	<-Grp>	<-Member->	<--Mult-->	<Name>		<Name> x x	***
<Name>		<Name>	x x<-factor->				
RCHRES	OFLOW	OVOL	1 1	1.00	RCHRES	INFLOW	IVOL

```

RCHRES      OFLOW  ODQAL  1  1      1.00      RCHRES      INFLOW  IDQAL  1
RCHRES      OFLOW  ODQAL  1  2      1.00      RCHRES      INFLOW  IDQAL  2
RCHRES      OFLOW  OSED   1  1      1.00      RCHRES      INFLOW  ISED   1
RCHRES      OFLOW  OSED   1  2      1.00      RCHRES      INFLOW  ISED   2
RCHRES      OFLOW  OSED   1  3      1.00      RCHRES      INFLOW  ISED   3
      END MASS-LINK      4

```

END MASS-LINK

SPEC-ACTIONS

```

*** USER-DEFINED VARIABLE QUANTITY LINES
***          addr
***          <----->
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
<****> <-----> <-----> <-> <-----><-><-><-><-><-----> <-><-> <-><-> <---> ***
UVQUAN prec1  PERLND 301  PREC          3          DY  1  SUM

```

*** Phosphorus fertilizer application, distributed over 10 days

```

*** DISTRIBUTIONS
*** kwd  ds  ct  tc  ts  dff  f1  f2  f3  f4  f5  f6  f7  f8  f9  f10
<****>< > < > < > < > <---> <---><---><---><---><---><---><---><---><---><--->
DISTRB  1  10  DY  1  SHIFT  .10 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10

```

```

*** USER-DEFINED TARGET VARIABLE NAMES
***          addr          addr
***          <----->          <----->
*** kwd  varnam ct  vari  s1 s2 s3  frac oper  vari  s1 s2 s3  frac oper
<****> <-----><-> <-----><-><-><-> <---> <---> <-----><-><-><-> <---> <--->
***          TN          TP
UVNAME  MANURE  2  SQO  2          0.600  QUAN  SQO  4          0.400  QUAN

```

```

*** ACTION LINES
***          addr          uvquan
***          f  -1          <----->          <----->
***optyp range dc ds yr  mo da hr mn d t  vari  s1 s2 s3 ac  value  tc ts num
<****><-><---><-><-> <---><---><---><---><---><---> <-----><-><-><-> <---> < > < > >
*** After 1 year decay rate 0.9998 = 2.9%, 0.9997 = 0.5%, 0.9996 = 0.1% left over
PERLND301  DY          3  SQO  2          4  0.9900  DY  1
PERLND302  DY          3  SQO  2          4  0.9900  DY  1
PERLND303  DY          3  SQO  2          4  0.9900  DY  1
PERLND301  DY          3  SQO  4          4  0.9900  DY  1
PERLND302  DY          3  SQO  4          4  0.9900  DY  1
PERLND303  DY          3  SQO  4          4  0.9900  DY  1

```

*** 1/2 application spread over the month (27.2 lb/ac/yr total)

```

*** added TN and TP total loads and divided by % of that load
IF (prec1 < 0.10) THEN
  PERLND301  DY  2007  6  1          1  3  MANURE          2  13.60  YR  1  30
  PERLND302  DY  2007  6  1          1  3  MANURE          2  13.60  YR  1  30
  PERLND303  DY  2007  6  1          1  3  MANURE          2  13.60  YR  1  30
  PERLND301  DY  2007  5  15         1  3  MANURE          2  13.60  YR  1  30
  PERLND302  DY  2007  5  15         1  3  MANURE          2  13.60  YR  1  30
  PERLND303  DY  2007  5  15         1  3  MANURE          2  13.60  YR  1  30
END IF

```

END SPEC-ACTIONS

END RUN

Appendix F: Management Measures

The following provides detailed profiles of the Best Management Practices (BMPs) evaluated and recommended for the Brewer Lake watershed. Each profile outlines the practice’s purpose, implementation considerations, and anticipated performance in relation to sediment, nutrient reduction, and other watershed objectives. This section is intended to serve as a technical reference for planners and stakeholders, offering practical insights into how these measures function and their potential contributions to long-term watershed health. Additionally, cost estimates are provided for planning purposes. These costs are a Class 4 estimate and are intended for planning purposes only (U.S. Army Corps of Engineers, 1993). Additional analysis will be needed for each site-specific implementation proposed as a result of this plan. Costs presented with an asterisk (*) have been adjusted for inflation from the time of the source to the September 2025 inflation data from the U.S. Bureau of Labor Statistics (U.S. Bureau of Labor and Statistics, 2025).

This section also includes the Pollutant Load Estimation Tool (PLET) (USEPA, 2023) removal efficiencies identified for each practice. This provides a quantitative estimate of their performance in reducing pollutant loads and supports the water quality improvement goals outlined in Section 3.0 in the main body of the report.

Riparian Buffers and Buffer Zones

Riparian buffers are strips of vegetation alongside a waterway. These strips provide many functions. Trees, grasses, and shrubs on the outside border slow the flow of water, capture sediment, stabilize existing sediment, and consume nitrogen and phosphorus before they reach the waterway. The vegetation on the waterway’s edge helps to stabilize the streambank and prevent erosion, while also collecting sediment and nutrients. Additionally, these strips can provide habitat for wildlife. Generally, buffers are between 30 and 200 feet wide. In USDA’s Conservation Practice Standard for riparian forest buffers, the recommended minimum width for a buffer is 50 feet to see benefits for small wildlife like fish, invertebrates, reptiles, amphibians, and birds (USDA-NRCS, 2020a). To see benefits with large mammals, 165 feet is the recommended minimum. Native plant species are preferred but not required for a functional buffer. A common design strategy includes an outer layer of grasses and shrubs and an inner layer of forest (USEPA, 2008). Some buffer zones can implement a middle layer of managed and productive trees (e.g., fruit and nut producing species) (USDA National Agroforestry Center, 2015).

The cost of implementing buffers is identified below.

Cost	Unit	Source	Cost Category
\$500-\$3,000	Acre	USDA-NRCS, n.d.	Low/Medium

Buffers have also been shown to greatly reduce the potential cost per pound input to treat an equivalent amount of pollutant with traditional BMPs. A study commissioned by Greenville County, SC and included in this appendix, analyzed the economic benefits of preserving buffer areas following the adoption of increased buffer standards. A literature review was performed to determine costs per pound of sediment and nutrients removed using structural BMPs. While the review aimed to focus on studies with similar soil conditions, rainfall patterns, and labor/material costs, little information was available, and so the search extended to nationwide data. After sorting through the most relevant sources of information and removing some less applicable sources from further consideration, inflation was applied to cost data from prior studies. Thirteen relevant studies provided data related to TN and TP, while five provided usable data related to sediment. All sources included construction costs. The cost per pound for pollutant

removal varied considerably; therefore, to be conservative, the median values were used to reduce the sensitivity of data from a study with unknown or unintended assumptions. The unit costs for pollutant removal are given in the following tables. The total reduction for the Brewer Lake Watershed was estimated by multiplying the total loads of TN and TP from the HSPF model output by the percent watershed area identified as suitable for treatment by buffers or similar practice in Appendix G - PLET Model Application. This load was then multiplied by the respective PLET removal efficiency of riparian buffers. The cost savings represent the costs saved by preserving or implementing buffer space as opposed to installing structural BMPs. Based on this approach, the economic benefits of the preservation of riparian buffers are substantial.

	Sediment	Total Nitrogen	Total Phosphorus
Total Reduction [lbs/year]	7,797,131	14,984	1,265
Unit Cost for Pollutant Removal [cost/lb]	\$9.53	\$734	\$3977
Total Cost Savings [cost]	\$74,306,658	\$10,998,256	\$5,030,905

Two PLET removal efficiencies were selected for this practice. PLET has options for grassed and forested buffers. Because either option can be used in this watershed, both were used to evaluate the final removal efficiency in the PLET evaluation (see Appendix G).

PLET Practice	Nitrogen	Phosphorus	Sediment
Pastureland, Forest Buffer (minimum 35 ft wide)	0.45	0.4	0.53
Pastureland, Grass Buffer (minimum 35 ft wide)	0.87	0.89	0.65

Livestock Stream Access Control and Exclusion Fencing

Limiting livestock access to waterways can help reduce both stream bank erosion and excess nutrients. As livestock, especially cows, enter and exit a stream, they can significantly damage the banks and the vegetation holding the banks together. Breaking up sediment allows it to flow downstream and exacerbates stream erosion and incision. Additionally, the direct load of manure introduces high quantities of phosphorus and nitrogen to the waterway. In areas where no other practical sources of livestock water are available, controlled stream access points can be established to manage environmental effects. This involves fencing portions of the stream and providing access points, stabilized with geotextile, in designated areas. Ensuring access and activity only occurs in durable and stable portions of the stream reduces impacts to the waterway. Controlling erosion and manure exposure can improve waterway health both on-property and downstream. Similarly, using fencing to keep livestock away from eroding areas to prevent further grazing and trampling can assist in reducing sediment runoff. Intentional fencing practices can aid in rotational grazing, giving forages time to recover following grazing activities and resulting in reduced erosion. Additionally, many other practices require livestock exclusion to prevent damage and allow the BMP to function as intended.

The necessary distance between fencing and waterways is determined by factors including, but not limited to, slope of the bank entering the waterway, stock density, and drainage area. (Line & Osmond, 2023). A study by North Carolina State University found that in some contexts, as little as 10 feet between a stream and a fence showed notable improvements (“Livestock Exclusion Fencing”, 2023).

The cost of limiting livestock access to streams and exclusion fencing (per linear foot) is identified below.

Cost	Unit	Source	Cost Category
\$3-\$9*	LF (linear foot)	USDA-NRCS, 2006	Low

The PLET user manual provides a removal efficiency for livestock exclusion fencing that does not combine the practice with streambank stabilization. The value for exclusion fencing only was used in the Brewer Lake watershed PLET simulation.

PLET Practice	Nitrogen	Phosphorus	Sediment
Pastureland, Livestock Exclusion Fencing	0.2	0.43	0.64

Streambank Restoration and Stabilization

If left untreated, areas with unstable streambanks will continue to erode and spread to the surrounding land. Streambank restorations and stabilizations can slow and reverse the impacts of erosion. Additionally, because streambank restoration typically involves reintroduction of plants, they can create an additional opportunity for excess nutrients in runoff to be absorbed before they reach a waterway. Streambank restorations combine well with filter strips, riparian buffers, and exclusion fencing to create an effective nutrient management system. The cost of implementing streambank restoration and stabilization are outlined below.

Cost	Unit	Source	Cost Category
\$150-\$290*	LF	URS Corporation, Ecological Services Group, Thoma R., 2009	High

When incorporating this management measure into the PLET analysis performed in Appendix G, the practice selected from the PLET options was streambank stabilization without fencing. The removal efficiencies are included below.

PLET Practice	Nitrogen	Phosphorus	Sediment
Pastureland, Streambank Stabilization w/o Fencing	0.15	0.22	0.58

Filter Strips of Native Plants

Filter strips, similar to buffer zones, are a barrier of plants located between crops and waterways. They filter runoff before it reaches the waterways, preventing pollutants from making it into the body of water. Good candidates for planting in these zones are hardy (to withstand inflowing herbicides), stiff-stemmed (to withstand flow), somewhat tall (to prevent burial with sediment deposition), and dense-growing (to provide effective filtration). Good candidates in this region include native grasses like bluestems, switchgrass, and Indiangrass. In areas where phosphorus is a pollutant of concern, the filter strip needs to be harvested occasionally. Additionally, weeds need to be controlled. Special attention needs to be paid to any weeds on the Arkansas noxious weed list. To effectively filter sediment, these barriers need to be at least 20 feet wide. To filter dissolved nutrients, this width increases to 30 feet (USDA - NRCS, 2016a). Cost by acre for filter strips is documented below.

Cost	Unit	Source	Cost Category
\$1,500-\$2,500*	Acre	Mulhollem, 2021	Medium

The practice selected to represent filter strips in PLET was an urban equivalent. An assumption was made that the removal efficiencies would be similar between agricultural and urban settings.

PLET Practice	Nitrogen	Phosphorus	Sediment
Urban, Vegetated Filter Strips	0.4	0.45	0.73

Grassed Waterways

Grassed waterways are shallow channels seeded with grasses or similar plants. The grasses catch sediment and slow the flow of water. Nutrient runoff may also be reduced as the grasses feed on fertilizer runoff (Paletta, n.d.). These are especially effective where gullies are naturally starting to form and between high slope areas (USDA – NRCS, 2020b). Cost of implementation of grassed waterways is included below.

Cost	Unit	Source	Cost Category
\$30-\$1,700	Acre	SERA-17, n.d.; Ohio State University Extension, n.d.	Low/Medium

The PLET practice selected was an equivalent urban practice as PLET does not have an option for grassed waterways in agricultural settings. An assumption was made that removal efficiencies would be similar between urban and agricultural settings.

PLET Practice	Nitrogen	Phosphorus	Sediment
Urban, Vegetated Swale	0.08	0.18	0.48

Farm Pond/Sediment Basins

In large areas with significant sediment runoff, sediment basins can be an effective way to catch and prevent pollutants from reaching waterways. Sediment basins are ponds built to slow the flow of runoff and allow sediment to settle out before releasing water downstream or allowing it to infiltrate into the ground over the course of a few days after a rain event. These ponds can accumulate sediment over time and need periodic maintenance. While these practices do not prevent erosion, they are an effective last line of defense in areas where erosion is unavoidable. The cost per sediment basin or farm pond is included below.

Cost	Unit	Source	Cost Category
\$28,000-\$58,000*	Each	Hyde & Oakes, 1998	High

The removal efficiencies from an urban wet pond were selected as the closest parallel to a farm pond in PLET, as the tool does not have a pasture practice for detention ponds. An assumption was made that the removal efficiencies would be similar in urban versus pasture contexts.

PLET Practice	Nitrogen	Phosphorus	Sediment
Urban, Wet Pond	0.35	0.45	0.6

Prescribed/Rotational Grazing

Prescribed and rotational grazing is the practice of blocking off specific areas of a larger pasture for livestock to graze on and rotating between those areas over time. Giving forage time to recover can increase productivity, prevent bare patches from forming, and increase plant hardiness. This aids water quality by promoting healthier plant and root growth and improving the soil's structure. Healthier plants provide better soil coverage, which in turn protects soils from erosion. Rotational grazing is effective as a nutrient management method because the extended regrowth and recovery of plants allow them to more reliably take up nutrients and because it leads to a more even spread of manure over a pasture.

