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***Statewide Stream/River Probabilistic Monitoring Network for  
the State of Oklahoma from 2013-2017***

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Draft Final Report

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FY-17\_18 WPCP-Monitoring Section 106 Supplemental, Project 1 (CA# I-01F38401) –“The Statewide Stream/River Probabilistic Monitoring Network—Final Report”

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Technical assistance and advice provided by the United States Environmental Protection Agency. These include Office of Wetlands, Oceans and Watersheds in the Office of Water and the Western Ecology Division of the National Health and Environmental Effects Research Laboratory. Special thanks to Tony Olsen, Richard Mitchell, and Tom Kincaid for invaluable assistance in both planning and analysis of data.

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## **List of Acronyms**

Cd	Cadmium
CPP	Continuing Planning Process
Cu	Copper
DC	Direct Current
DO	Dissolved Oxygen
DP	Deep Pools
ECO	Ecoregion
EPA	Environmental Protection Agency
FPFH	Forested Plains and Flint Hills
GPP	Generator Powered Pulsator
GRTS	Generalized Random Tessellation Stratified
HBI	Hilsenhoff Biotic Index
IBI	Index of Biological Integrity
ISC	Instream Cover
LBM	Loose Bed Material
LRC-COMP	Large River Coarse-Composite
LRF-SUB	Large River Fine-Substrate
LRF-THAB	Large River Fine-Targeted Habitat
NARS	National Aquatic Resources Survey
NRSA	National Rivers and Streams Assessment
OCC	Oklahoma Conservation Commission
OCCFIBI	Oklahoma Conservation Commission Fish Index of Biological integrity
ODEQ	Oklahoma Department of Environmental Quality
OKFIBI	Oklahoma Fish Index of Biological Integrity
OKLS	Oklahoma Large Stream
OKRM	Oklahoma River Major
OKRO	Oklahoma River Other
OKSS	Oklahoma Small Stream
OWRB	Oklahoma Water Resources Board
Pb	Lead
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
RBP	Rapid Bioassessment Protocol
REMAP	Regional Environmental Monitoring Assessment Program
RVC	Riparian Vegetative Cover
Se	Selenium
SED	Sediment
SEL	State Environmental Laboratory

**List of Acronyms (Continued)**

SL	Screening Limit
SSV	Streamside Vegetation
TF	Temperate Forest
TN	Total Nitrogen
TP	Total Phosphorus
USAP	Use Support Assessment Protocol
WPT	Western Plains and Tablelands
WSA	Wadeable Streams Assessment
Zn	Zinc

## **EXECUTIVE SUMMARY**

From 2013-2017, Oklahoma completed its 5th and 6th statewide surveys of lotic waters. In Sample Year (SY) 2013-2014, Oklahoma participated in the National Rivers and Streams Assessment (NRSA) sampling 51 stations. The NRSA is a vital component of the OWRB Probabilistic Monitoring Program. The 2013-2017 study population included perennial streams and rivers throughout Oklahoma and continued through the NRSA draw into the remaining oversample sites. So that all sizes of perennial waterbodies are adequately represented, the design will assign unequal proportions to several Strahler Orders, including 1st – 2nd, 3rd-4th, 5th-6th, and above 6th order rivers. Additionally, the study will characterize the three separate aggregated ecoregions of Oklahoma as defined in the “2005-2007 Implementation of a Stream/River Monitoring Sampling Network for the State of Oklahoma” (OWRB, 2009). By combining the two studies, Oklahoma can report on several temporal scales, and on two size classes—smaller streams (1<sup>st</sup>-4<sup>th</sup> Order) and rivers (5<sup>th</sup> and above) and the three aggregated ecoregions of Oklahoma. The three aggregated ecoregions of Oklahoma are the Forested Plains and Flint Hills (FPFH), Temperate Forests (TF), and the Western Plains and Tablelands (WPT). For this study the temporal scales include:

- 69 sites in the 2013-2014 sampling period (51 NRSA Sites)
- 81 sites in the 2015-2017 sampling period
- 150 sites over the 2013-2017 sampling period

Table 1. Timeline of Past, Present, and Future OWRB Biological Streams Monitoring Studies. Final Reports are Available on the OWRB Web Site at <http://www.owrb.ok.gov>

Project Name	Probabilistic Timeline	Project Sample Years
Wadeable Streams Assessment (WSA)	1st	2004
Regional Environmental Monitoring and Assessment Program (REMAP)	2nd	2005-2007
National Rivers and Streams Assessment (NRSA) (Round 1)	3rd	2008-2009
Statewide Probabilistic Monitoring	4th	2010-2011
Data Analysis Year	N/A	2012
National Rivers and Streams Assessment (NRSA) (Round 2)	5th	2013-2014
Statewide Probabilistic Monitoring	6th	2015-2017
National Rivers and Streams Assessment (NRSA) (Round 3)	7th	2018-2019
Statewide Probabilistic Monitoring	8th	2020-2022

This probability-based survey was designed to assist Oklahoma's water quality managers in several ways.

1. Estimate the condition of multi-assemblage biological indicators for Oklahoma's waters through a statistically valid approach.
2. Estimate the extent of stressors that may be associated with biological condition.
3. Evaluate the relationship between stressors and biological condition for use in various long and short-term environmental management strategies.
4. Assess waters for inclusion in Oklahoma's Integrated Water Quality Report.

Furthermore, in keeping with the environmental goals of the state, an effective long-term management strategy based on sound and defensible science can be developed using this data.

To assess ecological health, one-time collections were made for a variety of biological, chemical, and physical parameters. When sites were verified as target, a sampling schedule was implemented. All target sites were visited once (in rare instances twice) during a late spring to late summer index period (June 1 – September 15) under base flow conditions. The studies measured the condition of three biotic assemblages—fish, macroinvertebrates, and sestonic/benthic algae (Table 15)—as well as a variety of stressors including nutrients, conductivity, turbidity (Table 16), habitat/sedimentation (Table 19), and toxics (Table 16). Habitat/sedimentation data are presented in tabular form in this report. Further data analyses are needed for these parameters. These data will likely be presented in a future addendum to this report. Fish data were analyzed using two indices of biological integrity (IBI) commonly used in Oklahoma bioassessment studies, as well as the IBI developed by the NRSA. Macroinvertebrate data were analyzed using a Benthic-IBI (B-IBI) developed for Oklahoma benthic communities (OCC, 2005b) and is commonly used by the OCC and OWRB Water Quality Divisions (OCC, 2008; OWRB, 2009; ODEQ, 2012). To estimate condition of algal biomass, chlorophyll *a* concentrations were compared to several screening levels.

Data outputs include: 1) Relative extent of indicator and stressor condition, 2) Relative risk of stressors to indicators, and 3) Attributable risk of stressors to indicator extent. Data will also combine with other sources and be included in future 303(d) assessments of the Oklahoma Integrated Water Quality Report.

Highlights of the relative extent include:

- For fish, 15.8% of total stream/river miles were in poor condition.
- 23% of total miles were in poor condition for macroinvertebrates.
- For algae, 23.8% sestonic (water column) and 10% (benthic) of total miles were in poor condition.
- For the four biological indicators, rivers had a much greater proportion of miles in poor condition for macroinvertebrates (35.5%) and sestonic algae (43.4%) than for fish (15.1%) and benthic algae (7.1%). The percentages for fish and benthic algae in poor condition for total miles on rivers were very similar to the poor condition percentages on streams (fish- 16.1%, benthic algae- 11.1%).
- Total phosphorus extent in poor condition for all sites was 45.8%.
- Total nitrogen extent in poor condition for all sites was 41%.
- Total phosphorus (TP) and total nitrogen (TN) extent in poor condition was noticeably higher in rivers (TP- 63.1%, TN- 49.7%) than in streams (TP- 39%, TN- 37.4%).

- Sample year 2015, a major flood year for Oklahoma, had the greatest percentage of miles in good condition for conductivity at 52%; showing that conductivity was positively associated with high amounts of rainfall.
- Turbidity extent in poor condition was between 14% (2013) and 35.5% (2014) depending on the sample year.

The current study allows for unique analysis between both study periods and waterbody size.

- For fish, 15.1% of river miles were in poor condition.
- For fish, 16.1% of stream miles were in poor condition.
- For macroinvertebrates, 35.5% of river miles were in poor condition.
- For macroinvertebrates, 17.9% of stream miles were in poor condition.
- Benthic algae show a different trend than the other biological indicators. The poor condition is higher in streams (11.1%) than in rivers (7.1%).
- For stressors, three of four are trending downward between study periods when comparing SY 13-15 to SY 15-17. The only stressor trending upward is conductivity (13-15, 22.1% to 15-17, 23.3%).
- On a positive note, nutrients (TP, TN) are showing strong statistically valid downward trends between sample years 13-15 and sample years 15-17. TN poor condition was at 46.8% for SY 13-15 and fell to just 30.0% in poor condition for SY 15-17. For TP, poor condition was 50.5% for sample years 13-15 and fell to just 37.3% for sample years 15-17.

Relative Risk analyses provided the following results:

- For fish, TP and TN demonstrate significant relative risk in streams at 4.2 (TP) and 2.9 (TN).
- The relative risk of poor macroinvertebrate condition is 5.1 to 7.8 times greater with poor TP condition for all stream sites.
- For all sites, streams, and the Temperate Forests aggregated ecoregion risk for poor macroinvertebrate condition is 2.8 to 4.4 times greater with poor TN condition.
- For the statewide assessment category, the risk of poor sestonic algae condition was significant for all stressors (TP, TN, conductivity, and turbidity).
- For the 2013-2017 study, nutrients (TN, TP) demonstrated no relative risk to benthic algae condition.
- With poor conductivity condition, the risk of poor benthic algae condition increased by 8.3 times in the Forested Plains and Flint Hills aggregated ecoregion.

