Lake Conway – Point Remove Watershed Management Plan

Developed by the

Lake Conway/Point Remove
Watershed Alliance
and
GBMc & Associates

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EXECUTIVE SUMMARY

In 2005 EPA released a guidance handbook for developing watershed-based management plans (EPA, 2005). This watershed management plan (WMP) has been developed based largely on the 2005 EPA guidance and addresses the nine minimum elements required by EPA in plans written for the 319 Non-Point Source Control Program. Preparation of this plan was funded partially by an EPA 319 Grant through the Arkansas Department of Agriculture, Natural Resources Division (NRD). The Lake Conway Point Remove Watershed Alliance (LCPRWA) was founded in 2014 and has spearheaded this effort over the past eight years and has provided the remainder of the funding that was required to get this plan completed.

The assessment portion of this plan contains data collected over approximately 12 years, with the most recent data being collected from 2018-2020 specifically for development of this plan. The ranking of key/critical sub-watersheds and the proposed management measures are based largely on that assessment work. The WMP includes identification of critical sub-watersheds at a small scale (10/12-digit HUC) and ranked implementation measures to reduce non-point source pollution loading from critical areas. This WMP refers to using 10/12-digit HUCs because some of the monitoring station locations had watersheds that included an area larger than a single HUC 12, but never more than a HUC 10. In addition, the way the sub-watersheds were broken out for the overall assessment, was based on this same premise. Most were at the HUC 12 level, but some were a bit larger, so we refer to it as a "10/12-digit HUC" level.

Lake Conway-Point Remove Watershed (LCPRW) is a priority watershed for the Arkansas Nonpoint Management Program and has listed streams on the Arkansas Department of Environmental Quality (ADEQ) 2018 303(d) list. The LCPRW (HUC 11110203) is approximately 1,140 mi^2 in size with sub-watersheds ranging in size from 25 mi^2 to 182 mi^2. The watershed is primarily located in the Arkansas River Valley with small portions in the Ouachita Mountains and the Boston Mountains ecoregions (Omernick, 1987). The watershed spans seven counties: Conway, Faulkner, Perry, Pope, Pulaski, Van Buren, and Yell counties. The watershed ultimately drains to the Arkansas River but not all through one outlet. LCPRW is atypical in that it does not have one mainstream system to which all smaller streams flow. Rather, there are several stream systems in this HUC that ultimately drain to the Arkansas River, the largest of which is Point Remove Creek.

Sediment (turbidity) and nutrients appear to be the principal concern in the watershed today, particularly as it relates to non-point source pollution. Several sources are believed to be contributors to these elevated levels including runoff from agriculture (pasture and row crops), runoff from the developed areas along the Interstate 40 corridor including Russellville, Morrilton and Conway, unpaved roads, streambank erosion and NPDES discharges.

Reductions in TSS loading (of approximately 10%), which will also provide reductions in nutrient and metals (of approximately 10%) will be targeted in critical/priority areas to improve water quality, ensure maintenance of the state in-stream criteria (for nitrates in Stone Dam Creek and Whig Creek due to a TMDL) and reduce nutrient loading to the Arkansas River/Mississippi River Basin.

The primary recommendations to improve water quality, for the five key/priority sub-watersheds in this WMP, are provided in Section 6, and a summary is provided in the table below.

Recommended Watershed Management Practices

Rank	Sub-watershed	Management Type	Management Action (Practice)
1	EPR-2 and WPR-2	BMP	Implementation of Pasture BMPs
2	EPR-2 and WPR-2	Restoration/BMP	Riparian Buffer/Vegetated filter Strips on all agricultural land
3	EPR-2 and WPR-2	Restoration	Streambank stabilization
	EPR-2 and WPR-2	BMP	Unpaved road maintenance and upgrades
4	TB-1	BMP	Implementation of Row Crop BMPs
5	TB-1	Restoration	Streambank stabilization
6	SD-1	BMP	Implementation of residential/commercial BMPs
7	SD-1	Restoration	Restore Riparian Buffers
8	EPR-1	Restoration	Streambank stabilization
9	EPR-1	BMP	Unpaved road maintenance and upgrades
10	EPR-1	BMP	Implementation of Pasture BMPs
11	EPR-1	Restoration/BMP	Riparian Buffer/Vegetated filter Strips on all agricultural land
12	EPR-1, EPR-2, WPR-2	BMP	Review all oil and gas well operations for stormwater BMP practices

Watershed Name
Upper East Point Remove (EPR-1)
Lower East Point Remove (EPR-2)
Tupelo Bayou (TB-1)
Upper West Point Remove (WPR-1)
Lower West Point Remove (WPR-2)

See Figure 2.1. for a general overview of the Lake Conway Point Remove Watershed showing sub-watersheds and monitoring locations.

1.0 INTRODUCTION

Since the late 1980s the Environmental Protection Agency (EPA) has encouraged states and territories to manage their waters using a watershed approach. The watershed approach provides a framework to assess and manage water quality and water resources on a drainage basin (watershed) basis, focusing attention not just on point source discharges and stream disturbances in the stream corridors, but also on the effects of anthropogenic land uses and the effects they have on stormwater run-off (non-point sources) in the entire watershed on the waters in that watershed.

In 2005 EPA released a guidance handbook for developing watershed-based management plans (EPA, 2005). This watershed management plan (WMP) has been developed based largely on the 2005 EPA guidance and addresses the nine minimum elements required by EPA in plans written for the 319 Non-Point Source Control Program (Table 1.1). Preparation of this plan was funded partially by an EPA 319 Grant through the Arkansas Department of Agriculture, Natural Resources Division (NRD). The Lake Conway Point Remove Watershed Alliance (LCPRWA) has spearheaded this effort over the past eight years and has provided the remainder of the funding that was required to get this plan completed.

Table 1.1. EPA Nine Minimum Elements.

EPA Nine Minimum Elements	Location Element Addressed in Watershed Management Plan
Element 1- Identification of causes of impairment and pollutant sources	Section 3.0, 4.0, 5.0
Element 2- Estimate of load reductions expected from management measures	Section 6.0
Element 3- Non-point source measures required to achieve load reductions	Section 6.0
Element 4- Estimate of funding needed and sources of funding to implement plan	Section 9.0
Element 5- Information and education component	Section 8.0
Element 6- Schedule for implementation	Section 6.0
Element 7- Interim measurable milestones	Section 6.0
Element 8- Criteria to measure success of reduction goals	Section 7.0
Element 9- Monitoring component to evaluate effectiveness of implementation measures	Section 7.0

The LCPRWA is a 501(c)3 non-profit corporation that was formed in 2014 to oversee development of a nine-element watershed management plan and to manage its implementation in the watershed. The LCPRWA is made up of local citizens, city officials and university faculty all with a desire to see the water resources protected. The creation and implementation of this plan will improve the water quality in each sub-watershed and will reduce pollutant transport to the Arkansas River Basin.

Arkansas Department of Agriculture , Natural Resource Division (NRD) designated the LCPRW as a priority watershed in the Nonpoint Source Pollution Management Plan during the 2006-2011 Plan and continued it in the 2018-2023 Plan. The NRD is the primary agency in Arkansas that spearheads NPS pollution control and is the agency through which 319 grant funding is managed for projects such as this. The parameters of concern in the LCPRW are sediment (turbidity), nutrients, pH and low dissolved oxygen. Six of the NRDs objectives for this watershed will be accomplished through, or because of development of this WMP, and many of the remaining 11 objectives will be set in motion by this plan's implementation priorities. The six that will be accomplished are:

15.1. Continue development of the Nine Element Plan until U.S. Environmental Protection Agency (EPA) approval is obtained.
15.2. Continue to develop support for implementation of the Nine Element Plan among potential cooperating entities and the general public.
15.3. Provide technical and financial assistance to local cooperating entities to implement the Nine Element Plan as resources allow.
15.4. As resources allow, use remote sensing and Geographical Information Systems (GIS) analysis to identify sub-watersheds where more extensive assessment is needed. Conduct targeted geomorphological and bioassessment to identify and target implementation of streambank stabilization projects for high impact sites (e.g., a geomorphologic study of logjams and assess beaver populations to determine their impact on streambank erosion and other studies).
15.5. Continue to refine models as new data becomes available to represent sediment and nutrient loads in the watershed and instream processes to enable prioritization of implementation projects in sub-watersheds. For this effort, we requested SWAT model files from the NRD and had hoped to use them for the BMP analysis, however the files were missing some GIS files and/or were corrupted. Results from SWAT depicted in the report (Sec.4.2) are from the original Saraswat 2010 report. We used the online version of SWAT, HAWQS, to run some BMP analysis to estimate what reductions could be achieved. This is documented in Section 6.1.1.2.
15.10. Continue to increase public awareness and provide education to build support for citizen action to improve water quality in the watershed.

Arkansas Department of Environmental Quality's approved 2018 303 (d) list contains four streams in the LCPRW, Cypress Creek, Stone Dam Creek, Whig Creek, and West Fork Point Remove. Cypress Creek (CC-1), otherwise known as Rock Cypress is listed for turbidity with surface erosion as the source with a low priority. The 303(d) list has 5 categories that water bodies are classified under, and category 5 defined as an impaired water body with one or more water quality standards are not attained and a TMDL is required. These water bodies are prioritized as high, medium, and low priority. Low priority is defined as one or more water quality standards are not met but designated uses are supported, or insufficient data are available to determine use attainment or ADEQ assess as unimpaired, but EPA assessed as impaired. Stone Dam (SD-1) is listed for dissolved oxygen, ammonia, and nitrate with agriculture, urban runoff and surface erosion listed as the source. Whig Creek (WC-1) is listed for dissolved oxygen, ammonia, and nitrate. West Fork Point Remove Creek (WPR-1) is listed for pH with a source unknown and a low priority. Some of the listings are likely to be (or have been) corrected by improvement to wastewater treatment plant (WWTP) point sources, i.e., City of Conway's discharge to Stone Dam Creek which has been relocated to the Arkansas River and Russellville's discharge to Whig Creek which has a TMDL.

Sediment (turbidity) and nutrients appear to be the principal concern in the watershed today, particularly as it relates to NPS. Several sources are believed to be contributors to these elevated levels including runoff from agriculture (pasture and row crop land use) runoff from the developed areas along the Interstate 40 corridor including Russellville, Morrilton and Conway, unpaved roads, streambank erosion and NPDES discharges.

A watershed monitoring program was funded and initiated in 2012 through the 319 program and implemented by Equilibrium. This monitoring program included extensive water quality sampling and physicochemical analysis on a bi-monthly basis (2/month), under various flow regimes, at multiple stream stations in the watershed. It also included streamgage measurements of each of the key streams in the watershed so flow and loading could be measured. These will all be discussed in Section 3 of this WMP.

This WMP has been developed based primarily on evaluation/analysis of existing watershed monitoring data and new data collected over the past four years specifically to develop this comprehensive WMP. The WMP includes identification of critical sub-watersheds at a small scale (10/12-digit HUC) and ranked implementation measures to reduce non-point source pollution loading from critical areas. This WMP will be used to direct watershed protection activities and watershed restoration activities with the goal being immediate reduction of pollutant loading and protection of the watershed.

2.0 WATERSHED DESCRIPTION

Lake Conway-Point Remove is a priority watershed for the Arkansas Nonpoint Management Program and has listed streams on the Arkansas Department of Energy and Environment Division of Environmental Quality (ADEQ) 2018 303(d) list. The LCPRW(HUC 11110203) is approximately 1,140 mi^2 in size (Figure 2.1) and 18 sub-watersheds range in size from 25 mi^2 to 182 mi^2. The watershed is primarily located in the Arkansas River Valley with small portions in the Ouachita Mountains and the Boston Mountains ecoregions (Omernick, 1987). The watershed spans seven counties: Conway, Faulkner, Perry, Pope, Pulaski, Van Buren, and Yell counties.

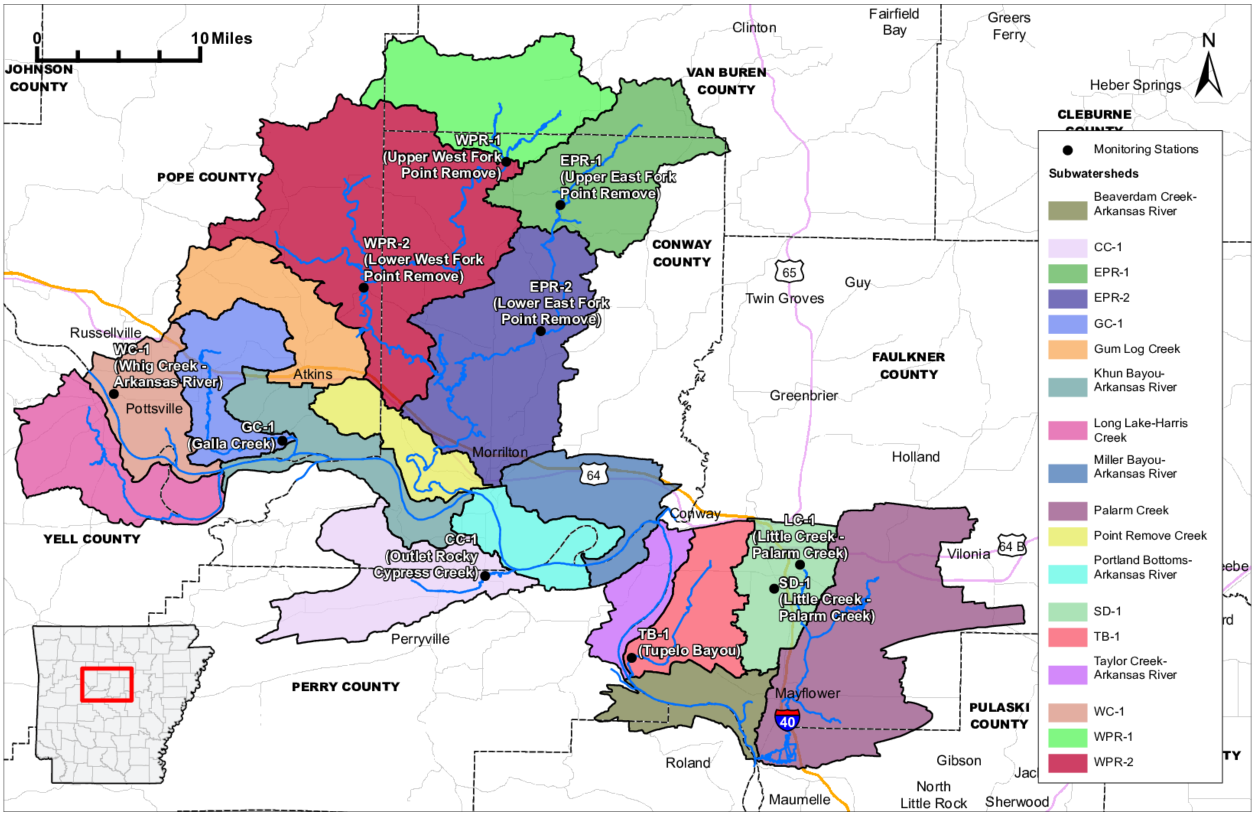


Figure 2.1. General Overview of LCPRW showing sub-watersheds and monitoring locations.

The watershed ultimately drains to the Arkansas River but not all through one outlet. LCPRW is atypical in that it does not have one mainstream system to which all smaller streams flow. Rather, there are several stream systems in this HUC that ultimately drain to the Arkansas River, the largest of which is Point Remove Creek.

The watershed is dominated by forest land-uses (44%) (Figure 2.2). Agricultural land-uses (mostly pasture) comprise a high percentage (34%), while developed areas make up approximately 9% of the watershed (NLCD, 2019). Soils on the land surface in the sub-watersheds are primarily dominated by the Mountainburg Linker, Leadvale, and Taft. These soils are composed mostly of a gravelly fine sandy loam, fine sandy loam and silt loam and have a moderate overall potential for erosion (Figure 2.3.) Slopes are flat overall (6.8% on average) with some moderately steep slopes (average 10-13%) along the northern and northwestern boundaries of the watershed (Figure 2.4.) The moderately steep slopes in the watershed make it somewhat vulnerable to erosion in un-forested areas.

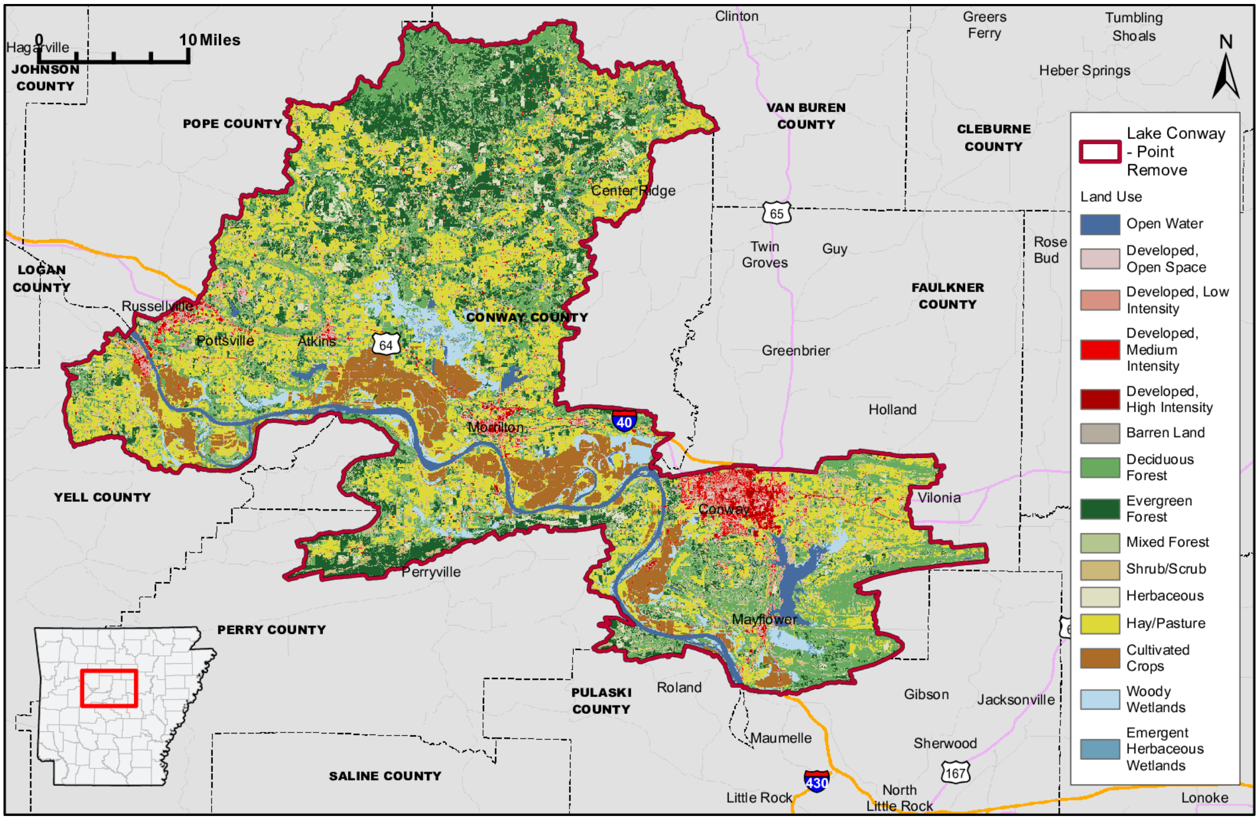


Figure 2.2. Watershed land uses (NLCD 2019).

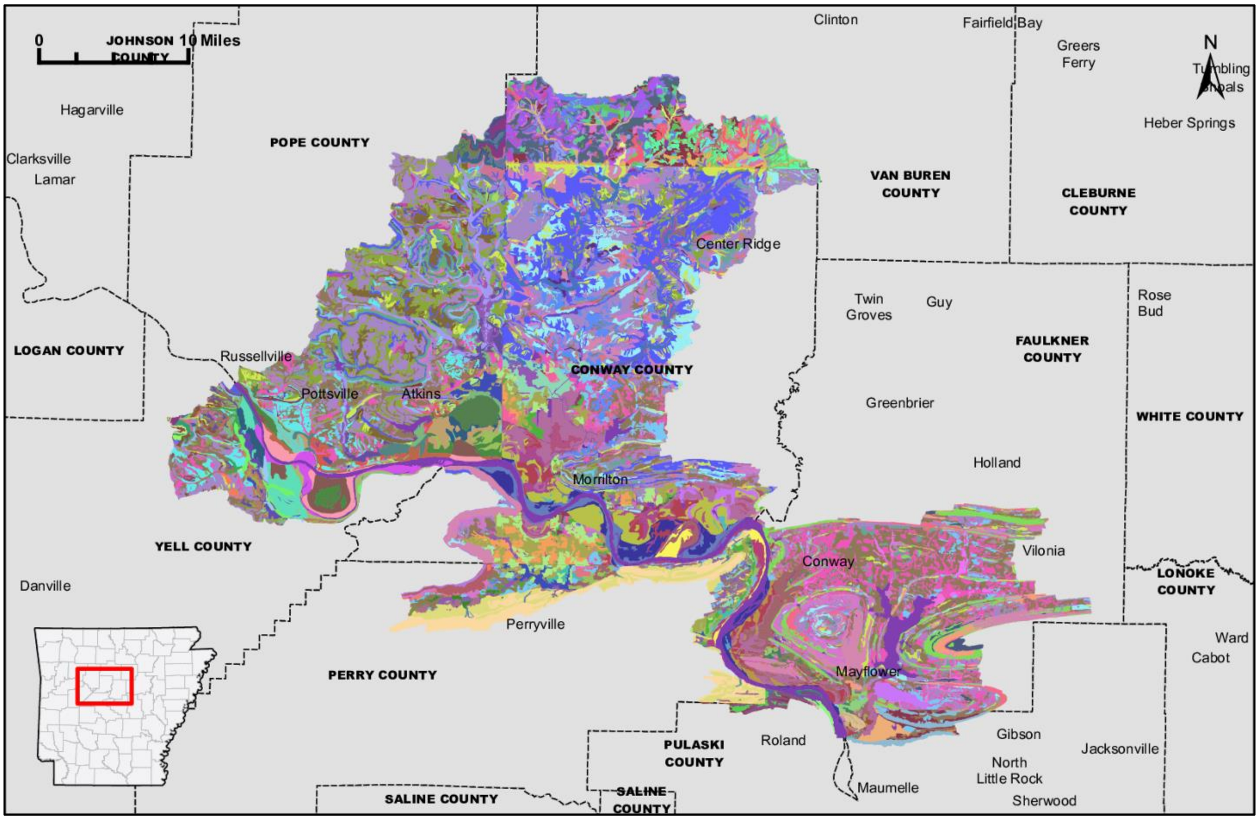


Figure 2.3. Map of soils in the LCPRW .

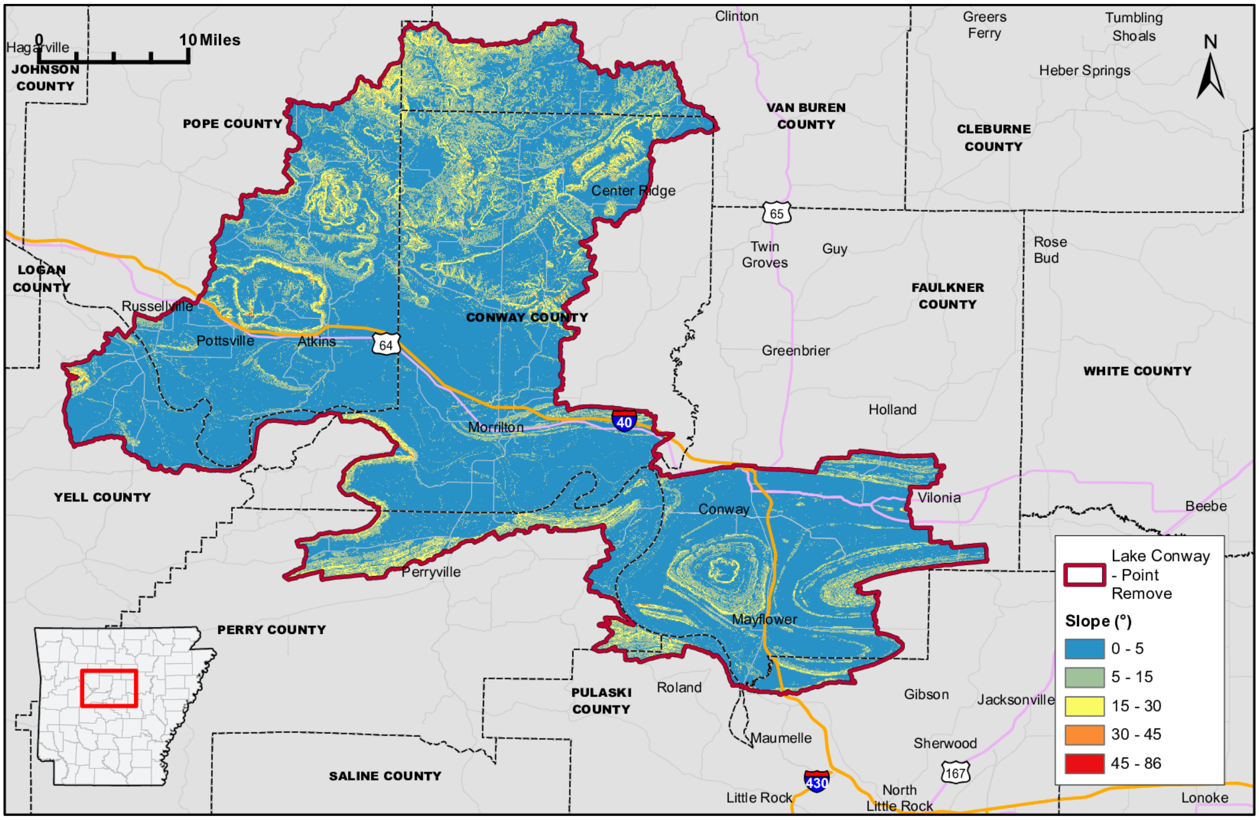


Figure 2.4. Land surface slope in the LCPRW.

All waters in the state of Arkansas have Designated Uses applied to them that dictate the level of water quality that must be maintained. The drainages in the LCPRW, including the primary (10-digit HUC) ones (West and East Forks Point Remove, Tupelo Bayou, Gala Creek, Whig Creek) are designated for the following uses set by the Arkansas Pollution Control and Ecology Commission, Rule #2:

- Primary contact recreation
- Secondary contact recreation
- Domestic, industrial, and agricultural water supply
- Fisheries (Aquatic life), Perennial in Arkansas River Valley, Ouachita Mountains or Boston Mountains

3.0 WATERSHED ASSESSMENT

A comprehensive assessment was completed on the LCPRW to evaluate its physical, chemical, and hydrologic condition. Each of the ten sub-watersheds with monitoring stations depicted on the map (Figures 2.1) were evaluated. Historical data, Unified Stream Assessments (USAs), GIS data, flow and recent water quality monitoring data were utilized for the assessment. In addition, sufficient monitoring data existed for two other sub-watersheds (Gum Log Creek and Palarm Creek) which were also evaluated though without USA data. Much of the historical data was collected by a nonprofit corporation, Equilibrium, Inc. under a 319 grant. In total there are 18 HUC-12 sub-watersheds, LCPRW Alliance received a 319 grant in 2017 and collected data at 9 of those sub-watersheds (LC-1 and SD-1 are in the same watershed). Historical data was collected by Equilibrium, Inc at five of the ten more recently sampled locations (signified by an asterisk below) and included water quality monitoring data, macroinvertebrate collections, and hydrology data. Gum Log Creek (GLC) and Palarm Creek (Palarm) were added into the assessment, alongside the sub-watersheds more recently assessed, since there was enough historical water quality data collected to calculate loading. A description of each assessment component is contained in the following sections. A list of the twelve sub-watersheds (defined at approximately a 10-12-digit HUC level) is provided below. Please note that This WMP refers to using 10/12-digit HUCs because some of the monitoring station locations had watersheds that included an area larger than a single HUC 12, but never more than a HUC 10. In addition, the way the sub-watersheds were broken out for the overall assessment, was based on this same premise. Most were at the HUC 12 level, but some were a bit larger, so we refer to it as a “10/12-digit HUC” level. These twelve sub-watersheds are believed to be a reasonable transect of all the sub-watersheds in the LCPRW and should facilitate informed management for the entire watershed.

1. Cypress Creek (CC-1)*
2. Upper East Point Remove (EPR-1)*
3. Lower East Point Remove (EPR-2)*
4. Galla Creek (GC-1)
5. Little Creek (LC-1) (later combined with SD-1)
6. Stone Dam Creek (SD-1)
7. Tupelo Bayou (TB-1)
8. Whig Creek (WC-1)
9. Upper West Point Remove (WPR-1)*
10. Lower West Point Remove (WPR-2)*

11. Gum Log Creek (GLC)
12. Palarm Creek (Palarm)

*Multiple years of data collected by both Equilibrium and GBMc.

3.1 GIS Non-point Source Assessment

A desktop assessment of the LCPRW was completed using GIS resources including soils maps, land surface slope (DEM), land use, aerial photographs, etc. The assessment was focused on identifying possible land areas and non-point sources of pollutants that could be transported to the stream system during storm water runoff events. The assessment was completed on all sub-watersheds, with an emphasis on the 12 sub-watersheds noted above.

3.1.1 Land Use by Sub-Watershed

Land use was evaluated using 2019 NLCD land-use land cover data from the Multi-Resolution Land Characteristics Consortium. Land use is an important attribute in a watershed analysis. The percentage of pasture, cultivated crops, and developed areas can provide great insight into a watershed's potential for NPS pollution. A summary of the land use assessment is provided in Table 3.1.1.1.

Table 3.1.1.1. Percent Land Use by Sub-Watershed.

Watershed	Watershed Area (mi2)	Forest	Developed Open Space/Low Intensity & Barren	Developed Medium & High Intensity	Wetlands & open water	Herbaceous & Shrub/ Scrub	Cultivated Crops	Hay/ Pasture
Beaverdam Creek-Arkansas River	34.0	46.2	5.7	0.6	20.5	4.8	8.8	13.5
CC-1	65.9	57.0	4.4	0.5	5.6	7.4	0.5	24.6
EPR-1	76.8	54.0	4.1	1.3	0.8	10.0	0	29.8
EPR-2	112	39.3	6.3	2.2	8.8	4.4	4.1	35.0
GC-1	45.6	39.4	8.7	1.3	6.4	3.1	0.9	40.3
Gum Log Creek	50.4	42.6	8.4	1.0	3.0	3.9	0.0	41.1
Khun Bayou-Arkansas River	50.7	24.6	5.5	0.3	23.7	1.7	14.1	30.2
Long Lake-Harris Creek	57.3	28.0	7.0	1.1	7.5	2.9	12.0	41.4
Miller Bayou-Arkansas River	45.0	28.9	7.2	1.7	18.8	2.5	16.9	24.0
Palarm Creek	129	47.6	7.9	1.2	10.9	2.9	1.9	27.6
Point Remove Creek	31.0	9.2	6.1	1.6	5.0	0.8	49.8	27.5

Watershed	Watershed Area (mi2)	Forest	Developed Open Space/Low Intensity & Barren	Developed Medium & High Intensity	Wetlands & open water	Herbaceous & Shrub/ Scrub	Cultivated Crops	Hay/ Pasture
Portland Bottoms-Arkansas River	35.1	11.4	4.7	1.3	15.6	3.6	40.4	23.1
SD-1	41.3	27.5	23.2	18.5	4.4	2.0	0	24.3
Taylor Creek-Arkansas River	25.2	29.0	7.5	1.1	22.3	3.4	3.3	33.4
TB-1	42.8	32.9	16.2	8.9	5.5	1.9	17.7	16.9
WC-1	41.1	25.9	12.8	6.2	10.3	1.7	10.4	32.8
WPR-1	73.4	83.2	3.8	0.4	0.5	3.9		8.2
WPR-2	182.1	56.8	4.4	0.5	4.5	8.3	0.1	25.4

Of the watersheds that more recent data has been collected, only one of the sub-watersheds has significant levels of cultivated crops, TB-1 (17.7%). The smallest sub-watersheds in the study had the highest levels of developed areas, LC-1, SD-1, and WC-1. The sub-watersheds having the highest percentage of pasture are GC-1, Gum Log Creek, and EPR-2, at 40.3%, 41.1% and 35.0%, whereas SD-1 and WPR-1 had the lowest (<10%). Pastures are generally associated with cattle use, commercial fertilizer, poultry litter used as fertilizer, or any combination of the three. Each association can be a source of nutrients to the stream system. Figure 3.1.1.1 below is a visual representation of each sub-watersheds' land use.

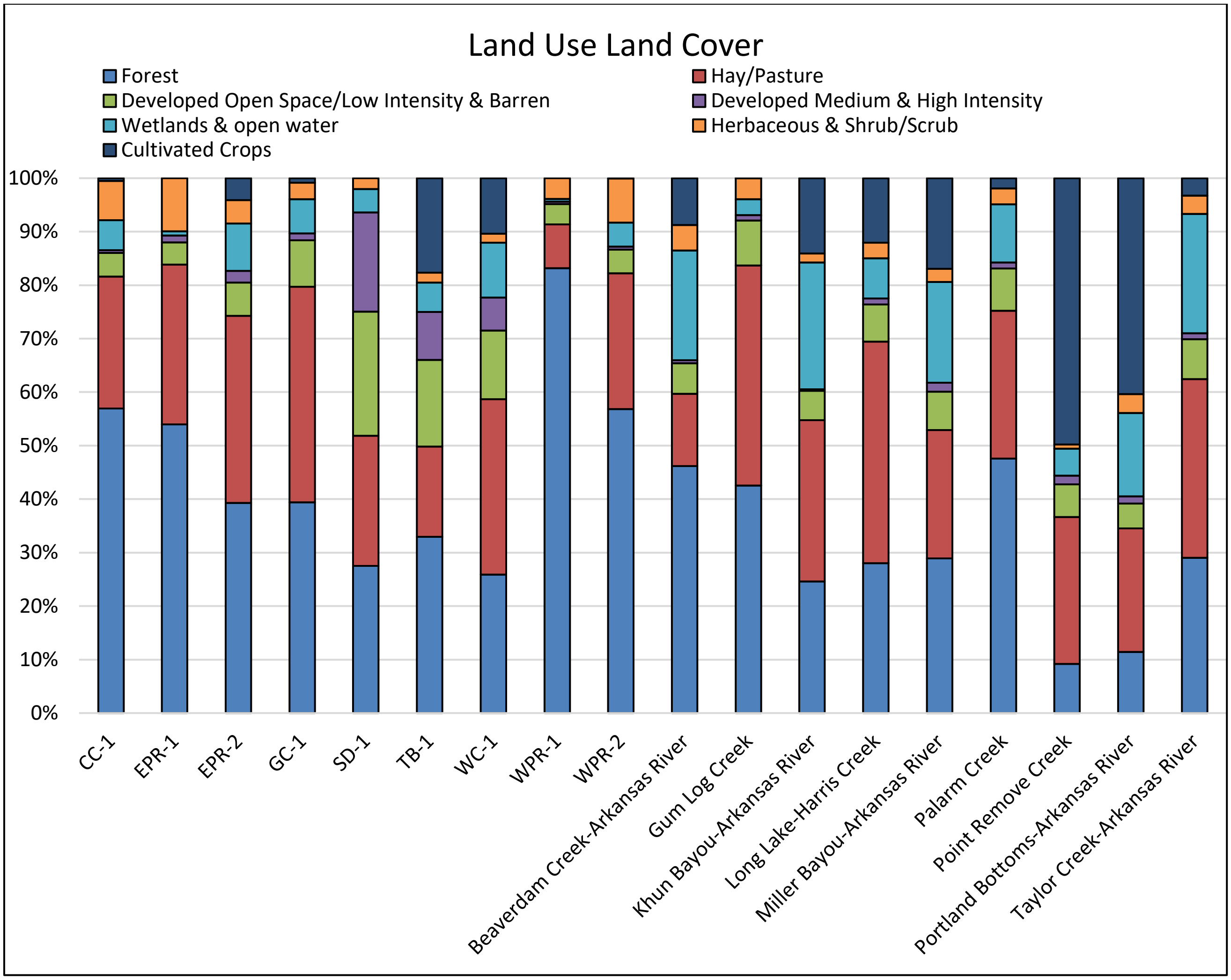


Figure 3.1.1.1. LCPRW Land Use.

3.1.2 Oil and Gas Well Density

The Fayetteville Shale natural gas field is in north central Arkansas and covers approximately 3,000 square miles, much of which is in the LCPRW. Over the past 15 years this area has seen extensive gas well and infrastructure development to extract this resource. The northern part of the LCPRW contains the majority of the 1,593 gas wells in the watershed (Figure 3.1.2.1). Drilling of natural gas wells and the creation of pipelines to transport and store the gas and access roads to the sites changes land use and creates additional areas for stormwater concentration. These changes could cause an increase in runoff volume and sediment from the gravel used to build the pads and roads. The number of oil and gas wells was used in the ranking matrix as another potential source for non-point source pollution.

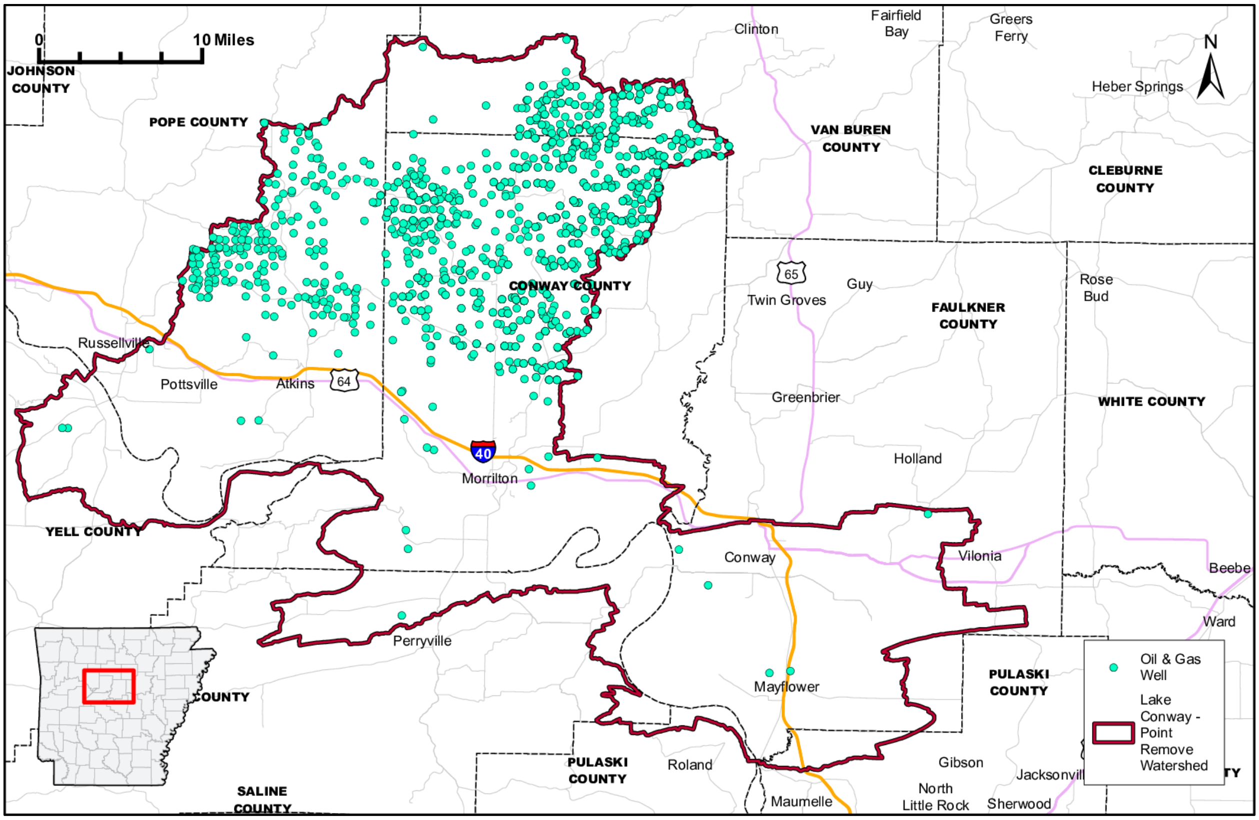


Figure 3.1.2.1. Oil and gas well density in the LCPRW.

3.2 Unified Stream Assessment

A variation (modified to address rural streams) of the Unified Stream Assessment (USA) protocol (Kitchel and Schueler, 2004) was completed on each sub-watershed in 2019. This visual based field assessment protocol consists of breaking the stream into manageable reaches and evaluating, on foot, each reach in its entirety. The evaluation is a screening level tool intended to provide a quick characterization of stream corridor attributes that can be used in determining the most significant problems in each stream reach from a physical, ecological, chemical, and hydrologic perspective. General categories of stream corridor characteristics assessed are:

1. Hydrology
2. Channel morphology
3. Substrate
4. Aquatic habitats
5. Land use
6. Riparian buffer
7. Water/sediment observations
8. Stream impacts (non-point source related, including bank erosion)

9. Floodplain dynamics
10. Geomorphic attributes (channel stability)
11. Restoration/retrofit opportunities.

Field data forms completed during the survey are included in Appendix A. A summary of the pertinent findings are provided in Table 3.2.1. A 1,500-foot (minimum) representative section of each monitoring location in each sub-watershed was assessed following the USA protocol. The impacts observed and their frequency of occurrence is assumed to be consistent with additional comparable stream reaches in that sub-watershed. That is, stream reaches not assessed on that stream have similar channel size to the assessed reach is anticipated to have similar characteristics and issues at a similar frequency to those of the reaches assessed.

Streambank erosion, storm water outfalls, and land use were noted as the biggest impacts on the reach at several areas in the sub-watersheds. Streambank erosion was noted most frequently and varied in severity from very low to high. Bank erosion was often times associated with pasture, cultivated crops and urban land uses where the riparian vegetation had been disturbed or removed. Often these impacted buffer areas are dominated by urban land use that extended to the streambank edge and the absence of well-developed vegetated buffers (both trees and under story vegetation) along the stream (Figure 3.2.1). Riparian buffers provide several benefits to streams, they provide stabilization to streambanks that prevents erosion, with shading that helps cool the water and limit periphyton growth, and they provide organic matter inputs which serve as food and habitat for aquatic biota. Well-developed riparian buffers can also filter storm water pollutants and allow for increased rainwater infiltration which aids in protecting the streams hydrology (through decreased peak flows and increased baseflow).

Table 3.2.1. Summary Of Pertinent Findings from the USA.

Site	% Stream with Bank Erosion (BE)	% Moderate Hazard BE	% High Hazard BE	Biggest Impact on Reach
CC-1	13.5	13.5	0.0	Bank erosion & channelization
EPR-1	80	5.9	74.1	Bank erosion
EPR-2	40	5.1	30.0	Pastureland use & bank erosion
GC-1	49	25.9	19.7	Impacted buffers & bank erosion
LC-1	0	0.0	0.0	Stormwater outfalls, bridge, & urban land use
SD-1	13	6.5	0.0	Stormwater outfalls, low water bridge crossings, & bank erosion
TB-1	100	0.0	100.0	Bank erosion, cultivated crop land use, & stormwater outfalls draining nearby crop fields
WC-1	93	17.8	75.0	Bank erosion, impacted buffers, & urban land use
WPR-1	0	0.0	0.0	None
WPR-2	41	12.9	0.0	Bank erosion

Figure 3.2.1. Comparison of an Impacted Riparian Buffer (Little to None, SD-1) to a Well-Developed Riparian Buffer (EPR).

Bank erosion was noted in several areas, particularly in EPR-1, SD-1, TB-1, and WPR-2. Each instance of bank erosion was tagged with a GPS coordinate and the length of the affected bank measured or estimated. The severity of bank erosion was then characterized using a bank erosion hazard index (BEHI) developed by Dave Rosgen (Rosgen, 2006). The BEHI uses several characteristics of the eroded bank (height, vegetated protection, bank angle, soil composition, etc.) to calculate an overall score that relates to level of erosion hazard. The possible levels are low, moderate, high, very high, and extremely high. Bank erosion observed in the LCPRW watershed ranged from very low active erosion to high active erosion. Some of the high erosion hazards were in areas where the riparian buffers had been removed and the banks were greater than five feet high (Figure 3.2.2). Silt/clay, the dominant substrate of these sub-watersheds, are the least susceptible to erosion. However, with the amount of urban, cultivated crops, and pastureland use in the sub-watersheds, banks have eroded from not being protected by good riparian areas.

Streambank erosion can add hundreds of tons of sediment (and nutrients) to a stream system annually. The number of eroded banks were calculated using the representative USA reach to scale up to the main tributary stream length in each sub-watershed. The main tributary stream length, the percent of USA reach affected by bank erosion, average bank height, dominant substrate and an erosion rate coefficient was used to determine pounds of sediment/foot of eroded bank (Table 3.2.2).

Table 3.2.2. Estimated Bank Erosion Rates for Each Sub Watershed.

Site ID	Stream Length (ft)	% stream affected	Stream Length Affected (ft)	Bank Height (ft)	% Gravel/Cobble	BEHI	Erosion Rate (ft/year)	Bank Volume Lost (ft3)	lbs bank lost	tons/mi of overal stream	lbs sed/ft eroded bank	Tons of Sediment	lbs sed/ft eroded bank
CC-1	72,471	14%	9,784	5.0	0.00	VLow	0	0	0	0	0	0	0
EPR-1	78,121	80%	62,497	5.3	0.00	High	1	328,108	30,130,176	1018	482	1018	482
EPR-2	63,988	40%	25,365	5.5	0.00	VLow	0	0	0	0	0	0	0
GC-1	116,044	49%	56,467	8.3	0.00	Mod	0.5	232,926	21,389,633	487	379	487	379
LC-1	19,768	0%	0	N/A	0.00	VLow	0	N/A	N/A	N/A	N/A	N/A	N/A
SD-1	26,260	13%	3,414	3.4	0.00	High	1	11,522	1,058,026	106	310	106	310
TB-1	72,780	100%	72,780	5.8	0.00	High	1	418,485	38,429,478	1394	528	1394	528
WC-1	43,239	93%	40,126	10.5	0.00	Mod	0.5	210,660	19,344,945	1181	482	1181	482
WPR-1	57,221	0%	0	N/A	0.00	VLow	0	N/A	N/A	N/A	N/A	N/A	N/A
WPR-2	107,273	41%	44,003	5.3	0.00	High	1	233,768	21,466,914	528	488	528	488

There were few other impacts that were observed while completing the USAs. The two streams in highly developed land use, LC-1, and SD-1, had several storm water outfalls identified in the reaches (Figure 3.2.3). Channelization of CC-1 was the other impact noted. Storm water outfalls allow for direct transport of sediment and nutrients into the stream system.

Figure 3.2.2. Streambanks with High Bank Erosion Hazard (left, SD-1;right, LC1).

Figure 3.2.3. Typical Storm Water Outfall from an Urban Area in Little Creek.

3.3 Geomorphology and Channel Stability

Fluvial geomorphology refers to the interrelationship between the land surface (topography, geology, and land-use) and stream channel shape (morphology). When the force of running water is exerted on the land surface it can have significant effects on the morphology of stream channels. A stable stream, or one said to be in “equilibrium”, is one where water flows do not significantly alter the channel morphology over short periods of time. The most important flow level in defining the shape of a stream is its bankfull flow (or effective discharge). Bankfull discharge is the stage at which water first begins to enter the active flood plain. A detailed geomorphic assessment of each sub-watershed was beyond the scope of this project. However, several geomorphic attributes were estimated during the USA, and are helpful in assessing channel stability (Rosgen, 1996). Table 3.3.1 provides a summary of the channel dimensions estimated (and some measured) during the USA as well as key stability issues noted.

Table 3.3.1. Summary of Geomorphic Characteristics.

Parameter (estimated)	Station ID									
	CC-1	EPR-1	EPR-2	GC-1	LC-1	SD-1	TB-1	WPR-1	WPR-2	WC-1
Watershed size (mi^2)	65.9	76.8	112	45.6	41.3	41.3	42.8	73.4	182	41.1
Bankfull depth (ft)	8	4.5	7.5	3	1	1.5	8	2.5	3.5	4.5
Bankfull width (ft)	50	55	36	25	25	36	51	40	19	90
Substrate size class	Silt/clay	Silt/clay	Silt/clay	Silt/clay	Cobble	Cobble	Silt/clay	Boulder	Boulder	Silt/clay
Width: Depth ratio	6	12	5	8	25	24	6	16	5	20
Entrenchment Ratio	1.00	1.00	1.39	1.00	1.29	1.09	1.05	1.16	6.00	1.60
Overall streambank erosion hazard	Very low	High	Very low	Moderate	Very low	High	High	Very low	Moderate/high	Moderate
Channel stability issues	Channelized	Bank scour and failure, sediment deposition	Minor bank scour	Bank scour and failure	Culvert scour	Bank and culvert scour	Channelized, aggrading, bank scour	None	Minor bank failure	Sediment deposition

3.3.1 Riparian Buffer Impacts

Impacted riparian, the vegetated area directly adjacent to the streambank, buffers (reduced buffer width and/or quality) provide a more direct pathway for NPS pollution to enter streams. Riparian buffers were assessed during the USA's and are a part of the desktop assessment. The TB-1 reach had the smallest riparian buffer width, less than 10 feet. On average, the impacted riparian buffers were 11-25 feet for the reaches evaluated (Table 3.3.1.1).

Impacted riparian buffers are often associated with higher streambank erosion because a lesser riparian area can allow an increasing amount of unfiltered storm water to enter the stream. Without sufficient riparian buffer, infiltration into the riparian does not happen and the roots of the riparian buffer help secure the banks to mitigate erosion. Encroachment by cultivated crops was one of the reasons for the small riparian buffer at TB-1. To account for more than just reach scale (USA based) riparian buffer condition, each main stem perennial stream (identified per aerial imagery from Google Earth) in each associated sub-watershed was examined using aerial photography to determine how many linear feet of stream was affected by impacted riparian buffer (< 50 ft of riparian width). These lengths were then divided by the total length (total length x2 to account for left and right bank riparian) of the perennial stream in that sub-watershed to represent percent of stream with impacted riparian buffers to help identify and assess where significant problems might exist (Table 3.2.2).

Table 3.3.1.1. Summary of Riparian Evaluation from the USAs and Desktop Analysis.

Site	CC-1	EPR-1	EPR-2	GC-1	LC-1	SD-1	TB-1	WC-1	WPR-1	WPR-2	Gum Log Creek	Palarm Creek
Riparian Width from USA Evaluation (ft)	>50	26-50	11-25	11-25	11-25	11-25	<10	11-25	>50	26-50	--	--
% Riparian Affected in Sub-watershed (<50 ft width)	8.6	15.0	11.7	14.0	67.0	61.6	32.1	29.9	9.5	3.7	16.6	14.6

The largely forested streams, WPR-1, WPR-2, EPR-2 and CC-1, have small percentages of impacted riparian buffer (<10%). The largely urban streams LC-1, SD-1 and WC-1 and the highest cultivated crop stream, TB-1, have considerably higher percentages, ranging 29.9% to 67%, respectively.

3.3.2 Unpaved Roads

Unpaved roads are common in rural Arkansas. According to ArDOT, 49% of all roads are unpaved and 72% of County roads are unpaved. Couty unpaved roads make up 58% of all unpaved roads in Arkansas. There are over 800 miles of unpaved roads in the watershed. During storm events these roads can transport significant loads of sediment into adjacent streams. The magnitude of the sediment load varies dependent on many factors including proximity to streams, condition of the road, slope, and the design of the road (Figure 3.3.2.1). Gravel roads can be designed to include BMPs that reduce erosion of the bed material and the transport of that material into streams.

Figure 3.3.2.1. Unpaved Road in Close Proximity to TB-1.

The unpaved road assessment was completed using GIS road layers for each sub-watershed in the LCPRW. A summary of this data is provided in Table 3.3.2.1. Sediment loading for each mile of unpaved road was estimated based on a recent study completed in Pennsylvania by the Center for Dirt and Gravel Road Studies (Penn State University). The study determined the load of sediment transported for several different unpaved road types and conditions that would result from a 0.6-inch rain event occurring over 30 minutes. Unpaved roads in the Pennsylvania study are not unlike unpaved roads in Arkansas.

For purposes of the LCPRW assessment an average rate of sediment transport was set at 485 lb/mile of unpaved road per rain event (Bloser and Scheetz, 2012). The 485 lb/mi sediment rate was the average runoff rate from roads with average maintenance and traffic levels and roads that had been recently topped with fresh aggregates which produce much lower levels of sediment runoff. Twelve rain events (>1.0 inch) were assumed to occur each year and each rain event would result in 485 lb sediment per mile of road (Table 3.3.2.1).

Table 3.3.2.1. Summary of Unpaved Roads in LCPRW.

Station ID	**Parameter**		
	Unpaved Roads (mi)	**TSS Load per Rain Event (lbs)**	**Annual Loads (12 Rain Events) (lbs)**
Beaverdam Creek – Arkansas River	30.0	14,572	174,865
CC-1	71.9	34,866	418,395
EPR-1	75.7	36,732	440,782
EPR-2	103.8	50,336	604,032
GC-1	18.7	9,056	108,669
Gum Log Creek	24.9	12,060	144,719
Kuhn Bayou – Arkansas River	24.3	11,766	141,195
Long Lake – Harris Creek	56.0	27,166	325,987
Miller Bayou – Arkansas River	42.2	20,476	245,716
Palarm Creek	59.4	28,803	345,637
Point Remove Creek	18.0	8,722	140,661
Portland Bottoms – Arkansas River	34.2	16,586	199,030
SD-1	12.5	6,079	72,648
Taylor Creek – Arkansas River	9.7	4,704	56,446
TB-1	25.4	12,336	148,037
WC-1	17.0	8,221	98,650
WPR-1	61.8	29,985	359,823
WPR-2	146.0	70,825	849,904

3.3.3 Land Slope

A land slope analysis was also completed for the watershed and is provided in Table 3.3.3.1. Slopes are generally homogenous between sub-watersheds. On average the slope was low, 6.8%, for our sub-watersheds and ranged from 2.4% to 12.2%. High slope (steep) areas have a higher potential for soil loss during high volume rain events and those areas also provide less opportunity for infiltration, allowing more water to run-off into the stream channels which besides carrying a large sediment load, can cause increased streambank erosion and channel scour compounding the issue. Slope in the majority of the LCPRW is less than 13%.

Table 3.3.3.1. Summary of Land Slope Analysis.

Station ID	Mean Slope (Percent Rise)
Beaverdam Creek – Arkansas River	9.9
CC-1	10.2
EPR-1	10.3
EPR-2	6.3
GC-1	6.3
Gum Log Creek	8.0
Kuhn Bayou – Arkansas River	5.1
Long Lake – Harris Creek	4.1
Miller Bayou – Arkansas River	6.0
Palarm Creek	6.2
Point Remove Creek	2.4
Portland Bottoms – Arkansas River	4.2
SD-1	4.9
Taylor Creek – Arkansas River	5.3
TB-1	6.1
WC-1	4.1
WPR-1	12.2
WPR-2	10.5

3.3.4 Soils

Soils on the land surface in the sub-watersheds are primarily dominated by the Mountainburg Linker, Leadvale, and Taft. These soils are composed mostly of a gravelly fine sandy loam, fine sandy loam and silt loam and have a moderate overall potential for erosion.

3.3.5 Agricultural Animal Numbers

Numbers of agricultural animals were estimated in the watershed. Poultry house numbers were counted using aerial imagery and the county agricultural census data for cattle numbers. In the case of poultry houses, each house was assumed to be managed consistent with industry standards. Houses generally contain approximately 24,000 birds each, have 5-6 batches per year and are cleaned out approximately 2 times per year. Poultry litter (a combination of manure and bedding material) is frequently used as fertilizer on pastures in Arkansas. For cows the number of “all cattle and calves” for each county was used, along with the number of acres of pasture in each county, to calculate number of cows per acre pasture. Cows were assumed to be evenly spread out over the pastures in the counties affected. A cows/acre number was then assigned to each sub-watershed using the number of acres of pasture determined through the land use analysis. A summary of the agricultural animal estimates is provided in Table 3.3.5.1.

Table 3.3.5.1. Agricultural Animal Estimates Per Sub-Watershed.

Parameter	Station ID											
	CC-1	EPR-1	EPR-2	GC-1	LC-1	SD-1	TB-1	WC-1	WPR-1	WPR-2	Gum Log Creek	Palarm Creek
All Cattle/Calves	1,738	5,009	7,330	2,057	2,206	2,206	2,290	1,853	4,793	8,219	2,274	6,934
Chickens (#/mi^2)[1]	89,232	42,207	43,800	126,376	0	0	0	2,922	42,479	93,557	128,571	0

[1] Poultry numbers based on total number at a point in time. Chicken numbers are based on 120,000/house/year (24,000 x 5 per year) then divided by watershed area to get chickens per mi^2.

3.4 Water Quality

3.4.1 319 Grant Efforts

The LCPRW has had ongoing water quality monitoring since 2012 that includes baseline and storm flow monitoring of water quality at 12 locations in the watershed. Before this project, there have been several recent water quality studies completed in the LCPRW. Project 09-1000 focused on water quality monitoring at two stations in the Galla Creek Sub-watershed (10-HUC 1111020303). Other 319 grant projects, 11-600 and 15-300, were completed by Equilibrium, Inc. Equilibrium has collected water quality samples at twelve stream stations from 2012-2017. Four of the Equilibrium stream stations were sampled during the most recent, 2018-2019, monitoring and assessment grant project completed by the LCPRWA and GBMc. Data from the monitoring program (collected primarily between 2012-2019) has been analyzed and summarized in Table 3.4.1.1. Loading data was also analyzed for the sampling period 11/5/15-9/9/19 and is Table 3.4.1.2. All historical data used in this WMP is provided as a summary in Appendix B.

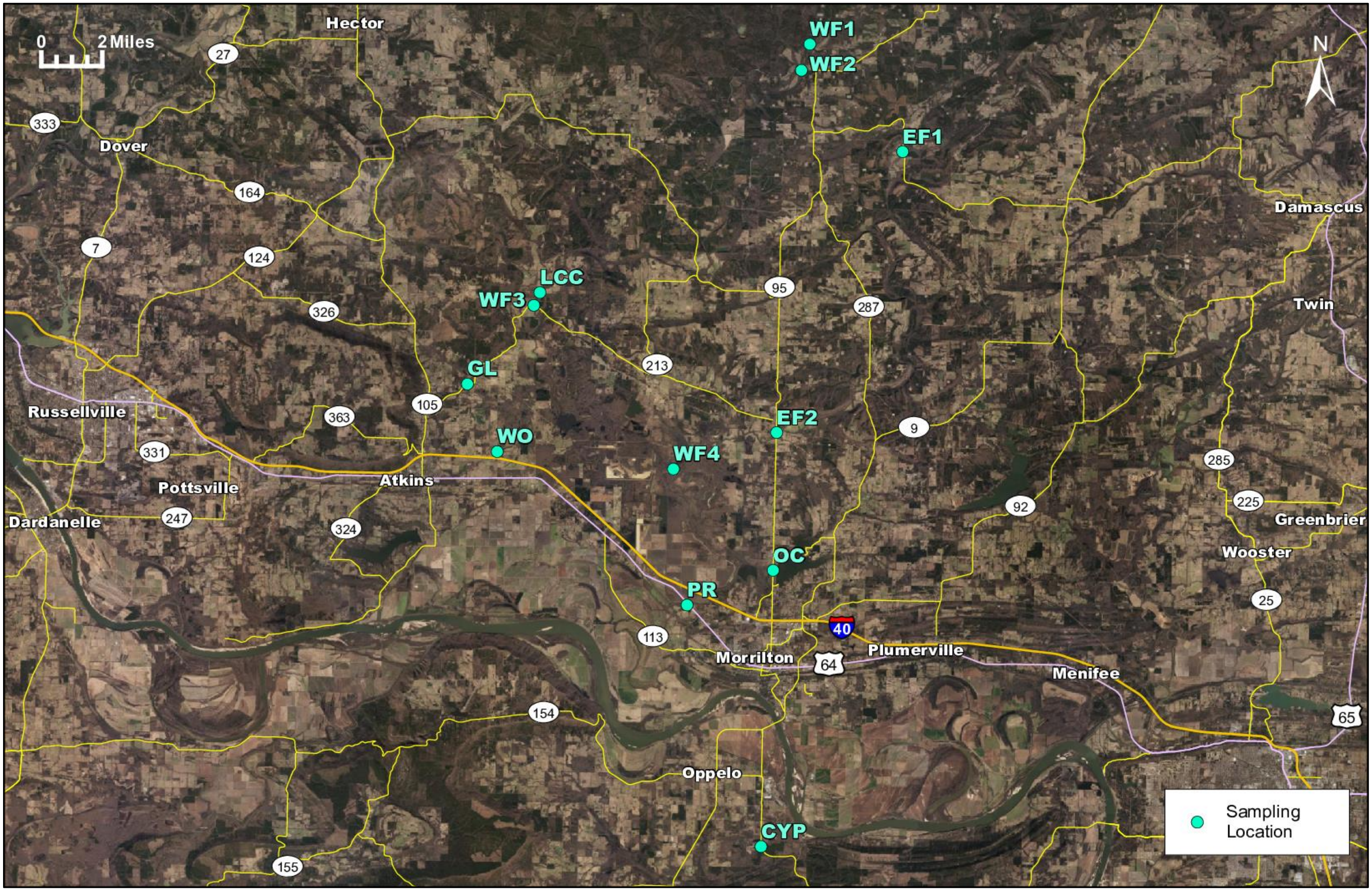


Figure 3.4.1.1. General overview of the Equilibrium Lake Conway Point Remove Watershed Sampling Points.

Table 3.4.1.1 Summary of Historical Monitoring Data Collected by Equilibrium.

Site ID	Total Phosphorus (mg/L)				Total Kjeldahl Nitrogen (mg/L)				Ammonia-N (mg/L)				TSS (mg/L)				Sulfate (mg/L)				Chloride (mg/L				Nitrate nitrite nitrogen (mg/L)			Total Nitrogen (mg/L)				
	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count
Cyp	0.16	0.06	0.32	85	0.69	0.38	1.6	85	0.05	0.01	0.28	85	15	2	53	85	4.6	0.02	18.6	85	6.5	2.0	17.1	85	0.6	0.0	5.0	85	1.3	0.50	5.6	85
EF1	0.05	0.01	0.27	197	0.44	0.17	1.2	197	0.03	0.00	0.15	197	7	1	110	197	4.0	0.07	12.4	197	4.0	1.6	9.8	197	1.2	0.0	5.8	197	1.7	0.20	6.1	197
EF2	0.08	0.02	0.41	200	0.66	0.24	2.4	200	0.10	0.00	1.6	200	12	1	111	200	3.2	0.00	10.3	200	4.9	1.5	12.2	200	1.1	0.0	6.1	200	1.8	0.34	7.4	200
GL	0.09	0.02	0.58	74	0.49	0.21	1.5	74	0.05	0.01	0.12	74	12	1	160	74	9.6	3.3	29.9	74	5.4	1.1	9.4	74	0.6	0.0	2.0	74	1.1	0.32	2.4	74
LCC	0.07	0.02	0.37	201	0.49	0.18	1.3	201	0.04	0.00	0.13	201	7	0	103	201	3.2	0.12	8.4	201	4.8	1.3	16.4	201	1.2	0.0	7.0	201	1.7	0.29	7.6	201
OC	0.16	0.04	1.6	125	1.2	0.37	10.1	125	0.13	0.00	3.4	125	46	2	1271	125	12.7	0.01	111	125	8.7	1.8	45.3	125	3.5	0.0	40.1	125	4.7	0.38	41.8	125
PR	0.12	0.04	0.38	201	0.71	0.25	1.5	201	0.07	0.00	0.41	201	23	2	130	201	5.2	0.06	23.	201	8.0	1.2	53.3	201	1.2	0.0	8.5	201	1.9	0.45	9.0	201
WF1	0.06	0.02	0.26	200	0.68	0.12	6.5	200	0.06	0.00	1.4	200	8	1	57	200	5.0	0.00	100	200	3.3	0.86	13.5	200	1.0	0.0	10.6	200	1.7	0.38	17.1	200
WF2	0.05	0.01	1.4	201	0.40	0.12	4.8	201	0.04	0.00	1.1	201	9	0	428	201	3.2	0.01	20.6	201	1.9	0.34	12.8	201	3.4	0.0	233	201	3.8	0.21	233	201
WF3	0.05	0.02	0.36	200	0.40	0.13	1.3	200	0.04	0.00	0.16	200	7	0	109	200	2.6	0.09	6.3	200	3.6	1.2	12.5	200	0.9	0.0	4.5	200	1.3	0.23	5.4	200
WF4	0.13	0.03	1.2	126	0.71	0.24	2.5	126	0.04	0.00	0.25	126	21	2	416	126	6.2	0.00	37.7	126	15.2	1.5	77.8	126	1.6	0.0	9.2	126	2.3	0.47	10.1	126
WO	0.17	0.04	3.0	74	0.96	0.38	10.3	74	0.14	0.01	2.5	74	14	1	306	74	14.9	3.6	47.4	74	22.6	1.6	63.7	74	0.31	0.02	0.77	74	1.3	0.42	10.5	74

Table 3.4.1.2 Summary of Loading Data Collected by Equilibrium.

Sampling Station	Sampling Period	Total Phosphorus (lbs/mi^2)	Total Kjeldahl Nitrogen (lbs/mi^2)	Ammonia (lbs/mi^2)	Total Suspended Solids (lbs/mi^2)	Sulfate (lbs/mi^2)	Chloride (lbs/mi^2)	Nitrate + Nitrite (lbs/mi^2)	Total Nitrogen (lbs/mi^2)
CYP	11/5/15 - 9/9/19	2.4	12.0	0.9	247	116	111	2.8	14.9
EF1	11/5/15 - 9/9/19	0.9	6.0	0.5	177	48.2	31.9	5.2	11.2
EF2	11/5/15 - 9/9/19	1.1	7.1	0.7	251	46.6	33.1	6.0	13.0
GL	11/5/15 - 9/9/19	4.0	25.4	2.5	879	170	121	21.7	47.2
LCC	11/5/15 - 9/9/19	1.8	9.9	0.8	254	68.4	45.8	7.8	17.7
PR	11/5/15 - 9/9/19	1.1	6.6	0.6	196	71.5	76.3	3.3	10.0
WF1	11/5/15 - 9/9/19	0.6	5.0	0.4	138	33.8	17.2	2.3	7.3
WF2	11/5/15 - 9/9/19	0.7	4.8	0.4	133	38.4	21.9	4.4	9.1
WF3	11/5/15 - 9/9/19	0.6	4.0	0.3	152	24.9	17.3	3.1	7.2
WO	11/5/15 - 9/9/19	1.8	12.1	2.5	335	152	240	3.3	15.4

3.4.2 Water Quality Data Collected Specifically for the WMP

As a component of the development of this WMP, additional water quality data was collected to supplement the historical monitoring data collected most recently by Equilibrium. Water samples and *in-situ* data were collected from 10 reaches in the LCPRW to determine the water quality during baseflow and storm flow conditions. Sample stations were selected to represent each of the 10 sub-watersheds depicted in Figure 3.4.2.1. The ten stations were sampled at least 32 times, 25-27 baseflow events and seven storm flow events. The Arkansas River flooding that occurred in 2019 caused several of the stations to back up into the tributaries. Samples were not collected from stations that were flooded. A description of each sample station is provided in Table 3.4.2.1. Several stations are situated close to the same locations as those used by Equilibrium, though often positioned lower in the watershed, to ensure all loading from that sub-watershed was accounted for. WPR-1, WPR-2, EPR-1, EPR-2, and CC-1 were monitored during the Equilibrium study. The five additional stations sampled by GBMc represented urban land uses, WC-1, SD-1, and LC-1, stations TB-1 represented cultivated crop area and one additional station, GC-1, represented rural (undeveloped) land uses.

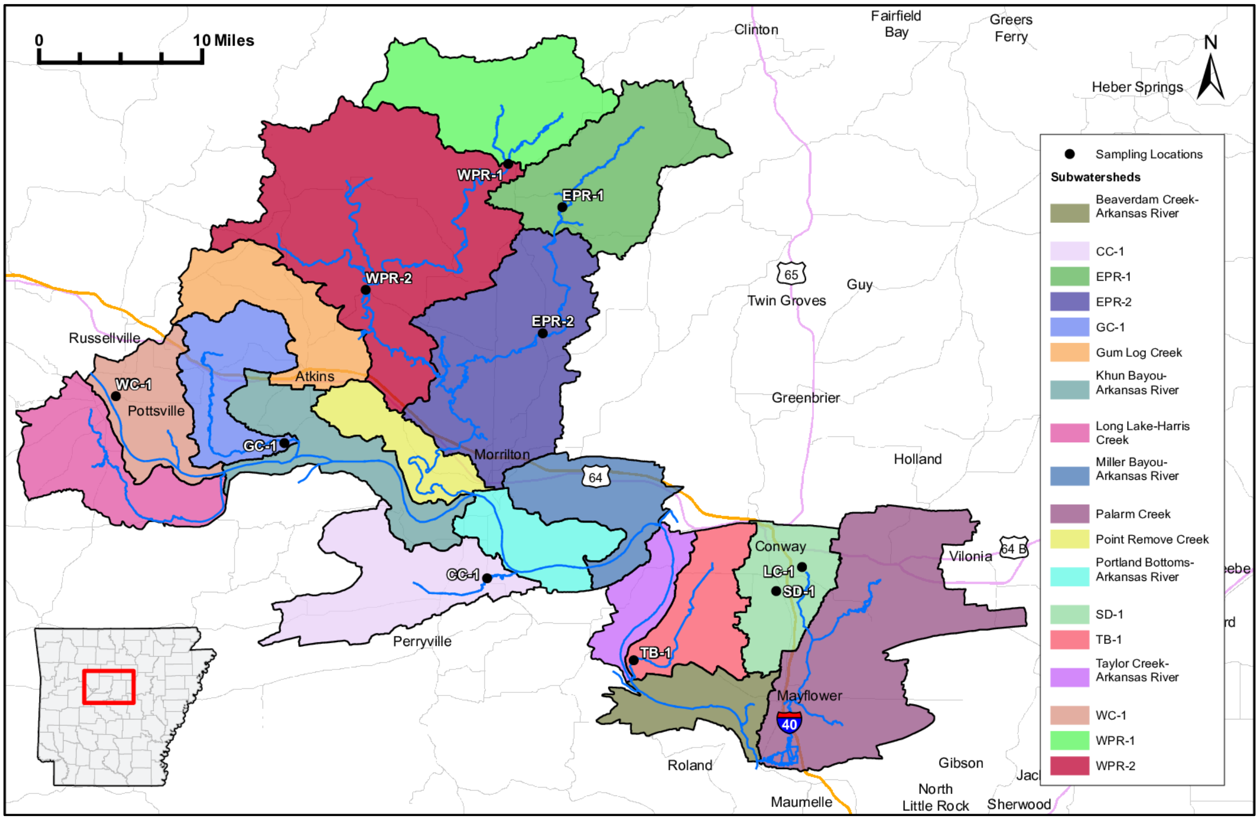


Figure 3.4.2.1. LCPRW and Sample Stations in each Sub-Watershed Utilized During this Study.

Samples were collected at each station according to the Quality Assurance Project Plan (QAPP) approved by the Arkansas Department of Agriculture Natural Resources Division (NRD) and EPA Region 6. In brief, grab samples were collected in clean, labeled containers from within the main area of flow in the channel and delivered to the laboratory for analysis following all chain of custody procedures (see QAPP for project, GBMc, 2018). Samples were collected for analysis of ammonia, nitrate+nitrite, soluble reactive phosphorus (SRP), total phosphorus, total dissolved solids (TDS), total suspended solids (TSS) and total nitrogen on baseflow samples. Water quality results, including *in-situ* parameters, from each station, are provided in Appendix C.

Table 3.4.2.1. Sample Station Descriptions.

Station I.D.	Station Description
WC-1	Whig Creek, access at Hwy 7/Hwy 247.
GC-1	Galla Creek, access is at Hwy 105 bridge.
CC-1	Cypress Creek, access at Hwy 113 and has been monitored in previous projects completed in the watershed.
WPR-1	West Fork Point Remove upstream site, access at Hwy34/Bridge Hill Rd and has been monitored in previous projects completed in the watershed.
WPR-2	West Fork Point Remove downstream site, access at Hwy 247 and has been monitored in previous projects completed in the watershed.
EPR-1	East Fork Point Remove upstream site, access is at Hwy124 and has been monitored in previous projects completed in the watershed.
EPR-2	East Fork Point Remove downstream site, access at Hwy 95 and has been monitored in previous projects completed in the watershed.
TB-1	Tupelo Bayou, access at a levee road off of Lollie Rd.
SD-1	Stone Dam Creek, access at Sturgis Rd.
LC-1	Little Creek, access is at East German Lane.

Water quality during baseflow conditions were found to be good and consistent, except at WC-1. Table 3.4.2.2 provides a summary of water quality data for the LCPRW stations for select constituents. Each station is near the outlet of its respective sub-watershed and should be typical of pollutant concentrations (and loads) in that system. The WC-1 station has the highest water quality parameter concentrations. The WC-1 station is below the Russellville WWTP (permit limits provided in Section 5.1) which likely accounts for some of the elevated values.

On average during baseflow, total nitrogen was highest at WC-1 (3.94 mg/L) and lowest at WPR-1 (0.31 mg/L). Average ammonia concentrations were lowest at EPR-1, EPR-2, and WPR-2 (0.02 mg/L) and highest at WC-1 (1.17 mg/L). Nitrate+Nitrite-N average concentrations were highest at WC-1 (1.81 mg/L) and the next highest average was 0.55 mg/L at SD-1. Total phosphorus under baseflow conditions at WC-1 was 1.25 mg/L but the next highest average was 0.20 mg/L at TB-1. The highest soluble reactive phosphorus concentration (the dissolved fraction of phosphorus that is generally considered biologically available) was 1.12 mg/L at WC-1 and the next highest was 0.093 mg/L at CC-1. On average TDS ranged from 32-177 mg/L during baseflow conditions and was highest at WC-1. TSS on average ranged from 5.6-61.6 mg/L with TB-1 with the highest average. Conductivity measurements during baseflow condition on average ranged from 26-333 µS/cm.

Figure 3.4.2.2. CC-1 and LC-1 During Stormflow Conditions.

Water quality during storm flow conditions is summarized in Table 3.4.2.2. Seven storm events were sampled, with the goal of each sample being collected prior to the peak instream flow (Figure 3.4.2.2). Storm events sampled varied in size from greater than 4 inches to around 0.65 inches. The concentration of some pollutants increased as flow increased, while other pollutants decreased or remained stable. Most notably TSS (Figure 3.4.2.8) increased at least an order of magnitude (on average) during storm flow events. TSS levels were highest at 448.0 mg/L, in Little Creek (LC-1). Other constituents depended upon the watershed as to whether the stormflow concentration was higher than baseflow (Figures 3.4.2.3-3.4.2.8).

Table 3.4.2.2. Summary of Average Baseflow and Storm Flow Water Quality.

Site ID	Event Type	Total Nitrogen (mg/L)				Ammonia (mg/L)				Nitrate+Nitrite (mg/L)				Soluble Reactive Phosphorus (mg/L)				Total Phosphorus (mg/L)				Total Dissolved Solids (mg/L)				Total Suspended Solids (mg/L)			
		Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count
CC-1	Base	0.72	0.45	1.58	19	0.06	0.02	0.19	21	0.21	0.08	0.46	19	0.093	0.031	0.432	19	0.14	0.05	0.48	19	64.21	36.4	96.90	19	11.81	2.5	65.8	19
	Storm	--	--	--	--	0.04	0.01	0.09	7	0.15	0.07	0.23	7	0.097	0.055	0.150	7	0.19	0.10	0.27	7	71.44	50.4	89.30	7	22.00	14.6	37.9	7
EPR-1	Base	0.62	0.38	0.96	21	0.02	0.00	0.09	21	0.38	0.16	0.64	21	0.017	0.002	0.041	21	0.04	0.02	0.08	21	41.67	21.1	63.30	21	10.55	1.9	94.7	21
	Storm	--	--	--	--	0.03	0.01	0.07	7	0.37	0.19	0.52	7	0.027	0.004	0.049	7	0.09	0.04	0.18	7	37.53	24.2	46.00	7	28.83	6.1	90.6	7
EPR-2	Base	0.72	0.36	1.22	21	0.02	0.00	0.06	21	0.47	0.12	0.88	21	0.023	0.003	0.118	21	0.05	0.02	0.13	21	40.60	21.3	67.20	21	8.29	1.4	20.2	21
	Storm	--	--	--	--	0.05	0.00	0.12	7	0.49	0.22	0.72	7	0.046	0.003	0.136	7	0.17	0.03	0.37	7	41.67	19.8	56.20	7	74.73	2.9	290.3	7
GC-1	Base	0.82	0.63	1.08	19	0.06	0.02	0.11	19	0.32	0.18	0.54	19	0.064	0.021	0.152	19	0.13	0.04	0.37	19	65.82	43.8	118.40	19	23.19	1.4	148.9	19
	Storm	--	--	--	--	0.07	0.04	0.18	7	0.26	0.12	0.50	7	0.105	0.059	0.184	7	0.26	0.11	0.71	7	67.29	41.8	89.30	7	30.70	16.2	51.3	7
LC-1	Base	0.57	0.31	0.82	21	0.04	0.01	0.08	21	0.24	0.07	0.42	21	0.045	0.010	0.450	21	0.05	0.03	0.13	21	92.70	43.3	118.20	21	14.06	2.6	56.6	21
	Storm	--	--	--	--	0.06	0.02	0.10	7	0.23	0.11	0.32	7	0.052	0.033	0.095	7	0.19	0.10	0.44	7	72.13	39.3	132.90	7	116.69	20.4	448.0	7
SD-1	Base	0.98		1.45	21	0.07	0.02	0.24	21	0.55	0.01	1.01	21	0.041	0.019	0.098	21	0.08	0.03	0.20	21	102.33	41.6	163.10	21	11.55	3.0	46.2	21
	Storm	--	--	--	--	0.07	0.02	0.19	7	0.40	0.20	0.68	7	0.082	0.063	0.116	7	0.19	0.14	0.23	7	63.43	40.9	86.40	7	55.61	17.1	104.7	7
TB-1	Base	0.90	0.52	1.56	19	0.08	0.04	0.23	19	0.15	0.03	0.34	19	0.079	0.028	0.468	19	0.20	0.08	0.57	19	108.50	39.6	414.90	19	61.55	10.5	191.3	19
	Storm	--	--	--	--	0.05	0.02	0.08	7	0.16	0.00	0.34	7	0.072	0.030	0.212	7	0.23	0.15	0.42	7	104.00	68.2	160.60	7	128.96	32.8	354.7	7
WC-1	Base	3.94	1.38	6.94	19	1.17	0.00	4.53	19	1.81	0.73	6.33	19	1.119	0.045	3.880	19	1.25	0.09	4.02	19	177.35	14.0	294.90	19	13.07	2.70	79.60	19
	Storm	--	--	--	--	1.80	0.04	11.06	7	0.53	0.20	1.20	7	0.221	0.019	0.496	7	1.00	0.39	1.33	7	108.16	73.3	207.10	7	247.39	42.9	440.20	7
WPR-1	Base	0.31	0.10	1.16	20	0.01	0.00	0.04	21	0.16	0.04	0.83	21	0.007	0.002	0.022	21	0.03	0.01	0.06	21	32.13	17.6	52.00	21	5.58	0.70	22.10	21
	Storm	--	--	--	--	0.01	0.00	0.02	7	0.11	0.04	0.18	7	0.011	0.002	0.033	7	0.04	0.02	0.07	7	31.56	20.9	40.00	7	12.64	2.00	41.90	7
WPR-2	Base	0.63	0.39	1.11	21	0.02	0.00	0.08	21	0.42	0.20	0.71	21	0.020	0.003	0.065	21	0.04	0.02	0.12	21	39.53	28.2	62.90	21	6.48	2.20	22.90	21
	Storm	--	--	--	--	0.05	0.01	0.09	7	0.49	0.22	0.91	7	0.050	0.003	0.087	7	0.15	0.03	0.26	7	43.44	20.2	54.20	7	59.23	2.90	183.10	7

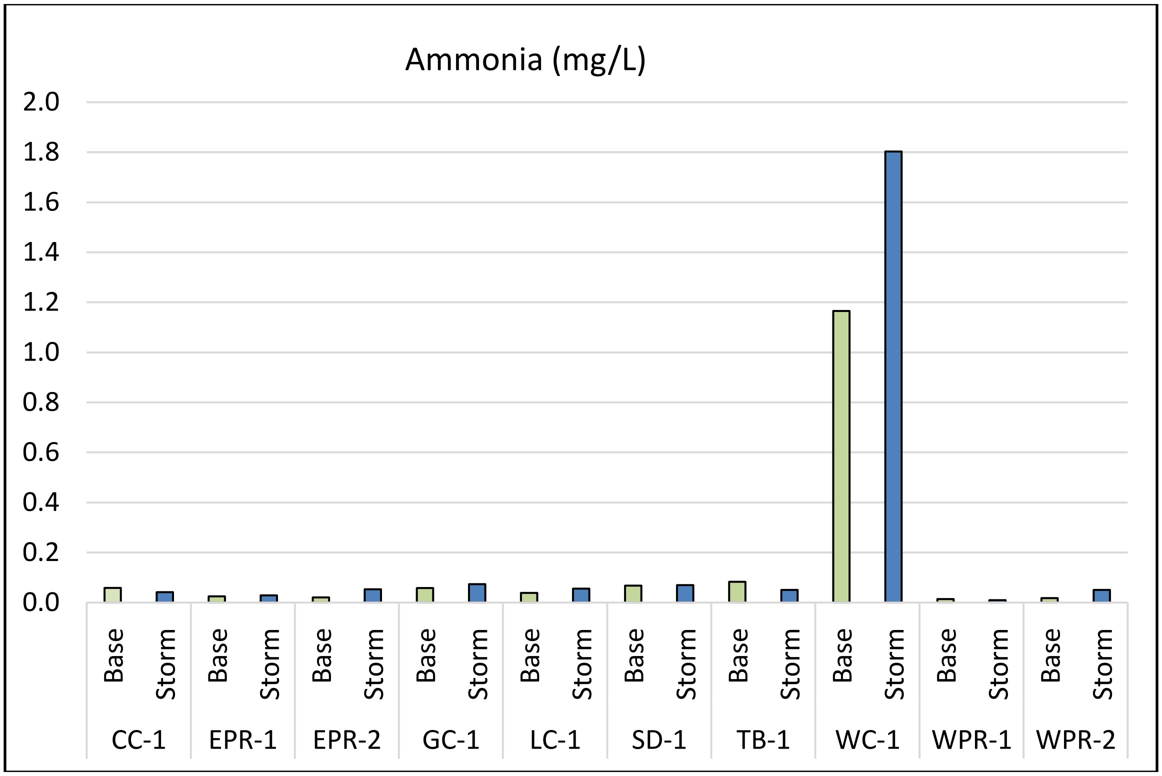


Figure 3.4.2.3. Average ammonia base and storm flow concentrations from each sub-watershed.

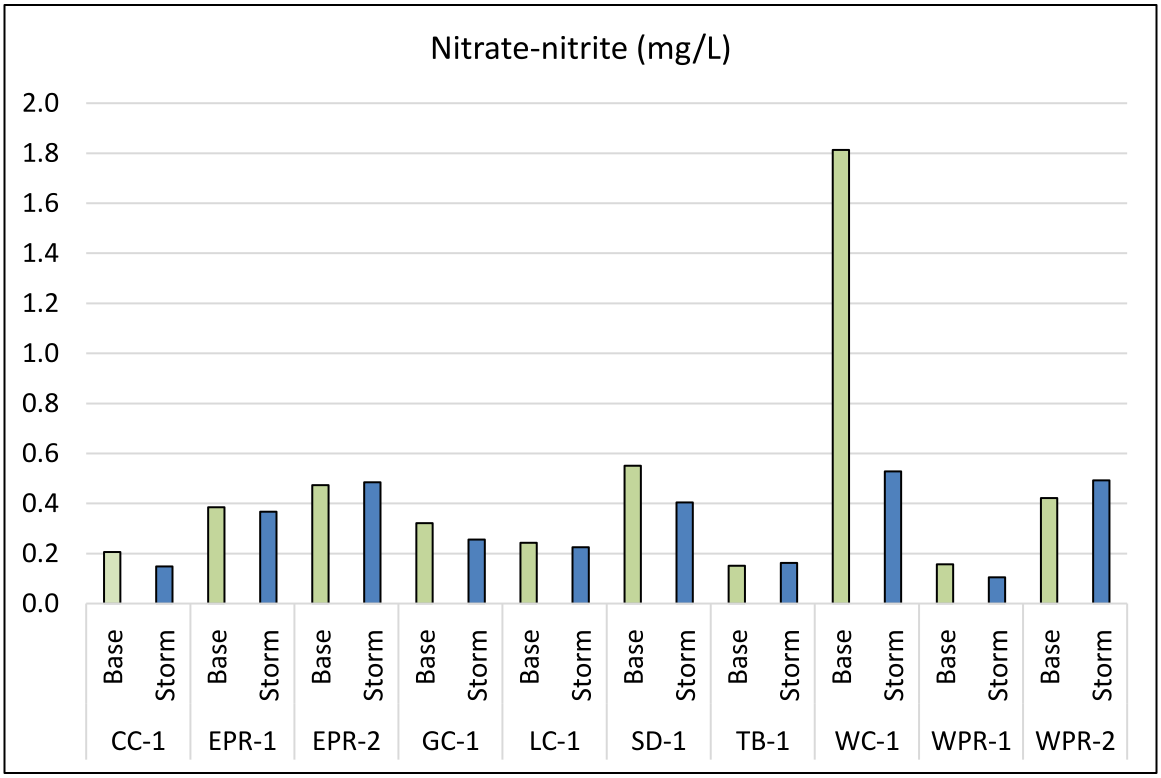


Figure 3.4.2.4. Average nitrate-nitrite base and storm flow concentrations from each sub-watershed.