Generally, a pasture is given between 20 and 40 days to rest between grazing cycles. When done correctly and effectively, rotational grazing can also allow for higher density of animals per acre. This method works best for beef and breeding cattle and is not as effective with dairy and stocker cattle. As secondary benefits to water quality, rotational grazing results in increased pasture yields, better distribution of manure nutrients throughout the pasture, and healthier livestock (USDA – NRCS, 2009). The cost to implement rotational or prescribed grazing is included below.

Cost	Unit	Source	Cost Category
\$130-\$550*	Acre	ATTRA – National Center for Appropriate Technology, 2016; USDA-NRCS, 2005; USDA-NRCS, 2006	Low

The PLET practice selected to represent these practices was Prescribed Grazing. Both prescribed and rotational grazing have overlap in methods and very similar (~3% difference) removal efficiencies for nitrogen and phosphorus. PLET does not include statistics for sediment removal for rotational grazing, however, so prescribed grazing was selected. The removal efficiencies are included below.

PLET Practice	Nitrogen	Phosphorus	Sediment
Pastureland, Prescribed Grazing	0.41	0.23	0.33

Alternative Pasture Water Sources

Providing livestock with alternative water sources (e.g. troughs, tanks, ponds) to discourage them from entering streams can be another effective way to protect waterways. This method can be combined with silvopasture establishment to provide shelter and encourage use of the alternative water source. Costs for alternative pasture water sources are included below.

Cost	Unit	Source	Cost Category
\$400-\$2,500	Each	Pfost et al., n.d.	Low

PLET only has one practice available for alternative water supplies. The default practice was selected for the analysis in Appendix G. The removal efficiencies for this practice are below.

PLET Practice	Nitrogen	Phosphorus	Sediment
Pastureland, Alternative Water Supply	0.18	0.4	0.53

Silvopasture Establishment

Silvopasture is the practice of growing livestock, forage, and timber on the same plot of land. While trees benefit from grazing livestock clearing the understory and providing nutrients through manure, livestock and forage benefit from the shade and shelter of trees. Aquatic environments also benefit from the reduced temperature shade imparts. As an environmental BMP, silvopasture has many benefits for water quality. Trees with old and large root systems stabilize the soil and absorb excess nutrients, which prevents those nutrients from running off. Increased runoff absorption is congruent with a decrease in water runoff volume, which typically indicates lower pollutant loadings (Agunbiade et al., 2025). When the trees are harvested, the nitrogen and phosphorus absorbed during growth are removed from the watershed. The potential for timber harvest also opens opportunities for landowners to diversify income streams (Asbjornsen, et al., 2023). Cost associated with silvopasture establishment is identified below.

Cost	Unit	Source	Cost Category
\$150-\$230*	Acre	Hamilton, 2008	Low

PLET does not have removal efficiencies for silvopasture as research determining its efficacy is actively undergoing. Although silvopasture is an encouraged practice, it was not considered when calculating overall removal efficiencies for the watershed.

Pasture Planting and Management; Heavy Use Area Revegetation

In high-traffic, high-slope zones of pasture, revegetation can be an effective way to prevent soil erosion. This practice requires livestock to be fenced off from an eroded area and a seed mixture to be planted and established. Depending on wear, this may have to be done repeatedly. As discussed in other practices, well established vegetation can reduce erosion by keeping soils intact and protecting the surface from splash erosion (USDA - NRCS, 2020c). Cost for these management measures is included below.

Cost	Unit	Source	Cost Category
\$340-\$1,300*	Acre	USDA-NRCS, 2005	Low/Medium

The PLET practice that best represents these management measures is pasture and hayland planting. The removal efficiencies below were used in the PLET analysis in Appendix G.

PLET Practice	Nitrogen	Phosphorus	Sediment
Pastureland, Pasture and Hayland Planting (also called Forage Planting)	0.18	0.2	0.42

Nutrient Management Plans

Nutrient management is a process for farmers to “maximize their economic benefit while minimizing their environmental impact” (USDA - NRCS, 2022a) by paying close attention to soil quality and crop needs. The USDA states that nitrogen is being overapplied on 28% of U.S. cropland and that nutrient management plans can save an average of \$30/acre. This method is extremely effective for reducing nutrient runoff because it relies on applying only as much fertilizer as is needed, reducing excess nutrients that can become runoff.

Nutrient management plans pay close attention to the exact needs of a crop and the exact properties of the soil. The management process begins with assessing a specific plot of land with a NRCS

conservationist. Then, using that information, land management planners can calculate exactly how much fertilizer needs to be applied. Special attention needs to be paid to the type of fertilizer, the method of application, the rate of application, and the timing of application.

Cost	Unit	Source	Cost Category
Free if enrolled in program; otherwise cost varies.	Each	USDA – NRCS, 2023	Low

The selected PLET removal efficiencies were chosen due to a difference in complexity between the PLET options for nutrient management. The simpler and more conservative method was selected due to ease and feasibility of application, which makes it more attractive to implement. The removal efficiencies for this method are included below.

PLET Practice	Nitrogen	Phosphorus	Sediment
Cropland, Nutrient Management 1 (Determined Rate)	0.15	0.45	-

Farm, Water Quality, and Conservation Plans

Farm, Water Quality, and Conservation Plan documents are composed by a landowner with assistance from the USDA detailing how BMPs may be best suited on a plot of land as means of improving or conserving the land’s existing natural resources. The USDA provides assistance drafting plans via the free Conservation Technical Assistance Program. These plans are the foundation for various forms of USDA financial assistance to ensure the conservation practices are installed in viable locations.

Cost	Unit	Source	Cost Category
Free if enrolled in program; otherwise cost varies.	Each	USDA – NRCS, n.d.	Low

This management measure overlaps with nutrient management plans, so the nutrient management removal efficiencies from PLET were chosen to represent this practice.

PLET Practice	Nitrogen	Phosphorus	Sediment
Cropland, Nutrient Management 1 (Determined Rate)	0.15	0.45	-

Fertilizer Application Technology

USDA guidelines for fertilizer application break down the primary factors that influence phosphorus loss into rate, method, and timing.

Rate of fertilizer application involves applying just as much fertilizer as is needed to provide the necessary nutrients for crops. By applying the minimum amount of fertilizer needed, nutrient runoff is reduced (USDA, 2022a).

The method of fertilizer application used greatly affects how much phosphorus can run off. The USDA’s Economic Research Service (Lim et al., 2023) states that subsurface injection of manure results in the least phosphorus loss, while surface broadcast applications result in the most. Tilling after a surface application to incorporate fertilizer reduces nutrient runoff by as much as 20 times in some scenarios.

Timing of fertilizer application is crucial for runoff reduction. Longer periods of time between application and precipitation results in lower nutrient loss. Timing, however, can be difficult to control, especially for operations where manure is created and applied on-site. In these cases, if no storage is available, manure needs to be applied as it is created rather than when it is optimal.

The cost range for fertilizer application technology is included below.

Cost	Unit	Source	Cost Category
\$64.77-\$77.72	Per plan	USDA – NRCS, 2024	High

Fertilizer application technology is not available as an option in the PLET program. Instead, nutrient management removal efficiency values were used due to similarity in practice.

PLET Practice	Nitrogen	Phosphorus	Sediment
Cropland, Nutrient Management 1 (Determined Rate)	0.15	0.45	-

Prescribed Forest Burns

Forest burns can be an effective way to encourage forest growth. Forest burns clear dense understories of accumulated leaf litter. As it burns, the leaf litter releases stored nitrogen into the atmosphere. Fire can break down understory debris for young plants while clearing dead and unhealthy plants. Additionally, when trying to establish native species in buffer zones, fire is an effective tool for clearing out non-native species and allowing native, fire resistant species to flourish. Cost associated with prescribed forest burns is included below.

Cost	Unit	Source	Cost Category
\$155*	Acre	Cleaves et al., 2000	Low

Forest burns are not available as a practice in PLET. While encouraged, the practice was not included in final removal efficiency calculations.

Dry Stacks, Composters, Incinerators for Poultry Houses

Having sufficient storage available for manure can give farmers more control over when to apply fertilizers. As discussed in the Fertilizer Application Technology section, this can lead to reduced nutrient runoff. Dry stacks, or open-faced structures with a roof, can provide storage for manure while also reducing nutrient runoff. The walls and roof of the structure divert water from running over and through the manure, preventing contamination of surface runoff. This comes with the additional benefit of keeping the manure pile dry. Dry manure is cheaper and easier to transport than wet manure.

Because fertilizer applications are generally calculated based on nitrogen needs, manure fertilizers tend to result in the runoff of a significant amount of phosphorus. Composting chicken litter has been shown to create fertilizer with more consistent nitrogen mineralization rates than fresh chicken litter. Although composting manure has no direct impact on the availability of phosphorus in chicken litter, less frequent and lower volume applications introduce less phosphorus to the watershed. The nitrogen mineralization rate, or the rate at which nitrogen becomes usable to plants, in fresh manure varies between 42 and 64%. Composted manure has a lower and far more consistent mineralization rate of 1 to 9%. This slower release of nitrogen from composted manure means that there is less excess nitrogen to run off and results in higher nutrient retention. Composting manure comes with other benefits, including the

reduction in pathogens in fresh litter. Additionally, the reduction in volume from being allowed to dry makes composted litter significantly easier to store and transport (Preusch et al., 2002).

Manure and litter banking services aim to connect farms that need fertilizer with farms that need to dispose of manure. Litter-Link is an example of an organization that does this in Arkansas and the surrounding states. Participating in a program like this can aid in getting rid of excess manure in an efficient way.

Poultry incinerators are another option of manure management. By incinerating manure rather than using it as fertilizer, potential for nutrient runoff is removed. Incineration also reduces the need for storage. The resulting ash from incineration can still be used as phosphorus fertilizer but has a significantly reduced volume compared to raw manure. Additionally, incinerating manure destroys pathogens and helps reduce odors.

Cost per unit for dry stacks, composters, and incinerators for poultry houses are indicated below.

Cost	Unit	Source	Cost Category
\$13,500-\$48,000*	Unit	Donald, 2023	High

These three practices are not available in PLET so they were not considered when calculating the final removal of pollutants.

No-Till Practices

No-till farming practices involve disturbing the soil as little as possible. This allows organic matter to build up over time, which increases soil health and prevents erosion. No-till is effective at reducing sediment, nitrogen, and phosphorus runoff by keeping soils, organic matter, and nutrients intact within the natural structure and cover of the soil. The practice also comes with a reduction in labor and effort, as farmers only have to plant rather than till and plant. No-till, however, is incompatible with surface spreading methods of fertilizer application and can be more heavily reliant on herbicides. No-till methods can be implemented on both pasture and row cropped acreage. The cost per acre for no-till practices is included below.

Cost	Unit	Source	Cost Category
\$13-\$45	Acre	Newman, 2025	Low

The PLET practice selected to represent no-till in the analysis in Appendix G was conservation tillage, scenario 1, as it is the most conservative estimate in its removal efficiencies.

PLET Practice	Nitrogen	Phosphorus	Sediment
Cropland, Conservation Tillage 1 (30-59% Residue)	0.07	0.36	0.46

Cover Crops and Crop Rotation

Cover crops, or crops allowed to grow between harvest and planting of hay or production crops, are an effective BMP for nutrient runoff reduction, sediment runoff reduction, and increasing soil quality. These plants take up leftover nutrients from fertilizers that remain after harvest. The cover and structure they provide from leaves and roots can reduce the impact of rain and runoff. If cover crops are tilled back into the soil, they increase readily available organic matter for the next season's crop.

The type of cover crop used should be determined based on site-specific needs. For example, in low-nitrogen soils, nitrogen-fixing species can be selected as a cover crop. “Managing Cover Crops Profitably” by the Sustainable Agriculture Research and Education Outreach (SARE, 2007) organization provides information on types of cover crops and when to plant and kill each species. The USDA also provides guidelines for species selection and timing.

Rotating a nitrogen-fixing cover crop with nitrogen demanding production crops can be an incredibly effective way to reduce the need for fertilizer application.

Below is the cost per acre associated with cover crops and crop rotation.

Cost	Unit	Source	Cost Category
\$20-\$100*	Acre	SARE, 2019	Low

The PLET practice selected to represent these management measures in the analysis in Appendix G was cover crop scenario 2. Commodity cover crops were not considered because they may require applications of fertilizer that contradict the desired outcome for this watershed. Normal planting time was used for this scenario, but it should be noted that early planting has significant benefits for pollutant removal. Below are the removal efficiency estimates.

PLET Practice	Nitrogen	Phosphorus	Sediment
Cropland, Cover Crop 2 (Group A Traditional Normal Planting Time) (High Till only for TP and Sediment)	0.2	0.07	0.1

Wastewater System Management – Repair or Replacement

Human activities can also be a significant source of excess nutrients. Poorly maintained septic and wastewater systems can leech into waterways. Regular inspection, maintenance, and repair are necessary components of effective waste management systems. Cost per acre for wastewater system management is included below.

Cost	Unit	Source	Cost Category
\$7,000-\$15,000	Acre	New Cost Report, n.d.	High

Non-agricultural human activity has minimal impact on the Brewer Lake watershed. Additionally, PLET did not have a practice option that aligned with this management measure. Thus, wastewater system management was not included in the PLET analysis.

Unpaved Roads Management

Unpaved roads release sediment as they erode and can carry car byproducts like oil and grease into waterways. Poorly maintained gravel roads not only pose safety risks to drivers but also exacerbate environmental impacts. Over-maintaining roads and disturbing the surface can also release more sediment than necessary. Rather than regularly and uniformly maintaining gravel roads, processes like blading and grading should be performed on an as-needed basis. This limits the amount of sediment released while maintaining the integrity of the road. Additionally, maintenance should not be performed if precipitation is likely within the next 48 hours. Work around waterways should be strategically scheduled for dry times of the year. The cost of unpaved road management is included below.

Cost	Unit	Source	Cost Category
\$800-\$4,800	Per Mile Annually	Rural Roads, 2026	Medium

Non-agricultural human activity has minimal impact on the Brewer Lake watershed. Additionally, PLET did not have a practice option that aligned with this management measure. Thus, unpaved roads management was not included in the PLET analysis.

Watershed Stewardship Education

A robust education program is crucial to the success of the above-mentioned management strategies. Promoting watershed stewardship allows everyone the opportunity to take part in the water quality improvement process. As mentioned above, small changes add up to significant return over time. As citizens are educated on why and how to take care of watersheds, they become equipped to make decisions that positively affect the environment and water quality. Many of these decisions are considered good neighbor practices, as both other people and waterways are neighbors to citizens. Things that are good for waterways are also good for those around us! Watershed education programs aligned with the goals of this plan are discussed below and can focus on septic maintenance and general land stewardship.