Trend Analyses provided the following results:

- For indicators, fish are showing a significant trend downward between the 2008-2011 and 2013-2017 studies (35.5% to 15.8% of total miles in poor condition).
- For stressors, conductivity is trending upward between studies going from 14.6% to 23.8% of total miles in poor condition.
- TN is trending upward between studies going from 28.6% to 41.0% of total miles in poor condition.
- TP is trending upward between studies going from 39.3% to 45.9% of total miles in poor condition.

Attributable risk analyses provided the following results:

- Notably, for fish, reduction of TP and TN on streams and TN in the Western Plains and Tablelands aggregated ecoregion could create a significant reduction of poor condition for fish.
- For macroinvertebrates, reduction of TP and TN statewide and in streams would both create a significant decrease in the poor condition of the macroinvertebrate community.
- Sestonic algal condition shows significant reduction in poor condition when all four stressors (TN, TP, conductivity, and turbidity) analyzed for the statewide study are reduced.
- Benthic algae response to the reduction of stressors was quite different from that of sestonic algae. Benthic algae only responded to reduction of conductivity in the Forested Plains and Flint Hills aggregated ecoregion and by the reduction of turbidity in rivers respectively.

## **INTRODUCTION**

Several agencies conduct water quality monitoring in the State of Oklahoma. These agencies meet complementary monitoring objectives that support the management of Oklahoma's surface waters. The two primary components of the statewide monitoring program include (a) the Beneficial Use Monitoring Program, a long-term, fixed-station water quality monitoring network of the Oklahoma Water Resources Board (OWRB), and (b) Oklahoma Conservation Commission's (OCC) Small-Watershed Rotating Basin Monitoring Program, targeting water quality and ecological conditions in waters flowing from 11-digit hydrologic units. Additionally, the state bi-annually completes a water quality monitoring strategy that describes their existing programs in detail and monitoring objectives that cannot be met with existing resources (OWRB, 2018a). These objectives include the ability to make statistically valid inferences about environmental conditions throughout the state, based on a probabilistic selection of sites. Meeting this objective will improve the capacity to make condition estimates, as required by section 305(b) of the Clean Water Act. Also required is a description of the quality for all lotic waters, and to what extent all waters provide for the protection and propagation of aquatic life. The Environmental Protection Agency (EPA) released guidance establishing the "10 Required Elements of a State Water Monitoring and Assessment Program" (USEPA, 2005). Among other things, the document states, "a State monitoring program will likely integrate several monitoring designs (e.g., fixed station, intensive and screening-level monitoring, rotating basin, judgmental and probability design) to meet the full range of decision needs. The State monitoring design should include probability-based networks (at the watershed or state-level) that support statistically valid inferences about the condition of all state water types, over time. EPA expects the State to use the most efficient combination of monitoring designs to meet its objectives."

As stated, Oklahoma has several monitoring programs that met these requirements including the Beneficial Use Monitoring Program (BUMP) and the Rotating Basin Monitoring Program (RBMP) (OWRB, 2018a). Furthermore, the state developed several programs to intensively monitor areas that have been listed on Oklahoma's 303(d) list of impaired waters (ODEQ, 2018).

In 2001, the state requested assistance with design of a probabilistic approach to stream and river site selection from the U.S. Environmental Protection Agency, Office of Research and Development (ORD), Western Ecology Division (OWRB, 2006a). Study design was completed, but Oklahoma agencies remained unable to initiate further planning and implementation due to a lack of resources. In 2004, the OWRB and OCC took part in the National Wadeable Streams Assessment (WSA) (USEPA, 2006), which was fortuitous to future planning efforts for several reasons. First, timing of the study coincided with discussions in the state about launching a probabilistic design. Although money was a question, staff and management were worried staff time could not be spent performing all of the necessary reconnaissance work or sampling that is required in a random based monitoring program. Participating in the WSA instilled confidence that this type of monitoring could be accomplished without impeding the success of other programs. In fact, this facet of Oklahoma's monitoring program has only enhanced other programs. Second, since the state showed interest in implementing a random design, USEPA Region 6 began working with staff to find appropriate funding. Initial funding came through a Clean Water Act (CWA) Section 104(b)(3) grant. This money funded the SY 2005. The study investigated feasibility on two fronts—logistic and funding. The logistic portion could be overcome through proper planning and coordination of staff. The funding, however, was not easily dealt with because of program priorities. In 2005, another funding opportunity became available when the USEPA announced further funding of the Regional Environmental Monitoring and Assessment Program (REMAP) (OWRB, 2009). Funding from the REMAP grant allowed

the state to continue implementation of probabilistic monitoring for an additional two years through 2007. Through this study, the OWRB completed a large-scale statewide assessment of perennial rivers and streams, as well as assessments for three large ecoregion groupings including the Western and High Plains, the Forested Plains and Flint Hills, and the Eastern Highlands. A significant limitation during that study was the inability to determine biological condition in large rivers.

In 2008, Oklahoma began its 3<sup>rd</sup> (2008-2009 NRSA) and 4<sup>th</sup> (2010-2011 Statewide) surveys. The data was published in 2013 (OWRB, 2013) and is included in the trend analysis between studies. A subset of sites sampled for the 2013-2017 study are revisit sites from 2008-2011. This allows for trends between studies.

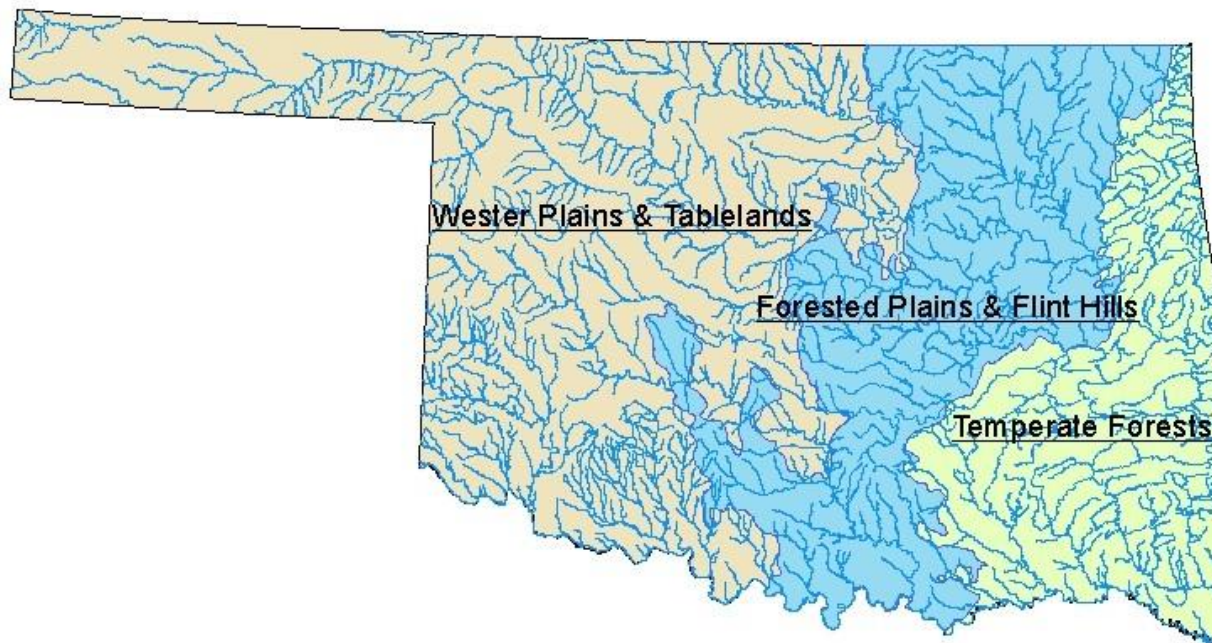
From 2013-2017, Oklahoma completed its 5<sup>th</sup> and 6<sup>th</sup> statewide surveys of lotic waters. In Sample Year (SY) 2013-2014, Oklahoma participated in the National Rivers and Streams Assessment (NRSA) sampling 51 stations. An additional 18 sites were sampled in 2013-2014 that were not part of the NRSA study which increased the sample size for the two-year period to 69 sites. In SY 2015-2017, Oklahoma completed its 6<sup>th</sup> statewide probabilistic study with a sample size of 81 perennial streams and rivers. The new study population for both studies included perennial streams and rivers throughout Oklahoma and continued through the NRSA draw into the remaining oversample sites. So that all sizes of perennial waterbodies were adequately represented, the design assigned unequal proportions to several Strahler Orders, including 1<sup>st</sup> – 2<sup>nd</sup>, 3-4<sup>th</sup>, 5-6<sup>th</sup>, and above 6<sup>th</sup> order rivers. Additionally, the study characterized the three separate aggregated ecoregions of Oklahoma as defined in the “2005-2007 Implementation of a Stream/River Monitoring Sampling Network for the State of Oklahoma” (OWRB, 2009). By combining the two studies, Oklahoma can report on several temporal scales, and on two size classes—smaller (streams) and larger waterbodies (rivers) and the three aggregated ecoregions including the Forested Plains and Flint Hills (FPFH), Temperate Forests (TF), and the Western Plains and Tablelands (WPT). Temporal scales include:

- 69 sites in the 2013-2014 sampling period (51 NRSA sites)
- 81 sites in the 2015-2017 sampling period
- 150 sites over the 2013-2017 sampling period

The probability-based survey was designed to assist Oklahoma’s water quality managers in several ways. Furthermore, in keeping with the environmental goals of the state, an effective long-term management strategy based on sound and defensible science can be developed using this data. The four over-arching goals were:

1. Estimate the condition of multi-assemblage biological indicators for Oklahoma’s waters through a statistically valid approach.
2. Estimate the extent of stressors that may be associated with biological condition.
3. Evaluate the relationship between stressors and condition for use in various long and short-term environmental management strategies.
4. Assess waters for inclusion in Oklahoma’s Integrated Water Quality Report.