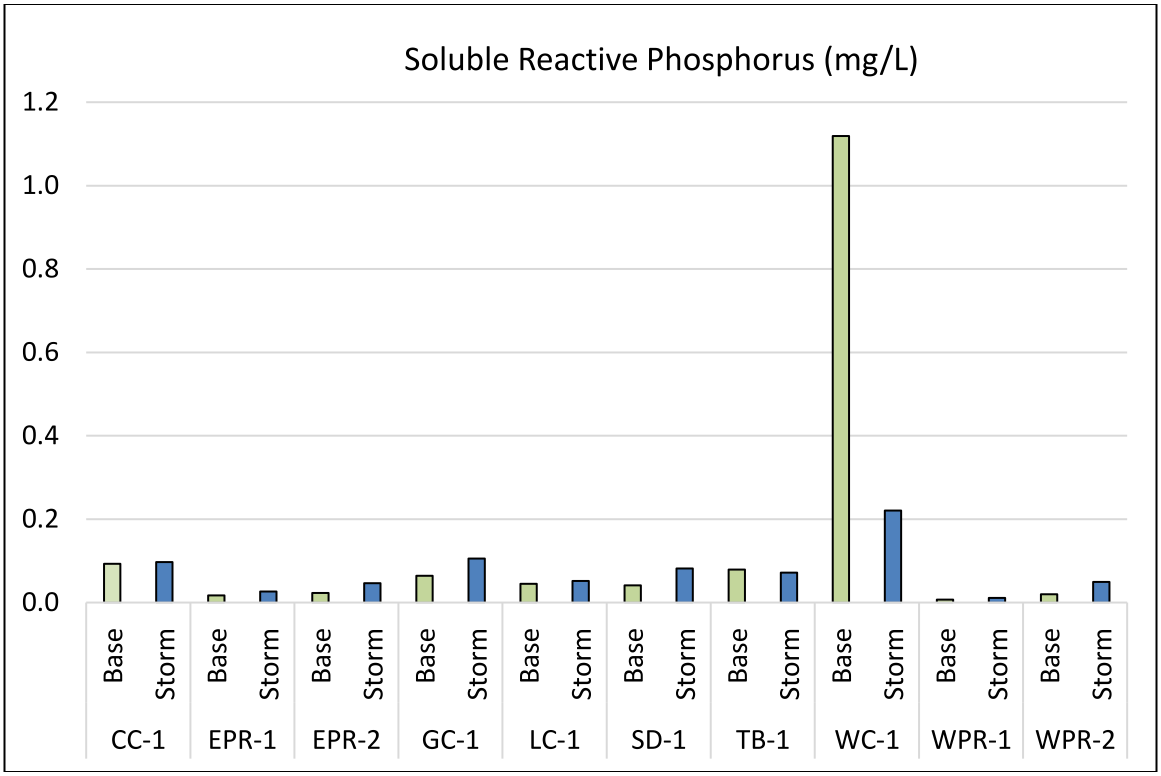


Figure 3.4.2.5. Average soluble reactive phosphorus base and storm flow concentrations from each sub-watershed.

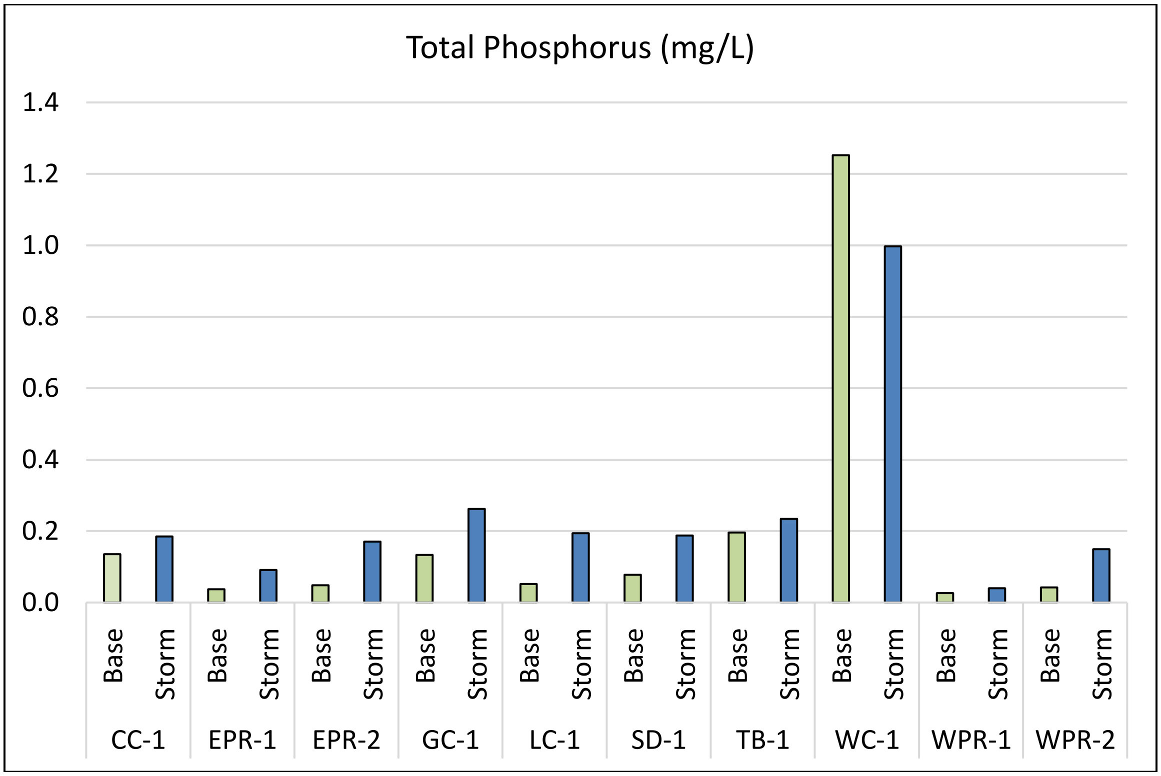


Figure 3.4.2.6. Average total phosphorus base and storm flow concentrations from each sub-watershed.

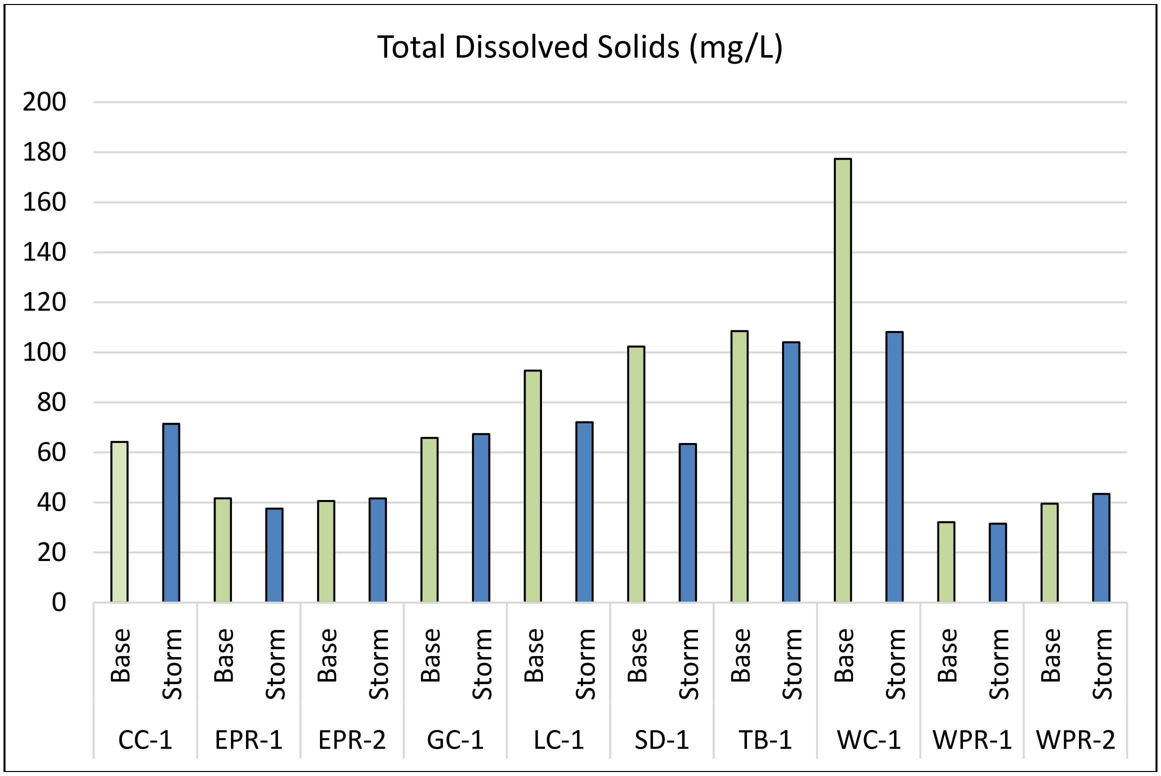


Figure 3.4.2.7. Average TDS for base and storm flow concentrations from each sub-watershed.

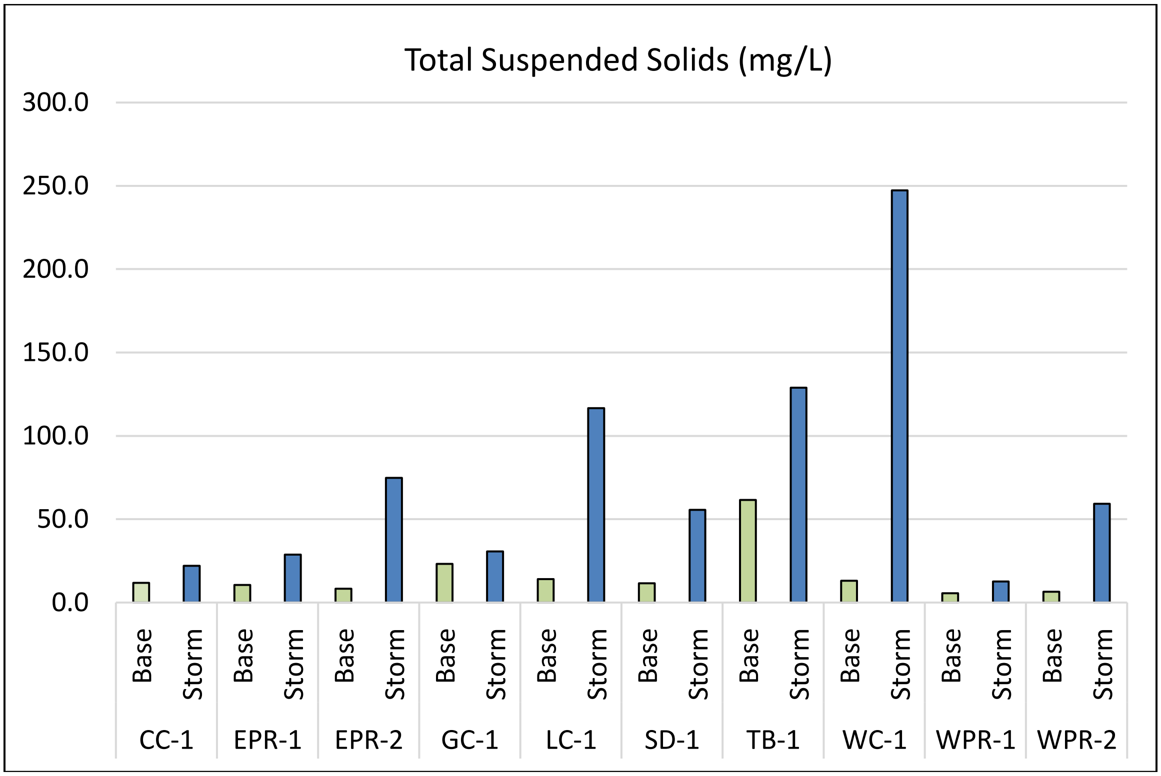


Figure 3.4.2.8. Average TSS base and storm flow concentrations from each sub-watershed.

3.4.3 Designated Use Assessment Criteria

The approved 2018 303 (d) list contains four of the streams in the LCPRW, Cypress Creek, Stone Dam Creek, Whig Creek, and West Fork Point Remove. Cypress Creek (CC-1), otherwise known as Rock Cypress is listed for turbidity with surface erosion as the source and with a low TMDL development priority. Stone Dam Creek (SD-1) is listed for dissolved oxygen, ammonia, and nitrate with agriculture urban runoff and surface erosion listed as the source. Whig Creek (WC-1) is listed for dissolved oxygen, ammonia, and nitrate. West Fork Point Remove Creek (WPR-1) is listed for pH with a source unknown and a low TMDL development priority.

To evaluate maintenance of LCPRW designated uses based on water quality data collected for the plan, the Arkansas assessment methodology for the Arkansas River Valley Ecoregion was utilized. Constituents analyzed for this study that have water quality criteria were compared to those criteria. For temperature, EPR-2 exceeded 31 ºC on one occasion in June of 2018. For dissolved oxygen, there were several exceedances in June of 2018 and one in December of 2018 that are listed below in Table 3.5.2.3. According to the assessment criteria, when temperatures exceed 22 °C, the critical season dissolved oxygen standard may be depressed by 1 mg/L for no more than 8 hours during a 24-hour period. Continuous measurements of temperature and dissolved oxygen were not collected. However, less than 10% of the measurements made during this two-year study were below the criteria, therefore the streams are not in violation of the criteria. Turbidity and pH were not consistently measured for evaluation of baseflow data. Storm flow turbidity was exceeded at all stations except WPR-1. According to the assessment criteria for turbidity, if more than 20% of samples collected (with at least 24 samples) exceeds the storm flow value, the stream is listed as impaired for turbidity. Based on the new data collected it does not appear that any of the sub-watersheds are at risk for impairment due to turbidity because there were less than 24 storm samples collected. Ammonia and TDS were all under criteria standard. Table 3.4.3.1 provides a summary of the assessment criteria that are pertinent to this WMP study’s focus.

Table 3.4.3.1 Arkansas River Valley water quality criteria and assessment methodology for attainment decisions.

Parameter	Standard		Support	Non-Support
Temperature[1]	31°C		≤10 %	>10 %
Dissolved Oxygen[1] (mg/L)	Primary	Critical		
<10 mi^2	5	2		
10-150 mi^2	5	3		
pH	6.0-9.0 S.U.			
Cl/SO_4/TDS	250/250/500			
Ammonia				
Acute (Salmoids absent, pH=6.5)	48.8 mg/L		I-hour average not exceeded more than once every 3 years	
Chronic (using 14°C and pH=6.5)	6.5 mg/L		Monthly average shall not exceed	
Turbidity				

Parameter	Standard		Support	Non-Support
Base flows	21 NTU		≤20 %	>20 %
All flows	40 NTU		≤25%	>25 %

[1] Except for site specific standards approved in water quality standards.

3.5 Hydrologic Analysis

The hydrologic regime of a stream (magnitude and frequency of flow levels) influences the shape of the stream channel, the type and abundance of habitat available to biota, and the type and load of pollutants transported in the system. Geology, land use, weather patterns and seasons affect the hydrologic regime of a stream. In more recent years there has been a trend with increasing intensity of rain (i.e. more rain in a short period of time). High intensity events create more runoff as it doesn't allow as much time for infiltration (EPA, 2016). Understanding a stream's hydrology is integral to the assessment of stream stability, ecology, and water quality.

Five automated level measuring gages were installed at Galla Creek (GC-1), Whig Creek (WC-1), Stone Dam (SD-1), Tupelo Bayou (TB-1) and Little Creek (LC-1) station locations. The upstream East Point Remove (EPR-1), upstream West Point Remove (WPR-1) and Cypress Creek (CC-1) had automated level measuring gages already installed from the previous study competed by Equilibrium. Each level logger was maintained, and data was downloaded throughout the year. These automatic level measuring gages continuously measured stream level (stage) and recorded the data every 15 minutes. The downstream West (WPR-2) and East (EPR-2) Point Remove stations have USGS gages at those site locations (Figure 3.5.2).

Flow was measured during each sample event following the USGS velocity-area method, conditions allowing. If conditions did not allow (i.e., too deep to wade and/or velocity too high to safely measure), an alternative such as the floating orange method and/or the developed rating curve from the onsite level loggers was used to estimate flow. All the flow measurements, which were collected at various levels, were correlated with stage to develop a rating curve for each gage (Appendix C). Figure 3.5.1 is an example of one of the rating curves developed from the level logger and measured flow data. Once the rating curves were established at each site, the equation from each rating curve could be used to calculate flow from the level measurements collected every 15 minutes at the eight stations (Figures 3.5.2 and 3.5.3). This flow data allows pollutant loading to be calculated more effectively for each sub-watershed. When graphing the flow data over time, hydrologic dynamics such as flashiness can be seen visually. For specific rain events, the rise and fall can be dramatically different across the sub-watersheds (Figure 3.5.3) dependent on event size and watershed land uses. This data was used to calculate pollutant loading more effectively in the watershed.

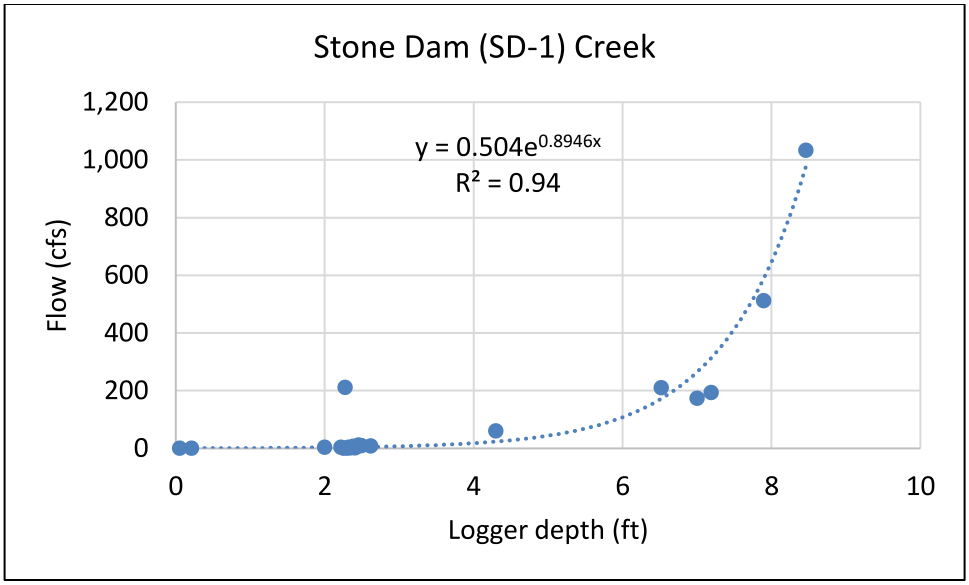


Figure 3.5.1. Rating Curve Developed Using Level Logger Data and Measured Flow from SD-1.

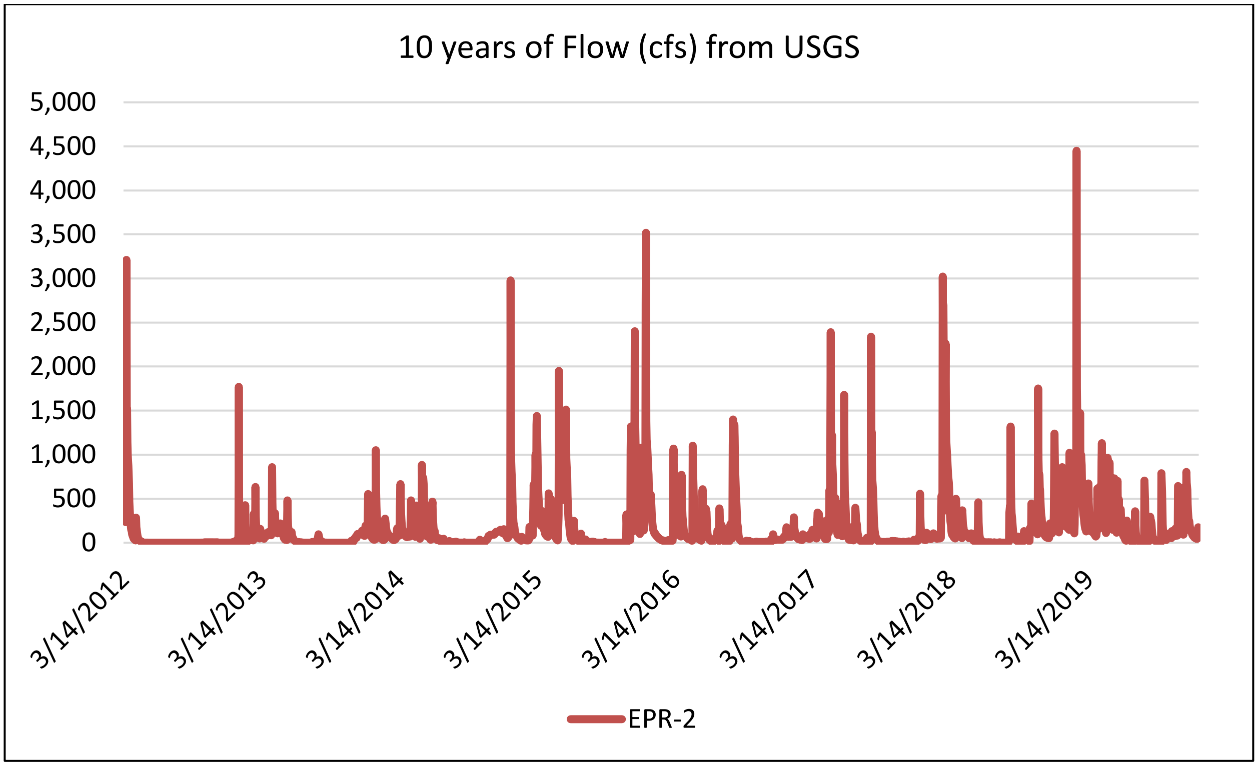


Figure 3.5.2. Flow data from the EPR-2 USGS gages within the LCPRW. Data prior 3/13/2012 was not available for EPR-2.

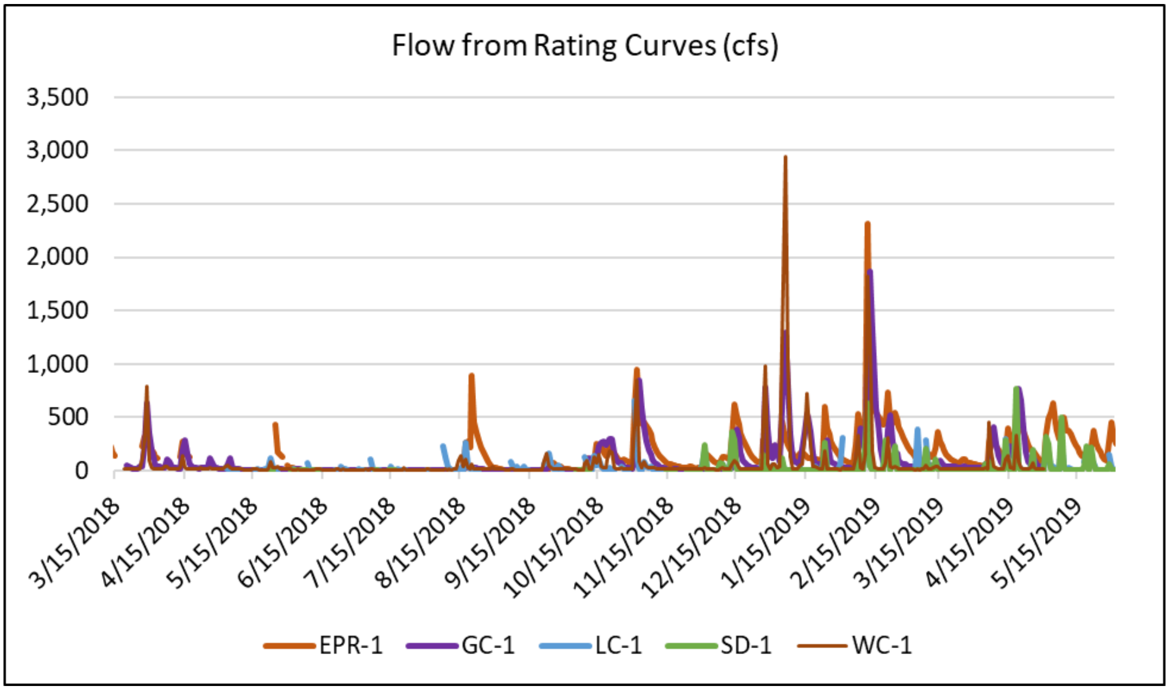


Figure 3.5.3. Flow Estimated Using Rating Curve Equations and Stage Data from Level Loggers.

4.0 LOADING ANALYSIS

4.1 Pollutant Loading from Most Recent Monitoring Study

The loading of pollutants in the LCPRW was calculated from the base and storm flow data collected during the study. A summary of the load for key constituents is provided in Table 4.1.1.

For most constituents, loads appear to be greatest in the sub-watersheds EPR-2, WC-1, and WPR-2. Loading viewed in this fashion is misleading when used to assess critical NPS pollution that need to be addressed, as some of the sub-watersheds are much larger than others and thus will have greater flows and loads. To account for watershed size, loads from each of the sub-watersheds were normalized according to watershed area (in mi^2) to arrive at a loading in each watershed on a per mi^2 basis (Table 4.1.2). In addition to the normalizing of loading data, WC-1 has a point source discharge from the Russellville WWTP upstream of the sampling location. The loads from the WWTP were taken out of the WC-1 load to focus on nonpoint source pollution but both (with and without the WWTP) loads are presented.

Table 4.1.1. Average Loading of Key Constituents.

Site ID	Event Type	Average of Total Nitrogen (lb/day)	Average of Ammonia (lb/day)	Average of Nitrate + Nitrite (lb/day)	Average of SRP (lb/day)	Average of Total Phosphorus (lb/day)	Average of Total Dissolved Solids (lb/day)	Average of Total Suspended Solids (lb/day)
CC-1	Base	370	30.1	88.7	44.4	68.3	31,868	7,399
	Storm	--	81.6	241	176	305	116,008	33,871
EPR-1	Base	448	17.4	277	14.2	30.6	28,832	11,770
	Storm	--	158	1,476	199	677	185,200	293,216
EPR-2	Base	504	13.7	367	21.0	42.5	23,399	104
	Storm	--	354	2,466.8	251	2,125	233,155	1,542,711
GC-1	Base	382	19.6	150	21.0	41.1	29,804	4,412
	Storm	--	179	588	259	674	151,496	71,983
LC-1	Base	9.4	0.6	4.5	0.8	0.8	1,320	182
	Storm	--	109	353	101	345	113,515	189,243
SD-1	Base	38.5	2.0	16.0	2.1	3.8	4,509	353
	Storm	--	133	582	163	350	102,334	110,730
TB-1	Base	344	25.2	87.8	38.1	80.9	67,388	26,298
	Storm	--	103	384	183	519	225,592	271,866
WC-1	Base	1,011	500	311	125	156	44,087	1,941
	Storm		1,282	1,164	447	2,421	208,339	762,315
WC-1 without WWTP discharge	Base	--	365	196	--	82.3	--	0.0
	Storm		1,147	1,049		2,347		759,404
WPR-1	Base	304	12.7	131	8.6	27.0	35,210	6,689
	Storm		40.9	320	49.2	178	109,623	89,190
WPR-2	Base	1,793	26.1	1,298.8	56.5	136	72,077	19,438
	Storm		1,027	5,870.5	829	3,059	592,460	1,823,903

Table 4.1.2. Loading of Key Storm Flow Constituents Normalized on a Per Mi^2 Basis.

Site ID	Event Type	Average of Total Nitrogen (lb/mi2)	Average of Ammonia (lb/mi2)	Average of Nitrate + Nitrite (lb/mi2)	Average of SRP (lb/mi2)	Average of Total Phosphorus (lb/mi2)	Average of Total Dissolved Solids (lb/mi2)	Average of Total Suspended Solids (lb/mi2)
CC-1	Base	6.35	0.518	1.52	0.76	1.17	548	127
	Storm	--	1.402	4.13	3.03	5.25	1,993	582
EPR-1	Base	7.88	0.306	4.88	0.25	0.54	508	207
	Storm	--	2.772	26.0	3.51	11.9	3,261	5,162
EPR-2	Base	11.8	0.320	8.60	0.49	0.99	548	2.4
	Storm	--	8.297	57.8	5.88	49.8	5,460	36,129
GC-1	Base	8.51	0.437	3.34	0.47	0.92	664	98.3
	Storm	--	3.981	13.1	5.78	15.0	3,374	1,603
LC-1	Base	1.87	0.114	0.90	0.16	0.16	264	36.4
	Storm	--	21.8	70.7	20.2	68.9	22,703	37,849
SD-1	Base	4.82	0.244	2.00	0.27	0.47	564	44.1
	Storm	--	16.6	72.8	20.4	43.7	12,792	13,841
TB-1	Base	8.38	0.613	2.14	0.93	1.97	1,640	640
	Storm	--	2.495	9.34	4.45	12.6	5,489	6,615
WC-1	Base	75.4	37.3	23.2	9.31	11.7	3,290	145
	Storm	--	95.7	86.9	33.4	180	15,548	56,889
WC-1 w/o WWTP	Base	--	27.2	14.6	--	6.14	--	0.0
	Storm		85.6	78.3		175		56,672
WPR-1	Base	4.14	0.173	1.78	0.12	0.37	479	91.0
	Storm	--	0.557	4.35	0.67	2.42	1,492	1,214
WPR-2	Base	12.1	0.177	8.79	0.38	0.92	488	132
	Storm	--	6.950	39.7	5.61	20.7	4,009	12,340

When loading is evaluated on a per unit area basis, it becomes clear which sub-watersheds are producing the most pollutants during runoff events. Sub-watersheds EPR-2, LC-1, SD-1 and WC-1 have the highest TSS and highest nutrient loads per mi^2 during storm water runoff events (Figures 4.1.1 through 4.1.6).

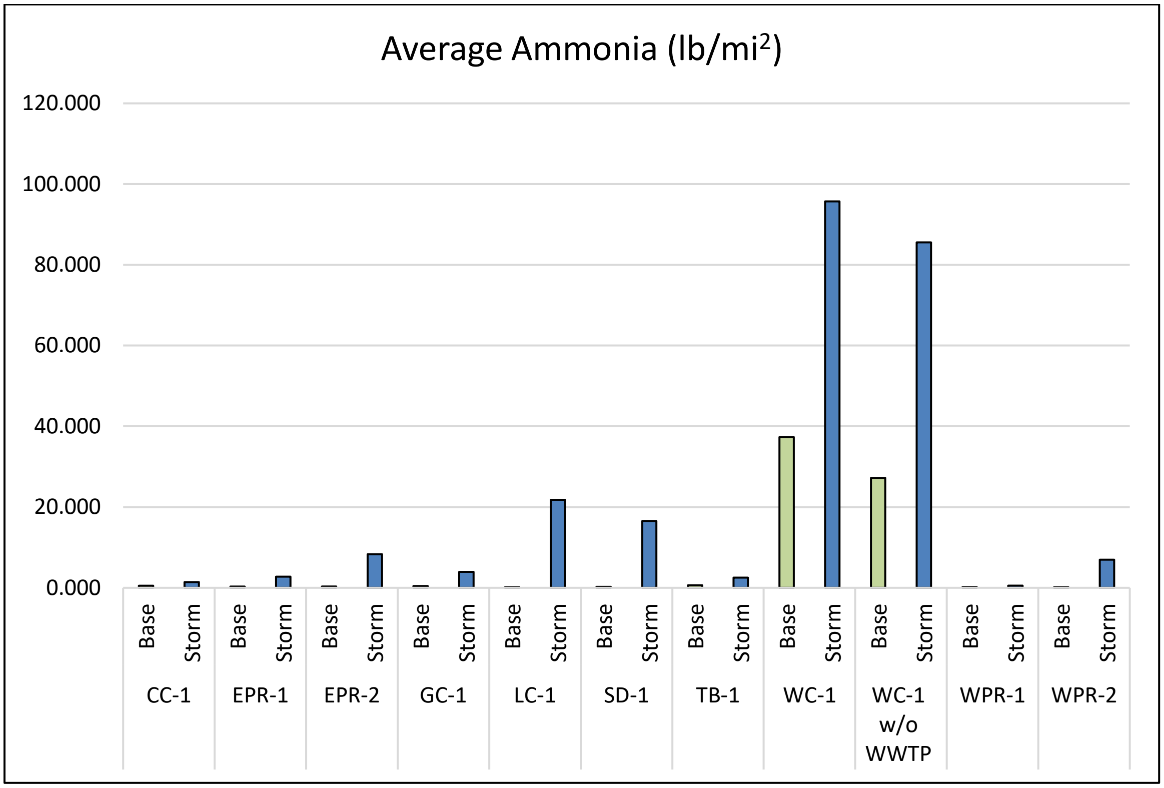


Figure 4.1.1. Base and Storm Flow Average Loads of Ammonia (lb/mi^2).

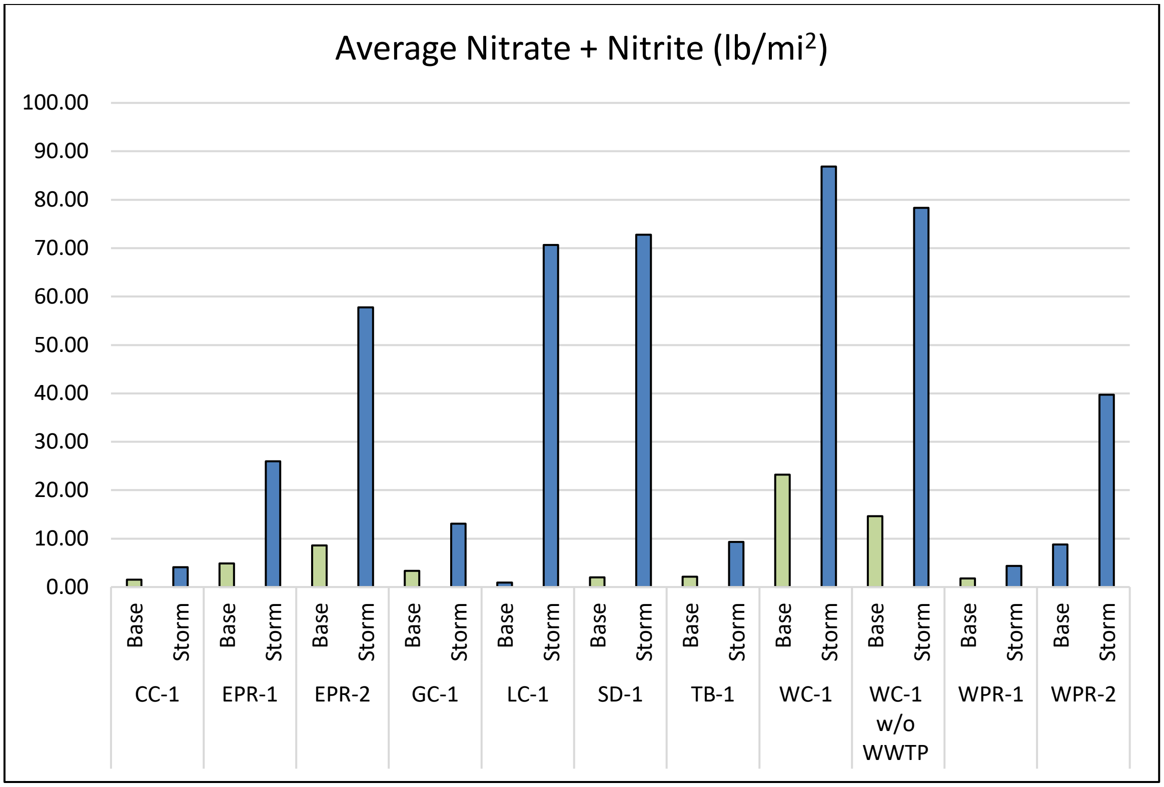


Figure 4.1.2. Base and Storm Flow Average Loads of Nitrate + Nitrite (lb/mi²).

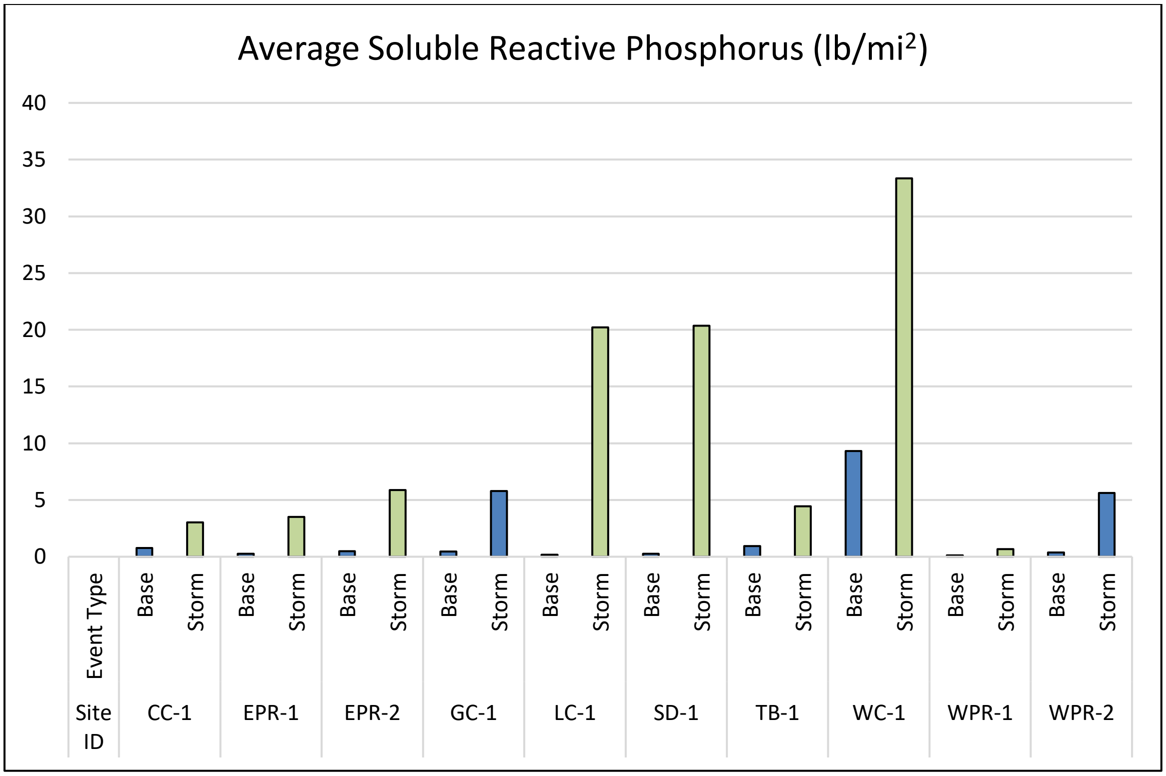


Figure 4.1.3. Base and Storm Flow Average Loads of Soluble Reactive Phosphorus (lb/mi²).

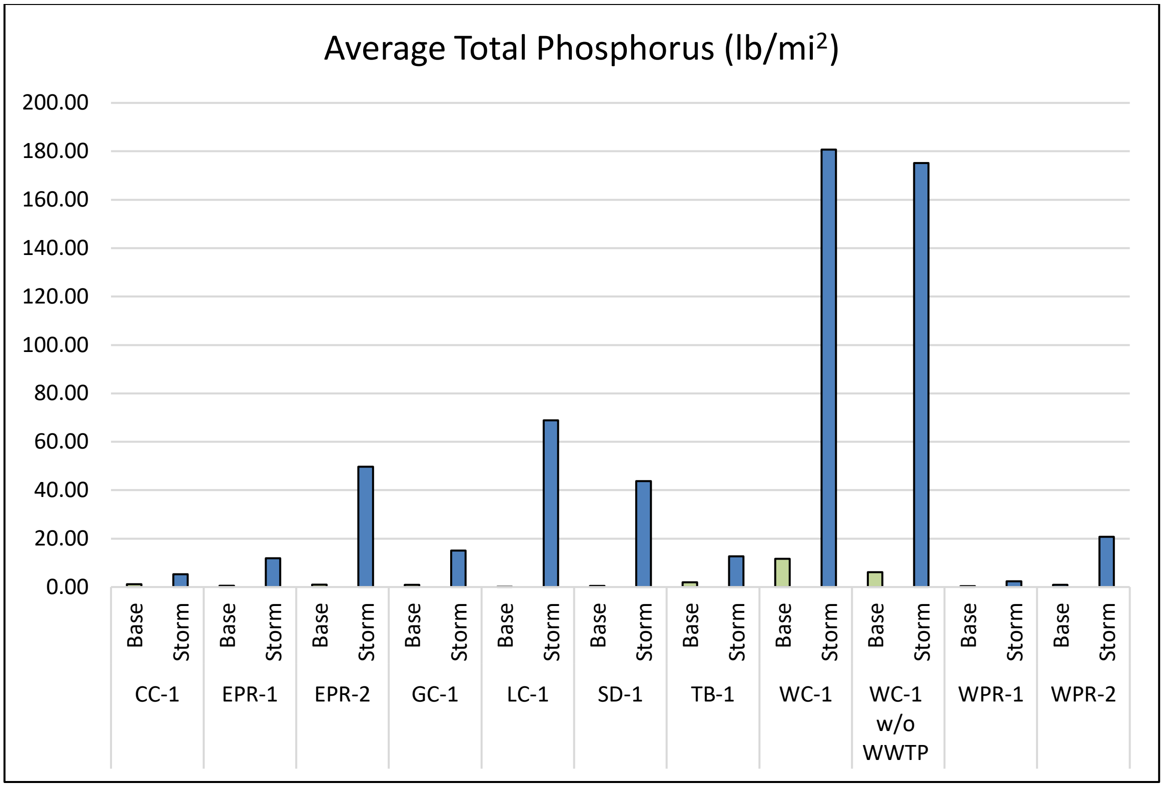


Figure 4.1.4. Base and Storm Flow Average Loads of Total Phosphorus (lb/mi^2).

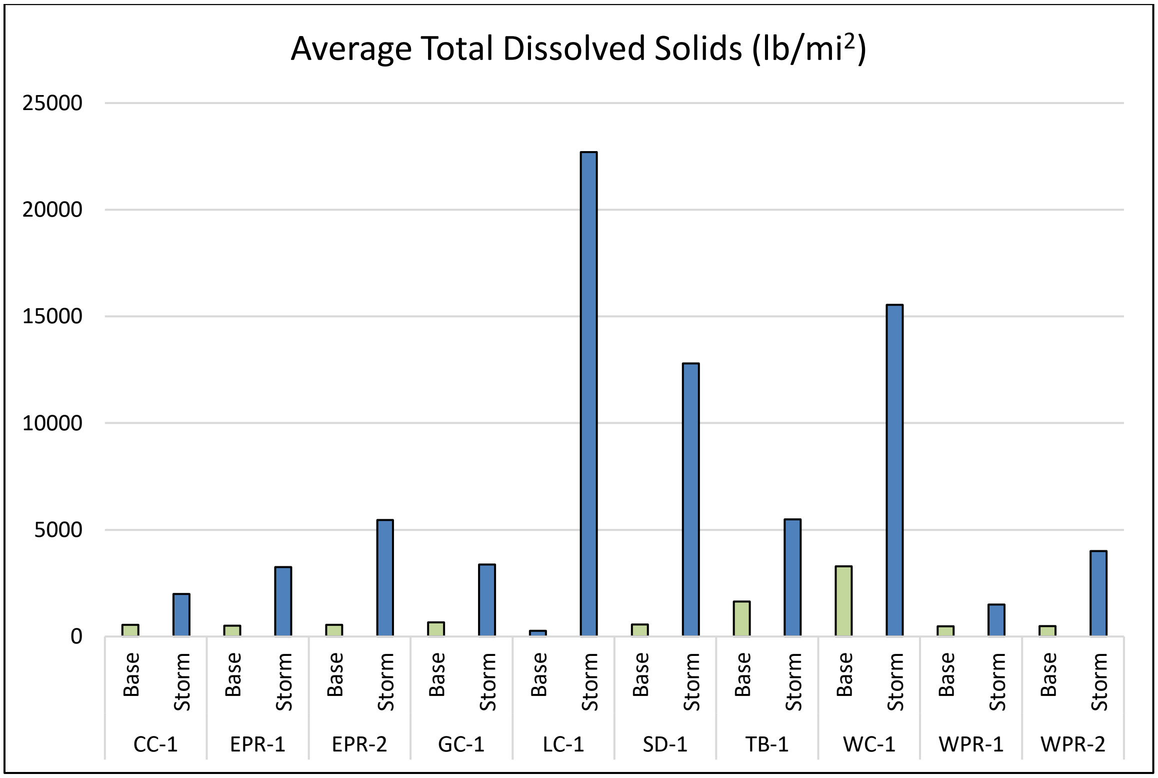


Figure 4.1.5. Base and Storm Flow Average Loads of TDS (lb/mi^2).

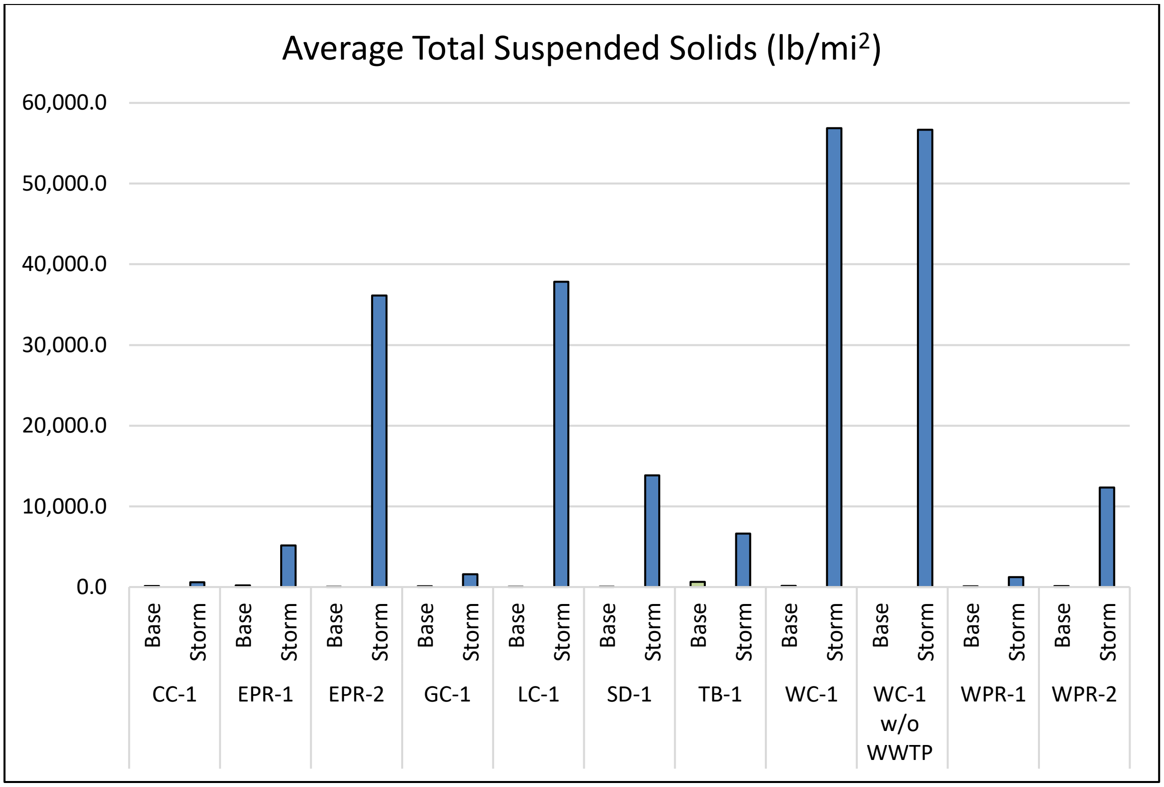


Figure 4.1.6. Base and Storm Flow Average Loads of TSS (lb/mi^2).

Figures 4.1.7-4.1.9 depict the portion of pollutant loading attributed to each sub-watershed for TSS, nitrate + nitrite, and total phosphorus. Sub-watersheds identified with the highest loading of key constituents (EPR-2, LC-1, SD-1, and WC-1) will receive higher priority for management. Load reductions will be accomplished accordingly for these key sub-watersheds as well as other sub-watersheds according to the plan outlined in Sections 5 and 6.

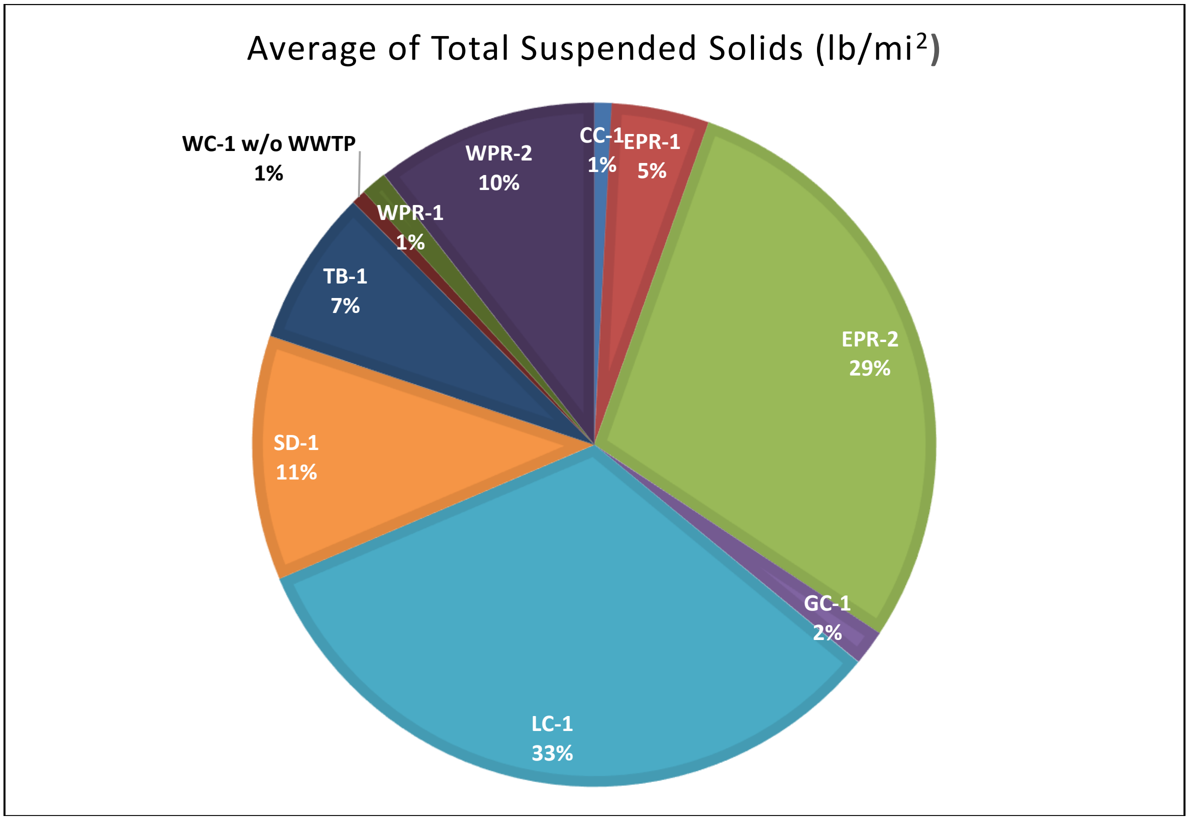


Figure 4.1.7. TSS Storm and Baseflow Loading Proportional To Entire Watershed.

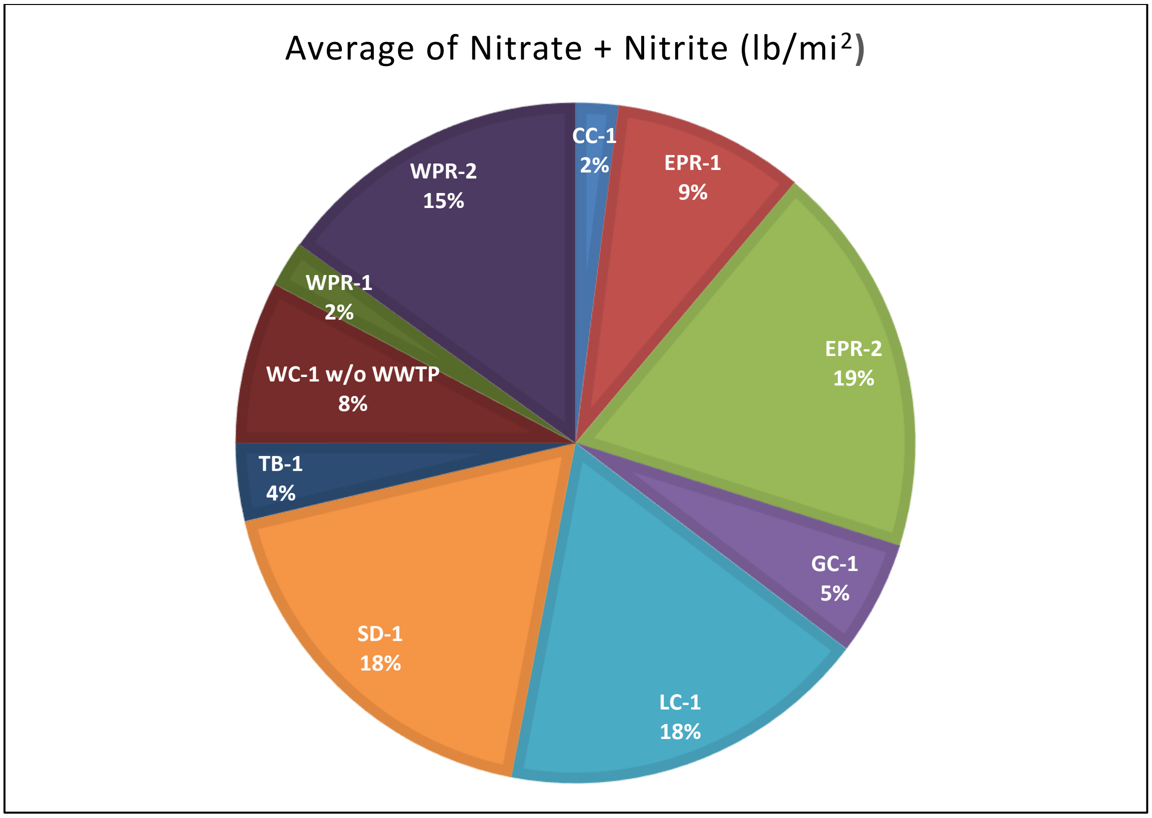


Figure 4.1.8. Total Nitrate + Nitrite Storm and Baseflow Loading Proportional to Entire Watershed.

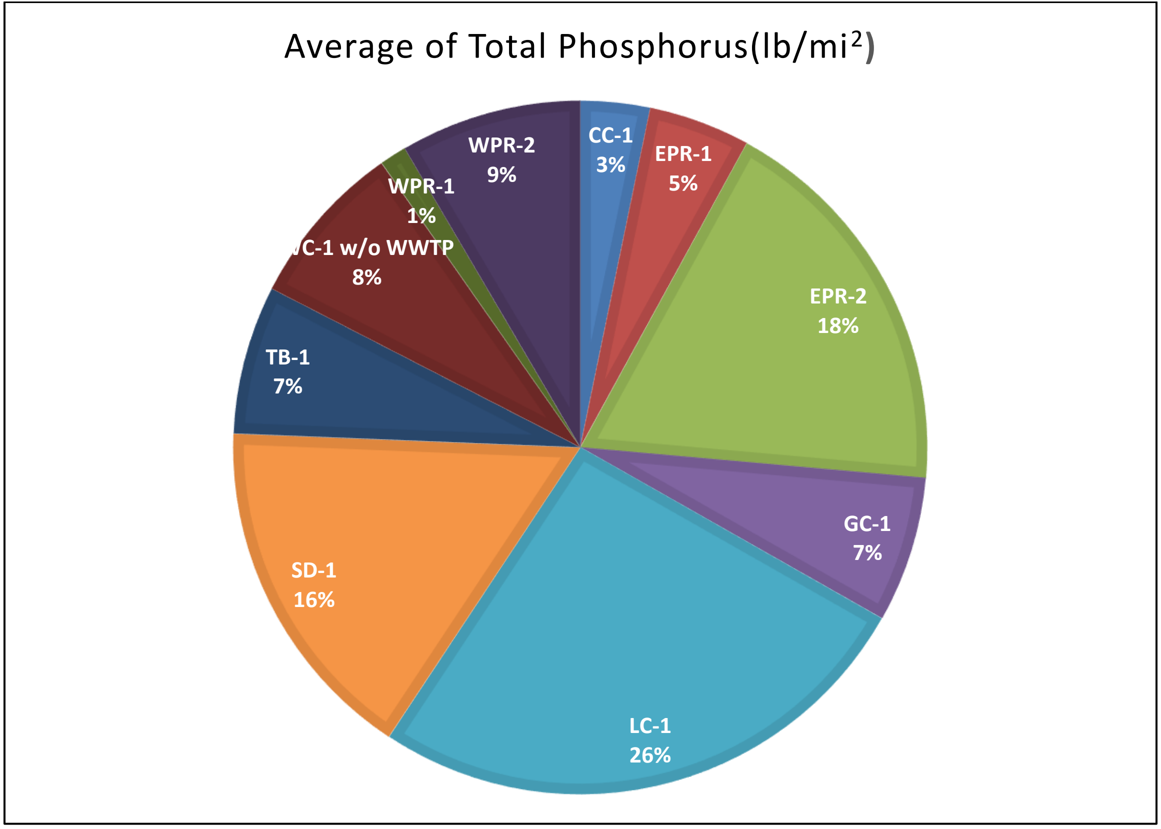


Figure 4.1.9. Total Phosphorus Storm and Baseflow Loading Proportional to Entire Watershed.

4.2 Historical Reports Related to Watershed Pollutant Loading

The Lake Conway Point Remove watershed has been the subject of several studies over the years. Studies have varied greatly from those focused on macroinvertebrate community effects of gas wells in the headwater streams to nutrient enrichment of Lake Conway. The most relevant reports and data are:

- Water Quality Monitoring of the Lake Conway Pointe Remove Watershed - 319 grant projects No. 11-600 and 15-300 (Equilibrium, 2014 and 2020)
- Lake Conway Management Plan (AGFC, 2003)
- Craig D. Campbell Lake Conway Reservoir & Inflow Tributaries Water Quality and Sediment Study (FTN, 2015)
- LCPRW Assessment, 319 grant No. (LCPRWA and GBMc & Associates, 2019)
- UCA/ADEQ macroinvertebrates - Most notable is the macroinvertebrate data that has been collected by UCA at the same 3 locations for 5 years (2010-2014). Arkansas Division of Environmental Quality has also collected macroinvertebrate data on 9 occurrences from 1996-2012. Macroinvertebrate sampling locations can be found in Figure 4.2.1 below.
- SWAT Modeling of the Lake Conway Point Remove Watershed (Saraswat, 2010)

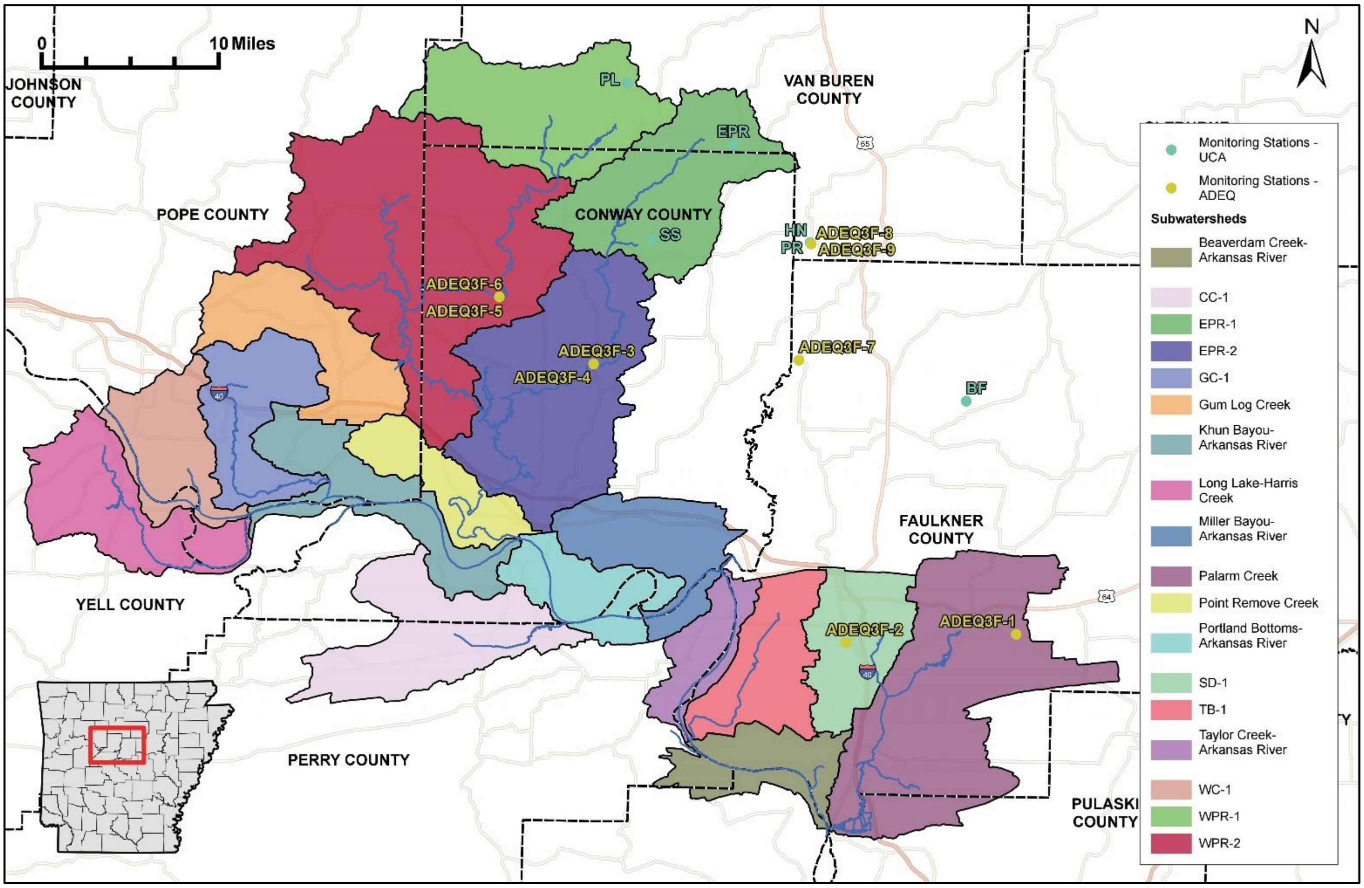


Figure 4.2.1. Macroinvertebrate collection locations in the LCPRW.

A summary of the two most relevant reports, which were both used in the development of this management plan, are provided below.

Lake Conway Study (FTN, 2015) - In 2015 FTN & Associates, Inc (FTN) completed a study of Lake Conway for the Arkansas Game and Fish Commission. In that study they collected water quality samples from the main six lake tributaries, from the lake and from the lake outlet. Samples were collected 1/month at baseflow and during five storm flow events. Flow was also monitored so loading could be assessed. Results from that study indicated that Stone Dam creek was the largest nutrient load carrier to the lake. However, during the time of the study Stone Dam Creek also contained flow from the Conway WWTP. Since that time the WWTP outfall has been moved from the creek to the Arkansas River. Except for Stone Dam Creek, data from the report should be somewhat representative of current conditions and since it was collected during a normal climatic season it is comparable to data collected elsewhere in the watershed under similar conditions. Loading data from this study was used to represent the Palarm Creek sub-watershed.

University of Arkansas Division of Agriculture SWAT (Saraswat, et.al., 2010) - To assess and manage nonpoint source pollution, the NRD recommends evaluating pollutant loading and implementing mitigation efforts on the sub-watershed scale. Watershed models, particularly the Soil & Water Assessment Tool (SWAT), are often used for assessing, planning, and prioritizing NPS mitigation efforts and watershed management activities.

SWAT, which stands for Soil and Water Assessment Tool, is a comprehensive river basin modeling system developed by the United States Department of Agriculture (USDA) Agricultural Research Service. SWAT is a physically based, continuous-time hydrologic model that simulates the impact of land management practices on water, sediment, and agricultural chemical yields in large complex watersheds.

SWAT modeling integrates various components, including hydrology, weather, land use, soil properties, and land management practices, to simulate the movement of water and contaminants through a watershed over time. It can be applied to assess the impact of different land management scenarios on water resources, soil erosion, and water quality.

The SWAT model predicts the impacts of differing land uses, land management, and agriculture on water, sediment, and nutrient yields on the watershed scale over long periods of time. Overall, SWAT modeling is a valuable tool for researchers, environmental scientists, and decision-makers to understand and manage water resources and land use in a holistic and integrated manner.

A SWAT model was developed for the LCPRW in 2010 by the University of Arkansas Division of Agriculture to prioritize sub-watersheds based on nutrient and sediment yields (Saraswat et al. 2010). The SWAT model was developed using a variety of datasets including topography, land use/land cover, soil, weather, and existing management practices. The LCPRW was divided into USGS 12-digit HUC sub-watersheds (26 total), and the model was calibrated for flow between 2001 and 2005 at the Hattieville USGS gauge. To prioritize sub-watershed contributions, flow-weighted sediment and nutrient concentrations simulated from the SWAT model were ranked and divided into five percentile categories (i.e., 0-20, 21-40, 41-60, 61-80, and 81-100 percentiles) based on sediment, total phosphorus (TP), and nitrate-nitrogen (NO_3-N).

The highest priority sub-watersheds (i.e., 81-100 percentiles) based on sediment and TP flow-weighted concentrations were Portland Bottoms (sub-watershed #14), Beaverdam Creek (sub-watershed #18), Overcup Creek (sub-watershed #25), Khun Bayou (sub-watershed #26), Point Remove Creek (sub-watershed #28), and Miller Bayou (sub-watershed #29) (Figures 4.2.2 and 4.2.3). These six sub-watersheds occupy about 20% of the LCPRW but contributed about 72% and 52% of the sediment and TP loads, respectively. The highest priority sub-watersheds based on NO_3-N flow-weighted concentrations were Whig Creek (sub-watershed #6), Portland Bottom (sub-watershed #14), Stone Dam Creek (sub-watershed #17), Little Palarm Creek (sub-watershed #14), Overcup Creek (sub-watershed #25) and Khun Bayou (sub-watershed #26) (Figure 4.1.4). These sub-watersheds occupy about 21% of LCPRW but contributed about 58% of the NO_3-N loads.

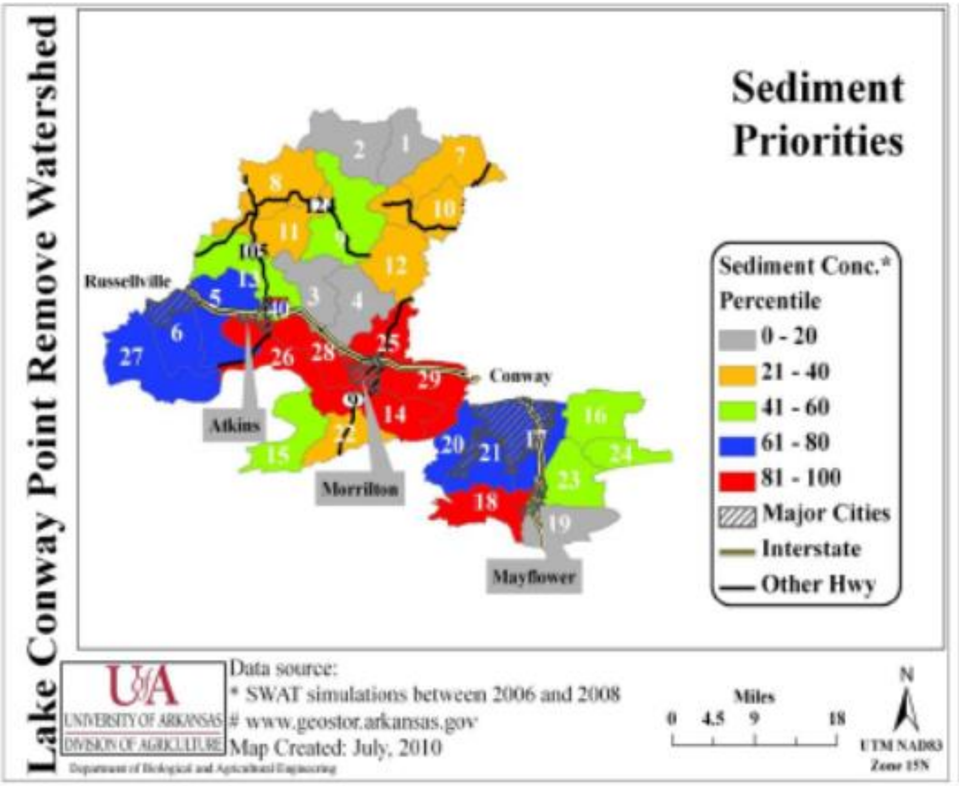


Figure 4.2.2. Priority sub-watersheds within the Lake Conway Point Remove Watershed based on flow-weighted concentrations of sediments. Figure from Saraswat et al. 2010.

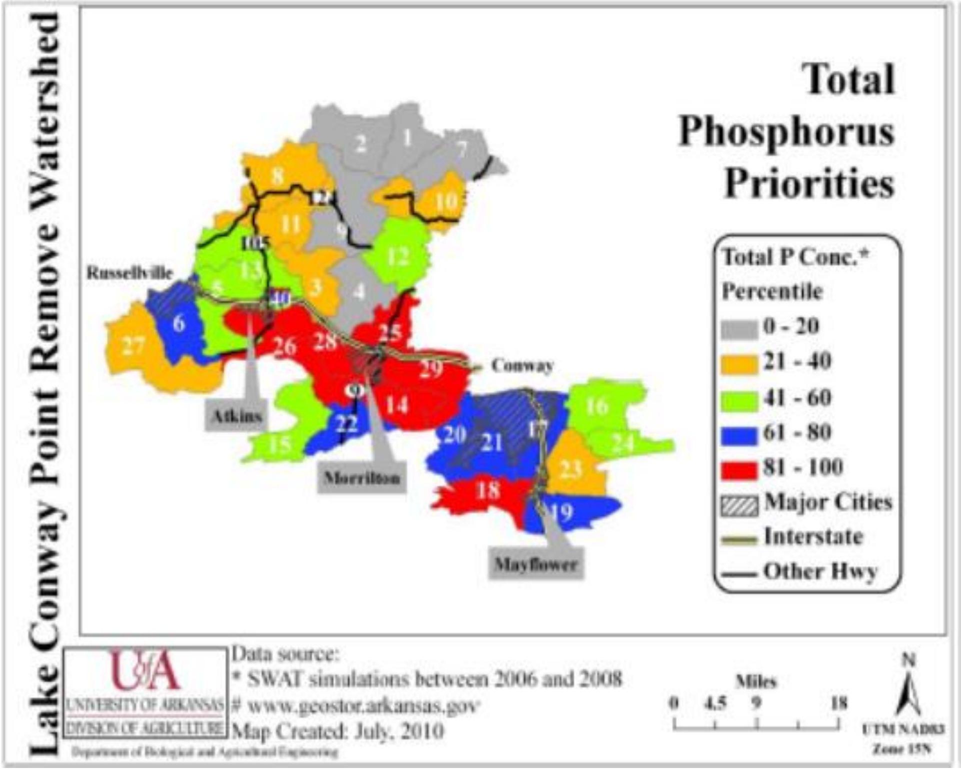


Figure 4.2.3. Priority sub-watersheds within the Lake Conway Point Remove Watershed based on flow-weighted concentrations of total phosphorus. Figure from Saraswat et al. 2010.

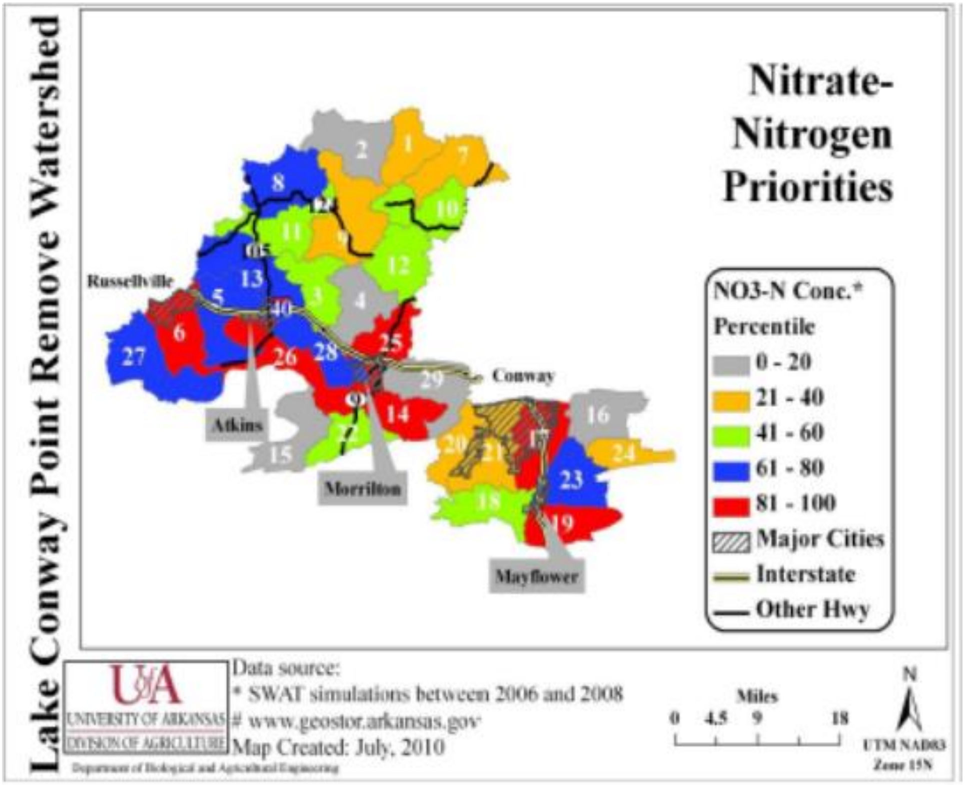


Figure 4.2.4. Priority sub-watersheds within the Lake Conway Point Remove Watershed based on flow-weighted concentrations of nitrogen. Figure from Saraswat et al. 2010.

Similar priority sub-watersheds for sediment and TP are likely due to the transport mechanism of phosphorus adsorbed onto sediments, while the different NO_3-N priority sub-watersheds may be due to impacts of point sources. At the time of the SWAT model development, Stone Dam Creek and Whig Creek sub-watersheds contained the Conway and Russellville wastewater treatment plant effluents, respectively, and both the Stone Dam Creek and Whig Creek were listed on the 2008 303(d) list for NO_3-N.

In one of the priority sub-watersheds, Portland Bottom, best management practices (BMPs) were implemented to determine the impact on nutrient and sediment yields (Saraswat et al. 2010). Much of the land use in this watershed consists of row crops (44.6%), followed by forests (19.9%), and pastures (16.2%). Vegetated filter strips (VFS) were simulated spatially between 1% and 75% of the pasture/crop area of the Portland Bottom sub-watershed, and the BMP effectiveness was evaluated as the percent change in nutrient or sediment load before and after the BMP. The reduction efficiency of the VFS ranged from 0% to 40%, 41%, and 39% for sediment, TP, and NO_3-N, respectively. Locations with higher slopes had slightly higher BMP efficiencies, and it was suggested that these areas should be prioritized for BMP implementation.

5.0 POLLUTION SOURCE ASSESSMENT

The LCPRW was broken down into 11 sub-watersheds to create watershed sizes that were manageable, for assessment, planning, and implementation. These 11 sub-watersheds form the basis for how the findings from the assessment phase will be utilized to identify and prioritize pollutant sources for management. Some of the HUC-12 sub-basins were not monitored as they were believed to be of either lesser loading concern or were represented by one of the monitored sub-basins. That is, they were similar enough to another sub-basin that it could serve as a surrogate regarding source assessment and management prioritization. For the unmonitored HUC-12 sub-basins the following surrogates will be considered:

- CC-1 represents Long Lake/Harris Creek
- TB-1 represents Point Remove Creek, Miller Bayou, and Portland Bottoms

5.1 Point Sources

Figure 5.1.1 depicts where all the NPDES permits are within the LCPRW. Within the 11 sub-watersheds sampled there are 28 active NPDES permits whose discharges ultimately end up in the Arkansas River. There are four major permittees (design flow > 1.0 MGD) and 24 nonmajor permittees (design flow < 1.0 MGD). Green Bay Packaging (NPDES Permit No. AR0001830), Russellville Wastewater Treatment Plant (WWTP) (NPDES Permit No. AR0021768), Tucker Creek WWTP (NPDES Permit No, AR0047279), and Tupelo Bayou WWTP (City of Conway-NPDES Permit No. AR0051951) are the major discharges in the LCPRW. Green Bay Packaging, Tucker Creek WWTP, and Tupelo Bayou WWTP discharge directly to the Arkansas River and are thus a less concern on this WMP. The Russellville WWTP discharges to Whig Creek upstream of the WC-1 sampling location then to the Arkansas River. Effluent limits for each of these entities are presented in Table 5.1.1. There are currently no effluent limits for phosphorus, however, Tucker Creek WWTP has a monitor and report requirement for total phosphorus due to a TMDL.

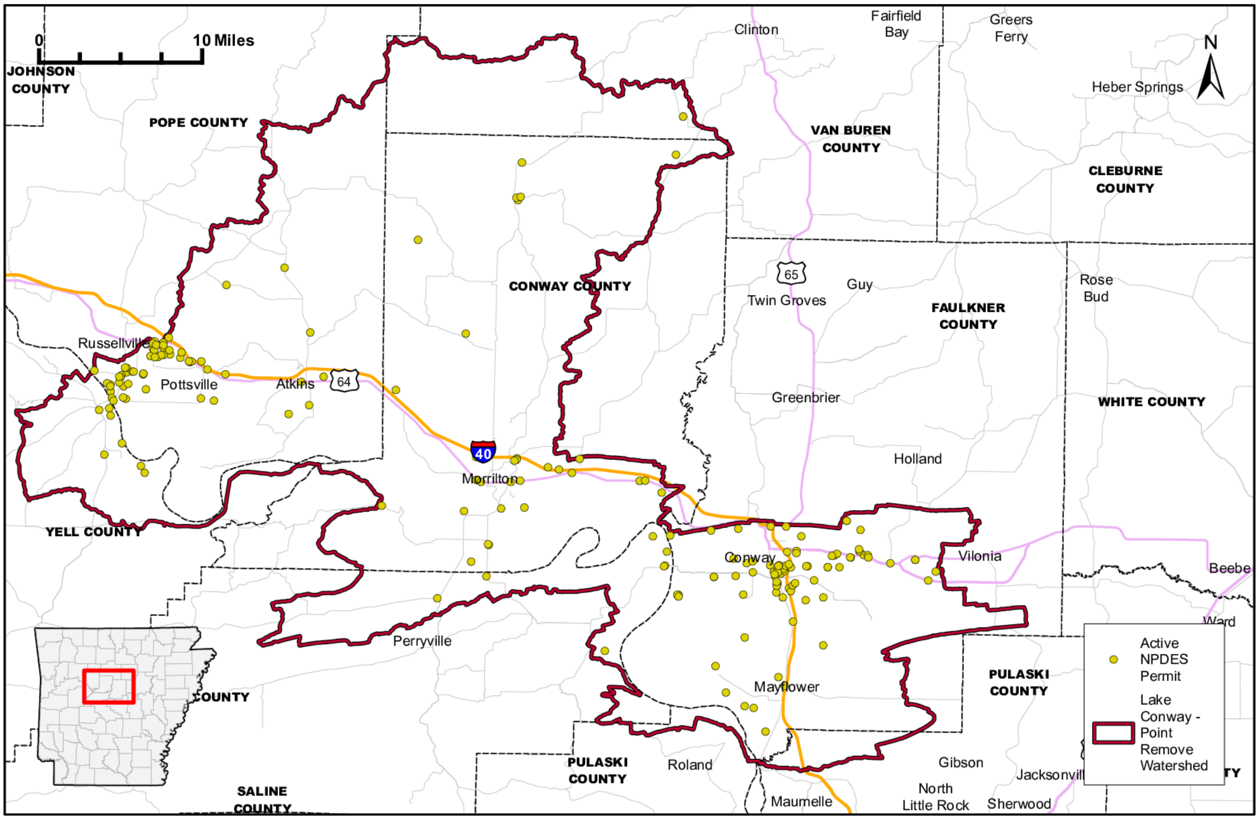


Figure 5.1.1. Active NPDES permits in the LCPRW.

Table 5.1.1 NPDES Permit Limits for major NPDES Discharges in the Watershed.

Parameter	Load, Monthly Average (lb/day)				Concentration, Monthly Average (mg/L)				7 Day Average (mg/L)			
	Green Bay Packaging (GBP)	Russellville WWTP	Tucker Creek WWTP	Tupelo Bayou WWTP	GBP	Russ. WWTP	Tucker C. WWTP	Tupelo B. WWTP	GBP[1]	Russ. WWTP	Tucker C. WWTP	Tupelo B. WWTP
BOD_5	19,181.0	N/A	1,601.0	4,000.0	Report	N/A	30.0	30.0	Report	N/A	45.0	45.0
$CBOD_5$ (May-Oct)	N/A	608.8	N/A	N/A	N/A	10.0	N/A	N/A	N/A	15.0	N/A	N/A
$CBOD_5$ (Nov-April		913.2				15.0				22.5		
TSS (May-Oct)	14,613.0	913.2	4,804.0	4,000.0	Report	15.0	90.0	30.0	Report	22.5	135.0	45.0
TSS (Nov-Apr)	14,613.0	1,217.6	4,804.0	4,000.0	Report	20.0	90.0	30.0	Report	30.0	135.0	45.0
Fecal coliform (col/100mL) (May-Sept)	N/A	N/A	N/A	N/A	200.0	1,000.0	200.0	200.0	400.0	2,000.0	400.0	400.0
Fecal coliform (col/100mL) (Oct-Apr)					1,000.0	1,000.0	1,000.0	1,000.0	2,000.0	2,000.0	2,000.0	2,000.0
Ammonia Nitrogen (April-Oct)		133.9			N/A	2.2	N/A	N/A	N/A	5.6	N/A	N/A
Ammonia Nitrogen (Nov-Mar)		243.5				4.0				6.0		
Dissolved Oxygen		N/A				6.0	2.0	2.0		6.0	2.0	2.0
Nitrate		542.0				10.0	N/A	N/A		15.0	N/A	N/A
Total Residual Chlorine (TRC)		N/A				0.011	< 0.1			0.011	< 0.1	
pH						min 6.0 and max 9.0 s.u.						
Total Recoverable Copper		0.5				9.2 µg/L	N/A	N/A	N/A	18.5 µg/L	N/A	N/A
Total Recoverable Mercury		0.0				0.0134 µg/L				0.0269 µg/L		
Total Recoverable Zinc		5.2				85.5 µg/L				171.6 µg/L		
Parameters Reported without limits	Flow, BOD5, TSS	Flow, Arsenic, Chronic WET Tests	Flow, Overflow, Chronic WET Tests	Flow, Overflows, Total Phosphorus, Nitrate-nitrite, Arsenic, Chronic WET Tests								
[1]Daily max concentration (mg/L)												

5.2 Non-point Sources

Based on the results of the assessment work completed in the watershed, the following is a summary of what are believed to be the main sources of key pollutants in each sub-watershed evaluated.

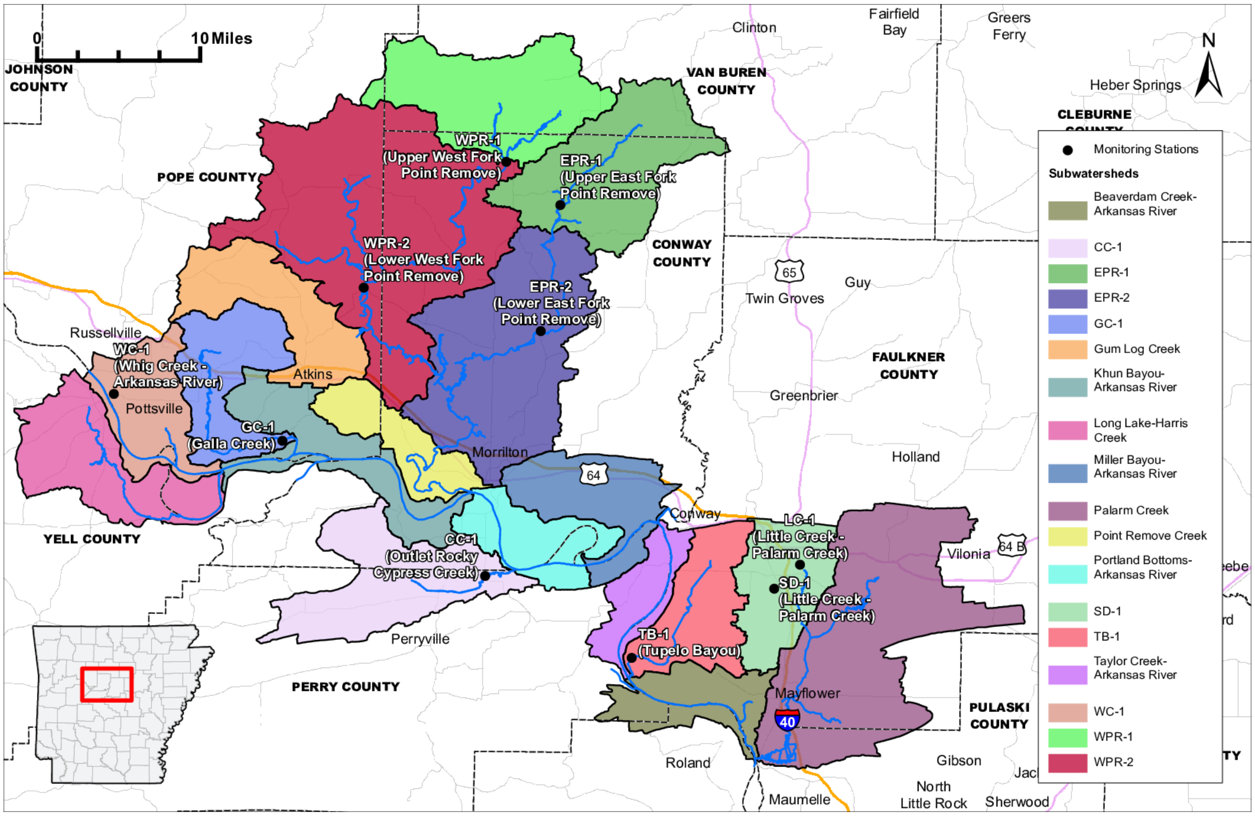


Figure 5.2.1. General Overview of LCPRW showing sub-watersheds and monitoring locations.