Septic maintenance education can take many forms. Failing septic systems can result in untreated sewage reaching the nearby surface waters, resulting in high nutrient counts. Septic systems should be inspected every three to five years and cleaned as needed to prevent failures. Education programs can remind homeowners to have their systems inspected and pumped. They can also instruct owners on proper waste disposal and septic friendly products. The efficacy of these programs is difficult to assess, so other measures may be needed. Septic questionnaires and inspection policies could allow for the identification of failing septic systems, but often residents don't participate in surveys and are reluctant to permit inspections of property. Alternatively, the extension of public sewer to areas currently served by septic reduces the number of failing septic systems in the watershed. Ordinances for new development should prohibit new septic systems in areas where public sewer extension is feasible.

With much of the watershed containing residential property, education to homeowners on the proper maintenance of riparian buffers could be effective in preserving and improving water quality in the lake. While there are many resources both nationally and locally on buffer preservation, homeowner knowledge of those requirements is often lacking. Buffers are occasionally cleared and replaced with grass or pasture. Enforcement of buffer policies is often difficult, as these buffers are usually only visible from the water. Additional education efforts should be considered through homeowner workshops and outreach.

Costs associated with watershed stewardship education are included below.

Cost	Unit	Source	Cost Category
\$30,000-\$50,000	Annually	-	High

Non-agricultural human activity has minimal impact on the Brewer Lake watershed. Additionally, PLET did not have a practice option that aligned with this management measure. Thus, watershed stewardship education was not included in the PLET analysis.

Encourage Good Neighbor Practices

Good-neighbor practices encourage consideration for the impact of one's actions on neighbors and downstream communities. The impact of small, responsible actions, such as keeping yards free of trash, proper disposal of pet waste and household chemicals, and responsible car washing, can collectively lead to meaningful improvement across the watershed. This differs from a more formal watershed stewardship education program because it represents additional actions that existing organizations can integrate into their ongoing community work by adopting a "see something, say something" approach. The following costs account for the incremental workload associated with these added responsibilities.

Cost	Unit	Source	Cost Category
\$10,000-\$30,000	Annually	-	High

Non-agricultural human activity has minimal impact on the Brewer Lake watershed. Additionally, PLET did not have a practice option that aligned with this management measure. Thus, encouraging good neighbor practices was not included in the PLET analysis.

Illicit Discharge Detection and Elimination

Illicit Discharge Detection and Elimination (IDDE) is the process of identifying unwanted discharges into stormwater infrastructure. Non-stormwater flows, which are easiest to identify during dry weather, commonly contain pollutants and pathogens that may negatively alter the downstream water quality. Common illicit discharge examples include sewage and septic overflows, gray water (laundry, carwashes, etc.), liquids like oils and heavily contaminated water, and tap water leaks. The creation or support of an existing program to detect, identify, and eliminate discharges can reduce undesirable pollutants by stopping them at the source. Costs for an IDDE program are identified below.

Cost	Unit	Source	Cost Category
\$32,000-\$80,000	Annually	USEPA, 2007	High

Non-agricultural human activity has minimal impact on the Brewer Lake watershed. Additionally, PLET did not have a practice option that aligned with this management measure. Thus, IDDE was not included in the PLET analysis.

Fracking SWPPP Updates

Updates to Stormwater Pollution Prevention Plans (SWPPPs) for fracking pads involve revising site-specific strategies to better manage stormwater runoff and prevent contamination from drilling activities. These updates typically include improved site mapping to identify pollutant sources, enhanced Best Management Practices (BMPs) such as erosion controls and spill containment, and stricter monitoring protocols to ensure compliance with current environmental regulations. By incorporating these changes, SWPPPs reduce the risk of sediment, hydrocarbons, and chemical additives entering nearby waterways. This proactive approach is beneficial for water quality because it minimizes pollutant discharge, protects aquatic ecosystems, and helps maintain compliance with the Clean Water Act and related state standards, ultimately safeguarding surface waters from contamination. The cost associated with fracking SWPPP updates is included below.

Cost	Unit	Source	Cost Category
\$3,000-\$6,000	Each	-	Medium

Fracking SWPPP updates were not included in the PLET analysis since PLET did not have a practice option that aligned with this management measure.

References

- Agunbiade, G., Sahoo, D., O'Halloran, L., Silva, L., & Malcomson, H. 2025. Impact of silvopasture on soil health and water quality in the Southeast USA: A review. *Journal of Hydrology: Regional Studies*, 59, 102448.
- Appropriate Technology Transfer for Rural Areas (ATTRA) – National Center for Appropriate Technology. 2016. Rotational grazing.
- Appropriate Technology Transfer for Rural Areas (ATTRA) – National Center for Appropriate Technology. 2023. Planting and managing pastures.
- Asbjornsen, H., Coble, A., Contosta, A., Jennings, K.A., Orefice, J., Smith, R., Stewart, A., & Vadeboncoeur, M. 2023. Silvopasture: A climate-friendly alternative to conventional open pasture practices. New Hampshire Agricultural Experiment Station INSPIRED Forestry Report, Winter 2023, 6.
- Cleaves, D. A., Martinez, J., & Haines, T. K. 2000. Influences on prescribed burning activity and costs in the National Forest System (General Technical Report SRS-37). U.S. Department of Agriculture, Forest Service, Southern Research Station.
- Donald, J. 2023, August 15. Commercial poultry mortality management economics. Alabama Cooperative Extension System.
- Hamilton, J. (Ed.). 2008. Silvopasture: Establishment & management principles for pine forests in the Southeastern United States. USDA National Agroforestry Center.
- Hyde, C., & Oakes, P. 1998. Pond building: A guide to planning, constructing & maintaining recreational ponds (ANR-1114). Alabama Cooperative Extension System.
- Lim, Teng, Ray Massey, Laura McCann, Timothy Canter, Seabrook Omura, Cammy Willett, Alice Roach, Nigel Key and Laura Dodson. March 2023. Increasing the Value of Animal Manure for Farmers, AP-109, U.S. Department of Agriculture, Economic Research Service.
- Line, D. & Osmond, D. 2023. Livestock Exclusion Fencing: Lessons Learned (AG-948). North Carolina State Extension Publications.
- Livestock exclusion fencing: Lessons learned*. 2023, May 17. NC State Extension Publications.
- Mulhollem, J. 2021, June 9. Novel study looks at nitrogen credit trading to spur growth of riparian buffers. Penn State News.
- Newman, N. 2025, April 21. Iowa's average custom no-till rate increases by 65 cents in 2025. No-Till Farmer.
- New Cost Report. (n.d.). Cost to replace a septic system: Budget guide. New Cost Report.
- Ohio State University Extension. (n.d.). Grassed waterways (NRCS 412). Ohio State University Agricultural BMPs
- Paletta, L. (n.d.). Grassed waterways are fundamental in reducing erosion and impacting water quality. University of Wisconsin-Madison, Division of Extension: Agriculture Water Quality.

Pfost, D., Gerrish, J., Davis, M., & Kennedy, M. (n.d.). Pumps and watering systems for managed beef grazing (EQ380). University of Missouri Extension.

Preusch, P. L., Adler, P. R., Sikora, L. J., & Tworkoski, T. J. 2002. Nitrogen and Phosphorus Availability in Composted and Uncomposted Poultry Litter. *Journal of Environmental Quality*, 31(6), 2051-2057.

Rural Roads. 2026. Road maintenance realities. Rural Roads. <https://ruralroads.org/road-maintenance-realities/>

SERA-17. (n.d.). Grassed waterways. SERA-17: Southern Extension and Research Activities Information Exchange Group. <https://sera17.wordpress.ncsu.edu/grassed-waterways/>

Sustainable Agriculture Research and Education (SARE). 2007. *Managing Cover Crops Profitably*, 3rd Edition. SARE.

Sustainable Agriculture Research and Education (SARE). 2019. Cover crop economics: Opportunities to improve your bottom line in row crops. SARE.

U.S. Army Corps of Engineers. 1993. Engineering and design: Civil works cost engineering (Engineer Regulation ER 1110-2-1302). Department of the Army.

U.S. Bureau of Labor Statistics. 2025. *CPI Inflation Calculator*.

U.S. Department of Agriculture National Agroforestry Center. 2015. Non-Timber Forest Products Riparian Buffer. U.S. Department of Agriculture, Forest Service.

U.S. Department of Agriculture, Natural Resources Conservation Service. (n.d.). Arkansas EQIP. Environmental Quality Incentives Program. USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. (n.d.). Field Office Technical Guide (FOTG). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2005. Pasture and Hayland Planting: Conservation Practice Standard (CPS 512). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2006. Conservation Practice Standard: Fence (CPS 382). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2009. Rotational Grazing: Small Scale Solutions for your Farm. USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2016a. Filter Strip: Conservation Practice Standard (CPS 393). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2016. Sediment Basin: Conservation Practice Standard (CPS 350). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. Heavy Use Area Protection: Conservation Practice Standard (CPS 561). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2020a. Riparian Forest Buffer: Conservation Practice Standard (CPS 391). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2020b. Grassed Waterway: Conservation Practice Standard (CPS 412). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2020c. Pasture and Hay Planting: Conservation Practice Standard (CPS 512). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2022a. Getting Assistance: Nutrient Management. USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2022. Riparian Herbaceous Cover: Conservation Practice Standard (CPS 390). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2023. Arkansas conservation practice scenarios (Fiscal Year 2023). USDA NRCS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2024. State cost list (Fiscal Year 2024). USDA NRCS.

U.S. Environmental Protection Agency (USEPA). 2007. Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments. Water Permits Division, Office of Water and Wastewater, U.S. Environmental Protection Agency, Washington, DC.

U.S. Environmental Protection Agency (USEPA). 2008. Riparian buffer design and maintenance for water quality protection. EPA 841-B-07-006.

U.S. Environmental Protection Agency (USEPA). 2023. Best Management Practice Definitions Document for Pollutant Load Estimation Tool. U.S. Environmental Protection Agency.

URS Corporation, Ecological Services Group, Thoma, R. 2009. Lower Black River Ecological Restoration Master Plan. Prepared for U.S. Environmental Protection Agency, Great Lakes National Program Office.



Memo

To: Judy Wortkoetter, PE

Cc: Jacob Burkey, PE
Julianna Hunter, EIT

From: James Riddle, PE

Date: September 11, 2024

Subject: Economic Benefits of Greenville County Riparian Buffers

Background

Woolpert understands that the County passed amendments to its “Greenville County Land Development Regulations” (LDR) on January 2, 2024. Article 8 of the LDR includes the requirement for riparian stream buffers in Section 8.22 as follows:

- Minimum 50-foot riparian buffer as measured from the top of stream bank inland shall be established along each side of all intermittent, perennial, and blue line streams.
- Minimum 100-foot riparian buffer as measured from the top of stream bank inland shall be established along each side of all intermittent, perennial, and blue line streams within watersheds draining 50 acres or more.

The County requested that Woolpert conduct a planning-level effort to estimate the potential economic benefits of the new requirements due to the prevention of additional sediment/nutrients from entering local creeks/streams. Since the prior version of the LDR required 35-foot riparian stream buffers, the benefits of the new riparian buffers were compared to this standard as a baseline for comparison. Due to state/federal scrutiny on nutrients in the Reedy River Watershed and the County’s ongoing efforts as a primary stakeholder in the Reedy River Water Quality Group, the analysis focused upon benefits related to sediment/nutrients. To approximate the value of riparian buffers at a County-wide scale, many assumptions are required, but the following summary should provide the County with valuable information for consideration in maintaining water quality and compliance with state/federal water quality permitting restrictions.

Estimate of Undeveloped Riparian Buffers

The requirements in the LDR affect future growth/development and have no relevance on existing development. Therefore, the first component of the evaluation process was to identify undeveloped land adjacent to creeks/streams across the County where buffer restrictions were applicable. Woolpert conducted detailed GIS processing to segregate

these areas using publicly available USGS Waters of the State (WOTUS) and 2021 National Land Coverage Data (NLCD). The NLCD spatial information distinguishes land use types among eight main categories with subcategories. For this effort developed land is considered fully built out with no future development possible and the remaining categories are all considered to be areas that are undeveloped and protected by the buffer requirement. This provided a means for identifying those parcels of land that were adjacent to the creeks/streams in the WOTUS coverage, yet undeveloped within 100 feet of that respective stream.

Additional GIS processing was used to distinguish the sizes of watersheds draining to each of these respective streams. This allowed for the partitioning of stream segments into two categories where either the 50-foot or 100-foot buffer restriction applied. In most cases, the headwaters of streams included a short reach where the 50-foot buffer was applicable that soon thereafter transitioned to segments of streams that require the 100-foot buffer. Figure 1 depicts the results of the GIS analysis.

In many cases, one side of the creek/stream was developed, but the other remained undeveloped. Therefore, the length of currently undeveloped riparian buffers were evaluated independently on either side of each creek/stream and are referred to in this evaluation as “Stream Bank Length”, rather than a more simple reference to stream miles. Table 1 below is a summary of the Stream Bank Length where the riparian buffer requirements apply:

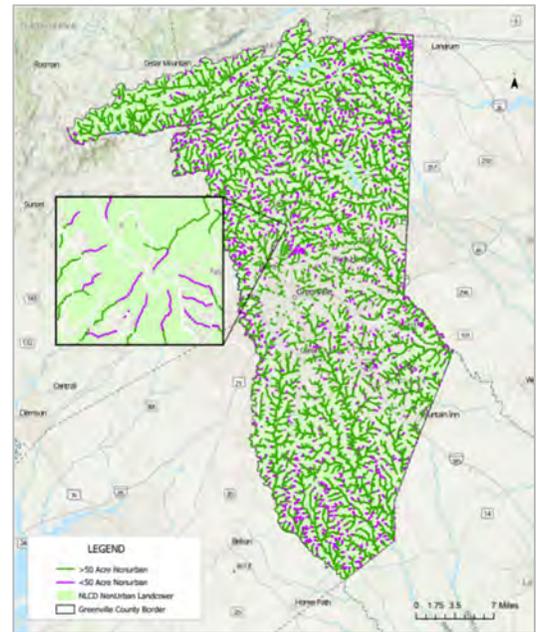


Figure 1: GIS Analysis to Determine Applicable Stream Bank Length for Buffer Analysis

Table 1: Stream Bank Length of All and Undeveloped Buffers in Greenville County

Greenville County Creeks/Streams	Drainage Area (acres)	Stream Bank Length (miles)
All Stream Buffers	< 50	524
	> 50	3766
Undeveloped Buffers	< 50	394
	> 50	1544

After estimating the potential length of stream bank subject to the riparian buffer restrictions, the next step of the evaluation was to estimate potential sediment/nutrient (herein referred to as “pollutant”) removal of those respective buffers.