The current assessment allows the state to make a statistically valid assessment of the condition for all of Oklahoma's streams and rivers, as required under Section 305(b) of the Clean Water Act (CWA) (ODEQ, 2012). The sample size allows for a statewide estimate of fish, macroinvertebrate, and algal condition on three temporal scales (all years, yearly, and by two years), two size classes (rivers and streams), as well as within the three aggregated ecoregions (FPFH, TF, WPT) (



). Additionally, stressor extent is evaluated for several potential environmental stressors (TP, TN, conductivity, and turbidity). Under the guidelines of the Integrated Listing Methodology (ODEQ, 2012), data allow for the assessment of the Fish & Wildlife Propagation beneficial use on more waters of the state. Although currently limited to certain beneficial uses and associated criteria, the support status of more waters can be determined using data collected in these studies. Finally, the survey provides information that will allow for better long and short-range planning and resource allocation.

A benefit of probabilistic design is that data results can be applied in a much broader context. For example, the relationship of condition can be associated with stressor extent through methodologies like relative risk analysis. The 2013-2017 study yielded a wealth of biological, chemical, and physical data across a broad gradient of environmental conditions which supports the evaluation of these stressor-indicator relationships. Data can be used to calibrate existing biocriteria ranges, establish reference condition, and assist in nutrient criteria development. When integrated with fixed-station networks such as the OWRB's Beneficial Use Monitoring program (BUMP), probabilistic data can assist in identifying local areas of concern.

Also, although not accomplished by this report, landscape metrics can be associated with stressors and condition to develop predictive models. Probabilistic data can also assist in efforts to regionalize environmental concerns. A bottom up approach to management identifies not only statewide issues but allows managers to identify local and regional concerns first, which often

lead to issues farther down the watershed, and put resources where they are needed. This probabilistic methodology adds a valuable layer to that management approach.

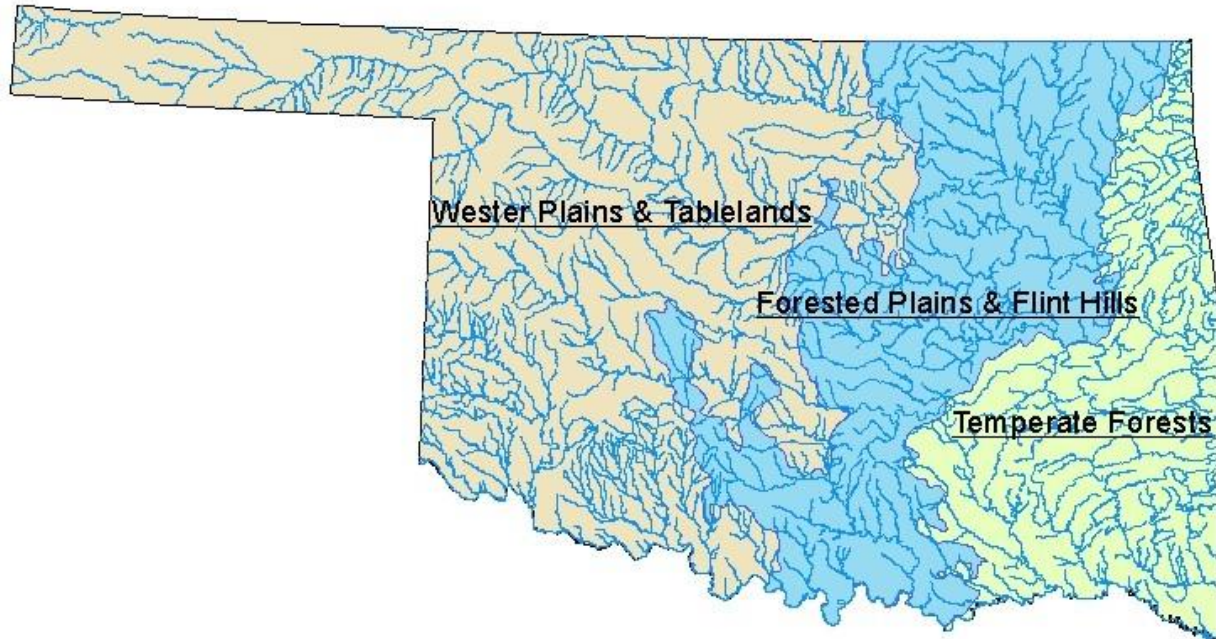


Figure 1. Map of the three Aggregated Ecoregions of Oklahoma- Western Plains and Tablelands (WPT), Forested Plains and Flint Hills (FPFH), and Temperate Forests (TF).

## **METHODS**

### **Study Design**

A Generalized Random Tessellation Stratified (GRTS) survey design (Stevens, 1997; Stevens, Jr., D. L., and A. R. Olsen, 2004) was used to select stream sample sites across the state (USEPA, 2013-2014 NRSA QAPP). The original design for the five-year study emanated from Oklahoma's site file for the 2013-2014 NRSA study. Unequal probability categories were defined separately for Rivers Major (RM), Rivers Other (RO), Large Streams (LS), and Small Streams (SS). A few other categories were also defined such as Revisit (RV), river revisit from 2009 (R9), and stream revisit from 2009 (S9). The terms wadeable and non-wadeable were used to designate Strahler order classes and did not imply that the streams were actually wadeable or non-wadeable, as defined by protocol. For the wadeable stream category, unequal selection probabilities were defined for 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> order streams so that an equal number of sites would occur for each order. Then these unequal selection probabilities were

adjusted by the Wadeable Streams Assessment (WSA) nine aggregated ecoregion categories as defined by the National Aquatic Resource Survey (NARS) survey, so that an equal number of sites would occur in each WSA nine aggregated ecoregion category. For the non-wadeable river category, unequal selection probabilities were defined for 5<sup>th</sup>, 6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> + Strahler order rivers so that the expected number of sites nationally would be 350, 275, 175, and 100 sites, respectively. Then these unequal selection probabilities were adjusted by WSA nine aggregated ecoregion categories so that an equal number of sites would occur in each WSA nine aggregated ecoregion category. Additionally, certain sites were selected as revisit sites from the 2008-2009 NRSA, and included in the initial study design, weighted equally across the Strahler order categories mentioned above. In Oklahoma for the five-year study period (2013-2017) the expected sample size was 150 for both wadeable streams and non-wadeable rivers combined. Oversample sites were provided for each Strahler order grouping. Site replacement was done within the two major Strahler order categories, 1<sup>st</sup>-4<sup>th</sup> and 5<sup>th</sup>+

The study was spatially, temporally, and hydrologically limited. Spatially, the study was limited to only streams defined as perennial in flow and excluded all sites within a reservoir flood pool. Temporal limitations were defined by biological index periods. The index period for fish assemblage in Oklahoma was May 15<sup>th</sup> through September 15<sup>th</sup> with an optional extension to October 1<sup>st</sup> if the stream had not risen above summer seasonal base flow (OWRB, 2013a). The summer index habitat period for macroinvertebrate assemblage in Oklahoma was June 1<sup>st</sup> through September 15<sup>th</sup> with collections completed in as short a time period as possible (OWRB, 2013c). The winter index habitat period for macroinvertebrate assemblage in Oklahoma was January 1<sup>st</sup> through March 15<sup>th</sup>. Hydrologically, this study was limited by extensive flooding in 2015 which made sampling very challenging logistically. However, this obstacle was overcome through planning and rearranging of the sampling schedule.

The study and subsequent site selection were designed to allow for five reporting periods and sub-categorization of “river major”, “river other”, “large stream”, and “small stream” sites. The 2013-2017 study was sub-categorized to evaluate data in one and two-year increments as well as by the three aggregated ecoregions and by rivers and streams. The rolling bi-annual data included 2013-2014, 2014-2015, 2015-2016, and 2016-2017, as well as the total survey period from 2013-2017. The 2013-2017 data was also sub-categorized by three-year increments to assist in trend analysis.

### **Site Reconnaissance**

Limited site accessibility is the most serious problem with any probabilistic study. Unlike a fixed station design, study sites are typically not accessible by public roads and may only be accessed by foot. Compounding the problem is private ownership of land and the need to respect a landowner’s choice of who may or may not access the property. Finally, probabilistic sites are selected from data frames that are not 100% accurate and may include non-candidate sites. Fortunately, proper planning and having an excess of available oversample sites can alleviate these issues. During the EPA’s Wadeable Streams Assessment (USEPA, 2006) and Oklahoma’s Statewide Probabilistic Study (REMAP) (OWRB, 2009) the OWRB developed (with assistance from EPA documentation) and implemented a three stage reconnaissance plan.