CC-1 Sub-Watershed (including Harris Creek) – is located south of the Arkansas River near Perry, Arkansas and is mostly composed of forest with some pastureland use. There is little streambank erosion in the sub-watershed. Cattle pasture and unpaved roads have the largest potential for non-point source pollution. A list of all potential non-point sources identified in the sub-watershed are listed below:

Non-point source	Severity/Risk
Unpaved roads	High
Pastureland use	Moderate
Poultry houses	Moderate
Cattle (388)	Moderate-low

EPR-1 Sub-Watershed – is north of Arkansas River near Lost Corner, Arkansas and is mostly composed of forest and pastureland use . Streambank erosion and cattle pasture is more prominent in this sub-watershed than in CC-1 and has the highest potential for non-point source pollution. A list of all potential non-point sources identified in the sub-watershed are listed below:

Non-point source	Severity/Risk
Streambank erosion	High
Unpaved roads	High
Pastureland use	Moderate
Cattle (962)	Moderate

EPR-2 Sub-Watershed – is north of Arkansas River near Solgohachia, Arkansas and is mostly composed of forest and pastureland use. Cattle pasture is the more prominent in this watershed than in CC-1 or EPR-1. Agricultural activities have the highest potential for non-point source pollution in this watershed. A list of all potential non-point sources identified in the sub-watershed are listed below:

Non-point source	Severity/Risk
Pastureland use	Moderate
Cattle (936)	Moderate
Poultry houses	Moderate
Unpaved roads	Moderate

GC-1 Sub-Watershed – is located south of the Arkansas River near Wilson, Arkansas. Pasture and forest are the dominant land uses and agricultural activities have the highest potential for non-point source pollution. Specific potential non-point sources are listed below:

Non-point source	Severity/Risk
Pastureland use	Moderate
Streambank erosion	Moderate
Cattle (869)	Moderate
Poultry houses	Moderate
Unpaved roads	Moderate

Palarm Creek Sub-Watershed – is located north of the Arkansas River near Conway, Arkansas. This sub-watershed drains the eastern portion of the City of Conway. Urban land use, pasture and little riparian buffer are the largest sources for non-point source pollution. Potential non-point sources are listed below:

Non-point source	Severity/Risk
Riparian buffer with <50 ft	High
Urban land use	Moderate - High
Culvert scour	Moderate
Cattle	Moderate
Unpaved roads	Low

SD-1 Sub-Watershed (including LC-1) – is located north of the Arkansas River near Conway, Arkansas. This sub-watershed drains a large portion of the City of Conway and the Universities. Urban land use, streambank erosion, and little riparian buffer are the largest sources for non-point source pollution. Potential non-point sources are listed below:

Non-point source	Severity/Risk
Riparian buffer with <50 ft	High
Urban land use	High
Streambank erosion	High
Culvert scour	Moderate
Unpaved roads	Low

TB-1 Sub-Watershed (including Point Remove Creek, Miller Bayou, and Portland Bottoms) – is located just upstream of the Arkansas River near Lollie, Arkansas. This sub-watershed contains the highest percentage of cultivated crop land use. This sub-watershed also drains a small southwestern portion of Conway. Potential non-point sources are listed below:

Non-point source	Severity/Risk
Streambank erosion	High
Cultivated Crops	Moderate
Urban land use	Moderate
Riparian buffer with <50 ft	Moderate
Cattle (378)	Moderate-low
Unpaved roads	Low

WC-1 Sub-Watershed – is just north of the Arkansas River near Dardanelle, Arkansas. This sub-watershed drains the southeastern portion of Russellville, Arkansas. There is approximately even amounts of forest, pasture and urban land use in this sub-watershed with moderate levels of streambank erosion and affected riparian buffers. Potential non-point sources are listed below:

Non-point source	Severity/Risk
Urban land use	Moderate
Streambank erosion	Moderate
Riparian buffer with <50 ft	Moderate
Unpaved roads	Low

WPR-1 Sub-Watershed – is north of the Arkansas River near Cleveland, Arkansas. Forest is the dominant land use with lots of unpaved roads. Potential non-point sources are listed below:

Non-point source	Severity/Risk
Unpaved roads	High
Streambank erosion	High
Cattle (151)	Moderate-low
Poultry houses	Moderate-low

WPR-2 Sub-Watershed - is north of the Arkansas River near Economy, Arkansas. This sub-watershed is dominantly forest with some pastureland use. The largest potential for non-point source pollution in this sub-watershed is cattle pasture. Potential non-point sources are listed below:

Non-point source	Severity/Risk
Cattle (1,753)	High
Poultry houses	High
Unpaved roads	High
Streambank erosion	Moderate-high
Pastureland use	Moderate

GLC Sub-Watershed - is north of the Arkansas River near Atkins, Arkansas. This sub-watershed is dominantly forest and pastureland use each at approximately 40%. The largest potential for non-point source pollution in this sub-watershed is cattle pasture, chickens, unpaved roads, and natural gas wells. Potential non-point sources are listed below:

Non-point source	Severity/Risk
Cattle	High
Poultry houses	High
Unpaved roads	High
Pastureland use	High
Impacted riparian	High
Streambank erosion	Moderate

5.3 Priority Sub-Watershed Ranking

Many factors play into determining which sub-watersheds are priority to address with implementation efforts and what impacts need to be addressed first. To aid in this analysis a matrix was developed to consider each of the impact assessment categories including oil and gas well numbers, developed and row crop land use percent, average nitrate-nitrite, total phosphorus and TSS loads, concentration of agricultural animals, amount of impacted riparian buffers , miles of unpaved roads, SWAT model loads and amount of bank erosion if it was available. There were three water quality loading parameters that were included in the matrix giving water quality more weight in the ranking. Scores were assigned to sub-watersheds that ranked either first (5 points), second (4 points), third (3 points), fourth (2 points), and fifth (1 point) worst in a given impact category. The maximum possible score was 60. The higher the score the higher the priority. Table 5.3.1 provides a summary of the score totals for each sub-watershed. As noted previously, not all sub-watersheds had monitoring stations or were the focus of assessment efforts. The unmonitored HUC-12 sub-basins are represented in this assessment by other sub-watersheds with similar land use (i.e. CC-1 represents Long Lake/Harris Creek and TB-1 represents Point Remove Creek, Miller Bayou, and Portland Bottoms.)

Table 5.3.1 Ranking of each Impact Category for Each Sub-Watershed.

Impact	Watershed										
	CC-1	EPR-1	EPR-2	GC-1	SD-1 (w/ LC-1)	Tb-1	WC-1 (w/o WWTP)	WPR-1	WPR-2	GLC	Palaram
Sum of Number of Oil & Gas Wells (#)		5	3					2	4	1	
Developed LULC (%)				2	5	4	3			1	
Row Crop LULC (%)	1		3			5	4				2
GBMc Average of Nitrate + Nitrite (lb/mi2)		1	5		3				2	4	
GBMc Average of Total Phosphorus (lb/mi2)			4	1	5	2	2		3		
GBMc Average of Total Suspended Solids (lb/mi2)		1	5		4	2			3		
Approximate # of Cows in each Watershed (#)		2	5						4	1	3
% riparian affected in sub watershed (<50 ft width)		2	5						4	1	3
Unpaved Roads (mi)	2	3	4					1	5		
Approximate # of chicken in each Watershed (#)	3		1	2					5	4	
Bank Erosion (tons)		4		2		5	1		3		
SWAT Sed/N/P	1			3	3	3	3			1	1

Table 5.3.2. Total Scores and Matrix Ranking.

Watershed	Total Score
WPR-1	3
CC-1	7
Palarm	9
GC-1	10
WC-1	13
GLC	13
EPR-1	18
SD-1	20
TB-1	21
WPR-2	33
EPR-2	35

Some clarifications on how matrix scores were derived are necessary. Only the more recent loading data was used in the matrix ranking. Equilibrium data was collected for a longer period than the more recent GBMc data, but most of the data appeared to have been collected at or near baseflow. Because GBMc collected more samples at high flow (stormflow), it produced consistently higher loading rates than did the data collected by Equilibrium (Figure 5.3.1), therefore the GBMc data was the focus of the loading analysis in the matrix. However, since GBMc did not collect data at Gum Log Creek, Equilibrium data was used for that sub-watershed. In addition, GBMc did not collect data in Palarm Creek (outside of little Creek) so data from the FTN report was used for that sub-watershed. The last clarification needed for the matrix was in how bank erosion data was used. Bank erosion was estimated during the USAs in sub-watersheds with a sampling station, therefore Gum Log and Palarm did not have erosion estimates in the matrix, since they were not sampled during the most recent GBMc study.

According to the matrix ranking, the three key sub-watersheds in most need of source reductions are EPR-2, WPR-2, and TB-1. A visualization of the matrix rankings in each of the watersheds is provided below in Figure 5.3.2.

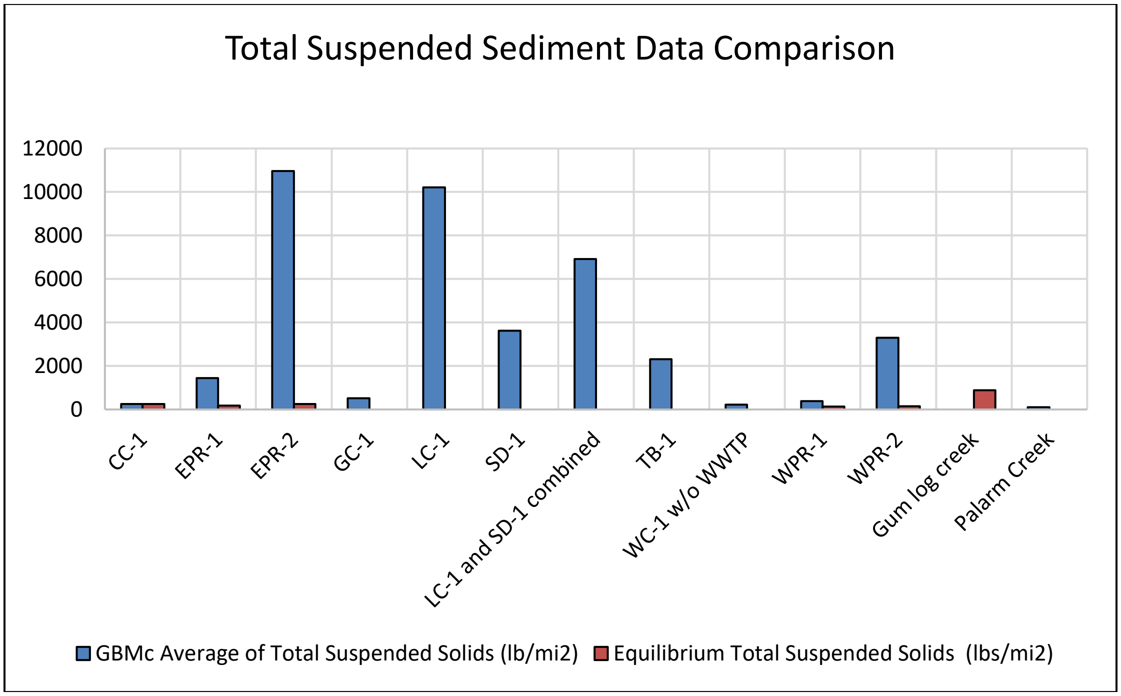


Figure 5.3.1 Total suspended sediment comparison of Equilibrium and GBMc data.

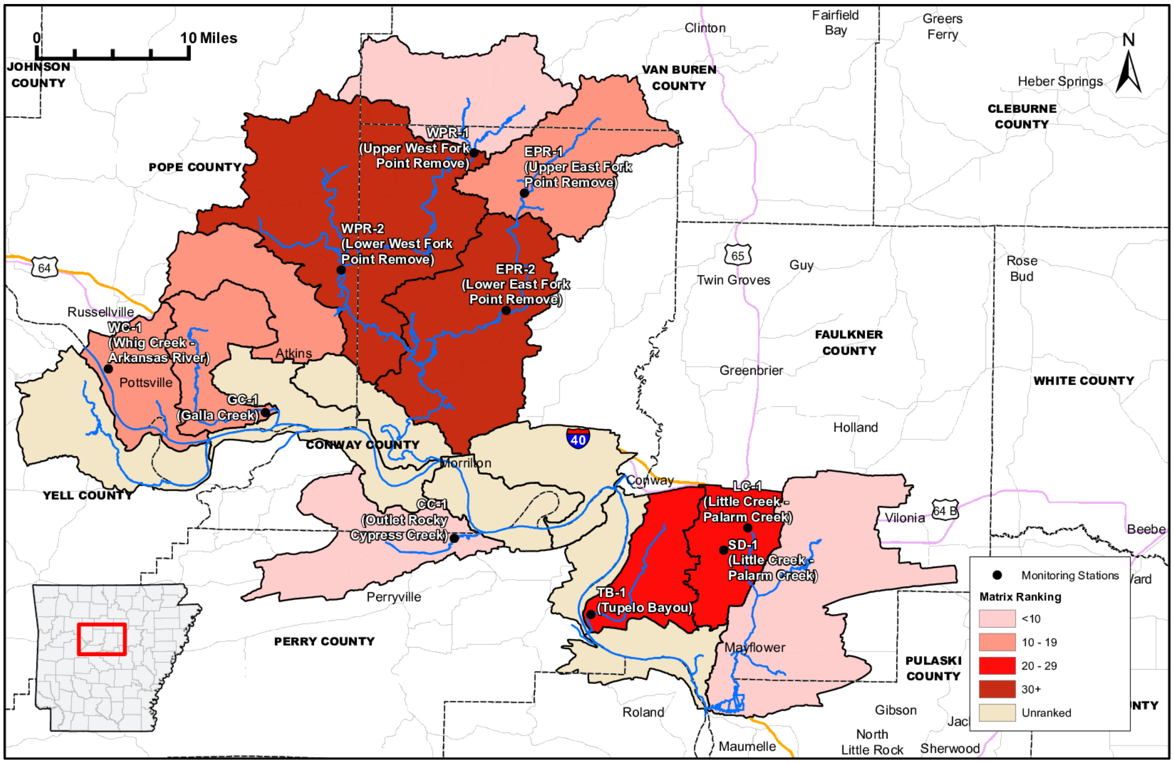


Figure 5.3.2. Matrix rankings of the LCPRW.

6.0 RECOMMENDATIONS FOR WATERSHED MANAGEMENT

The following sections provide recommendations for management of the LCPRW through protection, enhancement, and restoration. Ideally all recommendations could be easily implemented. However, this not being the case, the final portion of this section provides a ranked list of recommendations based on priority and necessity. The recommendations for watershed management are designed to address and remedy the critical problem areas/sources discussed in the previous sections.

6.1 Recommended Load Reductions

Based on the Designated Use Assessment Criteria (Section 3.1) and the data collected by GBMc during the most recent watershed monitoring study, most sub-watersheds in the LCPRW appear to be maintaining their Arkansas designated uses. However, in-stream criteria in certain stream segments still appear to be exceeded.

Therefore, reductions in TSS (sediment), which will also garner reductions in nutrients and improve dissolved oxygen levels should be targeted to ensure maintenance of the standards and to improve water quality in all sub-watersheds affected. A reduction of 10% for TSS loading (and 10% for N & P) will be targeted for all sub-watersheds scoring above a 10 in the matrix and for the key sub-watersheds, EPR-2, WPR-2, TB-1, SD-1, and EPR-1, with the highest matrix scores, and which contained streams on the Arkansas 303(d) list.

Annual loading for each of the assessed sub-watersheds was evaluated in three different ways to determine the best approach to establishing a baseline for loading and to set a target for loading reductions. Loading from the SWAT modeling (Saraswat, 2010), Hydrologic and Water Quality System (HAWQS) modeling and loading from the GBMc monitoring study were all considered (Table 6.1.1).

Table 6.1.1. Comparison of loading calculated by modeling and from monitoring.

Loading Source	**TSS (lb/yr)**	**N (lb/yr)[1]**	**P (lb/yr)**
SWAT[2]	1,034,020,210	6,644,810	1,300,741
HAWQS	2,196,093,824	14,112,516	2,762,566
Monitoring Data	1,087,579,663	3,489,320	2,088,297
A 10% reduction in the load based on Monitoring data			
Target Reduction	108,757,966	348,932	208,830

[1] Nitrogen is total N for each model but is only NO3-NO2 for the monitoring.

[2] SWAT nutrients loading derived using SWAT sed load and HAWQS nutrient ratios.

Based on the similarity between the SWAT modeling for TSS and the monitoring data, and the higher P resulting from the monitoring, the monitoring loads will be used as the baseline and the percent reduction targets are derived from those loads (Table 6.1.1.)

6.1.1 Modeling Non-Point Source (NPS) Load Reduction Potential

Two water quality models were used to determine the potential of different management practices to reduce TSS and nutrients in the LCPR Watershed. The Center for Watershed Protections Watershed Treatment Model (WTM) was used to model non-structural BMPs and urban BMPs. The USDA SWAT model and/or its online streamlined companion model, HAWQS, was used to model rural/agricultural BMPs. Each sub-watershed was modeled independently to arrive at a predicted load reduction potential with multiple management measures applied.

Both models (SWAT and WTM) are generally considered land-use based models that utilize annual rainfall, soil hydrologic groups and land-use categories to calculate primary pollutant loading in a watershed.

6.1.1.1 WTM Modeling for Non-Structural BMPs

The WTM model was used to assess potential load reductions (Table 6.1.1.1.1) from non-structural and urban land use BMPs. The WTM is used in this plan exclusively as a tool to determine which non-structural and urban stormwater BMPs most effectively reduce TSS and nutrients in each of the six sub-watersheds that contained the largest percentage of urban/developed land uses. BMPs evaluated with the WTM include:

- Catch Basin Cleanouts
- On-Site Sewage Disposal Systems (OSDSs)
- Riparian Buffers
- Septic System Repair/Maintenance (SSO)
- Stormwater retrofits (extended detention and bioswales/bioretention)
- Street Sweeping

There are three areas of information entry in the WTM: source data, existing practices data and future practices data. Source data used in the model included stream length, annual rainfall, watershed area, land use land cover, hydrologic soil information number of dwellings, soil nutrient concentration, and annual rainfall (50 inches) was entered. Based upon the area of each sub-watershed, and the total number of housing units and area of the county; a proportion calculation was used to determine the number of housing units in each sub-watershed. Soil nutrient concentration is expressed as a percent, 0.035% was used for phosphorus and 0.07% was used for nitrogen.

For the existing practices data, street sweeping was selected. To estimate street sweeping in the developed watersheds, 25% of the developed medium and high-density land use acres were used. The area was entered into the model as being street swept mechanically once per month.

For the future practices BMPs, catch basin cleanouts, OSDS programs, riparian buffers, sanitary sewer overflow (SSO) repair, stormwater retrofits, and street sweeping. For catch basin cleanouts we used 25% of the developed medium and high-density land use acres as the impervious surface area captured would be cleaned out semi-annually and monthly clean outs for 10 acres captured. For OSDS programs, it was estimated that 25% of people would be willing to change the behavior through education, 25% of people would repair their system, 25% would upgrade their systems, and 25% would be converted to a WWTP. Riparian buffer BMPs were estimated using 25% of the impacted riparian stream length (riparian with < 50ft) to be improved to a 50-foot buffer width. SSO repair was estimated at all 6 streams with a goal reduction of 25% and 10% of that to be completed. Stormwater retrofits were estimated using two practices: bioretention and dry extended detention pond. The design storm event for both was 3.0 inches of rain. Bioretention was estimated as 15% of the developed medium and high-density land use acres with 75% of the water volume captured. Dry extended detention pond was estimated as 25% of the developed medium and high-density land use acres with 75% of the water volume captured. For street sweeping, 25% of the developed medium and high-density land use acres were used to estimate the number of acres to be swept weekly. All data used in the model inputs is in Appendix D. Stormwater treatment options for the watershed can be found in Appendix E. Other future practices that were considered but not represented here due to minimal reduction potential or difficulty in quantifying the reductions were pet waste education, marina pump outs, watershed education and residential lawn care education.

Table 6.1.1.1.1. Summary of projected pollutant reductions achieved by urban land BMPs.

BMP/Future Practices	Sub-watershed	Total Nitrogen (lbs/year)	Total Phosphorus (lbs/year)	Total Suspended Solids (lbs/year)	Runoff Reduction (acre-ft/year)
Catch Basin Cleanouts	EPR-2	73.3	8.0	6,978.8	0.0
OSDS Program	EPR-2	345.7	57.6	2,304.7	0.0
Riparian Buffers	EPR-2	24,167.4	51.7	4,184.2	32.8
SSO Repair/Abatement	EPR-2	23.6	3.9	157.4	0.0
Stormwater Retrofit Options	EPR-2	11,915.5	28.0	3,426.9	9.2

BMP/Future Practices	Sub-watershed	Total Nitrogen (lbs/year)	Total Phosphorus (lbs/year)	Total Suspended Solids (lbs/year)	Runoff Reduction (acre-ft/year)
Street Sweeping	EPR-2	124.1	18.3	3,618.8	
Catch Basin Cleanouts	LC-1	234.4	25.5	22,235.5	
OSDS Program	LC-1	2,491.8	415.3	16,612.1	
Riparian Buffers	LC-1	613.0	158.0	13,005.7	106.2
SSO Repair/Abatement	LC-1	23.6	3.9	157.4	
Stormwater Retrofit Options	LC-1	381.7	103.4	13,061.9	34.5
Street Sweeping	LC-1	478.2	70.6	13,946.8	
Catch Basin Cleanouts	SD-1	361.5	39.3	34,269.1	
OSDS Program	SD-1	2,714.9	619.2	24,766.0	
Riparian Buffers	SD-1	650.9	174.1	11,248.4	97.1
SSO Repair/Abatement	SD-1	23.6	3.9	157.4	
Stormwater Retrofit Options	SD-1	728.0	198.8	20,457.9	54.0
Street Sweeping	SD-1	756.5	111.7	22,064.9	
Catch Basin Cleanouts	TB-1	299.1	32.5	28,353.3	
OSDS Program	TB-1	1,557.7	259.6	10,384.9	
Riparian Buffers	TB-1	894.4	237.1	19,012.4	149.9
SSO Repair/Abatement	TB-1	23.6	3.9	157.4	
Stormwater Retrofit Options	TB-1	497.4	138.4	16,932.9	44.7
Street Sweeping	TB-1	618.8	91.3	18,048.4	
Catch Basin Cleanouts	WC-1	217.3	23.6	20,611.3	
OSDS Program	WC-1	3,714.9	619.2	24,766.0	
Riparian Buffers	WC-1	455.5	119.3	9,669.3	77.6
Sso Repair/Abatement	WC-1	23.6	3.9	157.4	
Stormwater Retrofit Options	WC-1	830.7	300.8	89,943.7	22.3
Street Sweeping	WC-1	439.6	64.9	12,821.9	0.0
Catch Basin Cleanouts	WPR-2	74.8	8.1	7,121.8	
OSDS Program	WPR-2	1,037.1	172.9	6,914.0	
Riparian Buffers	WPR-2	84,237.6	156.9	12,510.0	95.5
SSO Repair/Abatement	WPR-2	23.6	3.9	157.4	
Stormwater Retrofit Options	WPR-2	14,672.3	29.5	3,522.9	9.5
Street Sweeping	WPR-2	127.4	18.8	3,715.3	
Sum Of Reductions	---	155,853.1	4,375.8	497,454.2	733.3

6.1.1.2 SWAT/HAWQS Modeling for Rural BMPs

The soil and water assessment tool (SWAT) is a widely used land use-based watershed model that can evaluate point source and non-point source loading of pollutants, transport, and their effect on water quality. SWAT (or HAWQS) was used in this report to evaluate BMP removal rates from various land uses in the Watershed. The model addresses load reductions from BMPs on a land use by land use basis. Each BMP is set-up in the model with BMP type, type of land use the BMP is effective for, and the percentage of that land use area (acres) that it is applied to.

The Lake Conway Point Remove Watershed was simulated in the Hydrologic and Water Quality System (HAWQS) Version 1.2. The model was run yearly from January 2008 to December 2018, with the first two years as the model warm-up period. Several best management practices (BMPs) were then simulated, and sub-watershed loadings of sediment, total nitrogen, and total phosphorus were compared to the base model. The BMPs simulated in HAWQS include:

1. Rotational grazing- the number of grazing days was reduced by 25% across all pasture and hay land uses to simulate 25% less time on each grazing area, including efforts to maximize vegetative cover/growth and limit overgrazing.
2. Row crop vegetated filter strips- a 15-meter-wide vegetated filter strip was added in 25% of the row crop areas (i.e., corn, rice, soybean, and soybean-corn rotation).
3. Cover crops- Rye was simulated from November 1st to March 31st every year in 25% of the row crop areas (i.e., corn, rice, soybean, and soybean-corn rotation).
4. Filter Strips/Riparian buffers- a 15-meter-wide vegetated filter strip was added to 25% of row crops. Additionally, filter strips were added to 25% of the urban, pasture/hay, and row crop areas.

Results of the HAWQS modeling of BMP effectiveness are provided in Table 6.1.1.2.1.

Table 6.1.1.2.1. Summary of projected load reductions for agricultural BMPs.

BMP	TSS (lbs)	N (lbs)	P (lbs)
Cover crop	531,440	0	5,033
Cover Crops/Conserv. tillage (Adjusted)[1]	2,581,352	41,201	11,947
Rotational/prescribed grazing[2]	0	0	6,211
Filter strips (Row crops)	7,959,168	90,376	29,150
Filter strips on all	65,883,796	1,166,161	238,618
Total	66,415,236	1,166,161	249,862

[1] Cover crops adjusted to favor literature %reduction rates and to include conservation tillage.

[2] Rotational grazing returned much lower reductions than typical. Likely real-world reductions would be higher.

6.2 Land-Use and Runoff Management

The following is a list of best management practices recommended to protect water quality and/or the hydrologic regime of the major tributaries of the LCPRW. Practices are recommended according to land-use type. The listings are not comprehensive but provide those typically applied successfully to such land-uses as those found in this watershed. Reduction estimates (below) are from modeling or assessments described in this report, and costs (Section 9.0) are based on a survey of literature values from documents cited in Section 10.0.

6.2.1 Agricultural Land-Use

Farmers should be encouraged to implement BMPs appropriate to their land use habits. This encouragement probably needs to occur as some form of educational materials mail out, forums and face to face meetings. Assistance (including financial) with these types of efforts is available through the National Resource Conservation Service (NRCS), the Arkansas Department of Agriculture NRD, the University of Arkansas Cooperative Extension Service and others. Frequently farmers can enter cost share agreements with one of these federal or state entities that provide most funds to accomplish some of these BMPs.

Pasture - It is likely that many farmers in the watershed already implement some BMPs to enhance hay and cattle production. However, experience has shown that these are not as widespread and/or consistent as needed. In each sub-watershed, and particularly in sub-watersheds GC-1, EPR-1, EPR-2, CC-1, WC-1, WPR-2, Gum Log Creek, Harris Creek and Taylor Creek, where pasture is the most prevalent, it is recommended that landowners be encouraged to consider implementation of pasture management practices. For pasture with on-going grazing operations the following BMPs should be considered in all sub-watersheds:

- Riparian buffers along stream corridors. Minimum of 25 feet forest and 25 feet native grasses. This protects the streambanks from erosion and provides filtration of sediment and associated pollutants in the runoff.
- Alternative water sources (away from stream) for cattle use. This helps keep the cattle out of the stream and away from the banks where they contribute to erosion.
- Fencing cattle out of stream.
- Rotating pasture usage (rotational/prescribed grazing). This helps prevent over grazing, preventing grasses from becoming too thin or trampled, allowing them to help buffer the stream. It also helps prevent soil compaction.
- Control/reduce stocking rate, number of head per acre of pasture.

Hay - For agricultural land being used for hay operations in all sub-watersheds the following BMPs should be considered:

- Riparian buffers/filter strips along stream corridors (see detail above).
- Control fertilizer applications (magnitude, timing and method) according to soil tests and USDA or NRCS recommendations to maximize productivity yet protect water quality.
- Use of cover crops during off season. Prevents topsoil erosion and utilizes remaining nutrients.

Row crop - For all row crop land uses, and in sub-watersheds TB-1, Point Remove Creek, Miller Bayou and Portland Bottoms, the following are recommended:

- Riparian buffers along stream corridors (see detail above).
- Vegetative filter strips along edges of cropped areas and particularly where rainwater drains off the fields.
- Control fertilizer applications (magnitude, timing, and method) according to soil tests and USDA or NRCS recommendations to maximize productivity yet protect water quality.
- Use of cover crops during off season. Prevents topsoil erosion and utilizes remaining nutrients.
- Crop rotation. Maintains cover on soils and improves soils.
- Conservation tillage. Reduces exposed soil and improves overall soil health and assimilative capacity.

Potential load reductions from use of the three primary agricultural BMPs, cover crops (or conservation tillage), rotational/prescribed grazing, and filter strips, in key sub-watersheds are:

- ❖ **TSS – 68,465,148**
- ❖ **N – 1,207,362**
- ❖ **P – 256,776**

6.2.2 Rural Residence On-Site Treatment Systems (Septic Systems)

For rural residences that use septic systems the following BMPs are recommended to ensure nutrient loading is minimized:

- Septic system education (how to maintain and prolong good functionality).
- Septic system inspection and repair program.

- Septic system upgrades.
- Septic system retirement (convert to city sewer where available).

Potential load reductions from septic system repair and maintenance programs in key sub-watersheds are:

- **TSS – 85,748**
- **N- 11,862**
- **P- 2,144**

6.2.3 Developed - Commercial and Industrial Land-Uses

In all sub-watersheds and particularly in SD-1, WC-1, TB-1, GC-1 and Gum Log Creek it is recommended that facilities and commercial establishments be encouraged to adopt industry specific BMPs. There are over 100 NPDES permits in this watershed, most of which are stormwater related. Many of those are concentrated along the Hwy 40 corridor in and near the urban areas of Conway and Russellville. Ensuring these entities are following their permits is an important component of managing the water quality and quantity in those sub-watersheds. Several sub-watersheds, particularly in the East Point Remove and West Point Remove, also contain natural gas well pads or transfer stations. Well pads and their associated infrastructure can be a significant source of sediments during construction, but this risk diminishes dramatically after soil stabilization with vegetation.

The following BMPs should be considered:

- Riparian buffers along stream corridors. In addition to the benefits discussed previously, buffers help control storm flow hydrographs. Minimum 50 feet on each side of streams.
- Encourage green area enlargement and enhancement and reduce impervious surfaces on new and existing developments.
- Encourage good housekeeping practices. Keep outside storage areas covered, immediately clean up spills of liquid or dry materials, etc.
- Enforce construction storm water management plans.
- Encourage and/or implement stormwater detention/retention/treatment requirements for large impervious areas. In some cases, particularly in commercial and institutional areas, bioswale/bioretention may be appropriate (figure 6.2.1).
- Land conservation. Where possible attain land or establish easements in areas critical to the stream (i.e. buffer zones, wetlands, etc.) and maintain these as green areas.

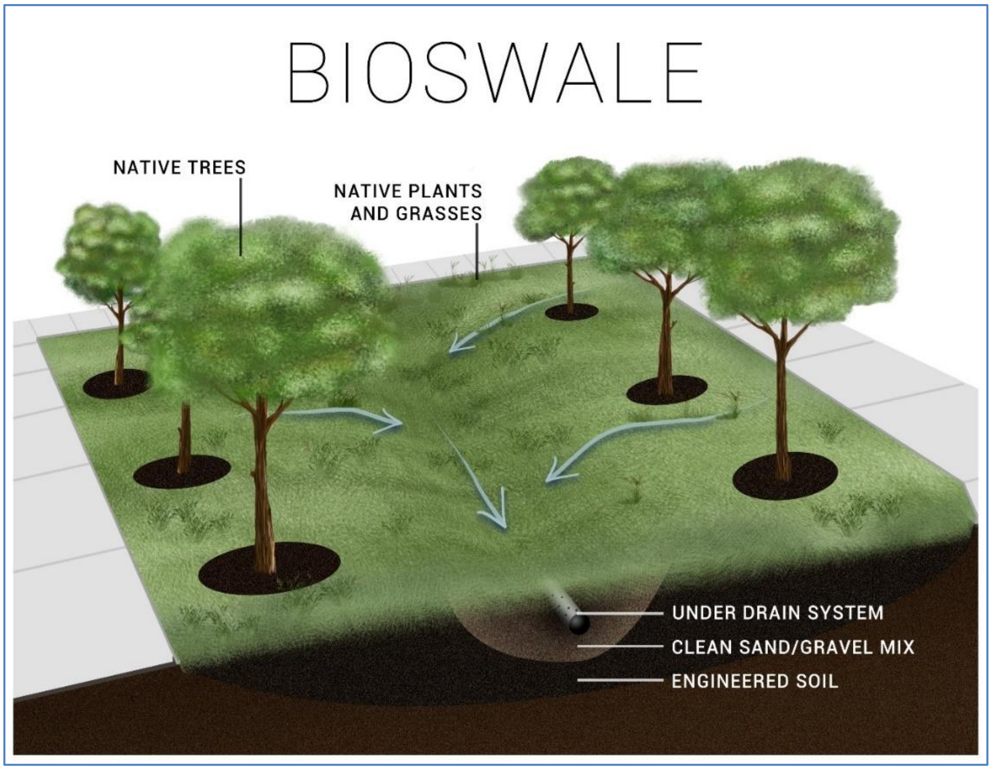


Figure 6.2.1. A bioswale (bioretention) that is effective in reducing pollutant load in stormwater run-off from commercial and institutional areas.

6.2.4 Developed - Residential Land-Uses

In the overall watershed and particularly in sub-watersheds SD-1, WC-1, TB-1, GC-1 and Gum Log Creek it is recommended implementation of best management practices by residents be encouraged.

For residential developments the following BMPs should be considered:

- Riparian buffers along stream corridors. Minimum 50 feet on each side of streams.
- Encourage green area enlargement and enhancement and reduce impervious surfaces on new and existing developments.
- Encourage good neighbor practices. Keep yard free of junk and garbage, proper disposal of pet waste, proper disposal of household chemicals, etc.
- Encourage adherence to construction storm water management plans which include BMPs designed to minimize their impacts.
- Encourage and/or implement stormwater detention/retention/treatment requirements for large developments.

- Encourage (through education and possible incentives) or require use of low impact development techniques (LID) in new developments in critical areas or on steep slopes. Encourage current homeowners to install rain gardens or similar small on-site stormwater retrofits (Figure 6.2.2).
- Limit and manage fertilizer application.
- Encourage watershed stewardship through education.

Potential load reductions from use of urban/developed land management practices (catch basin clean out, street sweeping, extended detention and bioswales/bioretention) on approximately 25% of medium to high density developed land in key sub-watersheds are:

- **TSS – 333,894**
- **N - 18,031**
- **P - 1,263**

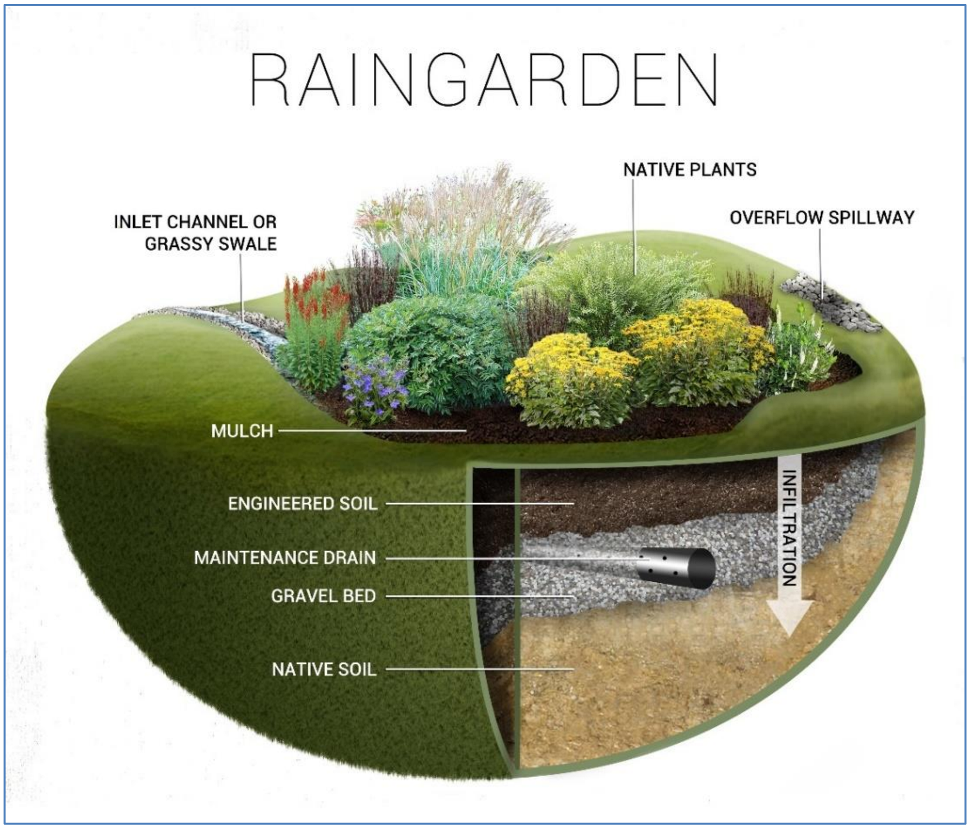


Figure 6.2.2. Example of a rain garden that can be easily and inexpensively installed in most yards and/or commercial areas to improve stormwater quality.

6.2.5 Unpaved Roads Management

Several BMPs are available to decrease sediment transport from unpaved roads. Key sub-watersheds where there is a high concentration of unpaved roads are CC-1, EPR-1, EPR-2, Harris Creek, Miller Bayou, and Portland Bottoms. The following BMPs are believed to be appropriate to the forest roads and dirt roads in the watershed:

- Aggregates replacement
- Water bars in steep sections
- Roadside ditch maintenance and check dams
- Proper road surface stabilization/road grading/maintenance
- Turnouts

Table 6.2. Potential load reductions from implementation of unpaved road BMPs.

Parameter	Total Current Load (lbs)	50% Reduction (lbs)
TSS (12 rain events)	4,839,499	2,419,750
N load	2,696	1,348
P Load	1,418	709

Potential load reductions from use of a combination of these management practices on approximately 50% of unpaved roads in key sub-watersheds, based on info from Bloser, S.M. and Sheets B.E., 2012:

- **TSS – 2,419,750**
- **N – 1,348**
- **P - 709**

6.3 Stream Corridor Restoration/Enhancement

6.3.1 Riparian Buffers

Riparian vegetated buffers are lacking or limited in several reaches in the LCPRW. As discussed previously in this report (Section 3.0) riparian buffers are critical to the health of a stream system. The following areas should be targeted for establishment or enhancement of vegetative riparian buffers: EPR-2, WPR-2, SD-1, TB-1, WC-1, EPR-1, Palarm Creek and Gum Log Creek.

Buffer widths should be planted as wide as possible on each side of the stream. A width of at least 50 ft on each side of the stream should be targeted as a minimum. When riparian buffers are considered, more is always better. Buffers should be composed of native vegetation including trees, shrubs, herbaceous plants, and grasses. Figure 6.3.1 presents a representation of how buffers are designed.

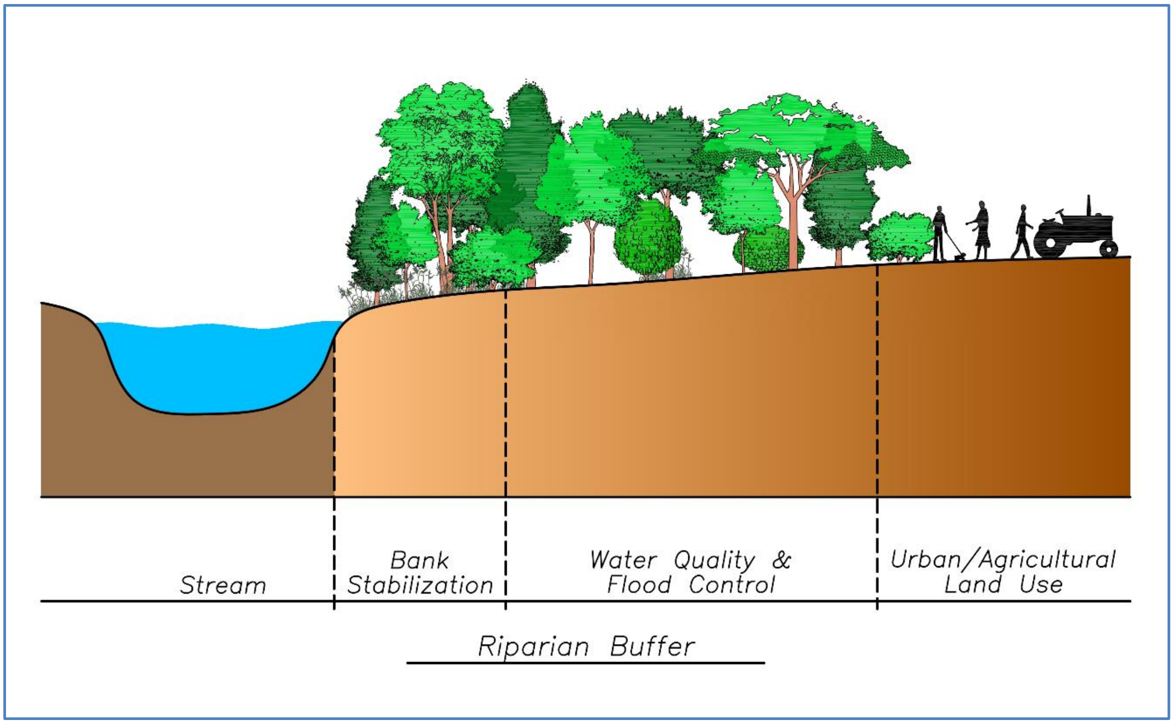


Figure 6.3.1. Generic Representation of the ideal Riparian Buffer Zone.

Potential load reductions from use of these management practices were evaluated using the WTM model and the HAWQS model. The WTM model focused on traditional riparian restoration in urban areas while the HAWQS model considered a design capable of more water filtration and for various land uses including urban, pasture and row crops. Results (anticipated reductions) of the later analysis are included in the agriculture section 6.2 and below:

- **TSS – 65,883,796**
- **N – 1,166,161**
- **P - 238,618**

6.3.2 Streambank and Channel Stabilization

Several of the streams in the LCPRW are exhibiting significant streambank erosion at several locations. Streambanks should be stabilized in as many of the locations as possible and particularly in the critical areas that are easily accessible for the required heavy construction equipment. TB-1, EPR-1, WPR-2, GC-1 and WC-1 should be the primary target of these efforts. Potential load reductions from bank stabilization alone exceed 200 lb sediment/foot of eroded bank restored (Table 6.3.2.1). Root causes of streambank instability should be evaluated in each reach and necessary measures taken to reduce the risk of bank erosion. These measures frequently include reduction in stormwater run-off peak flows to the system including riparian restoration/enhancement and changes in land uses throughout the watershed to slow down stormwater run-off and increase infiltration. Measures can also include completion of channel restoration features (i.e. installation of grade control, flow training and key habitat features, etc.).

Each streambank and channel stabilization project comes with its own individual challenges and opportunities. Each stream stretch will need to be evaluated to determine what restoration techniques work best and meet the needs for sediment and nutrient reduction. Where possible, preference should be given to techniques that focus on bioengineering.

- Bank re-sloping (to flatten slope) and creation of bankfull benches.
- Toe protection in conjunction with various vegetative protection measures (such as live stakes, live cribwalls, etc.)
- Stone armoring (such as the use of boulder toes/revetments, vegetated riprap, etc.)
- Use of bioengineered materials (coir, jute, excelsior™, etc) including erosion control blankets, wattles, fiber rolls, soil wraps, etc.
- Engineered structures for grade control, energy dissipation and flow guidance, (cross veins, J-hooks, step pools, riffles, etc.)
- Revegetation of the streambanks and riparian area using native grasses and trees.

The projects would generally utilize natural channel design techniques (Rosgen, 1996) and be supplemented with other guidance including *The WES Stream Investigation and Streambank Stabilization Handbook and USDA Engineering Field Handbook* “Chapter 16: Streambank and Shoreline Protection” as guidance for the projects in the watershed. Additional help may come from contract engineering companies who have additional experience with streambank stabilization.

Table 6.3.2.1. Load reductions possible from streambank stabilization.

Sub-watershed	lbs of TSS (Sediment)	lbs of N	lbs of P
CC-1	0	0	0
EPR-2	0	0	0
SD-1	1058026	589	310
LC-1	0	0	0
TB-1	38429478	21405	11260
EPR-1	30130176	16783	8828
WPR-1	0	0	0
WPR-2	21466914	11957	6290
WC-1	19344945	10775	5668
GC-1	21389633	11914	6267
Total load	131819172	73423	38623
25% Reduction	**32954793**	**18356**	**9656**

Potential load reductions from use of these management practices on 25% of highly eroded banks in key sub-watersheds:

- **TSS – 32,954,793**
- **N – 18,356**
- **P – 9,656**

6.3.3 Critical Area Conservation

Land conservation should become a priority. Where possible, attainment of land and/or establishment of conservation easements should be considered in areas critical to the stream (i.e. buffer zones, wetlands, etc.) and maintain these as green areas. The first place to begin this effort is typically in developed land use areas where support from the local municipality may be garnered. Key elements that should be developed in tributaries are provided in Table 6.3.3.1.

Table 6.3.3.1. Key management measures to encourage, develop and manage.

Technique	Description of Technique
Construction storm water protection plans	Require for all new developments to reduce site run-on and reduce sediment and other pollutants leaving the work site. Includes diversion ditches/berms, silt fences, temporary detention ponds, hay bales, mulch, grass covers, synthetic erosion control blankets, etc. **These requirements must be enforced.**
Natural area conservation	Minimize lot clearing to that essential for the home and a small yard, maintain as many trees as possible. Riparian vegetated buffers will be along all stream corridors and be protected by local ordinance or easement where possible.
Avoid septic system use	All homes should be connected to local sewers and wastewater treatment facilities when possible.

6.4 Priority Recommendations and Implementation Schedule

Based on the load reductions projected in Section 6.2 for various BMPs, the most effective for sediment appear to be vegetated filter Strips/riparian buffers and streambank stabilization (Figure 6.4.1). The most effective for N and P removal appear to be vegetated filter Strips/riparian buffers (Figures 6.4.2 and 6.4.3).

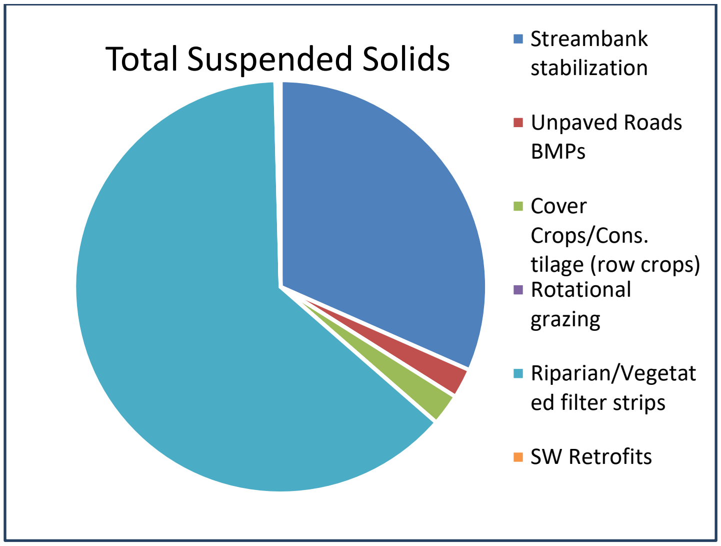
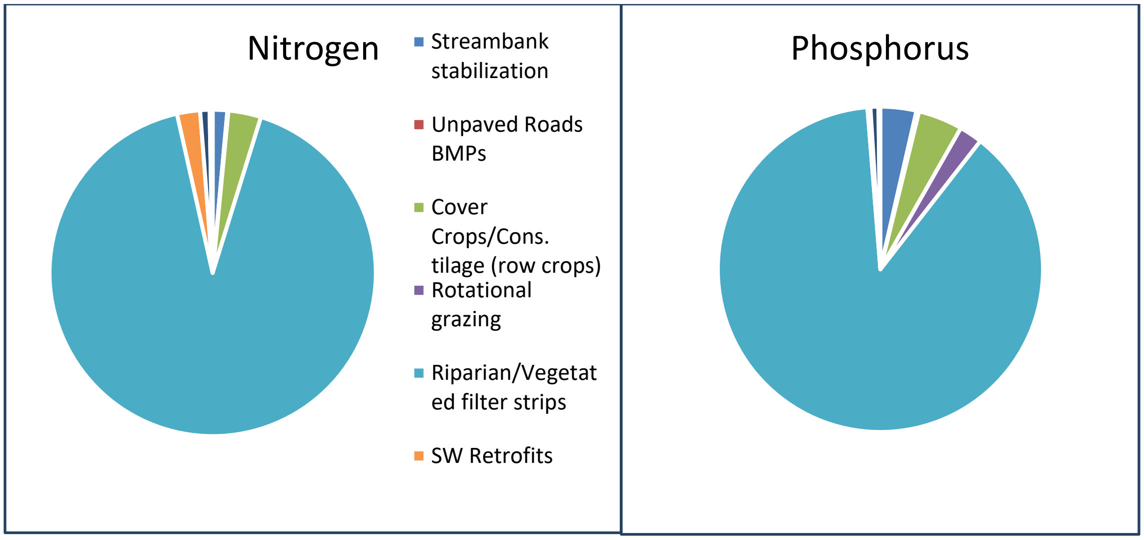


Figure 6.4.1. Source and scale of Total Suspended Solids (TSS) load reductions.



Figures 6.4.2 and 6.4.3. Source and scale of Nitrogen (N) and Phosphorus (P) load reductions.

Table 6.4.1 provides a ranking of the watershed management practices recommended as a result of the assessment. Each management action is ranked based on its ability to move the watershed towards attainment of the goals expressed.

Table 6.4.1. Recommended Watershed Management Practices.

Rank	Sub-watershed	Management Type	Management Action (Practice)
1	EPR-2 and WPR-2	BMP	Implementation of Pasture BMPs
2	EPR-2 and WPR-2	Restoration/BMP	Riparian Buffer/Vegetated filter Strips on all agricultural land
3	EPR-2 and WPR-2	Restoration	Streambank stabilization
	EPR-2 and WPR-2	BMP	Unpaved road maintenance and upgrades
4	TB-1	BMP	Implementation of Row Crop BMPs
5	TB-1	Restoration	Streambank stabilization
6	SD-1	BMP	Implementation of residential/commercial BMPs
7	SD-1	Restoration	Restore Riparian Buffers
8	EPR-1	Restoration	Streambank stabilization
9	EPR-1	BMP	Unpaved road maintenance and upgrades
10	EPR-1	BMP	Implementation of Pasture BMPs
11	EPR-1	Restoration/BMP	Riparian Buffer/Vegetated filter Strips on all agricultural land
12	EPR-1, EPR-2, WPR-2	BMP	Review all oil and gas well operations for good stormwater practices

A watershed management plan should be a living and active document that serves as the guide to direct watershed management activities, including implementation of projects to achieve load reductions, monitoring water quality and biota to gauge goal attainment, continuing education efforts, etc. The plan should be reviewed at least every 5 years and updated to ensure it is still relevant to the current conditions of the watershed. To help ensure all these action items are completed it is necessary to have a schedule listing the tasks that need to be accomplished. A summary of the action items that resulted from this WMP are provided in Table 6.4.2. The schedule provides ten years for actions to be accomplished that will result in a 10% reduction of sediment and nutrients in the watershed.

Table 6.4.2. Implementation Schedule[1].

Action Item	Target Date for completion
Meet with stakeholder group to coordinate implementation projects and monitoring and plan for future funding	December 1, 2022
Apply for grants to fund future monitoring and implementation projects	June 1, 2023
Initiate new monitoring program	August 1, 2023
Implement a pasture management education effort and invite all farmers in the watershed	December 30, 2023
Meet with county judges and US Forest Service to discuss unpaved road maintenance	June 30, 2023
See 50% of unpaved roads in CC-1 and EPR-1 receive new BMP application	December 1, 2024
Achieve new pasture management BMPs utilized in 25% of pastures in EPR-2 and WPR-2	December 1, 2025
Bank stabilization of 15% of eroded banks in TB-1 and EPR-1 (moderate or worse rating)	December 1, 2026
Achieve new pasture management BMPs utilized in 25% of pastures in EPR-1 and Palarm Creek.	December 1, 2027
Bank stabilization of 15% of eroded banks WPR-2 and GC-1 (moderate or worse rating)	December 1, 2028
Install stormwater retrofits to capture 25% of existing high intensity development focused on commercial and industrial development	December 1, 2029
Install stormwater retrofits to capture 25% of medium to high intensity developed area, including single and multi-family residential developments	December 1, 2030
See 50% of the remaining unpaved roads in EPR-2, Harris Creek Miller Bayou and Portland Bottoms receive new BMPs	December 1, 2031
See remaining 10% of streambanks stabilized in key sub-watersheds	December 1, 2032

[1] Participation by landowners and funding are unknown and could have a significant effect on the schedule and implementation success.

6.5 Interim Milestones

To monitor progress, it is necessary to have measurable milestones that can be easily interpreted. The milestones that will be used for gauging progress on of this WMP are provided in Table 6.5.1.

Table 6.5.1. Interim Measurable Milestones.

Milestone	Measurement method
Stakeholder group success	Meetings at least 2/year and attendance of at least 40% of group on average
Monitoring program initiated	First round of routine samples collected
Pasture BMP meetings	Meeting occurred on schedule
Unpaved road BMP meeting	Meeting occurred on schedule
Bank stabilization	Stabilization completed on schedule. Length of stream completed as planned
Future Watershed loading is monitored and assessed	LCPRWA completes annual monitoring as planned, per the plan in Section 7.0
First two years of monitoring complete and complied with historical data to set a baseline	Monitoring baseline established
Monitoring shows TSS and TP loading is stable or decreasing	Data analysis (per Section 7.0) of first three-year monitoring cycle (2023-2025)
Pasture management practice implemented	Completed on schedule and attaining percentage goals
SW retrofits installed	Completed on schedule and attaining percentage goals
WMP reviewed and updated every five years	Plan review is completed in 2028 and needed updates included

Success will be achieved if the above tasks are completed according to schedule. Future success will be measured by the number of implementation projects that are completed. In addition, the LCPRWA will implement and continue their watershed monitoring program and continue to evaluate sediment and nutrient loading to key outlets in the watershed.

6.6 Adaptive Management

As with any undertaking of this magnitude, obstacles will arise, and plans change. Therefore, every effort will be made to make this management plan dynamic, so that it can be easily adapted and adjusted to the needs of the watershed to benefit water quality, aesthetics, biotic communities, and the public.

Every five years the plan will be reviewed to evaluate the effectiveness of:

1. BMPs/Management practices,
2. Monitoring of loading,
3. Interim milestone completion, and
4. Education Outreach

Should any one of these components be found to be ineffective or insufficient then the plan will be revised accordingly to improve that component. After every 10 years the WMP will be updated. The update will include goals, revisions to key components that have changed over time as well as revisions needed to improve accomplishment of its goals.

7.0 WATER QUALITY TARGETS (SUCCESS CRITERIA) AND MONITORING

A load reduction target of 10% (Section 6.1) for sediment and nutrients has been established to ensure continued maintenance of the water quality criteria and the overall integrity of these waters. A 10% reduction was selected as being the most feasible way to begin sediment and nutrient reductions. Subsequent evaluation of success or failure of measures implemented will help drive future efforts. The Alliance will begin routine monitoring of key sub-watershed stations within 12 months of WMP acceptance by EPA. At a minimum the five key sub-watersheds identified in this plan will be monitored. The proposed five key stations are SD-1, EPR-2 (near the existing USGS flow gauge), WPR-2, TB-1 and EPR-1. Besides the existing USGS gauge each of these watersheds should have level loggers already installed which allow fairly accurate flow gauging. These loggers will be maintained for at least the first five years of monitoring. LCPRWA will continue to partner with UCA on long term monitoring. UCA has a history of water quality and bioassessment studies in the headwater portions of both East and West Fork Point Remove and of a significant amount of work in the Stone Dam Creek watershed which will all be a part of the long-term monitoring in these key areas. The Alliance will use loading data (TSS, N and P) collected in the future to compare to the loading data collected historically in their program and data collected during this watershed assessment. Load reductions or increases will be determined using the loading data, control charts and trend analysis.

The Alliance will use control charts and trend analysis to gauge if the watershed loading is responding positively or negatively to load reduction efforts. A predictive trend line will be used to quantify load reductions in key sub-watersheds. Any bioassessment data collected in the watershed will also be used as it has been used historically. Should the bioassessment metrics and stream condition indices vary from the historical norms (as observed in control charts) then it will be evidence of either positive effects or negative within the watershed. If the monitoring results indicate that loading has not been decreasing over three consecutive years, then additional monitoring will be completed to assess the problem and determine if loading had remained constant or if new load sources could be to blame. The first year and possibly even the second year of WMP implementation (2023 and 2024) will not be assessed in the first three-year assessment cycle. Those years will be assumed to be “building” years for both the water quality database and the implementation measures. That is, it is unlikely that many new BMPs will have been implemented within the first year and those implemented during the second year will need time to stabilize prior to producing their maximum benefits. After the first five years of post WMP monitoring the assessment of loading status will be completed for the most recent three years of data. This cycle of monitoring and evaluation will then continue forward until what time revisions are needed.

BMP effectiveness will be monitored in two of three ways:

1. Implementation of BMPs on the ground, and
2. Modeling of reductions from BMPs implemented, or
3. Monitoring of runoff above and below BMPs.

8.0 PUBLIC INVOLVEMENT, EDUCATION AND STAKEHOLDERS

8.1 Creation of the LCPRWA and other Stakeholder Involvement

The LCPRWA (the Alliance) was born out of a series of public meetings concerning water studies done in 2006. In 2012 the Arkansas Natural Resource Commission, Metroplan, the City of Conway, the UA Dept. of Agriculture, and the UA Community Design Center, through an EPA grant, began organizing further public meetings for the development of an award winning (Nationally Recognized) Urban Watershed Plan for the City of Conway, and a Nine Element Plan for the entire LCPRW. Through this process, the Alliance was formed in 2014 to oversee finalization and implementation of the Nine Element Plan. The group incorporated as a non-profit in April 2014 and filed for and was recognized as a 501(c) 3 in July 2015. The Alliance is currently governed by a seven-member board, with a goal to reach 15 members representative of the entire watershed. The board meets regularly (2/year at a minimum) to discuss new concerns, coordinate watershed efforts and work on the WMP.

Since inception of the Alliance, publicly open stakeholder meetings were held over several months where concerns about the watershed could be disclosed and addressed. These meetings included stakeholders living in the sub-watersheds potentially impacted by activities in the watershed and allowed stakeholders to express issues concerning the watershed as well as the relevant local, state, and federal agencies.

Participating stakeholders include U.S. Forest Service, Arkansas Master Naturalists, Arkansas Canoe Club, The Nature Conservancy, Arkansas Department of Health, Arkansas Department of Environmental Quality, Arkansas Natural Resources Division, Arkansas Game and Fish Commission, City of Morrilton, City of Conway, Arkansas Tech University, University of Central Arkansas, homeowner associations living around Lake Conway, conservation districts, concerned citizens, . Agendas were made available to attendees and included a summary of the Draft WMP and key points of the meeting and contact information which were also highlighted during the presentation and discussion.

Through these meetings, and other communications with stakeholders, the Alliance formulated plans to address these issues. Stakeholders were given the opportunity to provide feedback on the WMP and suggestions concerning sources of pollutants in the watershed. This information was evaluated and used to set priorities in the action plan.

8.2 Educational Outreach

The LCPRWA is active in educating the public concerning relevant environmental and watershed issues. Several activities/actions have been taken over the past few years to inform/educate the public in watershed management, these include:

- The Alliance has been a longstanding contributor, supporter, and participant in Conway’s annual Ecofest since the Alliance’s inception.
- In 2018 Sponsored the underwater concert titled the “AQurld Waves at the Water About Us,” in conjunction with UCA, and their event series, “The Water About Us,” aimed at bringing attention to the importance of water.
- Participated in efforts to initiate a “Drain Smart” program in Conway to highlight the importance of stormwater management and the health of the watershed. This program would add art to stormwater drains with an environmental theme.
- The Alliance established a Facebook page to increase outreach and keep interested parties informed of the Alliances’ activities.

- Informational brochures will be distributed to key locations in the watershed to encourage continued education.

A public stakeholder meeting was held by the LCPRWA to increase awareness and knowledge of the efforts being made to improve and preserve the watershed. The meeting was advertised by posting flyers, sending mail-outs, e-mailing announcements to organizations/agencies, announcements on social media and word-of-mouth.

The goals of the meeting were to identify water quality concerns in the watershed, increase education and involvement in watershed planning and further coordinate efforts with the public. The initial draft of watershed management plan was covered in the meeting explaining data that have been collected in the past. Citizens and stakeholders gave feedback on the plan and suggestions concerning major sources of pollutants and concerns in the watershed.

Table 8.2.1. Stakeholder feedback on issues in the watershed

Good Quality	**Legacy Nutrients**	**Streambank Erosion**
Flooding	Urbanization	Agriculture
Streambank Erosion	Point Source Discharges	Development
Unpaved Roads	Fertilizer applications (Ag)	Industry
Urban Runoff	Septic Tanks	Municipal Stormwater
Septic Tanks		Storm Runoff
Illegal Dumping		Unpaved Roads

Main concerns noted were that unpaved roads and construction sites have been observed to be big transporters of sediment as well as flooding issues experienced around Lake Conway. Unpaved roads could contribute to the amount of TSS measured in water quality samples collected from the watershed. For this final version of the WMP unpaved roads and sediment loading from the roads were estimated and incorporated into the plan as a key impact. Key stakeholders were given the opportunity to review information in the draft WMP and will be sent future drafts of the plan for review until the watershed management plan is finalized. Key stakeholders involved in this process include the LCPRWA board, the Arkansas Natural Resources Commission, and the Arkansas Department of Environmental Quality.

Once accepted by EPA, the final version of the watershed management plan will be made publicly available electronically to all key stakeholders for continued review and comment. The WMP is intended to be a living document that will continually undergo review and revision through adaptive management to further refine the objectives of the plan. Future proposed revisions of the watershed management plan and schedules will be sent to all stakeholders and made electronically available.

8.3 Continuing Education

The Alliance will continue educating the residents of the Lake Conway Point Remove Watershed on implementation of BMPs, programs that can assist residents financially to implement BMPs, status of the watershed, and provide details of any successes realized. A series of meetings will be held in the first 2 years post WMP approval to educate landowners on BMP related activities and how to fund such efforts. Once every 3 years, and during the years the WMP is reviewed, public meetings will be held in various locations throughout the watershed to receive comment regarding issues that still need to be addressed and success of programs. It is the intent of the Alliance to make all this information available via social media outlets, meetings, and articles to keep all interested citizens educated and informed. Funding sources for such efforts will be sought out to facilitate these activities.

9.0 TECHNICAL AND FINANCIAL ASSISTANCE

The projected costs to accomplish a 10% reduction in sediment (and the associated nitrogen and phosphorus) in the LCPRW are summarized in the table below.

Table 9.0.1 Sediment load reductions for the LCPRW.

Management Measure	lbs TSS or P Reduced	Cost Estimate ($)	Costs/lb Reduced
Stream restoration (bank stabilization)	32,954,793	19,772,876	$0.60
Riparian buffer/vegetated filter strips (urban, row crops and pasture)	65,883,796	23,059,329	$0.35
Unpaved road improvement	2,419,750	9,195,050	$3.80
Stormwater retrofits[1]	147,346	2,652,228	$18.00
Agricultural BMPs – cover crops/conserve. till[2]	11,947[3]	5,376	$0.45
Agricultural BMPs – rotational/prescribed grazing	6,211[3]	53,415	$8.60
Urban BMPs - catch basin clean out and street sweeping	513[3]	111,321	$217
Education/Public Outreach	---	10,000	1/3 yrs

[1] Stormwater retrofits are BMPs designed to be implemented in urban, suburban, and commercial/industrial areas. In this case the focus is on detention and bioretention (including rain gardens)

[2] These costs are for BMP implementation in row crops.

[3] This load reduction cost is for P.

A vast array of federal funding opportunities exists for developing and implementing effective watershed management activities. A number of incentives and grants are available for landowners to implement agricultural BMPs; and grants are available to communities to install stormwater treatment practices and replant riparian areas. Some grants will be more easily obtained by non-profit or community groups, such as the LCPRWA, which has already successfully leveraged federal funding for some watershed related activities, including development of this WMP. The majority of grant applications cycle on an annual basis with applications due the same time each year. Many of the grants listed in Table 38 require matching funds from the applicant. Awards are usually distributed within a few months of the application deadline. Many grants require recommendations by the Governor or a state/federal agency of the respective state in which a project will be completed. Grants highlighted in yellow are those which best fit the overall goals of the assessment findings and recommendations. It is anticipated that approximately 1/3 of the funding will come from a combination of these programs. The remainder of the funding will come from local landowners and investors/doners.

Table 9.0.2. Private/Match Funding Entities for Watershed Management.

Entity
Conway County (Unpaved roads)
Pope County (Unpaved roads)
Van Buren County (Unpaved roads)
Faulkner County (Unpaved roads)
City of Conway
City of Russellville
City of Morrilton
State Conservation Districts in each county
AGFC
Local Landowners

Table 9.0.3. Federal Funding Opportunities for Watershed Management.

Grant Name	Source	Type/Purpose
American Rescue Plan (ARP)	EPA/States	Non-point source reduction, stormwater drainage improvements related to watershed management and climate change
Conservation Reserve Program (CRP)	USDA	Agricultural BMPs
Cooperative Forestry Assistance	US Forest Service	Preservation of forested land
Environmental Education Grants	EPA	Community education
Environmental Quality Incentives Program (EQIP)	USDA (NRCS)	Agricultural BMPs
Five Star Restoration Matching Grants Program	EPA and National Fish and Wildlife Foundation	Restoration of riparian and aquatic habitats

Grant Name	Source	Type/Purpose
Flood Mitigation Assistance Program	FEMA	Flood mitigation
National Fish and Wildlife Service General Matching Grants	National Fish and Wildlife Foundation	Fish, wildlife, habitat conservation
Native Plant Conservation Initiative	National Fish and Wildlife Foundation	Protect/enhance/restore native plant communities
Non-point Source Implementation Grants (319 Program)	USDA (NRCS) EPA (ANRC or OCC)	Non-point source reduction and watershed protection
Targeted Watershed Grants	EPA	Watershed protection and management
Urban and Community Forestry Challenge Cost-Share Grants	US Forest Service	Forest conservation and restoration in urban settings
Water Quality Cooperative Agreements	EPA	Watershed protection and pollution prevention
Watershed Processes and Water Resources Program	Cooperative State Research, Education and Extension Service	Watershed management
Watershed Protection and Flood Protection Program	USDA (NRCS)	Watershed protection and management
Conservation Innovation Grants	USDA (NRCS)	Conservation related to agriculture

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Appendix A

USA Field Data Sheets

Unified Stream Assessment (USA)

REACH ID: CC-1	**STREAM:** Cypress Creek	**DATE/TIME:** 8/8/19 @ 1130	**INITIALS:** ENJ DMB

REACH START	**REACH END**
LAT:	**LAT:**
LONG:	**LONG:**

Average Conditions (check applicable)

Weather – Antecedent (24-h) Rain in past 72-h: y / n
☐Heavy rain ☐Steady rain ☐Showers ☐Clear/sunny
☒Mostly cloudy ☐Partly cloudy

Weather – Current conditions
☐Heavy rain ☐Steady rain ☐Showers ☐Clear/sunny
☒Mostly cloudy ☐Partly cloudy

Stream Classification
☒ Perennial ☐ Intermittent ☐ Ephemeral ☐ Tidal
☐ Coldwater ☐ Coolwater ☐ Warmwater Order_____

Stream Origin
☐ Spring-fed ☒ Mixture of origins ☐ Glacial
☐ Montane (non-glacial) ☐ Swamp/bog ☐ Other________

Hydrology
Flow: ☐ High ☐ Moderate ☒ Low ☐ None
Base Flow as %Channel Width: ☐0-25% ☐50-75% ☑25-50% ☐75-100% **Flows Measured:** Yes [✓ No]
Stream Gradient: ☐ High (≥25ft/mi) ☐ Moderate (10-24 ft/mi) ☑ Low (<10 ft/mi) ~Slope: ________ft/mi
Sinuosity: ☐ High ☐ Moderate ☑ Low

Channel Morphology **System:** Step/Pool [✓ Riffle/Pool] Pool (circle)
☑ Riffle 10 % ☐ Run ______% ☑ Pool 90 % ☐ Steps ______%

Dominant Substrate
☑Silt/clay (fine or slick) ☐Cobble (2.5-10")
☐Sand (gritty) ☐Boulder (>10")
☐Gravel (0.1-2.5") ☐Bed Rock

Dominant In-Stream Habitats
☐Woody Debris ☐Root Wads ☐Leaf Packs
☐Deposition ☐Undercut Bank
☐Aquatic Plants ☑Overhanging Vegetation
Habitat Quality: ☑Poor ☐Fair ☐Good ☐ Optimal

Land use
☑ Forest 85 % ☐ Pasture _____% ☐ Urban _____%
☐ Commercial_____% ☐ Row Crops _____%
☐ Hay_____% ☑ Industrial 15 % ☐ Sub-Urban____%

Local Watershed NPS Pollution
☐ Industrial Storm Water
☐ Urban/Sub-Urban Storm Water ☐ Row crops
☐ Cattle ☐ Other____________ ☑ No evidence

Riparian Buffer
Vegetation Type: ☑ Forest 85 % ☑ Shrub/Sapling 15 % ☐ Herbs/Grasses ____% ☐ Turf/Crops ____%
Riparian Width: ☐<10 ft ☐11-25 ft ☐ 26-50 ft ☑> 50 ft

Stream Shading (water surface)
☐Mostly shaded (≥75% coverage) ☑Partially shaded (≥25% coverage)
☐Halfway shaded (≥50% coverage) ☐Unshaded (<25% coverage)

Water Quality Observations

Odors Noted:
☒Normal/None ☐ Sewage ☐ Anaerobic
☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other___________

Water Surface Appearance:
☐ Slick ☐ Sheen ☐ Globs
☐ Flecks ☑ None ☐ Other___________

Turbidity/Water Clarity:
☐ Clear ☒ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other______________

Sediment Deposits: ☑ None ☐ Sludge ☐ Sawdust ☐ Oils ☐ Sand ☐ Relict shells

↳ very bayou like u/s of bridge

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* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA Reach Impact Data Detail Sheet (optional)

Reach ID/Stream: CC-1	**Date:** 8/8/19	**Initials:** ENJ DMB

Impact I.D.[1]	Coordinates (Lat / Long) or Waypoint	Severity (1-3)[2]	Restoration Opportunity (1-3)[3]	Description
ID-1	just U/S of bridge to the end of ENJ's track	2	3	Channelization of entire creek

BEHI I.D.	Coordinates (Lat / Long) or Waypoint	Bank Erosion Hazard	Bank Lth. (ft)	Rest. Opp. (1-3)[3]	Bank information for BEHI
ER-1	RB Downstream Top of erosion ENJ GPS	L [✓ M] H VH EX (circle one)	40	3	Bank: Height 6 ft, Angle 80 Deg Protection: Roots 15 %, Root Depth 1 ft Vegetation 10 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - % 100
ER-2	LB downstream RB as well but ENJ GPS less [illegible]	L [✓ M] H VH EX (circle one)	refer to ENJ's GPS	2	Bank: Height 4 ft, Angle 70 Deg Protection: Roots 5 %, Root Depth 1 ft Vegetation 5 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____

[1] Impacts: Outfall(OT), Bank Erosion(ER), Impacted buffer(IB), Utilities in channel(UT), Stream crossing(SC), Channel modification(CM), Trash in stream(TR), other.

[2] Severity: 1=minor, 2=moderate, 3=severe

[3] Restoration Potential: 1=minimal, 2=moderate, 3=high

[4] Bank material: circle base type, silt/clay or sand and if present circle rock type and note %.

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA, Cont.

REACH ID: CC-1	**STREAM:** Cypress Creek	**DATE/TIME:** 7/18/19 1130	**INITIALS:** EWJ/OMB
OTHER INFO:			

Average Conditions (check applicable)

Flood Plain Dynamics

Connection: ☐ Poor ☑ Fair ☐ Good   Vegetation: ☐ Forest ☐ Shrub/Sapling ☐ Tall grasses ☐ Turf/crops

Habitat: ☐ Poor ☑ Fair ☐ Good   Encroachment: ☐ Poor ☐ Fair ☐ Good

Periphyton (attached algae):

Filamentous: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Prostrate: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Suspended Algae (phytoplankton) abundance:

☐ None noticeable (water basically clear)

☑ Moderate (water slightly green tinted)

☐ Abundant (water appears green)

Aquatic Plants In Stream:

Submerged: ☐ None ☑ Sparse ☐ Moderate ☐ Abundant

Emergent: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Floating: ☐ None ☐ Sparse ☑ Moderate ☐ Abundant

Aquatic Life Observed:

☑Fish ☐Snails ☐Crawfish ☐Macroinvertebrates

Wildlife/Livestock In or Around Stream (evidence of):

☐Cattle ☐Beaver ☐Deer ☐Other________

Reach Impacts: (circle impact level 1=minor, 2=moderate, 3=major, and tag with a GPS waypoint(s) (Wpt) ID)

☐Outfalls(OT): 1 2 3 Wpt________

☐Stream Crossing(SC): 1 2 3 Wpt________

☑Bank Erosion(ER) : 1 [✓ 2] 3 Wpt________

☑Channel Modification(CM) : 1 2 [✓ 3] Wpt U/S of bridge to end of EWJ's track

☐Impacted Buffers(IB): 1 2 3 Wpt________

☐Trash(TR): 1 2 3 Wpt________

☐Utilities(UT): 1 2 3 Wpt________

☐Other________: 1 2 3 Wpt________

Notes:

If any of these impacts are significant use back of page 1 (pg. 2) for detailed description.

Channel Dynamics:

☐ Incised (degrading)
☐ Widening
☐ Headcutting
☐ Channelized
☐ Aggrading
☐ Bank scour
☐ Bed Scour
☐ Bank Failure
☐ Slope failure
☐ Sediment Deposition
☐ Culvert Scour (upstream / downstream / top)
☐ None (natural stabile channel)

Channel Dimensions (facing downstream):

Lt bank Ht: 4 (ft) Bankfull Depth 8 (ft) Wetted Width: 30 (ft) Riffle/Run Depth 0.3 (ft)

Rt bank Ht: 3.5 (ft) Bankfull Width 50 (ft)) TOB Width: 50 (ft) Pool Depth 4.5 (ft)

Channel Stability:

Lt Bank: Angle 65 degrees

LtBank Vegetation protection: 10 % cover

LtBank Erosion Hazard: L M [✓ H] VH EX (circle one)

Length Lt Bank Affected: Veto to EWJ's GPS

Wpt(s):________

Rt Bank: Angle 50 degrees

RtBank Vegetation protection 30 % cover

RtBank Erosion Hazard: L [✓ M] H VH EX (circle one)

Length Rt Bank Affected: ←

Wpt(s):________

Reach Accessibility For Restoration

Good: Open area in public ownership. Easy stream channel access by vehicle.		**Fair:** Forested or developed near stream. Vehicle access limited.		**Difficult:** Must cross wetland, steep slope, heavy forest or sensitive areas to get to stream. Access by foot/ATV only.
5	4	3	[✓ 2]	1

Notes: (biggest problem(s) you see in survey reach)

Creek very channelized. Almost bayou-like

Restoration Potential:

☐Riparian reforestation
☐Stormwater retrofit
☑Channel modification
☐ Culvert rehab.
☐Bank stabilization
☐Outfall stabilization
☐PS investigation
☐ Other ________

Place sketch of reach on back of page.

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* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

Unified Stream Assessment (USA)

REACH ID: EPR-1 U/S	**STREAM:** Section	**DATE/TIME:** 6/29/19	**INITIALS:** EMT/PMB

REACH START	**REACH END**
LAT:	**LAT:**
LONG:	**LONG:**

Average Conditions (check applicable)

Weather – Antecedent (24-h) Rain in past 72-h: y / n
☐Heavy rain ☐Steady rain ☐Showers ☑Clear/sunny
☐Mostly cloudy ☐Partly cloudy

Weather – Current conditions
☐Heavy rain ☐Steady rain ☐Showers ☑Clear/sunny
☐Mostly cloudy ☐Partly cloudy

Stream Classification
☑ Perennial ☐ Intermittent ☐ Ephemeral ☐ Tidal
☐ Coldwater ☐ Coolwater ☐ Warmwater Order_____

Stream Origin
☐ Spring-fed ☑ Mixture of origins ☐ Glacial
☐ Montane (non-glacial) ☐ Swamp/bog ☐ Other________

Hydrology
Flow: ☐ High ☑ Moderate ☐ Low ☐ None
Base Flow as %Channel Width: ☐0-25% ☑50-75% ☐25-50% ☐75-100% **Flows Measured:** Yes / No
Stream Gradient: ☐ High (≥25ft/mi) ☐ Moderate (10-24 ft/mi) ☑ Low (<10 ft/mi) ~Slope: ________ft/mi
Sinuosity: ☐ High ☑ Moderate ☐ Low

Channel Morphology **System:** Step/Pool - Riffle/Pool - Pool (circle)
☑ Riffle 15 % ☑ Run 30 % ☑ Pool 55 % ☐ Steps ______%

Dominant Substrate
☑Silt/clay (fine or slick) ☐Cobble (2.5-10")
☐Sand (gritty) ☐Boulder (>10")
☐Gravel (0.1-2.5") ☐Bed Rock

Dominant In-Stream Habitats
☑Woody Debris ☑Root Wads ☑Leaf Packs
☐Deposition ☑Undercut Bank
☑Aquatic Plants ☑Overhanging Vegetation
Habitat Quality: ☐Poor ☑Fair ☐Good ☐ Optimal

Land use
☑ Forest 70 % ☑ Pasture 30 % ☐ Urban _____%
☐ Commercial_____% ☐ Row Crops _____%
☐ Hay_____% ☐ Industrial_____% ☐ Sub-Urban____%

Local Watershed NPS Pollution
☐ Industrial Storm Water
☐ Urban/Sub-Urban Storm Water ☐ Row crops
☐ Cattle ☐ Other____________ ☐ No evidence

Riparian Buffer
Vegetation Type: ☑ Forest 100 % ☐ Shrub/Sapling ____% ☐ Herbs/Grasses ____% ☐ Turf/Crops ____%
Riparian Width: ☐<10 ft ☐11-25 ft ☑ 26-50 ft ☐ > 50 ft

Stream Shading (water surface)
☐Mostly shaded (≥75% coverage) ☑Partially shaded (≥25% coverage)
☐Halfway shaded (≥50% coverage) ☐Unshaded (<25% coverage)

Water Quality Observations

Odors Noted:
☑Normal/None ☐ Sewage ☐ Anaerobic
☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other____________

Water Surface Appearance:
☐ Slick ☐ Sheen ☐ Globs
☐ Flecks ☑ None ☐ Other__________

Turbidity/Water Clarity:
☐ Clear ☑ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other______________

Sediment Deposits: ☑ None ☐ Sludge ☐ Sawdust ☐ Oils ☐ Sand ☐ Relict shells

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA Reach Impact Data Detail Sheet (optional)

Reach ID/Stream:	Date:	Initials:

Impact I.D.[1]	Coordinates (Lat / Long) or Waypoint	Severity (1-3)[2]	Restoration Opportunity (1-3)[3]	Description
None				

BEHI I.D.	Coordinates (Lat / Long) or Waypoint	Bank Erosion Hazard	Bank Lth. (ft)	Rest. Opp. (1-3)[3]	Bank information for BEHI
ER LB	Wypt 22 [illegible] ups goes d/s to wypt 23	L M [✓ H] VH EX (circle one)	wypt to wypt	1	Bank: Height 7 ft, Angle 85 Deg Protection: Roots 15 %, Root Depth 2.5 ft Vegetation 08 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - %____
ER LB	wpt 24	L [✓ M] H VH EX (circle one)	26 yds going d/s	1	Bank: Height 3.5 ft, Angle 80 Deg Protection: Roots 40 %, Root Depth 2 ft Vegetation 35 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - %____
ER LB	from 25 to 26 wypt	L M [✓ H] VH EX (circle one)		1	Bank: Height 5.5 ft, Angle 85 Deg Protection: Roots 20 %, Root Depth 2.5 ft Vegetation 40 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - %____
ER RB		L M [✓ H] VH EX (circle one)	41 yds	1	Bank: Height 5 ft, Angle 75 Deg Protection: Roots 10 %, Root Depth 1.5 ft Vegetation 5 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots________%, Root Depth ______ft Vegetation _______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____

[1] Impacts: Outfall(OT), Bank Erosion(ER), Impacted buffer(IB), Utilities in channel(UT), Stream crossing(SC), Channel modification(CM), Trash in stream(TR), other.

[2] Severity: 1=minor, 2=moderate, 3=severe

[3] Restoration Potential: 1=minimal, 2=moderate, 3=high

[4]Bank material: circle base type, silt/clay or sand and if present circle rock type and note %.

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA, Cont.

REACH ID: EDR-1 U/S Section
STREAM:
DATE/TIME: 6/29/19
INITIALS: EW/DMR
OTHER INFO:

Average Conditions (check applicable)

Flood Plain Dynamics
Connection: ☑ Poor ☐ Fair ☐ Good
Habitat: ☐ Poor ☑ Fair ☐ Good
Vegetation: ☑ Forest ☐ Shrub/Sapling ☐ Tall grasses ☐ Turf/crops
Encroachment: ☐ Poor ☑ Fair ☐ Good

Periphyton (attached algae):
Filamentous: ☐ None ☑ Sparse ☐ Moderate ☐ Abundant
Prostrate: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Suspended Algae (phytoplankton) abundance:
☐ None noticeable (water basically clear)
☐ Moderate (water slightly green tinted)
☐ Abundant (water appears green)

Aquatic Plants In Stream:
Submerged: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Emergent: ☐ None ☑ Sparse ☐ Moderate ☐ Abundant
Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Aquatic Life Observed:
☑ Fish ☐ Snails ☐ Crawfish ☐ Macroinvertebrates

Wildlife/Livestock In or Around Stream (evidence of):
☐ Cattle ☑ Beaver ☑ Deer ☐ Other________________

Reach Impacts: (circle impact level 1=minor, 2=moderate, 3=major, and tag with a GPS waypoint(s) (Wpt) ID)
☐ Outfalls(OT): 1 2 3 Wpt________
☐ Stream Crossing(SC): 1 2 3 Wpt________
☑ Bank Erosion(ER) : 1 [✓ 2] 3 Wpt________
☐ Channel Modification(CM) : 1 2 3 Wpt________
☒ Impacted Buffers(IB): 1 [✓ 2] 3 Wpt________
☐ Trash(TR): 1 2 3 Wpt________
☐ Utilities(UT): 1 2 3 Wpt________
☐ Other________________: 1 2 3 Wpt________
Notes:

If any of these impacts are significant use back of page 1 (pg. 2) for detailed description.

Channel Dynamics:
☐ Incised (degrading) ☐ Widening ☐ Headcutting
☐ Channelized ☐ Aggrading ☐ Bank scour
☐ Bed Scour ☐ Bank Failure ☐ Slope failure
☐ Sediment Deposition ☐ Culvert Scour (upstream / downstream / top) ☐ None (natural stabile channel)

Channel Dimensions (facing downstream):
Lt bank Ht: 6 (ft) Bankfull Depth 4.5 (ft) Wetted Width: 50 (ft) Riffle/Run Depth 1 (ft)
Rt bank Ht: 3 (ft) Bankfull Width 55 (ft)) TOB Width: 60 (ft) Pool Depth 3 (ft)

Channel Stability:
Lt Bank: Angle 85 degrees
LtBank Vegetation protection: 15 % cover
LtBank Erosion Hazard: L M [✓ H] VH EX (circle one)
Length Lt Bank Affected: a 10ft
Wpt(s):________________

Rt Bank: Angle ~~70~~ 40 degrees
RtBank Vegetation protection 25 % cover
RtBank Erosion Hazard: [✓ L] M H VH EX (circle one)
Length Rt Bank Affected:________________
Wpt(s):________________

Reach Accessibility For Restoration

Good: Open area in public ownership. Easy stream channel access by vehicle.	**Fair:** Forested or developed near stream. Vehicle access limited.	**Difficult:** Must cross wetland, steep slope, heavy forest or sensitive areas to get to stream. Access by foot/ATV only.

5 4 3 2 1

Notes: (biggest problem(s) you see in survey reach)

Place sketch of reach on back of page.