Estimate of Pollutant Removal

Since the County regulates post construction water quality through the use of the IDEAL model, the same tool was used to evaluate potential benefits for this study. The IDEAL model provides design engineers with a suite of best management practice (BMP) options to treat storm water runoff after development, including riparian buffers. Undisturbed riparian buffers provide a variety of environmental benefits including those associated with storm water runoff. Riparian buffers offer two forms of quantifiable pollutant reduction for storm water that were considered in the analysis. The following section summarizes initial attempts to approximate “average” storm water treatment expected from riparian buffers, yet ultimately focuses on a more definitive and simplistic means of estimating a portion of the expected benefits through buffer preservation.

Due to the scale of this study, it was necessary to approximate pollutant reduction benefits provided by a unit length of riparian buffer, that could then be applied across the County to quantify benefits provided by all undeveloped buffers. Figure 2 below depicts a simple schematic for 1,000 linear feet of stream buffer that was modeled in IDEAL to compare the water quality benefits of the 35-foot buffers in the prior LDR relative to the new 100-foot buffer requirements in the current LDR:

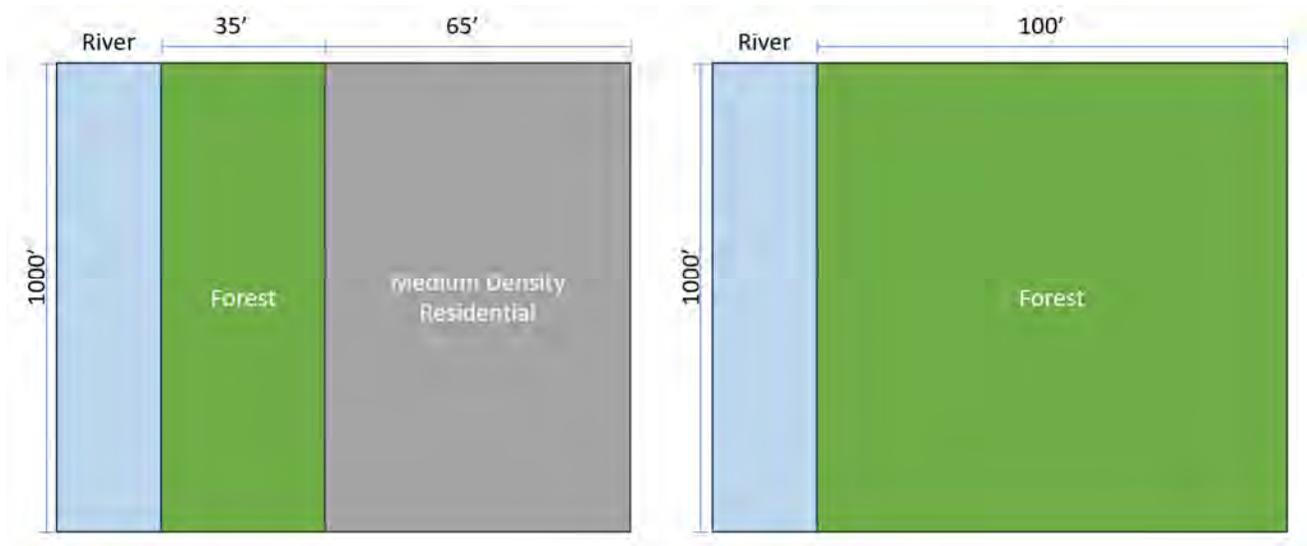


Figure 2: Schematic of Conceptual Stream Buffer Modeled in IDEAL

For the initial comparison (as labeled in the schematic above) it was assumed that conceptual development subject to the prior riparian buffer requirements would have been Medium Density Residential (MDR). This type of land development was selected because it generates intermediate event mean pollutant concentrations (EMCs), compared to low or high-density residential development. MDR also generates EMCs that are very similar to commercial development (see EMC tables within IDEAL model). Commercial development tends to have more imperviousness than residential development and would thereby generate higher pollutant loads; this would produce inflated results when assessing the benefits of buffers. Industrial development has lower EMCs than MDR, but is a less prevalent type of land use development across the County. Industrial development also tends to have greater imperviousness area than MDR and was expected to also produce higher pollutant loads. The use of MDR for this conceptual development provided “average” potential water quality impacts downstream.

Additional physical characteristics of the terrain within any stream buffer will vary, so conservative assumptions were used to model the 1000 linear feet of stream buffer as follows in Table 2:

Table 2: IDEAL Model Input Assumptions for Stream Buffer Modeling

Model Parameter	Value	Comment
Slope	5%	Average expected buffer cross slope
Soil Type	Cecil Soil	Most prominent soil type in County
Time of Concentration	0.1 hrs	
Soil Erodibility	0.28	Recommended values within IDEAL model
Nutrient EMCs	TN – 0.97 mg/L TP – 0.2 mg/L	Recommended values within IDEAL model

Pollutant reduction that is most intuitive when considering land development is the treatment of the runoff from adjacent property. However, there are many different types of post construction BMPs other than the riparian buffer that a design engineer might consider implementing for a given development project. These options would be impacted by many factors including, but not limited to, the layout of the development, the terrain/grading plan, design constraints

such as existing ROWs or wetlands, long term operation and maintenance of the proposed BMPs, and aesthetics. In addition, the use of the buffers for water quality treatment requires appropriate slope within the buffer and a level-spreader at the entry of storm water runoff into the buffer to ensure sheet flow conditions for proper function/treatment. In some cases, the installation and maintenance of these features can be challenging and may not be desired. The design engineer could choose not to use the buffer for storm water treatment, use it for partial treatment, or not use the buffer at all. **For these reasons, the average treatment of runoff from riparian buffers as BMPs were highly difficult to approximate and was not considered in this analysis.**

The second form of pollutant reduction offered by riparian buffers is from direct preservation of the buffer corridor itself. By avoiding any form of land development within the buffer areas, concentrations and loads of sediment/nutrients are maintained at natural and more sustainable levels. **Since the area within the required buffer is finite and quantifiable, the economic analysis ultimately focused solely upon the pollutant reduction offered by preservation only.**

The preserved 50-foot and 100-foot buffers (compared to the prior required 35-foot buffers) were then modeled to estimate the annual pollutant loading for sediment, total phosphorus (TP), and total nitrogen (TN) every 1000 linear feet. As shown in Table 3, the loadings were then compared to approximate the difference in annual pollutant loading generated by the existing required 35-foot forested buffer with an adjacent 65-foot MDR development, compared to an undeveloped 100-foot forested buffer.

Table 3: Modeled Pollutant Reductions for the 100-ft Buffer Scenario

Parameter	Buffer Mass Loading (lbs)		Change	
	35 ft Forest 65 ft MDR	100 ft Forest	Mass (lbs)	% Difference
Sediment	4,522	1,470	-3,052	-68%
TN	2.52	0.42	-2.10	-83%
TP	0.33	0.09	-0.24	-73%

Similar analysis and tables were developed for those stream segments where 50-foot buffers are required, as shown in Table 4.

Table 4: Modeled Pollutant Reductions for the 50-ft Buffer Scenario

Parameter	Buffer Mass Loading (lbs)		Change	
	35 ft Forest 65 ft MDR	50 ft Forest 50 ft MDR	Mass (lbs)	% Difference
Sediment	4,522	3,347	-1,175	-26%
TN	2.52	2.04	-0.48	-19%
TP	0.33	0.27	-0.06	-18%

After development of these pollutant load estimates, the mass loading (per 1000 feet of Stream Bank Length) due to buffer preservation was multiplied by the length of undeveloped buffers in Table 1. Table 5 shows annual estimates of pollutants that are prevented from discharging into County creeks/streams due to the new riparian buffer requirements in the LDR, based on the modeling and GIS exercise described above.

Table 5: Annual Pollutant Loads Reduced by Buffer Preservation

Annual Pollutant Loads (lbs)		
Sediment	TN	TP
27,325,257 (13,663 tons)	18,118	2,081

Estimate of Economic Benefits

The final step of the analysis was to estimate the potential economic benefits of the undeveloped riparian buffers subject to the requirements in the new LDR. The value of the buffers were approximated by calculating the cost to achieve the same pollutant load reductions estimated above, with alternative types of post construction BMPs. The calculation of economic benefits assumed that all undeveloped buffers outside of the current 35-foot required buffers would ultimately become developed.

Using the annual pollutant loads calculated in Table 5 above, it was desired to identify potential average costs/pound for pollutant removal. As previously stated, there are many types of BMPs that alternatively could be utilized for pollutant removal and many variables that affect the costs of storm water treatment. Woolpert consulted with representatives of the County, reviewed costs/pound of several recent BMP projects within the County, and conducted an on-line literature search for similar information to approximate these values. The literature search focused upon the Piedmont region of the southeast to attempt to find nearby studies with similar soil conditions, rainfall patterns, and labor/material costs.

Although various related sources of information were identified, the studies provided a wide-ranging mixture of data that could be used. Among other variables, BMP studies with costs/pound of pollutant removal may or may not have included property acquisition costs, design costs, operation/maintenance, and costs for the same water quality parameters of interest. Some studies were identified with relevant costs but did not provide data related to mass loading of pollutant removed. In addition, the cost of pollutant removal is heavily dependent upon the concentrations of influent to the BMPs; it's easier (ie. cheaper) to incrementally improve water quality of nutrient rich storm water rather than clean water. After sorting through the most relevant sources of information and removing some less applicable sources from further consideration, inflation was applied to cost data from prior studies. Figure 3 below summarizes the cost/pound to remove sediment/nutrients from storm water runoff through a variety of other types of BMPs.

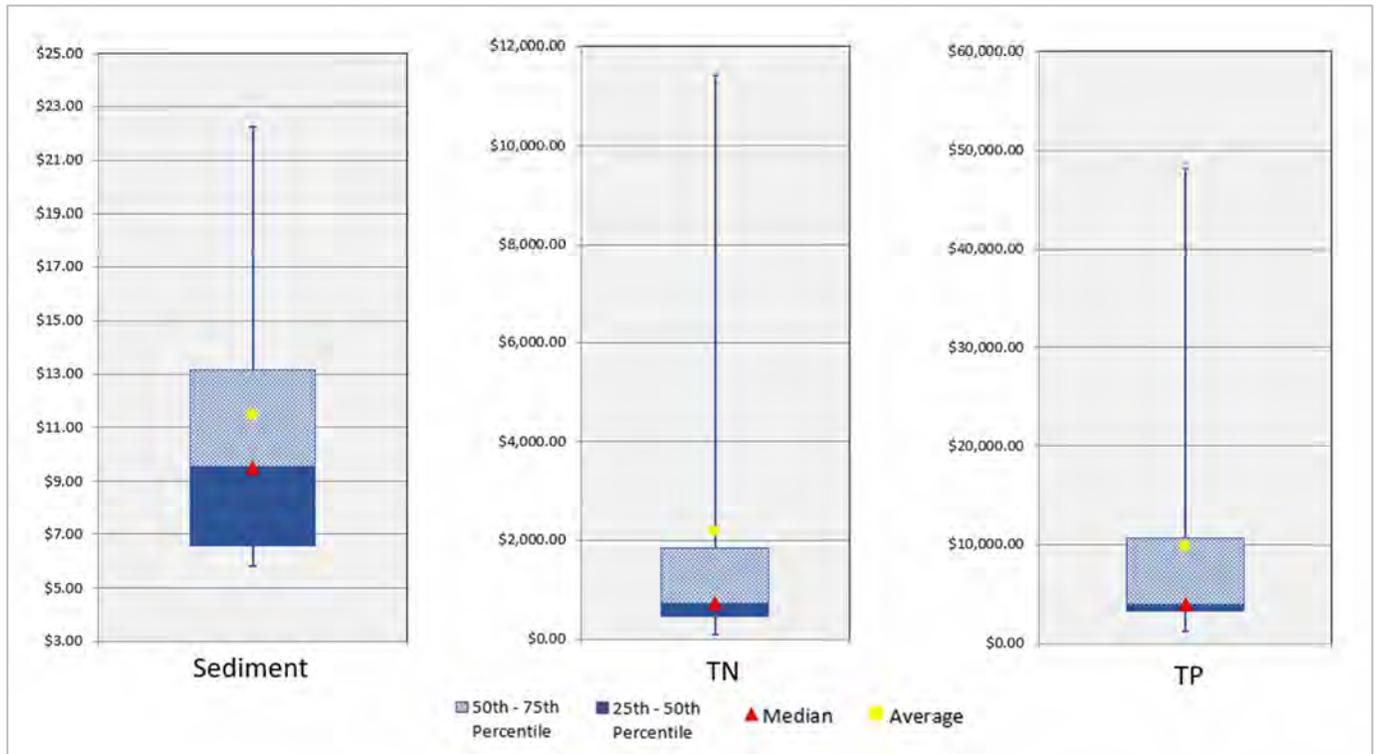


Figure 3: Summary Statistics for Literature Review on Cost/Pound of Pollutant Removal by Storm Water BMPs

Thirteen relevant studies were included in the literature review and provided data related to TN and TP. Five of the studies also provided usable data related to sediment. All of these studies included construction costs, while there was some uncertainty in a few studies regarding what was and was not included in their respective cost data. As expected

and depicted above, the cost/pound for pollutant removal varied considerably. Since a single study can skew the results by increasing the average costs, the median values were used to reduce the sensitivity of data from a study with unknown or unintended assumptions. The median cost/pound to treat each pollutant was then multiplied times the annual pollutant loads calculated in Table 5 to extrapolate costs across the County as shown in Table 6 below.

Table 6: Estimated Cost Savings from Buffer Preservation

	Pollutants			
	Units	Sediment	Total Nitrogen	Total Phosphorus
Annual Mass Loading	lbs	27,300,000	18,118	2,081
Unit Cost for Pollutant Removal	cost/lb	\$9.53	\$734	\$3977
Total Cost	cost (millions)	\$260M	\$13.3M	\$8.3M

Based on this approach, the economic benefits of the new riparian buffers required in the LDR are substantial. It is further believed that these estimates are conservative due to the noted assumptions throughout this summary, but particularly because the calculation is based upon the benefits of **buffer area preservation only**, without consideration of the buffer for storm water treatment. In addition, there are other forms of environmental benefits related to wider riparian buffers that cannot be easily quantified such as greater potential for stream bank stabilization, shading of the stream corridor that improves habitat, wildlife passage/corridors, and removal of other pollutants that were not included in this analysis.

References

American Forests. (2010). *Urban ecosystem analysis: Mecklenburg County and the City of Charlotte, North Carolina*. American Forests.

BMP life cycle cost comparisons are highly variable. (n.d.). Brown and Caldwell.

Center for Watershed Protection. (2013). *Comparing urban stormwater BMPs by cost effectiveness*. (Includes graphics and Calvert County pollutant-removal dataset.)