The first stage of planning is a “desktop” reconnaissance to determine if the proposed site is a candidate site. Candidate sites must meet certain criteria, including: 1) perennial flow, 2) not within normal pool elevation of a lake (oxbows or reservoirs), 3) not a wetland/swamp dominated river, 4) accessible by foot, and 5) landowner permission granted. Initially, each site was located using a variety of resources including Google Earth Pro, and other GIS mapping

tools (North American Commission for Environmental Cooperation, 1997). For each site, a site reconnaissance and tracking form (Figure 2) was created with the ultimate determination made to “accept” or “reject”. At the outset, required hydrological characteristics were verified, and if not met, the site was rejected without further consideration. Then, a series of site maps containing at least two geographic scales were included with the site tracking form and the necessary information to determine landowner was collected, including legal description of site and county. The County Assessor website is the main source of landowner information. However, for some problem sites, staff used a variety of other resources including previously developed relationships with local landowners/business owners or personal visits to nearby residences. Finally, a landowner permission packet was sent to each landowner, including a standardized permission letter (Figure 3), maps, a study brochure, and self-addressed/stamped envelope for them to review and mail back to the OWRB either approving or not allowing access to their property. Based on landowner response, the site was accepted, accepted with restrictions/further instructions, or rejected. Response to permission requests was occasionally slow for a variety of reasons. Therefore, a two-stage process was developed to deal with slow responses. After two to three weeks staff attempted contact by phone, and if unsuccessful, would send a reminder postcard. If still unsuccessful, in-person contact was attempted. If each of these attempts failed, the site was rejected.

Once site accessibility was verified, and labeled as a study target site, a second planning stage was initiated. The planning objective was simply to collect thorough, well-documented information to assist field crews in locating and accessing sampling reach. Through color aerial satellite imagery, considerable satellite imagery was gathered using the desktop. Notes were incorporated into the tracking form for special considerations such as hazards, best route of entry, time of travel, etc. Unfortunately, some sites required an on-site initial visit to complete the planning phase. Concerns arose about cost versus benefit of an extra site visit. However, over the course of three years, crews discovered that much of the information collected during the initial on-site planning visit was of great benefit on the actual day of sampling. Furthermore, because sites could be visited in batches and only one staff member was required, little expense was incurred.

Final planning stage involved all activities up to the first sampling visit and involved compiling a complete site packet. The packet incorporated all information gathered in stages one and two, including a completed tracking form, landowner permission letter, and pertinent pictures and maps. In addition, all necessary field forms and labels were compiled and a checklist of equipment needed was completed.

During the 2013-2017 study period a total of 250 sites were evaluated. Of these 250 sites, 150 were able to be sampled. The other 100 sites were rejected for various reasons such as access permission was denied by the landowner, dry channel, impounded stream, etc. The two most common reasons a site was rejected was access permission denied and dry channel (Figure 8).

Probabilistic Monitoring – Site Reconnaissance & Tracking Form

Stream Name: Brazil Creek

Site ID: OKLS-1181

Lat/Long: 35.14874 / -94.70434

Site Type: target or oversample

Sample Status: Accepted or Rejected

If rejected, what is the reason:

- Landowner Denied Permission
- Site is Dry
- Site is Impounded (part of a lake)
- Site is Not Riverine Habitat (i.e., wetland, swamp, etc.)
- Site is Not Physically Accessible
- Other, Please Explain:

If rejected, what site replaces this one:

Landowner Contact Information:

John Doe (Doe Land & Cattle Co.)  
P.O. Box A  
Your Town, OK 11111  
(580)555-2222

Landowner Requests:

None. You can drive down to the site if you need to. (see attached permission letter)

Directions/Access to Site:

From Your Town, go west on SH 1 for 3.25 miles. The property is South of this point. Walk or drive across pasture to get to the X-site. (See attached maps)

Figure 2. Template Site Reconnaissance and Tracking Form

Date

John Doe Trust  
C/O Jane Doe  
Rt. 1 Box 1  
Anywhere, OK 74534

Dear Sir/Madam:

The Oklahoma Water Resources Board (OWRB) is conducting a five-year project to perform environmental assessments on 210 to 220 randomly selected streams across Oklahoma. This effort involves on-site visits by OWRB personnel to a stream adjacent to your property to take samples of the water, fish and other aquatic life, and to gather other information concerning stream habitat such as measurements of stream width and depth and observations of stream bed and vegetation characteristics. The findings of the study are not intended for enforcement or regulatory purposes.

One of the sites that we would like to assess is a point on Your Creek located on your property in Section 1, Township 1 N, Range 1 E, in Your County, Oklahoma. We have enclosed a copy of a topographic map with the site identified by an "X" at the specific point on the stream to be sampled.

We are writing to ask for your permission to come onto your property to visit the site and conduct sampling activities. We realize that working on your property is a privilege and we will respect your landowner rights at all times. If you grant us permission, we will make no more than three visits to your land. The first visit will be for site reconnaissance and will occur sometime between March and April of 2013. A crew of one to two people will use your land to access the site and only gather information about site accessibility. In addition, one or two more visits will be made between May and October of 2013 for sampling and collection. We expect to have a crew of no more than four OWRB employees or its contractors coming on site during the sample collection visits. Fish will only be collected during one of these visits.

Once a sampling date is set, OWRB employees will contact you, either by telephone or in person, before entering onto your land. After OWRB staff contact you, they will access the site either on foot or by vehicle and collect the necessary samples and data. Other than driving or walking across your land and walking in and around the stream site, we expect that staff will not leave any trace of their activity. Staff will honor any special instructions you have, such as accessing land only by foot, driving on pasture roads only, and opening and closing gates responsibly.

If you are agreeable to the activities described above, please complete and sign one copy of the "Landowner Permission" page and mail it back to us in the enclosed, stamped return envelope by Date. We have enclosed a duplicate of this page, which you may keep for your records. Please include contact information so that we may contact you by phone. Thank you for your consideration. If you have any questions about this request, please contact please contact Josh Bailey (Biological Monitoring Coordinator) or Chris Hargis (Environmental Programs Specialist) at 405-530-8800. Sincerely,

Josh Bailey  
Probabilistic Monitoring Coordinator

Enclosures:        Topo map  
                         Duplicate original of letter  
                         Return envelope

**LANDOWNER PERMISSION**

I grant permission to the employees of the Oklahoma Water Resources Board to come onto my property and conduct stream sampling activities as described in this letter.

\_\_\_\_\_ Permission granted  
\_\_\_\_\_ Permission granted, subject to the following restrictions or instructions:  
\_\_\_\_\_  
\_\_\_\_\_ Permission not granted

Landowner's Name (please print): \_\_\_\_\_

Landowner's Signature: \_\_\_\_\_

Landowner's Daytime Phone No. \_\_\_\_\_

Figure 3. Template landowner permission letter

## Data Collection

When sites were verified as target a sampling schedule was implemented. All target sites were visited once (in rare instances twice) during a late spring to late summer index period (June 1 – September 15), under base flow conditions. To assess ecological health, one-time collections were made for a variety of biological, chemical, and physical parameters (Table 2). Collections also included a comprehensive water chemistry sample and measurement of *in situ* water quality parameters including water temperature, dissolved oxygen, pH, and specific conductance. Additionally, biological assemblages were collected including fish, macroinvertebrates, sestonic algae (sestonic chlorophyll *a*), and benthic periphyton (benthic algae) in the form of benthic chlorophyll *a*. A comprehensive suite of physical habitat, riparian, and anthropogenic disturbance measurements were made as well as a variety of site observational information along with photodocumentation as needed. The physical habitat and sediment data are only presented in tabular form in this report. The current plan is to submit a future addendum to this report with graphics for these data.

Table 2. Water quality variables included in study.

<b>SAMPLE VARIABLES</b>		
<b><i>In situ</i> Variables</b>		
Dissolved Oxygen (D. O.)	% D. O. Saturation	pH
Water Temperature	Specific Conductance	
<b>Field Variables</b>		
Nephelometric Turbidity	Total Alkalinity	Total Hardness
Instantaneous Flow	Phenolphthalein Alkalinity	
<b>Laboratory Variables--General Chemistry</b>		
Total Kjeldahl Nitrogen	Nitrate/Nitrite	Total Phosphorus
Nitrate Nitrogen	Nitrite Nitrogen	Ammonia Nitrogen
Total Dissolved Solids—gravimetric	Chlorides	Sulfates
Total Settleable Solids	Total Suspended Solids	
<b>Laboratory Variables—Metals</b>		
Arsenic	Cadmium	Chromium
Copper	Lead	Mercury
Nickel	Selenium	Silver
Zinc	Thallium	Calcium
Barium	Iron	Magnesium
Potassium	Sodium	
<b>Biological Variables</b>		
Fish	Macroinvertebrates	Sestonic chlorophyll <i>a</i>
Habitat—NRSA Forms	Habitat—RBP form	Benthic chlorophyll <i>a</i>

From 2013-2014, all NRSA collections strictly followed the NRSA field operations manual (USEPA, NRSA 2013-2014 Field Operations Manual, 2013) and Quality Assurance Project Plan (USEPA, 2013-2014 NRSA QAPP). Sample analyses for these years were provided by the NRSA contract laboratories and data/assessments for all samples and assemblages were provided by the USEPA through either their National Aquatic Resource Survey (NARS) Share file portal (<https://nars.sharefile.com/>) (USEPA, 2019) or personal communication from EPA staff (Mitchell, Personal Communications, 2013-2014 NRSA Data, USEPA. ).