Restoration Potential:
☐ Riparian reforestation ☑ Bank stabilization
☐ Stormwater retrofit ☐ Outfall stabilization
☐ Channel modification ☐ PS investigation
☐ Culvert rehab. ☐ Other ____________

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

-in field 1400 ft was roughly calculated as surveyed

Unified Stream Assessment (USA)

REACH ID: EPR-2
STREAM: East Fork Point Remove
DATE/TIME: 8-8-19 1455
INITIALS: ENJ DMB

REACH START
LAT:
LONG:

REACH END Could see to where ENJ's
LAT: gps has marked EPR C
LONG:

Average Conditions (check applicable)

Weather – Antecedent (24-h) Rain in past 72-h: y / n
☐Heavy rain ☐Steady rain ☐Showers ☐Clear/sunny
☒Mostly cloudy ☐Partly cloudy

Weather – Current conditions
☐Heavy rain ☐Steady rain ☐Showers ☐Clear/sunny
☒Mostly cloudy ☐Partly cloudy

Stream Classification
☒ Perennial ☐ Intermittent ☐ Ephemeral ☐ Tidal
☐ Coldwater ☐ Coolwater ☐ Warmwater Order_____

Stream Origin
☐ Spring-fed ☒ Mixture of origins ☐ Glacial
☐ Montane (non-glacial) ☐ Swamp/bog ☐ Other________

Hydrology
Flow: ☐ High ☐ Moderate ☑ Low ☐ None
Base Flow as %Channel Width: ☑0-25% ☐50-75% ☐25-50% ☐75-100% **Flows Measured:** Yes [✓ No]
Stream Gradient: ☐ High (≥25ft/mi) ☐ Moderate (10-24 ft/mi) ☑ Low (<10 ft/mi) ~Slope: ________ft/mi
Sinuosity: ☐ High ☐ Moderate ☑ Low

Channel Morphology **System:** Step/Pool - Riffle/Pool - Pool (circle)
☑ Riffle 25 % ☑ Run 10 % ☑ Pool 65 % ☐ Steps ______%

Dominant Substrate
☑Silt/clay (fine or slick) ☑Cobble (2.5-10")
☐Sand (gritty) ☐Boulder (>10")
☐Gravel (0.1-2.5") ☐Bed Rock

Dominant In-Stream Habitats
☑Woody Debris ☑Root Wads ☑Leaf Packs
☐Deposition ☑Undercut Bank
☑Aquatic Plants ☑Overhanging Vegetation
Habitat Quality: ☐Poor ☐Fair ☑Good ☐ Optimal

Land use
☐ Forest _____% ☑ Pasture 100 % ☐ Urban _____%
☐ Commercial_____% ☐ Row Crops _____%
☐ Hay_____% ☐ Industrial_____% ☐ Sub-Urban____%

Local Watershed NPS Pollution
☐ Industrial Storm Water
☐ Urban/Sub-Urban Storm Water ☐ Row crops
☐ Cattle ☑ Other Haying ☐ No evidence

Riparian Buffer
Vegetation Type: ☑ Forest 70 % ☐ Shrub/Sapling ____% ☑ Herbs/Grasses 30 % ☐ Turf/Crops ____%
Riparian Width: ☐<10 ft ☑11-25 ft ☐ 26-50 ft ☐ > 50 ft

Stream Shading (water surface)
☐Mostly shaded (≥75% coverage) ☐Partially shaded (≥25% coverage)
☑Halfway shaded (≥50% coverage) ☐Unshared (<25% coverage)

Water Quality Observations

Odors Noted:
☑ Normal/None ☐ Sewage ☐ Anaerobic
☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other____________

Water Surface Appearance:
☐ Slick ☐ Sheen ☐ Globs
☐ Flecks ☑ None ☐ Other___________

Turbidity/Water Clarity:
☑ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other______________

Sediment Deposits: ☑ None ☐ Sludge ☐ Sawdust ☐ Oils ☐ Sand ☐ Relict shells

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* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA Reach Impact Data Detail Sheet (optional)

Reach ID/Stream: EPR-2	**Date:** 8-8-19	**Initials:** DMB ENJ

Impact I.D.[1]	**Coordinates (Lat / Long) or Waypoint**	**Severity (1-3)**[2]	**Restoration Opportunity (1-3)**[3]	**Description**

BEHI I.D.	**Coordinates (Lat / Long) or Waypoint**	**Bank Erosion Hazard**	**Bank Lth. (ft)**	**Rest. Opp. (1-3)**[3]	**Bank information for BEHI**
ER-1	ENT GPS LB Down-Stream WP 27	L [✓ M] H VH EX (circle one)	24 yd	2	Bank: Height 3 ft, Angle 90 Deg Protection: Roots 80 %, Root Depth 2.5 ft Vegetation 40 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - % 100
Property cleared up to bank by 12 ft - 15 ft ER-2	RB downstream WP 28 @ end downstream	L M H [✓ VH] EX (circle one)	55 yd	2.5	Bank: Height 7 ft, Angle 80 Deg Protection: Roots 30 %, Root Depth 2.5 ft Vegetation 20 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - % 100
ER-3	LB downstream WP 29 @ Beginning downstream	[✓ L] M H VH EX (circle one)	21 yd	1.5	Bank: Height 3 ft, Angle 80 Deg Protection: Roots 80 %, Root Depth 3 ft Vegetation 5 % 50 [4]Material: [✓ Silt/Clay] Sand / Gravel [✓ Cobble] 50 %
ER-4	RB downstream WP 30 @ end downstream	L M [✓ H] VH EX (circle one)	85 yd	1	Bank: Height 9 ft, Angle 85 Deg Protection: Roots 75 %, Root Depth 8 ft Vegetation 25 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - % 100
ER		L M H VH EX (circle one)			Bank: Height ___ ft, Angle ___ Deg Protection: Roots ___ %, Root Depth ___ ft Vegetation ___ % [4]Material: Silt/Clay Sand / Gravel Cobble - % ___

[1] Impacts: Outfall(OT), Bank Erosion(ER), Impacted buffer(IB), Utilities in channel(UT), Stream crossing(SC), Channel modification(CM), Trash in stream(TR), other.

[2] Severity: 1=minor, 2=moderate, 3=severe

[3] Restoration Potential: 1=minimal, 2=moderate, 3=high

[4] Bank material: circle base type, silt/clay or sand and if present circle rock type and note %.

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA, Cont.

REACH ID: FPR-2
STREAM: East Point Remove
DATE/TIME: 8/8/19 1455
INITIALS: ENT/DMB
OTHER INFO:

Average Conditions (check applicable)

Flood Plain Dynamics
Connection: ☐ Poor ☑ Fair ☐ Good
Habitat: ☐ Poor ☐ Fair ☑ Good
Vegetation: ☑ Forest ☑ Shrub/Sapling ☐ Tall grasses ☐ Turf/crops
Encroachment: ☐ Poor ☑ Fair ☐ Good

Periphyton (attached algae):
Filamentous: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Prostrate: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Suspended Algae (phytoplankton) abundance:
☑ None noticeable (water basically clear)
☐ Moderate (water slightly green tinted)
☐ Abundant (water appears green)

Aquatic Plants In Stream:
Submerged: ☐ None ☑ Sparse ☐ Moderate ☐ Abundant
Emergent: ☐ None ☑ Sparse ☐ Moderate ☐ Abundant
Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Aquatic Life Observed:
☒ Fish ☐ Snails ☐ Crawfish ☐ Macroinvertebrates

Wildlife/Livestock In or Around Stream (evidence of):
☐ Cattle ☒ Beaver ☐ Deer ☐ Other

Reach Impacts: (circle impact level 1=minor, 2=moderate, 3=major, and tag with a GPS waypoint(s) (Wpt) ID)
☐ Outfalls(OT): 1 2 3 Wpt
☐ Stream Crossing(SC): 1 2 3 Wpt
☑ Bank Erosion(ER) : 1 [✓ 2] 3 Wpt see ENT's gps
☐ Channel Modification(CM) : 1 2 3 Wpt
☑ Impacted Buffers(IB): 1 [✓ 2] 3 Wpt ag on either side
☐ Trash(TR): 1 2 3 Wpt
☐ Utilities(UT): 1 2 3 Wpt
☐ Other: 1 2 3 Wpt
Notes:

If any of these impacts are significant use back of page 1 (pg. 2) for detailed description.

Channel Dynamics:
☐ Incised (degrading) ☐ Channelized ☐ Bed Scour ☐ Sediment Deposition
☐ Widening ☐ Aggrading ☐ Bank Failure ☐ Culvert Scour (upstream / downstream / top)
☐ Headcutting ☑ Bank scour ☐ Slope failure ☐ None (natural stabile channel)

Channel Dimensions (facing downstream):
Lt bank Ht: 5 (ft) Bankfull Depth 7.5 (ft) Wetted Width: 32 (ft) Riffle/Run Depth 0.5 (ft)
Rt bank Ht: 6 (ft) Bankfull Width 36 (ft)) TOB Width: 56 (ft) Pool Depth 2 (ft)

Channel Stability:
Lt Bank: Angle 55 degrees
LtBank Vegetation protection: 75 % cover
LtBank Erosion Hazard: L [✓ M] H VH EX (circle one)
Length Lt Bank Affected: less than right
Wpt(s): Check ENT's gps
Rt Bank: Angle 60 degrees
RtBank Vegetation protection 60 % cover
RtBank Erosion Hazard: L M [✓ H] VH EX (circle one)
Length Rt Bank Affected:
Wpt(s): ←

Reach Accessibility For Restoration

Good: Open area in public ownership. Easy stream channel access by vehicle.		**Fair:** Forested or developed near stream. Vehicle access limited.		**Difficult:** Must cross wetland, steep slope, heavy forest or sensitive areas to get to stream. Access by foot/ATV only.
5	4	[✓ 3]	2	1

Notes: (biggest problem(s) you see in survey reach)
The farmes are cutting right up to the banks in spots on either side 10-12 ft from stream. Too much energy when high flow events occur scouring banks

Place sketch of reach on back of page.

Restoration Potential:
☑ Riparian reforestation ☐ Bank stabilization
☐ Stormwater retrofit ☐ Outfall stabilization
☐ Channel modification ☐ PS investigation
☐ Culvert rehab. ☐ Other

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

Unified Stream Assessment (USA)

REACH ID: GC-1	**STREAM:** Gala Creek	**DATE/TIME:** 8/14/19	**INITIALS:** ENJ/DKF

REACH START wpt 47
LAT: 35° 13.383'
LONG: 93° 2.433

REACH END 49 wpt
LAT: 35 13.640
LONG: 93° 02.324

Average Conditions (check applicable)

Weather – Antecedent (24-h) Rain in past 72-h: [✓ y]/ n
☐Heavy rain ☐Steady rain ☐Showers ☑Clear/sunny
☐Mostly cloudy ☐Partly cloudy

Weather – Current conditions
☐Heavy rain ☑Steady rain ☐Showers ☐Clear/sunny
☐Mostly cloudy ☐Partly cloudy

Stream Classification
☐ Perennial ☑ Intermittent ☐ Ephemeral ☐ Tidal
☐ Coldwater ☐ Coolwater ☐ Warmwater Order_____

Stream Origin
☐ Spring-fed ☑ Mixture of origins ☐ Glacial
☐ Montane (non-glacial) ☐ Swamp/bog ☐ Other________

Hydrology
Flow: ☐ High ☐ Moderate ☑ Low ☐ None
Base Flow as %Channel Width: ☑0-25% ☐50-75% ☐25-50% ☐75-100% **Flows Measured:** Yes / [✓ No]
Stream Gradient: ☐ High (≥25ft/mi) ☐ Moderate (10-24 ft/mi) ☑ Low (<10 ft/mi) ~Slope: ________ft/mi
Sinuosity: ☐ High ☑ Moderate ☐ Low

Channel Morphology **System:** Step/Pool - [✓ Riffle/Pool] - Pool (circle)
☑Riffle 5 % ☑ Run 15 % ☑Pool 50 % ☐ Steps ______%

Dominant Substrate
☑Silt/clay (fine or slick) ☐Cobble (2.5-10")
☐Sand (gritty) ☐Boulder (>10")
☐Gravel (0.1-2.5") ☐Bed Rock

Dominant In-Stream Habitats
☑Woody Debris ☑Root Wads ☐Leaf Packs
☐Deposition ☐Undercut Bank
☐Aquatic Plants ☑Overhanging Vegetation
Habitat Quality: ☐Poor ☑Fair ☐Good ☐ Optimal

Land use
☐ Forest _____% ☑ Pasture 100 % ☐ Urban _____%
☐ Commercial_____% ☐ Row Crops _____%
☐ Hay_____% ☐ Industrial_____% ☐ Sub-Urban____%

Local Watershed NPS Pollution
☐ Industrial Storm Water
☐ Urban/Sub-Urban Storm Water ☐ Row crops
☑ Cattle ☐ Other_____________ ☐ No evidence

Riparian Buffer
Vegetation Type: ☑ Forest 10 % ☐ Shrub/Sapling ____% ☐ Herbs/Grasses ____% ☑ Turf/Crops 90 %
Riparian Width: ☐<10 ft ☐11-25 ft ☐ 26-50 ft ☑ > 50 ft 10-30 ft forest then pasture

Stream Shading (water surface)
☑Mostly shaded (≥75% coverage) ☐Partially shaded (≥25% coverage)
☐Halfway shaded (≥50% coverage) ☐Unshared (<25% coverage)

Water Quality Observations

Odors Noted:
☐ Normal/None ☐ Sewage ☐ Anaerobic
☐ Petroleum ☐ Chemical ☐ Fishy ☑ Other Cattle

Water Surface Appearance:
☐ Slick ☐ Sheen ☐ Globs
☐ Flecks ☑ None ☐ Other__________

Turbidity/Water Clarity:
☐ Clear ☑ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other_____________

Sediment Deposits: ☐ None ☐ Sludge ☐ Sawdust ☐ Oils ☑ Sand ☐ Relict shells

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* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA, Cont.

REACH ID: GC-1	**STREAM:** Gala Creek	**DATE/TIME:** 8/14/19	**INITIALS:** ENT/DKF
OTHER INFO:			

Average Conditions (check applicable)

Flood Plain Dynamics

Connection: ☑ Poor ☐ Fair ☐ Good

Habitat: ☑ Poor ☑ Fair ☐ Good

Vegetation: ☑ Forest ☐ Shrub/Sapling ☐ Tall grasses ☑ Turf/crops

Encroachment: ☑ Poor ☐ Fair ☐ Good

Periphyton (attached algae):

Filamentous: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Prostrate: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Suspended Algae (phytoplankton) abundance:

☑ None noticeable (water basically clear)

☐ Moderate (water slightly green tinted)

☐ Abundant (water appears green)

Aquatic Plants In Stream:

Submerged: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Emergent: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Aquatic Life Observed:

☑ Fish ☑ Snails ☑ Crawfish ☐ Macroinvertebrates

Wildlife/Livestock In or Around Stream (evidence of):

☑ Cattle ☑ Beaver ☐ Deer ☐ Other________

Reach Impacts: (circle impact level 1=minor, 2=moderate, 3=major, and tag with a GPS waypoint(s) (Wpt) ID)

☐ Outfalls(OT): 1 2 3 Wpt________

☐ Stream Crossing(SC): 1 2 3 Wpt________

☑ Bank Erosion(ER): 1 [✓ 2] 3 Wpt________

☐ Channel Modification(CM): 1 2 3 Wpt________

☑ Impacted Buffers(IB): 1 [✓ 2] [✓ 3] Wpt________

☐ Trash(TR): 1 2 3 Wpt________

☐ Utilities(UT): 1 2 3 Wpt________

☐ Other________: 1 2 3 Wpt________

Notes:

If any of these impacts are significant use back of page 1 (pg. 2) for detailed description.

Channel Dynamics:

☐ Incised (degrading) ☐ Widening ☐ Headcutting

☐ Channelized ☐ Aggrading ☑ Bank scour

☐ Bed Scour ☑ Bank Failure ☐ Slope failure

☐ Sediment Deposition ☐ Culvert Scour (upstream / downstream / top) ☐ None (natural stabile channel)

Channel Dimensions (facing downstream):

Lt bank Ht: 12 (ft) Bankfull Depth 3.0 (ft) Wetted Width: 15 (ft) Riffle/Run Depth 0.3 (ft)

Rt bank Ht: 14 (ft) Bankfull Width 25 (ft)) TOB Width: 40 (ft) Pool Depth 3 (ft)

Channel Stability:

Lt Bank: Angle 65 degrees

LtBank Vegetation protection: 60 % cover

LtBank Erosion Hazard: [✓ L] M H VH EX (circle one)

Length Lt Bank Affected: refer to BEHI

Wpt(s): ENT's gps

Rt Bank: Angle 70 degrees

RtBank Vegetation protection 55 % cover

RtBank Erosion Hazard: L [✓ M] H VH EX (circle one)

Length Rt Bank Affected: ←

Wpt(s): ←

Reach Accessibility For Restoration

Good: Open area in public ownership. Easy stream channel access by vehicle.	**Fair:** Forested or developed near stream. Vehicle access limited.	**Difficult:** Must cross wetland, steep slope, heavy forest or sensitive areas to get to stream. Access by foot/ATV only.

5 4 [✓ 3] 2 1

Notes: (biggest problem(s) you see in survey reach)

Property owners adjacent to stream are mowing to 5-25 ft of river. Also evidence of cattle in ~~the~~ Most of the legth of the stream

Place sketch of reach on back of page.

Restoration Potential:

☑ Riparian reforestation ☐ Bank stabilization

☐ Stormwater retrofit ☐ Outfall stabilization

☐ Channel modification ☐ PS investigation

☐ Culvert rehab. ☐ Other ________

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* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA Reach Impact Data Detail Sheet (optional)

Reach ID/Stream: GC-1	**Date:** 8/14/19	**Initials:** ENJ DKF

Impact I.D.[1]	Coordinates (Lat / Long) or Waypoint	Severity (1-3)[2]	Restoration Opportunity (1-3)[3]	Description
N/A				

BEHI I.D.	Coordinates (Lat / Long) or Waypoint	Bank Erosion Hazard	Bank Lth. (ft)	Rest. Opp. (1-3)[3]	Bank information for BEHI
ER 1	wypt 41 ENJ Both Banks RB is much worse	L [✓ M] [✓ H] VH EX (circle one)	4 yds	2	landowner mows up to RB RB LB / RB LB Bank: Height 12 8 ft, Angle 75 55 Deg Protection: Roots 15 %, Root Depth 3 ft Vegetation 25 % [4]Material: [✓ Silt/Clay] [✓ Sand] / Gravel Cobble - % 50/50
ER	LB Began c wypt 41 all the way to wypt 42	L [✓ M] H VH EX (circle one)	36 yds + 314	2	Bank: Height 6 ft, Angle 85 Deg Protection: Roots 25 %, Root Depth 6 ft Vegetation 35 % [4]Material: [✓ Silt/Clay] [✓ Sand] / Gravel Cobble - % 50/50
ER	wypt 43 to wypt 44	L M [✓ H] VH EX (circle one)	[illegible] refer to GPS pts	1	Bank: Height 9 ft, Angle 80 Deg Protection: Roots 45 %, Root Depth 3.5 ft Vegetation 40 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - % 50/50
ER	wypt 46 RB ↑ at end	L [✓ M] H VH EX (circle one)	[illegible] 28 yds	2	Bank: Height 6.5 ft, Angle 20 Deg Protection: Roots 55 %, Root Depth 4.5 ft Vegetation 5 % [4]Material: [✓ Silt/Clay] [✓ Sand] / Gravel Cobble - % 50/50
ER	17 yds u/s of 47 wpt	[✓ L] M H VH EX (circle one)	refer to GPS	1	Bank: Height 8 ft, Angle 85 Deg Protection: Roots 30 %, Root Depth 4.5 ft Vegetation 50 % [4]Material: [✓ Silt/Clay] [✓ Sand] / Gravel Cobble - % 60/50

[1] Impacts: Outfall(OT), Bank Erosion(ER), Impacted buffer(IB), Utilities in channel(UT), Stream crossing(SC), Channel modification(CM), Trash in stream(TR), other.

[2] Severity: 1=minor, 2=moderate, 3=severe

[3] Restoration Potential: 1=minimal, 2=moderate, 3=high

[4] Bank material: circle base type, silt/clay or sand and if present circle rock type and note %.

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

Unified Stream Assessment (USA)

REACH ID: LC-1	**STREAM:** Little Creek	**DATE/TIME:** 4/30/14 835	**INITIALS:** [illegible]
REACH START [illegible]		**REACH END** [illegible] 930	
LAT:		**LAT:**	
LONG:		**LONG:**	

Average Conditions (check applicable)

Weather – Antecedent (24-h) Rain in past 72-h: y / n
☐Heavy rain ☐Steady rain ☐Showers ☐Clear/sunny
☑Mostly cloudy ☐Partly cloudy

Weather – Current conditions
☐Heavy rain ☐Steady rain ☐Showers ☐Clear/sunny
☑Mostly cloudy ☐Partly cloudy

Stream Classification
☐ Perennial ☑ Intermittent ☐ Ephemeral ☐ Tidal
☐ Coldwater ☐ Coolwater ☐ Warmwater Order_____

Stream Origin
☐ Spring-fed ☑ Mixture of origins ☐ Glacial
☐ Montane (non-glacial) ☐ Swamp/bog ☐ Other________

Hydrology
Flow: ☐ High ☑ Moderate ☐ Low ☐ None
Base Flow as %Channel Width: ☐0-25% ☐50-75% ☐25-50% ☑75-100% **Flows Measured:** Yes / [✓ No]
Stream Gradient: ☐ High (≥25ft/mi) ☐ Moderate (10-24 ft/mi) ☑ Low (<10 ft/mi) ~Slope: ________ft/mi
Sinuosity: ☐ High ☐ Moderate ☑ Low

Channel Morphology **System:** Step/Pool - Riffle/Pool - Pool (circle)
☑ Riffle 15 % ☑ Run 10 % ☑ Pool 75 % ☐ Steps ______%

Dominant Substrate
☐Silt/clay (fine or slick) ☑Cobble (2.5-10") [illegible]
☐Sand (gritty) ☐Boulder (>10")
☐Gravel (0.1-2.5") ☑Bed Rock

Dominant In-Stream Habitats
☑Woody Debris ☑Root Wads ☐Leaf Packs
☐Deposition ☐Undercut Bank ☑ [illegible]
☐Aquatic Plants ☐Overhanging Vegetation
Habitat Quality: ☐Poor ☐Fair ☐Good ☐ Optimal

Land use
☐ Forest _____% ☐ Pasture _____% ☑ Urban 100%
☐ Commercial_____% ☐ Row Crops _____%
☐ Hay_____% ☐ Industrial_____% ☐ Sub-Urban____%

Local Watershed NPS Pollution
☑ Industrial Storm Water
☑ Urban/Sub-Urban Storm Water ☐ Row crops
☐ Cattle ☐ Other____________ ☐ No evidence

Riparian Buffer
Vegetation Type: ☑ Forest 20 % ☑ Shrub/Sapling 80 % ☐ Herbs/Grasses ____% ☐ Turf/Crops ____%
Riparian Width: ☐<10 ft ☑11-25 ft ☐ 26-50 ft ☐ > 50 ft

Stream Shading (water surface)
☐Mostly shaded (≥75% coverage) ☐Partially shaded (≥25% coverage)
☑Halfway shaded (≥50% coverage) ☐Unshaded (<25% coverage)

Water Quality Observations

Odors Noted:
☑ Normal/None ☑ Sewage ☐ Anaerobic
☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other____________

Water Surface Appearance:
☐ Slick ☐ Sheen ☐ Globs
☐ Flecks ☑ None ☐ Other__________

Turbidity/Water Clarity:
☑ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other________________

Sediment Deposits: ☑ None ☐ Sludge ☐ Sawdust ☐ Oils ☐ Sand ☐ Relict shells

[*] Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA Reach Impact Data Detail Sheet (optional)

Reach ID/Stream:	Date:	Initials:
Little Creek	4/30/19	ENT/WHG

Impact I.D.[1]	Coordinates (Lat / Long) or Waypoint	Severity (1-3)[2]	Restoration Opportunity (1-3)[3]	Description
1	SW-1	1	1	SW outfall from road ditch
2	Bridge no gps there	1	1	Bridge
3	SW-2	2	2	Trash in outfall, been concreted
4	SW-3	1	1	outfall from facility on d/S left bank barely dripping

BEHI I.D.	Coordinates (Lat / Long) or Waypoint	Bank Erosion Hazard	Bank Lth. (ft)	Rest. Opp. (1-3)[3]	Bank information for BEHI
ER	No real bank erosion in places it might there was bedrock protecting it.	L M H VH EX (circle one)			Bank: Height _________ft, Angle _________Deg Protection: Roots_______%, Root Depth ______ft Vegetation _______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER	2 spots had been restored w/ riprap on both sides WHG	L M H VH EX (circle one)			Bank: Height _________ft, Angle _________Deg Protection: Roots_______%, Root Depth ______ft Vegetation _______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER	has notes + ENT has pics	L M H VH EX (circle one)			Bank: Height _________ft, Angle _________Deg Protection: Roots_______%, Root Depth ______ft Vegetation _______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height _________ft, Angle _________Deg Protection: Roots_______%, Root Depth ______ft Vegetation _______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height _________ft, Angle _________Deg Protection: Roots_______%, Root Depth ______ft Vegetation _______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____

[1] Impacts: Outfall(OT), Bank Erosion(ER), Impacted buffer(IB), Utilities in channel(UT), Stream crossing(SC), Channel modification(CM), Trash in stream(TR), other.

[2] Severity: 1=minor, 2=moderate, 3=severe

[3] Restoration Potential: 1=minimal, 2=moderate, 3=high

[4] Bank material: circle base type, silt/clay or sand and if present circle rock type and note %.

[*] Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

from bowling up

Unified Stream Assessment (USA)

REACH ID: LC-1	**STREAM:** Little Creek	**DATE/TIME:** 4/30/19 815	**INITIALS:** ENT/WHG

REACH START ENT GPS	**REACH END** finished by 930
LAT:	**LAT:**
LONG:	**LONG:**

Average Conditions (check applicable)

Weather – Antecedent (24-h) Rain in past 72-h: y / n
☐ Heavy rain ☐ Steady rain ☐ Showers ☐ Clear/sunny
☑ Mostly cloudy ☐ Partly cloudy

Weather – Current conditions
☐ Heavy rain ☐ Steady rain ☐ Showers ☐ Clear/sunny
☑ Mostly cloudy ☐ Partly cloudy

Stream Classification
☐ Perennial ☑ Intermittent ☐ Ephemeral ☐ Tidal
☐ Coldwater ☐ Coolwater ☐ Warmwater Order_____

Stream Origin
☐ Spring-fed ☑ Mixture of origins ☐ Glacial
☐ Montane (non-glacial) ☐ Swamp/bog ☐ Other________

Hydrology
Flow: ☐ High ☑ Moderate ☐ Low ☐ None
Base Flow as %Channel Width: ☐ 0-25% ☐ 50-75% ☐ 25-50% ☑ 75-100% **Flows Measured:** Yes / [✓ No]
Stream Gradient: ☐ High (≥25ft/mi) ☐ Moderate (10-24 ft/mi) ☑ Low (<10 ft/mi) ~Slope: ________ft/mi
Sinuosity: ☐ High ☐ Moderate ☑ Low

Channel Morphology **System:** Step/Pool - Riffle/Pool - Pool (circle)
☑ Riffle 15 % ☑ Run 10 % ☑ Pool 75 % ☐ Steps ______%

Dominant Substrate
☐ Silt/clay (fine or slick)
☐ Sand (gritty)
☐ Gravel (0.1-2.5")
☑ Cobble (2.5-10") mostly this on average
☐ Boulder (>10")
☑ Bed Rock

Dominant In-Stream Habitats
☑ Woody Debris ☑ Root Wads ☐ Leaf Packs
☐ Deposition ☐ Undercut Bank ☑ Boulders
☐ Aquatic Plants ☐ Overhanging Vegetation
Habitat Quality: ☐ Poor ☐ Fair ☐ Good ☐ Optimal

Land use
☐ Forest _____% ☐ Pasture _____% ☑ Urban 100 %
☐ Commercial_____% ☐ Row Crops _____%
☐ Hay_____% ☐ Industrial_____% ☐ Sub-Urban____%

Local Watershed NPS Pollution
☑ Industrial Storm Water
☑ Urban/Sub-Urban Storm Water ☐ Row crops
☐ Cattle ☐ Other_____________ ☐ No evidence

Riparian Buffer
Vegetation Type: ☑ Forest 20 % ☑ Shrub/Sapling 80 % ☐ Herbs/Grasses ____% ☐ Turf/Crops ____%
Riparian Width: ☐ <10 ft ☑ 11-25 ft ☐ 26-50 ft ☐ > 50 ft

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage) ☐ Partially shaded (≥25% coverage)
☑ Halfway shaded (≥50% coverage) ☐ Unshaded (<25% coverage)

Water Quality Observations

Odors Noted:
☑ Normal/None ☑ Sewage ☐ Anaerobic
☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other____________

Water Surface Appearance:
☐ Slick ☐ Sheen ☐ Globs
☐ Flecks ☑ None ☐ Other__________

Turbidity/Water Clarity:
☑ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other________________

Sediment Deposits: ☑ None ☐ Sludge ☐ Sawdust ☐ Oils ☐ Sand ☐ Relict shells

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* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA, Cont.

REACH ID: LC-1
STREAM: Little Creek
DATE/TIME: 4/30/19 815
INITIALS: ENT/WHG
OTHER INFO:

Average Conditions (check applicable)

Flood Plain Dynamics
Connection: ☐ Poor ☑ Fair ☑ Good
Habitat: ☐ Poor ☑ Fair ☐ Good
Vegetation: ☑ Forest ☑ Shrub/Sapling ☐ Tall grasses ☐ Turf/crops
Encroachment: ☐ Poor ☐ Fair ☐ Good

Periphyton (attached algae):
Filamentous: ☐ None ☑ Sparse ☐ Moderate ☐ Abundant
Prostrate: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Suspended Algae (phytoplankton) abundance:
☑ None noticeable (water basically clear)
☐ Moderate (water slightly green tinted)
☐ Abundant (water appears green)

Aquatic Plants In Stream:
Submerged: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Emergent: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Aquatic Life Observed:
☑ Fish ☐ Snails ☑ Crawfish ☑ Macroinvertebrates

Wildlife/Livestock In or Around Stream (evidence of):
☐ Cattle ☐ Beaver ☐ Deer ☐ Other________

Reach Impacts: (circle impact level 1=minor, 2=moderate, 3=major, and tag with a GPS waypoint(s) (Wpt) ID)
☑ Outfalls(OT): 1 2 3 Wpt SW outfall(s)
☐ Stream Crossing(SC): 1 2 3 Wpt________
☐ Bank Erosion(ER): 1 2 3 Wpt________
☐ Channel Modification(CM): 1 2 3 Wpt________
☐ Impacted Buffers(IB): 1 2 3 Wpt________
☐ Trash(TR): 1 2 3 Wpt________
☐ Utilities(UT): 1 2 3 Wpt________
☐ Other________: 1 2 3 Wpt________
Notes:

If any of these impacts are significant use back of page 1 (pg. 2) for detailed description.

Channel Dynamics:
☐ Incised (degrading) ☐ Channelized ☐ Bed Scour ☐ Sediment Deposition
☐ Widening ☐ Aggrading ☐ Bank Failure ☑ Culvert Scour (upstream / downstream / top)
☐ Headcutting ☐ Bank scour ☐ Slope failure ☐ None (natural stabile channel)

Channel Dimensions (facing downstream):
Lt bank Ht: 2 (ft) Bankfull Depth 1 (ft) Wetted Width: 17 (ft) Riffle/Run Depth 0.4 (ft)
Rt bank Ht: 2 (ft) Bankfull Width 25 (ft)) TOB Width: 25 (ft) Pool Depth 0.8 (ft)

Channel Stability:
Lt Bank: Angle 75 degrees
LtBank Vegetation protection: 85 % cover
LtBank Erosion Hazard: [✓ L] M H VH EX (circle one)
Length Lt Bank Affected: None
Wpt(s):________

Rt Bank: Angle 20 degrees
RtBank Vegetation protection 90 % cover
RtBank Erosion Hazard: [✓ L] M H VH EX (circle one)
Length Rt Bank Affected: None
Wpt(s):________

Reach Accessibility For Restoration

Good: Open area in public ownership. Easy stream channel access by vehicle.	**Fair:** Forested or developed near stream. Vehicle access limited.	**Difficult:** Must cross wetland, steep slope, heavy forest or sensitive areas to get to stream. Access by foot/ATV only.

5 4 [✓ 3] 2 1

Notes: (biggest problem(s) you see in survey reach)

Restoration Potential:
☐ Riparian reforestation ☐ Bank stabilization
☑ Stormwater retrofit ☐ Outfall stabilization
☐ Channel modification ☐ PS investigation
☐ Culvert rehab. ☐ Other________

Place sketch of reach on back of page.

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

Unified Stream Assessment (USA)

REACH ID: SD-1	**STREAM:** Stone Dam	**DATE/TIME:** 4/30/19 940	**INITIALS:** ENJ/WHG

REACH START	**REACH END**
LAT:	**LAT:**
LONG:	**LONG:**

Average Conditions (check applicable)

Weather – Antecedent (24-h) Rain in past 72-h: y / n
☐Heavy rain ☐Steady rain ☐Showers ☐Clear/sunny
☑Mostly cloudy ☐Partly cloudy

Weather – Current conditions
☐Heavy rain ☐Steady rain ☐Showers ☐Clear/sunny
☑Mostly cloudy ☐Partly cloudy

Stream Classification
☐ Perennial ☑ Intermittent ☐ Ephemeral ☐ Tidal
☐ Coldwater ☐ Coolwater ☐ Warmwater Order_____

Stream Origin
☐ Spring-fed ☑ Mixture of origins ☐ Glacial
☐ Montane (non-glacial) ☐ Swamp/bog ☐ Other________

Hydrology
Flow: ☐ High ☑ Moderate ☐ Low ☐ None
Base Flow as %Channel Width: ☐0-25% ☐50-75% ☑25-50% ☐75-100% **Flows Measured:** Yes / No
Stream Gradient: ☐ High (≥25ft/mi) ☐ Moderate (10-24 ft/mi) ☑ Low (<10 ft/mi) ~Slope: ________ft/mi
Sinuosity: ☐ High ☐ Moderate ☑ Low

Channel Morphology **System:** Step/Pool - Riffle/Pool - Pool (circle)
☑ Riffle 10 % ☑ Run 5 % ☑ Pool 85 % ☐ Steps ______%

Dominant Substrate
☐Silt/clay (fine or slick) ☑Cobble (2.5-10")
☐Sand (gritty) ☐Boulder (>10")
☐Gravel (0.1-2.5") ☐Bed Rock

Dominant In-Stream Habitats
☑Woody Debris ☐Root Wads ☐Leaf Packs
☐Deposition ☐Undercut Bank
☐Aquatic Plants ☑Overhanging Vegetation
Habitat Quality: ☐Poor ☑Fair ☐Good ☐ Optimal

Land use
☑ Forest 10 % ☐ Pasture _____% ☑ Urban 40 %
☐ Commercial_____% ☐ Row Crops _____%
☐ Hay_____% ☐ Industrial_____% ☑ Sub-Urban ~~40~~ 50 %

Local Watershed NPS Pollution
☐ Industrial Storm Water
☑ Urban/Sub-Urban Storm Water ☐ Row crops
☐ Cattle ☐ Other____________ ☐ No evidence

Riparian Buffer
Vegetation Type: ☑ Forest 40 % ☑ Shrub/Sapling 60 % ☐ Herbs/Grasses ____% ☑ Turf/Crops 20 %
Riparian Width: ☐<10 ft ☑11-25 ft ☐ 26-50 ft ☐ > 50 ft

Stream Shading (water surface)
☐Mostly shaded (≥75% coverage) ☐Partially shaded (≥25% coverage)
☑Halfway shaded (≥50% coverage) ☐Unshared (<25% coverage)

Water Quality Observations

Odors Noted:
☑ Normal/None ☐ Sewage ☐ Anaerobic
☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other____________

Water Surface Appearance:
☐ Slick ☐ Sheen ☐ Globs
☐ Flecks ☑ None ☐ Other___________

Turbidity/Water Clarity:
☑ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other______________

Sediment Deposits: ☑ None ☐ Sludge ☐ Sawdust ☐ Oils ☐ Sand ☐ Relict shells

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* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA Reach Impact Data Detail Sheet (optional)

Reach ID/Stream: SD-1	**Date:** 4/30/19	**Initials:** ENT/WHG

Impact I.D.[1]	**Coordinates (Lat / Long) or Waypoint**	**Severity (1-3)**[2]	**Restoration Opportunity (1-3)**[3]	**Description**
1	at or near Start	1	2	low water crossing & outfall
2	SW/1 ENT	1	1	SW outfall Point
3	SD 10-3 GPS	1	2	Low water crossing
4	SD SW-2	1	2	SW outfall/ Tributary crossing
5	SD 10-3	1	2	Low water crossing
6	SD-10-4	1	2	"

BEHI I.D.	**Coordinates (Lat / Long) or Waypoint**	**Bank Erosion Hazard**	**Bank Lth. (ft)**	**Rest. Opp. (1-3)**[3]	**Bank information for BEHI**
ER -1	ENT ER-1 GPS	[✓ L] M H VH EX (circle one)	60ft [illegible] ER-1 end	1	Bank: Height 3 ft, Angle 90 Deg Protection: Roots 35 %, Root Depth 2.5 ft Vegetation 15 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - %____
ER	SD 10-5	L [✓ M] [✓ H] VH EX (circle one)	150ft	3	Bank: Height 3.75 ft, Angle 70 Deg Protection: Roots 5 %, Root Depth 1.5 ft Vegetation 5 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle _________Deg Protection: Roots_______%, Root Depth ______ft Vegetation _______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle _________Deg Protection: Roots_______%, Root Depth ______ft Vegetation _______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle _________Deg Protection: Roots_______%, Root Depth ______ft Vegetation _______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____

[1] Impacts: Outfall(OT), Bank Erosion(ER), Impacted buffer(IB), Utilities in channel(UT), Stream crossing(SC), Channel modification(CM), Trash in stream(TR), other.

[2] Severity: 1=minor, 2=moderate, 3=severe

[3] Restoration Potential: 1=minimal, 2=moderate, 3=high

[4] Bank material: circle base type, silt/clay or sand and if present circle rock type and note %.

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA, Cont.

REACH ID: SD-1
STREAM: Stone Dam
DATE/TIME: 4/30/19 940
INITIALS: EM/WHG
OTHER INFO:

Average Conditions (check applicable)

Flood Plain Dynamics
Connection: ☐ Poor ☑ Fair ☐ Good
Habitat: ☐ Poor ☑ Fair ☐ Good
Vegetation: ☑ Forest ☑ Shrub/Sapling ☐ Tall grasses ☑ Turf/crops
Encroachment: ☐ Poor ☑ Fair ☐ Good

Periphyton (attached algae):
Filamentous: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Prostrate: ☐ None ☐ Sparse ☑ Moderate ☐ Abundant
Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Suspended Algae (phytoplankton) abundance:
☑ None noticeable (water basically clear)
☐ Moderate (water slightly green tinted)
☐ Abundant (water appears green)

Aquatic Plants In Stream:
Submerged: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Emergent: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Aquatic Life Observed:
☑ Fish ☐ Snails ☑ Crawfish ☐ Macroinvertebrates

Wildlife/Livestock In or Around Stream (evidence of):
☐ Cattle ☐ Beaver ☐ Deer ☐ Other________

Reach Impacts: (circle impact level 1=minor, 2=moderate, 3=major, and tag with a GPS waypoint(s) (Wpt) ID)
☑ Outfalls(OT): [✓ 1] 2 3 Wpt________
☑ Stream Crossing(SC): 1 2 3 Wpt________
☑ Bank Erosion(ER) : [✓ 1] 2 3 Wpt________
☐ Channel Modification(CM) : 1 2 3 Wpt________
☑ Impacted Buffers(IB): [✓ 1] 2 3 Wpt________
☑ Trash(TR): [✓ 1] 2 3 Wpt________
☐ Utilities(UT): 1 2 3 Wpt________
☑ Other Low water crossing: 1 2 [✓ 3] Wpt [illegible]
Notes:

If any of these impacts are significant use back of page 1 (pg. 2) for detailed description.

Channel Dynamics:
☐ Incised (degrading)
☐ Widening
☐ Headcutting
☐ Channelized
☐ Aggrading
☑ Bank scour
☐ Bed Scour
☐ Bank Failure
☐ Slope failure
☐ Sediment Deposition
☑ Culvert Scour (upstream / downstream / top)
☐ None (natural stabile channel)

Channel Dimensions (facing downstream):
Lt bank Ht: 4 (ft) Bankfull Depth 1.5 (ft) Wetted Width: 34 (ft) Riffle/Run Depth 0.8 (ft)
Rt bank Ht: 4.5 (ft) Bankfull Width 36 (ft)) TOB Width: 50 (ft) Pool Depth 3.5 (ft)

Channel Stability:
Lt Bank: Angle 35 degrees
LtBank Vegetation protection: 85 % cover
LtBank Erosion Hazard: L M H VH EX (circle one)
Length Lt Bank Affected: 0%
Wpt(s):________
Rt Bank: Angle 45 degrees
RtBank Vegetation protection 75 % cover
RtBank Erosion Hazard: L M H VH EX (circle one)
Length Rt Bank Affected: 30%
Wpt(s):________

Reach Accessibility For Restoration

Good: Open area in public ownership. Easy stream channel access by vehicle.	**Fair:** Forested or developed near stream. Vehicle access limited.	**Difficult:** Must cross wetland, steep slope, heavy forest or sensitive areas to get to stream. Access by foot/ATV only.

5 4 3 2 1

Notes: (biggest problem(s) you see in survey reach)

Place sketch of reach on back of page.

Restoration Potential:
☑ Riparian reforestation
☐ Stormwater retrofit
☑ Channel modification
☐ Culvert rehab.
☑ Bank stabilization
☑ Outfall stabilization
☐ PS investigation
☑ Other LW Crossing

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* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

Unified Stream Assessment (USA)

REACH ID: TB-1
STREAM: Tyelo Bayou
DATE/TIME: 4/30/19 1530
INITIALS: EN/WHG

REACH START
LAT:
LONG:

REACH END
LAT:
LONG:

Average Conditions (check applicable)

Weather – Antecedent (24-h) Rain in past 72-h: y / n
☐Heavy rain ☐Steady rain ☐Showers ☑Clear/sunny
☐Mostly cloudy ☑Partly cloudy

Weather – Current conditions
☐Heavy rain ☐Steady rain ☐Showers ☑Clear/sunny
☐Mostly cloudy ☑Partly cloudy

Stream Classification
☑ Perennial ☐ Intermittent ☐ Ephemeral ☐ Tidal
☐ Coldwater ☐ Coolwater ☐ Warmwater Order_____

Stream Origin
☐ Spring-fed ☑ Mixture of origins ☐ Glacial
☐ Montane (non-glacial) ☐ Swamp/bog ☐ Other________

Hydrology
Flow: ☐ High ☑ Moderate ☐ Low ☐ None
Base Flow as %Channel Width: ☐0-25% ☑50-75% ☐25-50% ☐75-100%
Flows Measured: Yes [✓ No]
Stream Gradient: ☐ High (≥25ft/mi) ☐ Moderate (10-24 ft/mi) ☑ Low (<10 ft/mi)
~Slope: ________ft/mi
Sinuosity: ☐ High ☐ Moderate ☑ Low

Channel Morphology
System: Step/Pool - Riffle/Pool - Pool (circle)
☑ Riffle 5 % ☑ Run 15 % ☑ Pool 80 % ☐ Steps ______%

Dominant Substrate
☑Silt/clay (fine or slick) ☐Cobble (2.5-10")
☐Sand (gritty) ☐Boulder (>10")
☐Gravel (0.1-2.5") ☐Bed Rock

Dominant In-Stream Habitats
☑Woody Debris ☑Root Wads ☐Leaf Packs
☐Deposition ☑Undercut Bank
☐Aquatic Plants ☑Overhanging Vegetation
Habitat Quality: ☐Poor ☑Fair ☐Good ☐ Optimal

Land use
☐ Forest _____% ☐ Pasture _____% ☐ Urban _____%
☐ Commercial_____% ☑ Row Crops 100 %
☐ Hay_____% ☐ Industrial_____% ☐ Sub-Urban____%

Local Watershed NPS Pollution
☐ Industrial Storm Water
☐ Urban/Sub-Urban Storm Water ☑ Row crops
☐ Cattle ☐ Other____________ ☐ No evidence

Riparian Buffer
Vegetation Type: ☐ Forest ____% ☑ Shrub/Sapling 10 % ☑ Herbs/Grasses 10 % ☑ Turf/Crops 80 %
Riparian Width: ☑<10 ft ☐11-25 ft ☐ 26-50 ft ☐ > 50 ft

Stream Shading (water surface)
☐Mostly shaded (≥75% coverage) ☑Partially shaded (≥25% coverage)
☐Halfway shaded (≥50% coverage) ☐Unshared (<25% coverage)

Water Quality Observations

Odors Noted:
☑ Normal/None ☐ Sewage ☐ Anaerobic
☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other____________

Water Surface Appearance:
☐ Slick ☐ Sheen ☐ Globs
☐ Flecks ☑ None ☐ Other__________

Turbidity/Water Cl[illegible]y:
☐ Clear ☐ Slightly turbid ☑ Turbid
☐ Opaque ☐ Stained ☐ Other_______________

Sediment Deposits: ☑ None ☐ Sludge ☐ Sawdust ☐ Oils ☐ Sand ☐ Relict shells

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* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA Reach Impact Data Detail Sheet (optional)

Reach ID/Stream:	Date:	Initials:
TB-1	4/30/19	EMS/WMG

Impact I.D.[1]	Coordinates (Lat / Long) or Waypoint	Severity (1-3)[2]	Restoration Opportunity (1-3)[3]	Description
1	GL SW1	1	1	sw outfall draining ~~near~~ nearby fields
2	11 wypt [illegible]	1	1	sw outfall draining nearby fields

BEHI I.D.	Coordinates (Lat / Long) or Waypoint	Bank Erosion Hazard	Bank Lth. (ft)	Rest. Opp. (1-3)[3]	Bank information for BEHI Left
ER	The entire reach was eroded that we looked at	L M [✓ H] VH EX (circle one)		2	Bank: Height 5.5 ft, Angle 55 Deg Protection: Roots 5 %, Root Depth 1.5 ft Vegetation 5 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)		Right	Bank: Height 6 ft, Angle 60 Deg Protection: Roots 5 %, Root Depth 1.5 ft Vegetation 5 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____

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[1] Impacts: Outfall(OT), Bank Erosion(ER), Impacted buffer(IB), Utilities in channel(UT), Stream crossing(SC), Channel modification(CM), Trash in stream(TR), other.

[2] Severity: 1=minor, 2=moderate, 3=severe

[3] Restoration Potential: 1=minimal, 2=moderate, 3=high

[4]Bank material: circle base type, silt/clay or sand and if present circle rock type and note %.

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA, Cont.

REACH ID: TB-1
STREAM: Tupelo Bayou
DATE/TIME: 4/30/19 1530
INITIALS: LVJ/WH6
OTHER INFO:

Average Conditions (check applicable)

Flood Plain Dynamics
Connection: ☑ Poor ☐ Fair ☐ Good
Habitat: ☑ Poor ☐ Fair ☐ Good
Vegetation: ☐ Forest ☐ Shrub/Sapling ☐ Tall grasses ☑ Turf/crops
Encroachment: ☑ Poor ☐ Fair ☐ Good

Periphyton (attached algae):
Filamentous: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Prostrate: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Suspended Algae (phytoplankton) abundance:
☑ None noticeable (water basically clear)
☐ Moderate (water slightly green tinted)
☐ Abundant (water appears green)

Aquatic Plants In Stream:
Submerged: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Emergent: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Aquatic Life Observed:
☑ Fish ☐ Snails ☑ Crawfish ☐ Macroinvertebrates

Wildlife/Livestock In or Around Stream (evidence of):
☑ Cattle ☐ Beaver ☐ Deer ☐ Other________

Reach Impacts: (circle impact level 1=minor, 2=moderate, 3=major, and tag with a GPS waypoint(s) (Wpt) ID)
☐ Outfalls(OT): 1 2 3 Wpt________
☐ Stream Crossing(SC): 1 2 3 Wpt________
☑ Bank Erosion(ER): 1 2 [✓ 3] Wpt the entire reach
☐ Channel Modification(CM): 1 2 3 Wpt________
☑ Impacted Buffers(IB): 1 2 [✓ 3] Wpt [illegible]
☐ Trash(TR): 1 2 3 Wpt________
☐ Utilities(UT): 1 2 3 Wpt________
☐ Other________: 1 2 3 Wpt________
Notes:

If any of these impacts are significant use back of page 1 (pg. 2) for detailed description.

Channel Dynamics:
☐ Incised (degrading) ☐ Widening ☐ Headcutting
☑ Channelized ☐ Aggrading ☑ Bank scour
☐ Bed Scour ☐ Bank Failure ☐ Slope failure
☐ Sediment Deposition ☐ Culvert Scour (upstream / downstream / top) ☐ None (natural stabile channel)

Channel Dimensions (facing downstream):
Lt bank Ht: 5.5 (ft) Bankfull Depth 08 (ft) Wetted Width: 45 (ft) Riffle/Run Depth 0.051 (ft)
Rt bank Ht: 6 (ft) Bankfull Width 51 (ft)) TOB Width: 66 (ft) Pool Depth 03 (ft)

Channel Stability:
Lt Bank: Angle 55 degrees
LtBank Vegetation protection: 5 % cover
LtBank Erosion Hazard: L M [✓ H] VH EX (circle one)
Length Lt Bank Affected: the entire reach
Wpt(s):________

Rt Bank: Angle 60 degrees
RtBank Vegetation protection 5 % cover
RtBank Erosion Hazard: L M [✓ H] VH EX (circle one)
Length Rt Bank Affected: the entire rea
Wpt(s):________

Reach Accessibility For Restoration

Good: Open area in public ownership. Easy stream channel access by vehicle.	**Fair:** Forested or developed near stream. Vehicle access limited.	**Difficult:** Must cross wetland, steep slope, heavy forest or sensitive areas to get to stream. Access by foot/ATV only.

5 4 3 2 1

Notes: (biggest problem(s) you see in survey reach)

Place sketch of reach on back of page.

Restoration Potential:
☐ Riparian reforestation ☑ Bank stabilization
☐ Stormwater retrofit ☑ Outfall stabilization
☑ Channel modification ☐ PS investigation
☐ Culvert rehab. ☐ Other________

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* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

Unified Stream Assessment (USA)

REACH ID: WC-1
STREAM: Whig Creek
DATE/TIME: 8/14/19 1440
INITIALS: EMT/OKF

REACH START
LAT:
LONG:

REACH END
LAT:
LONG:

Average Conditions (check applicable)

Weather – Antecedent (24-h) Rain in past 72-h: y / n
☐ Heavy rain ☐ Steady rain ☑ Showers ☐ Clear/sunny
☐ Mostly cloudy ☐ Partly cloudy

Weather – Current conditions
☐ Heavy rain ☐ Steady rain ☐ Showers ☑ Clear/sunny
☐ Mostly cloudy ☐ Partly cloudy

Stream Classification
☑ Perennial ☐ Intermittent ☐ Ephemeral ☐ Tidal
☐ Coldwater ☐ Coolwater ☐ Warmwater Order_____

Stream Origin
☐ Spring-fed ☑ Mixture of origins ☐ Glacial
☐ Montane (non-glacial) ☐ Swamp/bog ☐ Other________

Hydrology
Flow: ☐ High ☐ Moderate ☑ Low ☐ None
Base Flow as %Channel Width: ☐ 0-25% ☐ 50-75% ☑ 25-50% ☐ 75-100% **Flows Measured:** Yes / [✓ No]
Stream Gradient: ☐ High (≥25ft/mi) ☐ Moderate (10-24 ft/mi) ☑ Low (<10 ft/mi) ~Slope: ________ft/mi
Sinuosity: ☐ High ☐ Moderate ☐ Low

Channel Morphology **System:** Step/Pool - Riffle/Pool - Pool (circle)
☑ Riffle 5 % ☑ Run 75 % ☑ Pool 20 % ☐ Steps _____%

Dominant Substrate
☑ Silt/clay (fine or slick) ☐ Cobble (2.5-10”)
☐ Sand (gritty) ☐ Boulder (>10”)
☐ Gravel (0.1-2.5”) ☐ Bed Rock

Dominant In-Stream Habitats
☐ Woody Debris ☑ Root Wads ☐ Leaf Packs
☑ Deposition ☑ Undercut Bank
☐ Aquatic Plants ☑ Overhanging Vegetation
Habitat Quality: ☑ Poor ☐ Fair ☐ Good ☐ Optimal

Land use
☑ Forest 50 % ☐ Pasture _____% ☐ Urban _____%
☐ Commercial_____% ☐ Row Crops _____%
☐ Hay_____% ☑ Industrial 50 % ☐ Sub-Urban____%

Local Watershed NPS Pollution
☐ Industrial Storm Water
☐ Urban/Sub-Urban Storm Water ☐ Row crops
☐ Cattle ☒ Other Wastewater Treatment ☐ No evidence

Riparian Buffer
Vegetation Type: ☑ Forest 30 % ☑ Shrub/Sapling 35 % ☑ Herbs/Grasses 35 % ☐ Turf/Crops ____%
Riparian Width: ☐ <10 ft ☐ 11-25 ft ☐ 26-50 ft ☐ > 50 ft

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage) ☐ Partially shaded (≥25% coverage)
☑ Halfway shaded (≥50% coverage) ☐ Unshared (<25% coverage)

Water Quality Observations

Odors Noted:
☐ Normal/None ☐ Sewage ☐ Anaerobic
☑ Petroleum ☑ Chemical ☐ Fishy ☐ Other____________

Water Surface Appearance:
☐ Slick ☐ Sheen ☐ Globs
☐ Flecks ☑ None ☐ Other__________

Turbidity/Water Clarity:
☑ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other______________

Sediment Deposits: ☐ None ☐ Sludge ☐ Sawdust ☐ Oils ☐ Sand ☐ Relict shells

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA Reach Impact Data Detail Sheet (optional)

Reach ID/Stream:	Date:	Initials:
WC-1	8/14/19	ENT/DKF

Impact I.D.[1]	Coordinates (Lat / Long) or Waypoint	Severity (1-3)[2]	Restoration Opportunity (1-3)[3]	Description

BEHI I.D.	Coordinates (Lat / Long) or Waypoint	Bank Erosion Hazard	Bank Lth. (ft)	Rest. Opp. (1-3)[3]	Bank information for BEHI
ER	wpt ~~[illegible]~~7 RB 4	L [✓ M] H VH EX (circle one)	50ft	2	Bank: Height 8 ft, Angle 80 Deg Protection: Roots 6040 %, Root Depth 6 ft Vegetation 5 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - %____
ER	wypt 48 u/s LB at the top	L [✓ M] H VH EX (circle one)	46yds	1	Bank: Height 8.5 ft, Angle 50 Deg Protection: Roots 40 %, Root Depth 5.5 ft Vegetation 45 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - %____
ER	Start @ wpt 49 End of track ~~RB~~ LB + RB	L M [✓ H] VH EX (circle one)	Refer to GIS	1	Bank: Height 15 ft, Angle 75 Deg Protection: Roots 40 %, Root Depth 10 ft Vegetation 30 % [4]Material: [✓ Silt/Clay] Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____

[1] Impacts: Outfall(OT), Bank Erosion(ER), Impacted buffer(IB), Utilities in channel(UT), Stream crossing(SC), Channel modification(CM), Trash in stream(TR), other.

[2] Severity: 1=minor, 2=moderate, 3=severe

[3] Restoration Potential: 1=minimal, 2=moderate, 3=high

[4] Bank material: circle base type, silt/clay or sand and if present circle rock type and note %.

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA, Cont.

REACH ID: WC1	**STREAM:** Whis Creek	**DATE/TIME:** 8/14/19	**INITIALS:** DF/ENJ
OTHER INFO:			

Average Conditions (check applicable)

Flood Plain Dynamics

Connection: ☒ Poor ☐ Fair ☐ Good — Vegetation: ☑ Forest ☑ Shrub/Sapling ☑ Tall grasses ☐ Turf/crops

Habitat: ☒ Poor ☐ Fair ☐ Good — Encroachment: ☐ Poor ☐ Fair ☐ Good

Periphyton (attached algae):

Filamentous: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Prostrate: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Suspended Algae (phytoplankton) abundance:

☑ None noticeable (water basically clear)

☐ Moderate (water slightly green tinted)

☐ Abundant (water appears green)

Aquatic Plants In Stream:

Submerged: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Emergent: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Aquatic Life Observed:

☑ Fish ☐ Snails ☐ Crawfish ☐ Macroinvertebrates

Wildlife/Livestock In or Around Stream (evidence of):

☐ Cattle ☐ Beaver ☑ Deer ☐ Other________________

Reach Impacts: (circle impact level 1=minor, 2=moderate, 3=major, and tag with a GPS waypoint(s) (Wpt) ID)

☐ Outfalls(OT): 1 2 3 Wpt________

☐ Stream Crossing(SC): 1 2 3 Wpt________

☑ Bank Erosion(ER) : 1 2 [✓ 3] Wpt________

☐ Channel Modification(CM) : 1 2 3 Wpt________

☑ Impacted Buffers(IB): 1 2 [✓ 3] Wpt________

☑ Trash(TR): [✓ 1] 2 3 Wpt________

☐ Utilities(UT): 1 2 3 Wpt________

☐ Other________________: 1 2 3 Wpt________

Notes:

If any of these impacts are significant use back of page 1 (pg. 2) for detailed description.

Channel Dynamics:

☐ Incised (degrading) ☐ Channelized ☐ Bed Scour ☑ Sediment Deposition

☐ Widening ☐ Aggrading ☐ Bank Failure ☐ Culvert Scour (upstream / downstream / top)

☐ Headcutting ☐ Bank scour ☐ Slope failure ☐ None (natural stabile channel)

Channel Dimensions (facing downstream):

Lt bank Ht: 12 (ft) Bankfull Depth 4.5 (ft) Wetted Width: 8 (ft) Riffle/Run Depth 0.3 (ft)

Rt bank Ht: 15 (ft) Bankfull Width 70 (ft)) TOB Width: 60 (ft) Pool Depth 3.5 (ft)

Channel Stability:

Lt Bank: Angle 70 degrees

LtBank Vegetation protection: 40 % cover

LtBank Erosion Hazard: L [✓ M] H VH EX (circle one)

Length Lt Bank Affected: Refer to ENJ GPS

Wpt(s):________________

Rt Bank: Angle 75 degrees

RtBank Vegetation protection 35 % cover

RtBank Erosion Hazard: L M [✓ H] VH EX (circle one)

Length Rt Bank Affected: Refer to ENJ GPS

Wpt(s):________________

Reach Accessibility For Restoration

Good: Open area in public ownership. Easy stream channel access by vehicle.		**Fair:** Forested or developed near stream. Vehicle access limited.		**Difficult:** Must cross wetland, steep slope, heavy forest or sensitive areas to get to stream. Access by foot/ATV only.
5	4	3	[✓ 2]	1

Notes: (biggest problem(s) you see in survey reach)

Place sketch of reach on back of page.

Restoration Potential:

☑ Riparian reforestation ☑ Bank stabilization

☐ Stormwater retrofit ☐ Outfall stabilization

☐ Channel modification ☐ PS investigation

☐ Culvert rehab. ☐ Other ________________

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

Unified Stream Assessment (USA)

REACH ID: WBYR-1 U/S	**STREAM:**	**DATE/TIME:** 6/29/19	**INITIALS:** EW/DMB

REACH START	**REACH END**
LAT:	**LAT:**
LONG:	**LONG:**

Average Conditions (check applicable)

Weather – Antecedent (24-h) Rain in past 72-h: y / n
☐Heavy rain ☐Steady rain ☐Showers ☑Clear/sunny
☐Mostly cloudy ☐Partly cloudy

Weather – Current conditions
☐Heavy rain ☐Steady rain ☐Showers ☑Clear/sunny
☐Mostly cloudy ☐Partly cloudy

Stream Classification
☑ Perennial ☐ Intermittent ☐ Ephemeral ☐ Tidal
☐ Coldwater ☐ Coolwater ☐ Warmwater Order_____

Stream Origin
☑ Spring-fed ☑ Mixture of origins ☐ Glacial
☐ Montane (non-glacial) ☐ Swamp/bog ☐ Other________

Hydrology
Flow: ☐ High ☑ Moderate ☐ Low ☐ None
Base Flow as %Channel Width: ☐0-25% ☑50-75% ☐25-50% ☐75-100% **Flows Measured:** Yes [✓ No]
Stream Gradient: ☑ High (≥25ft/mi) ☐ Moderate (10-24 ft/mi) ☐ Low (<10 ft/mi) ~Slope: ________ft/mi
Sinuosity: ☐ High ☑ Moderate ☐ Low

Channel Morphology **System:** Step/Pool - Riffle/Pool - Pool (circle)
☑ Riffle 30 % ☑ Run 60 % ☑ Pool 10 % ☐ Steps ______%

Dominant Substrate
☐Silt/clay (fine or slick) ☐Cobble (2.5-10")
☐Sand (gritty) ☑Boulder (>10")
☐Gravel (0.1-2.5") ☐Bed Rock

Dominant In-Stream Habitats
☑Woody Debris ☑Root Wads ☑Leaf Packs
☐Deposition ☐Undercut Bank
☑Aquatic Plants ☑Overhanging Vegetation
Habitat Quality: ☐Poor ☐Fair ☐Good ☐ Optimal

Land use
☑ Forest 100 % ☐ Pasture _____% ☐ Urban _____%
☐ Commercial_____% ☐ Row Crops _____%
☐ Hay_____% ☐ Industrial_____% ☐ Sub-Urban____%

Local Watershed NPS Pollution
☐ Industrial Storm Water
☐ Urban/Sub-Urban Storm Water ☐ Row crops
☐ Cattle ☐ Other____________ ☑ No evidence

Riparian Buffer
Vegetation Type: ☑ Forest 100 % ☐ Shrub/Sapling ____% ☐ Herbs/Grasses ____% ☐ Turf/Crops ____%
Riparian Width: ☐<10 ft ☐11-25 ft ☐ 26-50 ft ☑ > 50 ft

Stream Shading (water surface)
☑Mostly shaded (≥75% coverage) ☐Partially shaded (≥25% coverage)
☐Halfway shaded (≥50% coverage) ☐Unshared (<25% coverage)

Water Quality Observations

Odors Noted:
☑ Normal/None ☐ Sewage ☐ Anaerobic
☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other____________

Water Surface Appearance:
☐ Slick ☐ Sheen ☐ Globs
☐ Flecks ☑ None ☐ Other__________

Turbidity/Water Clarity:
☐ Clear ☑ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other______________

Sediment Deposits: ☑ None ☐ Sludge ☐ Sawdust ☐ Oils ☐ Sand ☐ Relict shells

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA Reach Impact Data Detail Sheet (optional)

Reach ID/Stream: WPR-1	**Date:** 6/29/19	**Initials:** ENJ/DMB

Impact I.D.[1]	Coordinates (Lat / Long) or Waypoint	Severity (1-3)[2]	Restoration Opportunity (1-3)[3]	Description
None				

None

BEHI I.D.	Coordinates (Lat / Long) or Waypoint	Bank Erosion Hazard	Bank Lth. (ft)	Rest. Opp. (1-3)[3]	Bank information for BEHI
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ________ft, Angle ________Deg Protection: Roots______%, Root Depth ______ft Vegetation ______% [4]Material: Silt/Clay Sand / Gravel Cobble - %____

[1] Impacts: Outfall(OT), Bank Erosion(ER), Impacted buffer(IB), Utilities in channel(UT), Stream crossing(SC), Channel modification(CM), Trash in stream(TR), other.

[2] Severity: 1=minor, 2=moderate, 3=severe

[3] Restoration Potential: 1=minimal, 2=moderate, 3=high

[4]Bank material: circle base type, silt/clay or sand and if present circle rock type and note %.

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA, Cont.

REACH ID: WPR-1
STREAM:
DATE/TIME: 6/29/19
INITIALS: EWT/OMB
OTHER INFO:

Average Conditions (check applicable)

Flood Plain Dynamics
Connection: ☐ Poor ☐ Fair ☑ Good
Habitat: ☐ Poor ☐ Fair ☑ Good
Vegetation: ☑ Forest ☐ Shrub/Sapling ☐ Tall grasses ☐ Turf/crops
Encroachment: ☐ Poor ☐ Fair ☑ Good

Periphyton (attached algae):
Filamentous: ☐ None ☑ Sparse ☐ Moderate ☐ Abundant
Prostrate: ☐ None ☐ Sparse ☐ Moderate ☐ Abundant
Floating: ☐ None ☐ Sparse ☐ Moderate ☐ Abundant

Suspended Algae (phytoplankton) abundance:
☑ None noticeable (water basically clear)
☐ Moderate (water slightly green tinted)
☐ Abundant (water appears green)

Aquatic Plants In Stream:
Submerged: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Emergent: ☐ None ☐ Sparse ☑ Moderate ☐ Abundant
Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Aquatic Life Observed:
☑ Fish ☐ Snails ☐ Crawfish ☐ Macroinvertebrates

Wildlife/Livestock In or Around Stream (evidence of):
☐ Cattle ☐ Beaver ☐ Deer ☐ Other ________

Reach Impacts: (circle impact level 1=minor, 2=moderate, 3=major, and tag with a GPS waypoint(s) (Wpt) ID)
☐ Outfalls(OT): 1 2 3 Wpt________
☐ Stream Crossing(SC): 1 2 3 Wpt________
☐ Bank Erosion(ER) : 1 2 3 Wpt________
☐ Channel Modification(CM) : 1 2 3 Wpt________
☐ Impacted Buffers(IB): 1 2 3 Wpt________
☐ Trash(TR): 1 2 3 Wpt________
☐ Utilities(UT): 1 2 3 Wpt________
☐ Other________: 1 2 3 Wpt________

Notes:

If any of these impacts are significant use back of page 1 (pg. 2) for detailed description.

Channel Dynamics:
☐ Incised (degrading)
☐ Widening
☐ Headcutting
☐ Channelized
☐ Aggrading
☐ Bank scour
☐ Bed Scour
☐ Bank Failure
☐ Slope failure
☐ Sediment Deposition
☐ Culvert Scour (upstream / downstream / top)
☑ None (natural stabile channel)

Channel Dimensions (facing downstream):
Lt bank Ht: 1.5 (ft) Bankfull Depth 2.5 (ft) Wetted Width: 11 (ft) Riffle/Run Depth 0.5 (ft)
Rt bank Ht: 1.5 (ft) Bankfull Width 40 (ft)) TOB Width: 47 (ft) Pool Depth 1.5 (ft)

Channel Stability:
Lt Bank: Angle 40 degrees
LtBank Vegetation protection: 30 % cover mostly rocks
LtBank Erosion Hazard: [✓ L] M H VH EX (circle one)
Length Lt Bank Affected: 0
Wpt(s): 0

Rt Bank: Angle 35 degrees
RtBank Vegetation protection 30 % cover mostly rocks
RtBank Erosion Hazard: [✓ L] M H VH EX (circle one)
Length Rt Bank Affected: 0
Wpt(s): 0

Reach Accessibility For Restoration

Good: Open area in public ownership. Easy stream channel access by vehicle.	**Fair:** Forested or developed near stream. Vehicle access limited.	**Difficult:** Must cross wetland, steep slope, heavy forest or sensitive areas to get to stream. Access by foot/ATV only.

5 4 3 2 [✓ 1]

Notes: (biggest problem(s) you see in survey reach)

Restoration Potential:
☐ Riparian reforestation ☐ Bank stabilization
☐ Stormwater retrofit ☐ Outfall stabilization
☐ Channel modification ☐ PS investigation
☐ Culvert rehab. ☐ Other ________

Place sketch of reach on back of page.

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

Unified Stream Assessment (USA)

REACH ID: WPR D/S section	**STREAM:** West point Remna	**DATE/TIME:** 6/26/19 1230	**INITIALS:** ENT/DMB

REACH START wypt 20
LAT:
LONG:

REACH END wypt 17
LAT:
LONG:

Average Conditions (check applicable)

Weather – Antecedent (24-h) Rain in past 72-h: y / n
☐ Heavy rain ☐ Steady rain ☐ Showers ☐ Clear/sunny
☐ Mostly cloudy ☑ Partly cloudy

Weather – Current conditions
☐ Heavy rain ☐ Steady rain ☐ Showers ☐ Clear/sunny
☐ Mostly cloudy ☑ Partly cloudy

Stream Classification
☑ Perennial ☐ Intermittent ☐ Ephemeral ☐ Tidal
☐ Coldwater ☐ Coolwater ☐ Warmwater Order_____

Stream Origin
☐ Spring-fed ☑ Mixture of origins ☐ Glacial
☐ Montane (non-glacial) ☐ Swamp/bog ☐ Other________

Hydrology
Flow: ☐ High ☑ Moderate ☐ Low ☐ None
Base Flow as %Channel Width: ☐ 0-25% ☑ 50-75% ☐ 25-50% ☐ 75-100% **Flows Measured:** Yes / No
Stream Gradient: ☐ High (≥25ft/mi) ☑ Moderate (10-24 ft/mi) ☐ Low (<10 ft/mi) ~Slope: ________ft/mi
Sinuosity: ☐ High ☑ Moderate ☐ Low

Channel Morphology **System:** Step/Pool - Riffle/Pool - Pool (circle)
☑ Riffle 25 % ☑ Run 50 % ☑ Pool 25 % ☐ Steps ______%

Dominant Substrate
☐ Silt/clay (fine or slick)
☐ Sand (gritty)
☐ Gravel (0.1-2.5")
☐ Cobble (2.5-10")
☑ Boulder (>10")
☐ Bed Rock

Dominant In-Stream Habitats
☑ Woody Debris ☑ Root Wads ☑ Leaf Packs
☐ Deposition ☐ Undercut Bank
☑ Aquatic Plants ☑ Overhanging Vegetation
Habitat Quality: ☐ Poor ☐ Fair ☐ Good ☑ Optimal

Land use
☑ Forest 70 % ☑ Pasture 30 % ☐ Urban _____%
☐ Commercial_____% ☐ Row Crops _____%
☐ Hay_____% ☐ Industrial_____% ☐ Sub-Urban____%

Local Watershed NPS Pollution
☐ Industrial Storm Water
☐ Urban/Sub-Urban Storm Water ☐ Row crops
☐ Cattle ☐ Other_____________ ☑ No evidence

Riparian Buffer
Vegetation Type: ☑ Forest 70 % ☑ Shrub/Sapling 30 % ☐ Herbs/Grasses ____% ☐ Turf/Crops ____%
Riparian Width: ☐ <10 ft ☐ 11-25 ft ☑ 26-50 ft ☐ > 50 ft

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage) ☑ Partially shaded (≥25% coverage)
☐ Halfway shaded (≥50% coverage) ☐ Unshared (<25% coverage)

Water Quality Observations

Odors Noted:
☑ Normal/None ☐ Sewage ☐ Anaerobic
☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other___________

Water Surface Appearance:
☐ Slick ☐ Sheen ☐ Globs
☐ Flecks ☑ None ☐ Other__________

Turbidity/Water Clarity:
☐ Clear ☑ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other____________

Sediment Deposits: ☐ None ☐ Sludge ☐ Sawdust ☐ Oils ☑ Sand ☐ Relict shells

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* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA Reach Impact Data Detail Sheet (optional)

Reach ID/Stream:	Date:	Initials:
WPR D/S Section	6/29/19	EM/OMB

Impact I.D.[1]	Coordinates (Lat / Long) or Waypoint	Severity (1-3)[2]	Restoration Opportunity (1-3)[3]	Description
ID-1	wypt 14	1	3	old road but only on one side of stream & not used in many years

BEHI I.D.	Coordinates (Lat / Long) or Waypoint	Bank Erosion Hazard	Bank Lth. (ft)	Rest. Opp. (1-3)[3]	Bank information for BEHI
ER	wpt 13 d/s of ↑	L M H VH EX (circle one)	26yds	2	Bank: Height 3.5 ft, Angle 65 Deg Protection: Roots 55 %, Root Depth ____ ft Vegetation 20 % [4]Material: [✓ Silt/Clay] [✓ Sand] / Gravel Cobble - %____
ER	wyp 15 u/s of ↑wypt	L M H VH EX (circle one)	39yds	3	Bank: Height 10 ft, Angle 80 Deg Protection: Roots 45 %, Root Depth 3 ft Vegetation 15 % [4]Material: [✓ Silt/Clay] [✓ Sand] / Gravel Cobble - %____
ER	wypt 16 walking d/s to beginning begins @ wypt 17	[✓ L] [✓ M] H VH EX (circle one)		2	Bank: Height 1.75 ft, Angle 55 Deg Protection: Roots 50 %, Root Depth 1 ft Vegetation 20 % [4]Material: [✓ Silt/Clay] [✓ Sand] / Gravel Cobble - %____
ER	wypt 20 start 40 yards going d/s	L M H VH EX (circle one)	40yds	2	Bank: Height 6 ft, Angle 50 Deg Protection: Roots 70 %, Root Depth 3 ft Vegetation 20 % [4]Material: Silt/Clay [✓ Sand] / Gravel Cobble - %____
ER		L M H VH EX (circle one)			Bank: Height ____ ft, Angle ____ Deg Protection: Roots ____ %, Root Depth ____ ft Vegetation ____ % [4]Material: Silt/Clay Sand / Gravel Cobble - %____

[1] Impacts: Outfall(OT), Bank Erosion(ER), Impacted buffer(IB), Utilities in channel(UT), Stream crossing(SC), Channel modification(CM), Trash in stream(TR), other.

[2] Severity: 1=minor, 2=moderate, 3=severe

[3] Restoration Potential: 1=minimal, 2=moderate, 3=high

[4] Bank material: circle base type, silt/clay or sand and if present circle rock type and note %.

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

USA, Cont.

REACH ID: WPR D/S Section	**STREAM:**	**DATE/TIME:** 6/29/19	**INITIALS:** ANJ/PMB
OTHER INFO:			

Average Conditions (check applicable)

Flood Plain Dynamics
Connection: ☐ Poor ☐ Fair ☑ Good
Habitat: ☐ Poor ☐ Fair ☑ Good
Vegetation: ☑ Forest ☑ Shrub/Sapling ☐ Tall grasses ☐ Turf/crops
Encroachment: ☐ Poor ☑ Fair ☐ Good

Periphyton (attached algae):
Filamentous: ☐ None ☐ Sparse ☐ Moderate ☐ Abundant
Prostrate: ☐ None ☐ Sparse ☐ Moderate ☐ Abundant
Floating: ☐ None ☐ Sparse ☐ Moderate ☐ Abundant
Mats ☑ Macro

Suspended Algae (phytoplankton) abundance:
☑ None noticeable (water basically clear)
☐ Moderate (water slightly green tinted)
☐ Abundant (water appears green)

Aquatic Plants In Stream:
Submerged: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant
Emergent: ☐ None ☐ Sparse ☑ Moderate ☐ Abundant
Floating: ☑ None ☐ Sparse ☐ Moderate ☐ Abundant

Aquatic Life Observed:
☑ Fish ☐ Snails ☐ Crawfish ☐ Macroinvertebrates

Wildlife/Livestock In or Around Stream (evidence of):
☐ Cattle ☐ Beaver ☐ Deer ☐ Other________________

Reach Impacts: (circle impact level 1=minor, 2=moderate, 3=major, and tag with a GPS waypoint(s) (Wpt) ID)
☐ Outfalls(OT): 1 2 3 Wpt________
☑ Stream Crossing(SC): [✓ 1] 2 3 Wpt 14
☑ Bank Erosion(ER) : [✓ 1] 2 3 Wpt________
☐ Channel Modification(CM) : 1 2 3 Wpt________
☐ Impacted Buffers(IB): 1 2 3 Wpt________
☐ Trash(TR): 1 2 3 Wpt________
☐ Utilities(UT): 1 2 3 Wpt________
☐ Other________________: 1 2 3 Wpt________

Notes:

If any of these impacts are significant use back of page 1 (pg. 2) for detailed description.

Channel Dynamics:
☐ Incised (degrading)
☐ Widening
☐ Headcutting
☐ Channelized
☐ Aggrading
☐ Bank scour
☐ Bed Scour
☑ Bank Failure
☐ Slope failure
☐ Sediment Deposition
☐ Culvert Scour (upstream / downstream / top)
☐ None (natural stabile channel)

Channel Dimensions (facing downstream):
Lt bank Ht: 6 (ft)
Rt bank Ht: 3.75 (ft)
Bankfull Depth 3.5 (ft)
Bankfull Width 19 (ft))
Wetted Width: 17yd (ft)
TOB Width: 22' (ft)
Riffle/Run Depth 1.5 (ft)
Pool Depth 4.5 (ft)

Channel Stability:
Lt Bank: Angle 55 degrees
LtBank Vegetation protection: ~~40~~50 % cover
LtBank Erosion Hazard: [✓ L] M H VH EX (circle one)
Length Lt Bank Affected:________________
Wpt(s):________________
Rt Bank: Angle 50 degrees
RtBank Vegetation protection 45 % cover
RtBank Erosion Hazard: [✓ L] M H VH EX (circle one)
Length Rt Bank Affected:________________
Wpt(s):________________

Reach Accessibility For Restoration

Good: Open area in public ownership. Easy stream channel access by vehicle.	**Fair:** Forested or developed near stream. Vehicle access limited.	**Difficult:** Must cross wetland, steep slope, heavy forest or sensitive areas to get to stream. Access by foot/ATV only.

5 [✓ 4] 3 2 1

Notes: (biggest problem(s) you see in survey reach)

Restoration Potential:
☑ Riparian reforestation
☐ Stormwater retrofit
☐ Channel modification
☐ Culvert rehab.
☑ Bank stabilization
☐ Outfall stabilization
☐ PS investigation
☐ Other ____________

Place sketch of reach on back of page.