Center for Watershed Protection. (2013). *Cost-effectiveness study of urban stormwater BMPs in the James River Basin* (Revised June 2013). James River Association.

Center for Watershed Protection & James River Association. (2015). *Cost-effective stormwater management in the James River watershed*. <https://cwp.org/cost-effective-stormwater-management-in-the-james-river-watershed>

Cost of buffers. (n.d.). Riparian Forest Buffer Guidance, Pennsylvania DEP; Adams County Trout Unlimited. (Cost ranges and estimates based on 2009 dollars.)

Delaware Department of Natural Resources and Environmental Control. (2007). *Appendix F: BMP cost calculations*.

Environmental Finance Center at the University of North Carolina at Chapel Hill. (2019). *Literature review: Cost-effectiveness of nutrient removal practices*. University of North Carolina School of Government.

Helmets, M. J., Isenhardt, T., Dosskey, M., Dabney, S., & Stroock, J. (n.d.). *Buffers and vegetative filter strips*. USDA National Agroforestry Center; Iowa State University; USDA-ARS; University of Minnesota.

Mason, D. (2012). *Southeast Stormwater Association 2012 Annual Conference notes*. Southeast Stormwater Association.

Price, E. W., Flemming, T. H., & Wainger, L. A. (2021). *Cost analysis of stormwater and agricultural practices for reducing nitrogen and phosphorus runoff in Maryland* (UMCES Technical Report No. TS-772-21). University of Maryland Center for Environmental Science; prepared for the Maryland Department of the Environment.

Preliminary opinion of probable costs. (n.d.). (Section on unit costs and implementation scenarios for green infrastructure).

StormH2O: Low-impact development BMP cost analysis. (2013). *Stormwater Magazine / StormH2O*. (March/April 2013 issue; includes cost ranges and case studies).

Appendix G: PLET Model Application

Appendix G: PLET Model Application

Following completion of the Hydrologic Simulation Program – Fortran (HSPF) watershed model for the Brewer Lake watershed, the EPA’s Pollutant Load Estimation Tool (PLET) (<https://www.epa.gov/nps/plet>) was used to support development of tangible recommendations for the watershed-based plan. While HSPF provides a detailed, continuous simulation of watershed hydrology and pollutant generation, the model outputs alone are not designed to directly quantify the pollutant reductions associated with specific best management practices (BMPs). Note that PLET is an uncalibrated estimation tool for annual average removal, therefore the data that follows are estimates. Detailed model simulations would be needed to fully assess nutrient and sediment load reduction; however, this was not included as part of this plan.

PLET estimates baseline annual pollutant loads using a land use export coefficient approach. For each land use category, baseline loads are calculated as:

$$L_{baseline,i} = A_i \times EC_i$$

Where:

$L_{baseline,i}$ = baseline annual pollutant load from land use i

A_i = area of land use i (acres)

EC_i = export coefficient for land use i (lbs/acre/year)

Total watershed load for each pollutant is calculated by summing loads across all land use categories.

To align PLET with the HSPF model, the values from the National Land Cover Database (NLCD) 2021 were input for the watershed. Since this was also utilized in the HSPF model, this provided a point of commonality between the two programs. These values are documented as they were input into PLET Table 1. Cropland and feedlots were not considered in the analysis because none were shown in the NLCD. Because pastureland showed the most significant contributions to pollutants in the HSPF model, pastureland was identified as the target for BMP recommendations in PLET. The program’s default values were utilized for other inputs and additional information, and sources for these values can be found in Appendix B of the 2024 PLET User Manual (<https://www.epa.gov/nps/plet>).

Table 1 PLET Land Use in Brewer Lake Watershed

Land Use	Number of Acres
Urban	1135.56
Cropland	0.00
Pastureland	6697.41
Forest	8890.00
Other	1118.87
Feedlots	0.00

For a given BMP applied to a land use area, pollutant load reductions are calculated as:

$$R_{BMP} = L_{treated} \times E_{BMP}$$

Where:

R_{BMP} = annual pollutant load reduction attributable to the BMP

$L_{treated}$ = baseline pollutant load from the treated area

E_{BMP} = pollutant-specific BMP removal efficiency (fractional)

BMP removal efficiencies are derived from national literature and embedded within PLET as default values.

The agricultural and rural landuse in the Brewer Lake watershed drove the development of three different BMP scenarios in the custom BMP calculator. Separate scenarios were created to reflect the range of feasible treatment strategies in the watershed, which generally fall into one of three categories: pasture-focused practices, stream-focused practices, and a combined approach of both pasture and stream practices. BMPs were grouped by sorting the list of practices available in PLET and categorizing them according to whether they applied to livestock pastures, waterways, or neither. Practices that were not specific to livestock or stream applications were included only in the combined scenario.

When creating treatment scenarios, the BMP calculator allows users to specify if practices are used in parallel, where there no crossover in contributing treatment area, or in series, where multiple practices treat the same contributing drainage area. For pasture-focused practices (Figure 1), BMPs were placed in series because many livestock related practices address overlapping areas and are typically implemented on the same parcels of land. For the stream-focused practices (Figure 2), each site selected for a buffer would have to be either forested or grassed buffers because these are mutually exclusive practices. As a result, these were modeled in series. Both buffer types were placed in series with streambank stabilization to maximize the increase in efficacy when paired with stabilization efforts. The combination scenario (Figure 3) incorporates select cattle practices, stream practices, and general BMPs that do not fall exclusively into either category. These practices were arranged in series of parallel based on their functional similarity and practical feasibility. In scenarios requiring the allocation of pastureland among multiple treatment pathways, available pasture acreage was evenly divided among applicable BMPs. This assumption was applied consistently across all scenarios and reflects the planning-level intent of the analysis rather than site-specific implementation design.

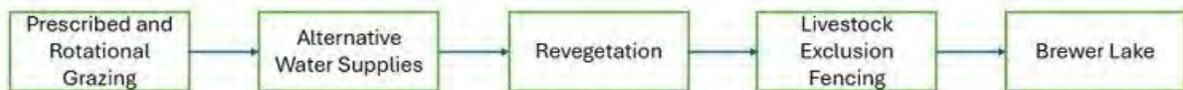


Figure 1 Relationship of Practices Used in Pasture-Focused Scenario

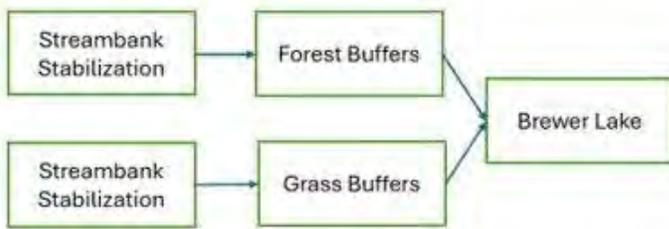


Figure 2 Relationship of Practices Used in Stream-Focused Scenario

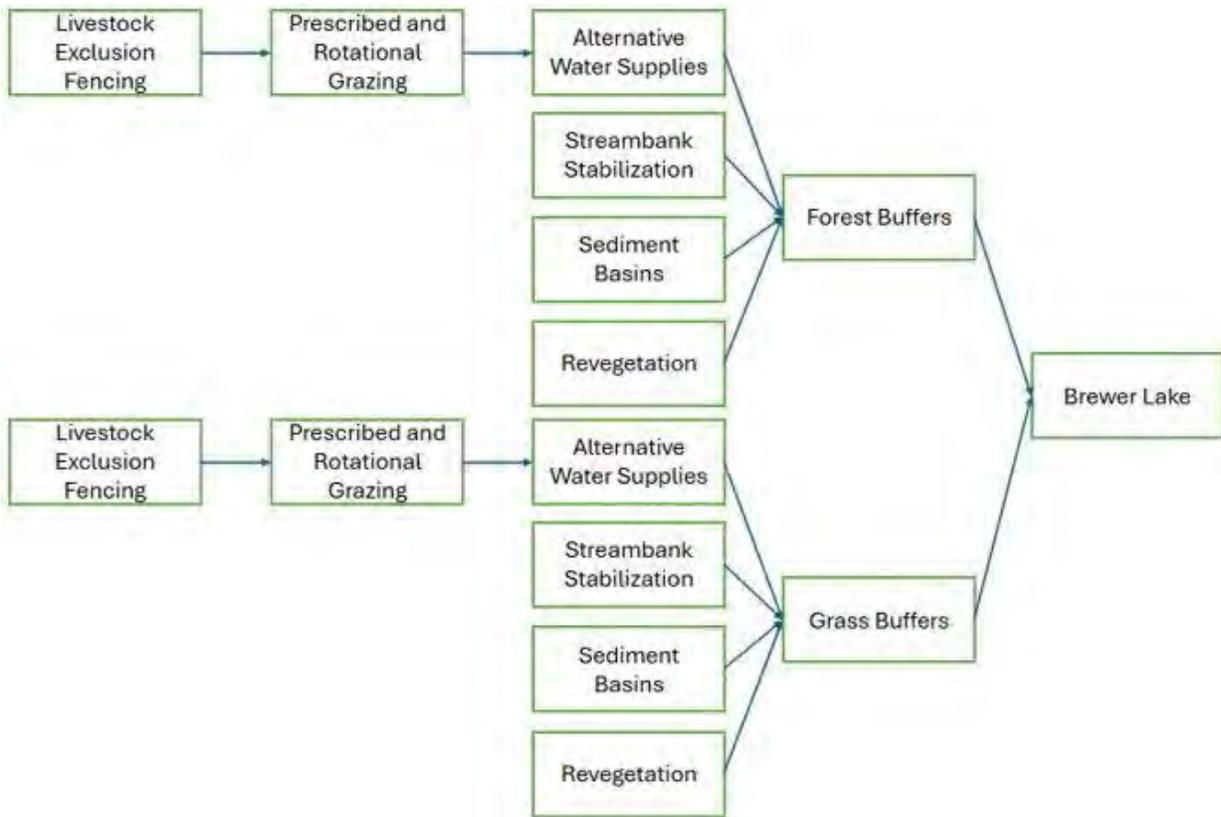


Figure 3 Relationship of Practices Used in All-Practices Scenario

When BMPs are applied in parallel, each practice treats a separate portion of the contributing land use area. Load reductions are calculated independently for each BMP and then summed:

$$R_{total} = \sum_{j=1}^n (L_{treated,j} \times E_{BMP,j})$$

Where j represents each individual BMP applied to a distinct area.

When BMPs are applied in series, multiple practices treat the same contributing area sequentially. In this case, the remaining load after each BMP is passed to the next BMP:

$$L_{remaining,1} = L_{treated} \times (1 - E_{BMP,1})$$

$$L_{remaining,2} = L_{remaining,1} \times (1 - E_{BMP,2})$$

$$R_{total} = L_{treated} - L_{remaining,n}$$

This approach prevents double-counting of load reductions and reflects diminishing returns when multiple BMPs treat the same pollutant source.

As mentioned in section 6.1 of the report, to determine the treatment area needed to achieve a 15% reduction, each scenario of practices was applied to the watershed individually. Then, the contributing drainage area of the BMP was adjusted until nitrogen, phosphorus, and sediment loads were reduced by at least 15% each. The results of this analysis are shown in Figure 8 in the report and Figure 4 (below). This exercise showed that using the pasture-focused practices only across 62% of the pasture in the watershed would achieve the target reductions. To achieve the same reduction using stream-focused BMPs, 43% of the pasture lands would need to be treated. The combination scenario would need to cover 41% of the watershed-wide pasture to achieve a 15% reduction.

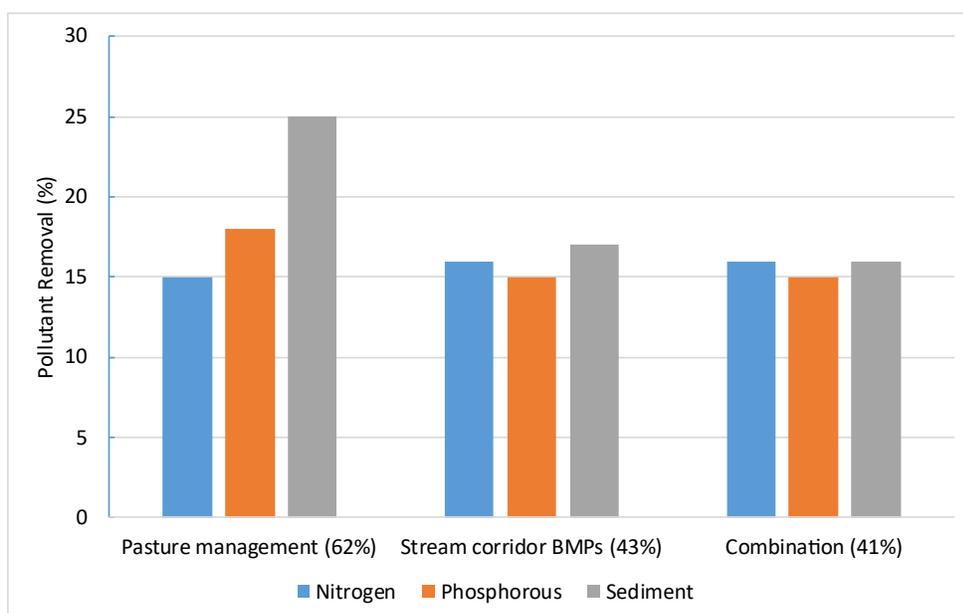


Figure 4 Pollutant removal rates for three scenarios of BMP application to achieve 15% pollutant removal goals

When creating these scenarios, PLET assumes even application of both pollutants and BMPs across the watershed and applies uniform pollutant concentrations, rather than incorporating HSPF-derived concentrations. However, this assumption is not representative of the Brewer Lake watershed, as the HSPF model found that the majority of nitrogen, phosphorus, and sediment runoff originates from a few specific areas. These areas exhibit higher pollutant concentrations and, consequently, a greater potential for treatment and load reduction. These higher loads were accounted for through the catchment ranking method discussed in Section 6.2.1. The contributing drainage area of BMPs could be reduced by

strategically implementing them in areas known to have high pollutant loads. To estimate the drainage area of BMPs needed to achieve a 15% reduction in all pollutants of interest for the entire watershed while only applying BMPs to high priority watersheds, the removal efficiencies determined using PLET's BMP calculator were applied to only the areas and loads of the high priority catchments. The results of this analysis can be seen in Figure 11 in the report and Table 2 below.

PLET-derived load reductions represent estimated average annual reductions under assumed BMP implementation and performance. These results are intended to support comparison of alternative management scenarios and prioritization of practices rather than to predict precise post-implementation water quality conditions.