For the remaining 2013-14 sites and for SY 2015-17, data for water quality variables was collected following the OWRB Standard Operating Procedures (OWRB, 2013). Several variables (pH, dissolved oxygen, water temperature, and specific conductance) were monitored *in-situ* utilizing a YSI® multi-probe instrument. The probes (except water temperature) of all instruments were calibrated at least weekly and verified daily with appropriate standards. Measurements were taken at the thalweg of the channel at a depth of at least 0.1 meters and no greater than one-half of the total depth. The data were uploaded from the instrument and saved to a data recorder, then transferred manually to a field log sheet or electronically on a field computer and uploaded into the OWRB Water Quality database. Data for all other variables were amassed from water quality samples collected at the station. Grab samples were the standard method of collection during this study. The sample was collected at the deepest, fastest flowing portion of the horizontal transect by completely submerging the bottle, allowing it to fill to the top, and capping the bottle after all air was removed. Prior to filling, each bottle was primed (rinsed) three times with ambient stream water. Each sample included three bottles for general chemistry analyses (two ice preserved and one sulfuric acid preserved), one bottle for total metals analysis (nitric acid preserved), two bottles for dissolved metals analysis and one bottle each for field chemistry analysis and sestonic chlorophyll *a* (ice preserved and kept in the dark). For benthic chlorophyll *a*, a sample was composited, placed on ice to be preserved, and kept dark. For 2013-2014, sample analysis was provided by the NRSA contract laboratories. From 2015-2017, the Oklahoma Department of Environmental Quality-State Environmental Laboratory (ODEQ-SEL) in accordance with the ODEQ's Quality Management Plan (QTRACK No. 19-014) (ODEQ, 2018) analyzed samples for most parameters listed in Table 2. OWRB personnel measured hardness and alkalinity using Hach® titration protocols, and nephelometric turbidity using a Hach® Portable turbidimeter.

Samples for algal biomass were collected in both the sestonic and benthic zones of each waterbody and processed in accordance with OWRB standard operating procedures (OWRB, 2006b). Sestonic samples were processed from water collected during the general water quality collection. Sestonic chlorophyll *a* samples were processed by passing the sample water through a 0.45 micron filter (47-mm diameter) subsequently putting the filter in the dark (wrapped inside aluminum foil) placing the filter on dry ice (if in the field) or in a freezer (if at the OWRB lab) until the filter can be ground and sent in for analysis by the Oklahoma Department of Environmental Quality. A benthic sample was processed from a reach-wide transect based collection composite. Benthic filters were extracted using an alternate method, whereby filters are placed in a standard aliquot of ethanol (25 mL) and extracted at room temperature for at least 72 hours. All chlorophyll *a* samples were analyzed by NRSA contract lab (2013-2014) and the ODEQ SEL (2015-2017) under the previously mentioned QMP (ODEQ, 2018). Additionally, a 50-mL sample was collected from both water column and benthic composites for subsequent sestonic and benthic algal ID analysis. These samples were preserved with 10% formalin, wrapped with foil, and placed at 4°C.

Biological assemblages included aquatic macroinvertebrates and fish that were collected in accordance with Oklahoma's Rapid Bioassessment Protocols (RBP) (OWRB, 1999) and the OWRB's biological collection protocols (OWRB, 2013a; OWRB, 2013c). Collections were completed over a 150-4000 meter reach depending on average wetted width of the selected site. Fish were collected during the summer index period using a backpack, pram (tote barge), or boat depending upon the depth of the river or stream. The pram unit consisted of a Smith-Root 2.5 generator powered pulsator (GPP) attached to a 3000W Honda generator, and were operated with DC output current at 2-8 amps. The boat was equipped with a 9.0 GPP powered by a 9,000 Kohler generator, and operated at a DC output range of 4-30 amps. A battery

powered Smith-Root/Aquashock backpack electrofisher was used on rare occasions in sites too narrow for pram setup. Using two netters (one netter during NRSA site visits) with ¼ inch mesh dip nets collections were made in an upstream direction (wadeables) or downstream direction (boatables) with target effort depending on reach length, site conditions, and protocol. When existing habitats could not be effectively electrofished, supplemental or stand-alone collections were made using 6' X 10-20' seines of ¼ inch mesh equipped with 8' brailles. Fish were processed at several intervals during each collection. Most fish were processed in the field, including enumeration and identification to species. Representative site voucher collections were made with a combination of appropriate photodocumentation and representative species vouchers. Fish that were not readily identifiable were fixed in 10% formalin and returned to the OWRB laboratory for identification and enumeration. Additionally, all representative voucher fish were fixed in a 10% formalin solution, subsequently preserved in 70% ethanol and permanently housed in the OWRB fish collection library that is currently located at the University of Central Oklahoma in Edmond, Oklahoma. OWRB fish photodocumentation is housed on one of the OWRB network drives.

Aquatic macroinvertebrate collections were made during the summer and winter index period of each study year (OWRB, 2013c). Each sampling event included a variety of samples as defined in the OWRB's macroinvertebrate collection protocols. At wadeable sites staff collected samples from available targeted habitats including streamside vegetation, woody debris, and rocky riffles. The streamside vegetation (SSV) and woody debris (Woody) collections were semi-qualitative samples collected over flowing portions of the reach for total collection times of three (SSV) and five minutes (Woody), respectively. The streamside sample was collected using a 500-micron D-frame net to agitate various types of fine structure sample including fine roots, algae, and emergent and overhanging vegetation. Likewise, the wood sample was collected using a 500-micron D-frame net to agitate, scrape, and brush wood of any size in various states of decay. A standard dish cleaning brush was utilized to help dislodge macroinvertebrates from woody debris. Wood that could be removed from the stream was scanned for additional organisms. Riffle collection was a quantitative sample of three composites representing slow, medium, and fast areas of the selected riffle. Each sub-sample was collected by fully disturbing one square meter of substrate into a 500-micron zooplankton seine (kick net). The standard household dish washing brush was also utilized in collections of macroinvertebrate riffle samples. At non-wadeable sites, a large river collection protocol was used, with sub-protocol determined by dominant reach substrate, either fine substrate (silt and sand) or coarse substrate (fine gravel and larger). In each protocol, dominant substrate is sampled at each transect and within each sub-reach the dominant targeted habitat is sampled. The primary difference between sub-protocols was the treatment of samples. Coarse substrate protocol requires that all samples are processed and composited in a final collection type called large river coarse-composite (LRC-Comp). While at the large river fine (LRF) sites, collections were kept separate and processed as LRF-THab (targeted habitat) and LRF-Sub (substrate) samples in two different D-frame nets. At all LR (large river) sites, a riffle composite is collected, if available. All samples were field post-processed in a 500-micron sieve bucket to remove large material and silt to reduce sample size to fill no more than ¾ of a quart sample jar. All nets and buckets were thoroughly scanned to ensure that no organisms were lost. After processing, each sample type was preserved independently in quart size wide mouth polypropylene jars with ethanol as a preservative and an interior and exterior label for sample differentiation. Samples were then sent to the contract laboratory for sorting, identification, and enumeration. Taxonomic data for each sample were grouped and metrics calculated by the contract laboratory. In general, most organisms were identified to genera with midges identified to tribe. The contract lab used in this study was Rhithron Associates, Inc., Missoula, MT.

Additionally, a detailed habitat assessment was conducted targeting in-stream substrate, in-stream fish cover (ISC), wetted and bank full width, water depth, bank and riparian measurements, as well as anthropogenic disturbance characteristics. Collections included both Oklahoma's semi-qualitative RBP habitat protocols (OWRB, 2013b), and the NRSA semi-quantitative habitat protocols (USEPA, NRSA 2013-2014 Field Operations Manual, 2013). To date, the USEPA assessments have not been processed.

Discharge and/or stage data were also collected at each site (OWRB, 2016a). Flow was determined through several methods including direct measurement of instantaneous discharge using a flow meter, interpolation of flow from a stage/discharge rating curve developed by the United States Geological Survey (USGS) or the OWRB, or through estimation of discharge using a float test (OWRB, 2004).

For a more detailed discussion of sampling procedures please visit the OWRB website at: <http://www.owrb.ok.gov/quality/monitoring/monitoring.php#SOPs>

### **Analytical Methods**

Condition classes for biotic assemblages and stressors were assigned by either the USEPA or OWRB, depending on study year. All data collected from 2013-2014 were processed and assessed by USEPA staff and associated labs. All data collected from 2015-2017 were processed and assessed by OWRB staff and/or contracted labs.

### **Analysis of Fish Biological Condition**

Fish community structure can be a useful biological indicator of water quality. Fishes have highly variable tolerance levels to water pollution. There are over 170 species of fishes in Oklahoma. These 27 families of Oklahoma fishes are highly variable in life span, tolerance, spawning behavior, and other life history traits (Jester, 1992). Spatially these species are all highly variable across Oklahoma. Some species are ubiquitous and occur throughout Oklahoma such as the Red shiner. Other species such as the Banded pygmy sunfish only occur in Southeastern Oklahoma in a very limited range of specialized stream sites. Oklahoma also has its fair share of threatened and endangered fishes such as the Leopard darter, Arkansas river shiner, and the Neosho madtom. The fish community that is collected from a stream/river can tell you a lot about the water quality and habitat type of the site sampled. Fish are highly susceptible to low oxygen levels that are often related directly to water quality degradation by inputs of high levels of nutrients (TP, TN) that may result in excess algal blooms.