* Modified from *Unified Stream Assessment: A Users Manual*, (Kitchall & Schuller, 2004)

Appendix B

Historical Data

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
4/2/12	LCPR	East Fork Point Remove Creek	EF2	35°23'47.04"N	92°39'32.79"W	0.06	0.48	0.01	9.4	6	3.7	2.0	0.21	0.69
4/2/12	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.46	0.01	8.0	5	3.8	2.2	0.53	0.99
4/2/12	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.16	0.93	0.10	7.5	6	3.3	1.8	0.03	0.96
4/2/12	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.59	0.02	9.3	10	3.1	1.5	0.05	0.64
4/2/12	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.43	0.01	8.8	6	2.7	0.9	0.03	0.46
4/2/12	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N	92°43'4.08"W	0.02	0.21	0.00	12.5	6	2.3	0.3	0.02	0.23
4/2/12	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.31	0.01	10.8	6	2.9	1.2	0.22	0.53
4/2/12	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.10	0.65	0.01	8.8	8	2.7	1.5	0.00	0.65
4/9/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.36	0.03	8.6	6	4.0	2.8	0.27	0.63
4/9/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.37	0.03	7.6	3	4.1	2.5	0.47	0.84
4/9/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.12	1.08	0.14	14.1	12	5.4	3.0	0.04	1.12
4/9/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.21	0.78	0.15	19.0	13	3.0	2.6	0.12	0.90
4/9/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.63	0.02	9.4	8	3.1	1.4	0.24	0.87
4/9/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.29	0.03	9.2	2	2.3	0.6	0.07	0.36
4/9/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.36	0.01	8.8	5	3.1	1.6	0.25	0.61
4/9/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.13	0.54	0.06	24.8	30	3.5	1.9	0.20	0.74
4/16/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.32	1.24	0.20	34.5	32	4.9	4.2	0.38	1.62
4/16/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.27	1.16	0.13	37.2	26	5.1	3.6	0.71	1.87
4/16/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.10	0.97	0.12	18.4	17	5.7	2.8	0.06	1.03
4/16/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.26	1.30	0.19	72.7	55	5.2	9.6	0.35	1.65
4/16/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	0.77	0.03	16.9	12	3.8	2.2	0.24	1.01
4/16/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.27	0.03	9.8	5	3.1	1.5	0.12	0.39
4/16/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.16	0.75	0.07	24.4	18	4.2	2.8	0.49	1.24
4/16/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.19	0.70	0.09	46.1	58	4.6	3.9	0.28	0.98
4/23/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.46	0.04	11.8	8	3.2	4.1	0.31	0.77
4/23/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.41	0.04	8.5	4	3.1	4.3	0.52	0.93
4/23/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.79	0.05	13.4	11	2.7	5.1	0.02	0.81
4/23/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.16	0.67	0.08	40.1	44	4.3	5.0	0.31	0.98
4/23/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.76	0.01	9.7	8	2.0	3.0	0.26	1.02
4/23/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.32	0.03	10.6	4	1.5	2.8	0.14	0.46
4/23/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.40	0.02	6.8	5	2.5	3.7	0.28	0.68
4/23/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.11	0.56	0.04	23.6	30	3.1	4.1	0.31	0.87
4/30/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.41	0.04	10.8	8	2.6	4.3	0.26	0.67
4/30/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.45	0.09	11.5	10	3.3	3.9	0.22	0.67
4/30/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.37	0.05	6.6	5	3.5	4.4	0.56	0.93
4/30/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	0.78	0.14	14.0	13	2.8	5.0	0.08	0.86
4/30/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.17	0.47	0.09	40.1	38	5.0	4.4	0.20	0.67
4/30/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.84	0.11	10.2	8	2.3	2.9	0.47	1.31
4/30/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.35	0.03	10.1	6	1.4	2.6	0.18	0.53
4/30/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.41	0.06	7.4	6	2.6	3.2	0.28	0.69
4/30/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.13	0.64	0.09	26.4	34	3.6	3.9	0.19	0.83
5/7/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.45	0.05	9.3	6	4.5	2.6	0.29	0.74

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
5/7/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	0.67	0.12	14.4	9	3.7	3.6	0.23	0.90
5/7/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.48	0.08	6.8	3	4.7	3.8	0.47	0.95
5/7/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.10	0.80	0.09	13.3	14	5.1	2.7	0.23	1.03
5/7/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.15	0.71	0.17	25.7	22	4.3	6.5	0.23	0.94
5/7/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.07	0.72	0.05	8.6	7	2.5	2.3	0.82	1.54
5/7/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.48	0.03	7.8	8	2.5	1.4	0.25	0.73
5/7/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.46	0.07	6.6	4	3.3	2.6	0.31	0.77
5/7/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.20	1.05	0.09	37.7	36	4.1	6.1	0.15	1.20
5/14/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.42	0.10	12.6	8	4.4	2.9	0.32	0.74
5/14/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.53	0.15	17.0	12	3.6	3.8	0.21	0.74
5/14/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.84	0.10	6.8	3	4.7	4.3	0.36	1.20
5/14/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.12	0.57	0.11	15.9	12	5.4	3.3	0.31	0.88
5/14/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.15	0.46	0.08	34.4	33	4.6	8.6	0.26	0.72
5/14/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.29	0.08	8.7	6	2.9	3.6	1.85	2.14
5/14/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.38	0.06	5.5	4	2.7	1.7	0.20	0.58
5/14/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.86	0.07	6.1	2	3.6	3.2	0.26	1.12
5/14/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.16	0.46	0.25	34.7	32	3.3	4.8	0.14	0.60
5/21/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.38	0.03	10.0	8	4.5	2.8	0.19	0.57
5/21/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.12	0.60	0.09	14.7	13	3.0	3.8	0.10	0.70
5/21/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.57	0.08	6.0	5	4.5	4.4	0.21	0.78
5/21/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.10	0.75	0.10	15.6	10	4.8	3.2	0.30	1.05
5/21/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.67	0.01	34.5	24	4.8	10.3	0.15	0.82
5/21/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	0.60	0.11	9.5	10	3.7	5.4	2.15	2.75
5/21/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.17	0.04	4.6	3	2.7	1.6	0.23	0.40
5/21/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.31	0.06	4.0	4	3.5	3.4	0.16	0.47
5/21/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.14	0.71	0.09	32.7	26	3.1	3.7	0.10	0.81
5/29/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.36	0.02	8.3	7	4.4	2.9	0.06	0.42
5/29/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.55	0.01	6.3	6	2.2	4.5	0.00	0.55
5/29/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.36	0.07	4.3	3	4.1	5.8	0.07	0.43
5/29/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.11	0.75	0.04	13.2	11	5.0	3.5	0.18	0.93
5/29/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	0.71	0.04	19.0	16	4.7	14.5	0.05	0.76
5/29/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.10	0.81	0.16	5.4	6	4.1	6.9	0.46	1.27
5/29/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.20	0.04	4.3	8	2.5	1.4	0.05	0.25
5/29/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.30	0.04	4.3	2	3.4	4.1	0.14	0.44
5/29/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.22	1.27	0.23	26.7	42	19.1	41.5	0.16	1.43
6/4/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.09	0.48	0.02	9.6	14	4.6	2.8	0.09	0.57
6/4/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.13	0.74	0.20	8.8	14	1.7	4.8	0.02	0.76
6/4/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.45	0.07	3.4	4	3.8	5.5	0.08	0.53
6/4/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.11	0.77	0.11	12.4	16	4.6	3.4	0.23	1.00
6/4/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.59	0.07	11.7	13	3.9	14.5	0.06	0.65
6/4/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.12	3.56	1.17	9.2	28	4.5	4.0	0.16	3.72
6/4/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.14	2.52	1.07	44.0	28	4.8	1.5	0.13	2.65

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
6/4/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.37	0.07	3.6	2	3.1	4.1	0.13	0.50
6/4/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.14	0.86	0.10	12.4	23	2.3	7.4	0.05	0.91
6/11/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.06	0.54	0.00	9.3	4	3.4	2.6	0.00	0.54
6/11/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.13	0.76	0.16	10.6	6	1.6	4.5	0.04	0.80
6/11/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.44	0.05	4.8	2	3.2	6.6	0.09	0.53
6/11/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.10	0.82	0.02	16.0	13	4.1	3.4	0.10	0.92
6/11/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.17	1.02	0.01	23.3	22	3.1	13.8	0.01	1.03
6/11/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.22	1.65	0.00	18.3	22	0.2	3.3	0.01	1.66
6/11/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.50	0.03	5.8	7	2.3	1.8	0.03	0.53
6/11/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.39	0.03	3.3	4	3.1	4.8	0.04	0.43
6/11/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.10	0.62	0.05	14.9	16	1.5	6.5	0.02	0.64
6/18/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.43	0.00	5.2	4	3.0	2.7	0.00	0.43
6/18/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.14	0.89	0.07	13.0	10	1.0	5.5	0.02	0.91
6/18/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.66	0.05	5.1	2	3.2	6.8	0.08	0.74
6/18/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.10	0.78	0.06	15.3	12	3.9	3.3	0.20	0.98
6/18/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.18	1.31	0.04	27.1	24	3.4	15.8	0.04	1.35
6/18/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.07	0.65	0.00	8.0	5	0.1	3.3	0.00	0.65
6/18/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.62	0.06	15.7	6	2.8	1.8	0.04	0.66
6/18/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.53	0.08	3.2	1	2.9	5.1	0.08	0.61
6/18/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.14	1.10	0.01	19.7	24	28.5	47.3	0.00	1.10
6/25/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.45	0.01	6.4	4	2.3	2.9	0.00	0.45
6/25/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.13	0.87	0.11	9.6	10	0.4	5.9	0.02	0.89
6/25/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.38	0.05	5.1	3	3.3	7.7	0.09	0.47
6/25/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.76	0.03	10.8	8	3.8	4.0	0.12	0.88
6/25/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.15	1.14	0.01	10.7	16	1.3	17.0	0.00	1.14
6/25/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.09	0.96	0.01	14.4	10	0.0	4.0	0.00	0.96
6/25/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.82	0.06	4.1	2	2.7	2.1	0.04	0.86
6/25/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.40	0.07	3.0	2	2.5	5.2	0.11	0.51
6/25/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.07	0.56	0.01	11.7	18	34.3	55.5	0.00	0.56
7/2/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.59	0.02	4.6	3	2.5	2.9	0.01	0.60
7/2/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.12	0.89	0.03	9.3	7	0.4	5.9	0.01	0.90
7/2/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.50	0.04	4.8	1	2.4	7.1	0.05	0.55
7/2/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	0.82	0.02	12.5	12	3.4	3.6	0.09	0.91
7/2/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.11	0.94	0.02	16.0	15	0.9	18.2	0.01	0.95
7/2/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.12	1.21	0.00	22.6	10	0.2	4.0	0.00	1.21
7/2/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.73	0.06	4.4	5	2.2	2.0	0.05	0.78
7/2/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.54	0.05	2.4	1	2.3	5.2	0.06	0.60
7/2/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.11	0.70	0.02	27.3	34	35.5	61.6	0.00	0.70
7/9/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.56	0.03	5.4	6	1.6	3.0	0.01	0.57
7/9/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	0.88	0.15	9.0	8	0.4	6.3	0.01	0.89
7/9/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.46	0.02	4.2	2	2.0	6.8	0.04	0.50
7/9/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.11	0.81	0.05	11.2	12	3.5	4.3	0.01	0.82

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
7/9/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.93	0.04	10.5	12	0.9	18.9	0.02	0.95
7/9/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.12	1.36	0.01	22.8	17	0.6	4.5	0.01	1.37
7/9/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.64	0.05	5.1	6	2.0	2.2	0.08	0.72
7/9/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.46	0.05	3.6	4	2.2	5.3	0.07	0.53
7/9/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.12	0.98	0.01	15.5	18	1.9	15.3	0.01	0.99
7/16/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.49	0.02	5.9	3	1.7	3.0	0.01	0.50
7/16/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	1.15	0.25	9.4	7	0.2	4.7	0.03	1.18
7/16/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.49	0.06	6.5	3	2.4	7.6	0.03	0.52
7/16/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	0.72	0.06	12.0	12	2.6	3.8	0.02	0.74
7/16/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.06	0.82	0.01	11.1	8	0.9	18.5	0.00	0.82
7/16/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.20	2.63	0.01	30.5	16	0.1	4.3	0.01	2.64
7/16/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.80	0.06	5.5	3	2.7	2.3	0.04	0.84
7/16/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.49	0.09	3.1	2	2.1	4.9	0.05	0.54
7/16/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.14	0.68	0.02	28.5	37	37.0	60.4	0.04	0.72
7/23/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.58	0.04	8.3	9	1.6	3.4	0.01	0.59
7/23/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	1.15	0.34	11.7	9	0.1	5.1	0.04	1.19
7/23/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.08	0.54	0.06	7.9	2	1.7	5.9	0.03	0.57
7/23/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.11	0.70	0.04	7.6	8	2.0	3.7	0.00	0.70
7/23/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.79	0.02	12.5	10	0.5	18.6	0.01	0.80
7/23/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.15	1.75	0.04	32.5	14	0.3	4.4	0.01	1.76
7/23/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.71	0.02	4.1	4	2.8	2.2	0.04	0.75
7/23/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.50	0.07	3.2	3	1.8	5.2	0.06	0.56
7/23/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.11	0.50	0.02	17.1	22	37.7	63.1	0.00	0.50
7/30/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.65	0.00	5.2	5	1.1	3.3	0.00	0.65
7/30/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.12	1.03	0.15	13.3	20	0.0	6.4	0.02	1.05
7/30/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.44	0.02	6.0	2	0.8	5.5	0.05	0.49
7/30/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.16	1.03	0.03	7.1	8	1.7	3.5	0.01	1.04
7/30/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	1.07	0.06	18.4	22	17.2	29.5	0.31	1.38
7/30/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.26	2.84	0.02	45.8	28	0.1	5.1	0.01	2.85
7/30/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.83	0.02	10.7	6	4.0	2.1	0.06	0.89
7/30/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.54	0.10	3.2	2	2.0	5.1	0.06	0.60
7/30/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.10	0.55	0.00	17.3	16	34.6	67.2	0.00	0.55
8/6/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.07	0.82	0.01	5.5	6	0.9	4.0	0.00	0.82
8/6/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.14	1.09	0.14	14.6	14	0.0	6.8	0.01	1.10
8/6/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.52	0.04	5.0	2	1.0	6.3	0.03	0.55
8/6/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.60	0.05	5.4	7	1.9	3.6	0.00	0.60
8/6/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.23	1.45	0.06	37.1	44	18.0	41.5	0.01	1.46
8/6/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.23	2.20	0.04	53.8	24	0.1	5.7	0.00	2.20
8/6/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.88	0.03	12.2	4	4.2	2.2	0.03	0.91
8/6/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.61	0.16	5.7	2	1.9	5.5	0.13	0.74
8/6/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.18	1.19	0.02	42.7	42	9.6	33.9	0.01	1.20
8/13/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.06	0.84	0.03	5.8	5	3.4	4.8	0.03	0.87

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
8/13/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.12	0.97	0.22	17.4	10	0.0	5.2	0.10	1.07
8/13/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.86	0.03	3.6	3	1.7	6.8	0.06	0.92
8/13/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.45	0.03	7.2	4	10.4	5.6	0.04	0.49
8/13/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.22	1.47	0.03	34.9	36	13.7	42.2	0.02	1.49
8/13/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.17	0.95	0.02	45.5	27	0.0	5.2	0.03	0.98
8/13/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	1.87	0.03	17.4	18	4.7	2.1	0.08	1.95
8/13/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.07	1.01	0.16	10.0	6	2.9	5.3	0.15	1.16
8/13/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.14	0.68	0.03	19.4	30	30.7	60.8	0.02	0.70
8/20/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.09	0.81	0.10	7.0	6	2.4	4.6	0.00	0.81
8/20/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.87	0.17	7.6	6	1.8	5.9	0.00	0.87
8/20/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.48	0.02	6.8	2	2.9	7.4	0.00	0.48
8/20/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.57	0.04	3.8	2	4.2	3.2	0.00	0.57
8/20/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.12	0.96	0.03	31.3	33	14.1	50.4	0.00	0.96
8/20/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.09	1.85	0.09	4.5	4	4.8	13.1	0.00	1.85
8/20/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.93	0.01	5.9	4	7.3	1.7	0.00	0.93
8/20/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.54	0.01	7.1	8	3.4	1.2	0.00	0.54
8/20/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.21	0.85	0.01	7.9	12	28.1	73.3	0.00	0.85
8/27/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.11	1.24	0.05	37.9	24	1.8	4.0	0.02	1.26
8/27/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	1.07	0.23	9.6	6	1.1	6.6	0.02	1.09
8/27/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.02	0.55	0.03	3.0	0	1.5	9.7	0.02	0.57
8/27/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.05	0.74	0.04	3.7	2	1.3	2.9	0.01	0.75
8/27/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	1.00	0.04	25.2	26	11.1	53.3	0.01	1.01
8/27/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.11	2.22	0.17	7.2	6	8.6	13.5	0.03	2.25
8/27/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	1.42	0.04	10.5	12	4.5	2.6	0.01	1.43
8/27/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.54	0.03	5.9	6	2.6	5.4	0.00	0.54
8/27/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.18	0.77	0.02	5.5	4	23.3	77.8	0.02	0.79
9/3/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.08	0.76	0.08	43.0	26	4.9	2.8	0.17	0.93
9/3/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	1.05	0.28	9.8	6	0.8	6.6	0.02	1.07
9/3/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.58	0.03	5.2	7	1.1	8.1	0.00	0.58
9/3/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.12	0.87	0.07	8.6	30	1.0	5.8	0.06	0.93
9/3/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	1.25	0.39	30.0	18	9.5	5.9	0.65	1.90
9/3/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	6.52	1.39	3.9	4	100.1	9.7	10.60	17.12
9/3/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	1.00	0.09	15.3	10	7.8	2.0	0.06	1.06
9/3/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.60	0.02	6.1	8	1.8	4.8	0.00	0.60
9/3/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.20	0.85	0.05	7.8	12	24.7	58.0	0.02	0.87
9/10/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.06	0.67	0.08	29.5	15	2.3	3.6	0.01	0.68
9/10/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.98	0.20	17.4	12	0.1	7.0	0.01	0.99
9/10/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.55	0.06	9.6	4	0.8	5.8	0.00	0.55
9/10/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.06	0.65	0.11	3.4	4	2.4	5.8	0.00	0.65
9/10/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	1.22	0.41	32.0	14	9.2	3.9	0.37	1.59
9/10/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	4.59	0.54	2.0	2	90.7	10.2	1.76	6.35
9/10/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.73	0.03	38.7	12	8.5	2.1	0.06	0.79

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
9/10/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.55	0.12	2.0	2	1.8	4.9	0.01	0.56
9/10/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.15	0.87	0.04	12.6	11	22.5	57.2	0.01	0.88
9/17/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.08	0.68	0.08	24.4	19	2.8	3.1	0.03	0.71
9/17/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	1.11	0.36	15.7	11	1.2	6.8	0.06	1.17
9/17/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.50	0.08	4.5	2	1.1	7.2	0.04	0.54
9/17/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.18	1.81	0.05	47.9	24	18.9	8.2	2.14	3.95
9/17/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.37	1.04	0.25	212.0	130	11.0	3.4	3.23	4.27
9/17/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.07	1.24	0.26	11.7	10	7.2	6.3	0.02	1.26
9/17/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.21	1.30	0.12	143.0	42	9.7	1.9	0.55	1.85
9/17/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.41	0.06	4.6	4	2.1	4.1	0.06	0.47
9/17/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.14	0.81	0.05	16.2	20	16.5	50.0	0.08	0.89
9/24/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.61	0.01	8.5	6	4.0	3.7	0.02	0.63
9/24/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	1.92	1.18	12.4	10	2.4	8.5	0.09	2.01
9/24/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.55	0.05	2.8	4	1.0	4.2	0.01	0.56
9/24/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.21	1.18	0.07	42.0	120	1.7	6.5	0.00	1.18
9/24/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.80	0.12	26.2	25	18.3	33.1	0.49	1.29
9/24/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	1.24	0.25	16.1	11	13.3	6.4	0.02	1.26
9/24/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.73	0.03	38.3	11	9.5	2.5	0.35	1.08
9/24/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.47	0.05	2.2	1	1.4	4.5	0.02	0.49
9/24/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.09	0.94	0.02	8.2	10	8.5	34.5	0.00	0.94
10/1/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.72	0.02	6.7	5	6.6	3.1	0.00	0.72
10/1/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	2.36	1.56	7.3	4	3.3	8.3	0.05	2.41
10/1/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.11	0.82	0.05	4.6	4	2.0	16.4	0.03	0.85
10/1/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.23	1.08	0.05	20.6	22	11.7	8.0	0.00	1.08
10/1/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.16	1.43	0.38	46.3	34	19.2	12.9	1.15	2.58
10/1/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.10	1.34	0.15	13.3	8	14.0	6.4	0.00	1.34
10/1/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.06	0.75	0.04	32.3	7	14.6	2.8	0.91	1.66
10/1/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.61	0.04	3.2	4	1.5	8.2	0.02	0.63
10/1/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.26	1.76	0.03	9.0	13	8.2	29.6	0.01	1.77
10/8/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.39	0.02	6.0	3	8.0	3.8	0.01	0.40
10/8/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	1.95	1.26	10.6	6	3.7	6.6	0.08	2.03
10/8/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.02	0.52	0.03	2.1	1	2.1	16.0	0.02	0.54
10/8/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.14	1.24	0.04	8.0	4	12.5	12.7	0.01	1.25
10/8/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.93	0.03	23.9	18	23.0	26.2	0.70	1.63
10/8/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	1.27	0.17	13.4	8	17.1	6.7	0.02	1.29
10/8/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.58	0.04	24.3	6	9.0	2.5	0.13	0.71
10/8/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.50	0.06	1.8	1	1.5	11.0	0.02	0.52
10/8/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.10	0.93	0.02	10.0	10	5.8	27.5	0.02	0.95
10/15/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.35	0.02	9.7	6	8.2	4.1	0.06	0.41
10/15/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	1.70	0.89	9.4	8	3.9	5.5	0.12	1.82
10/15/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.86	0.04	2.1	2	1.9	13.9	0.01	0.87
10/15/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.20	1.38	0.17	46.3	17	37.5	12.8	0.14	1.52

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
10/15/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.28	1.38	0.22	126.0	82	11.3	4.9	0.94	2.32
10/15/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.07	1.21	0.19	11.2	6	20.4	6.6	0.02	1.23
10/15/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.19	4.84	0.05	164.0	42	20.6	3.6	1.95	6.79
10/15/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.51	0.05	3.1	2	1.5	12.5	0.00	0.51
10/15/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.15	1.17	0.06	10.9	8	5.6	25.3	0.01	1.18
10/22/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.29	0.01	4.8	9	7.5	3.4	0.01	0.30
10/22/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	1.22	0.44	6.0	6	3.8	7.1	0.10	1.32
10/22/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.55	0.02	2.3	4	2.3	9.1	0.00	0.55
10/22/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.18	1.09	0.06	11.1	10	7.5	13.4	0.01	1.10
10/22/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	1.00	0.05	13.1	11	18.6	31.7	0.62	1.62
10/22/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	1.10	0.09	7.1	9	23.2	6.6	0.03	1.13
10/22/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.06	0.78	0.02	33.6	18	13.1	2.9	0.53	1.31
10/22/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.47	0.04	2.9	5	2.6	10.8	0.27	0.74
10/22/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.17	0.97	0.03	11.5	8	5.1	30.5	0.01	0.98
10/29/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.29	0.02	5.2	4	7.4	4.0	0.01	0.30
10/29/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.94	0.26	6.2	7	3.3	11.6	0.03	0.97
10/29/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.57	0.03	3.9	4	2.1	8.9	0.06	0.63
10/29/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.35	1.10	0.05	16.5	8	5.4	15.1	0.00	1.10
10/29/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.06	0.64	0.03	6.2	6	20.4	38.3	0.09	0.73
10/29/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.79	0.05	4.5	2	22.8	7.0	0.01	0.80
10/29/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.58	0.04	19.6	8	11.9	3.9	0.28	0.86
10/29/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.44	0.03	1.9	2	1.8	10.4	0.03	0.47
10/29/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.21	1.14	0.03	19.3	26	4.4	31.4	0.01	1.15
11/5/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.19	0.02	4.7	4	7.3	4.0	0.01	0.20
11/5/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.43	0.02	9.1	4	7.7	2.5	0.01	0.44
11/5/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.58	0.02	4.3	4	1.9	8.6	0.00	0.58
11/5/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.22	0.93	0.04	19.3	11	5.5	14.9	0.01	0.94
11/5/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.06	0.57	0.04	9.6	12	19.2	40.3	0.06	0.63
11/5/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.81	0.03	4.2	2	23.3	7.0	0.01	0.82
11/5/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.08	0.83	0.13	9.0	10	2.8	12.8	0.04	0.87
11/5/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.46	0.04	2.1	2	1.7	8.5	0.02	0.48
11/5/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.18	0.94	0.03	15.2	12	4.3	34.8	0.01	0.95
11/12/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.32	0.01	7.6	5	7.2	4.3	0.04	0.36
11/12/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.88	0.02	5.9	6	3.3	12.2	0.03	0.91
11/12/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.64	0.01	3.6	3	1.9	9.0	0.02	0.66
11/12/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.32	1.36	0.12	42.0	28	41.9	18.0	0.68	2.04
11/12/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.62	0.01	16.5	19	20.9	37.0	0.09	0.71
11/12/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.80	0.01	4.7	4	23.8	6.8	0.05	0.85
11/12/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.18	1.06	0.03	130.0	42	18.1	4.9	1.49	2.55
11/12/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.47	0.02	2.8	2	1.7	7.0	0.01	0.48
11/12/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.19	1.01	0.02	15.8	14	2.3	35.2	0.02	1.03
11/19/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.28	0.01	5.5	3	7.2	4.8	0.23	0.51

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
11/19/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.87	0.03	6.0	7	1.5	9.4	0.02	0.89
11/19/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.60	0.02	3.0	3	2.6	8.8	0.02	0.62
11/19/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.22	1.14	0.02	30.1	4	20.2	15.2	0.01	1.15
11/19/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.93	0.01	8.4	4	16.5	14.5	0.07	1.00
11/19/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.81	0.02	4.1	3	23.6	9.1	0.07	0.88
11/19/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.48	0.02	27.8	10	11.9	3.6	0.38	0.86
11/19/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.48	0.01	2.2	1	1.9	7.0	0.02	0.50
11/19/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.13	0.86	0.01	12.2	7	8.4	37.8	0.01	0.87
11/26/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.19	0.01	3.7	2	7.9	4.5	0.07	0.26
11/26/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.87	0.00	6.9	11	1.6	7.9	0.00	0.87
11/26/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.52	0.01	3.4	3	2.6	9.4	0.00	0.52
11/26/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.11	0.73	0.01	25.7	12	44.5	22.2	0.00	0.73
11/26/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.55	0.01	10.0	6	13.8	11.8	0.28	0.83
11/26/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.77	0.01	4.9	4	27.0	7.6	0.01	0.78
11/26/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.36	0.01	14.2	4	8.7	3.2	0.17	0.53
11/26/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.48	0.01	2.2	2	2.2	7.4	0.05	0.53
11/26/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.13	0.88	0.01	11.4	10	13.3	43.7	0.00	0.88
12/3/12	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.25	0.01	1.9	1	7.7	4.2	0.11	0.36
12/3/12	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.79	0.00	6.7	12	1.1	7.2	0.00	0.79
12/3/12	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.57	0.02	3.0	3	2.3	8.8	0.01	0.58
12/3/12	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	0.71	0.01	9.7	6	62.7	29.4	0.00	0.71
12/3/12	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.58	0.00	7.7	11	13.7	13.5	0.00	0.58
12/3/12	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.78	0.02	4.4	2	25.7	7.7	0.00	0.78
12/3/12	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.36	0.01	8.4	2	5.9	2.4	0.00	0.36
12/3/12	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.44	0.01	2.3	1	2.2	7.4	0.01	0.45
12/3/12	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.10	0.74	0.00	9.3	9	16.7	50.3	0.00	0.74
12/10/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.32	0.01	3.7	2	10.2	6.9	0.02	0.34
12/10/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.79	0.01	11.4	17	3.9	6.3	0.11	0.90
12/10/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	1.34	0.03	2.8	2	3.3	8.4	0.00	1.34
12/10/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.29	0.37	0.34	39.4	22	75.5	33.4	0.01	0.38
12/10/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.12	0.90	0.21	32.2	20	13.7	10.0	0.51	1.41
12/10/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.84	0.03	3.4	3	23.4	7.7	0.03	0.87
12/10/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.40	0.03	49.5	15	5.5	2.2	0.12	0.52
12/10/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.39	0.02	2.6	2	3.0	7.0	0.00	0.39
12/10/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.11	0.63	0.01	7.1	7	13.6	45.2	0.03	0.66
12/17/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.19	0.01	2.3	2	9.6	6.6	0.11	0.30
12/17/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.58	0.05	15.4	13	3.4	5.6	0.09	0.67
12/17/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.30	0.01	2.1	1	4.0	7.9	0.00	0.30
12/17/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.12	0.77	0.13	17.8	8	111.7	45.3	0.01	0.78
12/17/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.75	0.01	15.4	10	19.0	14.7	0.37	1.12
12/17/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.94	0.04	4.7	2	12.7	10.1	0.25	1.19
12/17/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.41	0.02	22.6	6	9.7	3.3	0.66	1.07

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
12/17/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.33	0.02	1.9	2	3.3	6.3	0.01	0.34
12/17/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.67	0.01	8.1	8	12.2	36.3	0.01	0.68
12/31/2012	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.25	0.00	8.0	3	10.3	5.8	0.53	0.78
12/31/2012	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.37	0.02	9.2	3	5.7	5.6	0.43	0.80
12/31/2012	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.02	0.20	0.01	1.7	1	4.8	7.0	0.09	0.29
12/31/2012	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.17	1.27	0.06	71.8	33	47.4	22.5	0.93	2.20
12/31/2012	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.16	1.10	0.12	64.3	28	16.7	24.0	0.93	2.03
12/31/2012	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.74	0.01	3.7	1	20.8	7.8	0.46	1.20
12/31/2012	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.21	0.00	12.0	6	4.0	1.4	0.22	0.43
12/31/2012	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.29	0.00	1.9	1	4.2	6.1	0.35	0.64
12/31/2012	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.09	0.65	0.01	6.1	4	4.0	23.0	0.01	0.66
1/7/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.19	0.00	3.8	3	5.8	5.3	2.30	2.49
1/7/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.51	0.07	4.2	2	4.6	5.6	0.73	1.24
1/7/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.35	0.03	2.4	2	5.3	6.2	1.08	1.43
1/7/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.12	0.76	0.06	41.7	22	71.4	29.1	0.11	0.87
1/7/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.54	0.03	9.9	6	13.1	8.9	0.57	1.11
1/7/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.65	0.01	4.7	5	4.7	5.0	0.42	1.07
1/7/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.37	0.04	4.9	3	3.7	2.7	0.39	0.76
1/7/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.30	0.02	2.5	3	4.1	5.2	0.93	1.23
1/7/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.04	0.40	0.03	9.6	6	12.7	7.4	0.86	1.26
1/13/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.27	0.82	0.06	101.0	68	4.2	2.6	2.43	3.25
1/13/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.41	1.45	0.06	130.0	111	3.7	2.9	1.62	3.07
1/13/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.37	1.32	0.08	129.0	99	3.2	1.9	1.87	3.19
1/13/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.14	1.06	0.01	25.7	14	3.7	1.8	0.27	1.33
1/13/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.38	0.97	0.03	153.0	95	3.3	1.2	0.35	1.32
1/13/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.24	1.02	0.03	102.0	57	3.8	2.8	1.38	2.40
1/13/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.16	0.71	0.02	82.6	53	2.6	1.3	0.59	1.30
1/13/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.36	1.33	0.05	125.0	109	2.7	1.8	1.61	2.94
1/13/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	1.16	2.50	0.13	542.0	416	2.0	1.9	0.90	3.40
1/21/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.09	0.42	0.05	38.2	17	4.7	3.4	2.83	3.25
1/21/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.46	0.06	32.8	14	4.7	4.1	2.87	3.33
1/21/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.15	0.59	0.08	32.0	13	3.4	3.4	2.92	3.51
1/21/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	0.64	0.01	12.4	8	6.8	4.4	0.04	0.68
1/21/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.11	0.55	0.01	36.8	14	4.6	2.8	1.61	2.16
1/21/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	0.56	0.04	38.6	16	3.5	1.9	1.34	1.90
1/21/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.07	0.46	0.01	54.6	21	2.6	0.9	0.54	1.00
1/21/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.10	0.53	0.04	38.0	16	3.1	2.1	1.74	2.27
1/21/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.11	0.64	0.03	39.4	16	4.6	3.2	1.39	2.03
1/28/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.24	0.01	18.2	5	4.8	3.8	3.30	3.54
1/28/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.34	0.04	19.1	12	4.6	5.0	3.35	3.69
1/28/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.31	0.03	12.4	4	4.1	4.2	3.73	4.04
1/28/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.06	0.66	0.01	11.2	7	8.5	4.5	0.09	0.75

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
1/28/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.48	0.04	26.6	12	5.8	3.9	1.82	2.30
1/28/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.42	0.04	20.4	6	3.8	2.8	1.88	2.30
1/28/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.33	0.03	27.1	8	2.8	1.4	0.67	1.00
1/28/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.32	0.01	21.4	6	3.2	2.5	1.68	2.00
1/28/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.07	0.51	0.03	26.1	11	4.9	3.2	1.54	2.05
2/4/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.29	0.03	23.8	8	4.9	3.6	2.74	3.03
2/4/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.42	0.05	21.9	8	5.0	4.7	2.97	3.39
2/4/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.32	0.04	13.9	4	4.1	4.0	3.26	3.58
2/4/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.06	0.64	0.05	10.2	6	7.3	4.1	0.03	0.67
2/4/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.54	0.06	23.3	8	5.6	3.9	1.86	2.40
2/4/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	1.00	0.05	31.9	10	4.2	2.6	1.64	2.64
2/4/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.35	0.05	18.6	4	3.2	1.8	0.78	1.13
2/4/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.32	0.05	16.5	5	3.6	2.9	1.99	2.31
2/4/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.05	0.44	0.04	19.4	6	5.1	3.3	1.87	2.31
2/11/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.25	0.00	16.4	7	5.3	3.8	2.38	2.63
2/11/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.34	0.02	25.5	14	5.2	4.9	2.55	2.89
2/11/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.30	0.01	16.2	10	4.5	4.1	2.59	2.89
2/11/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	0.69	0.01	11.2	10	7.3	4.3	0.16	0.85
2/11/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.51	0.04	24.0	10	5.8	4.6	1.76	2.27
2/11/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.35	0.02	19.3	8	4.5	3.3	1.58	1.93
2/11/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.19	0.02	11.4	4	3.5	2.0	0.66	0.85
2/11/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.31	0.02	14.7	8	4.0	3.5	1.94	2.25
2/11/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.13	0.55	0.03	32.7	20	5.6	4.2	1.77	2.32
2/18/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.32	0.01	8.8	4	5.2	3.9	2.14	2.46
2/18/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.24	0.01	8.8	7	5.0	5.1	2.28	2.52
2/18/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.19	0.02	6.6	4	4.2	4.3	2.53	2.72
2/18/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.79	0.02	15.2	18	7.3	4.3	0.13	0.92
2/18/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.45	0.04	11.1	5	5.7	4.4	1.39	1.84
2/18/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.25	0.02	11.9	6	4.5	3.3	1.47	1.72
2/18/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.15	0.01	8.0	3	3.7	2.0	0.61	0.76
2/18/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.18	0.01	6.8	3	3.8	3.3	1.64	1.82
2/18/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.04	0.29	0.02	10.5	4	5.5	4.4	1.48	1.77
2/25/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.25	0.01	12.4	6	4.8	3.7	1.90	2.15
2/25/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.30	0.02	17.5	12	4.7	4.5	2.06	2.36
2/25/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.29	0.02	9.6	5	4.1	3.8	2.24	2.53
2/25/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	0.84	0.02	15.0	12	7.8	4.2	0.03	0.87
2/25/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.06	0.45	0.02	17.1	8	5.3	4.2	1.37	1.82
2/25/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.27	0.02	13.5	6	4.5	3.0	1.26	1.53
2/25/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.20	0.01	21.1	18	3.4	1.8	0.44	0.64
2/25/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.22	0.02	9.2	4	3.9	3.1	1.54	1.76
2/25/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.06	0.36	0.02	17.4	8	5.1	3.5	1.39	1.75
3/4/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.26	0.00	11.6	4	4.7	3.4	1.64	1.90

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
3/4/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.30	0.01	28.7	23	4.5	3.8	1.67	1.97
3/4/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.02	0.20	0.01	6.1	4	4.2	3.7	2.07	2.27
3/4/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	0.88	0.02	9.0	4	7.5	4.4	0.07	0.95
3/4/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.39	0.01	15.1	8	5.1	3.7	1.12	1.51
3/4/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.33	0.02	18.1	8	4.4	2.4	1.01	1.34
3/4/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.17	0.01	10.6	4	3.3	1.6	0.35	0.52
3/4/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.22	0.02	9.4	5	3.9	2.8	1.23	1.45
3/4/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.10	0.72	0.01	27.7	13	5.0	4.1	0.72	1.44
3/11/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.31	0.01	11.6	6	4.9	3.5	1.39	1.70
3/11/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.46	0.02	25.6	21	4.8	4.4	1.60	2.06
3/11/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.08	0.53	0.02	16.5	8	4.2	3.2	1.37	1.90
3/11/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.86	0.02	13.4	12	7.0	3.7	0.02	0.88
3/11/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	1.30	0.26	21.3	12	6.7	4.3	1.05	2.35
3/11/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.32	0.01	13.3	8	4.3	2.7	0.86	1.18
3/11/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.32	0.01	10.3	3	3.3	1.6	0.25	0.57
3/11/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.35	0.01	15.1	12	4.2	2.9	1.16	1.51
3/11/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.20	0.91	0.06	38.5	34	5.0	3.4	1.01	1.92
3/18/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.22	0.02	5.7	4	4.8	3.5	1.28	1.50
3/18/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.45	0.02	8.3	7	4.6	4.3	1.35	1.80
3/18/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.29	0.01	5.3	4	4.2	3.6	1.65	1.94
3/18/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.87	0.04	11.4	10	8.5	4.8	0.05	0.92
3/18/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.06	0.46	0.06	11.1	6	5.2	3.9	0.79	1.25
3/18/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	1.05	0.01	7.6	6	4.1	2.7	0.81	1.86
3/18/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.16	0.01	7.2	2	3.2	1.7	0.26	0.42
3/18/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.21	0.01	5.8	4	3.7	2.7	0.96	1.17
3/18/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.04	0.40	0.03	10.6	10	4.6	3.3	0.89	1.29
3/25/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.30	0.02	5.7	4	5.1	3.7	1.10	1.40
3/25/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.24	0.02	5.2	3	4.9	4.4	1.21	1.45
3/25/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.26	0.01	5.8	2	4.4	3.6	1.27	1.53
3/25/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	0.74	0.10	15.8	8	10.2	5.2	0.04	0.78
3/25/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.46	0.04	11.2	6	5.7	4.4	0.95	1.41
3/25/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.02	0.32	0.01	7.1	7	4.2	2.9	0.70	1.02
3/25/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.15	0.01	5.7	1	3.2	1.8	0.22	0.37
3/25/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.21	0.01	5.0	2	4.0	3.0	0.89	1.10
3/25/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.04	0.39	0.02	9.4	4	5.4	3.7	0.89	1.28
4/1/13	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.25	0.01	4.4	2	5.1	3.8	0.95	1.20
4/1/13	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.31	0.00	6.3	5	4.8	4.5	1.01	1.32
4/1/13	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.28	0.01	5.1	4	4.7	3.8	1.11	1.39
4/1/13	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	0.90	0.04	21.2	12	9.4	5.0	0.04	0.94
4/1/13	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.58	0.04	15.3	8	6.0	4.6	0.66	1.24
4/1/13	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.28	0.01	6.1	6	4.4	3.0	0.65	0.93
4/1/13	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.13	0.00	5.0	2	3.5	1.8	0.23	0.36

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
4/1/13	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.25	0.01	4.5	2	4.1	3.0	0.78	1.03
4/1/13	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.06	0.59	0.01	14.2	10	5.5	4.7	0.65	1.24
4/8/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.26	0.02	3.7	2	4.9	3.6	0.84	1.10
4/8/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.28	0.02	3.5	4	4.7	4.4	0.85	1.13
4/8/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.78	0.02	3.9	4	4.7	3.6	1.09	1.87
4/8/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	0.58	0.02	13.2	15	8.7	4.6	0.01	0.59
4/8/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.06	0.25	0.06	11.2	8	5.6	4.6	0.64	0.89
4/8/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.02	0.12	0.02	5.7	4	4.5	3.0	0.64	0.76
4/8/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.17	0.02	4.6	2	3.2	2.0	0.23	0.40
4/8/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.45	0.02	3.9	3	4.0	3.0	0.74	1.19
4/8/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.07	0.31	0.03	16.1	26	5.0	3.7	0.70	1.01
4/15/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.44	0.02	17.4	8	4.4	2.9	0.71	1.15
4/15/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.51	0.04	14.1	8	4.6	3.5	0.80	1.31
4/15/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.09	0.41	0.02	14.3	10	4.0	2.8	0.99	1.40
4/15/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.83	0.02	7.1	6	7.7	4.0	0.01	0.84
4/15/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.60	0.04	17.0	8	4.0	3.0	0.45	1.05
4/15/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.42	0.02	18.7	10	4.1	2.3	0.39	0.81
4/15/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.23	0.01	16.0	5	3.1	1.4	0.17	0.40
4/15/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.39	0.01	13.5	4	3.3	2.4	0.70	1.09
4/15/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.11	0.73	0.04	17.6	6	4.3	2.8	0.41	1.14
4/22/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.26	0.02	10.4	4	4.9	3.3	0.63	0.89
4/22/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.36	0.02	10.9	10	4.7	3.8	0.69	1.05
4/22/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.33	0.02	6.5	5	4.2	3.5	0.90	1.23
4/22/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.05	0.69	0.03	7.6	8	7.9	4.2	0.00	0.69
4/22/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.61	0.05	13.9	12	4.5	3.8	0.44	1.05
4/22/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.36	0.02	8.1	4	4.1	2.6	0.36	0.72
4/22/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.19	0.02	7.7	4	3.2	1.6	0.11	0.30
4/22/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.27	0.02	6.7	4	3.7	2.7	0.53	0.80
4/22/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.12	0.69	0.05	14.2	14	4.2	4.8	0.38	1.07
4/29/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.23	0.01	7.7	4	4.7	3.0	0.54	0.77
4/29/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.39	0.03	12.7	16	4.6	3.7	0.61	1.00
4/29/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.37	0.02	8.2	8	4.3	3.3	0.68	1.05
4/29/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	0.66	0.05	8.9	8	7.8	4.2	0.02	0.68
4/29/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	0.55	0.07	21.9	20	4.8	3.7	0.51	1.06
4/29/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.34	0.03	8.9	5	4.3	2.5	0.28	0.62
4/29/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.21	0.02	7.5	3	3.2	1.5	0.10	0.31
4/29/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.34	0.02	8.3	7	3.6	2.5	0.43	0.77
4/29/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.46	0.04	12.8	16	4.4	3.0	0.45	0.91
5/6/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.29	0.01	7.1	4	4.9	3.2	0.59	0.88
5/6/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.40	0.02	9.0	8	4.9	4.0	0.65	1.05
5/6/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.36	0.02	7.1	7	4.3	3.4	0.76	1.12
5/6/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	0.69	0.01	8.0	9	8.3	4.4	0.01	0.70

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
5/6/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.38	0.04	15.3	11	4.3	3.2	0.40	0.78
5/6/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.33	0.02	10.3	6	4.5	2.7	0.33	0.66
5/6/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.15	0.01	10.0	4	2.9	1.5	0.11	0.26
5/6/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.43	0.00	8.0	7	3.7	2.5	0.48	0.91
5/6/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.07	0.44	0.02	13.3	12	4.8	3.0	0.42	0.86
5/13/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.26	0.01	4.5	3	4.8	3.3	0.55	0.81
5/13/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.41	0.03	9.7	14	4.7	4.2	0.50	0.91
5/13/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.30	0.01	5.2	4	4.4	3.7	0.83	1.13
5/13/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.16	0.96	0.13	8.4	10	7.9	4.3	0.04	1.00
5/13/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.11	0.48	0.05	17.5	26	4.4	3.5	0.36	0.84
5/13/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.33	0.04	6.8	5	4.2	2.7	0.38	0.71
5/13/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.15	0.01	6.9	3	2.9	1.4	0.11	0.26
5/13/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.24	0.01	6.3	6	3.4	2.4	0.36	0.60
5/13/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.40	0.05	15.9	24	3.9	3.6	0.34	0.74
5/20/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.39	0.05	7.1	6	5.3	3.7	0.54	0.93
5/20/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.54	0.10	13.6	16	4.4	4.1	0.45	0.99
5/20/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.47	0.04	8.0	7	4.3	3.3	0.68	1.15
5/20/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.14	0.98	0.16	7.6	8	7.9	4.4	0.04	1.02
5/20/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.11	0.58	0.06	20.1	27	4.5	3.5	0.37	0.95
5/20/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	0.44	0.08	12.8	8	4.6	2.6	0.29	0.73
5/20/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.24	0.03	8.8	6	3.3	1.7	0.13	0.37
5/20/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.34	0.03	8.5	8	3.8	2.5	0.42	0.76
5/20/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.09	0.48	0.05	16.1	24	4.4	3.3	0.37	0.85
5/28/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.42	0.03	8.9	7	4.8	3.1	0.45	0.87
5/28/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.53	0.06	13.9	17	4.5	4.0	0.50	1.03
5/28/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.09	0.50	0.03	10.7	10	4.0	3.6	0.69	1.19
5/28/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.11	0.95	0.09	12.2	17	7.5	4.3	0.02	0.97
5/28/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	0.57	0.05	13.7	12	4.5	3.6	0.32	0.89
5/28/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.45	0.05	11.3	6	4.0	2.2	0.29	0.74
5/28/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.24	0.03	8.5	4	3.1	1.5	0.14	0.38
5/28/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.07	0.40	0.02	9.6	9	3.6	2.8	0.46	0.86
5/28/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.13	0.65	0.05	16.4	21	4.4	3.7	0.42	1.07
6/3/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.34	0.02	9.3	8	4.8	3.3	0.32	0.66
6/3/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.51	0.05	14.0	15	4.5	4.2	0.45	0.96
6/3/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.12	0.57	0.04	17.4	16	3.6	2.9	0.59	1.16
6/3/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	1.06	0.07	16.3	18	6.9	4.1	0.01	1.07
6/3/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.14	0.67	0.08	21.8	18	4.2	3.2	0.36	1.03
6/3/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.45	0.03	15.8	6	3.9	2.1	0.13	0.58
6/3/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.30	0.01	15.9	6	2.7	1.3	0.07	0.37
6/3/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.08	0.45	0.04	15.9	16	3.4	2.4	0.41	0.86
6/3/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.11	0.58	0.05	19.4	24	3.9	2.7	0.37	0.95
6/10/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.27	0.02	6.6	4	4.7	3.5	0.36	0.63

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
6/10/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.47	0.06	12.6	14	4.4	4.4	0.27	0.74
6/10/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.36	0.02	6.6	5	3.9	3.4	0.71	1.07
6/10/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	1.01	0.26	19.2	14	6.8	4.4	0.09	1.10
6/10/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.52	0.08	18.6	16	3.9	3.4	0.32	0.84
6/10/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.52	0.07	8.9	6	3.7	2.3	0.34	0.86
6/10/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.22	0.02	10.3	2	2.6	1.3	0.11	0.33
6/10/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.29	0.02	8.2	5	3.1	2.2	0.35	0.64
6/10/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.41	0.04	18.1	22	3.6	2.5	0.33	0.74
6/17/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.85	0.03	8.1	6	4.6	3.5	0.38	1.23
6/17/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.12	0.55	0.09	13.3	12	3.4	4.5	0.15	0.70
6/17/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.53	0.03	4.9	4	4.1	3.7	0.49	1.02
6/17/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	1.56	8.75	3.40	3116.0	1271	9.3	7.0	0.08	8.83
6/17/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.16	0.63	0.06	29.1	35	3.9	4.4	0.29	0.92
6/17/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.47	0.04	6.3	2	3.2	2.4	0.60	1.07
6/17/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.26	0.01	5.8	2	2.8	1.6	0.18	0.44
6/17/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.38	0.06	4.7	4	3.2	2.7	0.32	0.70
6/17/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.56	0.05	12.1	15	3.8	3.5	0.26	0.82
6/24/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.50	0.01	5.5	2	4.1	3.3	0.23	0.73
6/24/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.12	0.65	0.09	10.0	6	2.8	4.6	0.04	0.69
6/24/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.47	0.03	5.9	4	3.9	3.8	0.28	0.75
6/24/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	1.36	6.64	1.29	1088.0	563	6.7	8.8	0.20	6.84
6/24/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.15	0.64	0.03	30.6	30	3.8	5.4	0.17	0.81
6/24/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.43	0.01	5.0	3	3.1	2.5	0.55	0.98
6/24/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.24	0.00	4.1	2	2.8	1.7	0.16	0.40
6/24/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.46	0.03	5.0	3	2.9	2.8	0.17	0.63
6/24/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.09	0.49	0.07	12.2	12	2.9	3.1	0.16	0.65
7/1/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.37	0.02	6.2	4	3.7	3.4	0.10	0.47
7/1/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.21	1.05	0.11	11.7	10	1.9	4.9	0.00	1.05
7/1/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.39	0.03	5.2	5	3.6	4.5	0.16	0.55
7/1/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.81	4.99	0.89	203.0	393	6.3	10.3	0.72	5.71
7/1/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.62	0.05	30.8	25	3.3	6.6	0.11	0.73
7/1/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	0.63	0.01	8.3	6	2.7	3.2	0.38	1.01
7/1/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.21	0.00	4.0	0	2.5	1.4	0.12	0.33
7/1/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.36	0.02	4.5	2	2.8	3.3	0.10	0.46
7/1/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.11	0.58	0.12	14.3	15	2.1	3.5	0.04	0.62
7/8/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.36	0.01	7.5	4	3.8	3.2	0.05	0.41
7/8/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	0.67	0.03	9.0	7	2.0	5.1	0.00	0.67
7/8/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.51	0.05	3.7	2	3.2	4.9	0.07	0.58
7/8/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.84	10.10	1.19	2128.0	1259	10.3	13.2	0.41	10.51
7/8/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.12	0.62	0.04	18.1	18	3.3	7.6	0.00	0.62
7/8/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.09	0.80	0.10	5.2	6	1.0	3.2	0.00	0.80
7/8/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.19	0.03	3.4	3	2.6	1.5	0.07	0.26

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
7/8/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.38	0.04	5.1	6	2.4	3.8	0.06	0.44
7/8/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.21	1.50	0.00	33.5	29	1.4	4.8	0.00	1.50
7/15/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.52	0.04	6.6	26	3.3	3.0	0.03	0.55
7/15/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.12	0.84	0.04	12.5	13	2.0	5.6	0.00	0.84
7/15/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.41	0.03	3.2	4	2.9	5.0	0.03	0.44
7/15/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.11	0.67	0.08	14.7	14	2.6	7.7	0.02	0.69
7/15/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.15	0.99	0.08	10.2	4	0.4	3.3	0.00	0.99
7/15/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.28	0.03	4.3	4	2.4	1.4	0.03	0.31
7/15/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.41	0.04	3.8	1	1.9	3.5	0.04	0.45
7/15/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.12	0.65	0.01	16.2	16	19.6	19.1	0.00	0.65
7/22/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.41	0.04	9.4	8	2.6	2.7	0.03	0.44
7/22/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	1.09	0.21	9.1	8	2.1	5.3	0.01	1.10
7/22/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.52	0.08	4.8	5	2.7	4.9	0.08	0.60
7/22/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.60	0.08	6.3	6	2.3	7.8	0.02	0.62
7/22/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.16	1.02	0.17	17.7	8	1.2	2.9	0.01	1.03
7/22/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.10	0.38	0.05	36.8	22	2.7	1.3	0.09	0.47
7/22/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.51	0.08	4.1	4	1.6	3.7	0.07	0.58
7/22/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.12	0.72	0.05	12.2	14	11.0	13.6	0.00	0.72
7/29/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.39	0.01	7.5	6	3.8	3.6	0.04	0.43
7/29/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.76	0.11	10.1	10	1.7	4.4	0.03	0.79
7/29/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.46	0.04	4.8	2	2.3	6.6	0.07	0.53
7/29/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.76	0.07	28.1	20	24.2	5.9	0.04	0.80
7/29/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.54	0.02	10.6	8	1.6	8.8	0.02	0.56
7/29/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.13	0.52	0.06	21.2	5	1.1	3.1	0.01	0.53
7/29/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.22	0.01	9.6	6	2.4	1.5	0.04	0.26
7/29/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.46	0.05	4.5	2	2.0	5.4	0.08	0.54
7/29/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.17	0.79	0.10	33.2	31	0.9	4.6	0.02	0.81
8/5/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.33	0.01	4.9	4	4.6	5.0	0.08	0.41
8/5/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.50	0.07	9.7	6	2.1	4.3	0.03	0.53
8/5/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.46	0.04	5.5	2	2.1	5.4	0.08	0.54
8/5/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.20	1.14	0.01	143.0	41	27.5	6.6	0.01	1.15
8/5/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.14	1.21	0.29	36.4	37	7.6	7.3	0.48	1.69
8/5/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.10	0.78	0.04	18.2	4	0.7	3.1	0.00	0.78
8/5/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.16	0.01	5.6	2	2.3	1.8	0.11	0.27
8/5/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.42	0.03	4.1	2	1.4	4.0	0.04	0.46
8/5/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.12	0.70	0.10	21.8	20	0.9	4.5	0.04	0.74
8/12/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.54	0.01	9.3	8	5.3	4.9	0.38	0.92
8/12/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.53	0.01	8.1	9	4.1	5.0	0.10	0.63
8/12/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.16	0.88	0.09	10.9	8	2.7	3.3	0.91	1.79
8/12/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	0.83	0.01	49.6	24	37.8	7.3	0.01	0.84
8/12/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.72	0.12	22.0	20	1.4	5.0	0.08	0.80
8/12/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.58	0.02	20.9	14	3.0	1.7	0.13	0.71

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
8/12/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.46	0.00	13.4	8	2.7	1.5	0.10	0.56
8/12/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.08	0.56	0.03	7.8	6	2.0	2.4	0.37	0.93
8/12/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.16	1.05	0.17	16.5	21	2.9	4.3	0.48	1.53
8/19/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.47	0.02	5.5	4	5.2	5.1	0.30	0.77
8/19/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.57	0.02	9.6	11	5.0	5.2	0.20	0.77
8/19/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.46	0.03	4.7	4	3.1	4.1	0.70	1.16
8/19/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.11	0.98	0.01	48.6	32	41.7	8.7	0.00	0.98
8/19/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.66	0.05	31.2	28	4.4	3.9	0.22	0.88
8/19/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.58	0.02	9.1	9	3.5	1.9	0.12	0.70
8/19/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.39	0.01	6.6	6	2.9	1.7	0.14	0.53
8/19/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.37	0.02	4.5	5	2.8	2.2	0.19	0.56
8/19/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.10	0.52	0.04	19.9	23	3.7	3.8	0.20	0.72
8/26/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.38	0.02	9.4	12	4.8	5.2	0.16	0.54
8/26/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.73	0.06	8.1	7	4.4	5.5	0.05	0.78
8/26/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.49	0.05	4.2	4	2.9	4.4	0.23	0.72
8/26/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.10	0.99	0.01	32.5	26	23.8	7.2	0.00	0.99
8/26/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.11	0.60	0.04	31.8	29	5.2	5.7	0.11	0.71
8/26/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.56	0.01	7.1	8	2.9	2.0	0.26	0.82
8/26/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.38	0.01	5.1	4	2.7	1.8	0.13	0.51
8/26/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.42	0.02	3.9	5	2.8	2.8	0.09	0.51
8/26/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.06	0.58	0.00	5.7	6	4.1	5.7	0.00	0.58
9/2/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.41	0.01	5.6	3	4.5	5.5	0.11	0.52
9/2/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	1.08	0.04	8.7	4	3.5	6.0	0.03	1.11
9/2/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.47	0.04	3.7	3	2.7	4.6	0.12	0.59
9/2/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.22	1.47	0.07	149.0	60	21.8	7.4	0.06	1.53
9/2/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.14	0.72	0.04	42.4	34	4.5	6.8	0.11	0.83
9/2/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.52	0.01	5.3	3	2.6	2.3	0.49	1.01
9/2/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.41	0.01	4.3	6	2.7	2.1	0.17	0.58
9/2/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.49	0.02	3.7	4	2.5	3.0	0.10	0.59
9/2/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.57	0.00	7.0	7	4.8	10.0	0.01	0.58
9/9/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.38	0.01	4.9	2	4.1	5.6	0.03	0.41
9/9/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.43	0.03	3.2	2	2.0	4.9	0.06	0.49
9/9/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	0.84	0.00	41.1	16	16.1	6.9	0.01	0.85
9/9/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.59	0.06	14.5	13	3.5	7.5	0.09	0.68
9/9/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.54	0.02	4.9	4	2.4	2.6	0.10	0.64
9/9/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.22	0.02	3.2	2	2.4	1.6	0.04	0.26
9/9/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.44	0.01	3.4	2	2.0	3.2	0.04	0.48
9/9/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.09	0.61	0.01	9.2	8	3.5	9.9	0.00	0.61
9/16/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.43	0.02	11.2	15	3.8	5.9	0.02	0.45
9/16/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.24	1.50	0.31	106.0	62	4.0	6.6	0.03	1.53
9/16/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.42	0.03	2.4	2	2.0	5.1	0.05	0.47
9/16/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.06	0.82	0.02	14.9	6	14.7	8.5	0.01	0.83

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
9/16/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.60	0.03	12.1	13	4.2	8.6	0.10	0.70
9/16/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.59	0.05	5.0	2	1.9	3.0	0.08	0.67
9/16/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.28	0.02	3.4	4	2.6	1.8	0.02	0.30
9/16/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.38	0.03	2.2	1	1.8	3.5	0.03	0.41
9/16/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.09	0.68	0.00	9.9	10	3.8	13.9	0.01	0.69
9/23/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.43	0.02	6.3	4	3.5	5.8	0.01	0.44
9/23/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.16	0.94	0.03	45.4	32	2.7	5.9	0.05	0.99
9/23/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.43	0.03	2.1	1	1.9	5.0	0.04	0.47
9/23/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.04	0.66	0.01	9.5	10	15.6	9.7	0.00	0.66
9/23/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.56	0.05	14.4	12	3.0	8.4	0.06	0.62
9/23/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.09	0.63	0.06	8.1	3	1.0	4.5	0.00	0.63
9/23/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.29	0.02	21.0	8	2.6	1.7	0.03	0.32
9/23/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.40	0.04	2.2	0	1.7	3.8	0.08	0.48
9/23/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.07	0.61	0.01	8.4	6	2.0	8.3	0.00	0.61
9/30/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.39	0.01	2.9	2	3.4	5.8	0.01	0.40
9/30/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.15	1.12	0.02	22.4	26	2.0	6.2	0.00	1.12
9/30/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.45	0.05	1.9	2	1.6	5.0	0.07	0.52
9/30/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.69	3.11	0.19	58.5	170	15.8	13.5	0.01	3.12
9/30/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.75	0.04	9.4	11	2.7	8.0	0.03	0.78
9/30/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.12	1.33	0.02	9.9	12	0.6	2.7	0.00	1.33
9/30/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.32	0.03	4.8	3	2.3	1.9	0.02	0.34
9/30/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.47	0.04	1.7	1	1.4	3.6	0.03	0.50
9/30/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.09	0.74	0.02	10.5	13	1.7	8.1	0.01	0.75
10/7/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.40	0.04	5.9	7	3.4	5.7	0.01	0.41
10/7/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.17	0.94	0.02	45.0	42	3.1	6.1	0.02	0.96
10/7/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.40	0.03	2.4	4	1.7	4.9	0.04	0.44
10/7/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.13	0.93	0.20	40.3	26	13.2	10.0	0.07	1.00
10/7/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.62	0.06	14.2	16	3.0	8.9	0.02	0.64
10/7/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.09	0.75	0.12	10.9	6	0.9	3.1	0.00	0.75
10/7/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.06	0.36	0.03	50.7	18	2.8	2.0	0.02	0.38
10/7/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.35	0.03	1.9	3	1.5	3.8	0.06	0.41
10/7/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.09	0.58	0.02	15.4	16	1.8	8.8	0.01	0.59
10/14/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.41	0.02	4.6	3	3.0	6.2	0.02	0.43
10/14/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.16	1.11	0.01	31.5	30	1.6	6.3	0.01	1.12
10/14/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.35	0.01	2.2	0	1.6	5.1	0.04	0.39
10/14/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.20	1.33	0.02	95.0	95	7.3	17.4	0.01	1.34
10/14/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.53	0.04	11.9	12	2.4	8.9	0.04	0.57
10/14/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.64	0.01	6.3	5	2.8	3.4	0.00	0.64
10/14/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.24	0.02	6.8	6	2.2	1.9	0.02	0.26
10/14/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.30	0.02	3.1	2	1.2	3.9	0.01	0.31
10/14/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.47	0.01	12.7	10	1.5	8.5	0.00	0.47
10/21/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.27	0.00	6.2	6	4.0	6.2	0.01	0.28

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
10/21/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.14	1.03	0.10	29.6	22	1.4	5.9	0.05	1.08
10/21/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.33	0.01	2.8	2	1.7	4.5	0.03	0.36
10/21/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.75	0.01	27.0	21	61.9	17.9	0.00	0.75
10/21/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.48	0.01	14.5	13	3.0	10.4	0.00	0.48
10/21/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.69	0.15	10.6	4	0.9	3.2	0.00	0.69
10/21/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.24	0.02	17.2	6	2.4	1.9	0.01	0.25
10/21/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.32	0.02	2.0	2	1.4	3.5	0.05	0.37
10/21/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.10	0.58	0.00	17.9	15	1.9	10.4	0.00	0.58
10/28/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.28	0.01	4.2	4	4.6	6.2	0.01	0.29
10/28/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.83	0.13	20.9	16	1.6	6.1	0.04	0.87
10/28/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.31	0.02	2.6	2	2.6	5.2	0.02	0.33
10/28/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.28	0.95	0.38	42.0	48	14.6	12.8	0.07	1.02
10/28/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.45	0.01	12.0	10	3.7	11.3	0.00	0.45
10/28/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.55	0.05	7.1	4	1.4	3.3	0.01	0.56
10/28/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.01	0.20	0.01	4.7	2	3.3	2.1	0.01	0.21
10/28/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.28	0.03	1.7	2	1.6	4.1	0.02	0.30
10/28/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.58	0.01	14.0	11	4.2	24.8	0.00	0.58
11/4/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.30	0.01	2.1	2	4.02	6.2	0.00	0.30
11/4/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.13	1.43	0.02	16.0	20	1.52	5.9	0.00	1.43
11/4/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.47	0.01	1.7	3	2.0	5.1	0.00	0.47
11/4/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.87	0.01	24.2	8	35.4	13.8	0.00	0.87
11/4/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.45	0.02	8.3	9	7.89	10.4	0.00	0.45
11/4/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.51	0.03	5.1	3	1.51	3.3	0.00	0.51
11/4/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.13	0.62	0.02	35.6	10	2.79	2.3	0.00	0.62
11/4/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.33	0.02	1.2	0	1.51	4.1	0.03	0.36
11/4/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.65	0.01	12.0	11	3.7	22.4	0.00	0.65
11/11/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.01	0.39	0.01	3.7	2	5.0	6.0	0.30	0.69
11/11/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.50	0.02	3.8	2	3.2	6.0	0.00	0.50
11/11/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.38	0.00	1.9	2	2.4	6.0	0.01	0.39
11/11/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.06	0.76	0.02	33.6	28	29.1	15.8	0.00	0.76
11/11/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.59	0.01	15.2	12	12.1	6.2	0.15	0.74
11/11/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.56	0.01	4.9	2	3.5	3.0	0.04	0.60
11/11/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.42	0.02	4.7	2	3.4	3.0	0.03	0.45
11/11/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.35	0.01	1.8	2	2.0	3.3	0.01	0.36
11/11/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.07	0.58	0.02	15.1	11	5.4	29.2	0.01	0.59
11/18/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.32	0.00	5.0	8	5.3	6.4	0.20	0.52
11/18/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.47	0.03	7.9	8	3.9	6.2	0.00	0.47
11/18/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.50	0.01	2.0	4	2.9	6.4	0.00	0.50
11/18/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.80	0.02	9.4	7	26.6	18.1	0.00	0.80
11/18/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.56	0.01	13.7	12	2.4	7.9	0.00	0.56
11/18/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.38	0.01	3.2	3	3.6	3.0	0.02	0.40
11/18/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.31	0.01	3.1	2	3.5	2.8	0.01	0.32

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
11/18/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.38	0.02	1.7	0	2.1	4.1	0.01	0.39
11/18/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.07	0.57	0.00	10.3	6	4.0	24.9	0.00	0.57
11/25/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.40	0.04	5.1	5	5.9	6.3	0.22	0.62
11/25/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.40	0.04	2.8	2	5.1	6.4	0.05	0.45
11/25/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.42	0.03	2.4	2	3.6	6.2	0.00	0.42
11/25/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.10	0.85	0.05	23.2	9	36.8	16.2	0.65	1.50
11/25/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.85	0.11	48.1	33	10.5	11.4	0.44	1.29
11/25/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.41	0.04	5.7	6	3.4	2.9	0.11	0.52
11/25/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.28	0.03	5.1	2	3.1	2.3	0.04	0.32
11/25/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.53	0.04	1.7	2	6.0	5.5	0.02	0.55
11/25/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.56	0.06	8.3	7	3.9	21.6	0.01	0.57
12/2/13	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.40	0.01	2.7	2	5.7	6.0	0.32	0.72
12/2/13	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.02	0.34	0.02	2.4	2	4.5	6.2	0.00	0.34
12/2/13	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.28	0.01	1.4	2	4.1	5.8	0.01	0.29
12/2/13	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.05	0.60	0.1	10.6	6	52.8	24.0	0.02	0.62
12/2/13	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.06	0.45	0.02	7.6	6	5.1	9.9	0.02	0.47
12/2/13	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.02	0.37	0.03	2.8	3	3.4	2.9	0.19	0.56
12/2/13	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.28	0.01	2.7	1	3.2	2.4	0.11	0.39
12/2/13	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.22	0.02	1.4	1	2.9	4.0	0.01	0.23
12/2/13	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.62	0.01	7.7	4	2.4	16.1	0.00	0.62
12/9/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.31	0.01	4.7	2	5.8	6.2	0.67	0.98
12/9/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.43	0.08	7.7	4	5.6	8.9	0.32	0.75
12/9/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.37	0.01	6.2	4	4.6	6.1	1.59	1.96
12/9/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.12	0.94	0.03	45.5	15	62.5	31.2	1.33	2.27
12/9/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.35	0.02	11.0	6	5.2	6.7	0.10	0.45
12/9/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.25	0.02	3.4	3	3.4	2.6	0.19	0.44
12/9/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.35	0.02	5.0	2	3.9	4.5	0.82	1.17
12/9/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.04	0.34	0.01	8.6	5	4.4	5.3	0.13	0.47
12/16/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.37	0.03	7.5	5	5.9	6.4	1.00	1.37
12/16/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.63	0.14	10.0	5	5.6	7.7	0.92	1.55
12/16/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.46	0.04	7.5	5	5.7	6.0	2.16	2.62
12/16/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.10	0.92	0.03	42.2	15	80.8	25.1	1.60	2.52
12/16/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.42	0.04	13.3	11	7.9	6.5	1.16	1.58
12/16/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.39	0.02	6.5	5	5.2	4.1	0.48	0.87
12/16/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.25	0.03	6.8	4	3.7	2.5	0.24	0.49
12/16/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.35	0.02	7.1	5	4.8	4.5	1.08	1.43
12/16/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.04	0.37	0.01	8.7	6	9.6	5.3	1.55	1.92
12/23/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.08	0.48	0.06	19.3	11	5.5	5.1	1.14	1.62
12/23/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.64	0.11	22.2	13	5.7	6.4	1.32	1.96
12/23/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.15	0.60	0.08	23.4	14	4.6	4.3	2.20	2.80
12/23/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.34	1.18	0.03	77.0	28	11.4	4.8	0.67	1.85
12/23/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.69	0.08	34.5	19	5.3	4.6	1.27	1.96

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
12/23/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.47	0.03	18.9	10	4.8	3.1	0.59	1.06
12/23/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.30	0.03	17.4	8	3.6	1.9	0.22	0.52
12/23/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.10	0.54	0.05	21.2	12	4.2	3.5	1.39	1.93
12/23/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.12	0.60	0.08	28.3	23	5.9	3.6	1.43	2.03
12/30/2013	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.28	0.03	7.6	3	5.4	5.0	1.27	1.55
12/30/2013	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.42	0.08	11.4	7	5.5	6.3	1.62	2.04
12/30/2013	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.36	0.04	8.6	4	5.4	5.0	2.59	2.95
12/30/2013	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.10	0.67	0.07	28.1	10	49.1	13.1	0.09	0.76
12/30/2013	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.40	0.03	12.6	6	6.3	4.4	1.42	1.82
12/30/2013	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.47	0.05	14.9	13	6.1	3.1	0.68	1.15
12/30/2013	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.26	0.03	12.0	6	3.3	1.8	0.28	0.54
12/30/2013	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.26	0.05	9.7	3	4.2	3.4	1.30	1.56
12/30/2013	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.05	0.32	0.02	11.0	5	5.9	4.1	1.45	1.77
1/6/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.24	0.02	6.3	5	1.25	5.4	5.5	5.74
1/6/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.31	0.04	6.8	3	1.66	6.7	5.3	5.61
1/6/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.26	0.01	6.4	3	2.64	5.4	5.1	5.36
1/6/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.41	1.73	0.03	131	227	0.05	13.3	40.1	41.83
1/6/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.04	0.3	0.03	10.1	6	1.69	5.8	6.4	6.70
1/6/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.34	0.03	8.3	3	0.78	3.1	4.7	5.04
1/6/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.22	0.02	6.9	2	0.46	2.4	3.6	3.82
1/6/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.22	0.02	6.8	2	1.58	4	4	4.22
1/6/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.03	0.27	0.02	7.6	2	1.71	4.5	5.7	5.97
1/13/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.09	0.42	0.03	19.9	11	1.27	4.1	4.8	5.22
1/13/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.12	0.53	0.06	23.2	13	1.54	4.9	4.7	5.23
1/13/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.14	0.49	0.05	23.2	12	1.93	4	4	4.49
1/13/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.31	1.1	0.05	57.9	20	0.56	4.6	7.4	8.50
1/13/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.16	0.72	0.05	30.4	15	1.23	4.6	5.2	5.92
1/13/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.07	0.45	0.02	21.7	9	0.58	2.5	3.9	4.35
1/13/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.25	0.01	16.3	4	0.21	1.5	3	3.25
1/13/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.09	0.45	0.03	20.3	11	1.28	3.1	3.6	4.05
1/13/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.13	0.6	0.03	30.5	20	1.28	3.4	4.7	5.30
1/20/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.2	0.01	9	3	1.22	4.2	5	5.20
1/20/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.28	0.02	10.8	4	1.65	5.3	4.8	5.08
1/20/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.24	0.01	9.3	4	2.21	4.3	4.2	4.44
1/20/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.17	1.06	0.02	42	11	0.09	9.3	23	24.06
1/20/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.38	0.02	14.3	4	1.16	4.1	5.1	5.48
1/20/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.3	0.01	12.8	4	0.68	2.7	4.2	4.50
1/20/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.15	0.01	10.3	3	0.26	1.5	3	3.15
1/20/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.2	0.01	10	2	1.04	2.6	3.2	3.40
1/20/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.24	0.55	0.01	15.9	10	1.03	3.7	4.7	5.25
1/27/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.25	0.01	6.9	5	1.16	4.6	5.3	5.55
1/27/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.24	0.01	8.2	7	1.67	5.8	5.1	5.34

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
1/27/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.18	0	5.9	2	2.22	4.6	4.4	4.58
1/27/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	0.72	0.01	28.3	12	0.01	11.5	31.2	31.92
1/27/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.04	0.32	0.02	14	6	1.37	4.8	6	6.32
1/27/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.31	0.01	8.8	3	0.82	3.1	4.2	4.51
1/27/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.16	0	6.9	2	0.39	2.1	3.5	3.66
1/27/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.16	0	6.7	1	1.36	3.6	4	4.16
1/27/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.04	0.29	0.01	9.3	2	1.45	4.3	6.2	6.49
2/10/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.21	0.01	7.6	3	1.16	4.9	5.2	5.44
2/10/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.32	0.00	9.0	4	1.67	6.4	5.4	5.71
2/10/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.23	0.00	7.0	6	1.92	4.8	4.5	4.71
2/10/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.12	0.83	0.04	44.6	20	0.29	14.0	29.2	30.03
2/10/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.39	0.03	12.2	2	1.36	5.3	6.1	6.46
2/10/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.09	0.38	0.01	11.5	8	0.89	3.3	5.0	5.36
2/10/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.16	0.01	7.6	4	0.31	2.2	3.4	3.60
2/10/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.22	0.01	6.5	2	1.29	4.1	4.1	4.32
2/10/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.06	0.31	0.02	10.4	4	1.32	4.8	5.5	5.83
2/17/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.19	0.01	5.6	4	1.13	5.1	5.3	5.44
2/17/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.25	0.00	6.5	6	1.49	6.1	5.0	5.23
2/17/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.02	0.22	0.01	4.9	4	1.87	4.9	4.5	4.70
2/17/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.10	0.77	0.00	28.0	13	0.01	12.9	34.0	34.77
2/17/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.04	0.28	0.03	9.2	4	1.27	5.8	6.0	6.28
2/17/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.02	0.22	0.00	6.1	4	0.69	3.5	4.8	4.97
2/17/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.21	0.00	5.6	3	0.29	2.2	3.7	3.88
2/17/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.13	0.00	4.7	4	1.17	3.9	4.1	4.24
2/24/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.20	0.01	5.0	2	0.97	5.0	5.2	5.40
2/24/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.43	0.01	4.9	4	1.23	6.3	4.9	5.35
2/24/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.02	0.21	0.00	4.2	5	1.67	5.2	4.8	4.99
2/24/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	0.71	0.00	13.8	12	0.05	20.6	25.1	25.81
2/24/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.44	0.05	9.0	6	0.94	5.5	5.5	5.90
2/24/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.02	0.27	0.01	5.2	7	0.63	3.5	4.6	4.85
2/24/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.01	0.32	0.00	5.0	3	0.26	2.3	3.6	3.91
2/24/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.18	0.01	4.1	3	1.00	3.9	4.0	4.21
2/24/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.03	0.24	0.02	7.3	3	1.00	4.8	5.5	5.76
3/5/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.17	0.01	3.8	3	0.90	5.5	5.8	5.93
3/5/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.26	0.00	4.9	3	1.32	6.6	5.4	5.68
3/5/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.29	0.00	5.4	4	1.60	5.4	5.4	5.69
3/5/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.29	1.18	0.17	40.8	33	0.26	7.6	26.4	27.58
3/5/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.54	0.08	18.5	7	0.94	9.9	8.5	9.00
3/5/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.02	0.23	0.00	4.3	4	0.55	3.7	4.8	5.03
3/5/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.13	0.01	4.1	3	0.29	2.5	3.8	3.92
3/5/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.17	0.01	4.3	2	1.07	4.4	4.3	4.42
3/5/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.17	0.67	0.07	18.7	14	1.04	10.9	8.3	8.99

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
3/10/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.21	0.00	5.6	4	0.84	5.5	5.5	5.71
3/10/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.56	0.02	7.2	8	1.13	6.4	5.4	5.93
3/10/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.23	0.00	4.1	4	1.35	5.0	4.8	5.06
3/10/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.13	1.04	0.00	27.7	12	0.07	8.2	17.9	18.94
3/10/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.46	0.02	11.1	5	0.98	6.4	6.3	6.73
3/10/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.28	0.00	5.5	5	0.44	3.6	4.9	5.21
3/10/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.12	0.00	5.5	2	0.17	2.2	3.5	3.63
3/10/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.19	0.00	4.4	4	0.81	3.9	4.3	4.45
3/10/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.04	0.34	0.01	10.6	10	0.90	5.4	6.2	6.49
3/16/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.14	0.90	0.04	49.5	38	0.73	4.1	5.2	6.09
3/16/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.24	1.27	0.06	79.0	95	0.92	6.0	6.1	7.36
3/16/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.28	1.21	0.03	104.0	103	0.90	3.7	4.2	5.38
3/16/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.26	1.69	0.06	63.3	35	0.23	7.5	11.6	13.29
3/16/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	1.26	0.15	21.8	10	0.69	6.5	6.5	7.76
3/16/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	0.59	0.01	22.7	16	0.47	4.0	5.3	5.90
3/16/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.06	0.47	0.01	27.2	16	0.28	2.3	3.5	3.94
3/16/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.17	0.93	0.02	59.4	69	0.75	4.0	4.5	5.44
3/16/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.20	0.97	0.05	71.6	83	0.80	7.6	9.2	10.12
3/24/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.38	0.01	7.1	4	0.84	4.5	5.2	5.53
3/24/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.45	0.02	8.6	4	1.02	5.3	4.9	5.38
3/24/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.29	0.01	7.3	5	1.32	4.4	4.3	4.59
3/24/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	0.88	0.01	12.6	18	0.08	6.5	10.8	11.68
3/24/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.60	0.05	13.7	7	0.59	4.9	5.4	5.99
3/24/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.44	0.01	10.4	6	0.43	3.0	4.8	5.20
3/24/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.21	0.01	16.9	5	0.13	1.4	3.0	3.23
3/24/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.31	0.00	11.0	6	0.70	3.0	3.7	4.03
3/24/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.17	0.89	0.02	22.7	18	0.25	8.6	6.0	6.89
3/31/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.21	0.00	5.2	3	0.70	4.6	5.1	5.33
3/31/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.34	0.02	5.6	4	0.89	5.5	4.9	5.22
3/31/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.27	0.01	5.1	4	1.18	4.6	4.5	4.73
3/31/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.77	0.00	8.8	12	0.01	6.4	11.0	11.77
3/31/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.64	0.06	14.5	11	0.65	5.2	5.7	6.36
3/31/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.30	0.01	7.9	5	0.45	3.0	4.5	4.76
3/31/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.15	0.00	8.9	2	0.19	1.8	3.2	3.33
3/31/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.23	0.01	7.0	3	0.68	3.2	3.6	3.86
3/31/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.07	0.53	0.05	18.0	18	0.67	5.8	5.8	6.28
4/7/14	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.32	0.01	7.1	7	0.54	4.5	5.2	5.52
4/7/14	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.38	0.03	8.4	9	0.66	5.3	4.9	5.23
4/7/14	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.30	0.02	7.5	6	0.98	4.6	4.4	4.68
4/7/14	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.82	0.01	10.6	13	0.01	6.6	11.2	12.02
4/7/14	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.54	0.06	15.0	15	0.57	5.3	5.1	5.68
4/7/14	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.46	0.01	9.6	12	0.28	3.2	4.7	5.17

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
4/7/14	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.18	0.01	8.1	3	0.12	1.8	3.3	3.52
4/7/14	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.26	0.01	5.7	4	0.55	3.3	3.8	4.01
4/7/14	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.07	0.57	0.03	13.7	16	0.54	5.9	5.0	5.60
4/14/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.06	0.56	0.02	23.0	17	0.50	4.2	5.5	6.01
4/14/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.16	0.98	0.05	40.4	37	0.59	5.0	4.7	5.64
4/14/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.20	1.02	0.05	53.0	46	0.67	3.9	4.7	5.73
4/14/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.11	0.97	0.02	22.4	20	0.03	6.0	10.1	11.07
4/14/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.18	0.85	0.06	45.8	30	0.38	4.6	5.1	5.99
4/14/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.07	0.63	0.03	22.8	17	0.29	3.1	4.8	5.47
4/14/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.24	0.01	17.2	6	0.10	1.8	3.4	3.65
4/14/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.15	0.79	0.04	37.7	39	0.53	3.5	4.0	4.80
4/14/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.24	0.99	0.07	62.9	19	0.44	7.2	7.2	8.20
4/21/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.32	0.01	6.8	4	0.46	4.1	5.0	5.35
4/21/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.56	0.02	10.0	11	0.53	4.9	4.6	5.11
4/21/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.35	0.03	8.3	8	0.88	3.9	4.2	4.50
4/21/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.06	0.87	0.03	6.4	9	0.01	6.1	10.4	11.27
4/21/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.11	0.66	0.01	22.5	20	0.39	4.7	5.0	5.65
4/21/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.50	0.01	12.9	11	0.31	2.6	4.3	4.81
4/21/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.20	0.03	11.0	4	0.12	1.6	3.2	3.41
4/21/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.35	0.03	9.6	5	0.47	2.8	3.0	3.33
4/21/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.06	0.48	0.05	16.0	13	0.48	3.4	4.5	5.02
4/28/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.07	0.67	0.04	21.0	15	0.44	4.2	5.2	5.87
4/28/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.16	0.89	0.10	34.2	25	0.74	5.4	5.1	5.97
4/28/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.14	0.85	0.06	43.6	31	0.58	3.2	4.1	4.99
4/28/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.97	0.04	13.1	19	0.01	6.4	10.5	11.47
4/28/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.17	1.09	0.09	44.2	47	0.44	5.1	4.7	5.83
4/28/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.07	0.50	0.04	28.9	19	0.22	2.6	4.7	5.22
4/28/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.27	0.02	26.2	13	0.08	1.4	3.3	3.57
4/28/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.14	0.61	0.03	38.3	30	0.47	2.6	3.8	4.39
4/28/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.47	1.34	0.10	160.0	110	0.43	2.7	4.2	5.57
5/5/14	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.36	0.01	6.7	6	0.47	4.3	5.3	5.61
5/5/14	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.44	0.02	9.8	11	0.57	4.9	4.6	5.05
5/5/14	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.08	0.54	0.03	9.7	10	0.86	4.3	4.0	4.55
5/5/14	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.06	0.84	0.03	6.9	8	0.01	6.7	10.8	11.64
5/5/14	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.14	0.64	0.03	21.3	22	0.40	4.7	4.9	5.52
5/5/14	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.53	0.04	12.4	11	0.31	2.5	4.3	4.86
5/5/14	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.20	0.00	15.3	5	0.08	1.4	3.0	3.24
5/5/14	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.29	0.01	12.3	10	0.44	2.6	3.4	3.71
5/5/14	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.41	0.03	16.6	16	0.48	3.2	4.1	4.54
5/12/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.56	0.05	7.3	33	0.41	4.5	5.1	5.69
5/12/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.84	0.09	13.9	19	0.55	5.1	4.8	5.64
5/12/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.08	0.65	0.04	14.5	13	0.70	3.6	4.1	4.79

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
5/12/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.11	1.01	0.08	11.1	14	0.02	6.4	10.4	11.41
5/12/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.78	0.09	26.0	28	0.35	4.3	4.7	5.44
5/12/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.51	0.06	14.7	11	0.20	2.5	4.4	4.89
5/12/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.25	0.02	13.0	5	0.09	1.7	3.2	3.43
5/12/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.35	0.02	13.0	12	0.37	2.6	3.5	3.87
5/12/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.17	0.79	0.06	21.5	21	0.33	5.6	4.6	5.35
5/19/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.06	0.45	0.04	14.1	8	0.53	3.2	4.8	5.24
5/19/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.54	0.05	14.1	12	0.69	4.0	4.6	5.14
5/19/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.15	1.14	0.03	12.0	8	0.88	3.2	4.1	5.24
5/19/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	0.49	0.07	7.8	8	0.09	5.9	9.0	9.48
5/19/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.11	0.74	0.06	16.3	14	0.37	3.4	5.2	5.92
5/19/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.50	0.07	14.1	5	0.24	2.2	4.1	4.57
5/19/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.21	0.03	11.2	4	0.07	1.3	2.9	3.13
5/19/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.37	0.02	12.4	10	0.56	2.5	3.8	4.17
5/19/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.12	0.76	0.03	14.9	7	0.31	3.1	3.9	4.64
5/27/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.53	0.03	7.8	3	0.53	3.8	4.7	5.25
5/27/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.69	0.07	12.8	14	0.50	4.5	4.4	5.06
5/27/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.36	0.03	5.9	3	0.83	3.9	4.4	4.72
5/27/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.11	1.21	0.03	14.6	13	0.01	5.9	9.0	10.16
5/27/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.15	0.81	0.10	14.5	16	0.22	4.0	4.8	5.57
5/27/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.58	0.06	10.9	6	0.36	2.1	3.8	4.37
5/27/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.18	0.02	10.3	3	0.08	1.2	2.5	2.69
5/27/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.29	0.03	8.3	6	0.42	2.6	3.3	3.55
5/27/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.50	1.14	0.11	10.1	9	0.04	6.4	3.8	4.95
6/2/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.40	0.04	8.0	7	0.37	3.6	4.8	5.20
6/2/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.58	0.07	12.2	15	0.44	4.5	4.2	4.73
6/2/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.41	0.04	7.8	6	0.62	3.6	4.0	4.42
6/2/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	1.25	0.14	12.3	11	0.02	5.5	8.3	9.58
6/2/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.19	0.93	0.17	23.5	25	0.31	5.5	4.9	5.82
6/2/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.50	0.08	10.9	9	0.26	2.4	3.7	4.24
6/2/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.28	0.04	9.4	5	0.16	1.7	3.0	3.23
6/2/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.33	0.05	7.8	5	0.45	2.8	3.4	3.71
6/2/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.18	0.76	0.12	25.8	26	0.34	5.6	4.4	5.12
6/9/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.07	0.61	0.06	15.7	14	0.26	3.6	4.9	5.50
6/9/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.14	0.71	0.10	27.6	28	0.42	4.6	4.0	4.67
6/9/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.16	0.74	0.06	27.4	27	0.51	3.4	4.2	4.94
6/9/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.12	1.17	0.23	15.8	19	0.04	5.3	7.3	8.47
6/9/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.30	1.07	0.10	60.1	52	0.29	2.8	3.5	4.61
6/9/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.09	0.61	0.07	24.0	22	0.19	2.9	4.6	5.24
6/9/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.19	0.05	15.6	10	0.06	1.5	3.2	3.40
6/9/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.14	0.60	0.07	21.1	13	0.44	3.3	3.9	4.45
6/9/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.29	1.10	0.10	55.2	66	0.36	3.9	4.6	5.70

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
6/16/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.45	0.03	13.2	7	0.33	3.8	4.9	5.35
6/16/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.66	0.05	11.4	16	0.54	4.8	4.4	5.06
6/16/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.44	0.03	6.6	4	0.72	3.9	4.0	4.44
6/16/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	1.33	0.08	13.0	13	0.02	5.2	6.7	8.03
6/16/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.16	0.92	0.11	21.9	22	0.27	4.4	4.5	5.40
6/16/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.53	0.03	12.9	10	0.27	2.8	3.9	4.43
6/16/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.26	0.01	13.0	7	0.09	1.5	2.8	3.06
6/16/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.30	0.02	8.9	9	0.44	3.0	3.4	3.70
6/16/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.26	0.95	0.20	13.8	15	0.17	5.6	3.7	4.65
6/23/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.48	0.03	6.6	5	0.40	4.0	4.6	5.06
6/23/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.59	0.06	8.6	13	0.35	4.9	3.9	4.49
6/23/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.51	0.04	5.3	4	0.66	4.0	4.1	4.56
6/23/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	1.17	0.06	8.3	10	0.01	4.9	6.2	7.40
6/23/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.16	0.98	0.15	29.8	37	0.33	4.7	4.5	5.48
6/23/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.51	0.02	9.4	7	0.49	2.6	3.3	3.85
6/23/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.31	0.01	7.4	5	0.17	1.5	2.8	3.09
6/23/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.32	0.03	6.3	5	0.43	3.0	3.3	3.66
6/23/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.11	0.69	0.11	19.9	21	0.40	4.1	4.2	4.84
6/30/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.54	0.03	8.7	9	0.30	4.0	4.8	5.35
6/30/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.83	0.09	9.5	11	0.33	5.2	3.9	4.69
6/30/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.52	0.04	6.4	6	0.70	4.3	3.7	4.22
6/30/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	1.18	0.11	10.2	13	0.04	5.2	6.0	7.18
6/30/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.18	0.93	0.11	39.2	44	0.42	4.9	4.2	5.15
6/30/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.51	0.03	9.3	9	0.23	2.6	3.7	4.17
6/30/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.38	0.04	8.3	7	0.12	1.8	2.6	3.01
6/30/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.55	0.04	7.1	7	0.44	3.3	4.2	4.78
6/30/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.10	0.64	0.08	15.8	24	0.42	4.0	4.1	4.76
7/7/2014	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.18	0.65	0.10	29.1	16	0.38	5.0	5.0	5.62
7/7/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.38	0.07	5.6	4	0.27	4.2	4.6	4.94
7/7/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.63	0.11	10.4	11	0.18	5.1	3.9	4.53
7/7/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.65	0.07	5.0	5	0.54	4.7	7.0	7.64
7/7/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	1.09	0.17	9.6	14	0.02	5.0	5.7	6.81
7/7/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.18	0.90	0.14	45.7	54	0.30	4.9	4.4	5.32
7/7/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.63	0.05	6.6	6	0.22	2.6	3.6	4.24
7/7/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.24	0.04	5.6	4	0.15	2.0	3.0	3.23
7/7/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.34	0.07	4.7	5	0.30	3.2	3.0	3.38
7/7/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.09	0.67	0.09	14.3	18	0.33	3.8	4.0	4.65
7/14/2014	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.18	0.62	0.05	32.2	19	0.28	3.9	4.7	5.30
7/14/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.44	0.04	6.7	4	0.24	4.1	4.5	4.98
7/14/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.50	0.08	11.4	11	0.15	5.3	3.9	4.38
7/14/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.09	0.71	0.05	12.2	8	0.57	4.2	3.7	4.45
7/14/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	1.06	0.07	10.4	12	0.03	4.5	4.7	5.78

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
7/14/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.16	0.83	0.09	34.9	31	0.23	3.0	4.5	5.30
7/14/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.60	0.06	7.7	5	0.12	2.3	3.2	3.81
7/14/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.43	0.13	6.0	4	0.13	1.9	2.8	3.25
7/14/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.41	0.03	9.1	6	0.37	3.1	3.2	3.60
7/14/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.20	0.89	0.08	22.1	16	0.30	5.2	5.8	6.65
7/21/2014	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.23	0.74	0.05	32.4	17	0.31	5.3	4.1	4.88
7/21/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.59	0.04	5.5	4	0.25	4.3	4.1	4.70
7/21/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.63	0.07	10.7	9	0.12	4.9	3.4	3.99
7/21/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.57	0.03	6.4	4	0.53	4.1	3.5	4.09
7/21/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.20	3.63	1.97	13.5	15	0.05	5.9	5.4	8.98
7/21/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.18	0.84	0.08	49.0	5	0.40	5.1	4.9	5.74
7/21/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.50	0.03	7.9	4	0.25	2.7	3.2	3.70
7/21/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.24	0.02	4.9	2	0.14	1.9	2.7	2.96
7/21/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.43	0.04	5.9	3	0.37	3.5	3.3	3.69
7/21/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.25	1.09	0.08	31.1	27	0.22	8.8	6.7	7.79
7/28/2014	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.18	0.78	0.07	31.0	18	0.26	5.0	4.5	5.24
7/28/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.39	0.03	5.4	3	0.22	4.2	4.5	4.85
7/28/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.53	0.09	12.4	11	0.12	5.3	3.5	4.07
7/28/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.54	0.04	5.8	4	0.49	4.5	3.9	4.47
7/28/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	1.15	0.09	8.9	9	0.04	4.9	4.2	5.39
7/28/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.18	0.87	0.06	48.9	46	0.37	4.8	4.8	5.70
7/28/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.47	0.02	8.8	6	0.10	2.7	3.3	3.80
7/28/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.47	0.03	13.8	16	0.10	2.3	2.9	3.34
7/28/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.49	0.05	7.1	4	0.32	3.5	3.2	3.70
7/28/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.09	0.65	0.07	23.1	24	0.34	4.0	5.3	5.94
8/4/2014	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.18	0.62	0.05	39.0	22	0.19	5.2	4.3	4.96
8/4/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.41	0.04	5.9	5	0.23	4.4	4.2	4.62
8/4/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.77	0.12	14.0	11	0.13	5.0	3.1	3.90
8/4/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.58	0.06	4.9	3	0.45	4.0	3.6	4.22
8/4/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	1.25	0.28	7.6	8	0.16	4.7	3.7	4.91
8/4/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.15	0.85	0.07	39.3	34	0.23	8.1	5.0	5.84
8/4/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.69	0.09	7.9	4	0.23	2.6	2.9	3.63
8/4/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.39	0.05	5.8	4	0.16	2.2	2.7	3.04
8/4/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.34	0.06	5.1	4	0.31	3.2	3.2	3.51
8/4/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.65	0.07	11.7	11	0.13	3.2	3.3	3.99
8/11/2014	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.16	0.87	0.06	34.2	19	0.07	5.6	3.9	4.73
8/11/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.33	0.04	5.0	5	0.12	4.7	3.8	4.10
8/11/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	0.96	0.20	10.4	15	0.11	5.0	2.4	3.37
8/11/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.70	0.08	4.4	4	0.28	4.2	3.0	3.68
8/11/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.09	1.25	0.14	7.7	8	0.22	4.6	3.5	4.75
8/11/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.14	0.70	0.08	38.7	34	0.09	4.8	3.8	4.49
8/11/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.58	0.07	5.3	3	0.34	3.0	2.7	3.23