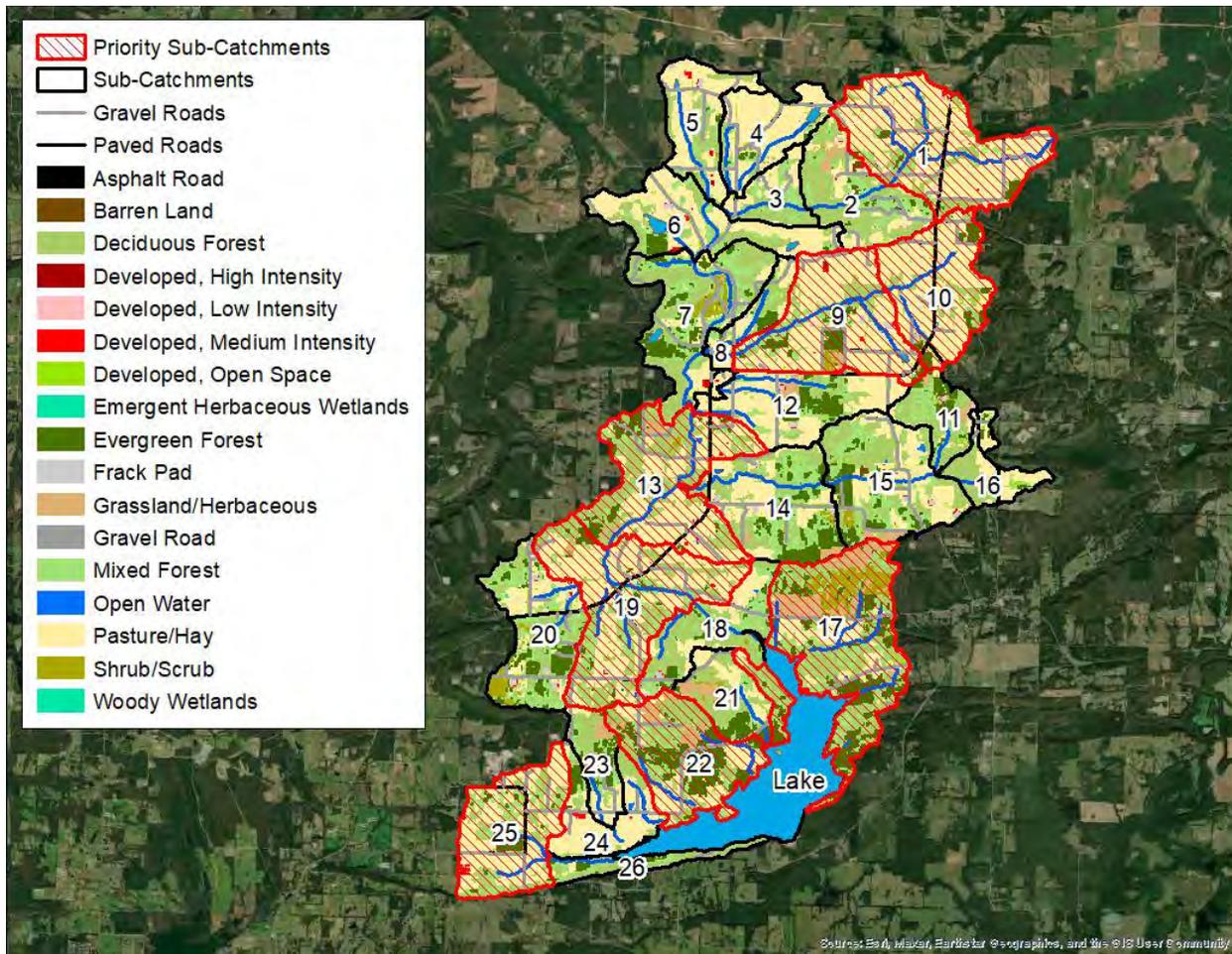


Figure 5 Prioritized sub-catchments for BMP implementation

Table 2

PLET Results

		Priority Catchments per Section 6.2.1									
		Extent Applied	1	9	10	13	17	19	22	25	Total Reduction
		TN Load (lbs/yr)	8,475	6,791	5,788	6,241	6,021	7,649	3,212	4,011	Goal:14,984
Reductions (lbs/yr)	All Pasture Practices	54%	3,301	2,645	2,254	2,431	2,345	2,979	1,251	1,562	15,955
	Cattle Practices	56%	3,101	2,485	2,118	2,283	2,203	2,799	1,175	1,468	14,988
	Stream Practices	87%	3,228	2,587	2,204	2,377	2,293	2,913	1,223	1,528	15,602
		TP Load (lbs/yr)	833	589	518	540	141	708	283	493	Goal: 1,265
Reductions (lbs/yr)	Pasture Practices	54%	317	224	197	205	54	270	108	188	1,266
	Cattle Practices	56%	397	281	247	257	67	338	135	235	1,587
	Stream Practices	87%	317	224	197	205	54	269	108	187	1,266
		Sediment Load (lbs/yr)	5,572,444	3,341,857	2,957,971	3,506,946	1,596,065	4,664,278	1,700,735	3,674,530	Goal: 7,797,131
Reductions (lbs/yr)	All Pasture Practices	54%	2,066,012	1,239,010	1,096,682	1,300,218	591,749	1,729,304	630,556	1,362,350	8,022,975
	Cattle Practices	56%	3,381,916	2,028,173	1,795,192	2,128,365	968,652	2,830,750	1,032,176	2,230,072	13,133,049
	Stream Practices	87%	2,196,680	1,317,373	1,166,044	1,382,452	629,175	1,838,677	670,437	1,448,514	8,530,401

Appendix H: Catchment Prioritization

Appendix H: Catchment Prioritization Methods

This watershed-based plan employs two complementary prioritization methods to identify optimal locations for best management practice (BMP) implementation. The first method uses a composite feasibility score that combines cost per acre, percent forested riparian buffer, and time of travel, which is then analyzed against pollutant load scores to identify sub-catchments that offer both high water quality improvement potential and practical implementation advantages. The second method applies a multiple criteria decision analysis (MCDA) weighted decision matrix that independently evaluates sub-catchments across five criteria: total nitrogen load, total phosphorus load, sediment load, travel time, and land use, with relative importance weights established through systematic pairwise comparisons. The selection of sub-catchments in both prioritization methods indicates a strong prioritization to achieve the watershed-based plan goals. Together, these approaches provide a robust framework for balancing environmental objectives with implementation feasibility in watershed management decision-making.

1.0 Prioritization Method 1 – Ranking

The ranking-based prioritization method evaluates the relationship between the feasibility of implementing best management practices (BMPs) and the relative pollutant loads generated by individual sub-catchments to identify areas of higher priority for BMP application. By integrating indicators of implementation feasibility with modeled estimates of sediment, nitrogen, and phosphorus loading, this approach provides a structured framework for comparing sub-catchments and highlighting locations where management actions may yield the greatest potential benefit. In the following prioritization methods, catchments from the HSPF model were combined to assess larger areas for prioritization and management.

1.1 Load

Pollutant fluxes (expressed in pounds per acre per year) of sediment, nitrogen, and phosphorus were estimated for each of the 26 sub-catchments using the Hydrologic Simulation Program–Fortran (HSPF). Annual fluxes, or pollutant loads, were used from HSPF for ranking. Sub-catchments were then ranked from 1 to 26 for each constituent, where a rank of 1 corresponded to the lowest pollutant flux and a rank of 26 corresponded to the highest. This ranking process was performed separately for sediment, nitrogen, and phosphorus. The average rank across all three constituents was subsequently used as a composite proxy to identify areas of relatively higher pollutant load within the watershed.

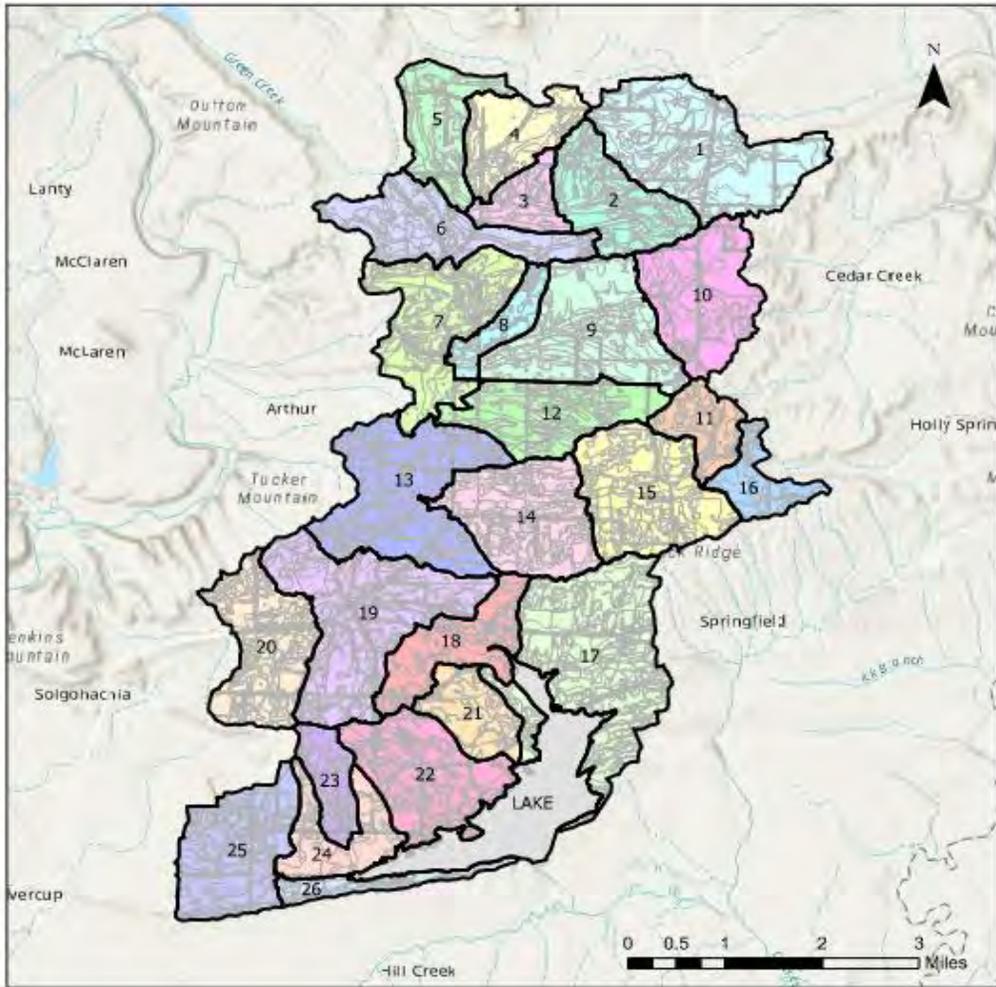


Figure 1 Prioritized Brewer Lake catchments

1.2 Feasibility

Feasibility serves as a metric to evaluate the practicality of implementing BMPs within this sub-catchment. Ideally, feasibility would be assessed using direct measures such as total project costs, stakeholder survey results, or other comparable data. However, because no such comprehensive metrics were available for the Brewer Lake watershed, a set of proxy indicators was used to provide a relative assessment of feasibility.

1.3 Cost

As a proxy for cost and affordability, the appraised land value from tax records was used as a factor. The "TOTALVALUE" attribute for each parcel, as provided in the attribute table of layer PUBLIC_LAND_BOUNDARIES_AHTD, was divided by the parcel area in acres to determine cost per acre for each parcel. This information comes from the Base Map provided by the Mapping Section, Planning and Research Division, Arkansas State Highway and Transportation Department, in cooperation with the U.S. Department of Transportation. The cost per acre per parcel was normalized to the sub-catchment by multiplying this value by the area of the parcel divided by the area of the sub-catchment. These normalized costs per acre were totaled to calculate the average cost per acre for each sub-catchment.

The average cost per acre ranged from nearly \$700 in one sub-catchment to almost \$6000 in another. Based on the average cost per acre, each sub-catchment was ranked relative to the other sub-catchments. The sub-catchment with the lowest cost per acre received a ranking of 26, while the sub-catchment with the highest cost per acre received a ranking of 1.

1.3.1 Forested Buffers

Second, the forested proportion of a 100-foot riparian area was used as a surrogate for the durability of BMPs with the assumption that, all else being equal, BMPs perform more effectively in areas with forested buffers. The presence of forested riparian 100-foot buffers was determined using the Forest Service Science tree canopy cover layer, a 30-meter-resolution dataset representing percent tree canopy cover (USDA Forest Service, 2025). Areas within 100 feet of waterways were classified as forested where tree canopy cover was 50% or greater. The forested proportion of the riparian area for each sub-catchment was calculated by dividing the area of forested riparian buffer by the total area of the 100-foot buffer within the sub-catchment. Figure 1 shows the results of this analysis. Forested buffer areas are shown in green, while buffers lacking canopy cover are shown in purple.