Fish IBIs are a very useful tool for evaluating the health of a fish community. These IBIs use specific metrics to populate a score that is used to determine whether a fish community is in good, fair, or poor condition (Table 15) and to determine if Beneficial uses such as Fish and Wildlife Propagation are being met.

Fish data were analyzed using two indices of biological integrity (IBI) commonly used in Oklahoma bioassessment studies, as well as the IBI developed by the NRSA. State biocriteria methods are outlined in Oklahoma's Use Support Assessment Protocols (OWRB, 2016b). In addition, an IBI commonly used by the OCC's Water Quality Division was used to provide an alternative bioassessment (OCC, 2005a; OCC, 2008; ODEQ, 2012). All metrics and IBI calculations were made using the OWRB's "Fish Assessment Workbook", an automated

calculator OWRB staff built in Microsoft Excel (OWRB, 2016). The NRSA condition assessments were taken from the tabular fish condition file on the USEPA's NARS Share file web site (USEPA, 2019).

Oklahoma's Fish Index of Biological Integrity (OKFIBI) uses a common set of metrics throughout the state (**Error! Reference source not found.**). Each metric is scored as 5, 3, or 1 depending on the calculated value, and scores are summed to reach two subcategory totals for sample composition and fish condition (OWRB, 2016). The two subcategories are then summed for a final IBI score. The score is compared to an ecoregional reference value to determine support status. For example, if the final IBI score is between 25-34, the status for sites in the Ouachita Mountain Ecoregion is deemed undetermined. Likewise, for scores greater than 34 and less than 25, the status is supported or not supported, respectively.

The Oklahoma Conservation Commission Fish Index of biological Integrity (OCCFIBI) uses "a modified version of Karr's Index of Biotic Integrity (IBI) as adapted from Plafkin et al., 1989 (OCC, 2008; ODEQ, 2012). The metrics as well as the scoring system are in Table 4. Metric scores are calculated in two ways for both the test site and composite reference metric values of high-quality streams in the ecoregion (OCC, 2005a). Species richness values (total, sensitive benthic, sunfish, and intolerant) are compared to composite reference value to obtain a "percent of reference". A score of 5, 3, or 1 is then given to the site depending on the percentages outlined in Table 5, while the reference composite is given a default score of 5. Proportional metrics (% individuals as tolerant, insectivorous cyprinids, and lithophilic spawners) are scored by comparing the base metric score for both the test site and the reference composite to the percentile ranges given in Table 4. After all metrics are scored, total scores are calculated for the test and composite reference sites. Finally, the site final score is compared to the composite reference final score and a percent of reference is obtained. The percent of reference is compared to the percentages in

Table 5 and an integrity classification is assigned with scores falling between assessment ranges classified in the closest scoring group.

Fish taxonomic results for each site were analyzed to produce a raw score for the OKFIBI and a percent of reference score for the OCCFIBI. Additionally, when available, the condition class determined from the NRSA analysis was included in the evaluation. A combination of these assessments were considered when assigning a final fish condition class of good, fair, or poor.

Table 3. Index of biological integrity used to calculate Oklahoma's fish scores. Referenced figures may be found in OAC 785:15: Appendix C.

Metric	Value	Scoring			Score
		5	3	1	
Total # of species		>23	12-22	<12	
Shannon's Diversity based upon numbers		>2.50	2.49-1.50	<1.50	
# of sunfish species		>3	2 to 3	<2	
# of species comprising 75% of sample		>5	3 to 4	<3	
Number of intolerant species		>5	3-5	<3	
Percentage of tolerant species		<33%	33-57%	>57%	
TOTAL SCORE FOR SAMPLE COMPOSITION					0
Percentage of lithophils		>36	18 to 36	<18	
Percentage of DELT anomalies		<0.1	0.1-1.3	>1.3	
Total individuals		>200	75 to 200	<75	
TOTAL SCORE FOR FISH CONDITION					0
TOTAL SCORE					0

Table 4. Metrics and scoring criteria used in the calculation of OCC's index of biological integrity.

Metrics	5	3	1
Number of species	>67%	33-67%	<33%
Number of sensitive benthic species	>67%	33-67%	<33%
Number of sunfish species	>67%	33-67%	<33%
Number of intolerant species	>67%	33-67%	<33%
Proportion tolerant individuals	<10%	10-25%	>25%
Proportion insectivorous cyprinid individuals	>45%	20-45%	<20%
Proportion individuals as lithophilic spawners	>36%	18-36%	<18%

Table 5. Integrity classification scores and descriptions used with OCC's index of biological integrity.

% Comparison to the Reference Score	Integrity Class	Characteristics
>97%	Excellent	Comparable to pristine conditions, exceptional species assemblage
80 - 87%	Good	Decreased species richness, especially intolerant species
67 - 73%	Fair	Intolerant and sensitive species rare or absent
47 - 57%	Poor	Top carnivores and many expected species absent or rare; omnivores and tolerant species dominant
26 - 37%	Very Poor	Few species and individuals present; tolerant species dominant; diseased fish frequent

### **Analysis of Macroinvertebrate Biological Condition**

Macroinvertebrates play a key role in aquatic ecology as both a food source for fish and as a grazer on algae. They have long been used as biological indicators of water quality for a variety of reasons. For instance, some macroinvertebrates spend their entire life in water. However, the life history of macroinvertebrates is highly variable. Other species only live in water as immature forms before hatching and flying away to spend their adult life as terrestrial insects. There are many factors that influence macroinvertebrate health such as quality/abundance of food sources, dissolved oxygen levels, bottom substrate types, nutrient levels, water pH, and riparian vegetation (Utah, 2019). These biological indicators are very sensitive to disturbances in riparian zones and degradation of water quality. The riparian zone controls food and habitat availability such as rotten wood and leaf matter. These are key elements to the life cycles of many macroinvertebrates. Stream morphology, water quality and overall stream health play important roles in determining the composition of macroinvertebrate communities that can thrive in a stream or river. Macroinvertebrate mobility and habitat preferences are highly variable. Species such as crayfish are very mobile while others may spend their entire aquatic life cycle in a single riffle. However, macroinvertebrates are not as mobile as fish are. This makes them highly susceptible to any and all changes to their aquatic environment such as the addition of pollutants. This is an example of why macroinvertebrates are very useful indicators of water quality and stream health.

Macroinvertebrate data were analyzed using a Benthic-IBI (B-IBI) developed for Oklahoma benthic communities (OCC, 2005a) and commonly used by the OCC and OWRB Water Quality Division (OCC, 2008; OWRB, 2009; OWRB, 2010a; ODEQ, 2012), as well as the IBI developed by the NRSA. Metrics and scoring criteria (Table 6) are taken from the original “Rapid Bioassessment Protocols for Use in Streams and Rivers” (Plafkin, 1989) with slight modifications to the EPT/Total and Shannon-Weaver tolerance metrics (OCC, 2008). Metrics were calculated by OWRB contractors and IBI calculations were made using the OWRB’s “B-IBI Assessment Workbook v. 4”, an automated calculator built by OWRB Staff in Microsoft Excel (OWRB, 2016). The NRSA condition assessments were taken from the tabular macroinvertebrate condition file on the USEPA’s NARS share file site (USEPA, 2019).

Calculation of the B-IBI is similar to the fish OCC-IBI discussed previously. Metric scores are calculated in two ways for both test site and composite reference metric values of high-quality streams in each ecoregion (OCC, 2008). Species richness (total and EPT) and modified HBI values that are compared to the composite reference value to obtain a “percent of reference”. A score of 6, 4, 2 or 0 is then assigned to the site depending on the percentages outlined in Table 6., while the reference composite is given a default score of 6. Proportional metrics (% dominant 2 taxa and %EPT of total) as well as the Shannon-Weaver Diversity Index are scored by comparing the base metric score for both the test site and reference composite to the percentile ranges given in Table 6. After all macroinvertebrate metrics are scored, total scores are calculated for test and composite reference sites. The site final score is then compared to the composite reference final score and a percent of reference is obtained (Appendix C, Table 18). The percent of reference is compared to the percentages in Table 7; and an integrity classification is assigned with scores falling between assessment ranges classified in the closest scoring group.

Macroinvertebrate taxonomic results for each site were analyzed to produce a percent of reference score for the OKBIBI. From these scores, biological integrity classifications were assigned. For NRSA sites, the condition classification assigned by the NRSA was used since samples were processed as 500 individual sub-samples. Instead of rarifying samples to a 100 individual sub-sample to allow use in Oklahoma’s B-IBI, it was decided that using NRSA

condition assignments was more defensible and efficacious for final data analyses. Furthermore, the NRSA IBI was used to assign condition classes for large rivers that were too large to be processed through Oklahoma B-IBI. These samples were compared to national reference metrics and screening limits developed for the NRSA.

Table 6. Metrics and scoring criteria used in the calculation of the B-IBI.

B-IBI Metrics	6	4	2	0
Taxa Richness	>80%	60-80%	40-60%	<40%
Modified HBI	>85%	70-85%	50-70%	<50%
EPT/Total	>30%	20-30%	10-20%	<10%
EPT Taxa	>90%	80-90%	70-80%	<70%
% Dominant 2 Taxa	<20%	20-30%	30-40%	>40%
Shannon-Weaver Diversity Index	>3.5	2.5-3.5	1.5-2.5	<1.5

Table 7. Integrity classification scores and descriptions used with the B-IBI.