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
8/11/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.55	0.05	11.0	5	0.16	2.0	2.3	2.87
8/11/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.48	0.04	4.1	4	0.25	3.6	2.9	3.33
8/11/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.06	0.79	0.04	7.3	8	0.03	3.9	4.2	4.97
8/18/2014	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.16	0.65	0.05	36.6	19	0.02	6.1	3.5	4.10
8/18/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.38	0.03	5.6	4	0.13	4.0	3.8	4.17
8/18/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.82	0.11	9.1	6	0.09	5.1	2.7	3.53
8/18/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.49	0.05	4.2	2	0.25	5.3	3.4	3.88
8/18/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.86	0.04	13.7	10	0.18	5.0	3.2	4.04
8/18/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.15	0.57	0.04	39.2	34	0.06	6.0	3.8	4.41
8/18/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.47	0.05	5.4	4	0.26	2.8	2.4	2.90
8/18/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.27	0.03	4.2	3	0.10	2.1	2.4	2.67
8/18/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.33	0.05	3.8	2	0.15	3.6	2.5	2.85
8/18/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.07	0.54	0.02	10.2	6	0.02	4.3	4.0	4.56
8/25/2014	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.16	0.62	0.05	37.2	16	0.03	6.4	3.2	3.82
8/25/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.46	0.05	5.4	3	0.07	4.3	3.8	4.28
8/25/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	1.07	0.14	10.1	8	0.02	5.4	2.1	3.17
8/25/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.50	0.06	4.6	3	0.15	5.5	3.2	3.74
8/25/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.08	0.85	0.04	10.9	11	0.08	5.1	2.8	3.66
8/25/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.12	0.73	0.09	27.2	18	0.06	8.0	4.0	4.71
8/25/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.10	1.00	0.26	6.3	6	0.03	3.5	1.3	2.31
8/25/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.23	0.03	3.2	3	0.02	1.7	2.0	2.21
8/25/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.40	0.06	4.5	3	0.10	4.3	2.7	3.12
8/25/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.15	1.30	0.04	16.4	13	0.01	4.8	3.9	5.17
9/2/2014	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.13	0.64	0.05	18.9	12	0.02	5.9	2.4	3.03
9/2/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.41	0.04	5.9	5	0.12	4.2	3.9	4.33
9/2/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.12	0.91	0.27	10.9	10	0.04	5.7	4.5	5.38
9/2/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.08	0.54	0.07	9.4	6	0.16	5.2	2.6	3.11
9/2/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.12	0.93	0.12	44.1	36	0.12	5.5	3.3	4.21
9/2/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.81	0.13	29.9	22	0.11	10.1	5.2	6.05
9/2/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	0.76	0.04	8.8	8	0.01	3.7	0.9	1.69
9/2/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.30	0.05	6.2	3	0.03	3.6	233.6	233.90
9/2/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.07	0.52	0.10	6.6	4	0.14	4.7	2.2	2.69
9/2/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.08	0.62	0.02	11.4	11	0.01	5.6	3.5	4.07
9/8/2014	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.09	0.56	0.06	14.3	9	0.04	6.8	2.1	2.68
9/8/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.68	0.10	7.3	5	0.09	3.9	3.3	4.02
9/8/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	1.16	0.32	9.7	14	0.03	4.8	3.7	4.83
9/8/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.68	0.10	4.2	2	0.12	5.6	2.7	3.38
9/8/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.07	0.83	0.06	9.7	7	0.08	5.8	2.9	3.70
9/8/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.18	0.95	0.07	44.9	44	0.07	10.8	4.7	5.69
9/8/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	0.82	0.11	7.0	6	0.02	3.7	0.7	1.53
9/8/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.34	0.05	4.5	2	0.02	3.8	219.5	219.84
9/8/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.41	0.05	3.3	2	0.09	5.0	2.1	2.55

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
9/8/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.10	1.00	0.05	12.4	12	0.01	5.0	2.3	3.32
9/15/2014	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.12	0.63	0.05	26.3	24	0.04	6.2	1.4	2.05
9/15/2014	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.41	0.04	5.4	5	0.13	5.4	3.8	4.23
9/15/2014	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	1.01	0.46	10.5	7	0.08	5.0	2.2	3.24
9/15/2014	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.41	0.04	4.5	6	0.13	6.0	3.5	3.95
9/15/2014	LCPR	Overcup Creek	OC	35°11'53.35"N	92°44'5.12"W	0.06	0.68	0.04	11.5	11	0.06	5.7	3.4	4.12
9/15/2014	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.17	0.71	0.13	48.4	45	0.16	8.5	4.7	5.38
9/15/2014	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.49	0.05	6.0	5	0.01	4.2	1.3	1.76
9/15/2014	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.20	0.03	3.2	4	0.01	2.8	96.8	97.00
9/15/2014	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.36	0.03	4.9	5	0.16	5.4	2.2	2.54
9/15/2014	LCPR	West Fork Point Remove Creek	WF4	35°14'46.07"N	92°48'9.13"W	0.07	0.46	0.01	10.0	12	0.00	4.4	2.1	2.56
11/5/2015	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.08	0.49	0.04	18.6	11	4.5	6.9	0.01	0.50
11/5/2015	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.54	0.06	5.2	6	2.5	4.9	0.03	0.57
11/5/2015	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	1.15	0.18	14.9	20	2.0	3.7	0.12	1.27
11/5/2015	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.22	1.36	0.06	16.6	25	4.7	9.4	0.39	1.75
11/5/2015	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.12	1.06	0.07	12.9	21	2.5	6.3	0.06	1.12
11/5/2015	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.96	0.26	31.5	28	5.8	8.1	0.35	1.31
11/5/2015	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.15	1.03	0.07	41.6	37	9.8	4.5	0.17	1.20
11/5/2015	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		1.35	1.61	0.17	922.0	428	4.2	2.3	0.33	1.94
11/5/2015	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.51	0.03	3.3	3	2.3	4.5	0.20	0.71
11/5/2015	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.29	1.15	0.06	55.1	39	8.7	5.3	0.46	1.61
11/10/2015	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.17	0.80	0.06	20.1	12	4.3	9.4	0.04	0.84
11/10/2015	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.06	0.76	0.15	11.0	6	4.9	4.1	0.70	1.46
11/10/2015	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.87	0.23	14.3	17	4.1	4.5	0.62	1.49
11/10/2015	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.06	0.56	0.08	11.4	3	29.9	5.1	1.15	1.71
11/10/2015	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.13	0.88	0.13	19.3	9	3.7	3.7	0.74	1.62
11/10/2015	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	0.89	0.12	22.7	19	4.3	4.0	0.57	1.46
11/10/2015	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.73	0.06	12.0	10	4.2	2.5	0.55	1.28
11/10/2015	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.53	0.06	15.1	7	2.4	1.5	0.30	0.83
11/10/2015	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.07	0.48	0.05	13.1	6	3.1	2.6	0.54	1.02
11/10/2015	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.14	0.91	0.10	25.0	4	13.6	10.4	0.48	1.39
11/17/2015	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.17	0.66	0.03	37.1	28	6.4	8.7	0.01	0.67
11/17/2015	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.23	1.14	0.04	66.3	110	4.7	3.3	0.61	1.75
11/17/2015	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	0.80	0.11	24.0	34	5.2	4.8	0.63	1.43
11/17/2015	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.58	1.45	0.08	166.0	160	10.6	3.5	0.91	2.36
11/17/2015	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.25	0.95	0.07	45.6	44	3.4	2.9	0.78	1.73
11/17/2015	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.31	1.08	0.15	118.0	103	8.8	4.1	0.48	1.56
11/17/2015	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.25	1.22	0.20	28.3	45	3.9	2.8	0.55	1.77
11/17/2015	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.16	1.04	0.13	31.7	53	3.5	2.0	0.50	1.54
11/17/2015	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.23	0.83	0.07	42.8	40	3.2	2.6	0.71	1.54
11/17/2015	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.23	1.04	0.05	77.2	39	11.1	5.9	0.42	1.46
11/24/2015	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.09	0.53	0.06	16.2	6	10.5	5.8	0.49	1.02

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
11/24/2015	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.09	0.56	0.06	14.0	8	3.9	3.1	0.66	1.22
11/24/2015	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	0.66	0.07	15.6	11	4.1	3.5	0.87	1.53
11/24/2015	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.30	0.04	7.9	5	16.4	5.6	1.99	2.29
11/24/2015	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.16	0.51	0.06	14.8	8	4.2	3.5	1.40	1.91
11/24/2015	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.11	0.60	0.04	16.4	9	4.5	3.2	0.63	1.23
11/24/2015	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.49	0.05	15.5	8	3.1	1.7	0.38	0.87
11/24/2015	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.06	0.41	0.04	17.5	15	2.9	1.6	0.31	0.72
11/24/2015	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.07	0.38	0.04	14.2	8	2.9	2.0	0.68	1.06
11/24/2015	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	3.02	10.30	2.50	24.5	25	19.8	24.8	0.17	10.47
12/1/2015	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.17	0.64	0.03	28.9	13	3.4	2.0	0.16	0.80
12/1/2015	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.10	0.54	0.03	15.0	11	3.8	2.4	0.64	1.18
12/1/2015	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.19	0.58	0.03	18.3	15	4.0	3.0	0.96	1.54
12/1/2015	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.13	0.48	0.05	19.5	26	9.9	3.5	1.37	1.85
12/1/2015	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.16	0.56	0.05	19.0	14	3.6	2.3	1.04	1.60
12/1/2015	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.18	0.64	0.01	20.7	12	4.2	2.6	0.44	1.08
12/1/2015	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	0.52	0.04	14.5	8	3.3	1.6	0.57	1.09
12/1/2015	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.36	0.01	12.9	7	2.7	1.2	0.28	0.64
12/1/2015	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.11	0.46	0.02	15.6	9	3.1	1.9	0.82	1.28
12/1/2015	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.14	0.76	0.09	29.1	12	10.1	7.0	0.40	1.16
12/8/2015	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.08	0.45	0.02	15.3	7	5.8	3.9	0.25	0.70
12/8/2015	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.41	0.04	8.5	7	4.0	2.8	0.59	1.00
12/8/2015	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.42	0.03	9.5	8	4.3	3.5	0.81	1.23
12/8/2015	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.11	0.28	0.02	7.9	7	11.0	4.7	1.43	1.71
12/8/2015	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.13	0.42	0.07	9.9	7	3.9	3.0	1.12	1.54
12/8/2015	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	0.54	0.05	10.5	6	4.1	2.8	0.55	1.09
12/8/2015	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.41	0.04	9.0	6	3.2	1.5	0.27	0.68
12/8/2015	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.31	0.05	9.6	5	2.8	1.6	0.21	0.52
12/8/2015	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.30	0.02	9.1	6	3.2	2.1	0.62	0.92
12/8/2015	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.06	0.43	0.06	16.9	7	14.5	12.2	0.45	0.88
12/15/2015	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.18	0.85	0.05	25.7	6	4.8	4.0	0.17	1.02
12/15/2015	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.07	0.68	0.04	14.7	8	4.3	2.9	0.53	1.21
12/15/2015	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.13	0.61	0.04	18.4	13	4.3	3.4	0.87	1.48
12/15/2015	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.10	0.46	0.01	19.5	15	9.0	3.5	1.15	1.61
12/15/2015	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.11	0.48	0.03	18.0	9	3.7	2.6	0.83	1.31
12/15/2015	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.12	0.70	0.04	20.3	10	4.3	3.0	0.44	1.14
12/15/2015	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.46	0.04	13.6	6	3.9	2.1	0.44	0.90
12/15/2015	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.32	0.03	12.8	5	3.0	1.5	0.21	0.53
12/15/2015	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.08	0.40	0.03	16.7	11	3.4	2.2	0.67	1.07
12/15/2015	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.14	0.80	0.07	33.4	10	9.7	7.3	0.32	1.12
12/22/2015	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.07	0.57	0.07	15.0	6	7.0	5.0	0.41	0.98
12/22/2015	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.31	0.09	6.9	6	4.9	3.2	0.63	0.94
12/22/2015	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.37	0.05	8.7	7	4.7	3.8	0.88	1.25

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
12/22/2015	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.32	0.08	8.5	6	10.2	4.7	1.22	1.54
12/22/2015	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.34	0.04	7.9	6	4.3	3.5	1.10	1.44
12/22/2015	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.06	0.49	0.08	10.5	6	4.8	3.2	0.54	1.03
12/22/2015	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.39	0.05	10.7	10	3.9	2.2	0.37	0.76
12/22/2015	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.30	0.06	10.1	6	4.1	1.6	0.17	0.47
12/22/2015	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.38	0.05	10.8	18	3.6	2.6	0.65	1.03
12/22/2015	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.05	0.42	0.11	14.3	7	13.9	14.2	0.35	0.77
12/28/2015	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.17	0.64	0.01	34.6	19	6.1	2.5	0.16	0.80
12/28/2015	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.16	0.71	0.03	41.4	52	12.4	1.6	0.51	1.22
12/28/2015	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.25	0.70	0.02	63.1	68	3.0	1.5	0.42	1.12
12/28/2015	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.40	0.78	0.02	117.0	88	4.5	1.1	0.42	1.20
12/28/2015	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.30	0.87	0.02	85.3	94	3.7	1.3	0.57	1.44
12/28/2015	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.12	0.59	0.04	21.8	14	4.9	2.5	0.29	0.88
12/28/2015	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.16	0.80	0.03	40.1	41	3.7	1.9	0.78	1.58
12/28/2015	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.10	0.48	0.02	27.6	24	3.0	1.4	0.34	0.82
12/28/2015	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.23	0.62	0.02	70.4	93	3.6	1.6	0.26	0.88
1/4/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.10	0.54	0.03	26.0	7	4.4	5.8	0.09	0.63
1/4/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.07	0.40	0.03	13.5	7	3.6	2.1	0.39	0.79
1/4/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.12	0.58	0.05	13.7	9	3.7	2.8	0.69	1.27
1/4/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.22	0.02	8.4	5	10.8	4.0	1.19	1.41
1/4/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.11	0.43	0.03	20.0	9	3.3	2.0	0.61	1.04
1/4/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	0.51	0.03	17.3	5	2.9	1.7	0.32	0.83
1/4/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.40	0.02	14.8	11	2.7	1.4	0.19	0.59
1/4/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.23	0.01	13.8	6	2.6	1.2	0.12	0.35
1/4/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.08	0.30	0.02	17.0	8	2.7	1.6	0.45	0.75
1/4/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.05	0.41	0.05	18.2	6	12.8	11.9	0.44	0.85
1/11/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.10	0.50	0.03	18.9	8	4.4	3.5	0.19	0.69
1/11/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.33	0.02	9.3	8	4.2	2.6	0.55	0.88
1/11/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.39	0.05	10.1	6	4.2	3.1	0.75	1.14
1/11/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.21	0.02	7.4	6	8.9	4.0	1.16	1.37
1/11/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.08	0.41	0.03	12.4	7	3.7	2.8	0.82	1.23
1/11/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.36	0.02	11.8	5	3.2	2.1	0.35	0.71
1/11/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.30	0.03	7.8	5	3.5	1.7	0.29	0.59
1/11/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.21	0.02	9.2	4	3.0	1.5	0.18	0.39
1/11/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.24	0.02	11.0	6	3.2	2.1	0.56	0.80
1/11/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.07	0.53	0.05	17.7	9	12.1	11.0	0.39	0.92
1/19/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.06	0.53	0.09	14.1	8	6.1	4.6	0.37	0.90
1/19/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.41	0.04	6.5	5	4.6	3.0	0.56	0.97
1/19/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.42	0.07	7.9	7	4.7	3.7	0.84	1.26
1/19/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.03	0.27	0.05	6.2	6	9.5	4.5	1.15	1.42
1/19/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.29	0.07	8.7	8	4.5	3.2	0.96	1.25
1/19/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.55	0.07	9.6	6	3.9	2.8	0.39	0.94

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
1/19/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.40	0.05	6.9	7	4.0	2.0	0.35	0.75
1/19/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.24	0.05	7.5	6	3.4	1.4	0.16	0.40
1/19/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.26	0.04	7.0	5	4.0	2.5	0.56	0.82
1/19/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.05	0.45	0.08	12.5	7	14.8	22.0	0.35	0.80
1/26/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.06	0.38	0.02	13.8	5	6.8	5.6	0.43	0.81
1/26/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.40	0.01	5.3	5	5.0	3.0	0.52	0.92
1/26/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.43	0.02	6.1	6	4.5	3.8	0.75	1.18
1/26/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.03	0.25	0.01	4.9	4	10.2	5.1	1.10	1.35
1/26/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.30	0.01	7.0	4	4.6	3.5	0.93	1.23
1/26/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.50	0.05	12.3	8	4.8	3.9	0.53	1.03
1/26/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.37	0.02	6.6	5	4.1	2.1	0.40	0.77
1/26/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.32	0.02	5.9	2	3.4	1.7	0.24	0.56
1/26/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.22	0.01	5.5	2	3.8	2.6	0.65	0.87
1/26/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.05	0.49	0.03	12.1	5	16.9	22.1	0.33	0.82
2/2/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.08	0.50	0.05	17.3	9	6.9	6.1	0.36	0.86
2/2/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.33	0.02	4.7	4	6.2	3.0	0.48	0.81
2/2/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.42	0.03	4.7	4	5.1	4.2	0.66	1.08
2/2/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.33	0.02	11.4	12	9.7	4.8	0.89	1.22
2/2/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.29	0.02	8.1	6	4.5	3.3	0.75	1.04
2/2/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.55	0.07	19.2	22	5.0	3.9	0.47	1.02
2/2/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.28	0.02	6.8	4	4.1	2.1	0.34	0.62
2/2/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.29	0.03	5.7	3	3.6	1.8	0.21	0.50
2/2/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.22	0.02	5.9	4	3.9	2.9	0.54	0.76
2/2/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.08	0.51	0.04	24.9	13	18.3	30.3	0.16	0.67
2/9/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.10	0.48	0.04	16.9	7	6.9	7.1	0.33	0.81
2/9/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.32	0.02	3.3	2	6.4	3.3	0.47	0.79
2/9/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.39	0.02	4.0	4	5.4	4.3	0.61	1.00
2/9/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.03	0.25	0.02	4.9	2	10.5	6.4	0.88	1.13
2/9/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.48	0.02	4.9	3	4.8	4.0	0.72	1.20
2/9/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.59	0.03	26.2	21	4.1	4.6	0.21	0.80
2/9/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.24	0.01	5.2	3	4.2	2.4	0.32	0.56
2/9/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.22	0.02	4.7	2	3.6	1.8	0.19	0.41
2/9/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.22	0.01	4.1	2	3.9	3.0	0.50	0.72
2/9/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.07	0.68	0.04	7.2	4	21.1	38.3	0.26	0.94
2/16/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.09	0.47	0.05	19.9	8	7.3	7.6	0.31	0.78
2/16/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.25	0.02	5.9	12	6.8	3.3	0.42	0.67
2/16/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.31	0.02	7.7	8	5.4	4.2	0.51	0.82
2/16/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.03	0.25	0.01	5.4	3	10.3	5.4	0.84	1.09
2/16/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.29	0.02	4.4	3	5.1	3.9	0.65	0.94
2/16/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.11	0.48	0.07	39.0	27	6.0	5.3	0.39	0.87
2/16/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.25	0.02	7.8	8	4.2	2.4	0.29	0.54
2/16/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.24	0.01	6.0	10	3.9	2.0	0.17	0.41

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
2/16/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.23	0.01	5.7	8	4.2	3.0	0.48	0.71
2/16/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.05	0.47	0.03	12.8	6	23.5	28.8	0.23	0.70
2/23/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.11	0.54	0.08	21.7	9	6.0	8.4	0.24	0.78
2/23/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.33	0.02	3.8	2	6.5	3.7	0.37	0.70
2/23/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.40	0.03	4.4	3	5.4	4.6	0.43	0.83
2/23/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.41	0.02	6.5	5	10.3	5.8	0.70	1.11
2/23/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.47	0.01	5.7	4	4.9	4.2	0.54	1.01
2/23/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.63	0.08	32.8	32	6.0	6.0	0.33	0.96
2/23/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.29	0.02	4.2	2	4.3	2.5	0.22	0.51
2/23/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.24	0.02	4.6	2	3.5	2.1	0.12	0.36
2/23/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.18	0.01	3.9	2	3.9	3.2	0.37	0.55
2/23/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.04	0.46	0.03	4.9	3	23.0	44.9	0.28	0.74
3/1/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.15	0.63	0.04	42.0	22	8.7	9.1	0.24	0.87
3/1/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.29	0.03	5.1	3	7.7	3.5	0.31	0.60
3/1/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.34	0.03	6.2	7	10.3	4.5	0.50	0.84
3/1/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.47	0.05	12.4	8	11.2	6.2	0.60	1.07
3/1/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.41	0.02	5.9	5	8.4	4.2	0.47	0.88
3/1/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.12	0.64	0.05	29.1	32	8.9	6.0	0.33	0.97
3/1/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.37	0.02	4.9	4	5.3	2.3	0.15	0.52
3/1/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.23	0.01	5.6	2	7.2	2.0	0.11	0.34
3/1/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.23	0.04	4.4	3	4.1	3.2	0.33	0.56
3/1/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.14	0.92	0.11	30.9	27	23.0	39.3	0.32	1.24
3/8/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.10	0.56	0.04	20.5	9	6.7	7.2	0.14	0.70
3/8/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0..03	0.25	0.02	4.0	2	8.0	3.6	0.22	0.47
3/8/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.43	0.04	5.0	1	7.4	4.8	0.36	0.79
3/8/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.39	0.03	7.8	4	11.1	5.6	0.50	0.89
3/8/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.40	0.01	5.5	5	6.4	4.2	0.40	0.80
3/8/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.12	0.78	0.08	30.6	33	9.6	6.2	0.25	1.03
3/8/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.44	0.04	5.0	2	5.1	2.4	0.11	0.55
3/8/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.26	0.20	5.1	2	4.5	1.9	0.09	0.35
3/8/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.25	0.01	4.3	1	4.3	3.2	0.29	0.54
3/8/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.06	0.64	0.04	11.2	4	21.6	30.9	0.18	0.82
3/14/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.12	0.62	0.05	24.1	10	4.7	2.6	0.13	0.75
3/14/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.08	0.47	0.02	17.0	11	4.8	2.6	0.43	0.90
3/14/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	0.61	0.07	22.6	17	4.6	3.1	0.60	1.21
3/14/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.29	0.93	0.05	62.4	74	5.4	2.6	0.56	1.49
3/14/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.17	0.67	0.03	37.3	30	3.8	2.1	0.51	1.18
3/14/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.70	0.07	26.4	17	4.6	3.0	0.41	1.11
3/14/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.57	0.04	19.2	11	4.1	1.9	0.25	0.82
3/14/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.37	0.03	17.9	11	3.4	1.4	0.14	0.51
3/14/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.14	0.49	0.02	35.1	29	3.2	2.0	0.46	0.95
3/14/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.23	1.25	0.08	39.3	22	9.0	6.8	0.16	1.41

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
3/22/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.10	0.50	0.05	23.9	11	5.5	4.1	0.24	0.74
3/22/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.47	0.03	7.6	3	4.4	2.8	0.30	0.77
3/22/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.63	0.04	9.3	8	3.7	2.1	0.14	0.77
3/22/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.32	0.03	9.3	5	8.4	4.5	0.66	0.98
3/22/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.35	0.02	9.0	7	4.2	2.8	0.60	0.95
3/22/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.63	0.03	19.5	18	4.2	2.9	0.23	0.86
3/22/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.38	0.03	12.0	8	4.4	3.7	0.45	0.83
3/22/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.37	0.02	11.4	7	3.4	1.6	0.10	0.47
3/22/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.25	0.01	9.5	5	3.4	2.0	0.33	0.58
3/22/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.06	0.49	0.03	18.5	7	13.3	18.0	0.11	0.60
3/29/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.11	0.57	0.03	23.3	14	6.4	6.4	0.19	0.76
3/29/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.29	0.01	5.1	4	5.0	9.8	0.26	0.55
3/29/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.45	0.02	7.1	10	4.5	3.9	0.28	0.73
3/29/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.22	0.02	8.6	7	9.3	5.4	0.65	0.87
3/29/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.30	0.02	5.4	5	5.1	3.9	0.51	0.81
3/29/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	0.67	0.03	24.8	26	4.9	4.3	0.26	0.93
3/29/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.24	0.01	8.7	8	4.2	1.9	0.16	0.40
3/29/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.15	0.01	8.1	6	3.6	1.7	0.10	0.25
3/29/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.18	0.01	6.5	6	4.0	2.6	0.36	0.54
3/29/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.06	0.47	0.01	14.9	7	15.2	21.8	0.09	0.56
4/5/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.12	0.55	0.06	22.4	12	5.4	4.3	0.13	0.68
4/5/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.57	0.03	7.4	4	4.9	2.9	0.24	0.81
4/5/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.65	0.04	9.0	10	3.8	3.3	0.30	0.95
4/5/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.40	0.04	8.6	5	9.2	4.0	0.55	0.95
4/5/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.33	0.04	8.2	6	5.5	2.6	0.43	0.76
4/5/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	0.53	0.01	22.0	21	4.3	3.4	0.24	0.77
4/5/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.39	0.02	10.4	7	4.4	1.9	0.10	0.49
4/5/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.32	0.02	12.3	9	3.7	1.4	0.07	0.39
4/5/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.19	0.02	9.3	5	3.6	2.0	0.27	0.46
4/5/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.07	0.57	0.06	15.6	7	7.6	23.3	0.10	0.67
4/12/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.15	0.61	0.05	22.5	13	4.6	4.6	0.18	0.79
4/12/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.35	0.01	4.7	3	5.0	2.7	0.23	0.58
4/12/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.56	0.05	6.0	12	4.3	3.4	0.24	0.80
4/12/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.30	0.02	7.5	6	8.9	4.5	0.40	0.70
4/12/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.32	0.03	5.8	3	4.7	3.0	0.39	0.71
4/12/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	0.56	0.06	20.7	22	4.9	3.5	0.18	0.74
4/12/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.32	0.02	6.4	5	4.1	1.8	0.11	0.43
4/12/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.23	0.05	7.3	4	4.3	1.4	0.07	0.30
4/12/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.21	0.02	6.1	3	3.6	2.4	0.25	0.46
4/12/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.08	0.79	0.18	14.5	7	15.5	21.7	0.22	1.01
4/19/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.17	0.68	0.08	26.5	19	4.6	5.2	0.22	0.90
4/19/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.34	0.03	5.2	6	4.3	3.0	0.25	0.59

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
4/19/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.40	0.07	9.6	14	4.0	3.9	0.32	0.72
4/19/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.42	0.05	8.1	7	8.8	5.3	0.45	0.87
4/19/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.53	0.07	5.4	6	4.3	3.3	0.49	1.02
4/19/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.68	0.12	28.9	36	4.9	4.2	0.23	0.91
4/19/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.31	0.05	5.3	6	3.7	2.4	0.13	0.44
4/19/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.25	0.02	6.4	5	3.2	1.7	0.07	0.32
4/19/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.23	0.03	4.8	5	3.6	2.3	0.29	0.52
4/19/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.08	0.92	0.25	10.6	10	18.6	42.9	0.54	1.46
4/26/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.19	0.72	0.10	25.2	16	4.3	6.2	0.27	0.99
4/26/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.46	0.08	5.2	6	4.3	2.9	0.24	0.70
4/26/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.52	0.08	9.1	14	4.1	3.6	0.30	0.82
4/26/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.45	0.08	9.3	7	8.3	4.5	0.40	0.85
4/26/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.44	0.08	7.2	7	4.5	3.3	0.44	0.88
4/26/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.59	0.08	30.5	39	4.8	4.6	0.27	0.86
4/26/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.48	0.10	7.3	6	3.9	1.9	0.15	0.63
4/26/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.29	0.05	5.7	3	3.0	1.4	0.08	0.37
4/26/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.29	0.03	5.5	5	3.6	2.4	0.26	0.55
4/26/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.07	0.64	0.08	8.2	5	15.0	32.3	0.51	1.15
5/3/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.23	0.90	0.11	19.9	11	3.4	2.9	0.08	0.98
5/3/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.12	0.62	0.06	18.4	12	3.6	2.2	0.26	0.88
5/3/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.60	0.09	18.1	13	3.7	2.6	0.35	0.95
5/3/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.07	0.60	0.07	17.3	12	7.5	2.8	0.57	1.17
5/3/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.12	0.66	0.07	26.0	16	3.5	2.2	0.44	1.10
5/3/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.16	0.77	0.09	24.6	18	3.6	2.4	0.21	0.98
5/3/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.60	0.07	19.0	11	3.0	3.6	0.13	0.73
5/3/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.06	0.49	0.04	19.6	9	2.6	1.2	0.10	0.59
5/3/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.09	0.43	0.05	22.3	11	3.0	1.7	0.32	0.75
5/3/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.12	0.83	0.12	28.9	10	9.9	10.4	0.24	1.07
5/10/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.17	0.58	0.08	36.2	18	4.5	3.7	0.33	0.91
5/10/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.06	0.65	0.06	12.3	4	3.6	2.3	0.27	0.92
5/10/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.56	0.07	12.6	10	3.6	2.6	0.32	0.88
5/10/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.06	0.44	0.05	14.4	7	8.2	3.6	0.48	0.92
5/10/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.42	0.06	11.5	6	3.7	2.4	0.47	0.89
5/10/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.15	0.69	0.11	25.3	20	3.9	3.1	0.16	0.85
5/10/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.52	0.08	10.0	7	3.2	1.5	0.12	0.64
5/10/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.41	0.08	11.2	4	2.8	1.1	0.09	0.50
5/10/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.46	0.06	9.9	5	3.0	1.8	0.29	0.75
5/10/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.12	0.70	0.09	37.3	16	10.9	11.6	0.30	1.00
5/17/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.17	0.64	0.06	29.1	18	4.9	4.6	0.38	1.02
5/17/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.54	0.06	8.9	4	4.1	2.6	0.32	0.86
5/17/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.48	0.08	12.5	12	3.9	3.2	0.35	0.83
5/17/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.40	0.07	10.5	8	9.0	3.8	0.45	0.85

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
5/17/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.44	0.06	7.4	6	4.2	2.9	0.44	0.88
5/17/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.14	0.86	0.13	29.6	28	4.6	3.5	0.26	1.12
5/17/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.51	0.08	9.2	5	3.3	1.8	0.13	0.64
5/17/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.33	0.05	10.0	6	3.0	1.3	0.10	0.43
5/17/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.36	0.06	7.2	6	3.4	2.1	0.28	0.64
5/17/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.08	0.63	0.07	15.5	6	13.9	25.6	0.33	0.96
5/24/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.20	0.69	0.06	36.6	25	4.8	5.7	0.38	1.07
5/24/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.47	0.04	7.7	5	4.2	2.8	0.34	0.81
5/24/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.48	0.07	10.3	9	4.1	3.6	0.36	0.84
5/24/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.45	0.05	11.7	8	8.6	4.5	0.41	0.86
5/24/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.44	0.05	8.4	6	4.2	3.2	0.43	0.87
5/24/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.14	0.64	0.07	26.9	31	4.5	4.2	0.28	0.92
5/24/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.62	0.04	8.5	8	4.3	1.7	0.06	0.68
5/24/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.44	0.04	8.2	7	3.9	1.3	0.06	0.50
5/24/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.40	0.04	9.4	12	3.0	2.3	0.28	0.68
5/24/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.07	0.63	0.04	18.2	7	17.5	33.2	0.42	1.05
5/31/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.23	0.64	0.05	32.7	20	6.0	5.0	0.39	1.03
5/31/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.08	0.74	0.04	14.2	9	3.8	2.6	0.29	1.03
5/31/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	0.61	0.06	19.4	21	3.6	3.0	0.38	0.99
5/31/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.06	0.40	0.06	12.8	8	8.4	5.7	0.47	0.87
5/31/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.07	0.48	0.03	11.4	9	3.9	2.9	0.43	0.91
5/31/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.59	0.07	25.8	25	3.9	3.0	0.28	0.87
5/31/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.47	0.03	14.7	11	3.3	1.7	0.06	0.53
5/31/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.06	0.37	0.02	19.8	9	2.5	1.1	0.04	0.41
5/31/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.63	0.04	14.5	11	3.2	2.0	0.22	0.85
5/31/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.08	0.46	0.05	22.7	7	14.0	23.4	0.33	0.79
6/7/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.20	0.94	0.12	26.0	17	2.2	2.3	0.06	1.00
6/7/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.06	0.49	0.04	12.4	8	4.1	2.7	0.24	0.73
6/7/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.64	0.06	16.4	19	3.7	3.1	0.31	0.95
6/7/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.45	0.06	12.7	8	8.8	6.0	0.47	0.92
6/7/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.45	0.05	10.4	7	3.8	3.1	0.40	0.85
6/7/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.64	0.07	28.4	27	3.4	3.1	0.25	0.89
6/7/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.50	0.03	14.9	13	3.7	1.9	0.04	0.54
6/7/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.40	0.03	16.3	11	2.7	1.4	0.03	0.43
6/7/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.46	0.04	14.6	10	3.0	2.2	0.24	0.70
6/7/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.08	0.79	0.07	16.4	11	13.4	25.8	0.41	1.20
6/14/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.19	0.55	0.06	30.9	18	4.2	3.1	0.29	0.84
6/14/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.34	0.03	7.4	5	5.0	2.9	0.33	0.67
6/14/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.45	0.06	8.8	7	3.8	3.4	0.34	0.79
6/14/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.06	0.41	0.07	10.8	7	6.8	4.6	0.39	0.80
6/14/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.18	0.74	0.07	39.6	16	3.8	3.6	0.66	1.40
6/14/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.19	0.84	0.13	35.8	35	4.7	5.8	0.30	1.14

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
6/14/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.57	0.04	9.6	10	3.2	1.8	0.08	0.65
6/14/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.27	0.02	9.7	6	2.8	1.3	0.10	0.37
6/14/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.09	0.46	0.05	21.8	9	3.0	2.6	0.40	0.86
6/14/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.20	1.37	0.10	25.0	10	8.7	20.0	0.35	1.72
6/21/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.22	0.70	0.07	32.3	19	3.7	4.1	0.27	0.97
6/21/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.44	0.04	5.8	5	4.8	3.0	0.29	0.73
6/21/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.66	0.12	9.6	8	3.9	3.8	0.25	0.91
6/21/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.06	0.52	0.10	9.8	6	6.1	5.3	0.25	0.77
6/21/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.73	0.06	6.1	4	3.7	3.7	0.50	1.23
6/21/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.18	0.94	0.13	33.8	34	3.6	4.6	0.27	1.21
6/21/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.52	0.06	6.9	6	2.9	1.8	0.16	0.68
6/21/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.35	0.06	7.2	6	2.3	1.3	0.14	0.49
6/21/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.37	0.05	6.0	5	3.0	2.4	0.31	0.68
6/21/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.06	0.62	0.06	6.5	5	18.4	63.7	0.49	1.11
6/28/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.20	0.68	0.06	29.2	20	2.1	3.6	0.14	0.82
6/28/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.56	0.06	5.4	6	4.1	3.3	0.26	0.82
6/28/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.13	0.82	0.18	8.8	9	3.2	3.9	0.17	0.99
6/28/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.08	0.56	0.12	15.0	9	4.7	4.4	0.15	0.71
6/28/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.58	0.11	5.1	5	3.3	4.1	0.34	0.92
6/28/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.18	0.82	0.12	34.6	35	3.5	6.3	0.20	1.02
6/28/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.53	0.06	6.1	5	2.3	1.8	0.25	0.78
6/28/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.31	0.05	4.3	4	2.0	1.4	0.15	0.46
6/28/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.49	0.07	4.8	5	2.6	2.9	0.22	0.71
6/28/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.15	1.07	0.14	29.6	12	8.8	9.6	0.61	1.68
7/5/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.15	0.60	0.03	25.7	12	2.2	4.2	0.02	0.62
7/5/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.06	0.54	0.03	9.0	7	4.0	2.9	0.14	0.68
7/5/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.15	0.93	0.04	18.4	19	3.4	3.7	0.29	1.22
7/5/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.34	1.48	0.03	63.5	36	7.6	4.2	0.59	2.07
7/5/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.12	0.80	0.06	20.2	15	3.7	3.6	0.47	1.27
7/5/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.22	0.87	0.10	76.5	66	3.6	4.8	0.35	1.22
7/5/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.44	0.04	4.9	4	2.5	1.9	0.36	0.80
7/5/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.36	0.03	4.7	2	2.1	1.7	0.17	0.53
7/5/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.11	0.63	0.05	25.3	15	2.4	2.3	0.45	1.08
7/5/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.21	1.57	0.09	54.5	23	8.1	8.4	0.52	2.09
7/12/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.15	0.61	0.04	33.5	14	2.1	4.2	0.02	0.63
7/12/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.11	0.94	0.05	22.6	12	3.9	3.1	0.30	1.24
7/12/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.13	0.97	0.07	19.0	21	4.0	3.7	0.42	1.39
7/12/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.08	0.63	0.06	12.6	6	10.9	4.7	0.50	1.13
7/12/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.08	0.76	0.06	13.6	8	3.5	3.2	0.49	1.25
7/12/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.16	0.91	0.12	30.4	27	4.2	3.8	0.41	1.32
7/12/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.55	0.05	8.2	7	3.1	2.1	0.18	0.73
7/12/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.44	0.03	5.9	3	2.7	1.9	0.23	0.67

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
7/12/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.06	0.63	0.05	10.7	6	2.9	2.7	0.41	1.04
7/12/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.10	0.88	0.06	20.9	5	8.9	11.2	0.40	1.28
7/19/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.13	0.61	0.06	28.3	9	2.3	4.6	0.02	0.63
7/19/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.07	0.91	0.07	12.6	13	3.8	3.5	0.16	1.07
7/19/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	0.79	0.04	15.3	17	3.5	3.6	0.21	1.00
7/19/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.06	0.54	0.08	9.2	5	9.1	5.5	0.34	0.88
7/19/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.59	0.08	7.2	4	5.5	3.4	0.40	0.99
7/19/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.14	1.05	0.14	26.5	32	4.1	3.7	0.27	1.32
7/19/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.61	0.09	6.6	7	2.9	2.2	0.14	0.75
7/19/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.35	0.13	5.6	2	2.2	1.4	0.10	0.45
7/19/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.56	0.07	7.1	5	2.9	2.8	0.32	0.88
7/19/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.10	0.97	0.12	14.7	3	11.6	13.0	0.32	1.29
7/26/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.18	0.84	0.06	28.8	45	2.0	4.9	0.04	0.88
7/26/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.06	0.50	0.04	7.8	6	3.6	3.3	0.24	0.74
7/26/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.80	0.06	14.3	14	3.6	4.1	0.09	0.89
7/26/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.07	0.53	0.08	12.0	7	7.2	5.1	0.18	0.71
7/26/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.28	0.89	0.06	25.7	16	2.9	3.4	0.57	1.46
7/26/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.30	1.30	0.16	90.0	69	4.8	3.3	0.50	1.80
7/26/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.13	0.84	0.06	45.5	28	2.6	1.4	0.16	1.00
7/26/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.10	0.64	0.04	37.3	22	2.6	1.3	0.14	0.78
7/26/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.18	0.69	0.05	42.0	35	2.7	2.4	0.32	1.01
7/26/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.05	0.58	0.05	5.1	3	16.1	41.8	0.34	0.92
8/2/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.13	0.56	0.06	18.7	24	2.0	4.9	0.04	0.60
8/2/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.09	0.76	0.05	9.9	7	3.8	2.9	0.28	1.04
8/2/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.58	0.05	9.9	12	3.2	2.1	0.11	0.69
8/2/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.12	0.67	0.07	20.7	9	5.6	4.3	0.47	1.14
8/2/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.10	0.54	0.05	10.3	8	3.2	3.2	0.41	0.95
8/2/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.19	0.92	0.08	30.4	24	3.6	2.7	0.28	1.20
8/2/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	0.50	0.06	11.6	8	3.8	2.0	0.10	0.60
8/2/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.06	0.33	0.03	11.2	6	2.2	1.4	0.10	0.43
8/2/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.09	0.79	0.03	12.6	8	2.7	2.1	0.27	1.06
8/2/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.38	1.32	0.15	32.7	10	7.8	8.1	0.40	1.72
8/9/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.21	0.61	0.05	31.5	19	4.9	5.6	0.09	0.70
8/9/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.06	0.62	0.06	10.8	8	4.3	3.1	0.29	0.91
8/9/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.11	0.75	0.08	18.7	15	3.4	3.4	0.33	1.08
8/9/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.15	0.84	0.07	26.3	14	7.8	4.0	0.46	1.30
8/9/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.14	0.69	0.06	20.5	18	2.9	2.5	0.37	1.06
8/9/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.21	0.78	0.08	43.2	40	3.4	2.8	0.28	1.06
8/9/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.07	0.68	0.05	14.7	14	3.2	2.2	0.10	0.78
8/9/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.41	0.04	19.4	9	2.3	1.2	0.07	0.48
8/9/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.09	0.51	0.05	22.8	17	3.8	1.7	0.21	0.72
8/9/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.58	1.89	0.12	38.3	16	6.6	6.5	0.25	2.14

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
8/16/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.21	0.97	0.07	34.5	23	5.1	3.6	0.18	1.15
8/16/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.12	0.53	0.05	21.1	15	3.2	2.2	0.35	0.88
8/16/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.19	0.90	0.07	25.2	24	3.3	2.6	0.45	1.35
8/16/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.17	0.87	0.06	20.9	20	8.7	3.9	0.72	1.59
8/16/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.13	0.67	0.06	20.8	16	3.6	2.6	0.51	1.18
8/16/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.16	0.83	0.09	28.9	23	3.4	2.4	0.26	1.09
8/16/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	0.66	0.05	14.6	10	3.4	1.7	0.16	0.82
8/16/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.08	0.53	0.04	17.8	10	2.6	1.4	0.11	0.64
8/16/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.10	0.65	0.09	20.6	15	2.7	1.7	0.32	0.97
8/16/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.36	1.63	0.07	32.9	16	6.9	6.4	0.17	1.80
8/23/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.21	0.90	0.08	22.5	14	5.0	5.4	0.22	1.12
8/23/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.08	0.59	0.04	10.4	11	3.5	2.4	0.25	0.84
8/23/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.54	0.05	10.9	10	3.6	2.7	0.42	0.96
8/23/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.08	0.54	0.04	11.6	8	10.0	4.3	0.62	1.16
8/23/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.11	0.63	0.08	16.0	13	3.2	2.1	0.46	1.09
8/23/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.12	0.85	0.07	14.0	11	3.1	2.2	0.20	1.05
8/23/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.64	0.05	10.2	7	3.1	1.5	0.09	0.73
8/23/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.07	0.41	0.04	33.0	16	2.2	0.8	0.06	0.47
8/23/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.09	0.48	0.05	22.6	16	2.7	1.6	0.31	0.79
8/23/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.21	1.19	0.07	15.8	7	9.7	12.6	0.37	1.56
8/30/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.32	1.60	0.28	14.3	13	7.4	6.7	0.25	1.85
8/30/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.57	0.04	6.3	10	3.8	2.8	0.36	0.93
8/30/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.57	0.07	7.3	11	3.4	3.3	0.36	0.93
8/30/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.07	0.59	0.05	8.7	8	8.9	5.0	0.52	1.11
8/30/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.08	0.48	0.04	5.7	5	3.4	2.9	0.55	1.03
8/30/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.14	0.77	0.06	7.7	12	3.1	2.5	0.09	0.86
8/30/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.08	0.79	0.03	5.9	10	2.4	1.6	0.00	0.79
8/30/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.45	0.03	13.5	12	2.0	1.0	0.02	0.47
8/30/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.08	0.50	0.03	14.0	22	2.4	1.5	0.21	0.71
8/30/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.10	0.95	0.06	10.8	6	15.0	17.5	0.77	1.72
9/6/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.29	0.89	0.06	24.6	16	3.4	5.8	0.25	1.14
9/6/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.61	0.05	5.5	4	3.7	3.4	0.44	1.05
9/6/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.47	0.06	12.4	16	3.9	4.0	0.39	0.86
9/6/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.06	0.54	0.04	7.7	5	10.6	5.1	0.47	1.01
9/6/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.06	0.40	0.02	5.2	3	4.3	3.2	0.50	0.90
9/6/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.20	0.83	0.11	39.5	47	3.5	3.5	0.24	1.07
9/6/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.56	0.08	7.2	6	2.7	1.8	0.15	0.71
9/6/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.49	0.06	9.0	4	2.2	1.0	0.10	0.59
9/6/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.33	0.02	7.4	3	2.8	1.5	0.27	0.60
9/6/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.08	0.66	0.04	10.1	5	11.8	25.3	0.43	1.09
9/13/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.22	0.83	0.05	19.4	12	4.2	5.9	0.06	0.89
9/13/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.43	0.03	4.3	2	4.2	3.8	0.38	0.81

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
9/13/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.54	0.08	11.8	9	3.7	4.0	0.33	0.87
9/13/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.06	0.43	0.04	7.5	3	8.6	6.8	0.29	0.72
9/13/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.59	0.06	4.7	3	4.2	3.7	0.55	1.14
9/13/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.19	0.97	0.13	50.9	51	4.3	4.4	0.26	1.23
9/13/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.59	0.06	6.3	3	2.8	2.0	0.30	0.89
9/13/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.50	0.04	5.6	2	2.4	1.3	0.26	0.76
9/13/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.47	0.05	4.6	2	2.6	2.4	0.33	0.80
9/13/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.05	0.52	0.04	3.7	3	17.6	46.4	0.10	0.62
9/20/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.20	1.04	0.12	26.7	15	3.8	3.5	0.41	1.45
9/20/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.47	0.07	5.1	2	3.6	3.2	0.27	0.74
9/20/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.46	0.08	10.5	8	3.2	3.8	0.22	0.68
9/20/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.11	0.72	0.08	11.3	4	11.7	5.1	0.54	1.26
9/20/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.11	0.74	0.05	8.6	5	7.6	8.0	0.39	1.13
9/20/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.29	0.82	0.12	52.0	56	4.8	5.0	0.35	1.17
9/20/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.61	0.06	6.5	3	2.7	1.9	0.30	0.91
9/20/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.37	0.05	4.8	1	2.0	1.3	0.24	0.61
9/20/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.08	0.70	0.06	6.9	6	3.2	2.8	0.32	1.02
9/20/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.12	0.82	0.06	21.6	5	10.0	8.5	0.39	1.21
9/27/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.21	0.81	0.06	27.1	18	5.5	6.5	0.13	0.94
9/27/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.50	0.05	3.9	1	3.5	3.8	0.26	0.76
9/27/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.49	0.07	7.2	4	3.3	4.6	0.25	0.74
9/27/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.06	0.42	0.05	8.5	4	9.6	5.7	0.43	0.85
9/27/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.54	0.04	4.8	2	3.4	3.8	0.35	0.89
9/27/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.19	0.69	0.09	53.4	52	4.4	5.4	0.23	0.92
9/27/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.53	0.04	5.2	2	2.7	2.2	0.31	0.84
9/27/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.28	0.04	3.8	1	2.4	2.0	0.21	0.49
9/27/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.39	0.04	4.1	2	3.4	3.2	0.31	0.70
9/27/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.06	0.67	0.03	4.6	2	14.6	32.1	0.29	0.96
10/4/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.30	1.11	0.04	41.1	53	4.8	7.3	0.06	1.17
10/4/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.32	0.01	4.0	4	4.2	4.3	0.29	0.61
10/4/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.50	0.07	11.2	13	3.5	4.8	0.22	0.72
10/4/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.07	0.34	0.02	10.3	5	8.6	5.8	0.30	0.64
10/4/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.45	0.03	4.3	3	4.4	4.3	0.40	0.85
10/4/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.14	0.57	0.03	37.3	32	5.1	7.9	0.27	0.84
10/4/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.51	0.04	6.3	7	3.4	2.2	0.36	0.87
10/4/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.23	0.02	3.5	2	2.3	1.4	0.14	0.37
10/4/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.40	0.02	4.1	4	3.1	3.5	0.29	0.69
10/4/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.09	0.57	0.03	10.0	22	19.8	53.5	0.17	0.74
10/11/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.12	0.57	0.04	15.2	7	4.4	6.6	0.14	0.71
10/11/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.32	0.04	4.3	4	4.3	4.2	0.19	0.51
10/11/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.59	0.15	11.1	10	3.3	4.7	0.18	0.77
10/11/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.07	0.38	0.05	9.7	3	7.3	5.4	0.09	0.47

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
10/11/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.40	0.05	4.8	4	4.8	4.5	0.26	0.66
10/11/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	0.61	0.04	28.9	23	4.9	10.7	0.18	0.79
10/11/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.48	0.06	4.4	3	3.4	2.8	0.12	0.60
10/11/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.27	0.05	3.1	3	2.2	1.4	0.08	0.35
10/11/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.46	0.05	4.8	4	3.3	3.7	0.20	0.66
10/11/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.04	0.44	0.05	2.4	2	20.4	60.4	0.03	0.47
10/17/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.11	0.59	0.03	9.9	5	3.9	6.4	0.04	0.63
10/17/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.32	0.01	3.5	2	4.5	3.7	0.13	0.45
10/17/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.53	0.04	9.4	8	3.1	4.1	0.10	0.63
10/17/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.07	0.39	0.03	8.1	3	6.4	5.2	0.07	0.46
10/17/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.47	0.03	3.5	2	4.0	4.3	0.23	0.70
10/17/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.17	0.85	0.20	45.9	45	6.2	5.5	0.37	1.22
10/17/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.54	0.02	7.8	7	3.1	1.9	0.12	0.66
10/17/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.36	0.02	5.0	5	3.8	1.5	0.09	0.45
10/17/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.41	0.02	4.6	4	3.2	3.0	0.11	0.52
10/17/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.15	0.90	0.04	13.1	5	11.7	11.3	0.39	1.29
10/25/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.10	0.52	0.04	32.9	36	3.2	7.0	0.08	0.60
10/25/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.38	0.04	4.2	3	4.9	4.0	0.18	0.56
10/25/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.46	0.07	12.2	12	2.7	4.3	0.10	0.56
10/25/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.08	0.31	0.04	9.0	2	5.2	5.5	0.01	0.32
10/25/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.33	0.04	3.1	1	4.4	4.6	0.11	0.44
10/25/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.11	0.54	0.06	30.3	29	5.1	8.7	0.14	0.68
10/25/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.57	0.03	5.8	4	3.0	1.9	0.12	0.69
10/25/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.23	0.02	3.8	5	2.2	1.4	0.07	0.30
10/25/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.34	0.04	3.4	1	3.1	3.7	0.07	0.41
10/25/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.07	0.46	0.04	2.5	1	15.5	31.2	0.09	0.55
11/1/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.08	0.49	0.04	5.2	2	4.4	7.6	0.12	0.61
11/1/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.44	0.05	3.8	3	5.6	4.9	0.12	0.56
11/1/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.07	0.48	0.07	8.6	6	3.6	4.9	0.09	0.57
11/1/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.12	0.62	0.05	8.8	7	5.2	6.7	0.01	0.63
11/1/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.39	0.04	3.0	2	5.0	5.6	0.05	0.44
11/1/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.11	0.62	0.06	28.3	24	5.9	9.7	0.05	0.67
11/1/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.45	0.03	4.9	4	4.0	2.4	0.03	0.48
11/1/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.25	0.03	2.8	3	2.4	1.6	0.04	0.29
11/1/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.42	0.04	3.7	4	4.5	4.4	0.05	0.47
11/1/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.07	0.51	0.03	2.2	2	19.3	49.1	0.02	0.53
11/8/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.11	0.55	0.05	11.8	6	3.1	7.1	0.01	0.56
11/8/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.36	0.03	3.4	4	4.7	5.0	0.07	0.43
11/8/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.63	0.11	5.4	8	2.0	4.8	0.04	0.67
11/8/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.12	0.48	0.05	7.2	7	3.3	6.2	0.00	0.48
11/8/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.41	0.05	2.7	2	3.8	5.6	0.02	0.43
11/8/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.47	0.04	16.7	12	5.4	10.5	0.04	0.51

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
11/8/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.36	0.04	3.9	3	5.3	3.0	0.02	0.38
11/8/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.20	0.02	3.0	3	2.4	1.8	0.05	0.25
11/8/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.41	0.04	3.2	2	3.3	5.1	0.02	0.43
11/8/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.06	0.44	0.04	2.0	1	18.5	50.4	0.02	0.46
11/15/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.09	0.63	0.03	10.6	5	2.8	7.8	0.00	0.63
11/15/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.37	0.04	3.8	1	5.0	5.1	0.04	0.41
11/15/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.10	0.72	0.06	9.2	9	3.1	5.7	0.11	0.83
11/15/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.08	0.45	0.06	6.9	2	3.3	6.7	0.01	0.46
11/15/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.27	0.03	2.3	1	4.1	5.9	0.03	0.30
11/15/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	0.63	0.05	21.0	16	5.2	11.3	0.02	0.65
11/15/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.48	0.03	4.6	2	3.2	3.2	0.01	0.49
11/15/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.21	0.05	3.5	3	3.5	1.9	0.06	0.27
11/15/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.36	0.05	3.1	1	3.3	5.1	0.03	0.39
11/15/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.05	0.38	0.04	2.5	1	17.1	47.0	0.04	0.42
11/21/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.12	0.73	0.05	13.7	12	3.7	7.7	0.01	0.74
11/21/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.41	0.05	3.5	3	2.9	5.2	0.10	0.51
11/21/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.61	0.06	8.1	9	9.0	5.2	0.02	0.63
11/21/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.11	0.48	0.04	7.6	5	5.0	6.3	0.01	0.49
11/21/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.46	0.04	2.3	2	4.7	5.9	0.02	0.48
11/21/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.66	0.05	21.5	16	6.4	10.8	0.02	0.68
11/21/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.44	0.04	5.2	4	3.4	3.1	0.00	0.44
11/21/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.20	0.04	3.0	2	2.9	1.6	0.04	0.24
11/21/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.41	0.04	3.6	3	3.2	5.0	0.02	0.43
11/21/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.07	0.56	0.04	3.5	3	47.4	31.4	0.51	1.07
11/29/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.12	0.61	0.02	39.7	22	2.8	6.4	0.00	0.61
11/29/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.07	0.61	0.05	16.5	6	5.0	3.6	0.34	0.95
11/29/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.49	0.11	7.4	6	3.3	4.4	0.05	0.54
11/29/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.09	0.55	0.04	15.4	3	26.6	5.8	0.36	0.91
11/29/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.08	0.79	0.07	8.3	2	4.4	4.2	0.41	1.20
11/29/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.25	0.86	0.11	105.0	56	6.8	5.3	0.32	1.18
11/29/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.07	0.63	0.06	9.2	8	3.6	2.2	0.11	0.74
11/29/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.52	0.09	7.8	6	3.3	1.9	0.10	0.62
11/29/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.05	0.42	0.03	6.3	3	2.8	3.4	0.22	0.64
11/29/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.23	1.11	0.08	41.7	13	10.7	8.2	0.42	1.53
12/6/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.19	0.76	0.02	41.7	16	8.7	14.6	0.13	0.89
12/6/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.37	0.04	5.7	2	5.0	3.5	0.37	0.74
12/6/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.42	0.06	7.5	3	4.6	4.4	0.33	0.75
12/6/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.35	0.03	6.3	1	13.6	6.1	0.59	0.94
12/6/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.46	0.09	4.9	3	4.1	3.9	0.68	1.14
12/6/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.10	0.44	0.05	30.9	24	4.7	4.8	0.30	0.74
12/6/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.46	0.03	7.2	7	3.9	2.1	0.19	0.65
12/6/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.34	0.02	6.8	7	2.8	1.6	0.15	0.49

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
12/6/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.30	0.04	4.5	2	3.2	2.7	0.37	0.67
12/6/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.13	0.90	0.28	12.4	4	12.7	14.4	0.23	1.13
12/13/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.17	0.80	0.02	18.1	10	7.1	17.1	0.01	0.81
12/13/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.43	0.05	4.6	3	4.7	3.8	0.37	0.80
12/13/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.39	0.05	5.2	5	3.6	4.1	0.33	0.72
12/13/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.37	0.06	6.0	4	13.4	6.6	0.61	0.98
12/13/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.05	0.36	0.05	3.8	2	4.5	4.4	0.73	1.09
12/13/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.47	0.04	11.7	9	5.3	4.9	0.32	0.79
12/13/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.38	0.03	5.0	6	3.9	2.4	0.20	0.58
12/13/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.30	0.04	5.3	5	3.1	2.0	0.15	0.45
12/13/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.28	0.03	4.3	3	3.7	3.2	0.39	0.67
12/13/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.13	1.06	0.60	8.8	4	14.8	18.0	0.25	1.31
12/20/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.24	0.81	0.05	27.8	14	5.3	11.4	0.00	0.81
12/20/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.39	0.04	4.1	2	5.1	4.1	0.38	0.77
12/20/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.43	0.06	4.8	4	4.2	4.8	0.28	0.71
12/20/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.32	0.05	5.1	4	11.9	7.0	0.53	0.85
12/20/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.38	0.05	3.6	2	4.7	4.6	0.71	1.09
12/20/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.05	0.45	0.03	10.2	8	5.0	6.0	0.28	0.73
12/20/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.38	0.04	3.8	4	3.9	2.3	0.18	0.56
12/20/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.29	0.03	4.6	4	2.9	1.8	0.14	0.43
12/20/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.35	0.04	3.8	3	4.0	3.2	0.36	0.71
12/20/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.10	0.97	0.39	7.9	5	17.5	27.2	0.42	1.39
12/27/2016	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.27	1.06	0.04	29.9	20	5.7	10.0	0.06	1.12
12/27/2016	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.03	0.33	0.05	5.7	3	5.0	4.7	0.25	0.58
12/27/2016	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.44	0.05	6.1	5	4.5	4.5	0.25	0.69
12/27/2016	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.35	0.05	5.3	4	13.2	7.3	0.49	0.84
12/27/2016	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.31	0.06	3.3	2	5.0	4.4	0.72	1.03
12/27/2016	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.19	0.68	0.06	68.7	44	6.9	5.1	0.31	0.99
12/27/2016	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.37	0.06	3.7	4	3.7	2.2	0.16	0.53
12/27/2016	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.31	0.04	4.1	3	3.7	1.9	0.14	0.45
12/27/2016	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.32	0.04	3.6	3	3.4	3.1	0.38	0.70
12/27/2016	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.14	0.98	0.39	23.3	9	14.7	20.1	0.18	1.16
1/3/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.24	0.98	0.04	32.1	20	3.6	7.5	0.14	1.12
1/3/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.60	0.06	14.7	10	4.3	3.9	0.32	0.92
1/3/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.51	0.06	9.0	10	4.5	4.5	0.36	0.87
1/3/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.07	0.59	0.03	9.6	8	10.3	6.7	0.34	0.93
1/3/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.41	0.04	3.7	3	6.2	4.5	0.74	1.15
1/3/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.13	0.58	0.05	36.7	28	5.3	5.0	0.27	0.85
1/3/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.50	0.04	7.6	10	4.1	2.5	0.13	0.63
1/3/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.43	0.05	7.4	9	3.6	2.5	0.13	0.56
1/3/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.38	0.04	4.1	4	3.0	3.0	0.35	0.73
1/3/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.41	1.58	0.11	50.2	21	10.4	10.9	0.36	1.94

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
1/11/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.15	0.77	0.03	22.7	15	4.9	10.9	0.05	0.82
1/11/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.30	0.06	5.5	5	5.5	4.7	0.51	0.81
1/11/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.46	0.06	6.1	4	5.2	5.1	0.63	1.09
1/11/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.03	0.27	0.04	4.5	3	9.7	6.7	0.68	0.95
1/11/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.02	0.27	0.05	3.3	5	5.6	5.0	0.88	1.15
1/11/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.04	0.46	0.05	8.5	8	5.6	5.3	0.47	0.93
1/11/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.35	0.04	7.0	6	4.4	2.8	0.26	0.61
1/11/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.31	0.04	6.5	4	4.1	2.5	0.24	0.55
1/11/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.31	0.04	4.3	3	6.3	3.7	0.50	0.81
1/11/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.07	0.64	0.15	10.1	5	17.0	20.3	0.30	0.94
1/18/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.12	0.48	0.03	23.8	12	18.6	10.0	0.04	0.52
1/18/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.31	0.06	6.1	6	6.0	4.3	0.45	0.76
1/18/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.42	0.04	4.4	5	5.1	5.4	0.52	0.94
1/18/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.44	0.05	11.1	6	12.5	6.6	0.52	0.96
1/18/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.33	0.04	4.5	4	5.6	5.0	0.77	1.10
1/18/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.50	0.07	18.9	21	6.0	5.6	0.41	0.91
1/18/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.38	0.04	6.7	6	5.1	2.8	0.28	0.66
1/18/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.31	0.05	7.9	8	4.7	2.4	0.21	0.52
1/18/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.33	0.05	4.8	5	4.1	4.0	0.50	0.83
1/18/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.10	0.73	0.23	15.5	4	16.1	19.8	0.22	0.95
1/25/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.19	0.99	0.04	30.3	12	9.3	9.9	0.33	1.32
1/25/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.38	0.03	9.1	7	6.2	4.6	0.64	1.02
1/25/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.06	0.54	0.04	14.2	15	6.4	5.4	0.78	1.32
1/25/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.32	0.03	10.4	5	12.7	6.6	1.39	1.71
1/25/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.35	0.04	8.5	7	5.3	5.1	1.13	1.48
1/25/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.56	0.04	20.3	17	6.1	5.2	0.61	1.17
1/25/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.04	0.22	0.03	9.8	9	5.0	3.1	0.31	0.53
1/25/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.24	0.02	11.2	7	4.5	2.4	0.25	0.49
1/25/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.38	0.03	8.8	6	4.6	3.5	0.67	1.05
1/25/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.16	0.98	0.11	24.9	7	19.0	17.7	0.29	1.27
2/1/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.19	0.78	0.09	17.9	11	1.5	12.1	0.02	0.80
2/1/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.39	0.04	5.7	4	5.0	4.6	0.63	1.02
2/1/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.42	0.05	6.0	6	5.3	5.2	0.77	1.19
2/1/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.03	0.26	0.09	4.6	4	12.1	6.6	1.15	1.41
2/1/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.34	0.06	4.7	4	4.5	4.8	1.05	1.39
2/1/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.06	0.51	0.06	13.1	10	6.5	5.4	0.63	1.14
2/1/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.37	0.05	6.9	6	4.7	2.7	0.31	0.68
2/1/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.28	0.05	9.3	5	3.8	1.9	0.22	0.50
2/1/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.26	0.05	6.2	4	4.2	3.4	0.66	0.92
2/1/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.07	0.65	0.13	8.2	4	19.8	23.4	0.37	1.02
2/7/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.11	0.50	0.07	21.2	11	5.6	10.6	0.17	0.67
2/7/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.30	0.04	6.2	5	5.6	4.7	0.61	0.91

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
2/7/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.47	0.05	8.0	10	5.4	5.6	0.70	1.17
2/7/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.35	0.05	11.2	9	12.3	7.2	0.90	1.25
2/7/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.37	0.05	5.0	5	6.3	4.8	1.06	1.43
2/7/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.56	0.04	21.7	23	6.4	6.6	0.53	1.09
2/7/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.32	0.04	5.6	5	5.0	2.9	0.33	0.65
2/7/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.30	0.04	7.8	6	5.2	2.2	0.26	0.56
2/7/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.37	0.05	5.8	5	4.5	3.5	0.66	1.03
2/7/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.11	1.21	0.71	12.3	8	22.7	30.1	0.37	1.58
2/14/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.09	0.51	0.03	22.3	18	7.3	11.2	0.02	0.53
2/14/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.40	0.04	5.0	4	6.7	4.8	0.49	0.89
2/14/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.48	0.05	6.6	10	5.2	5.8	0.59	1.07
2/14/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.03	0.34	0.06	5.9	6	11.2	7.1	0.66	1.00
2/14/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.40	0.04	3.6	3	5.5	5.2	0.85	1.25
2/14/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.55	0.06	20.9	19	6.2	7.5	0.43	0.98
2/14/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.51	0.04	5.6	6	5.2	3.1	0.26	0.77
2/14/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.26	0.05	6.8	7	4.7	2.3	0.19	0.45
2/14/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.33	0.03	4.2	3	4.1	3.8	0.52	0.85
2/14/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.08	0.88	0.19	11.7	7	18.9	25.1	0.49	1.37
2/21/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.12	0.84	0.02	49.9	20	8.1	11.2	0.22	1.06
2/21/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.35	0.05	7.1	6	5.2	5.0	0.48	0.83
2/21/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.38	0.03	8.3	7	5.7	5.9	0.59	0.97
2/21/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.06	0.52	0.03	9.6	6	9.0	7.2	0.72	1.24
2/21/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.03	0.35	0.04	5.1	2	4.8	5.6	0.88	1.23
2/21/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.59	0.05	35.4	31	6.9	8.0	0.43	1.02
2/21/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.36	0.01	6.4	7	4.7	3.5	0.24	0.60
2/21/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.25	0.01	6.9	7	4.3	2.9	0.19	0.44
2/21/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.33	0.03	5.0	2	3.7	4.5	0.56	0.89
2/21/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.21	1.29	0.15	51.8	27	15.1	16.1	0.27	1.56
2/28/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.11	0.58	0.06	20.0	11	7.0	10.5	0.15	0.73
2/28/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.36	0.05	5.4	4	5.1	5.2	0.43	0.79
2/28/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.03	0.54	0.05	8.0	10	4.9	5.9	0.53	1.07
2/28/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.02	0.31	0.05	4.9	3	10.6	7.3	0.84	1.15
2/28/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.02	0.28	0.04	4.7	4	5.5	5.6	0.79	1.07
2/28/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.07	0.51	0.05	18.0	18	5.9	7.0	0.41	0.92
2/28/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.02	0.32	0.04	5.5	6	5.0	3.5	0.20	0.52
2/28/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.22	0.04	7.1	6	3.3	2.6	0.15	0.37
2/28/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.02	0.28	0.04	4.7	5	4.3	4.5	0.50	0.78
2/28/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.12	0.84	0.13	9.6	4	19.5	25.9	0.40	1.24
3/7/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.15	0.80	0.04	57.5	35	5.4	9.4	0.18	0.98
3/7/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.05	0.40	0.02	20.2	14	5.9	4.6	0.33	0.73
3/7/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.08	0.66	0.05	34.0	28	5.6	5.1	0.43	1.09
3/7/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.08	0.37	0.02	23.3	35	8.5	6.7	0.51	0.88

Sample Date	Watershed	Stream name	Site ID	Latitude	Longitude	TP (mg/L)	TKN (mg/L)	Ammonia-N (mg/L)	Turb (NTU)	TSS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	NO3/NO2-N (mg/L)	TN (mg/L)
3/7/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.36	0.04	7.0	11	5.0	5.0	0.70	1.06
3/7/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.14	0.74	0.04	120.0	94	6.1	6.8	0.37	1.11
3/7/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.27	0.02	4.8	7	4.8	3.4	0.12	0.39
3/7/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.03	0.23	0.02	8.0	18	4.1	2.4	0.14	0.37
3/7/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.04	0.29	0.02	7.8	10	3.8	4.0	0.43	0.72
3/7/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.41	2.17	0.11	191.0	306	6.6	8.0	0.25	2.42
3/13/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.14	0.69	0.04	25.3	11	5.6	7.2	0.28	0.97
3/13/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.04	0.45	0.04	10.1	11	5.3	4.3	0.32	0.77
3/13/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.05	0.59	0.02	11.2	11	5.2	4.9	0.51	1.10
3/13/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.05	0.53	0.03	11.4	7	9.8	6.5	0.64	1.17
3/13/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.38	0.03	6.5	5	4.6	4.8	0.67	1.05
3/13/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.08	0.49	0.03	17.9	15	5.0	6.1	0.33	0.82
3/13/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.05	0.36	0.02	9.1	10	3.7	3.1	0.12	0.48
3/13/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.04	0.29	0.03	9.4	7	4.1	2.5	0.10	0.39
3/13/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.28	0.03	6.6	5	3.8	3.6	0.42	0.70
3/13/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.12	0.84	0.10	27.8	12	15.2	16.9	0.20	1.04
3/21/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.09	0.56	0.03	16.5	10	6.5	8.3	0.17	0.73
3/21/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.02	0.32	0.03	6.2	5	4.2	4.4	0.40	0.72
3/21/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.04	0.37	0.03	9.0	14	4.7	4.9	0.49	0.86
3/21/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.04	0.42	0.03	4.5	4	10.4	7.6	0.65	1.07
3/21/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.04	0.35	0.02	6.4	9	4.6	4.7	0.63	0.98
3/21/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.09	0.48	0.02	23.7	29	5.2	6.0	0.35	0.83
3/21/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.03	0.23	0.02	7.9	8	3.9	2.8	0.17	0.40
3/21/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.02	0.23	0.03	9.1	6	3.3	2.3	0.12	0.35
3/21/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.03	0.34	0.02	7.4	8	3.7	3.5	0.37	0.71
3/21/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.06	0.49	0.04	9.2	5	19.2	26.3	0.15	0.64
3/28/2017	LCPR	Cypress Creek	Cyp	35° 4'2.13"N	92°44'32.21"W	0.22	1.04	0.05	36.7	28	6.0	6.7	0.11	1.15
3/28/2017	LCPR	East Fork Point Remove Creek	EF1	35°23'47.04"N	92°39'32.79"W	0.06	0.45	0.03	16.9	12	4.2	3.8	0.47	0.92
3/28/2017	LCPR	East Fork Point Remove Creek	EF2	35°15'48.52"N	92°43'57.27"W	0.09	0.62	0.04	23.1	20	4.5	4.7	0.51	1.13
3/28/2017	LCPR	Gum Log Creek	GL	35°17'12.45"N	92°54'41.00"W	0.17	0.95	0.10	33.0	29	7.9	5.2	0.87	1.82
3/28/2017	LCPR	Clear Creek	LCC	35°19'48.34"N	92°52'9.55"W	0.12	0.67	0.06	29.1	19	4.2	4.0	0.78	1.45
3/28/2017	LCPR	Point Remove Creek	PR	35°10'56.43"N	92°44'5.12"W	0.15	0.74	0.05	47.8	39	4.8	4.7	0.48	1.22
3/28/2017	LCPR	West Fork Point Remove Creek	WF1	35°26'50.87"N	92°42'45.64"W	0.06	0.50	0.05	20.2	13	4.5	2.4	0.24	0.74
3/28/2017	LCPR	West Fork Point Remove Creek	WF2	35°26'6.59"N		0.05	0.36	0.03	24.4	11	3.4	2.0	0.15	0.51
3/28/2017	LCPR	West Fork Point Remove Creek	WF3	35°19'26.50"N	92°52'22.15"W	0.08	0.53	0.05	28.6	21	3.9	3.3	0.50	1.03
3/28/2017	LCPR	White Oak Creek	WO	35°15'16.96"N	92°53'38.97"W	0.21	1.27	0.08	30.1	11	12.8	11.2	0.22	1.49

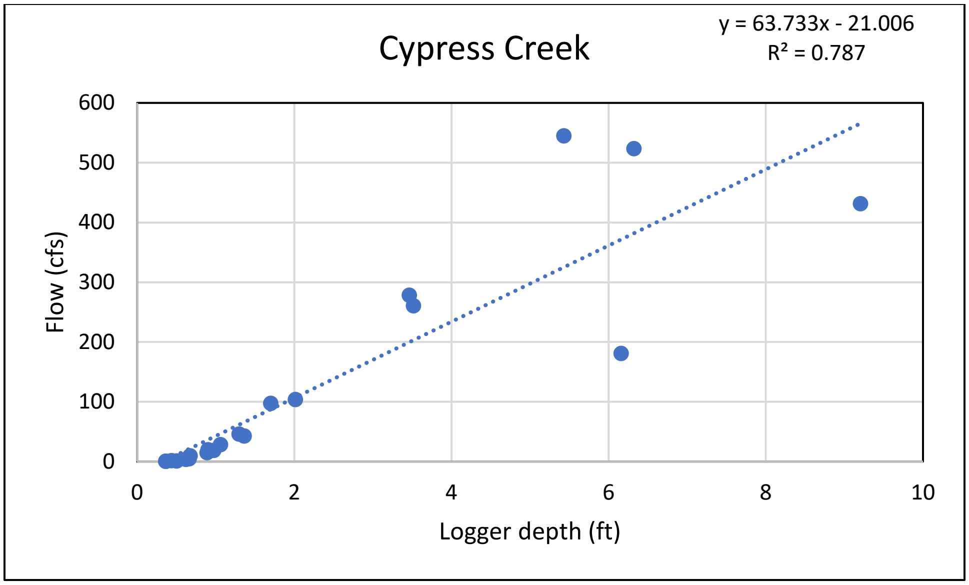
Appendix C

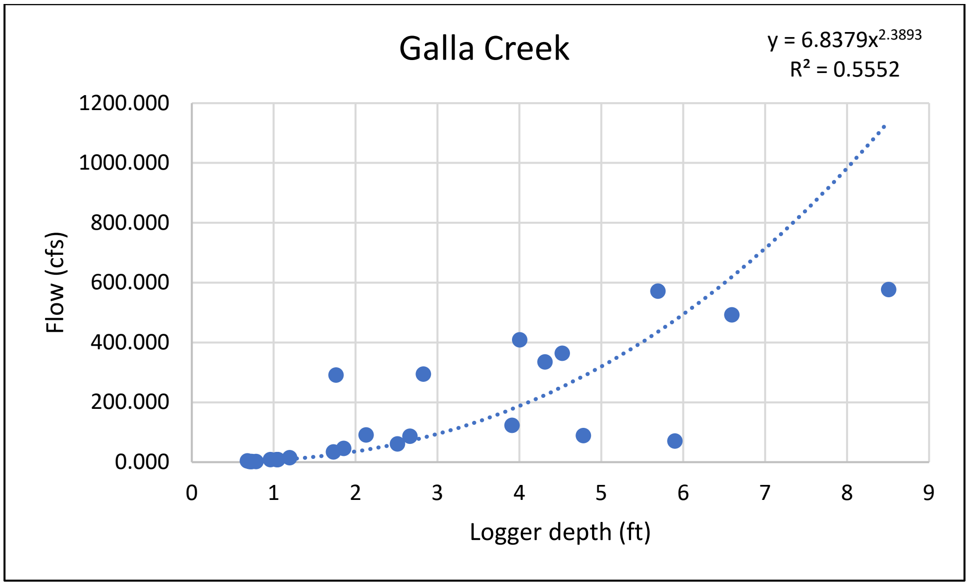
Water Quality Data

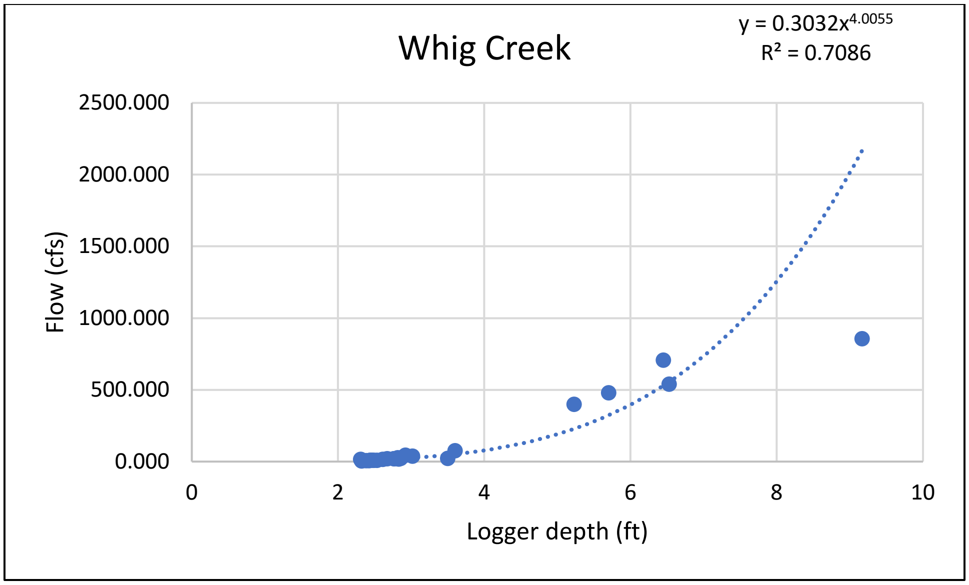
Date Sampled	Sample ID	Time Sampled	Flow measured	Rating curve flow	Storm or Base flow Sampling	Temp C	D.O. (mg/L)	D.O. %	Sp. Cond (µS)	pH	Turbidity (ntu)	Total Nitrogen	Ammonia (mg/L)	Nitrate+Nitrite (mg/L)	SRP (mg/L)	Total Phosphorus (mg/L)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
5/30/2018	CC-1	1300	1.16	11.49	Base	29.76	4.05	53	109	--	--	1	0.07	0.226	0.164	0.223	88.2	9.6
6/13/2018	CC-1	1300	1.54	3.97	Base	27.1	2.78	35	102	-	-	0.93	0.09	0.164	0.149	0.217	79.6	16.2
6/27/2018	CC-1	1300	0.37	1.62	Base	27.63	3.14	39.7	136	-	-	0.78	0.02	0.082	0.045	0.099	96.9	8.3
9/9/2018	CC-1	1300	104.02	106.97	Base	29.95	5.27	62.6	74	-	-	1.58	0.19	0.464	0.432	0.479	78.2	65.8
9/30/2018	CC-1	1300	18.67	29.91	Base	20.17	6.47	70	71	-	-	1.04	0.04	0.395	0.087	0.167	76.7	5.2
10/15/2018	CC-1	1205	278.52	199.7	Storm	16	6.3	63.8	61.2	6.2	37.5	-	0.03	0.138	0.138	0.231	89.3	16.6
10/21/2018	CC-1	1300	42.7	46.48	Base	13.67	9.96	95.7	60	-	-	0.79	0.03	0.363	0.066	0.1	75.1	6.6
11/1/2018	CC-1	935	380.78	421.87	Storm	15.2	6.3	63.1	44.2	6	53.4	-	0.01	0.107	0.15	0.272	63.3	25.3
11/11/2018	CC-1	1300	97.62	87.46	Base	8.35	13.55	115.8	58	-	-	0.63	0.02	0.172	0.08	0.116	54.9	2.6
11/27/2018	CC-1	1300	9.53	21.95	Base	5.36	13.28	105.2	74	-	-	0.72	0.07	0.384	0.067	0.093	67.3	2.5
12/14/2018	CC-1	1115	544.86	325.13	Storm	9.8	8.16	71.9	45.2	5.63	59.6	-	0.09	0.199	0.076	0.161	76	15.1
12/17/2018	CC-1	1300	-	400.07	Base	9.2	6.82	59.2	38	-	-	0.72	0.037	0.138	0.071	0.122	61.3	15.4
12/30/2018	CC-1	1300	-	123.35	Base	5.94	5.09	40.8	52	-	-	0.53	0.033	0.119	0.056	0.101	50.2	7.4
1/13/2019	CC-1	1300	46.22	61.78	Base	6.54	16.76	136.5	60	-	-	0.54	0.024	0.277	0.031	0.056	83.8	3.7
1/23/2019	CC-1	1120	260.58	203.08	Storm	6.1	13.01	104.7	35.3	6.2	57.6	-	0.039	0.23	0.058	0.181	74.2	37.9
1/27/2019	CC-1	1300	-	68.86	Base	4.51	14.87	114.6	47	-	-	0.45	0.019	0.149	0.031	0.053	42.7	26.9
2/11/2019	CC-1	1245	549.99	550	Storm	6.3	12.29	100.5	30	5.9	64.2	-	0.047	0.085	0.104	0.101	50.4	14.6
2/17/2019	CC-1	1300	-	195.88	Base	6.48	18.7	152.1	37	-	-	0.51	0.041	0.169	0.041	0.08	56.2	5.9
2/27/2019	CC-1	1300	-	227.93	Base	10.76	10.59	95.2	38	-	-	0.47	0.041	0.142	0.039	0.07	36.4	6.8
3/16/2019	CC-1	1300	-	224.24	Base	11.76	16.86	155.5	50	-	-	0.52	0.033	0.075	0.052	0.095	55.3	8
3/31/2019	CC-1	1300	14.84	33.29	Base	14.38	9.9	96.8	76	-	-	0.6	0.069	0.159	0.064	0.091	53.3	5.2
4/4/2019	CC-1	1425	28.14	48.8	Storm	13.92	8.17	-	73	6.41	59.4	-	0.031	0.214	0.055	0.162	86.9	29
4/18/2019	CC-1	1130	180.68	368.59	Storm	16.5	6.42	65.6	37.4	6.48	61.8	-	0.044	0.067	0.1	0.187	60	15.5
4/23/2019	CC-1	1300	-	301.74	Base	17.78	13.74	144.3	40	-	-	0.63	0.091	0.075	0.065	0.111	54.7	11.1
4/30/2019	CC-1	1300	19.83	36.48	Base	19.78	15.51	169.8	67	-	-	0.71	0.076	0.214	0.11	0.154	50.7	8.4
5/15/2019	CC-1	1300	-	Bkw	Base	20.06	8.42	92.7	60	-	-	0.56	0.117	0.147	0.116	0.141	58.4	8.7
5/30/2018	EPR-1	1030	40.83	35.25	Base	24.38	9.24	110.6	44	-	-	0.54	0.09	0.286	0.012	0.053	39.8	9.5
6/13/2018	EPR-1	1030	0.96	-27	Base	28.19	3.21	41.2	53	-	-	0.53	0.04	0.552	0.036	0.017	46.4	5.8
6/27/2018	EPR-1	1030	0.69	-38	Base	29.37	6	78.4	60	-	-	0.46	0.03	0.194	0.005	0.019	41.6	2.3
9/9/2018	EPR-1	1030	8.49	-3.63	Base	24.67	7.86	95	50	-	-	0.56	0.03	0.272	0.038	0.039	41.6	6.7
9/30/2018	EPR-1	1030	26.66	13.07	Base	2.88	8.23	91.6	57	-	-	0.5	0	0.286	0.006	0.025	44.4	2.7
10/15/2018	EPR-1	1300	228.14	236.46	Storm	17.2	8.5	89	52.2	6.4	16.9	-	0.07	0.446	0.007	0.051	46	10.6
10/21/2018	EPR-1	1030	-	124.92	Base	15.03	17.55	174.2	51	-	-	0.96	0.03	0.642	0.012	0.041	55.6	5.5
11/1/2018	EPR-1	900	1308.18	806.32	Storm	15.1	10.1	100	37.3	5.7	32.6	-	0.01	0.498	0.049	0.112	24.2	27.5
11/11/2018	EPR-1	1030	-	93.46	Base	11.36	17.26	157.6	42	-	-	0.75	0.01	0.531	0.009	0.023	30.9	2.5
11/27/2018	EPR-1	1030	16.63	32.17	Base	6.97	17.42	143.26	44	-	-	0.57	0.01	0.418	0.002	0.023	45.3	1.9
12/14/2018	EPR-1	1120	472.63	603.38	Storm	9.4	11.6	101	38.2	5.3	19.8	-	0.016	0.522	0.016	0.059	40.2	13.3
12/17/2018	EPR-1	1030	-	294.27	Base	8.95	7.37	63.9	41	-	-	0.96	0.017	0.599	0.03	0.047	41.6	94.7
12/30/2018	EPR-1	1030	-	192.79	Base	7.74	9.41	78.6	41	-	-	0.73	0.007	0.57	0.009	0.036	39	9.2
1/13/2019	EPR-1	1030	68.37	112.72	Base	6.59	16.34	132.9	39	-	-	0.67	0.009	0.54	0.004	0.017	63.3	3.7
1/23/2019	EPR-1	1205	219.9	597.69	Storm	6.7	12.3	101	31.5	5.7	21.6	-	0.022	0.473	0.026	0.078	42	15.6
1/27/2019	EPR-1	1030	-	155.23	Base	6.34	14.62	118.4	37	-	-	0.67	0.015	0.404	0.011	0.025	33.8	15.2
2/11/2019	EPR-1	1240	3424.52	3940.3	Storm	7.3	12.32	101.5	20	4.89	88.4	-	0.042	0.191	0.046	0.176	41.8	90.6
2/17/2019	EPR-1	1030	-	399.17	Base	7.94	18.1	152.4	29	-	-	0.66	0.065	0.4	0.041	0.076	61.8	8.9
2/27/2019	EPR-1	1030	-	259.7	Base	9.13	12.73	109.6	33	-	-	0.61	0.023	0.413	0.022	0.041	35.1	7.2
3/16/2019	EPR-1	1030	-	155.8	Base	8.65	18.4	157.6	36	-	-	0.58	0.016	0.431	0.016	0.044	38	6.7
3/31/2019	EPR-1	1030	50.68	54.02	Base	10.95	11.18	101.3	34	-	-	0.38	0.041	0.223	0.007	0.016	21.1	2.7
4/4/2019	EPR-1	1540	68.9	85.07	Storm	13.6	11.6	111.7	38.3	6.1	9.5	-	0.01	0.19	0.004	0.038	24.9	6.1
4/18/2019	EPR-1	1250	582.02	568.07	Storm	15	9.66	96.3	34.9	5.29	37.1	-	0.032	0.252	0.038	0.123	43.6	38.1
4/23/2019	EPR-1	1030	257.13	203.62	Base	15.78	12.6	126.8	36	-	-	0.6	0.015	0.275	0.018	0.048	37.8	8.1
4/30/2019	EPR-1	1030	42.92	325.55	Base	19.07	20.05	216.3	39	-	-	0.55	0.01	0.27	0.01	0.034	23.8	4
5/15/2019	EPR-1	1030	-	205.89	Base	17.48	9.6	100.3	38	-	-	0.51	0.023	0.276	0.021	0.045	39.6	7.9
5/29/2019	EPR-1	1030	96.57	155.62	Base	22.94	10.55	122.7	41	-	-	0.65	0.023	0.343	0.036	0.068	51.3	7
6/13/2019	EPR-1	1030	-	106.25	Base		-	-	-	-	-	0.51	0.018	0.159	0.015	0.04	43.3	9.3
5/30/2018	EPR-2	1000	40.9	56.5	Base	24.88	6.21	74.7	44	-	-	0.64	0.04	0.329	0.025	0.071	44.7	15.3
6/13/2018	EPR-2	1000	1.92	7.84	Base	29.3	2.97	39	53	-	-	0.49	0.04	0.251	0.013	0.03	39.6	5
6/27/2018	EPR-2	1000	1.69	7.96	Base	31.15	5.42	72.6	55	-	-	0.36	0.01	0.12	0.008	0.032	38.2	14.8
9/9/2018	EPR-2	1000	36.03	37.2	Base	24.77	7.37	88.6	49	-	-	0.93	0.05	0.496	0.118	0.127	44.9	9.9
9/30/2018	EPR-2	1000	48.15	46.7	Base	20.55	8.87	98.5	56	-	-	0.72	0	0.466	0.008	0.032	45.8	4.5
10/15/2018	EPR-2	1505	383	381	Storm	17.2	9.2	95	56.7	6.2	17.8	-	0.12	0.716	0.022	0.081	56.2	17.3
10/21/2018	EPR-2	1000	248.42	245	Base	15.24	14.28	142.1	55	-	-	1.22	0.01	0.881	0.017	0.07	52.9	20.2
11/1/2018	EPR-2	1040	1620	1780	Storm	15.3	10	100	38.8	5.7	59.7	-	0.02	0.592	0.059	0.208	34.2	69.5
11/11/2018	EPR-2	1000	191.52	186	Base	10.86	16.91	152.3	46	-	-	0.93	0.01	0.715	0.012	0.029	38.7	1.6
11/27/2018	EPR-2	1000	37.53	38.7	Base	6.59	18.39	150	50	-	-	0.76	0	0.569	0.003	0.024	46	1.9
12/14/2018	EPR-2	835	1250	1280	Storm	9.5	11.3	-	42	4.9	39.7	-	0.036	0.653	0.039	0.129	48.2	45
12/17/2018	EPR-2	1000	-	760	Base	9.4	13.54	119.2	39	-	-	0.69	0.014	0.584	0.018	0.034	38.9	7.4
12/30/2018	EPR-2	1000	235.31	244	Base	8.19	9.57	80.9	36	-	-	0.93	0.008	0.709	0.014	0.041	36.7	5.1
1/13/2019	EPR-2	1000	194.48	190	Base	6.74	16.39	134.1	44	-	-	0.89	0.001	0.738	0.008	0.018	67.2	1.4
1/23/2019	EPR-2	1430	1400	1040	Storm	7	12.1	100	34.3	5.9	43.6	-	0.03	0.58	0.032	0.12	48.2	38.8
1/27/2019	EPR-2	1000	-	158.2	Base	6.39	17.2	139.6	39	-	-	0.85	0.017	0.729	0.019	0.035	25.6	17
2/11/2019	EPR-2	1435	7200	4460	Storm	7.48	12.84	107.2	241	4.6	241	-	0.053	0.253	0.033	0.369	40	290.3
2/17/2019	EPR-2	1000	-	795	Base	7.78	11.4	95.6	33	-	-	0.75	0.034	0.483	0.065	0.105	28.7	12
2/27/2019	EPR-2	1000	-	504	Base	9.26	13.24	114.7	34	-	-	0.71	0.014	0.451	0.024	0.045	35.1	6.3
3/16/2019	EPR-2	1000	-	324	Base	9.2	14.27	123.5	27	-	-	0.74	0.025	0.54	0.019	0.048	43.6	7
3/31/2019	EPR-2	1000	69.61	66.9	Base	12.37	11.02	103.4	40	-	-	0.41	0.039	0.25	0.007	0.015	21.3	3.3
4/4/2019	EPR-2	1640	65	60.8	Storm	14	10.8	106	40.2	6.3	3.8	-	0.004	0.215	0.003	0.027	19.8	2.9
4/18/2019	EPR-2	1330	1100	1150	Storm	15.8	9.32	94.3	42.8	5.56	31.4	-	0.107	0.387	0.136	0.259	45.1	59.3
4/23/2019	EPR-2	1000	-	284	Base	15.58	14.19	142.3	33	-	-	0.67	0.014	0.389	0.025	0.051	41.1	8.8
4/30/2019	EPR-2	1000	88.94	82.9	Base	18.87	18.76	201.5	41	-	-	0.64	0.013	0.404	0.016	0.042	26.4	6.6
5/15/2019	EPR-2	1000	202.42	182	Base	17.83	9.15	96.3	39	-	-	0.63	0.024	0.389	0.026	0.046	41.1	7.3
5/29/2019	EPR-2	1000	-	705	Base	23.72	8.98	106.1	43	-	-	0.56	0.059	0.22	0.025	0.074	52.4	13.5
6/13/2019	EPR-2	1000	-	110	Base	-	-	-	-	-	-	0.54	0.011	0.227	0.013	0.043	43.6	5.2
5/30/2018	GC-1	1330	8.06	7.48	Base	26.61	4.73	58.9	69	-	-	1.08	0.11	0.413	0.076	0.373	118.4	148.9
6/13/2018	GC-1	1330	1.14	2.52	Base	27.77	2.9	35	86	-	-	1.07	0.1	0.496	0.096	0.293	104	56.2
6/27/2018	GC-1	1330	4.07	2.7	Base	26.75	2.5	31.3	-	-	-	1.03	0.1	0.544	0.113	0.274	108.4	29.5
9/9/2018	GC-1	1330	1.19	3.15	Base	25.36	4.52	55.1	91	-	-	0.63	0.07	0.175	0.152	0.166	73.6	18
9/30/2018	GC-1	1330	14.82	10.45	Base	21.87	8.52	97.1	69	-	-	0.72	0.02	0.281	0.054	0.129	63.1	19.2
10/15/2018	GC-1	1300	363.86	251	Storm	16.4	5.92	64.6	60.6	6.2	529	-	0.05	0.496	0.104	0.214	78.2	49.4
10/21/2018	GC-1	1330	88.52	103.34	Base	14.22	10.38	101	64	-	-	0.95	0.07	0.347	0.054	0.09	69.6	11.8
11/1/2018	GC-1	1045	492.3	618.93	Storm	14.9	6.3	62.3	54.9	6	64.9	-	0.18	0.278	0.167	0.319	74.4	51.3
11/11/2018	GC-1	1330	90.78	42.25	Base	9.12	15.31	132.7	63	-	-	0.88	0.06	0.378	0.047	0.075	49.6	6.7
11/27/2018	GC-1	1330	7.75	7.63	Base	5.23	13.14	103.2	66	-	-	0.65	0.03	0.291	0.042	0.075	58.9	7.7
12/14/2018	GC-1	1230	408.13	187.79	Storm	8.9	8.64	73.6	69.4	5.89	42.2	-	0.047	0.185	0.068	0.16	76.2	40.9
12/17/2018	GC-1	1330	-	298.44	Base	8.21	7.39	63.2	61	-	-	1.01	0.041	0.324	0.065	0.119	62.9	10.8
12/30/2018	GC-1	1330	-	103.82	Base	6.06	5.72	45.9	57	-	-	0.85	0.03	0.344	0.048	0.094	51.3	10.3