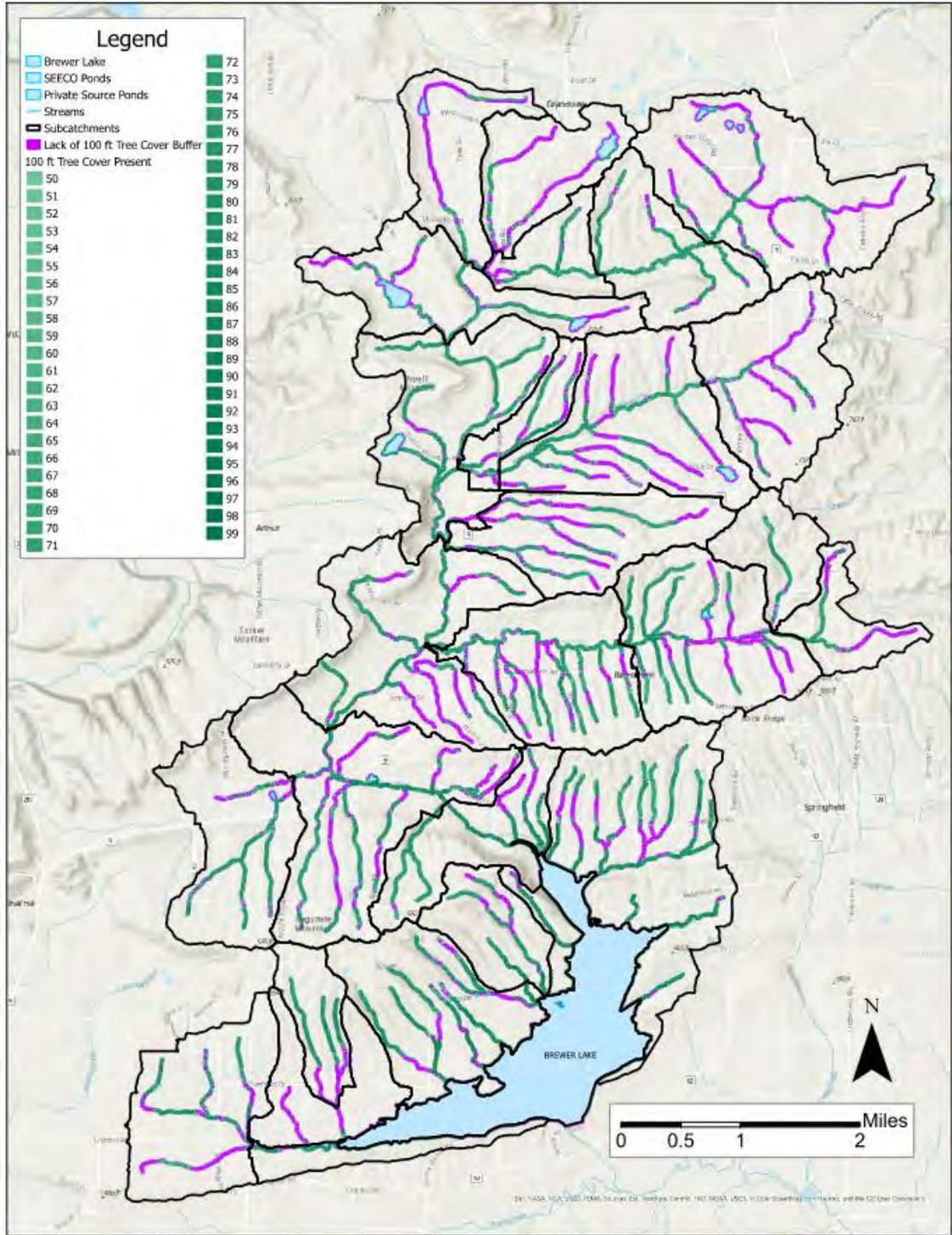


Figure 2 Tree cover by percentage within 100 ft of waterways in the Brewer Lake Watershed

The percent forested buffer ranged from 24% to 88%. Sub-catchments were then ranked from 1 to 26, with the sub-catchment with the highest percent of forested buffer ranked as 26 and the sub-catchment with the lowest percent of forested buffer ranked as 1.

1.4 Time of Travel

Third, the time of travel from each sub-catchment outlet to Brewer Lake, as estimated by HSPF, was used as a proxy for nutrient and sediment transport efficiency and its potential effects on lake water quality. Time of travel was calculated using the 50th-percentile flow velocity and ranged from 0 to greater than 6 days. Several sub-catchments had a calculated time of travel of 0 days because they are directly adjacent to Brewer Lake. Sub-catchments were ranked from 1 to 24 based on time of travel, with two sub-catchments tied: lake-adjacent sub-catchments were assigned rank 24, and those with the longest travel times were assigned rank 1.

1.5 Sub-Catchment Selection

A composite feasibility score for each sub-catchment was calculated as the average of the ranks for cost per acre, percent forested riparian buffer, and time of travel. Figure 2 illustrates the relationship between feasibility score and pollutant load score for each sub-catchment. The combined ranking of loading and feasibility provides a structured basis for identifying priority sub-catchments for BMP implementation.

High-priority sites may be identified based on either factor independently, such as Sub-catchment 1, which ranks highest from a pollutant loading perspective, or Sub-catchment 22, which ranks highest in feasibility. However, the greatest utility of this approach lies in identifying sub-catchments that score highly on both metrics (e.g., Sub-catchments 17 and 19) while deprioritizing those with low potential under both criteria (e.g., Sub-catchments 2 and 16). When comparing sub-catchments with similar pollutant loads, those with higher feasibility are considered preferable candidates for implementation (e.g., Sub-catchment 17 over Sub-catchment 15). Conversely, for sub-catchments with similar feasibility, those with higher pollutant loads are prioritized (e.g., Sub-catchment 19 over Sub-catchment 6). Based on this analysis, Sub-catchments 1, 17, 19, and 22 are identified as key opportunities for watershed management actions that balance water quality objectives with implementation feasibility.

Table 1 **Prioritization Method 1 rankings**

Sub-catchment	1	2	3	4	5	6	7	8	9	10	11	12	13
TN Load (lb/year)	8,475	2,810	1,519	3,594	3,297	4,347	3,721	1,363	6,791	5,788	1,264	5,241	6,241
TN Load Rank	26	9	5	12	11	17	14	4	24	21	2	20	23
TP Load (lb/year)	833	190	125	338	303	425	218	106	589	518	71	431	540
TP Load Rank	26	9	5	16	14	19	10	4	24	22	2	20	23
Sediment Load (1000 lb/year)	5,572	1,066	811	2,097	1,902	2,952	896	545	3,342	2,958	328	2,407	3,507
Sediment Load Rank	26	10	6	16	15	20	9	3	22	21	2	17	23
Average Load Rank	26	9	5	15	13	19	11	4	23	21	2	19	23
Cost/Acre Rank (\$/ac)	3	6	24	16	14	21	9	20	5	1	18	8	7
Percent Buffer Rank	5	26	18	2	3	9	24	13	6	4	25	8	12
Time of Travel Rank	1	2	3	4	5	10	9	8	7	7	12	14	16
Average Feasibility Rank	3	11	15	7	7	13	14	14	6	4	18	10	12

Table 1(continued)

Prioritization Method 1 rankings

Sub-catchment	14	15	16	17	18	19	20	21	22	23	24	25	26
TN Load (lb/year)	4,025	4,794	1,627	6,021	2,490	7,649	3,699	1,793	3,778	1,298	2,859	4,719	691
TN Load Rank	16	19	6	22	8	25	13	7	15	3	10	18	1
TP Load (lb/year)	301	403	141	368	167	708	286	129	283	93	336	493	38
TP Load Rank	13	18	7	17	8	25	12	6	11	3	15	21	1
Sediment Load (1000 lb/year)	1,646	2,550	875	1,878	869	4,664	1,558	711	1,701	553	2,761	3,675	156
Sediment Load Rank	12	18	8	14	7	25	11	5	13	4	19	24	1
Average Load Rank	14	18	7	18	8	25	12	6	13	3	15	21	1
Cost/Acre Rank (\$/ac)	15	19	10	22	23	13	4	25	26	12	17	2	11
Percent Buffer Rank	16	15	7	22	23	11	19	20	21	14	1	10	17
Time of Travel Rank	15	13	11	24	24	18	17	24	24	19	24	20	24
Average Feasibility Rank	15	16	9	23	23	14	13	23	24	15	14	11	17

1.6 Rationale for Selected Priority Sub-catchments

Based on the combined evaluation of pollutant loading and implementation feasibility, four sub-catchments (1, 17, 19, and 22) were identified as priority areas for BMP implementation. Each selected sub-catchment represents a distinct rationale within the ranking framework and illustrates how the prioritization methodology balances water quality objectives with practical constraints.

Sub-catchment 1 was selected due to its consistently high pollutant loading across all modeled constituents. This sub-catchment ranked highest (26) for nitrogen, phosphorus, and sediment loading, indicating a disproportionately large contribution to overall watershed pollutant loads. Although its feasibility score was relatively low compared to other sub-catchments, the magnitude and consistency of pollutant loading warranted its inclusion as a priority area, particularly from a load-reduction perspective.

Sub-catchment 17 was selected based on its elevated score across both loading and feasibility metrics. With a relatively high composite load score (18) and one of the highest feasibility scores (22.5), this sub-catchment represents an opportunity where BMP implementation is likely to be both impactful and practicable. Sub-catchment 17 ranked highly for cost per acre and forested buffer coverage (both ranked 22) and received the highest possible rank for time of travel (24) due to its adjacency to Brewer Lake. It was prioritized over Sub-catchment 15 because, despite similar pollutant loading, Sub-catchment 17 demonstrated substantially greater feasibility for implementation.

Sub-catchment 19 was selected as a high-loading sub-catchment with moderate-to-high feasibility. This sub-catchment exhibited one of the highest pollutant load scores (25) and ranked 25 for nitrogen, phosphorus, and sediment individually, indicating a significant contribution to watershed loading. While its feasibility score (14) was not among the highest, it was sufficient to justify prioritization given the magnitude of loading. Sub-catchment 19 was selected over Sub-catchment 6 because, despite comparable feasibility scores, Sub-catchment 19 had a substantially higher pollutant load, offering greater potential water quality benefit from BMP implementation.

Sub-catchment 22 was selected primarily due to its exceptionally high feasibility for BMP implementation. This sub-catchment received the highest composite feasibility score, ranking 26 for cost per acre, 21 for forested buffer coverage, and 24 for time of travel as a lake-adjacent sub-catchment. Although its pollutant load score was lower than that of some other priority areas, its high feasibility makes it an attractive candidate for implementation where logistical, financial, and temporal constraints are critical considerations.

Collectively, these four sub-catchments demonstrate how the prioritization framework identifies sites that either contribute disproportionately to pollutant loading, offer favorable conditions for BMP implementation, or represent an optimal balance of both. Their selection illustrates the flexibility of the ranking approach in supporting strategic, data-driven watershed management decisions.

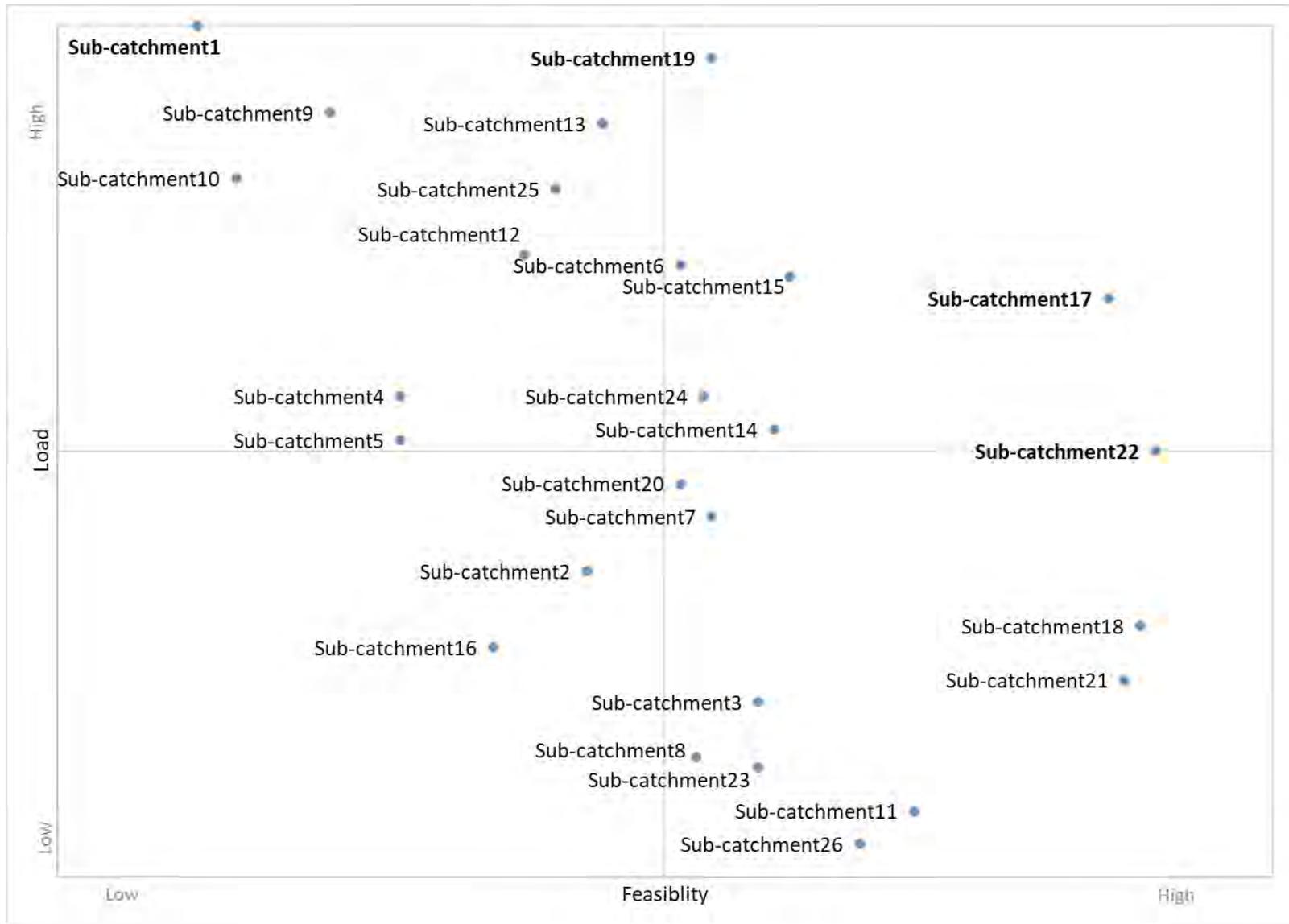


Figure 2 Prioritization based on average ranking relative to water quality loads (TN, TP, Sediment) and feasibility (appraised land value, riparian buffers, and time of travel to Brewer Lake).

2.0 Prioritization Method 2 – Multiple Criteria Decision Analysis Matrix

A multiple criteria decision analysis (MCDA) weighted decision matrix was also used to prioritize the 26 sub-catchments. This analysis, which was independent from the first prioritization method, was implemented in three phases. Phase one involves determining relevant criteria and establishing their relative importance. For this analysis, the selected criteria were total nitrogen load, total phosphorus load, sediment load, travel time, and land use. These criteria were then evaluated using a paired comparison approach. Table 2 summarizes the pairwise comparisons and resulting rankings. For each pair, the question “Which criterion is more important: the vertical (green) or horizontal (blue)?” was posed. If the horizontal criterion was deemed more important based on the goals of the watershed based plan, a value of one was entered in the corresponding cell; if the vertical criterion was more important, a zero was entered. Once all pairwise comparisons were completed, the sum of each row plus one was calculated to determine the relative rank of each criterion compared to the others.

Table 2 Pairwise comparison of criteria used to rank catchments

	TN Load	TP Load	Sediment Load	Travel Time	Land Use	Rank Value
TN Load	-	0	1	1	1	4
TP Load	1	-	1	1	1	5
Sediment Load	0	0	-	1	1	3
Travel Time	0	0	0	-	0	1
Land Use	0	0	0	1	-	2

Phase two of the weighted decision matrix involves assigning a rank to each sub-catchment for each criterion. Each rank represents a tier containing 20% of the total load for the respective contaminant. For this analysis, rankings ranged from 1 to 5, where a rank of 1 represents a low-priority watershed for the given criterion, and a rank of 5 represents a high-priority watershed. The final rankings for all sub-catchments across each criterion are provided in Table 3. For nitrogen, phosphorus, and sediment, thresholds were established to assign ranks based on total load. Table 4 summarizes these thresholds and illustrates how sub-catchments were allocated to each rank.