% Comparison to the Reference Score	Biological Condition	Characteristics
>83%	Non-impaired	Comparable to the best situation expected in that ecoregion; balanced trophic and community structure for stream size
54 - 79%	Slightly Impaired	Community structure and species richness less than expected; percent contribution of tolerant forms increased and loss of some intolerant species
21 - 50%	Moderately Impaired	Fewer species due to loss of most intolerant forms; reduction in EPT index
<17%	Severely Impaired	Few species present; may have high densities of 1 or 2 taxa

### **Analysis of Algal Biomass**

Algae play a key role in aquatic ecology acting as an important primary producer in aquatic food webs providing a food source for a wide variety of fish and macroinvertebrates. Furthermore, algae are indispensable producers of oxygen for aquatic organisms. Algal blooms are also an important indicator of water quality perturbation and nutrient productivity. Introduction of nutrients to waterbodies occurs through several sources including runoff from urban and agricultural areas, wastewater treatment discharges, and a variety of other sources. As nutrient concentrations increase, uptake by primary producers increase. This leads to algal blooms which may result in stress to fish and/or fish kills if toxic algae are present or if oxygen levels drop too low. As eutrophication happens, aquatic life and human health beneficial uses can become impaired, as well as the aesthetic and recreational appeal of waterbodies. This sort of impact to our water resources can be detrimental to not only the fish and wildlife propagation beneficial use but also to the recreational use of lakes and rivers if they must be closed during heavy use times (i.e. holidays) due to concerns about harmful algal blooms. This can be detrimental to the local economy near a popular lake (reservoir) or river. High levels of algae

may also result in taste and odor issues in drinking water. In addition, high levels of harmful bacteria may also cause human health concerns and make drinking water unsafe.

In order to quantify eutrophication, algae were measured in both the benthic and water column areas of all study streams. Various measures exist to determine algal biomass including chlorophyll *a* and ash free dry mass. For this study, chlorophyll *a* concentrations were calculated because the Oklahoma Water Quality Standards (OWQS) (OWRB, 2016c) provide screening levels for both benthic and sestonic chlorophyll *a*.

To estimate condition of algae, chlorophyll *a* concentrations were compared to several screening levels. First, Oklahoma's Use Support Assessment Protocol (USAP) (OWRB, 2016c) provides a screening level for chlorophyll *a* in the aesthetic beneficial use. A value of 100 mg/m<sup>2</sup> represents a nuisance level for benthic algae and was used as the cut-point for poor-fair condition. Second, the OWRB has collected chlorophyll *a* across the state for several programs throughout the years. To provide an alternate screening level, the 25<sup>th</sup> percentile of all OWRB benthic data were calculated at 45.7 mg/m<sup>2</sup>, which was used as the cut-point for fair-good condition. Similarly, several screening levels were established for sestonic chlorophyll *a*. The OWQS includes a standard for sensitive water supplies of 10 mg/m<sup>3</sup> of chlorophyll *a* (OWRB, 2016c), which was set as the fair-good cut-point for condition assessment. Additionally, to establish the cut-point for the poor-fair condition, the distribution of all OWRB sestonic chlorophyll *a* data were considered as a screening level (OWRB, 2009). The mean of all concentrations calculates at 19 mg/m<sup>3</sup> and was set as the poor-fair cut-point for sestonic chlorophyll *a* analyses.

### **Stressor Methodology**

During each visit several physical and water quality parameters were collected. These included nutrients, *in situ* measurements, metals, and salinity (specific conductivity) (Table 2). Stressor concentration can have a negative effect on biological communities. This effect can lead to decreased biological integrity (e.g., the effect of nutrients on fish condition) or may be responsible for the increase in a negative condition (e.g., the effect of total phosphorus on sestonic algal biomass concentration). Quantifying stressor extent is important for a variety of reasons including development and refinement of water quality screening levels and criteria, locating hotspots, and understanding the cause and effect relationship between stressors and indicators of biological integrity. Stressor descriptions are given in Table 8.

Table 8. Descriptions of stressors affecting biological condition.

Stressor Description	Stressor (code)	Source
Total nitrogen screening level (SL) from the National Rivers and Streams Assessment (NRSA)	TN_NRSA	USEPA
Total nitrogen SL from USEPA's regional nutrient criteria development	TN_ECO	USEPA
Total phosphorus SL from the NRSA	TP_NRSA	USEPA
Total phosphorus SL from USEPA's regional nutrient criteria development	TP_ECO	USEPA
Conductivity SL from the NRSA	Cond_NRSA	USEPA
Conductivity SL based on regional OWRB historical data	Cond_ECO	USEPA
Turbidity SL from USEPA's regional nutrient criteria development	Turb_ECO	USEPA
Sediment based on sediment metric from NRSA and combination of %loose bed material, % embeddedness, and % deep pools from Oklahoma's Rapid Bioassessment	Excess_Sed	USEPA/ OWRB
Instream cover assessment from the NRSA	InstCov	USEPA
Riparian vegetation cover from the NRSA	RipVegCov	USEPA
Metals chronic criteria for fish/wildlife propagation beneficial use housed in App. G, Table 2 of OWQS	XxChronic	OWRB

Nutrient stressors include measures of total phosphorus and total nitrogen (nitrate + nitrite + total Kjeldahl nitrogen). Two sources were used to determine screening levels for each parameter giving a variety of nutrient levels based upon stream characteristics and/or regional variation (Table 9). First, regional nutrient criteria were developed based on Omernik Level III ecoregions. The lower end thresholds represent the 25<sup>th</sup> percentile of data from a variety of sources (USEPA, 2000a; USEPA, 2001b; USEPA, 2001a; USEPA, 2001b; OWRB, 2009), while the upper end thresholds were developed from OCC regional monitoring data(OCC, 2005b; OCC, 2006a; OCC, 2006b; OCC, 2007; OCC, 2008; OCC, 2014). The nutrient cut-point thresholds are in Table 9.

Additionally, both salinity (specific conductivity) and turbidity were evaluated as water quality stressors and are described in Table 10. Conductivity was used as a surrogate for salinity and several sources including both the USEPA regional criteria development (USEPA, 2000a; USEPA, 2000b; USEPA, 2001a; USEPA, 2001b) and regional screening limits developed for Oklahoma's original statewide assessment were used for data analysis (OWRB, 2009). Turbidity screening levels were based only on the USEPA regional criteria development reports. The cut-points for conductivity and turbidity are provided in Table 10.

Numerical criteria for metals are housed in Appendix G, Table 2 of the Oklahoma Water Quality Standards (OWQS) (OWRB, 2016c). The OWQS provides criteria for several metals, but only cadmium, copper, lead, selenium, and zinc are considered in this study (Table 16 and Table 20). These analytes have both ecological and human health significance and appear often in Oklahoma's Integrated Report as causes of impairment (ODEQ, 2018). No other metals showed any level of potential impairment in the study. To facilitate analysis, dissolved metals concentrations were compared to the dissolved chronic criterion.

Sedimentation was analyzed as a potential stressor to biological condition by using the state rule (Table 19) (ODEQ, 2012). For this report, only stressor condition (good, fair, poor) was calculated (Table 19). To date, no relative risk/attributable risk were calculated for sediment or

other habitat parameters. These data may be provided in a future addendum to this report. For sites monitored as part of the NRSA, sedimentation assessments were taken from the tabular habitat condition file on the USEPA's NARS Share file web site (USEPA, 2019). For sites monitored in 2015-2017, metrics were calculated based on results from Oklahoma's Rapid Bioassessment Protocol (OWRB, 1999; OWRB, 2013b; OWRB, 2013c). The assessment consists of a variety of measurements including discharge, stream width and depth, substrates, embeddedness, habitat classification (pool, run, and riffle), fish cover, presence of point bars, erosion, and riparian structure. Metrics are scored based on predetermined ranges and a total score is obtained (Table 19). Oklahoma's USAP (OWRB, 2016c) contains a protocol for determining sedimentation based upon loose bottom substrates (%LBS), embeddedness (%EMB), and presence of deep pools (%DP). Screening levels for sedimentation metrics are determined by comparing final site scores to a percent of reference condition. Reference condition is derived from the habitat scores for ecoregion based on high quality sites developed by the OCC (OCC, 2005a). For the most part, all high-quality sites in an Omernik Level III ecoregion were used to develop reference condition. However, in certain ecoregions, some Omernik Level IV ecoregions were broken out from the whole. Omernik Level IV ecoregions used are the Broken Red Plains and Cross Timbers Transition of the Central Great Plains and the Arbuckle Uplift of the Cross Timbers. Additionally, the reference condition used is separated by aquatic life tier, and sites used to determine reference condition are required to be within two Strahler orders of the test stream. Finally, the cut-points for poor-fair-good are based on predetermined percent of reference for each metric, with two or three metrics deemed to be fair or poor, respectively (Table 19). Additionally, both instream cover and riparian vegetative cover were also evaluated as part of the NRSA. These stressors are included in the analysis of NRSA sites (Table 16).

### **Statistical Methods**

Processing of data for indicator extent, stressor extent, relative risk, and attributable risk values were accomplished by our colleagues at the USEPA Office of Wetlands, Oceans and Watersheds with R-statistical Software (Mitchell, EPA Assistance, 2019-2020) using R-scripts developed for the NARS program (Van Sickle, J., 2012). Adjusted site weights were calculated and provided by our colleagues with the USEPA Western Ecology Division (Kincaid, 2019). References to ecoregions throughout this document refer to those published by USEPA (Omernik, J.M., 1987).

Table 9. Ecoregion screening levels used as good/fair/poor cut-points for nutrient stressor analyses.