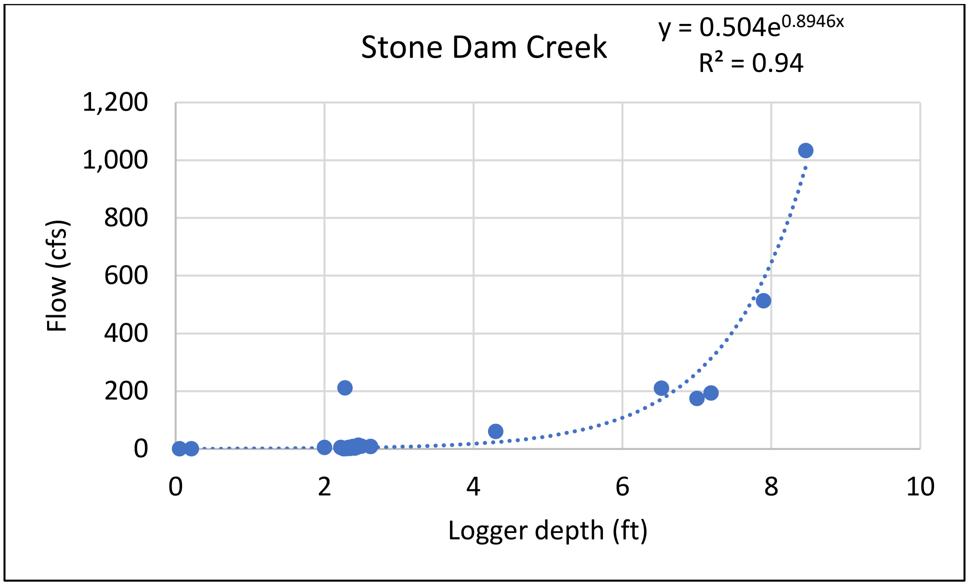
Date Sampled	Sample ID	Time Sampled	Flow measured	Rating curve flow	Storm or Base flow Sampling	Temp C	D.O. (mg/L)	D.O. %	Sp. Cond (µS)	pH	Turbidity (ntu)	Total Nitrogen	Ammonia (mg/L)	Nitrate+Nitrite (mg/L)	SRP (mg/L)	Total Phosphorus (mg/L)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
1/13/2019	GC-1	1330	-	474.45	Base	5.99	12.83	102.9	67	-	-	0.75	0.03	0.34	0.025	0.061	81.8	1.4
1/23/2019	GC-1	1215	334.41	220.24	Storm	5.1	14.22	-	53.6	5.86	27.7	-	0.072	0.21	0.059	0.112	54.4	16.2
1/27/2019	GC-1	1330	69.83	69.61	Base	4.52	13.9	107.1	55	-	-	0.74	0.018	0.412	0.021	0.042	45.6	19.2
2/11/2019	GC-1	1345	576.32	1139.09	Storm	6.3	13.12	106.2	40.3	6.25	33	-	0.042	0.303	0.066	0.141	41.8	20.9
2/17/2019	GC-1	1330	-	73.84	Base	5.34	22.2	175.4	43	-	-	0.79	0.04	0.438	0.034	0.091	48.4	6.8
2/27/2019	GC-1	1330	86.58	70.94	Base	11.66	10.26	94.4	51	-	-	0.63	0.029	0.261	0.038	0.063	51.8	10.6
3/16/2019	GC-1	13330	-	61.7	Base	10.95	16.16	145.6	67	-	-	0.72	0.024	0.177	0.039	0.086	56.4	10.8
3/31/2019	GC-1	1330	33.89	25.37	Base	12.6	11.44	107.6	68	-	-	0.74	0.093	0.182	0.093	0.122	49.6	9
4/4/2019	GC-1	1525	290.8	27.04	Storm	14.82	8.7	-	75	6.24	35.4	-	0.05	0.192	0.09	0.174	89.3	16.2
4/18/2019	GC-1	1225	571.49	435.62	Storm	16.5	6.32	64.1	45.4	6.5	38.2	-	0.076	0.124	0.184	0.711	56.7	20
4/23/2019	GC-1	1330	-	81.97	Base	18.43	18.51	197.1	54	-	-	0.79	0.085	0.207	0.072	0.122	56.2	17.5
4/30/2019	GC-1	1330	45.67	29.97	Base	19.67	18.88	206.1	56	-	-	0.82	0.087	0.27	0.082	0.147	43.8	26.6
5/15/2019	GC-1	1330	bkw	Bkw	Base	19.93	8.66	95.1	58	-	-	0.67	0.066	0.227	0.069	0.107	57.1	19.6
5/30/2018	LC-1	800	0.72	2.59	Base	29.26	6.09	80	175	-	-	0.68	0.04	0.184	0.022	0.067	101.6	21.7
6/13/2018	LC-1	800	1.44	2.74	Base	25.03	3.21	40	180	-	-	0.61	0.08	0.258	0.027	0.063	102	56.6
6/27/2018	LC-1	800	0.36	2.59	Base	-	-	-	-	-	-	0.66	0.06	0.214	0.016	0.094	83.1	45.2
9/9/2018	LC-1	800	4.8	34.77	Base	25.04	4.43	53.1	99	-	-	0.76	0.08	0.297	0.043	0.126	95.1	21.5
9/30/2018	LC-1	800	2.67	6.3	Base	21.67	9.36	105.8	159	-	-	0.43	0.01	0.14	0.019	0.041	96	8.9
10/15/2018	LC-1	900	243.68	316	Storm	15.1	8.92	88.6	60	6.33	829	-	0.03	0.217	0.037	0.439	132.9	448
10/21/2018	LC-1	800	3.97	4.32	Base	13.46	10.49	100.4	141	-	-	0.72	0.05	0.232	0.016	0.08	104	22.1
11/1/2018	LC-1	610	380.78	146.22	Storm	16	9.2	93.2	61.2	6	72.4	-	0.03	0.316	0.047	0.148	58.2	32.3
11/11/2018	LC-1	800	3.99	3.42	Base	8.2	11.93	100.7	150	-	-	0.82	0.04	0.291	0.45	0.051	87.1	4.8
11/27/2018	LC-1	800	2.12	2.72	Base	6.95	7.34	60.5	187	-	-	0.31	0.03	0.093	0.023	0.056	116.2	14.6
12/14/2018	LC-1	815	52.8	71.6	Storm	10.7	9.61	96.7	50.7	5.5	50.5	-	0.024	0.298	0.033	0.099	82.9	20.4
12/17/2018	LC-1	800	7.24	8.98	Base	7.89	7.14	59.6	126	-	-	0.71	0.041	0.401	0.024	0.045	85.3	8.5
12/30/2018	LC-1	800	4.41	35.86	Base	10.51	4.92	44.2	49	-	-	0.61	0.052	0.327	0.028	0.056	72	8.1
1/13/2019	LC-1	800	2.55	2.74	Base	8.45	15.25	130.9	150	-	-	0.52	0.013	0.283	0.014	0.042	118.2	13.3
1/23/2019	LC-1	805	170	326	Storm	6.4	15	120	-	-	4.14	-	0.101	0.169	0.095	0.13	54	62.3
1/27/2019	LC-1	800	4.73	5.51	Base	8.87	14.95	128.9	187	-	-	0.65	0.013	0.421	0.012	0.029	101.6	16.1
2/11/2019	LC-1	950	791.99	675.16	Storm	7.3	13.43	107.9	35.2	5.11	113	-	0.07	0.16	0.066	0.153	39.3	67.3
2/17/2019	LC-1	800	6.34	4.15	Base	8.21	18.97	160	126	-	-	0.58	0.023	0.368	0.011	0.032	43.3	3.9
2/27/2019	LC-1	800	3.34	5.51	Base	13	-	-	112.6	-	-	0.53	0.018	0.315	0.016	0.03	84.9	4
3/16/2019	LC-1	800	-	7.27	Base	14.17	17.35	168.2	124	-	-	0.53	0.02	0.297	0.017	0.032	87.3	5.2
3/31/2019	LC-1	800	1.39	2.51	Base	16.23	10.76	109.5	171	-	-	0.32	0.037	0.065	0.01	0.025	90	2.7
4/4/2019	LC-1	1125	167.56	151.05	Storm	13.8	9.42	-	76	6.06	175	-	0.066	0.309	0.034	0.219	76.9	118.6
4/18/2019	LC-1	915	582.75	647.59	Storm	16.8	7.98	82.4	38.6	5.4	143	-	0.065	0.108	0.049	0.17	60.7	67.9
4/23/2019	LC-1	800	1.13	3.26	Base	21.66	18.31	207	169	-	-	0.7	0.062	0.349	0.031	0.048	91.6	4.5
4/30/2019	LC-1	800	0.41	3.62	Base	23.07	16.65	193.3	155	-	-	0.5	0.044	0.178	0.022	0.048	74.4	4.9
5/15/2019	LC-1	800	1.05	5.82	Base	26.68	7.1	89	135	-	-	0.51	0.028	0.219	0.088	0.032	92.2	5.5
5/29/2019	LC-1	800	0.45	4.56	Base	27.87	10.65	135.8	156	-	-	0.4	0.038	0.1	0.033	0.056	115.6	2.6
6/13/2019	LC-1	800	-	No Data	Base	-	-	-	-	-	-	0.38	0.031	0.069	0.022	0.031	105.3	20.5
5/30/2018	SD-1	830	4.41	no curve	Base	29.67	6	78.5	154	-	-	0.97	0.17	0.283	0.035	0.109	96.2	20.3
6/13/2018	SD-1	830	0.36	no curve	Base	27.11	2.8	35.5	158	-	-	0.82	0.24	0.067	0.098	0.196	97.3	9
6/27/2018	SD-1	830	0.39	no curve	Base	27.81	3.34	41.5	120	-	-	0.74	0.17	0.164	0.058	0.129	65.3	46.2
9/9/2018	SD-1	830	6.49	no curve	Base	24.82	5.77	69.6	68	-	-	0.84	0.08	0.357	0.076	0.12	69.1	19.3
9/30/2018	SD-1	830	3.35	no curve	Base	21.21	7.83	88.1	154	-	-	1.16	0.05	0.898	0.027	0.079	106.2	14.1
10/15/2018	SD-1	950	174	no curve	Storm	14.5	7.43	72.9	31	7.8	143	-	0.05	0.373	0.063	0.202	40.9	104.7
10/21/2018	SD-1	830	3.45	no curve	Base	7.38	9.67	14.29	128	-	-	0.95	0.05	0.567	0.043	0.086	98.4	12.8
11/1/2018	SD-1	700	211.31	no curve	Storm	16.2	8.1	83	77	6.61	60.7	-	0.04	0.677	0.095	0.183	79.6	23.9
11/11/2018	SD-1	830	4.4	0.48	Base	8.44	14.86	110.8	153	-	-	1.45	0.04	1.008	0.037	0.069	97.8	7.1
11/27/2018	SD-1	830	1.78	6.22	Base	8.1	11.34	97	225	-	-	0.45	0.02	0.158	0.02	0.05	163.1	9.4
12/14/2018	SD-1	900	60.32	160.49	Storm	10.8	8.75	78.1	82.8	6.2	49.8	-	0.019	0.505	0.074	0.14	86.4	17.1
12/17/2018	SD-1	830	9.46	18.2	Base	8.32	7.95	63.3	161	-	-	1.3	0.041	0.869	0.032	0.056	104.2	5
12/30/2018	SD-1	830	6.07	28.51	Base	7.08	8.69	71.4	161	-	-	1.25	0.041	0.777	0.035	0.069	90.7	7.4
1/13/2019	SD-1	830	4.48	4.81	Base	7.5	14.27	119.1	173	-	-	1.11	0.02	0.861	0.023	0.04	131.6	4.2
1/23/2019	SD-1	850	193.65	377.21	Storm	6.1	14.28	115.2	29	5.9	76.8	-	0.051	0.311	0.073	0.175	69.3	61.6
1/27/2019	SD-1	830	7.73	9.45	Base	7.52	17.71	147.8	162	-	-	1.07	0.02	0.971	0.02	0.034	95.3	12
2/11/2019	SD-1	1015	1033.37	488.25	Storm	7.1	12.16	100.5	31.9	5.45	83	-	0.061	0.202	0.086	0.175	48	73
2/17/2019	SD-1	830	8.27	28.12	Base	7.71	22.61	189.9	157	-	-	1.31	0.053	0.721	0.021	0.033	41.6	3
2/27/2019	SD-1	830	12.07	13.24	Base	12.6	-	-	107.6	-	-	0.97	0.029	0.89	0.023	0.042	93.6	3.5
3/16/2019	SD-1	830	-	-	Base	13.71	18	173.1	145	-	-	1	0.029	0.738	0.027	0.047	97.6	3.5
3/31/2019	SD-1	830	0.7	0.63	Base	15.47	10.24	101.7	208	-	-	0.55	0.063	0.142	0.019	0.048	108.9	10.5
4/4/2019	SD-1	1230	210.35	335.47	Storm	13.9	7.7	-	49	6.98	117	-	0.189	0.474	0.065	0.227	68.2	78.3
4/18/2019	SD-1	945	512.47	443.6	Storm	16.8	8.12	83.7	43.4	6.49	71.6	-	0.081	0.291	0.116	0.214	51.6	30.7
4/23/2019	SD-1	830	2.18	11.35	Base	20.7	15.07	168	169	-	-	1.27	0.088	0.785	0.034	0.061	116.7	9.4
4/30/2019	SD-1	830	2.1	6.15	Base	22.14	13.91	162.6	173	-	-	1.2	0.061	0.658	0.036	0.078	114.4	11.6
5/15/2019	SD-1	830	2.23	6.39	Base	27.17	7.06	89.1	186	-	-	0.92	0.089	0.543	0.086	0.08	110.7	14.3
5/29/2019	SD-1	830	1.59	1.74	Base	28.61	8.44	109	208	-	-	0.56	0.031	0.106	0.055	0.099	142	13.3
6/13/2019	SD-1	830	-	83.24	Base	-	-	-	-	-	-	0.65	0.036	0.006	0.061	0.106	108.2	6.7
5/30/2018	TB-1	900	0.97	31.64	Base	30.16	4.69	62.1	227	-	-	1.38	0.12	0.04	0.029	0.217	129.1	45.2
6/13/2018	TB-1	900	0.87	10.5	Base	27.59	2.13	27.3	273	-	-	1.56	0.23	0.1	0.05	0.251	154.4	42.4
6/27/2018	TB-1	900	0.56	9.23	Base	27.8	1.92	24.7	345	-	-	1.43	0.12	0.076	0.028	0.262	189.1	63.8
9/9/2018	TB-1	900	67.95	12.47	Base	23.65	5.54	65.7	82	-	-	1.52	0.05	0.196	0.468	0.573	127.8	191.3
9/30/2018	TB-1	900	17.18	10.79	Base	21.74	5.94	67.9	90	-	-	0.98	0.12	0.247	0.035	0.189	85.6	59.5
10/15/2018	TB-1	1045	77.12	34	Storm	16.9	5.91	61.2	87.7	6.5	76.1	-	0.05	0.336	0.077	0.218	77.6	56
10/21/2018	TB-1	900	-	302.46	Base	16.48	7.77	79.5	785	-	-	0.96	0.07	0.338	0.073	0.151	414.9	52.1
11/1/2018	TB-1	715	548.56	686.53	Storm	16.8	6.6	68	45	6.5	176	-	0.02	0.118	0.212	0.324	80.2	104.5
11/11/2018	TB-1	900	41.44	11.3	Base	9.73	12.58	110.7	77	-	-	0.72	0.04	0.204	0.052	0.127	67.1	26.1
11/27/2018	TB-1	900	3.28	10.09	Base	7.65	8.28	69.2	116	-	-	0.57	0.04	0.186	0.045	0.098	78.9	29.9
12/14/2018	TB-1	1015	687.88	551.81	Storm	9.8	9.32	82.3	38.6	5.85	86.8	-	0.033	0.172	0.047	0.156	74.9	36.2
12/17/2018	TB-1	900	-	180.2	Base	8.92	7.63	65.9	42	-	-	0.75	0.044	0.11	0.097	0.235	87.8	88.5
12/30/2018	TB-1	900	-	58.59	Base	7.64	7.91	66	128	-	-	1.09	0.114	0.188	0.068	0.215	59.8	44.5
1/13/2019	TB-1	900	-	267.94	Base	6.34	12.78	102.8	141	-	-	0.73	0.038	0.312	0.045	0.139	130	42.5
1/23/2019	TB-1	1025	371.32	372.87	Storm	6.6	14.4	117.3	54.6	6.2	482	-	0.043	0	0.033	0.416	160.6	242
1/27/2019	TB-1	900	15.82	22.29	Base	5.64	-	-	-	-	-	0.53	0.037	0.211	0.031	0.077	39.6	62.7
2/11/2019	TB-1	1130	1029.41	767.91	Storm	6.2	13.55	110	38	5.65	106	-	0.045	0.162	0.046	0.146	68.2	32.8
2/17/2019	TB-1	900	-	437.05	Base	6.3	21.33	172.6	45	-	-	0.54	0.048	0.086	0.072	0.153	56.9	44.5
2/27/2019	TB-1	900	-	9.41	Base	10.6	-	-	50.4	-	-	0.52	0.054	0.084	0.047	0.141	61.8	72.5
3/16/2019	TB-1	900	-	10.8	Base	13.31	16.2	154.7	60	-	-	0.61	0.053	0.141	0.036	0.148	65.8	68.4
3/31/2019	TB-1	900	11.25	45.7	Base	15.05	10.45	103.7	151	-	-	0.59	0.057	0.032	0.052	0.156	89.1	47.8
4/4/2019	TB-1	1325	11.8	42.63	Storm	15.32	7.5	-	165	7.01	116	-	0.079	0.047	0.03	0.213	115.8	76.5
4/18/2019	TB-1	1035	400.78	529.83	Storm	17	7.68	79.3	48.7	6.67	960	-	0.081	0.305	0.057	0.164	150.7	354.7
4/23/2019	TB-1	900	-	27.34	Base	21.09	12	135	60	-	-	0.92	0.12	0.097	0.078	0.227	95.3	83.7
4/30/2019	TB-1	900	23.02	23.08	Base	22.79	13.36	154.6	97	-	-	0.96	0.176	0.153	0.06	0.215	66.9	93.6
5/15/2019	TB-1	900	Bkw	Bkw	Base	-	-	-	-	-	-	0.76	0.046	0.07	0.137	0.149	61.6	10.5

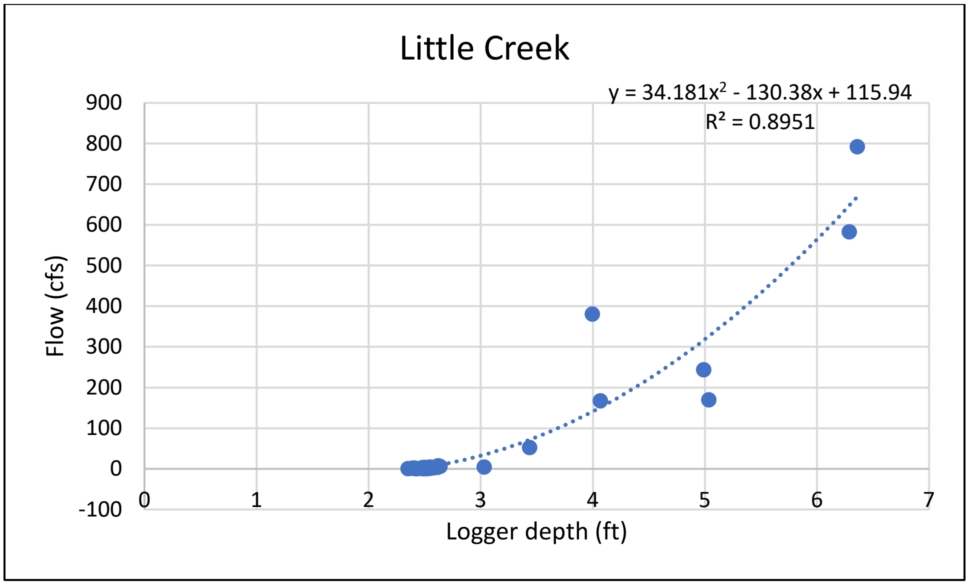
Date Sampled	Sample ID	Time Sampled	Flow measured	Rating curve flow	Storm or Base flow Sampling	Temp C	D.O. (mg/L)	D.O. %	Sp. Cond (µS)	pH	Turbidity (ntu)	Total Nitrogen	Ammonia (mg/L)	Nitrate+Nitrite (mg/L)	SRP (mg/L)	Total Phosphorus (mg/L)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
5/30/2018	WC-1	1230	22.96	20.31	Base	25.4	5.37	65.5	300	-	-	6.92	0.24	6.332	2.787	3.21	194.2	79.6
6/13/2018	WC-1	1230	7.02	10.47	Base	27.15	2.91	36.8	544	-	-	5.32	2	1.879	1.966	2.195	292.4	7.4
6/27/2018	WC-1	1230	16.3	8.63	Base	28.07	4.21	53.3	522	-	-	3.43	0.06	2.401	3.88	4.02	288.2	9.3
9/9/2018	WC-1	1230	6.47	9.82	Base	25.62	7.94	97.1	535	-	-	2.39	0.3	1.325	1.24	1.112	294.9	4.3
9/30/2018	WC-1	1230	9.58	10.94	Base	23.1	7.22	84.3	417	-	-	5.51	0	4.487	1.189	1.274	236	5.4
10/15/2018	WC-1	1015	478.65	451	Storm	17.1	8.71	91	100	6.3	281	-	0.04	1.197	0.456	1.287	97.3	341.4
10/21/2018	WC-1	1230	-	19.36	Base	16.45	9.01	92	234	-	-	2.26	0.05	1.699	1.919	2.131	152.4	15.3
11/1/2018	WC-1	720	540.12	555.65	Storm	15.8	8.2	83	88.4	5.6	144	-	0.07	0.594	0.052	1.143	89.1	152.8
11/11/2018	WC-1	1230	20.12	15.59	Base	11.93	13.85	128.5	301	-	-	3.9	0.09	3.049	0.081	0.135	170.4	5.3
11/27/2018	WC-1	1230	8.27	11.21	Base	9.88	12.48	118.8	424	-	-	3.39	0.1	2.003	3.261	3.707	263.6	5
12/14/2018	WC-1	1405	22	45.81	Storm	11.5	10.1	93	145.9	6.3	125	-	0.043	0.519	0.127	0.39	124.9	42.9
12/17/2018	WC-1	1230	43.84	26.85	Base	10.25	6.71	5.91	190	-	-	2.08	0.073	1.493	0.264	0.375	119.8	12.5
12/30/2018	WC-1	1230	38.87	20.8	Base	8.17	7.22	61.1	215	-	-	1.38	0.117	0.821	0.069	0.126	127.6	10.1
1/13/2019	WC-1	1230	-	494.25	Base	9.27	10.29	89.5	300	-	-	4.22	2.636	0.822	0.244	0.364	190.4	2.7
1/23/2019	WC-1	830	399.25	258.1	Storm	6.6	11.1	90	94.7	5.4	135	-	0.852	0.367	0.019	1.334	73.3	173.9
1/27/2019	WC-1	1230	19.42	17.9	Base	7.53	14.92	124.4	263	-	-	2.76	1.173	0.791	0.075	0.169	145.8	16.7
2/11/2019	WC-1	1020	856.42	2166.41	Storm	6.62	11.48	93.6	42	4.54	323	-	0.208	0.203	0.052	0.649	75.6	408.9
2/17/2019	WC-1	1230	23.6	18.6	Base	7.57	19.1	159.5	285	-	-	6.11	4.534	1.453	0.045	0.093	44	7.3
2/27/2019	WC-1	1230	27.35	18.82	Base	12.92	11.2	105.9	256	-	-	2.73	1.219	0.729	0.198	0.276	14	8.9
3/16/2019	WC-1	1230	-	17.8	Base	11.23	16.7	152.5	280	-	-	1.87	0.407	0.737	0.299	0.407	152	11.2
3/31/2019	WC-1	1230	7.87	12.56	Base	14.41	10.57	103.6	431	-	-	5.34	2.817	0.826	0.875	1.035	223.3	13.1
4/4/2019	WC-1	1225	76.4	57.48	Storm	15	6.4	63	437.8	6.5	165	-	11.064	0.466	0.496	1.147	207.1	171.6
4/18/2019	WC-1	1015	706.13	549.53	Storm	16.5	8	82	90.7	5.54	320	-	0.346	0.356	0.342	1.03	89.8	440.2
4/23/2019	WC-1	1230	18.24	19.61	Base	18.89	16.26	174.4	219	-	-	3.65	1.496	1.187	0.63	0.748	127.6	13.1
4/30/2019	WC-1	1230	15.34	14.21	Base	20.16	16.29	179.6	308	-	-	6.94	1.913	1.302	0.4	0.553	164.2	13.8
5/15/2019	WC-1	1230	-	Bkw	Base	20.72	9.08	101.4	304	-	-	4.71	2.919	1.116	1.838	1.863	168.9	7.4
5/30/2018	WPR-1	1100	24.24	7.98	Base	24.08	7.32	86.1	30	-	-	0.47	0.03	0.09	0.004	0.046	28.2	10.2
6/13/2018	WPR-1	1100	0.84	9.66	Base	26.61	3.76	46.8	34	-	-	0.41	0.02	0.265	0.004	0.027	36.8	22.1
6/27/2018	WPR-1	1100	0.48	18.57	Base	27.26	6.26	78.6	37	-	-	0.42	0.02	0.341	0.005	0.032	33.6	4.9
9/9/2018	WPR-1	1100	5.34	9.79	Base	24.1	7.7	91.6	35	-	-	0.41	0.02	0.215	0.022	0.023	37.8	1.3
10/2/2018	WPR-1	1100	1.82	16.9	Base	20.12	7.99	87.8	49	-	-	-	0	0.18	0	0.02	33.1	1.8
10/15/2018	WPR-1	1215	81.33	42.5	Storm	16.7	9.4	96	35.1	6.4	12.9	-	0	0.18	0.003	0.035	33.6	9.5
10/21/2018	WPR-1	1100	120.16	59.88	Base	15.79	13.43	135.4	31	-	-	1.16	0.04	0.825	0.016	0.046	52	6.3
11/1/2018	WPR-1	830	694.56	610.7	Storm	15.2	10	100	24.7	5.5	23.1	-	0.01	0.182	0.033	0.044	40	12.3
11/11/2018	WPR-1	1100	307.47	237.55	Base	11.51	15.53	142.3	26	-	-	0.29	0.01	0.162	0.003	0.02	26	2.3
11/27/2018	WPR-1	1100	25.4	14.79	Base	7.74	15.78	132.3	27	-	-	0.26	0	0.154	0.008	0.058	36.2	2.7
12/14/2018	WPR-1	1025	577	528.15	Storm	9.1	11.8	-	22.1	5.1	13.4	-	0.006	0.134	0.002	0.023	37.1	5.3
12/17/2018	WPR-1	1100	-	329.59	Base	9.4	7.44	64.8	23	-	-	0.27	0.005	0.176	0.005	0.017	32	3
12/30/2018	WPR-1	1100	-	272.41	Base	8.28	7.72	65.2	22	-	-	0.21	0.033	0.13	0.009	0.033	27.1	2.9
1/13/2019	WPR-1	1100	142.28	131.41	Base	7.13	14.85	122.5	23	-	-	0.2	0.003	0.133	0.002	0.007	42.2	9.7
1/23/2019	WPR-1	1020	130.6	601.38	Storm	6.7	12.3	100	19.5	5.6	16	-	0.015	0.087	0.005	0.034	32	8
1/27/2019	WPR-1	1100	490.32	367.99	Base	6.59	14.27	115.9	22	-	-	0.24	0.001	0.131	0.002	0.006	21.3	16.9
2/11/2019	WPR-1	1205	2301.6	2242.5	Storm	7.45	12.08	100.3	15	4.28	32	-	0.014	0.068	0.012	0.065	29.3	41.9
2/17/2019	WPR-1	1100	-	875.41	Base	7.85	19.81	166.4	17	-	-	0.24	0.012	0.061	0.015	0.031	22	5.8
2/27/2019	WPR-1	1100	-	539.95	Base	8.7	14.96	128.2	20	-	-	0.17	0.003	0.072	0.004	0.009	28.4	2.3
3/16/2019	WPR-1	1100	-	307.38	Base	9.4	18.39	159.4	20	-	-	0.15	0.003	0.08	0.003	0.017	22	2.4
3/31/2019	WPR-1	1100	94.42	66.44	Base	11.76	11.78	108.7	22	-	-	0.1	0.03	0.039	0.004	0.011	17.6	2.3
4/4/2019	WPR-1	1455	75.29	56.4	Storm	13.1	11.1	105.7	22.6	5.9	7.4	-	0.007	0.045	0.003	0.031	20.9	2
4/18/2019	WPR-1	1135	618.5	614.91	Storm	14.4	9.64	95	21.4	5.14	16.7	-	0.013	0.042	0.018	0.045	28	9.5
4/23/2019	WPR-1	1100	-	460.5	Base	14.7	19.69	194	21	-	-	0.18	0.004	0.044	0.005	0.034	34.2	4.9
4/30/2019	WPR-1	1100	160.17	133.56	Base	17.6	24.26	253.9	23	-	-	0.18	0.03	0.042	0.004	0.021	28.9	3.3
5/15/2019	WPR-1	1100	-	390.42	Base	16.83	10.09	104	22	-	-	0.22	0.005	0.043	0.005	0.017	31.6	4.3
5/29/2019	WPR-1	1100	60.4	76.4	Base	22.26	10.93	125.7	25	-	-	0.3	0.012	0.075	0.017	0.044	44.2	7
6/13/2019	WPR-1	1100	-	215.48	Base	-	-	-	-	-	-	0.28	0.012	0.035	0.007	0.027	39.6	0.7
5/30/2018	WPR-2	1130	50.91	51.6	Base	26.69	5.45	67.5	40	-	-	0.54	0.02	0.265	0.01	0.034	31.8	5.8
6/13/2018	WPR-2	1130	13.13	12.7	Base	28.71	3.21	41	51	-	-	0.43	0.08	0.331	0.026	0.027	42.8	3.2
6/27/2018	WPR-2	1130	10.91	4.5	Base	30.12	4.33	57.5	60	-	-	0.4	0.04	0.219	0.019	0.022	50.7	2.5
9/9/2018	WPR-2	1130	22.41	26.8	Base	25.59	7.32	89.5	45	-	-	0.63	0.04	0.387	0.065	0.031	46	2.2
9/30/2018	WPR-2	1130	24.71	30.2	Base	21.41	8.5	95.9	58	-	-	0.59	0	0.327	0.01	0.075	47.8	2.5
10/15/2018	WPR-2	1420	761	658	Storm	17.3	8.8	92	54.1	6.4	31	-	0.04	0.905	0.067	0.148	50.2	34.4
10/21/2018	WPR-2	1130	-	495	Base	15.01	12.14	119.9	47	-	-	0.61	0.01	0.314	0.003	0.032	43.6	6.7
11/1/2018	WPR-2	950	2760	2450	Storm	15.5	9.8	98	38.7	5.9	42.3	-	0.01	0.613	0.075	0.19	54	37.8
11/11/2018	WPR-2	1130	-	517	Base	10.86	15.67	141.5	39	-	-	0.85	0.01	0.639	0.014	0.041	40.4	2.8
11/27/2018	WPR-2	1130	66.72	82	Base	6.51	15.8	128	43	-	-	0.75	0	0.632	0.007	0.018	43.8	3
12/14/2018	WPR-2	920	1500	1490	Storm	9.3	11.6	-	38.2	5.3	24.3	-	0.046	0.547	0.021	0.077	41.3	22.2
12/17/2018	WPR-2	1130	-	1230	Base	8.74	7.59	65.7	38	-	-	1.11	0.012	0.674	0.013	0.121	38.2	22.9
12/30/2018	WPR-2	1130	-	811	Base	7.75	7.43	61.4	39	-	-	0.85	0.01	0.711	0.02	0.049	36.4	6.1
1/13/2019	WPR-2	1130	-	451	Base	6.74	10.57	85.9	37	-	-	0.77	0.006	0.645	0.008	0.018	62.9	8.1
1/23/2019	WPR-2	1355	1900	1670	Storm	6.7	12.4	101	31.6	5.9	26.8	-	0.088	0.53	0.04	0.086	41.3	29.3
1/27/2019	WPR-2	1130	-	773	Base	5.74	14.75	117.5	35	-	-	0.77	0.003	0.645	0.009	0.017	36.4	15
2/11/2019	WPR-2	1345	11400	9440	Storm	6.61	12.89	105	22	4.87	137	-	0.084	0.282	0.055	0.249	42.9	183.1
2/17/2019	WPR-2	1130	-	1820	Base	6.84	14.56	118.6	29	-	-	0.68	0.021	0.438	0.052	0.085	30.2	7.7
2/27/2019	WPR-2	1130	-	1080	Base	9.4	14.45	125.9	31	-	-	0.66	0.013	0.479	0.02	0.029	28.2	4.2
3/16/2019	WPR-2	1130	-	707	Base	9.42	18.82	163.7	33	-	-	0.57	0.007	0.447	0.009	0.028	34.7	5
3/31/2019	WPR-2	1130	161.31	183	Base	12.53	11.19	105.1	33	-	-	0.39	0.024	0.244	0.005	0.015	28.7	3.1
4/4/2019	WPR-2	1415	165	177	Storm	13.8	10.7	103.5	35	5.9	5.7	-	0.01	0.224	0.003	0.03	20.2	2.9
4/18/2019	WPR-2	1100	1700	1800	Storm	15.4	9.44	94.8	38.9	5.49	88.7	-	0.079	0.343	0.087	0.262	54.2	104.9
4/23/2019	WPR-2	1130	-	903	Base	15.74	17.22	173.5	33	-	-	0.6	0.01	0.349	0.022	0.046	29.1	8.4
4/30/2019	WPR-2	1130	-	384	Base	18.73	20.99	224.8	35	-	-	0.54	0.006	0.286	0.012	0.041	31.3	8
5/15/2019	WPR-2	1130	-	808	Base	17.91	10.41	110	35	-	-	0.51	0.012	0.316	0.025	0.04	36.9	7.3
5/29/2019	WPR-2	1130	-	642	Base	23.84	9.29	110	38	-	-	0.55	0.032	0.306	0.029	0.083	50.2	6.3
6/13/2019	WPR-2	1130	-	Bkw	Base	-	-	-	-	-	-	0.43	0.018	0.202	0.04	0.035	40	5.3

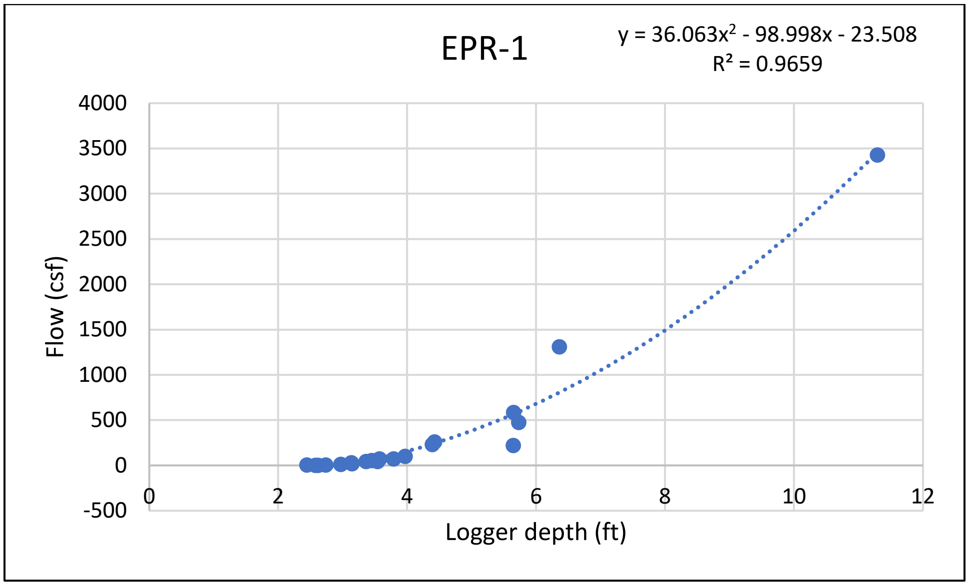

Cypress Creek
y = 63.733x - 21.006
R² = 0.787
Flow (cfs)
600
500
400
300
200
100
0
0
2
4
6
8
10
Logger depth (ft)

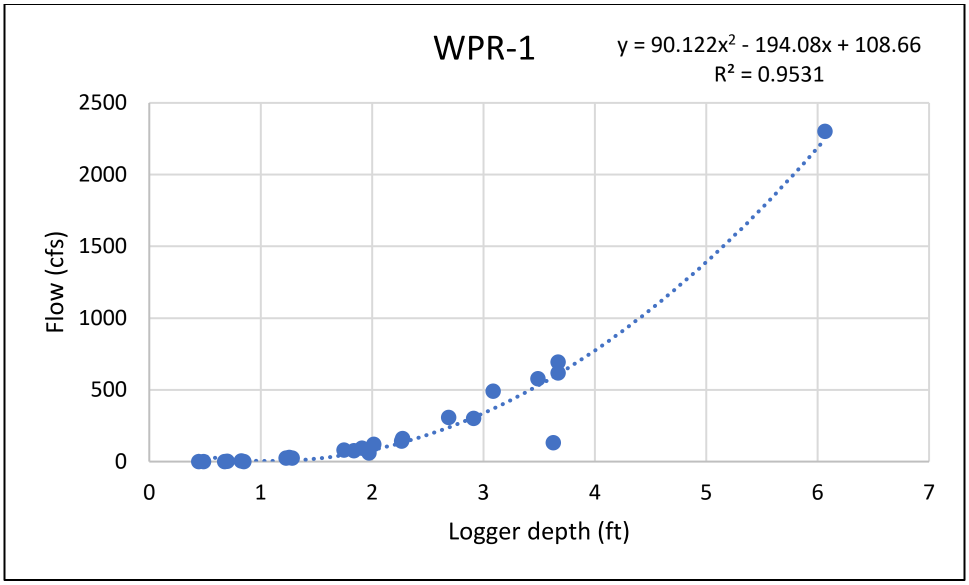

Galla Creek
y = 6.8379x^2.3893
R² = 0.5552
Flow (cfs)
1200.000
1000.000
800.000
600.000
400.000
200.000
0.000
0
1
2
3
4
5
6
7
8
9
Logger depth (ft)

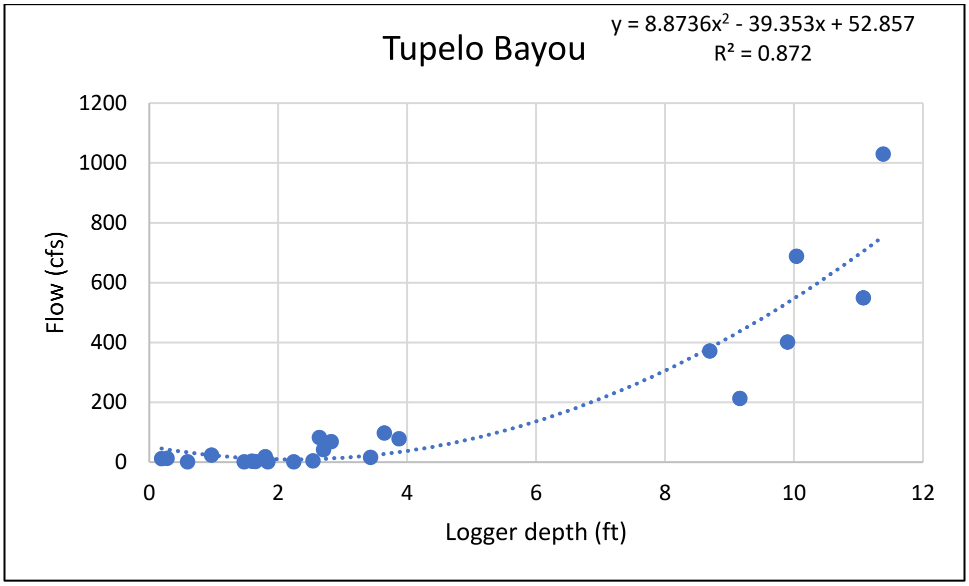

Whig Creek
y = 0.3032x^4.0055
R² = 0.7086
2500.000
2000.000
1500.000
1000.000
500.000
0.000
Flow (cfs)
0
2
4
6
8
10
Logger depth (ft)


Stone Dam Creek
y = 0.504e^0.8946x
R² = 0.94
1,200
1,000
800
600
400
200
0
Flow (cfs)
0
2
4
6
8
10
Logger depth (ft)


Little Creek
y = 34.181x² - 130.38x + 115.94
R² = 0.8951
Flow (cfs)
900
800
700
600
500
400
300
200
100
0
-100
0
1
2
3
4
5
6
7
Logger depth (ft)


EPR-1
y = 36.063x² - 98.998x - 23.508
R² = 0.9659
Flow (csf)
4000
3500
3000
2500
2000
1500
1000
500
0
-500
0
2
4
6
8
10
12
Logger depth (ft)


WPR-1
y = 90.122x² - 194.08x + 108.66
R² = 0.9531
Flow (cfs)
2500
2000
1500
1000
500
0
0
1
2
3
4
5
6
7
Logger depth (ft)


Tupelo Bayou
y = 8.8736x² - 39.353x + 52.857
R² = 0.872
Flow (cfs)
1200
1000
800
600
400
200
0
0
2
4
6
8
10
12
Logger depth (ft)

Appendix D

Watershed Treatment Model Inputs

Site ID	Stream Length (ft)	Stream Length (miles)	Watershed Size (acres)	Acres of Developed Open Space/Low Intensity & Barren	Acres of Developed Medium Intensity	Acres of Developed High Intensity	Acres of Forest	Acres of Pasture/Hay	Acres of Shrub/Grassland	Acres of Rural	Acres of Wetlands & Open Water	Acres of Cultivated Crops	% riparian unaffected in subwatershed	Stream miles with <50 ft	25% of affected stream miles	25% of sum of medium and high density	15% of sum of medium and high density	Homes
CC-1	72,471	14	37,248	1,534.3	58.3	11.5	21,264.6	9,411.7	3,128.1	12,539.8	1,837.9	1.6	8.60%	1.2	0.3	17.5	10.5	
EPR-1	78,121	15	36,352	1,412.1	175.3	136.0	20,361.6	9,433.0	4,561.6	13,994.7	272.0	0.2	15.00%	2.2	0.6	77.8	46.7	
EPR-2	63,988	12	27,328	1,140.7	139.6	115.2	14,036.7	9,174.1	2,580.5	11,754.6	141.2	0.0	5.70%	0.7	0.2	63.7	38.2	500
GC-1	116,044	22	28,736	2,209.6	137.0	35.5	11,425.9	12,321.2	711.3	13,032.4	1,724.4	171.1	14.00%	3.1	0.8	43.1	25.9	
LC-1	19,768	4	3,200	1,368.0	560.2	421.8	125.4	696.7	15.9	712.7	12.0	0.0	90.90%	3.4	0.9	245.5	147.3	2252.866
SD-1	26,260	5	5,120	2,720.5	951.1	602.5	345.7	440.0	8.4	448.4	50.2	1.5	61.60%	3.1	0.8	388.4	233.0	3604.585
TB-1	72,780	14	26,304	5,164.0	1,051.9	218.8	8,963.3	4,522.9	643.6	5,166.4	1,320.6	4,418.9	32.10%	4.4	1.1	317.7	190.6	18518.56
WC-1	43,239	8	8,576	2,331.3	653.5	249.2	2,724.7	2,225.3	310.0	2,535.3	81.2	0.9	29.90%	2.4	0.6	225.7	135.4	5373
WPR-1	57,221	11	47,040	1,776.2	90.2	59.4	38,360.8	4,081.0	2,439.6	6,520.6	232.9	0.0	9.50%	1.0	0.3	37.4	22.4	
WPR-2	107,273	20	94,592	3,980.7	170.0	91.4	56,648.8	24,863.9	8,449.4	33,313.3	387.7	0.0	4.20%	0.9	0.2	65.4	39.2	1500

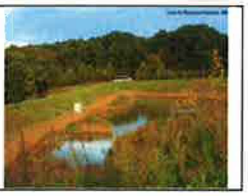
Appendix E

Best Management Practices Summary Sheet

ST-1

Stormwater Treatment Options

EXTENDED DETENTION



This option relies on 12 to 24 hour detention of stormwater runoff after each rain event. An under-sized outlet structure restricts stormwater flow so it backs up and is stored within a pond or wetland. The temporary ponding enables particulate pollutants to settle out and reduces the effective shear stress on downstream banks. Extended Detention (ED) differs from stormwater detention, which is used for peak discharge or flood control purposes and often detains flows for just a few minutes or hours. ED is normally combined with other stormwater treatment options such as wet ponds and constructed wetlands to enhance retrofit performance and appearance (Figure 1). The most common design variations for ED retrofits include:

- Micropool Extended Detention (Water Quality)
- Micropool Extended Detention (Channel Protection)
- Wet Extended Detention Pond
- ED Wetlands

Schematics of each ED retrofit design variation are provided in Figure 2. ED is an ideal stormwater treatment option because it is cost-effective, versatile and safe, and is also the preferred stormwater treatment option for providing downstream channel protection.

Typical ED Retrofit Applications

ED is an attractive option to retrofit existing ponds (SR-1), and can also be utilized for other storage retrofits with the possible exception of the conveyance system (SR-4). ED is generally not suited for on-site retrofit applications. Dry ED ponds should seldom be considered as a standalone retrofit strategy, unless downstream channel protection is a priority.

Figure 1: This shallow wetland was designed with extended detention. (Rolling Stone retrofit, Montgomery County, MD)

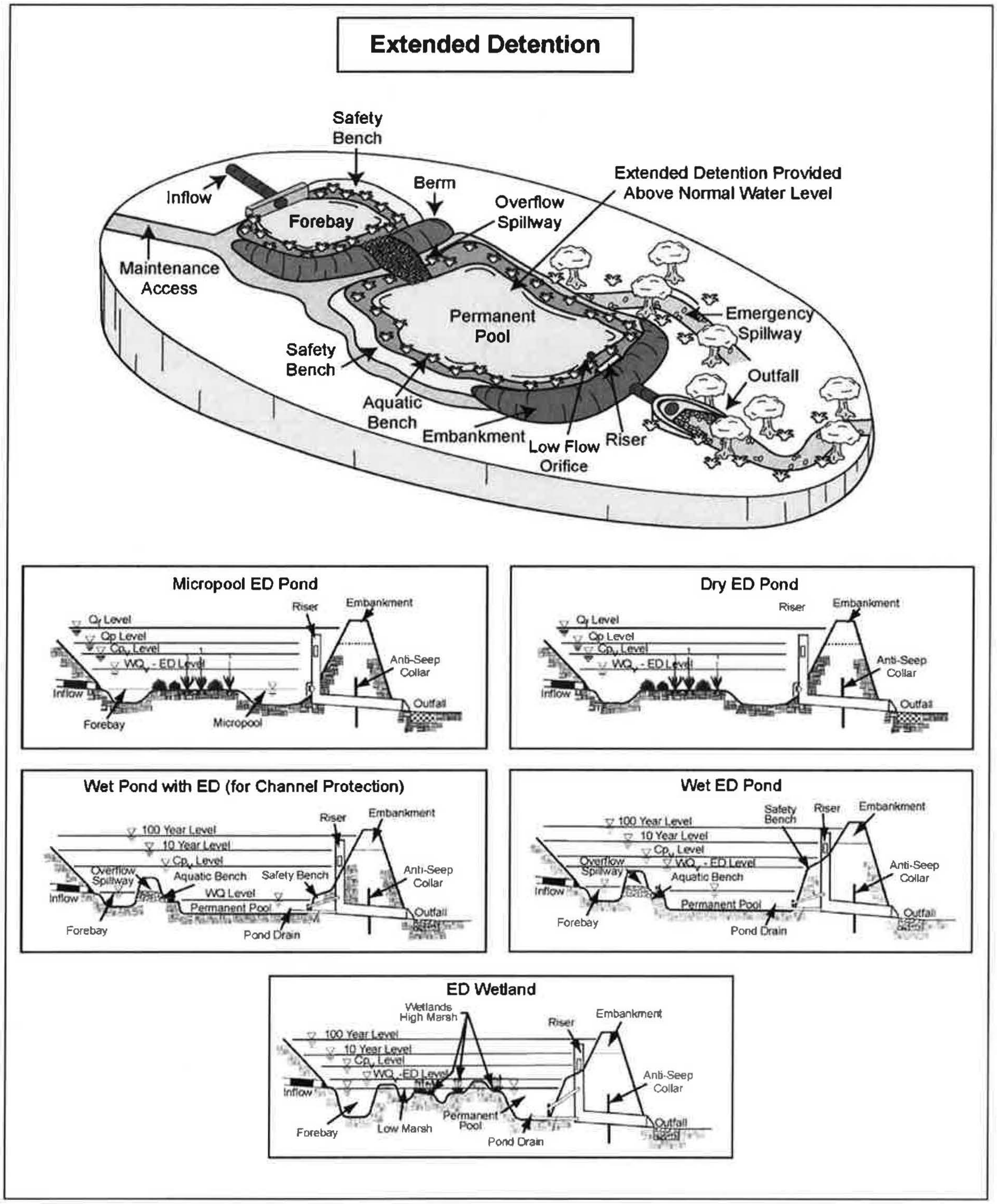


Figure 2: Extended Detention Schematics

ED Pollutant Removal Capability

ED ponds rely on gravitational settling as their primary pollutant removal mechanism. Consequently, they generally provide fair to good removal for particulate pollutants but low or negligible removal for soluble pollutants, such as nitrate and soluble phosphorus (Table 1). ED generally has the lowest overall pollutant removal rate of any stormwater treatment option. As a result, ED is normally combined with wet ponds or constructed wetlands to maximize pollutant removal rates.

Several site-specific factors can have a strong influence on ED pollutant removal rates. Designers should review the design factors in Table 2 to compute the expected pollutant removal rates for the individual retrofit using the design point method.

Table 1: Range of Reported Removal Rates for Dry Extended Detention Ponds

Pollutant	Low End	Median	High End
Total Suspended Solids	50	70	80
Total Phosphorus	15	20	30
Soluble Phosphorus	-10	-10	40
Total Nitrogen	25	25	35
Organic Carbon	15	25	35
Total Zinc	25	30	60
Total Copper	30	30	50
Bacteria	0	40	90
Hydrocarbons	40	70	80
Chloride	0	0	0
Trash/Debris	65	80	85
See Appendix D for data sources and assumptions used to derive these removal rates Low End and High End are the 25th and 75th quartiles			

Table 2: Design Point Calculation to Estimate Pollutant Removal for ED Retrofits

Design Factors	X	Points
Wet ED or Multiple Cell Design		+ 2
Exceeds target WQv by more than 25%		+ 1
Exceeds target WQv by more than 50%		+ 2
Off-line design		+ 1
Flow path greater than 1.5 to 1		+ 1
Sediment forebay		+ 1
Constructed wetland elements included in design		+ 1
On-line design		- 1
Flow path less than 1:1		- 1
Pond SA/CDA ratio less than 2%		- 2
Does not provide full WQv volume		- 2
Pond intersects with groundwater		- 2
NET DESIGN SCORE (max. of 5 points)		

An important factor influencing pollutant removal rates is whether ED is combined with another treatment option, such as a wet pond or stormwater wetland. As a general rule, if more than 50% of the target WQv is provided by a wet pond or constructed wetland, then the higher pollutant removal rate for the treatment option should be applied (see Profile Sheets ST-2 and ST-3).

Other Stormwater Benefits Provided by ED

ED retrofits can provide other stormwater benefits to address other restoration objectives:

Recharge: Dry ED pond retrofits can provide modest groundwater recharge benefits. Strecker *et al.* (2004) reported up to 30% runoff reduction for a large population of monitored dry ED ponds, presumably due to infiltration through the bottom soils of the basin. Recharge benefits will be reduced if the ED pond has impermeable or compacted soils, a liner, or a permanent pool of water.

Channel Protection: ED ponds are the primary means to protect downstream channels if full channel protection storage can be provided at the retrofit site. It should be noted, however, that channel protection normally requires about 20-40% more storage volume than that needed for water quality treatment (see Figure 1.3 in Chapter 1). Consequently, designers may have difficulty finding adequate space to retrofit channel protection storage at tight sites. Guidance on estimating channel protection storage volume for individual retrofit sites can be found in Appendix C.

ST-2

Stormwater Treatment Options

WET PONDS

Wet ponds consist of a permanent pool of standing water that promotes a better environment for gravitational settling, biological uptake and microbial activity (Figure 1). Runoff from each new storm enters the pond and partially displaces pool water from previous storms. The pool also acts as a barrier to re-suspension of sediments and other pollutants deposited during prior storms. When sized properly, wet ponds have a residence time that ranges from many days to several weeks, which allows numerous pollutant removal mechanisms to operate.

Wet pond retrofits can be employed in several different design configurations:

- Wet Pond
- Wet ED Pond
- Wet Pond with ED for Channel Protection
- Pond Wetland System

Figure 2 illustrates each wet pond design variation. Wet ponds are an ideal retrofit treatment option due to their high and reliable pollutant removal performance, community acceptance and amenity value. Wet ponds can also provide channel protection above the permanent pool in some retrofit situations.

Figure 1: Wet ponds can provide additional pollutant removal through settling

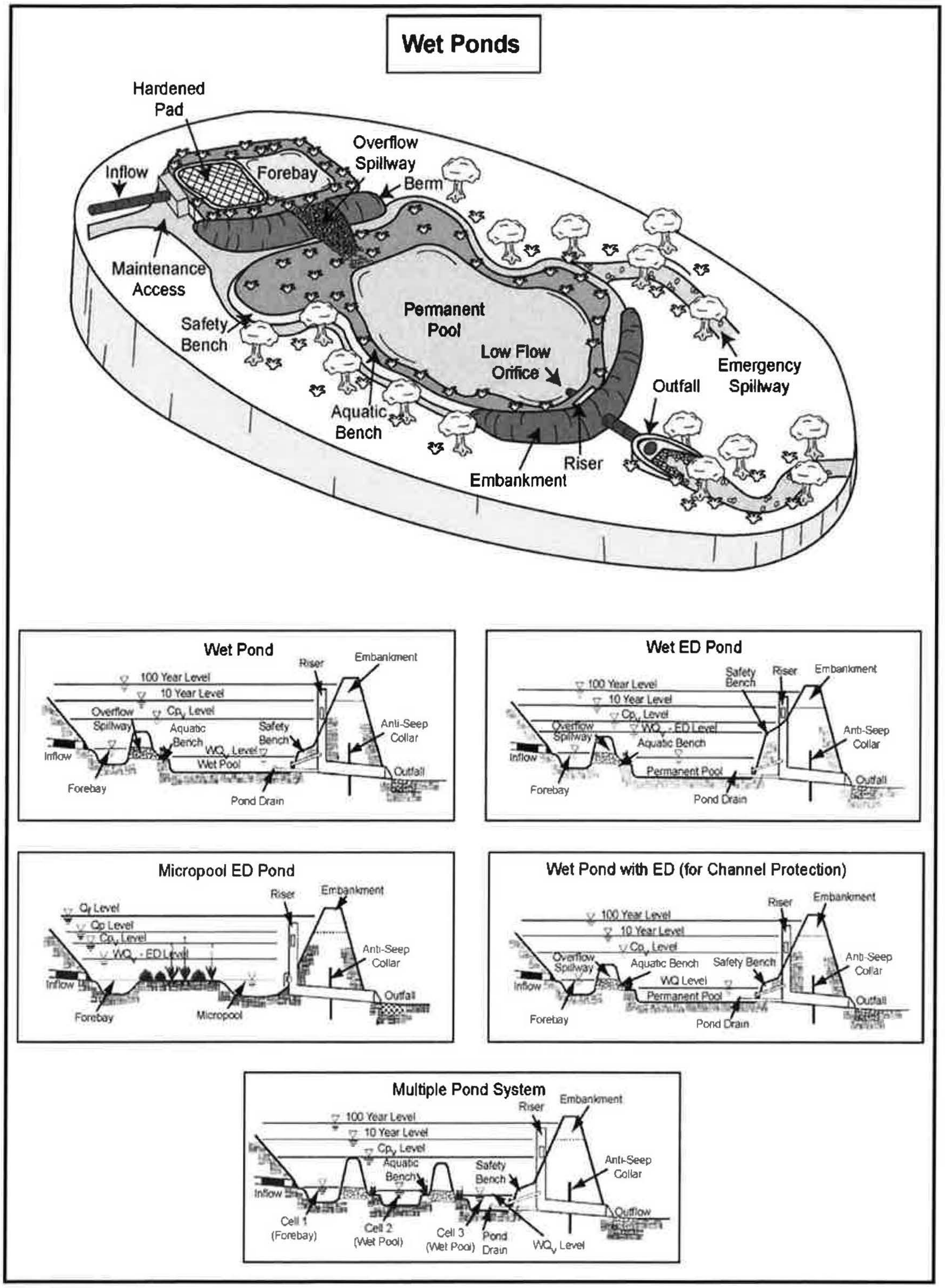


Figure 2: Schematics for various wet pond variations

Typical Retrofit Applications

Wet ponds can be used as either a primary or secondary treatment option in most storage retrofit situations. Wet ponds are not recommended for conveyance retrofits (SR-4) and most on-site retrofit applications.

Wet Pond Pollutant Removal Capability

Many pollutant removal mechanisms operate in the water column and bottom sediments of wet ponds including gravitational settling, algal uptake, adsorption, ultra-violet radiation and microbial processes. Many wet ponds have been intensively monitored in the past three decades and researchers consistently report moderate to high removal rates across the full range of stormwater pollutants (Table 1). Wet ponds generally have higher pollutant removal rates than other stormwater treatment options reviewed in this chapter.

Wet pond research has revealed many site-specific conditions and design factors than can enhance or detract from the median removal rates (Table 2). In general, the walkaway volume of a retrofit is when it cannot provide at least 35% of the target WQv. In addition, if more than 50% of the target water quality volume is provided by ED, the lower removal rates outlined in Profile Sheet ST-1 should be applied. Designers can review the design factors and site conditions in Table 2 to evaluate whether their individual retrofit design will perform better or worse than normal, using the design point method.

Other Stormwater Benefits Provided by Wet Ponds

Wet pond retrofits have limited potential to provide other stormwater benefits:

Groundwater Recharge: Due to their standing water and sealed bottoms, wet ponds do not offer much benefit in terms of groundwater recharge.

According to Strecker *et al.* (2004), wet ponds reduce incoming runoff volumes by less than 5%, most of which is accomplished by evaporation rather than soil infiltration.

Channel Protection: When site topography permits, extended detention can be stacked above the permanent pool to provide downstream channel protection. Designers should note that the CPv storage is typically 20 to 40% greater than the WQv storage so it is often hard to provide full channel protection at tight retrofit sites. Guidance on estimating the channel protection volume needed at individual retrofit sites can be found in Appendix C.

Table 1: Range of Reported Removal Rates for Wet Ponds

Pollutant	Low End	Median	High End
Total Suspended Solids	60	80	90
Total Phosphorus	40	50	75
Soluble Phosphorus	40	65	75
Total Nitrogen	15	30	40
Organic Carbon	25	45	65
Total Zinc	40	65	70
Total Copper	45	60	75
Bacteria	50	70	95
Hydrocarbons	60	80	90
Chloride	0	0	0
Trash/Debris	75	90	95
See Appendix D for data sources and assumptions used to derive these removal rates Low End and High End are the 25th and 75th quartiles			

Table 2: Design Point Calculation to Estimate Pollutant Removal for Wet Pond Retrofits

Design Factors	X	Points
Wet ED or Multiple Pond Design		+ 2
Exceeds target WQv by more than 50%		+ 2
Exceeds target WQv by more than 25%		+ 1
Off-line design		+ 1
Flow path greater than 1.5 to 1		+ 1
Sediment forebay at major outfalls		+ 1
Wetland elements cover at least 10% of surface area		+ 1
Single cell pond		- 1
Flow path less than 1:1		- 1
On-line design		- 1
Pond SA/CDA ratio less than 2%		- 2
Does not provide full WQv volume		- 2
Pond intersects with groundwater		- 2
NET DESIGN SCORE (max of 5 points)		

ST-3

Stormwater Treatment Options

CONSTRUCTED WETLANDS

How Constructed Wetlands Work

Constructed wetlands are shallow depressions that receive stormwater inputs for treatment. Wetlands are typically less than one foot deep (although they have deeper pools at the forebay and micropool) and possess variable microtopography to promote dense and diverse wetland cover (Figure 1). Runoff from each new storm displaces runoff from previous storms, and the long residence time allows multiple pollutant removal processes to operate. The wetland environment provides an ideal environment for gravitational settling, biological uptake, and microbial activity.

Constructed wetlands can be a stand-alone treatment option, or be combined with other stormwater treatment options in several configurations:

- Shallow Marsh
- ED Wetland
- Pond Wetland
- Wet Swales

Each constructed wetland design variation is illustrated in Figure 2.

Constructed wetlands are ideal because they replicate natural wetland ecosystems, provide efficient and reliable pollutant removal and have low construction costs (if ample space is available at the retrofit site). Well-designed stormwater wetlands enjoy widespread community acceptance, and possess high amenity and habitat value. Depending on site topography, constructed wetlands can also provide downstream channel protection when ED storage is stacked above the normal water level of the wetland.

Figure 1: This wetland was constructed to treat stormwater from a nearby commercial area.

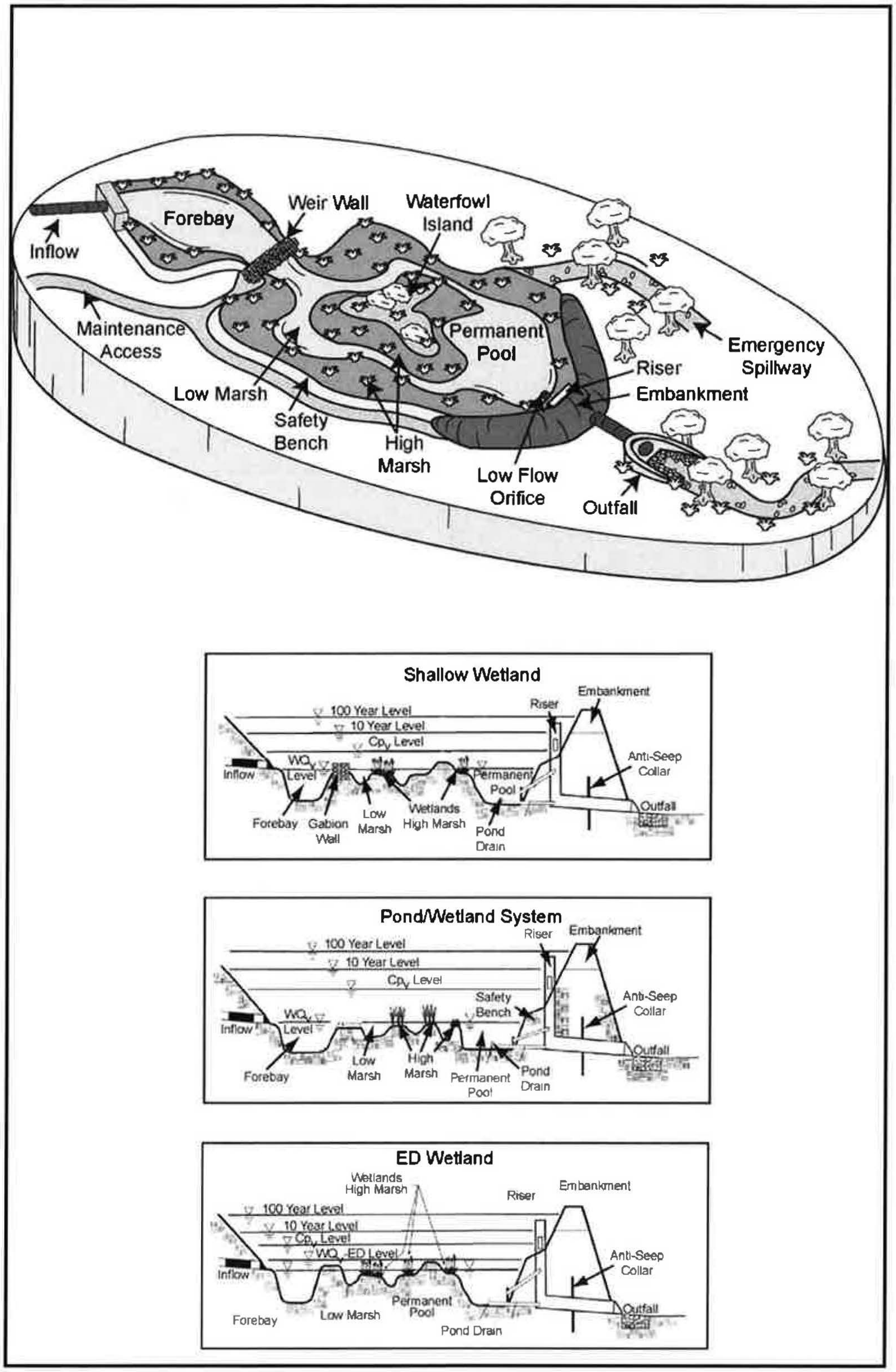


Figure 2: Schematics of three wetland variations

Typical Retrofit Applications for Constructed Wetlands

Constructed wetlands can be the primary or secondary form of stormwater treatment in the following storage retrofit applications:

- **SR-1** Excavate shallow wetland in bottom of pond or add aquatic benches to wet pond
- **SR-2** Create wooded wetlands above road crossings (often with ED)
- **SR-3** Divert runoff from pipe to shallow wetland treatment cells in floodplain
- **SR-4** Install offline shallow wetland cells or in-line wet swales in the conveyance system
- **SR-5** Install wetland cells in highway cloverleaf or create wet swales in highway right of way
- **SR-6** Create wetland treatment cell adjacent to large parking lots

Constructed wetlands are seldom used for on-site retrofit applications, although several may incorporate some wetland elements.

Pollutant Removal Capability of Constructed Wetlands

Constructed wetlands utilize a range of physical, chemical, microbial and biological mechanisms to remove pollutants. Wetland vegetation and sediments provide a growth media for microbes and filter and settle pollutants attached to sediments. Researchers have studied a large population of stormwater wetlands, and have concluded their removal rates are similar to wet ponds, but are somewhat more variable, especially for nutrients and organic carbon (Table 1).

Key design factors and site conditions that increase or decrease pollutant removal rates within constructed wetland retrofits are outlined in Table 2. The recommended walkaway volume for wetland retrofits is when they provide less than 35% of the target WQv. Constructed wetlands that allocate more than 50% of their storage for ED should use the lower removal rates for ED ponds shown in Profile Sheet ST-1. The median pollutant removal rates at individual retrofit sites can be adjusted to account for runoff capture volume and other site factors using the design point method (Table 2).

Other Stormwater Benefits Provided by Constructed Wetlands

Constructed wetlands can offer additional stormwater benefits:

Runoff Reduction: Constructed wetlands are capable of reducing 5 to 10% of the incoming runoff volume through evaporation and seepage losses, according to Strecker *et al* (2004). This minor reduction is not likely to provide a meaningful groundwater recharge benefit.

Channel Protection: Designers can stack ED above constructed wetlands to provide channel protection storage, although the frequent changes in water levels will degrade the quality and density of wetland cover. Designers can avoid the "bounce" problem by limiting the vertical depth of extended detention. Guidance on estimating the channel protection volume needed at an individual retrofit site is provided in Appendix C.

Table 1: Range of Reported Removal Rates for Constructed Wetlands			
Pollutant	**Low End**	**Median**	**High End**
Total Suspended Solids	45	70	85
Total Phosphorus	15	50	75
Soluble Phosphorus	5	25	55
Total Nitrogen	0	25	55
Organic Carbon	0	20	45
Total Zinc	30	40	70
Total Copper	20	50	65
Bacteria	40	60	85
Hydrocarbons	50	75	90
Chloride	0	0	0
Trash/Debris	75	90	95
See Appendix D for data sources and assumptions used to derive these removal rates Low End and High End are the 25th and 75th quartiles			

Table 2: Design Point Calculation to Estimate Pollutant Removal for Wetland Retrofits		
Design Factors	**X**	***Points***
Pond-Wetland or Multiple Cell Design		+ 2
Pond-Wetland or Multiple Cell Design		+ 2
Exceeds target WQv by more than 50%		+ 2
Complex wetland microtopography		+ 2
Exceeds target WQv by more than 25%		+ 1
Flow path greater than 1.5 to 1		+ 1
Wooded wetland design		+ 1
Off-line design		+ 1
No forebay or pretreatment features		- 1
Wetland intersects with groundwater		- 1
Flow path is less than 1:1		- 1
No wetland planting plan specified		- 2
Wetland SA to CDA ratio is less than 1.5%		- 2
Does not provide full WQv volume		- 2
NET DESIGN SCORE (max of 5 points)		

ST-4

Stormwater Treatment Options

BIORETENTION

Bioretention is a landscaping feature adapted to treat stormwater runoff at retrofit sites (Figure 1). Individual bioretention areas serve drainage areas of one acre or less. Surface runoff is directed into a shallow landscaped depression that incorporates many of the pollutant removal mechanisms that operate in forested ecosystems. The filter is composed of an 18 to 48 inch deep sand/soil bed with a surface mulch layer. During storms, runoff temporarily ponds six to nine inches above the mulch layer and then rapidly filters through the bed. Normally, the filtered runoff is collected in an underdrain and returned to the storm drain system (Figure 2). The underdrain consists of a perforated pipe in a gravel jacket installed along the bottom of the filter bed.

In other cases, bioretention can be designed to infiltrate runoff into native soils. This can occur at sites with highly permeable soils, a low groundwater table, and a low risk of groundwater contamination. This design features the use of a "partial exfiltration" system that promotes greater groundwater recharge. Underdrains are only installed beneath a portion of the filter bed or are eliminated altogether, thereby increasing stormwater infiltration.

Figure 1: Bioretention created in a parking lot turn-around

Bioretention creates an ideal environment for filtration, biological uptake, and microbial activity, and provides moderate to high pollutant removal. Bioretention can become an attractive landscaping feature with high amenity value and community acceptance. In the right landscape setting, bioretention can be a cost effective and flexible retrofit option.

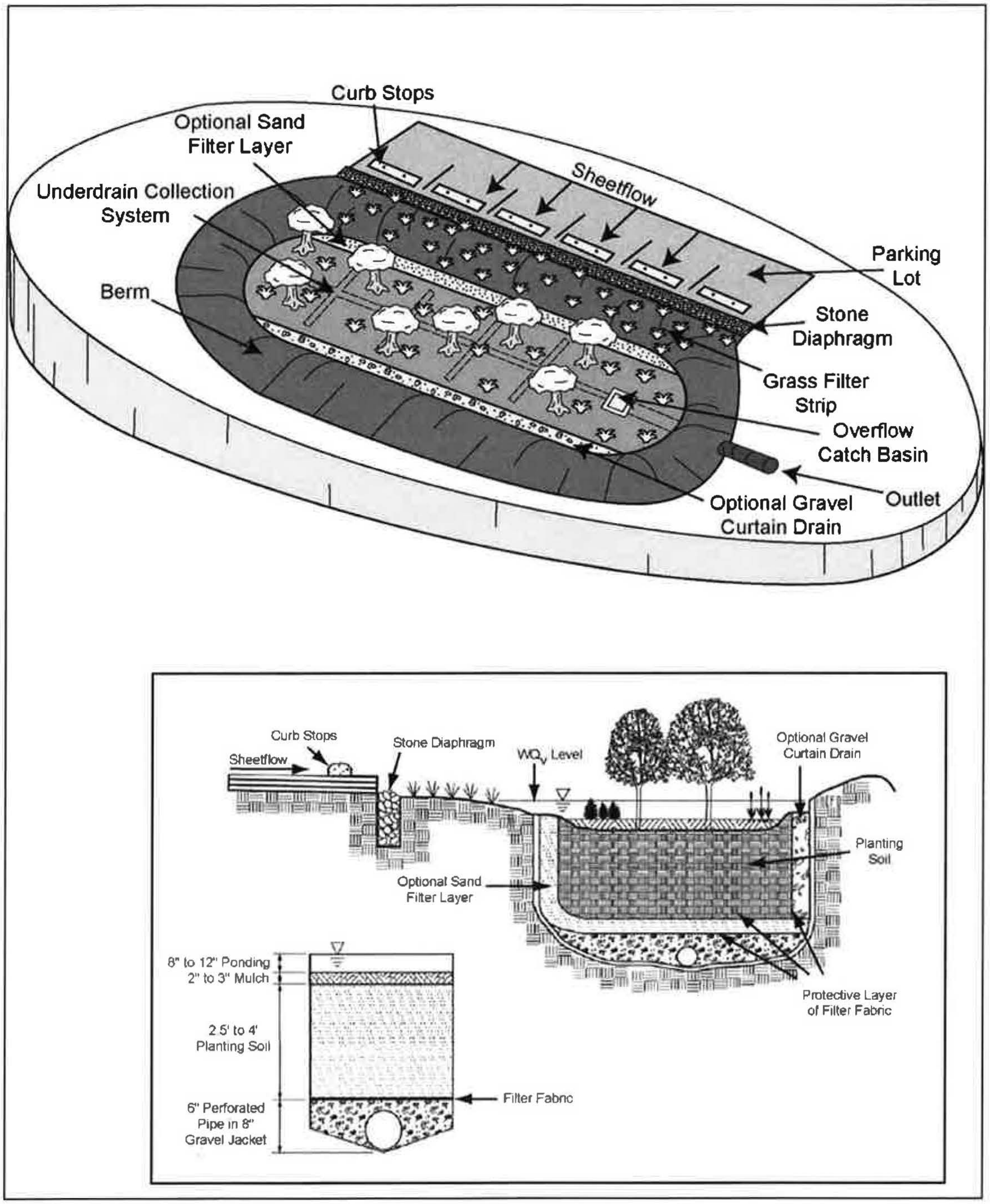


Figure 2: Bioretention schematic with underdrain

Typical Retrofit Applications for Bioretention

Bioretention is an extremely versatile stormwater treatment option for both storage and on-site retrofits that can fit within unused land at a variety of different sites. Common bioretention retrofit opportunities include:

- **SR-1** Install bioretention in bottom of dry pond
- **SR-3** Split flows from smaller pipes to a large bioretention area
- **SR-4** Create series of on-line or off-line bioretention cells
- **SR-5** Install two-cell bioretention area
- **SR-6** Divert flow to two-cell bioretention area
- **OS-7** Install bioretention w/ underdrain to treat hotspot
- **OS-8** Install bioretention within parking lot islands or perimeter
- **OS-9** Incorporate bioretention in streetscapes, tree pits, cul-de-sacs or traffic calming measures
- **OS-10** Install rain-garden to treat residential or commercial rooftop runoff
- **OS-12** Utilize bioretention as a landscape feature

Estimated Pollutant Removal by Bioretention

Until recently, only a handful of monitoring studies had measured the pollutant removal performance of bioretention areas. The most recent studies indicate that bioretention provides effective pollutant removal for many pollutants as a result of sedimentation, filtering, plant uptake, soil adsorption, and microbial processes. Table 1 summarizes bioretention pollutant removal rates for a variety of common stormwater pollutants.

The recommended walkaway volume for bioretention is about 50% of the target water quality volume. Another notable factor is whether the underlying soils have enough permeability to dispense with an underdrain. If an underdrain is not needed, pollutant removal will be enhanced by the greater infiltration of runoff into the soil and may approach the higher pollutant removal rates achieved by infiltration practices (see Profile Sheet ST-6). From the standpoint of nutrient removal, it is strongly recommended that the phosphorus index of topsoil mixed into the bioretention media be tested.

Table 2 can be used to adjust the median removal rates for individual retrofit projects by using the design point method.

Other Stormwater Benefits Provided by Bioretention

Bioretention retrofits can provide important stormwater benefits under certain site conditions.

Recharge: Bioretention has been shown to reduce runoff volume by 35 to 50% through evapotranspiration and infiltration of runoff, according to Hunt *et al.* (2006) and Traver (2006). Runoff reduction exceeding 90% has been reported for deeper filter beds that lack underdrains and are situated on permeable soils (Horner *et al.*, 2003).

Channel Protection: The feasibility of storing the channel protection volume within bioretention areas has not yet been demonstrated, although the impressive runoff reduction rates suggests that widespread use of bioretention could be an effective element of a larger strategy to protect downstream channels from erosion.

Table 1: Range of Reported Removal Rates for Bioretention Areas

Pollutant	Low End	Median	High End
Total Suspended Solids	15*	60*	75*
Total Phosphorus	-75	5	30
Soluble Phosphorus	-10	0	50
Total Nitrogen	40	45	55
Total Zinc	40	80	95
Total Copper	40	80	100
Bacteria	20	50	80
Hydrocarbons	80	90	95
Chloride	0	0	0
Trash/Debris	80*	90*	95*

* Adequate pretreatment must be provided to reduce sediment loads to bioretention areas or clogging and practice failure may result

See Appendix D for data sources and assumptions used to derive these removal rates

Low End and High End are the 25th and 75th quartiles

Table 2: Design Point Calculation to Estimate Pollutant Removal for Bioretention Retrofits

Design Factors	X	Points
Exceeds target WQv by more than 50%		+ 3
Exceeds target WQv by more than 25%		+ 2
Tested filter media soil P Index less than 30 (phosphorus only)		+ 3
Filter bed deeper than 30 inches		+ 1
Two cell design with pretreatment		+ 1
Permeable soils; no underdrain needed		+ 2
Upflow pipe on underdrain		+1
Impermeable soils; underdrain needed		- 1
Filter bed less than 18 inches deep		- 1
Single cell design		- 1
Bioretention cell is less than 5% of CDA		-1
Does not provide full water quality storage volume		- 2
Filter media not tested for P Index (phosphorus only)		- 3
NET DESIGN SCORE (max of 5 points)		
NET PHOSPHORUS SCORE (max of 5 points)		

ST-6

Stormwater Treatment Options

INFILTRATION

Infiltration practices capture and temporarily store stormwater runoff before infiltrating it into underlying soils where most pollutants are trapped. Infiltration can be an ideal on-site retrofit to treat stormwater runoff as long as minimum geotechnical requirements are met. Infiltration retrofits consists of a rock-filled chamber with no outlet. Stormwater runoff must first pass through some form of pretreatment, such as a swale or sediment basin. Runoff is then stored in the voids between the stones, where it slowly infiltrates into the soil matrix over a few days (Figure 1). Alternatively, proprietary materials such as perforated corrugated metal pipe, plastic arch pipe, or plastic lattice trays can be substituted for stone to increase storage capacity. A schematic of a typical infiltration trench is provided in Figure 2.

Where favorable soil conditions exist, infiltration can improve water quality, increase groundwater recharge and reduce runoff volumes. Infiltration practices are particularly desirable in subwatersheds that seek to reduce runoff volumes to prevent combined sewer overflows.