Table 3 Thresholds used to rank catchments based on contaminant amounts

Rank Value	Phosphorus Boundaries (lb/ac/yr)		Nitrogen Threshold (lb/ac/yr)		Sediment Threshold (lb/ac/yr)	
1	0	167	0	1,695	0	1,114,489
2	167	335	1,695	3,390	1,114,489	2,228,978
3	335	505	3,390	5,084	2,228,978	3,343,467
4	505	669.4	5,084	6,779	3,343,467	4,457,955
5	>669.4		>6,779		>4,457,955	

Watersheds were also ranked by time of travel to Brewer Lake. This ranking was based on the principle that watersheds closer to the lake convey water and any associated pollutants more directly. Sub-catchments with shorter travel times were therefore assigned higher ranks, reflecting the greater

potential impact of BMP implementation in these locations. The time of travel ranking values are in Table 4.

Table 4 Time of Travel and Corresponding Rank

Rank Value	Time of Travel (days)
1	>3.5-6.25
2	>2.4-3.5
3	>1.8-2.4
4	>0-1.8
5	0

Land use was the final criterion evaluated for each watershed. Land use data were obtained from the 2021 National Land Cover Database. Among the land uses present, pasture was identified as having the strongest influence on contaminant runoff. The percentage of each sub-catchment classified as pasture was calculated, and sub-catchments were ranked accordingly, as shown in Table 5.

Table 5 Percents and corresponding rank for land use

Rank Value	Pasture Land Use
1	<30%
2	30-40%
3	40-50%
4	50-60%
5	>60%

Table 6 Scores of each catchment

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
TN Load Rank	5	2	1	3	2	3	3	1	5	4	1	4	4	3
TP Load Rank	5	2	1	3	2	3	2	1	4	4	1	3	4	2
Sediment Load Rank	5	1	1	2	2	3	1	1	3	3	1	3	4	2
Land Use	5	1	2	5	4	4	1	2	4	5	1	3	2	1
Time of Travel	1	1	1	1	1	1	2	2	2	2	3	2	3	3
	13	14	15	16	17	18	19	20	21	22	23	24	25	26
TN Load Rank	4	3	3	1	4	2	5	3	2	3	1	2	3	1
TP Load Rank	4	2	3	1	3	1	5	2	1	2	1	3	3	1
Sediment Load Rank	4	2	3	1	2	1	5	2	1	2	1	3	4	1
Land Use	2	1	1	3	1	1	3	1	1	1	2	5	4	1
Time of Travel	3	3	3	3	5	5	4	4	5	5	4	5	4	5

The final step in this assessment involves calculating a weighted score for each catchment. This is achieved by multiplying the scores for each criterion in Table 1 by the corresponding criterion scores presented in Table 6. The resulting values represent the final weighted scores for each catchment, providing a comprehensive measure that accounts for the relative importance of each criterion. The

catchments with the six highest weighted scores are identified as the most suitable candidates for treatment with Best Management Practices (BMPs). The complete set of final weighted scores is summarized in Table 7. Based on this analysis, Catchments 1, 9, 10, 13, 19, and 25 are recommended as priority areas for BMP implementation as a result of the MCDA. Further information about how these two prioritization methods were used in tandem to recommend areas for effective BMP implementation can be found in Section 6.3 of the report.

Table 7 MCDA complete decision matrix

	Mult Value	1	2	3	4	5	6	7	8	9	10	11	12	13
Area (ac)	-	1,480	784	339	618	620	886	1,119	294	1,239	981	391	846	1,388
TN Load (lb/year)	-	8,475	2,810	1,519	3,594	3,297	4,347	3,721	1,363	6,791	5,788	1,264	5,241	6,241
TN Load Rank	4	5	2	1	3	2	3	3	1	5	4	1	4	4
TN Result		20	8	4	12	8	12	12	4	20	16	4	16	16
TP Load (lb/year)	-	833	190	125	338	303	425	218	106	589	518	71	431	540
TP Load Rank	5	5	2	1	3	2	3	2	1	4	4	1	3	4
TP Result		25	10	5	15	10	15	10	5	20	20	5	15	20
Sediment Load (1000 lb/year)	-	5,572	1,066	811	2,097	1,902	2,952	896	545	3,342	2,958	328	2,407	3,507
Sediment Load Rank	3	5	1	1	2	2	3	1	1	3	3	1	3	4
Sediment Result		15	3	3	6	6	9	3	3	9	9	3	9	12
Land Use	2	5	1	2	5	4	4	1	2	4	5	1	3	2
Land Use Result		10	2	4	10	8	8	2	4	8	10	2	6	4
Time of Travel (days)	1	1	1	1	1	1	1	2	2	2	2	3	2	3
Time of Travel Result		1	1	1	1	1	1	2	2	2	2	3	2	3
Sum of Result Values		71	24	17	44	33	45	29	18	59	57	17	48	55
Prioritization Rank		26	9	1.5	16.5	11.5	18	10	3	24	23	1.5	20	22

Table 7 (continued) MCDA complete decision matrix

	Mult Value	14	15	16	17	18	19	20	21	22	23	24	25	26
Area (ac)	-	1,033	1,126	347	1,764	681	1,545	934	467	1,003	352	533	970	245
TN Load (lb/year)	-	4,025	4,794	1,627	6,021	2,490	7,649	3,699	1,793	3,778	1,298	2,859	4,719	691
TN Load Rank	4	3	3	1	4	2	5	3	2	3	1	2	3	1
TN Result		12	12	4	16	8	20	12	8	12	4	8	12	4
TP Load (lb/year)	-	301	403	141	368	167	708	286	129	283	93	336	493	38
TP Load Rank	5	2	3	1	3	1	5	2	1	2	1	3	3	1
TP Result		10	15	5	15	5	25	10	5	10	5	15	15	5
Sediment Load (1000 lb/year)	-	1,646	2,550	875	1,878	869	4,664	1,558	711	1,701	553	2,761	3,675	156
Sediment Load Rank	3	2	3	1	2	1	5	2	1	2	1	3	4	1
Sediment Result		6	9	3	6	3	15	6	3	6	3	9	12	3
Land Use	2	1	1	3	1	1	3	1	1	1	2	5	4	1
Land Use Result		2	2	6	2	2	6	2	2	2	4	10	8	2
Time of Travel (days)	1	3	3	3	5	5	4	4	5	5	4	5	4	5
Time of Travel Result		3	3	3	5	5	4	4	5	5	4	5	4	5
Sum of Result Values		33	41	21	44	23	70	34	23	35	20	47	51	19
Prioritization Rank		11.5	15	6	16.5	7.5	25	13	7.5	14	5	19	21	4

References

USDA Forest Service. 2025. USFS Tree Canopy Cover (Science Version) CONUS v2023-5. Salt Lake City, UT.

Appendix I: Potential Funding Assistance Programs

Potential Funding Assistance Programs

Protecting and improving the Brewer Lake watershed requires coordinated investment from multiple stakeholders—cities, counties, water utilities, agricultural producers, and landowners. Fortunately, numerous federal and state funding programs are available to support water quality improvement, infrastructure upgrades, conservation practices, and watershed management activities.

This appendix provides a comprehensive overview of funding opportunities relevant to the Brewer Lake Watershed Management Plan. The programs listed represent diverse funding mechanisms including grants, low-interest loans, cost-share arrangements, and technical assistance from agencies such as the U.S. Environmental Protection Agency (EPA), U.S. Department of Agriculture (USDA), U.S. Army Corps of Engineers, and Arkansas state agencies.

The table (below) is organized to help you quickly identify programs that match your organization type and project needs:

- **Program Administering Agency** – The federal or state entity managing the program
- **Focus Areas** – Specific water quality and conservation objectives relevant to Brewer Lake
- **Eligible Applicants** – Whether cities/counties, utilities/water systems, or agricultural producers/landowners can apply
- **Funding Vehicle** – The type of financial assistance (grant, loan, cost-share, etc.)
- **Match Requirements** – The typical local or non-federal contribution needed
- **Typical Funding Amounts** – Expected project scales in Arkansas
- **Sources** – Direct links to program websites and guidance

Funding amounts, match requirements, and program priorities may change annually. Prospective applicants should consult the program websites and contact administering agencies directly for current application cycles and eligibility criteria. Interested parties seeking guidance on funding opportunities or partnership development should direct inquiries to comments@conwaycorp.net.

Table 1 Potential funding sources for watershed protection

Program	Administering Agency	Focus Areas	Cities / Counties	Utilities / Water Systems	Agricultural Producers / Landowners	Funding Vehicle	Typical Match Requirement*	Typical Arkansas Funding Amounts*	Sources
Clean Water Act Section 319 Nonpoint Source Grants	U.S. EPA (administered by Arkansas Department of Energy & Environment (DEQ))	Nutrient & sediment reduction upstream of Brewer Lake; watershed planning; BMP implementation	✓	✓	✓	Grant (cost-share)	40% non-federal match (cash or in-kind)	Project awards commonly \$100k–\$500k; targeted watershed projects favored	https://www.epa.gov/nps/319-grant-program-states-and-territories
Clean Water State Revolving Fund (CWSRF)	U.S. EPA / Arkansas agencies	Wastewater, stormwater, nutrient reduction affecting Brewer Lake source waters	✓	✓	-	Low-interest loan (principal forgiveness possible)	No match; repayment required	Projects range <\$1M to >\$50M; some principal forgiveness for hardship communities	https://www.epa.gov/cwsrf
Drinking Water State Revolving Fund (DWSRF) / AR Safe Drinking Water Fund	U.S. EPA / Arkansas Dept. of Health	Source water protection, treatment upgrades, compliance for Brewer Lake supply	✓	✓	-	Low-interest loan / principal forgiveness	No match; repayment required	Typical projects \$500k–\$20M; federal capitalization ~\$30M+/year	https://www.epa.gov/dwsrf https://media.ark.org/agri/00-AR-Drinking-Water-State-Revolving-Fund-IUP-SFY-2026-FINAL.pdf
Environmental Quality Incentives Program (EQIP)	USDA NRCS (Arkansas)	Pasture management, fencing, nutrient management upstream of Brewer Lake	-	-	✓	Cost-share payments	Producer share typically 25–50%	Practice-based payments; millions annually statewide	https://www.nrcs.usda.gov/programs-initiatives/eqip-environmental-quality-incentives/arkansas/arkansas-eqip
Conservation Stewardship Program (CSP)	USDA NRCS	Long-term soil and water stewardship in Brewer Lake watershed	-	-	✓	Incentive based on stewardship	No formal match; stewardship commitments required	Per-acre payments; funding varies annually	https://www.nrcs.usda.gov/programs-initiatives/csp-conservation-stewardship-program/arkansas/conservation-stewardship-program
Regional Conservation Partnership Program (RCPP)	USDA NRCS	Multi-partner nutrient reduction & pasture conversion projects in Central AR	✓	✓	✓	Grants / cooperative agreements	Partner match typically required (varies by agreement)	Arkansas projects have exceeded \$50M total in past rounds	https://www.nrcs.usda.gov/programs-initiatives/regional-conservation-partnership-program
Watershed Protection & Flood Prevention (PL-566)	USDA NRCS	Flood mitigation, erosion control feeding Brewer Lake tributaries	✓	-	✓	Federal cost-share project funding	Local sponsor share ~25–35%	Project-specific; often multi-million dollar watersheds	https://www.nrcs.usda.gov/state-offices/arkansas https://www.nrcs.usda.gov/programs-initiatives/watershed-protection-and-flood-prevention-operations-wfpo-program/arkansas/pl
USDA Rural Development – Water & Waste Disposal	USDA Rural Development	Rural water & wastewater improvements protecting Brewer Lake	✓	✓	-	Loans and grants	Match varies; grants often paired with loans	Projects commonly \$250k–\$10M	https://www.rd.usda.gov/programs-services/water-environmental-programs/water-waste-disposal-loan-grant-program-31

Program	Administering Agency	Focus Areas	Cities / Counties	Utilities / Water Systems	Agricultural Producers / Landowners	Funding Vehicle	Typical Match Requirement*	Typical Arkansas Funding Amounts*	Sources
National Water Quality Initiative (NWQI)	USDA NRCS	Targeted nutrient & sediment reduction in priority sub-watersheds	-	-	✓	Cost-share payments	Producer share typically 25–50%	Funding varies by watershed priority	https://www.nrcs.usda.gov/programs-initiatives/national-water-quality-initiative/arkansas/national-water-quality-initiative#assistance
Conservation Innovation Grants (CIG)	USDA NRCS / NIFA	Innovative BMPs and monitoring in Brewer Lake watershed	✓	✓	✓	Competitive grants	Typically 50% non-federal match	\$50k–\$2M depending on category	https://www.nrcs.usda.gov/programs-initiatives/cig-conservation-innovation-grants/cig-applicants https://www.nrcs.usda.gov/programs-initiatives/conservation-innovation-grants
USACE Section 206 Aquatic Ecosystem Restoration	U.S. Army Corps of Engineers	Stream and habitat restoration affecting Brewer Lake inflows	✓	-	-	Federal cost-share project funding	35% non-federal sponsor share	Federal share typically <\$10M per project	https://www.sas.usace.army.mil/Missions/CAP/Section-206-Aquatic-Ecosystem-Restoration/
Arkansas Conservation District Grant Program	Arkansas Department of Agriculture	Local conservation projects and landowner outreach near Brewer Lake	✓	-	✓	Grant (matching)	1:2 local match required	Up to \$25,000 per district annually	https://agriculture.arkansas.gov/natural-resources/conservation/conservation-district-support/
Arkansas Water Resource Agricultural Cost-Share Program (Title 10)	Arkansas Natural Resource Division & County Conservation Districts	Installing Best Management Practices (BMPs) reducing nonpoint source pollution, and improving water quality	-	-	✓	Cost-Share	60% federal cost-share / 40% landowner match	\$15,000 in federal/state funds over three years & combined federal funding (eg EQIP) cannot exceed 75% of the total project costs	https://agriculture.arkansas.gov/natural-resources/water-management/nonpoint-source-management/
Agricultural Conservation Easement Program (ACEP)	USDA NRCS	Wetland & agricultural land protection upstream of Brewer Lake	-	-	✓	Easement acquisition / cost-share	Landowner contribution varies by easement type	Project-specific; long-term land protection	https://www.nrcs.usda.gov/programs-initiatives/agricultural-conservation-easement-program

Conway Corporation is the manager of the Brewer Lake Watershed Management plan. Interested parties should send inquiries to comments@conwaycorp.net

*Subject to change.