Center for Watershed Protection, 2001

Figure 1: Infiltration Trench

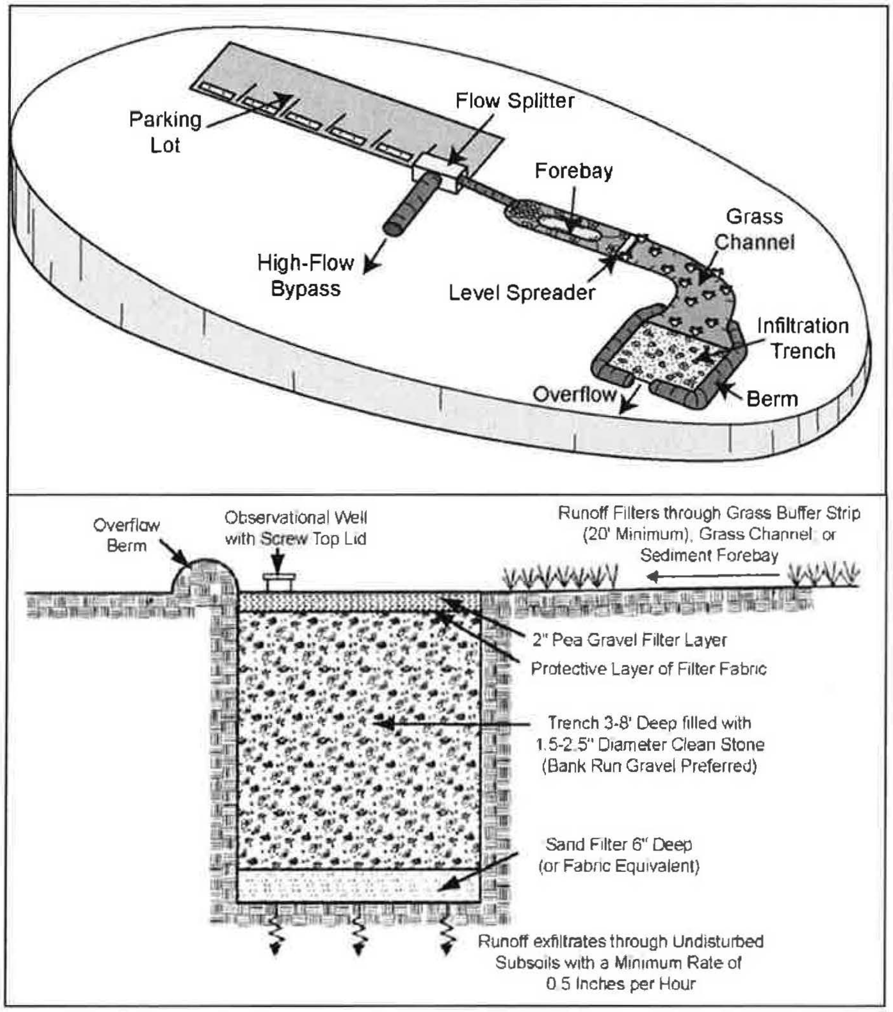


Figure 2: Schematic of an infiltration trench

Other Stormwater Benefits Provided by Stormwater Filters

Stormwater filter retrofits can seldom address other stormwater management objectives beyond water quality treatment. Since they have an impermeable liner and underdrain, they cannot recharge groundwater. They usually lack enough storage capacity to provide meaningful channel protection.

Typical Retrofit Application

Infiltration retrofits can be located on small, unused portions of a site and consume as little as 2-5% of site area. They are effectively used in narrow linear areas along setbacks or property boundaries. Where soils are acceptable, infiltration can treat runoff in the following retrofit locations:

- **OS-8** Infiltration trenches along margins of small parking lot or use of permeable pavers
- **OS-9** Perforated storm drain pipes to infiltrate street runoff
- **OS-10** Simple disconnection of roof leaders over appropriate soils or use of french drains/dry wells to infiltrate rooftop runoff

- **OS-11** Disconnection of small impervious surfaces
- **OS-12** Permeable pavers in urban hardscapes
- **OS-13** Underground infiltration galleries

Infiltration is seldom used for storage retrofits unless underlying soils have exceptional infiltration capability. It is important to confirm that retrofit soils can support adequate infiltration, since past grading, filling, disturbance, and compaction can greatly alter original soil infiltration qualities. The greatest opportunity for infiltration retrofits exists in sensitive or impacted subwatersheds, where some of the original soil structure may still exist. By contrast, most soils in non-supporting subwatersheds are not likely to be suitable for infiltration. Some regions of the country still have excellent soils that allow for widespread implementation of infiltration retrofits (e.g., glacial tills, sand).

Pollutant Removal by Infiltration Retrofits

Infiltration retrofits utilize several pollutant removal mechanisms including filtering, soil adsorption and transfer to groundwater. Theoretically, nearly all the pollutants that enter an infiltration practice should be removed except for soluble pollutants that travel through groundwater and return downstream. It is important to note that infiltration retrofits **are not** intended to treat sites with high sediment or trash/debris loads, as they will cause the practice to clog and fail.

Very few infiltration practices have been monitored, so only limited pollutant removal data has been published. Designers should therefore regard the infiltration pollutant removal rates shown in Table 1 as an initial estimate until more performance monitoring data becomes available.

Several site-specific and design factors can have a strong influence on infiltration pollutant removal rates (Table 2). As always, removal rates for individual retrofit projects should be adjusted to account for site-specific design factors that can enhance or diminish pollutant removal using the design point method. The most important design factor is the size of the individual retrofit in relation to the target WQv treatment. Pollutant removal rates diminish for under-sized infiltration retrofits; the recommended walkaway volume is about 50% of the target WQv.

Other Stormwater Benefits Provided by Infiltration

Infiltration retrofits are desirable because they confer other stormwater benefits:

Groundwater Recharge: Infiltration of stormwater runoff is the preferred means to provide groundwater recharge within a subwatershed. When designed properly, they can infiltrate the entire runoff reduction or WQv to keep stormwater runoff out of combined sewers.

Channel Protection: While infiltration practices are not specifically designed to store the channel protection volume, their ability to reduce runoff volumes should help protect downstream channels from erosion. If suitable soils are present across a subwatershed, infiltration may be an effective channel protection strategy.

Table 1: Range of Reported Removal Rates for Infiltration Practices			
Pollutant	**Low End**	**Median**	**High End**
Total Suspended Solids	60*	90*	95*
Total Phosphorus	50	65	95
Soluble Phosphorus	55	85	100
Total Nitrogen	0	40	65
Organic Carbon	80	90	95
Total Zinc	65	65	85
Total Copper	60	85	90
Bacteria	25	90	95
Hydrocarbons	85	90	95
Chloride	0	0	0
Trash/Debris	90*	95*	99*
* Adequate pretreatment must be provided to reduce sediment loads to infiltration practices or clogging and practice failure may result See Appendix D for data sources and assumptions used to derive these removal rates Low End and High End are the 25th and 75th quartiles			

Table 2: Design Point Calculation to Estimate Pollutant Removal for Infiltration Retrofits		
Design Factors	**X**	**Points**
Exceeds target WQv by more than 50%		+ 3
Exceeds target WQv by more than 25%		+ 2
Tested infiltration rates between 1.0 and 4.0 in/hr		+ 2
At least two forms of pretreatment prior to infiltration		+ 2
CDA is nearly 100% impervious		+ 1
Off-line design w/ cleanout pipe		+ 1
Underdrain utilized		- 1
Filter fabric used on trench bottom		- 1
CDA more than 1.0 acre		- 1
Soil infiltration rates < 1.0 in/hr or > 4.0 in/hr		- 2
Pervious areas or construction clearing in CDA		- 2
Does not provide full WQv volume		- 3
NET DESIGN SCORE (max of 5 points)		

ST-7

Stormwater Treatment Options

SWALES

Swales utilize the stormwater conveyance system to provide treatment in either storage or on-site retrofit applications. Swales have moderate pollutant removal capability, can reduce runoff volume and increase groundwater recharge. Swales are designed to treat the WQv within an open channel. The three design variants are the dry swale, wet swale, and grass channel.

Dry swales are a linear soil filter system that temporarily stores and then filters the desired WQv (Figure 1). Dry swales are similar to bioretention areas in that they rely on a fabricated soil bed on the bottom of the channel. Existing soils are replaced with a sand/soil mix that meets minimum permeability requirements. Dry swales provide a good environment for filtration, biological uptake, and microbial activity. Stormwater treated by the soil bed flows into an underdrain, which conveys treated runoff back to the conveyance system further downstream. The underdrain system is typically created by encasing a perforated pipe within a gravel layer on the bottom of the swale.

Wet swales are linear wetland cells that intercept shallow groundwater to maintain a wetland plant community (Figure 2). Saturated soils support wetland vegetation, which provides an ideal environment for gravitational settling, biological uptake, and microbial activity.

Grass channels are open channels that provide limited water quality treatment using rate-based design criteria. Grass channels reduce flow velocities and increase filtration capacity. Grass channels generally cannot provide the same degree of pollutant removal as dry or wet swales.

All three swale designs provide significantly better water quality treatment than the conventional roadside ditch. Schematics of the dry and wet swale designs are illustrated in Figure 3.

Figure 1: Dry Swale

Figure 2: Wet Swale

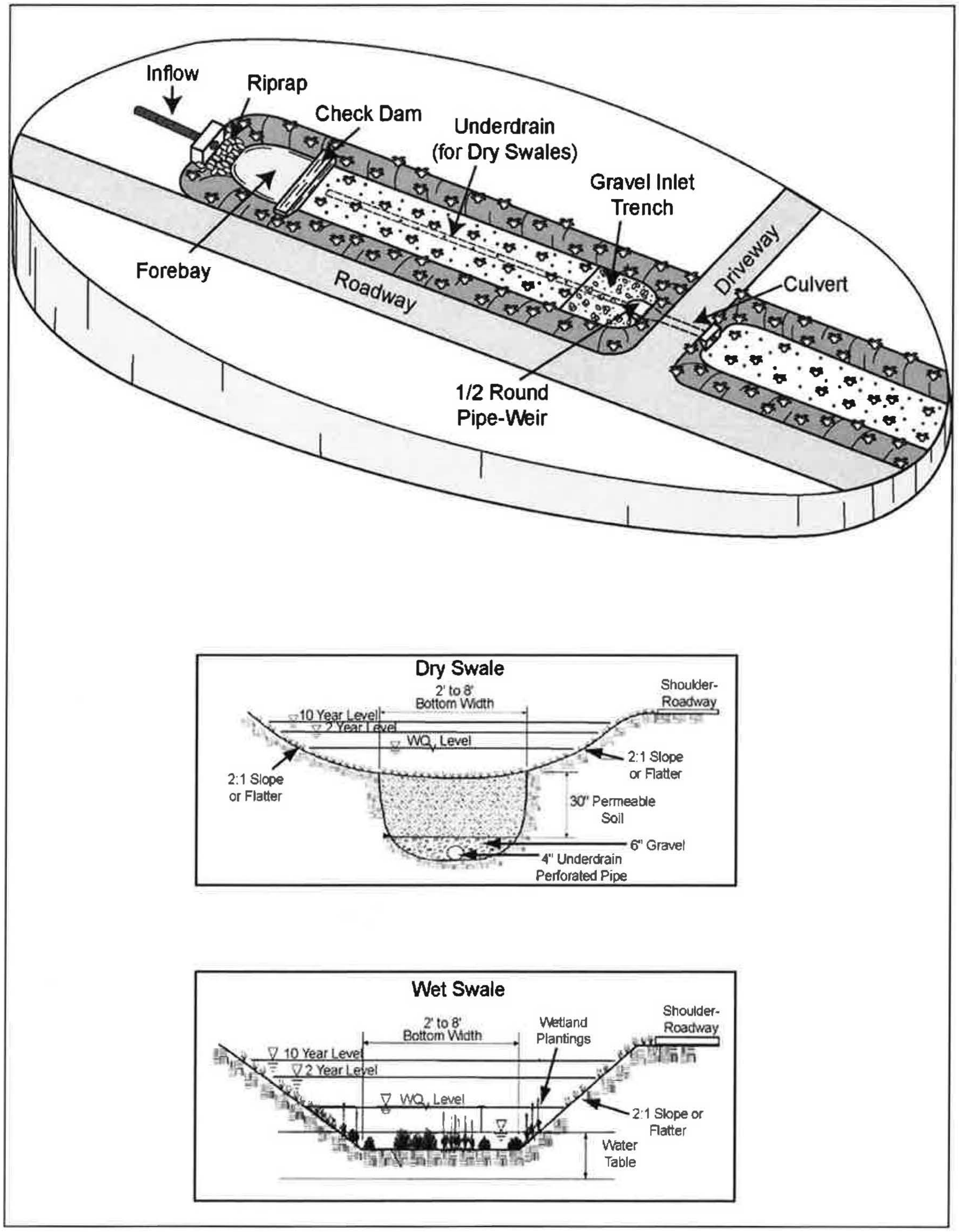


Figure 3: Schematic of a dry and wet swale

Typical Swale Retrofit Application

Most swale retrofits require that an existing open channel be widened, deepened, reduced in gradient, or some combination of all three. Swales are particularly well suited to treat runoff from low and medium density residential streets and small parking lots. Typical retrofit situations where swales can be applied include:

- **SR-4** Install dry swale or grass channel within existing conveyance system
- **OS-8** Install swales along margins of small parking lots
- **OS-9** Install swale retrofit along open section street or convert closed section street into dry swale
- **OS-11** Direct runoff to swale as means to disconnect a small impervious area

Estimating Pollutant Removal Capability of Swale Retrofits

The primary pollutant removal mechanisms operating in swales are settling, filtering infiltration and plant uptake. The reported pollutant removal rates for swales are highly variable. Table 1 shows the range in removal rates for swales that have been specifically designed for stormwater treatment (e.g., dry swales, wet swales and biofilters). Please note that the median removal rates should be cut in half if the proposed retrofit is a grass channel.

Designers may find it difficult to define the expected removal rate for a swale retrofit. Many site conditions and design factors can enhance or diminish their pollutant removal rates (Table 2). A reasonable estimate for each individual swale retrofit can be developed using the design point method. A primary factor influencing swale removal rates is the proportion of the WQv that is actually infiltrated or stored within retrofit treatment cells. A second influential factor is how the retrofit is sized in relation to the target WQv-- the recommended walkaway volume is about 50% of the target WQv.

Table 1: Range of Reported Removal Rates for Swales

Pollutant	Low End	Median	High End
Total Suspended Solids	70	80	90
Total Phosphorus	-15	25	45
Soluble Phosphorus	-95	-40	25
Total Nitrogen	40	55	75
Organic Carbon	55	70	85
Total Zinc	60	70	80
Total Copper	45	65	80
Bacteria	-65	0	25
Hydrocarbons	70	80	90
Chloride	0	0	0
Trash/Debris	0	0	50

See Appendix D for data sources and assumptions used to derive these removal rates
Low End and High End are the 25th and 75th quartiles

Table 2: Design Point Calculation to Estimate Pollutant Removal for Swale Retrofits

Design Factors	***X***	***Points***
Exceeds target WQv by more than 50%		+ 3
Dry or wet swale design		+ 2
Exceeds target WQv by more than 25%		+ 2
Longitudinal swale slope between 0.5 to 2.0%		+ 1
Velocity within swale < 1 fps during WQ storm		+ 1
Measured soil infiltration rates exceed 1.0 in/hr		+ 1
Multiple cells with pretreatment		+ 1
Off-line design w/ storm bypass		+ 1
Longitudinal swale slope < 0.5% or > 2%		- 1
Measured soil infiltration rates less than 1.0 in/hr		- 1
Swale sideslopes more than 5:1 h:v		- 1
Swale intersects groundwater (except wet swale)		- 1
No pretreatment to the swale or channel		- 1
Swales conveys stormflows up to 10 year storm		- 2
Does not provide full WQv volume		- 2
Grass channel		- 3
NET DESIGN SCORE (max of 5 points)		

Other Stormwater Benefits Provided by Swales

Swales retrofits can provide other stormwater benefits, including:

Groundwater Recharge: Swales can reduce runoff volumes by an average of 40% through infiltration on the swale bottom and across side-slopes, according to Strecker *et al.* (2004). Some research studies have reported as much as 80 to 90% runoff reduction for dry swales that are heavily landscaped with trees and shrubs to promote greater evapotranspiration (Horner *et al.*, 2003).

Channel Protection: While most swales are not designed to provide channel protection storage, the high degree of runoff reduction suggests that they have some potential to protect downstream channels from erosion. It may be possible to capture and detain the entire channel protection volume at small sites.

ST-8

Stormwater Treatment Options

Other Retrofit Treatment

This stormwater treatment option includes a diverse group of on-site techniques that capture, store and partially treat rooftop runoff in residential areas and highly urban landscapes, including:

Residential Rooftops

- Rainbarrels
- Rain Gardens
- French Drains/Drywells

Non-Residential Settings

- Cisterns
- Green Rooftops
- Permeable Pavers
- Stormwater Planters

Each rooftop technique has a unique ability to reduce runoff, remove pollutants or recharge groundwater and differs greatly in its design, installation cost and maintenance needs. A full description of each treatment option is provided in the series of fact sheets provided in Appendix F.

Typical Retrofit Applications

Many of these practices are primarily used to treat runoff from individual rooftops (OS-10), but stormwater planters and permeable pavers can also be applied to retrofit small parking lots (OS-8) and urban landscapes/hardscapes (OS-12).

Pollutant Removal Capability

These techniques can provide partial or full treatment of the target WQv, depending on site conditions. The pollutant removal rate for each technique varies greatly, so designers should consult the appropriate fact sheet in Appendix F to get an accurate estimate.

Benefits, Constraints, Concerns and Design, Construction and Maintenance Issues

Taken as a group, these stormwater treatment techniques are suitable for use in small, on-site retrofits and have few site constraints. Individually, each technique has numerous siting, design, and maintenance issues which are described in Appendix F.

Installation Costs for Other Stormwater Retrofits

The installation costs for this group of retrofits are compared in Table 1.

Table 1: Installation Costs for Other Stormwater Retrofits (per cubic foot treated)		
Retrofit Type	**Median Cost**	**Cost Range**
Residential Settings		
Rain Barrels	$ 25.00	$ 12.50 to $ 40.00
Rain Gardens:		
Volunteer Installation	$ 4.00	$ 3.00 to $ 5.00
Professional Installation	$ 7.00	$ 5.00 to $ 10.00
Professional Landscaping	$ 12.00	$ 10.00 to $ 15.00
French Drains/Drywells	$ 12.00	$ 10.50 to $ 13.50
Non-Residential Settings		
Cisterns	$ 15.00	$ 6.00 to $ 25.00
Intensive Green Rooftops	$ 360.00	$ 300.00 to $ 420.00
Extensive Green Rooftops	$ 225.00	$ 144.00 to $ 300.00
Permeable Pavers	$ 120.00	$ 96.00 to $ 144.00
Stormwater Planters	$ 27.00	$ 18.00 to $ 36.00
Rain Gardens	$ 12.00	$ 10.00 to $ 15.00
Note: See Appendix E for documentation and cost assumptions		

MO-4

Municipal Operation

STREET SWEEPING

Description

Public streets and roadways can comprise as much as 10 to 20% of total impervious cover in suburban subwatersheds and as much as 20 to 40% in highly urban subwatersheds. Particulate matter or "street dirt" tends to accumulate along the curbs of streets and roadways in between rainfall events. Sources of pollutants include run-on, atmospheric deposition, vehicle emissions and wear and tear, breakup of street surface, littering, leaves and other organic material and sanding. This results in the accumulation of stormwater pollutants such as sediment, nutrients, metals, hydrocarbons, bacteria, pesticides, trash and other toxic chemicals.

In many communities, these pollutants remain on public streets and roadways until they are washed into the storm drain system during a rainfall event. However, some communities use street sweeping (Figure 1) to remove some of these pollutants and prevent them from being conveyed into the storm drain system.

The ability of street sweepers to remove common stormwater pollutants varies depending on sweeper technology, sweeper operation and frequency, street conditions and the chemical and physical characteristics of the pollutants that have accumulated on the pavement. Although newer street sweeping technology can remove more than 90% of street dirt under ideal conditions, street sweeping does not necessarily guarantee water quality improvements (CWP, 2006a). Street sweepers are typically more effective at removing larger-sized particles than fine-grained particles and nutrients, although newer technology such as small-micron surface cleaning technologies may be capable of picking up smaller particles (Sutherland and Jelen, 1997). However, as illustrated in Figure 2, only 27% of Chesapeake Bay communities rely on this modern sweeping technology. The street sweepers most commonly used by Chesapeake Bay communities are mechanical brush and mechanical brush with vacuum assist sweepers (CWP, 2006b), which tend to have lower pollutant removal capabilities than newer air or vacuum assist technologies.

Figure 1. This broom sweeper is assisted by a following vacuum sweeper for increased removal.

Table 1 provides expected pollutant removal rates for street sweeping. These pollutant removal rates are lower than reported "pick-up" efficiencies of street sweepers, due to a number of discount factors that impact the effectiveness of street sweeping (CWP

2006a). In general, street sweeping is usually more effective in arid and semi-arid climates where pollutants can accumulate over longer intervals on street and curb surfaces.

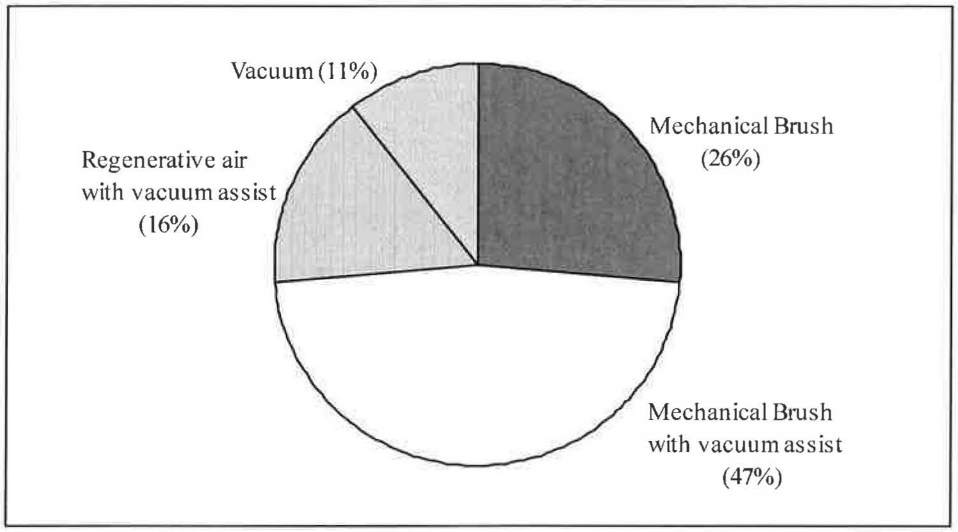


Figure 2. Most common street sweeping technology used by Chesapeake Bay communities

Table 1: Expected Pollutant Removal Rates for Street Sweeping (Law et al., 2008)

Frequency	Technology	Total Suspended Solids	Total Phosphorus	Total Nitrogen
Monthly	Mechanical	9%	3%	3%
	Regenerative Air/Vacuum	22%	4%	4%
Weekly	Mechanical	13%	5%	6%
	Regenerative Air/Vacuum	31%	8%	7%

Investigating and Improving the Operation

Improving or initiating street sweeping activities in your community can reduce the amount of stormwater pollution that is conveyed into local aquatic resources. It requires you to examine your existing street sweeping operations, if they exist, and identify where improvements can be made to reduce the amount of pollution that has accumulated on public streets and roadways. This can be accomplished within the context of the seven-step program planning and development process (Chapter 2), as described below.

Step 1: Identify Existing Municipal Operations

Recall that the first step in the process is to identify the municipal operations that are conducted within your community. In terms of street sweeping, this means determining whether or not your community currently sweeps any public streets and roadways. If it does, the next step in the process is to collect some basic information about how the way those activities are conducted. If not, you should consider developing a street sweeping program or begin investigating the other municipal operations that are conducted within your community.

Step 2: Collect Information About Each Operation

Once you have determined that your community currently conducts street sweeping operations, the next step in the process is to collect some basic information about how those operations are carried out. Basic information to collect about the street sweeping activities conducted in your community includes:

- Narrative description of the street sweeping activities
- Locations of active and planned street sweeping activities
    - Street address
    - Watershed and subwatershed address
    - Geospatial coordinates (e.g. latitude, longitude)
- Map showing locations of active and planned street sweeping activities
- Operation manager name
- Operation manager contact information

This information should be added to the simple database or binder that contains the information about all of the municipal operations conducted in your community.

As you collect some basic information about the street sweeping operations conducted in your community, you should begin communicating with the individual who oversees or manages these activities. This is an ideal time to inform this individual about the community's pollution prevention/good housekeeping efforts and the purpose of the community's municipal pollution prevention/good housekeeping program. It is also a good time to educate them about the influence that street sweeping can have on water quality and how it can be used to reduce the amount of pollution that has accumulated on public streets and roadways.

Step 3: Complete the Municipal Operations Analysis (MOA)

The next step in the process is to use the basic information that you have collected about the street sweeping activities conducted in your community to complete Section 4 of the MOA. This section of the MOA asks a series of questions about the nature, scope and distribution of the street sweeping operations conducted within your community. In some cases, you will be able to answer all of the questions using only the information that you have already collected about the street sweeping activities. In most cases, however, answering the questions will require additional input from the individual who manages or oversees your community's street sweeping operation.

Once you have answered all of the questions presented within Section 4 of the MOA, you should calculate your score to determine how well your community is currently conducting its street sweeping activities. When you have completed the entire MOA, you should also compare the score that you received in Section 4 with the scores you received in each of the other sections of the analysis. This will help you focus your pollution prevention/good housekeeping efforts on the municipal operations that have the greatest influence on water quality in your community.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

The next step in the process is to use the results of the MOA, as well as information about local subwatershed restoration goals and objectives, to develop a list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your local pollution prevention/good housekeeping efforts and ensure that you are using your resources on improving the operations that have the greatest influence on water quality in your community. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

If street sweeping comes out on top of your prioritized municipal operations list, the next step in the process is to further investigate the way that street sweeping activities are conducted in your community and determine the improvements that can be used to reduce the amount of pollution that has accumulated on public streets and roadways. If it does not, you should begin investigating the operation that is located at the top of your list. The other profile sheets presented in this chapter provide additional information about investigating each of the other municipal operations.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices

Step 5.1: Collect Additional Information About Street Sweeping Activities

Once you have determined that street sweeping will be the focus of your pollution prevention/good housekeeping efforts, the next step in the process is to collect some additional information about these activities to determine how they can be improve to reduce the amount of stormwater pollution that has accumulated on public streets and roadways. To collect this additional information, you should coordinate with the individual who manages or oversees these activities. This individual will be able to answer questions about the street sweeping activities and help you determine where improvements can be made. It is also a good opportunity for them to learn more about how street sweeping can influence stormwater quality. Table 2 provides a list of example questions that can be used to collect additional information from the individual who manages or oversees the street sweeping activities conducted in your community.

Table 2: Sample Discussion Questions

- Are you familiar with our pollution prevention/good housekeeping efforts and the purpose of our municipal pollution prevention/good housekeeping program?
- What pollutants are most commonly associated with street dirt?
- What areas or streets in the community are dirtier than others (e.g. have higher street particulate matter loadings compared to others)?
- What proportion of streets in the community is swept?
- Do sweepers pick up leaf piles?
- How is sweeping frequency defined?
- Is sweeping coordinated with fall leaf pickup?
- Is tandem sweeping used?
- Are no-parking zones used to increase pick up efficiency?
- What technology is being used and what is the size of the street sweeper fleet?

Table 2: Sample Discussion Questions

- What is the frequency of street sweeping for public streets?
- Do you have a training program for street sweeper operators?
- How do you dispose of material collected from the street sweepers?
- What problems affect the performance of street sweeping (e.g., on-street parking, inadequate budget, untrained operators)

When collecting addition information about the street sweeping activities conducted in your community, you should strive to determine what streets are being swept (if any), how frequently they are swept (e.g. twice a month) and the technology that is used to sweep them. The basic idea is to determine if the street sweeping program is operating at a level where measurable pollutant reductions can be achieved. In particular, you should evaluate:

- *Sweeper frequency* - should be defined based on local rainfall statistics, where the optimal frequency is about twice the interstorm period (runoff producing event) based on national rainfall statistics (i.e., approximately once a week, if the storm frequency is once every two weeks). At a minimum, sweeping should occur during periods of heavy accumulation. For example before the rain or wet season in drier, arid climates or in the fall and early spring in temperate climate. In the fall, sweepers should pick up leaves (and not avoid them) as they can contribute 25% of nutrient loadings in catch basins. If more substantial piles of leaves are found in your community during the fall, street sweeping activities should be coordinated with leaf pickup. Equally important is an early spring sweeping before rains begin to pick up sand, de-icing material and winter debris, to include municipally owned parking lots. More frequent sweeping may reduce the need for catch basin cleaning (see Profile Sheet MO-5). Figure 3 illustrates the percent of Chesapeake Bay communities that sweep more than once per year and the associated street sweeping frequency.

- *Sweeper technology and operations* – the ability of street sweeping to impact water quality is dependent on the sweeper's pick-up efficiency of fine-grained sediment. There are three main types of sweepers: mechanical, regenerative air, and vacuum sweepers. Mechanical sweepers (broom-type) are typically the least expensive and are better suited to pick up large-grained sediment particles. Vacuum and regenerative air sweepers are better at removing fine grained sediment particles and are more effective as part of a NPDES plan (Partland, 2001), but are less effective on wet surfaces and are more expensive. Removal efficiency can be improved through tandem sweeping (two sweepers sweeping the same route, with one following the other to pick up missed material) or if the street sweeper makes multiple passes on a street.

- *Conditions* – access to the curb is paramount to street sweeping efficiency, as the majority of pollutants on streets are closest to the curb. Parked cars can restrict access; a regional survey conducted for Concord, CA revealed that appropriately enforced no-parking zones overwhelming achieved adequate compliance to allow street sweeping (Berryman and Henigar, 2003).

- *Distance to storage and disposal facilities* - street sweepers do not travel very quickly so the distance to the storage and disposal facilities can significantly reduce the number of hours that operators actually spend sweeping streets.

- *Staff training* - street sweepers are a major investment and operators must be specially trained on how to properly drive and maintain them. Training should be held at least once a year for all staff to provide them with a thorough understanding of the proper implementation of sweeping and other pollution prevention/good housekeeping practices, and safety procedures. Also see Profile Sheet MO-10.

The most common purposes for street sweeping in the Chesapeake Bay area are aesthetics, followed by residential demand. Keeping material out of the storm drains and street safety were also common responses. Public health, safety, permit requirements, and water quality were not among the most frequently cited reasons for street sweeping, but are considered important by a significant proportion of communities (CWP 2006b).

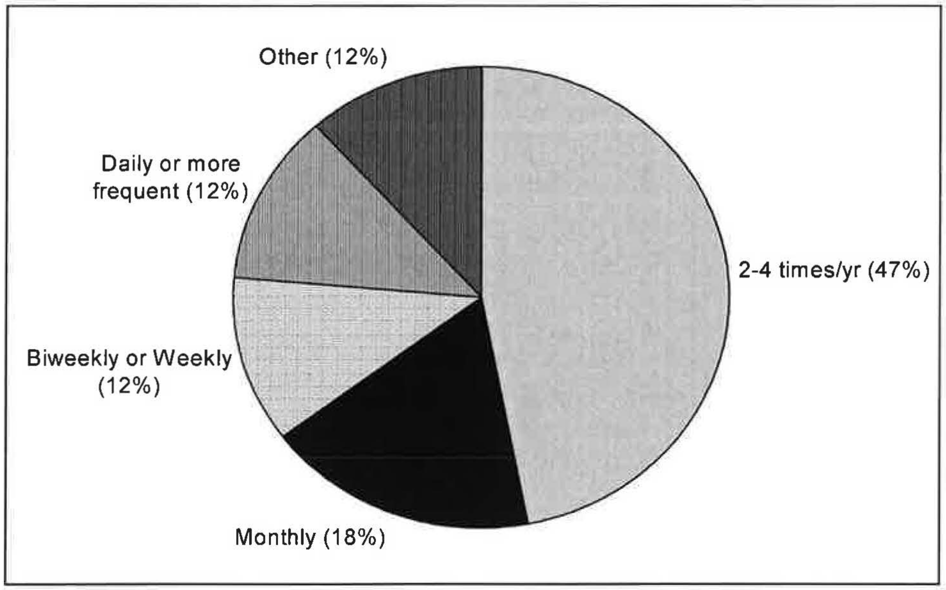


Figure 3. Percentage of communities that sweep more than once per year and the associated sweeping frequency

Step 5.2: Conduct Field Investigations

Once you have collected some additional information about the street sweeping activities conducted in your community, the next task is to conduct some field work to determine where street sweeping can be most effective in improving water quality your community. The Street and Storm Drains (SSD) investigation measures the average pollutant accumulation in the streets, curbs and catch basins of a subwatershed. It is a visual inspection of pollutant accumulation along streets curb and gutters, and storm drain inlets. This information should be used to identify the dirtiest streets and quantify the impact of current maintenance practices on urban streams and identify changes to current street sweeping program. For example, a high accumulation rate may suggest that more regularly scheduled street sweeping is needed. The SSD is time intensive and probably cannot be completed for all streets in a community; however, the stormwater manager should consider conducting the SSD in subwatersheds with impaired waters or sensitive aquatic resources. This information is particularly useful for communities with limited resources who may not be able to increase street sweeping in all areas. For more information on the SSD, see Manual 11.

Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices

Once existing operations have been assessed, the next step in the process is to develop a targeted street sweeping program that can help improve water quality by removing and properly disposing of the street dirt that has accumulated on public streets and roadways. In order to observe water quality improvements, most communities will need to invest in better street sweeping technologies and increase sweeping frequency. Depending on the results of Step 1, a variety of improvements can be made to the way that street sweeping operations currently occur (Table 3). If resources are limited, street sweeping should be concentrated on the dirtiest streets in sensitive subwatersheds at the right times of year (fall and early spring).

Table 3: Good Housekeeping Techniques for Street and Parking Lot Sweeping

- Analyze sweeper wastes for hazardous waste content and dispose of properly at the landfill
- Sweep prior to rainstorms so pollutants are not washed into storm drain system
- Sweep as soon as possible following application of deicers or other applied chemicals
- Properly maintain sweepers and operate according to manufacturers directions
- Store swept material in a covered and contained site until it can be disposed of at a landfill
- Implement parking controls to improve street sweeper efficiency by maximizing sweepable street edges where dirt tends to collect
- Routinely inspect street curbs for sediment and debris and schedule dirtiest streets for regular sweeping
- Coordinate seasonal sweeping schedules to coincide with important pollution prevention events during the subwatershed year. These include the end of curbside leaf collection, winter sanding operations, and peak pollen production in the spring
- Select the most effective combination of street sweeper technology that is consistent with municipal budget resources
- Sweep streets at the optimal frequency to remove the greatest pollutant removal, given local rainfall, street density, curb access and traffic safety
- Post permanent signs to notify vehicle owners and residents about forthcoming sweeping operations and associated parking restrictions
- Work with local police department to patrol designated routes to ticket illegally parked cars

Step 5.4: Develop Implementation Plan

Once there is a targeted street sweeping program, a brief implementation plan should be created. The plan should summarize the results of the assessment and the street sweeping effort that will be used to reduce the amount of pollution that has accumulated on public streets and roadways. The plan should also include a schedule that describes when the street sweeping program will be implemented. The implementation plan can be used to guide the implementation of the prescribed street sweeping program.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once an implementation plan has been created, the next step in the process is implementing the prescribed street sweeping program. Although it may be tempting to hand the responsibility for implementation over to the individual who manages or oversees the community's street sweeping activities, it is important to work with this individual during the implementation phase to get the prescribed street sweeping program up and running. Simple techniques that can be used to do this include providing additional education and information about the prescribed street sweeping program and providing assistance in securing funding for the program.

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the progress made in implementing the prescribed pollution prevention/good housekeeping practices. Measurable performance goals and implementation milestones will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Some example measurable goals and implementation milestones are presented in Table 4.

Table 4: Measurable Goals and Implementation Milestones for Improving Municipal Street Sweeping Activities[1]

Example Measurable Goals	Timeframe	Priority
Goals related to program startup		
Identify and collect basic information about municipal street sweeping activities	Complete shortly after program startup; update regularly after that	●
Add the information about street sweeping activities to the simple database or binder that contains basic information about each municipal operation		●
Develop a digital GIS or hard copy map showing the location of all municipal street sweeping activities		⊙
Complete Section 4 of the Municipal Operations Analysis (MOA)	Year 1; repeat every 5 years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Goals related to preventing or reducing stormwater pollution		
Collect additional information about the way that street sweeping activities are conducted within your community	Year 1	●
Prescribe pollution prevention/good housekeeping practices to improve the way that municipal street sweeping activities are conducted within your community		●
Develop implementation plan for prescribed street sweeping program		●
Secure funding and resources to implement prescribed street sweeping program	Begin in Year 1	●
Implement prescribed street sweeping program	Begin in Year 2	●
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update regularly after that	●
Evaluate progress in meeting measurable goals and implementation milestones		●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●

Table 4: Measurable Goals and Implementation Milestones for Improving Municipal Street Sweeping Activities[1]

Example Measurable Goals	Timeframe	Priority
Notes 1) Assumes that street sweeping is as the top of your prioritized municipal operations list. *Key* ● = Essential ◉ = Optional but Recommended		

The methods used to evaluate success in meeting these measurable performance goals and implementation milestones can be as simple as a semi-annual or annual inspections used to identify the improvements that have been put in place and the improvements that still need to be made.

Scoping the Required Level of Effort

The level of effort required to develop an effective street sweeping program varies greatly from one community to the next. Basic guidance on scoping the level of effort required to develop a street sweeping program is provided in Table 5. Communities can use this information to estimate the level of effort required to develop their own street sweeping programs.

Table 5: Scoping the Level of Effort Required to Improve Street Sweeping Operations

Step	Staff Hours
Step 1: Identify Existing Municipal Operations	4-8[1]
Step 2: Collect Information About Street Sweeping Activities	4-8
Step 3: Complete Section 4 of the Municipal Operations Analysis (MOA)	10-20
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8[1]
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices	80-200
Step 5.1: Collect Additional Information About Street Sweeping Activities	20-40
Step 5.2: Conduct Field Investigations	20-80
Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices	20-40
Step 5.4: Develop Implementation Plan	20-40
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation[1]
Notes 1: Represents total level of effort required to complete step for all municipal operations. 2: Varies according to the extent and type of improvements required.	

Resources

Urban Subwatershed Restoration Manual 11: Unified Subwatershed and Site Reconnaissance: A User's Manual. http://www.cwp.org/PublicationStore/USRM.htm

The Smart Watershed Benchmarking Tool. http://cwp.org.master.com/texis/master/search/+/form/Smart_Watershed.html

City Madison Street Sweeping Study
http://www.ci.madison.wi.us/engineering/stormwater/street_sweeping.htm

Stormwater Effects Handbook: Chapter 5
http://www.epa.gov/ednnrmrl/publications/books/handbook/index.htm

Sutherland, R.C., and Jelen, S.L. (1997). Contrary to Conventional Wisdom: Street Sweeping can be an Effective BMP. In James, W. *Advances in Modeling the Management of Stormwater Impacts* – Vol. 5. Published by CHI, Guelph, Canada. pp 179-190.

US Department of Transportation, Federal Highway Administration's Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring: Street Sweeping Fact Sheet http://www.fhwa.dot.gov/environment/ultraurb/3fs16.htm

Walker, T. and Wong, T. (1999). Effectiveness of Street Sweeping for Stormwater Pollution Control. Technical Report 99/08. Cooperative Research Centre for Catchment Hydrology, Melbourne, AUS. http://www.catchment.crc.org.au/archive/pubs/1000009.html

Waschbusch, Robert J.; Selbig, W. R.; Bannerman, Roger T.1999. WRI 99-4021. Sources of phosphorus in stormwater and street dirt from two urban residential basins in Madison, Wisconsin, 1994-95. http://wi.water.usgs.gov/pubs/WRIR-99-4021/

World Sweeper Website http://www.worldsweeper.com/Street/Studies/index.html

MO-5

Municipal Operation

STORM DRAIN MAINTENANCE

Description

Public streets and roadways can comprise as much as 10 to 20% of total impervious cover in suburban subwatersheds and from 20 to 40% of highly urban subwatersheds. Fine particles and pollutants naturally tend to accumulate along the curbs of roads in between rainfall events. Sources of pollutants include run-on, atmospheric deposition, vehicle emissions, breakup of street surface, littering, and sanding. This results in the accumulation of stormwater pollutants such as sediment, nutrients, metals, hydrocarbons, bacteria, pesticides, trash and other toxic chemicals.

Storm drain maintenance is often the last opportunity to remove pollutants before they enter the storm drain system. The effectiveness of this pollution prevention/good housekeeping practice depends on the basic design of the stormwater conveyance in a subwatershed. Most systems have a catch basin or sump pit located in the storm drain inlet to trap sediment and organic matter and prevent clogging (Figure 1). In some eras, however, conveyance systems were designed to be self-cleansing and thus have no storage. Each catch basin or sump pit tends to be unique in how quickly it fills up, and whether the trapped material is liquid, solid or organic. To this extent, each reflects the conditions and behaviors that occur within the few hundred feet of street it serves.

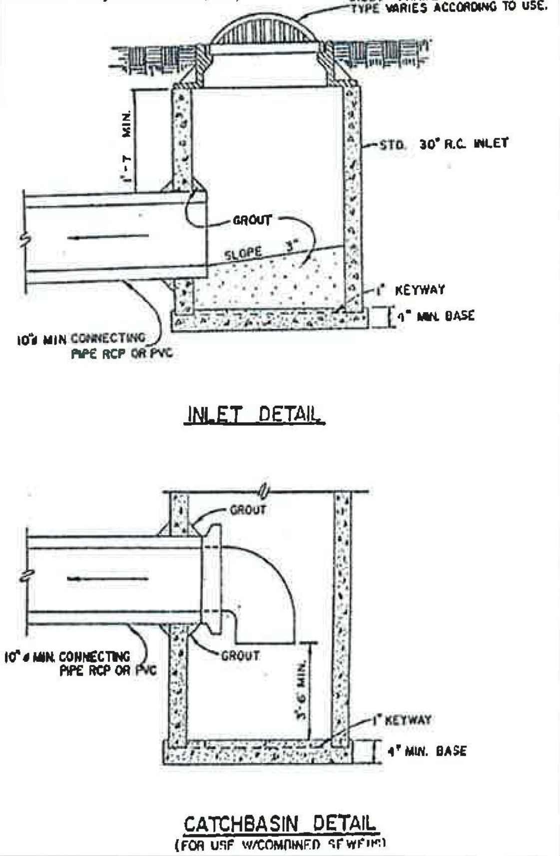

(Source: City of Garrett, IN)

Figure 1. Catch Basin Detail

Storm drain maintenance can be an effective strategy in urban subwatersheds that have few other feasible options to remove pollutants. For many communities, storm drain maintenance is reactive and conducted in response to complaints from residents. Water quality is not a commonly cited reason for a storm drain cleanout program (see Figure 2). When performed properly, regular maintenance can improve water quality and prevent clogging and flooding.

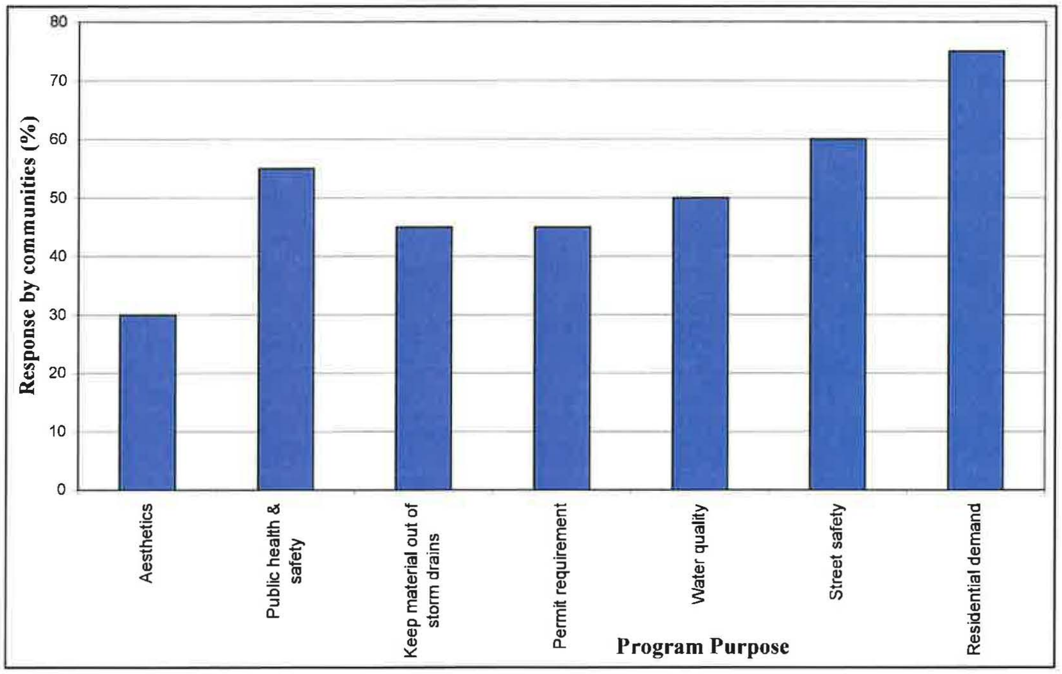


Figure 2: Purpose of storm drain cleanout programs in the Chesapeake Bay watershed

The amount of pollution removed by storm drain maintenance is influenced by the amount of pollution removed by street sweeping (see profile sheet MO-4). The amount of dirt removed by street sweeping influences the quantity of dirt that can be trapped within storm drains, inlets or catch basins. Storm drain cleanout effectiveness is also impacted by both the frequency and method of cleanout. Table 1 provides estimated pollutant removal rates for catch basin cleanouts.

Table 1: Expected Pollutant Removal Rates for Catch Basin Cleanouts (Law et al., 2008)

Frequency	Total Suspended Solids	Total Phosphorus	Total Nitrogen
Annual	18%	< 1%	3%
Semi-Annual	35%	2%	6%

Investigating and Improving the Operation

Improving or initiating storm drain maintenance your community can reduce the amount of stormwater pollution that is conveyed into local aquatic resources. It requires an examination of existing storm drain maintenance operations to identify where improvements can be made to reduce pollutant accumulation in catch basins, inlets and storm drain pipes. This can be accomplished within the context of the seven-step program planning and development process (Chapter 2), as described below.

Step 1: Identify Existing Municipal Operations

In this step, determine whether catch basin, inlet and storm drain cleanouts are currently conducted. If so, the next step in the process is to collect some basic information about how these activities are conducted. If not, you should consider developing a storm drain maintenance plan or investigating the other municipal operations that are conducted within the community.

Step 2: Collect Information About Each Operation

Once you have determined that your community currently conducts storm drain maintenance activities, the next step in the process is to collect some basic information about how those operations are conducted. Basic information to collect about the storm drain maintenance activities conducted in your community includes:

- Narrative description of the storm drain maintenance activities
- Locations of storm drain maintenance activities
    - Street address
    - Watershed and subwatershed address
    - Geospatial coordinates (e.g. latitude, longitude)
- Map showing locations of storm drain maintenance activities
- Operation manager name
- Operation manager contact information

This information should be added to the simple database or binder that contains the information about all of the municipal operations conducted in your community.

After collecting basic information about storm drain maintenance activities, begin communicating with the individual who oversees or manages these activities. This is an ideal time to inform this individual about the community's pollution prevention/good housekeeping efforts and its purpose. It is also a good time to educate them about the influence that storm drain maintenance can have on water quality and how it can be used to reduce the amount of pollution that has accumulated on public streets and roadways.

Step 3: Complete the Municipal Operations Analysis (MOA)

The next step in the process is to use the basic information that you have collected about the storm drain maintenance activities conducted in your community to complete Section 5 of the MOA. This section of the MOA asks a series of questions about the nature, scope and distribution of the storm drain maintenance operations. In some cases, you will be able to answer all of the questions using only the information that you have already collected about the street sweeping activities. In most cases, however, answering the questions will require additional input from the individual who manages or oversees your community's storm drain maintenance activities.

Once you have answered all of the questions presented within Section 5 of the MOA, you should calculate your score to determine how well your community is currently conducting its storm drain maintenance activities. When you have completed the entire MOA, you should also compare the score that you received in Section 5 with the scores you received in each of the other sections of the analysis. This will help you focus your pollution prevention/good housekeeping efforts on the municipal operations that have the greatest influence on water quality in your community.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

The next step in the process is to use the results of the MOA, as well as information about local subwatershed restoration goals and objectives, to develop a list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your local pollution prevention/good housekeeping efforts and ensure that you are using your resources on improving the operations that have the greatest influence on water quality in your community. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

If storm drain maintenance comes out on top of your prioritized municipal operations list, the next step in the process is to further investigate the way that storm drain maintenance activities are conducted in your community and determine the improvements that can be used to reduce the amount of pollution that has accumulated in inlets, catch basins and storm drain pipes. If it does not, you should begin investigating the operation that is located at the top of your list. The other profile sheets presented in this chapter provide additional information about investigating each of the other municipal operations.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices

Step 5.1: Collect Additional Information About Storm Drain Maintenance Activities

Once you have determined that storm drain maintenance will be the focus of your pollution prevention/good housekeeping efforts, the next step in the process is to collect some additional information about these activities to determine how they can be improve to reduce the amount of stormwater pollution that has accumulated in inlets, catch basins and storm drain pipes. To collect this additional information, you should coordinate with the individual who manages or oversees these activities. This individual will be able to answer questions about the storm drain maintenance activities and help you determine where improvements can be made. It is also a good opportunity for them to learn more about how street sweeping can influence stormwater quality. Table 2 provides a list of example questions that can be used to collect additional information from the individual who manages or oversees the storm drain maintenance activities conducted in your community.

Table 2: Sample Discussion Questions

- Are you familiar with our pollution prevention/good housekeeping efforts and the purpose of our municipal pollution prevention/good housekeeping program?
- Do you understand how storm drain maintenance can impact stormwater quality?
- How frequently do you perform catch basin, inlet and storm drain cleanouts?
- How do you dispose of materials removed from the storm drain system?
- What additional resources would you need to improve the community's existing storm drain maintenance program?
- Do you provide regular stormwater pollution prevention training to employees who are involved with storm drain maintenance activities?

When collecting addition information about the storm drain maintenance activities conducted in your community, you should strive to determine how the storm drain system is currently being maintained, how frequently it is maintained and the technology that is used to maintain it. The basic idea is to determine if the storm drain maintenance program is operating at a level where measurable pollutant reductions can be achieved. In particular, you should evaluate:

- *Tracking* – the location and maintenance of storm drains should be tracked using a database and spatial referencing system (e.g., Global Positioning System, Geographic Information System). Additionally, knowing the type and era of the storm drain system may be of use since some inlets/catch basins are designed to be self-cleaning while others have some trapping capacity.

- *Frequency* – should be defined such that blockage of storm sewer outlet is prevented and it is recommended that the sump should not exceed 40 – 50 percent of its capacity. Semiannual cleanouts in residential streets and monthly cleanouts for industrial streets are suggested by Pitt and Bissonnett (1984) and Mineart and Singh (1994). More frequent cleanouts should be scheduled in the fall as leaves can contribute 25% of nutrient loadings in catch basins.

- *Technology* – the four common methods of cleaning catch basins are described in Table 3. Almost 65% of the Chesapeake Bay communities used vacuum-based technology or hydraulic suctions to cleanout storm drains (Figure 3). The remaining communities use more basic technology such as manual removal or bucket loaders.

- *Staff training* - operators need to be properly trained in catch basin maintenance including waste collection and disposal methods. Staff should also be trained to report water quality problems and illicit discharges. See profile sheet MO-10 for more on employee training.

- *Material disposal* - since catch basin waste may contain hazardous material, it should be tested and disposed of accordingly. Maintenance personnel should keep a log of the amount of sediment collected and the removal date at the catch basin.

Table 3: Equipment Used for Catch Basin and Inlet Cleaning (from Lager et al. 1979)

Equipment	Description
Manual cleaning	Bail out sediment-laden water and shovel into street then truck. Or crew enters catch basin and fill buckets with sediment that are then carried to a dump truck. Clean water is used to refill the catch basin.
Eductor cleaning	Eductor truck evacuates the catchment of the sediment-laden water into a settling tank.
Vacuum cleaning	Air blower of the vacuum truck is used to create a vacuum and the air-solid-liquid material is separated in the vacuum truck unit by gravity separation and baffles.
Vacuum combination jet cleaning (e.g. Vaccon)	A vacuum assisted truck that uses a combination of air, water and hydraulic suction. Suction is used to extract material from storm inlets. Water is used to clear material from storm drain pipes that is not removed by the vacuum. The material is stored in the truck holding tank and transported for disposal.

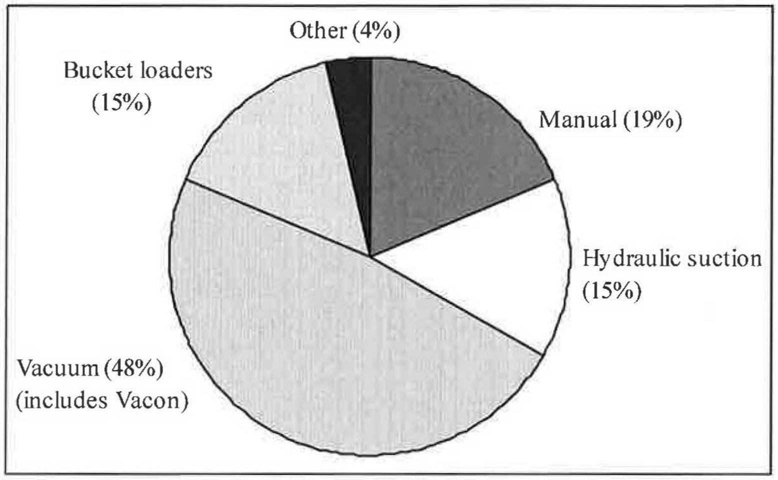


Figure 3. Most common storm drain cleanout technology used in NPDES Phase I and II Chesapeake Bay communities

<u>Step 5.2: Conduct Field Investigations</u>

After collecting some additional information about the storm drain maintenance activities in the community, it is time to conduct some field work to determine where storm drain maintenance can provide the most improvement to water quality (Figure 4). Conducting these field assessments is a key way to transform existing storm drain maintenance activities from reactive (response to resident complaints) to proactive activities. The Street and Storm Drains (SSD) investigation measures the average pollutant accumulation in the streets, curbs and catch basins of a subwatershed. The SSD can be used to characterize the current condition of storm drain infrastructure and the degree of pollutant accumulation in catch basins. This information should be used to quantify the impact of current maintenance practices on urban streams and identify changes to current storm drain maintenance program. For example, a high accumulation rate may suggest that more frequent and regular cleanouts are needed. The SSD is time intensive and probably cannot be completed for all streets, but the stormwater manager should consider conducting the SSD in subwatersheds with impaired waters or sensitive aquatic resources. This information is particularly useful for communities with limited resources who may not be able to increase storm drain maintenance in all areas. For more information on the SSD, see Manual 11.

Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices

Once existing operations have been assessed, the next step in the process is to select and implement the pollution prevention/good housekeeping practices that can help improve water quality through storm drain maintenance procedures and training. In order to observe water quality improvements, most communities will need to track maintenance activities and increase frequency. Depending on the results of Step 1, a variety of improvements can be made to the way that storm drain maintenance currently occurs (Table 4). If resources are limited, storm drain maintenance should be concentrated on the dirtiest streets in sensitive subwatersheds at the right times of year (just before and after rainy season).

Figure 4. Conducting the SSD in Watershed 263, Baltimore, MD

Table 4: Good Housekeeping Techniques for Storm Drain Cleanout

- Maintain a log of the amount of sediment collected and the date removed
- Analyze waste to determine the nature of disposal method
- Any liquids collected during cleanouts should be decanted and disposed of separately, depending on its hazard class
- Minimally clean once or twice per year (just before and just after the rainy season) or when the catch basin storage is one-third full, whichever happens first
- Plan cleaning to coincide with municipal street sweeping (MO-4)
- Locate and map all the catch basins within the community, and use these maps to promote widespread storm drain stenciling
- Keep records on accumulation rates within each individual catch basin using GIS or other tracking system
- Report all suspicious catch basins to appropriate local authorities for follow-up inspection and enforcement (e.g., inappropriate discharges and illegal dumping)

Step 5.4: Develop Implementation Plan

Once you have developed a targeted storm drain maintenance program, a brief implementation plan should be created. The plan should summarize the results of the assessment and the storm drain maintenance effort that will be used to reduce the amount of pollution that has accumulated in inlets, catch basins and storm drain pipes. The plan should also include a schedule that describes when the storm drain maintenance program will be implemented. The implementation plan can be used to guide the implementation of the prescribed storm drain maintenance program.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once an implementation plan has been created, the next step in the process is implementing the prescribed storm drain maintenance program. Although it may be tempting to hand the responsibility for implementation over to the individual who manages or oversees the community's storm drain maintenance activities, it is important to work with this individual during the implementation phase to get the prescribed storm drain maintenance program up and running. Simple techniques that can be used to do this include providing additional education and information about the prescribed storm drain program and providing assistance in securing funding for the program.

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the progress made in implementing the prescribed pollution prevention/good housekeeping practices. Measurable performance goals and implementation milestones will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Some example measurable goals and implementation milestones are presented in Table 5.

Table 5: Measurable Goals and Implementation Milestones for Improving Municipal Storm Drain Maintenance Operations[1]

Example Measurable Goals	Timeframe	Priority
Goals related to program startup		
Identify and collect basic information about current municipal storm drain maintenance operations	Complete shortly after program startup; update regularly after that	●
Add the information about storm drain maintenance activities to the simple database or binder that contains basic information about each municipal operation		●
Develop a digital (e.g. GIS) or hard copy map showing the location of all storm drain maintenance activities		◉
Complete Section 5 of the Municipal Operations Analysis (MOA)	Year 1; repeat every 5 years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Goals related to preventing or reducing stormwater pollution		
Collect additional information about the way that storm drain maintenance activities are conducted within your community	Year 1	●
Prescribe pollution prevention/good housekeeping practices to address deficiencies and improve the way that the municipal storm drain system is maintained within your community		●
Develop implementation plan for prescribed pollution prevention/good housekeeping practices		●
Secure funding and resources to implement prescribed pollution prevention/good housekeeping practices	Begin in Year 1	●
Implement prescribed pollution prevention/good housekeeping practices	Begin in Year 2	●

Table 5: Measurable Goals and Implementation Milestones for Improving Municipal Storm Drain Maintenance Operations[1]

Example Measurable Goals	Timeframe	Priority
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update regularly after that	●
Evaluate progress in meeting measurable goals and implementation milestones		●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●

Notes
1) Assumes that storm drain maintenance is as the top of your prioritized municipal operations list.
Key
● = Essential
⦿ = Optional but Recommended

The methods used to evaluate success in meeting these measurable performance goals and implementation milestones can be as simple as a semi-annual or annual inspections used to identify the improvements that have been put in place and the improvements that still need to be made.

Scoping the Required Level of Effort

The level of effort required to develop an effective storm drain maintenance program varies greatly from one community to the next. Basic guidance on scoping the level of effort required to improve storm drain maintenance operations is provided in Table 6. Communities can use this information to estimate the level of effort required to improve their own storm drain maintenance programs.

Table 6: Scoping the Level of Effort Required to Improve Storm Drain Maintenance Operations

Step	Staff Hours
Step 1: Identify Existing Municipal Operations	4-8[1]
Step 2: Collect Information About Street Sweeping Activities	4-8
Step 3: Complete Section 5 of the Municipal Operations Analysis (MOA)	10-20
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8[1]
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices	80-200
Step 5.1: Collect Additional Information About Storm Drain Maintenance Activities	20-40
Step 5.2: Conduct Field Investigations	20-8
Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices	20-40
Step 5.4: Develop Implementation Plan	20-40
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation[1]

Notes
1: Represents total level of effort required to complete step for all municipal operations.
2: Varies according to the extent and type of improvements required.

Resources

Urban Subwatershed Restoration Manual 11: Unified Subwatershed and Site Reconnaissance: A User's Manual. http://www.cwp.org/PublicationStore/USRM.htm

The Smart Watershed Benchmarking Tool.
http://cwp.org.master.com/texis/master/search/+/form/Smart_Watershed.html

U.S. EPA, Office of Water. Stormwater O&M Fact Sheet: Catch Basin Cleaning
http://www.epa.gov/owm/mtb/catchbas.pdf

Santa Clara Valley Urban Runoff Pollution Prevention Program
http://www.scvurppp.org/

N-9

Neighborhood Source Area: Yard

SEPTIC SYSTEM MAINTENANCE

Description

While most urban subwatersheds are served by sewers, some still rely on septic systems for sewage disposal, particularly in less developed subwatersheds that may lie outside of the sewer service envelope. The ideal watershed behavior is to regularly inspect and maintain septic systems, make repairs as needed, and prevent disposal of household chemicals through the leach field. The accepted practice is to inspect the tank and leach field once every two years to make sure it is working properly, and to pump out the tank (Ohrel, 1995; Figure 1). The negative watershed behavior is to ignore regular inspections and pumpouts to the point that the septic system becomes a subwatershed pollution source.

How Septic Systems Influence Subwatershed Quality

Failing septic systems can be a major source of bacteria, nitrogen, and phosphorus, depending on the overall density of systems present in a subwatershed (Swann, 2001). Failure results in surface or subsurface movement of nutrients and bacteria into the stream. According to the U.S. EPA (2002), more than half of all existing septic systems are more than 30 years old, which is well past their design life. The same study estimates that about 10% of all septic systems are not functioning properly at any given time, with even higher failure rates in some regions and soil conditions. It is extremely important to understand resident behavior in regard to inspection, pump out and repair, particularly if septic system density in a subwatershed is high.

Figure 1: Septic System Inspection/Cleaning Truck

Percentage of Homeowners Engaging in Septic System Maintenance

Until recently, homeowner awareness about septic system maintenance was poorly understood. Swann (1999) conducted one of the first surveys to examine how frequently homeowners maintain their septic systems. Roughly half of the owners were classified as "septic slackers," since they indicated that they had not inspected or cleaned out their systems in the past three years. A small, but significant, fraction (12%) of septic system owners had no idea where their septic system was located on their property. In addition, only 42% of septic system owners had ever requested advice on how to maintain their septic system, and they relied primarily on the private sector for advice (e.g., pumping service, contractors, and plumbers).

Variation in Septic System Maintenance

Septic system failure rates appear to vary regionally, ranging from five to 40% (Swann, 2001). In most regions, failure rates are tied to current or past design, construction and maintenance regulations, which are set by local or state public health authorities. Failing systems are often clustered together. At the neighborhood level, many factors can influence septic system problems. Key factors linked to failure include small lot size, aging systems, poor soil or water table conditions, and close proximity to streams, lake fronts or ditches. In other cases, failure rates are tied to experimental septic system technologies, and seasonal use of properties.

Difficulty in Improving Septic System Maintenance

Septic systems are a classic case of "out of sight, out of mind." Many owners take their septic systems for granted, until they back up or break out on the surface of their lawn. Subsurface failures, which are the most common, go unnoticed. In addition, inspections, pump outs, and repair can be costly, so many homeowners tend to put off these expenditures until there is a real problem. Lastly, many septic system owners lack basic awareness about the link between septic systems and water quality at the subwatershed level.

Techniques to Increase Septic System Maintenance

Many carrots and sticks have been developed in recent years to improve resident behaviors in regard to septic system maintenance, including:

- Media campaigns to increase awareness about septic system and water quality (e.g., billboards, radio, newspaper)
- Conventional outreach materials on maintenance (e.g., brochures, bill inserts, newsletters)
- Free or mandatory inspections
- Discount coupons for septic system maintenance
- Low interest loans for septic system repairs
- Performance certification upon property transfer
- Creation of septic management districts
- Certification and training of operation/maintenance professionals
- Termination of public services for failing systems

Good Examples

Swann (2001) describes a series of case studies of effective local programs to improve septic system maintenance. Some additional examples are provided below:

Washtenaw County, Michigan Time-Of-Sale Program: The County's septic system regulation requires the inspection of all residential septic systems by private evaluators at the time of sale of a property. Evaluations must be done by a certified inspector who has received a license after training and an exam. http://www.rougeriver.com/pdfs/illicit/OSS-02.pdf

Yarmouth, Maine Free Pumpouts (Septic Tank Pumping Ordinance) - The town offers free septic system pump-outs to residents once every three years. http://www.yarmouth.me.us/vertical/Sites/%7B13958773-A779-4444-B6CF-0925DFE46122%7D/uploads/%7B363C4270-0879-43BC-8639-55BFA419AC12%7D.PDF

Cannon Township, MI Septic Inspections and Testing - The township used school children to conduct dye tests to identify failing septic systems. This program doubled as an education campaign to increase awareness of septic system owners. http://peer.tamu.edu/curriculum_modules/Water_Quality/module_1/Kids%20Dye%20Project.htm

Top Resources

Many excellent resources are available to educate homeowners about septic systems and water quality. Some of the better reference websites are provided below, and many contain additional educational links.

On-site Wastewater Treatment Systems Manual
http://www.epa.gov/ord/NRMRL/Pubs/625R00008/html/625R00008.htm

A Homeowner's Guide to Septic Systems
http://www.epa.gov/npdes/pubs/homeowner_guide_long.pdf

National Small Flows Clearinghouse
http://www.nesc.wvu.edu/nsfc/nsfc_septicnews.htm

On-site Septic Systems: Educating the Homeowner
http://www.nesc.wvu.edu/nsfc/Articles/SFQ/SFQw02_web/SFQw02_Onsite Education.html

University of Minnesota Onsite Sewage Treatment Program
http://septic.coafes.umn.edu/

*North Carolina Coast*A*Syst*
http://www.soil.ncsu.edu/assist/cas/septic/index.htm

N-18

Neighborhood Source Area: Common Areas

PET WASTE PICKUP

Description

The ideal watershed behavior is to pick up and properly dispose of pet waste (Figure 1). The negative watershed behavior is to leave pet waste in common areas and the yard, where it can be washed off in storm water runoff.

How Pet Waste Influences Subwatershed Quality

Pet waste has been found to be a major source of fecal coliform bacteria and pathogens in many urban subwatersheds (Schueler, 1999). A typical dog poop contains more than three billion fecal coliform bacteria and as many as 10% of dogs are also infected with either *giardia* or salmonella, which is not surprising considering they drink urban creek water. Fecal coliform bacteria are frequently detected in urban streams and rivers after storms, with levels as high 5,000 fecal coliform per tablespoon. Thus, it is not uncommon for urban and suburban creeks to frequently violate bacteria standards for swimming and water contact recreation after larger rainstorms.

Percentage of Residents that Pick Up After Pets

Surveys indicate that about 40% of all households own one or more dogs (Swann, 1999). Not all dog owners, however, are dog walkers. Only about half of dogs are walked regularly. About 60% of dog walkers claim to pick up after their dog some or all of the time (Swann, 1999; HGIC, 1998; and Hardwick, 1997). The primary disposal method reported by residents for pet waste is the trash can, with toilets coming in distant second. Dog walkers that do not pick up after their dogs are highly resistant to change; nearly half would not pick up even if confronted with fines or complaints from neighbors (Swann, 1999). Men are also prone to pick up after their dogs less often than women (Swann, 1999).

Figure 1: Pet Waste Pickup Station

Techniques to Promote Pet Waste Pickup

The key technique is to educate residents on sanitary and convenient options for retrieving and disposing of pet waste. Several communities have used both carrots and sticks to get more owners to pick up after their pets, including:

- Mass media campaigns of the water quality impacts of pet waste
- Conventional outreach materials (brochures, flyers, posters)
- Pooper bag stations in parks, greenways and common areas
- Educational signs in same areas
- "Pooper scooper" ordinances and enforcement
- Banning dogs from beaches and waterfront areas
- Providing designated "dog parks"

Good Examples

Water Quality Consortium Nonpoint Source Education Materials
The Water Quality Consortium implemented an ad campaign focused on four themes: a man pushing a fertilizer spreader, a car driving on water leaking oil, a man washing his car, and man walking his dog. Each ad explains how the behavior leads to water pollution and provides specific tips outlining what residents can do to protect water quality.
http://www.psat.wa.gov/Programs/Pie_Ed/Water_Ed_Materials.htm

Pick It Up - It's Your Doodie Campaign (Gwinnett County Parks & Recreation Department) - The county park agency provides plastic grocery bags for pet owners to use to clean up after their pets as part of a pilot program. The baggies are attached to a wooden post at a local park. Underneath a sign explains their purpose. Pet owners are also encouraged to bring replacement bags when they visit the park.
http://www.gwinnettcitizen.com/0203/doodie.html

Top Resources

Public Open Space and Dogs: A Design and Management Guide for Open Space Professionals and Government
http://www.petnet.com.au/openspace/frontis.html

Considerations for the Selection and Use of Pet Waste Collection Systems in Public Areas
http://www.ecy.wa.gov/programs/wq/nonpoint/pet_waste/petwaste_station.pdf

Properly Disposing of Pet Waste
http://www.cleanwatercampaign.com/what_can_i_do/pet_waste_home.html

Managing Pet and Wildlife Waste to Prevent Contamination of Drinking Water
U.S. EPA Source Water Protection Practices Bulletin.
http://www.epa.gov/safewater/protect/pdfs/petwaste.pdf

N-1

Neighborhood Source Area: Yard

REDUCED FERTILIZER USE

Description

The ideal behavior is to not apply fertilizer to lawns. The next best thing for homeowners who feel they must fertilize is to practice natural lawn care: using low inputs of organic or slow release fertilizers that are based on actual needs as determined by a soil test. The obvious negative watershed behavior is improper fertilization, whether in terms of the timing, frequency or rate of fertilizer applications, or a combination of all three. The other important variable to define is who is applying fertilizer in the neighborhood. Nationally, about 75% of lawn fertilization is done by homeowners, with the remaining 25% applied by lawn care companies (Figure 1). This split, however, tends to be highly variable within individual neighborhoods, depending on its income and demographics.

How Fertilizer Influences Water Quality

Recent research has demonstrated that lawn over-fertilization produces nutrient runoff with the potential to cause downstream eutrophication in streams, lakes, and estuaries (Barth, 1995a and 1995b). Scientists have also discovered that nitrogen and phosphorus levels in lawn runoff are about two to 10 times higher than any other part of the urban landscape such as streets, rooftops, driveways or parking lots (Bannerman *et al.*, 1993; Steuer *et al.*, 1997; Waschbusch *et al.*, 2000; Garn, 2002).

Figure 1: Lawn Care Company Truck

Percentage of People Engaging in Fertilizer Use

Lawn fertilization is among the most widespread watershed behaviors in which residents engage. A survey of lawn care practices in the Chesapeake Bay indicated that 89% of citizens owned a yard, and of these, 50% applied fertilizer every year (Swann, 1999). The average rate of fertilization in 10 other regional lawn care surveys was even higher (78%), although this may reflect the fact that these surveys were biased towards predominantly suburban neighborhoods and excluded non-lawn owners. Several studies have measured the frequency of lawn fertilization, and have found that lawns are fertilized about twice a year, with spring and fall being the most common season for applications (Swann, 1999).

A significant fraction of homeowners can be classified as "over-fertilizers" who apply fertilizers above recommended rates. Surveys indicate the number of over-fertilizers at 50% to 70% of all fertilizers (Morris and Traxler, 1996; Swann, 1999; Knox *et al.*, 1995). Clearly, many homeowners, in a quest for quick results or a bright green lawn, are applying more nutrients to their lawns than they actually need.

Variation in Fertilization Behavior

Many regional and neighborhood factors influence local fertilization behavior. From a regional standpoint, climate is a very important factor, as it determines the length of the growing season, type of grass, and the irrigation needed to maintain a lawn. A detailed discussion of the role these factors play in fertilization can be found in Barth (1995a). A host of factors also comes into play at the individual neighborhood scale. Some of the more important variables include average income, market value of houses, soil quality, and the age of the development (Law *et al.*, 2004). Higher rates of fertilization appear to be very common in new suburban neighborhoods where residents seek to establish lawns and landscaping. Also, lawn irrigation systems and fertilization are strongly associated.

Difficulty in Changing Behavior

Changing fertilization behaviors can be hard since the desire for green lawns is deeply rooted in our culture (Jenkins, 1994; Teyssott, 1999). For example, the primary fertilizer is a man in the 45 to 54 year age group (BHI, 1997) who feels that "a green attractive lawn is an important asset in a neighborhood" (De Young, 1997). According to surveys, less than 10% of lawn owners take the trouble to take soil tests to determine whether fertilization is even needed (Swann, 1999; Law *et al.*, 2004). Most lawn owners are ignorant of the phosphorus or nitrogen content of the fertilizer they apply (Morris and Traxler, 1996), and are unaware that grass-cycling can sharply reduce fertilizer needs.

Most residents rely on commercial sources of information when making their fertilization decisions. The average consumer relies on product labels, store attendants, and lawn care companies as their primary, and often exclusive, sources of lawn care information. Consumers are also influenced by direct mail and word of mouth when they choose a lawn care company (Swann, 1999 and AMR, 1997).

Two approaches have shown promise in changing fertilization behaviors within a neighborhood, and both involve direct contact with individual homeowners. The first relies on using neighbors to spread the message to other residents, through master gardening programs. Individuals tend to be very receptive to advice from their peers, particularly if it relates to a common interest in healthy lawns. The second approach is similar in that it involves direct assistance to individuals at their homes (e.g., soil tests and lawn advice) or at the point of sale.

Techniques to Change Behavior

Most communities have primarily relied on carrots to change fertilization behaviors, although sticks are occasionally used in phosphorus-sensitive areas. The following are some of the most common techniques for changing fertilization behaviors:

- Seasonal media awareness campaigns
- Distribution of lawn care outreach materials (brochures, newsletters, posters, etc.; Figure 2)
- Direct homeowner assistance and training
- Master gardener program
- Exhibits and demonstration at point-of-sale retail outlets
- Free or reduced cost for soil testing
- Training and/or certification of lawn care professionals
- Lawn and garden shows on radio
- Local restrictions on phosphorus content in fertilizer

Good Examples

King County, Washington- Northwest Natural Yard Days. This month-long program offers discounts on natural yard care products and educational information about natural yard care in local stores throughout King County and Tacoma. Education specialists came to Saturday and Sunday events at some stores and spent time with buyers to help them make good choices and learn about natural yard care, including the use of organic fertilizers that don't wash off into streams and lakes as easily as "quick release" chemical fertilizers. For more details, consult: http://dnr.metrokc.gov/swd/ResRecy/events/naturalyard.shtml

North Carolina Department of Agriculture Free Residential Lawn Soil Testing. Residents can get a free soil test to determine the exact fertilizer and lime needs for their lawn, as well as for the garden, landscape plants and fruit trees. Information sheets and soil boxes are available from various government agencies, or local garden shops and other businesses. For more information, consult:
http://www.ncagr.com/agronomi/stfaqs.htm

Minnesota Department of Agriculture Phosphorus Lawn Fertilizer Use Restrictions. Starting in 2004, these restrictions limit the concentration of phosphorus in lawn care products and restrict its application at higher rates to specific situations based on need.
http://www.mda.state.mn.us/appd/ace/lawncwaterq.htm

Top Resources

Cornell Cooperative Extension. The Homeowner's Lawn Care Water Quality Almanac.
http://www.gardening.cornell.edu/lawn/almanac/index.html

University of Rhode Island Cooperative Extension Home*A*Syst Healthy Landscapes Program
http://www.healthylandscapes.org/

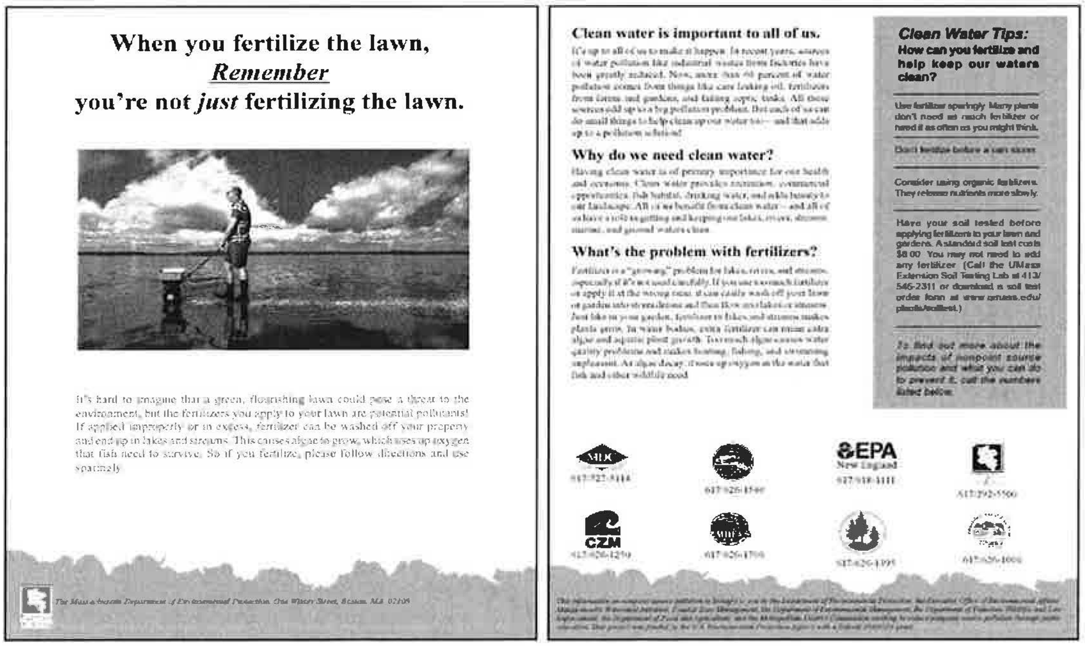
University of Maryland Cooperative Extension - Home and Garden Information Center.
http://www.agnr.umd.edu/users/hgic/

Turf and Landscape Best Management Practices. South Florida Water Management District and the Broward County Extension Education Division
http://www.sfwmd.gov/org/exo/broward/c11bmp/fertmgt.html

Florida Yards and Neighborhoods Handbook: A Guide to Environmentally Friendly Landscaping
http://hort.ufl.edu/fyn/hand.htm

University of Minnesota Extension Service Low-Input Lawn Care (LILaC)
http://www.extension.umn.edu/distribution/horticulture/DG7552.html

Austin TX, Stillhouse Spring Cleaning
http://www.ci.austin.tx.us/growgreen/stillhouse.htm



When you fertilize the lawn,
Remember
you're not *just* fertilizing the lawn.

It's hard to imagine that a green, flourishing lawn could pose a threat to the environment, but the fertilizers you apply to your lawn are potential pollutants! If applied improperly or in excess, fertilizer can be washed off your property and end up in lakes and streams. This causes algae to grow, which uses up oxygen that fish need to survive. So if you fertilize, please follow directions and use sparingly.

Clean water is important to all of us.

Why do we need clean water?

What's the problem with fertilizers?

Clean Water Tips:
How can you fertilize and help keep our waters clean?

Use fertilizer sparingly. Many plants don't need as much fertilizer or need it as often as you might think.

Consider using organic fertilizers. They release nutrients more slowly.

Have your soil tested before applying fertilizers to your lawn and gardens. A standard soil test costs $8.00. You may not need to add any fertilizer. (Call the UMass Extension Soil Testing Lab at 413/546-2311 or download a soil test order form at www.umass.edu/plants/soiltest.)

To find out more about the impacts of nonpoint source pollution and what you can do to prevent it, call the numbers listed below.

Figure 2: Educational Brochure on Fertilizer
Source: http://www.state.ma.us/dep/brp/wm/files/fertiliz.pdf

COVER CROP

(acre)

CODE 340

DEFINITION

Grasses, legumes, forbs, or other herbaceous plants established for seasonal cover and conservation purposes.

PURPOSES

- Reduce erosion from wind and water
- Increase soil organic matter
- Manage excess nutrients in the soil profile
- Promote biological nitrogen fixation
- Increase biodiversity
- Weed suppression
- Provide supplemental forage
- Soil moisture management

CONDITIONS WHERE PRACTICE APPLIES

On all lands requiring vegetative cover for natural resource protection

CRITERIA

General Criteria Applicable To All Purposes

Plant species, seedbed preparation, seeding rates, seeding dates, seeding depths, and planting methods will be consistent with approved local criteria and site conditions.

The species selected will be compatible with the nutrient management and pest management provisions of the plan.

Cover crops will be terminated by harvest, frost, mowing, tillage, and/or herbicides in preparation for the following crop.

Herbicides used with cover crops will be compatible with the following crop

Cover crop residue will not be burned

Additional Criteria to Reduce Erosion From Wind and Water

Cover crop establishment, in conjunction with other practices, will be timed so that the soil will be adequately protected during the critical erosion period(s).

Plants selected for cover crops will have the physical characteristics necessary to provide adequate protection.

The amount of surface and/or canopy cover needed from the cover crop shall be determined using current erosion prediction technology.

NUTRIENT MANAGEMENT

(Acre)
CODE 590

DEFINITION

Managing the amount, source, placement, form and timing of the application of nutrients and soil amendments.

PURPOSES

- To budget and supply nutrients for plant production.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To minimize agricultural nonpoint source pollution of surface and ground water resources.
- To maintain or improve the physical, chemical and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied.

CRITERIA

General Criteria Applicable to All Purposes

Plans for nutrient management shall comply with all applicable Federal, state, and local laws and regulations.

Plans for nutrient management shall be developed in accordance with policy requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities) and Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy); technical requirements of the NRCS Field Office Technical Guide (FOTG); procedures contained in the National Planning Procedures Handbook (NPPH), and the NRCS National Agronomy Manual (NAM) Section 503.

Persons who review or approve plans for nutrient management shall be certified through any certification program acceptable to NRCS within the state.

Plans for nutrient management that are elements of a more comprehensive conservation plan shall recognize other requirements of the conservation plan and be compatible with its other requirements.

A nutrient budget for nitrogen, phosphorus, and potassium shall be developed that considers all potential sources of nutrients including, but not limited to animal manure and organic by-products, waste water, commercial fertilizer, crop residues, legume credits, and irrigation water.

Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests. For new crops or varieties, industry yield recommendations may be used until documented yield information is available.

POND

(No.)

CODE 378

DEFINITION

A water impoundment made by constructing a dam or an embankment or by excavating a pit or dugout.
In this standard, ponds constructed by the first method are referred to as embankment ponds, and those constructed by the second method are referred to as excavated ponds. Ponds constructed by both the excavation and the embankment methods are classified as embankment ponds if the depth of water impounded against the embankment at spillway elevation is 3 ft or more.

PURPOSE

To provide water for livestock, fish and wildlife, recreation, fire control, crop and orchard spraying, and other related uses, and to maintain or improve water quality.

SCOPE

This standard establishes the minimum acceptable quality for the design and construction of ponds if:

1. Failure of the dam will not result in loss of life; in damage to homes, commercial or industrial buildings, main highways, or railroads; or in interruption of the use or service of public utilities.
2. The product of the storage times the effective height of the dam is less than 3,000. Storage is the volume, in acre-feet, in the reservoir below the elevation of the crest of the emergency spillway. The effective height of the dam is the difference in elevation, in feet, between the emergency spillway crest and the lowest point in the cross section taken along the centerline of the dam. If there is no emergency spillway, the top of the dam is the upper limit.
3. The effective height of the dam is 35 ft or less, and the dam is hazard class (a).

CONDITIONS WHERE PRACTICE APPLIES

Site conditions. Site conditions shall be such that runoff from the design storm can be safely passed through (1) a natural or constructed emergency spillway, (2) a combination of a principal spillway and an emergency spillway, or (3) a principal spillway.

Drainage area. The drainage area above the pond must be protected against erosion to the extent that expected sedimentation will not shorten the planned effective life of the structure. The drainage area shall be large enough so that surface runoff and groundwater flow will maintain an adequate supply of water in the pond. The quality shall be suitable for the water's intended use.

Reservoir area. The topography and soils of the site shall permit storage of water at a depth and volume that ensure a dependable supply, considering beneficial use, sedimentation, season of use, and evaporation and seepage losses. If surface runoff is the primary source of water for a pond, the soils shall be impervious enough to prevent excessive seepage losses or shall be of a type that sealing is practicable.

PRESCRIBED GRAZING

(Acre)
CODE 528A

DEFINITION

The controlled harvest of vegetation with grazing or browsing animals, managed with the intent to achieve a specified objective.

PURPOSES

This practice may be applied as part of a conservation management system to accomplish one or more of the following purposes:

- Improve or maintain the health and vigor of selected plant(s) and to maintain a stable and desired plant community.
- Provide or maintain food, cover and shelter for animals of concern.
- Improve or maintain animal health and productivity.
- Maintain or improve water quality and quantity.
- Reduce accelerated soil erosion and maintain or improve soil condition for sustainability of the resource.

CONDITIONS WHERE PRACTICE APPLIES

This practice may be applied on all lands where grazing and/or browsing animals are managed.

CRITERIA

General Criteria Applicable For All The Purposes Stated Above.

Removal of herbage will be in accordance with production limitations, plant sensitivities and management goals using Sections I & II of the FOTG and other references as guidance.

Frequency of defoliations and season of grazing will be based on the rate and physiological conditions of plant growth.

Duration and intensity of grazing will be based on desired plant health and expected productivity of key forage species to meet management unit objectives.

Maintain enough vegetative cover to prevent accelerated soil erosion due to wind and water.

Application of this practice will manipulate the intensity, frequency, duration, and season of grazing to:

- Insure optimum water infiltration,
- Maintain or improve riparian and upland area vegetation,
- Protect stream banks from erosion,
- Manage for deposition of fecal material away from water bodies, and
- Promote ecological and economical stable plant communities on both upland and bottom land sites which meet landowner objectives.

Additional Criteria For Improved Animal Health And Productivity.