Ecoregion	TN_NRSA Poor_Fair (mg/L)	TN_NRSA Fair_Good (mg/L)	TN_ECO Poor_Fair (mg/L)	TN_ECO Fair_Good (mg/L)	TP_NRSA Poor_Fair (mg/L)	TP_NRSA Fair_Good (mg/L)	TP_ECO Poor_Fair (mg/L)	TP_ECO Fair_Good (mg/L)
Southwest Tablelands	1.570	0.698	1.050	0.450	0.095	0.052	0.055	0.025
Central Great Plains	1.570	0.698	1.600	0.840	0.095	0.052	0.130	0.090
Cross Timbers	1.570	0.698	0.900	0.680	0.095	0.052	0.110	0.038
Arbuckle Uplift	1.570	0.698	1.500	0.680	0.095	0.052	0.050	0.038
South Central Plains	2.078	1.092	0.750	0.385	0.108	0.056	0.070	0.050
Ouachita Mountains	0.535	0.296	0.450	0.300	0.024	0.018	0.025	0.010
Arkansas Valley	0.535	0.296	0.683	0.270	0.024	0.018	0.060	0.043
Ozark Highlands	0.535	0.296	1.500	0.379	0.024	0.018	0.070	0.007
Central Irregular Plains	3.210	1.750	1.150	0.712	0.338	0.165	0.160	0.093

Table 10. Ecoregion screening levels used as good/fair/poor cut-points for conductivity and turbidity stressor analyses.

Ecoregion	Cond_NRSA Poor_Fair (uS/cm2)	Cond_NRSA Fair_Good (uS/cm2)	Cond_ECO Poor_Fair (uS/cm2)	Cond_ECO Fair_Good (uS/cm2)	Turb_ECO Poor_Fair (NTU)	Turb_ECO Fair_Good (NTU)
Southwest Tablelands	2000	1000	2300	1000	20	12
Central Great Plains	2000	1000	2925	1000	45	22
Cross Timbers	2000	1000	1000	550	40	4
Arbuckle Uplift	2000	1000	1000	500	7	4
South Central Plains	1000	500	500	180	20	10
Ouachita Mountains	1000	500	500	65	10	5
Arkansas Valley	1000	500	500	160	20	7
Ozark Highlands	1000	500	500	285	5	2
Central Irregular Plains	2000	1000	1000	450	40	16

## RESULTS—EXTENT AND CONDITION ESTIMATES

### Site Evaluation and Miles Assessed

Between the years of 2013 and 2017 a total of 150 randomly chosen sites were chosen as candidate target sites representing a total of 21,101 river/stream miles. The total sampleable river and stream miles assessed for the study period breaks down as follows:

- Total Miles Assessed= 21,101 ( Figure 4)
- SY\_13 Total Miles Assessed = 5,525
- SY\_14 Total Miles Assessed = 5,349
- SY\_15 Total Miles Assessed = 3,922
- SY\_16 Total Miles Assessed = 3,057
- SY\_17 Total Miles Assessed = 3,248
- Total River Miles Assessed (2013-2017) = 6,068
- Total Stream Miles Assessed (2013-2017) = 15,033

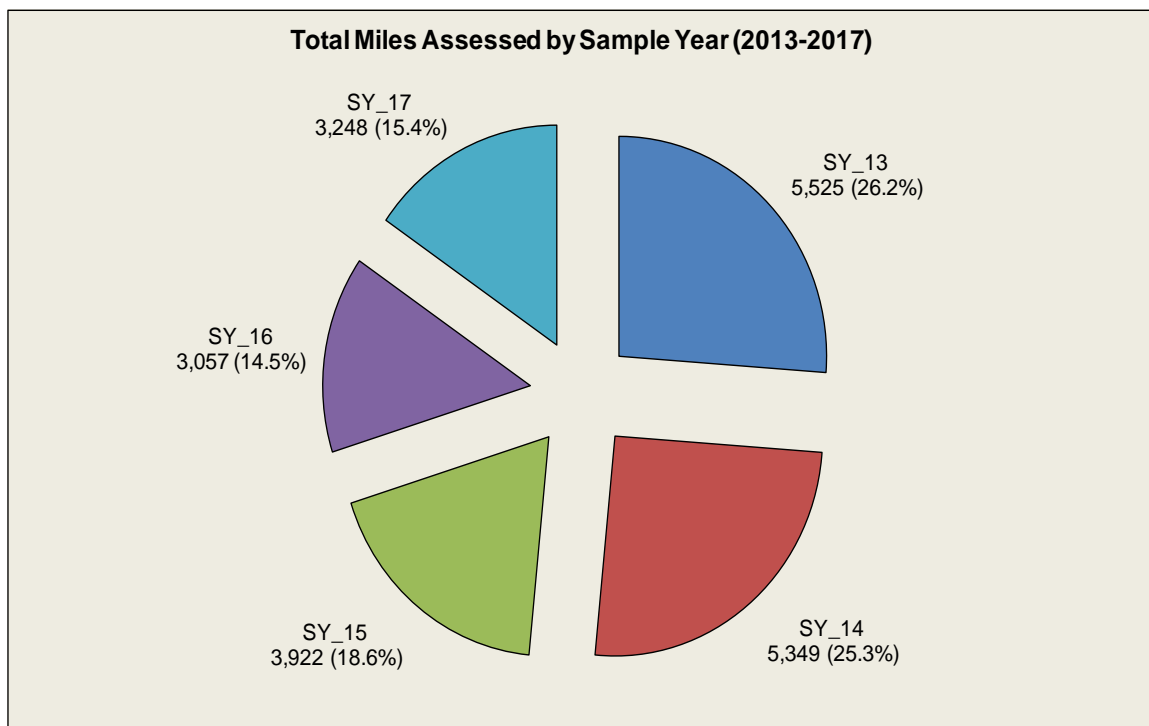


Figure 4. Total Miles Assessed and Percentages of Total Miles for Each Sample Year for the 2013-2017 Study Period. Total Miles Assessed= 21,101.

Total miles assessed for this study were calculated for rolling two-year study periods (13-14, 14-15, 15-16, and 16-17) (Figure 5). In addition, total miles assessed were also calculated for the three Aggregated Oklahoma ecoregions (FPFH, TF, and WPT) (Figure 6), and for a comparison of rivers versus streams for the five year study period (Figure 7). The 3 Aggregated ecoregions of Oklahoma are the Forested Plains and Flint Hills (FPFH), the Temperate Forests (TF), and the Western Plains and Tablelands. These three aggregated ecoregions have been used to combine similar Level three ecoregions of Oklahoma into more manageable units (Figure 1). Additionally, Figure 8 shows the site evaluation status for all sites. For the total study period 250 sites were evaluated and 150 were sampled.

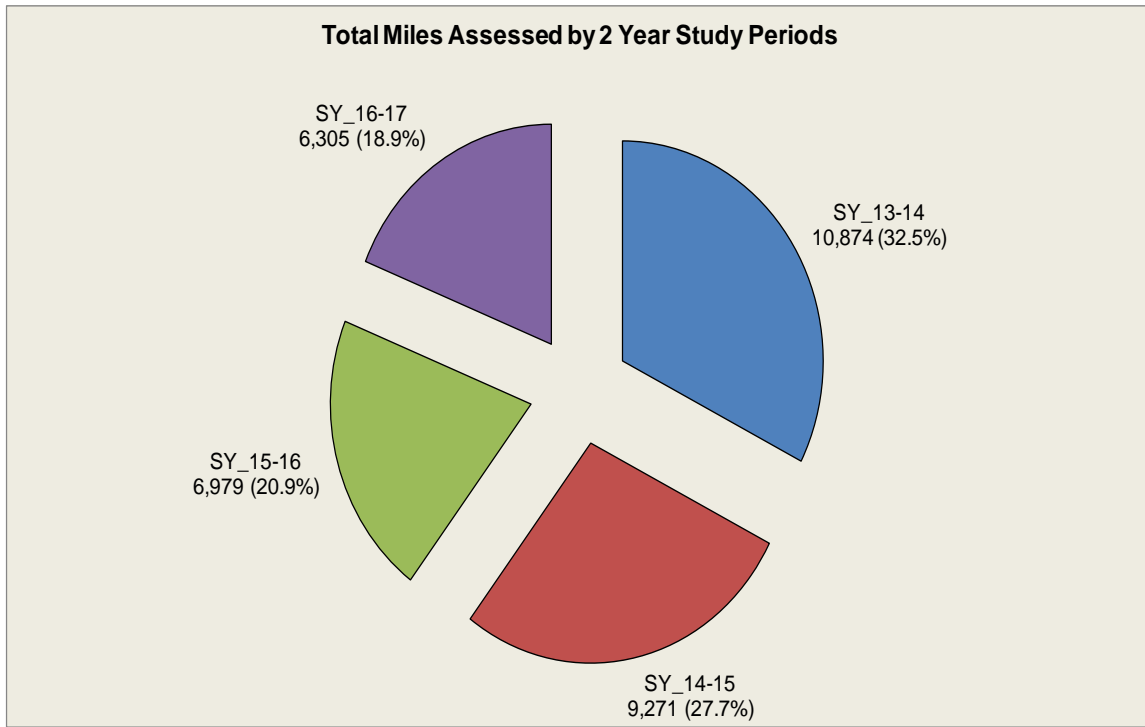


Figure 5. Total Miles Assessed and Percentages of Total Miles by Two Year Study Periods.

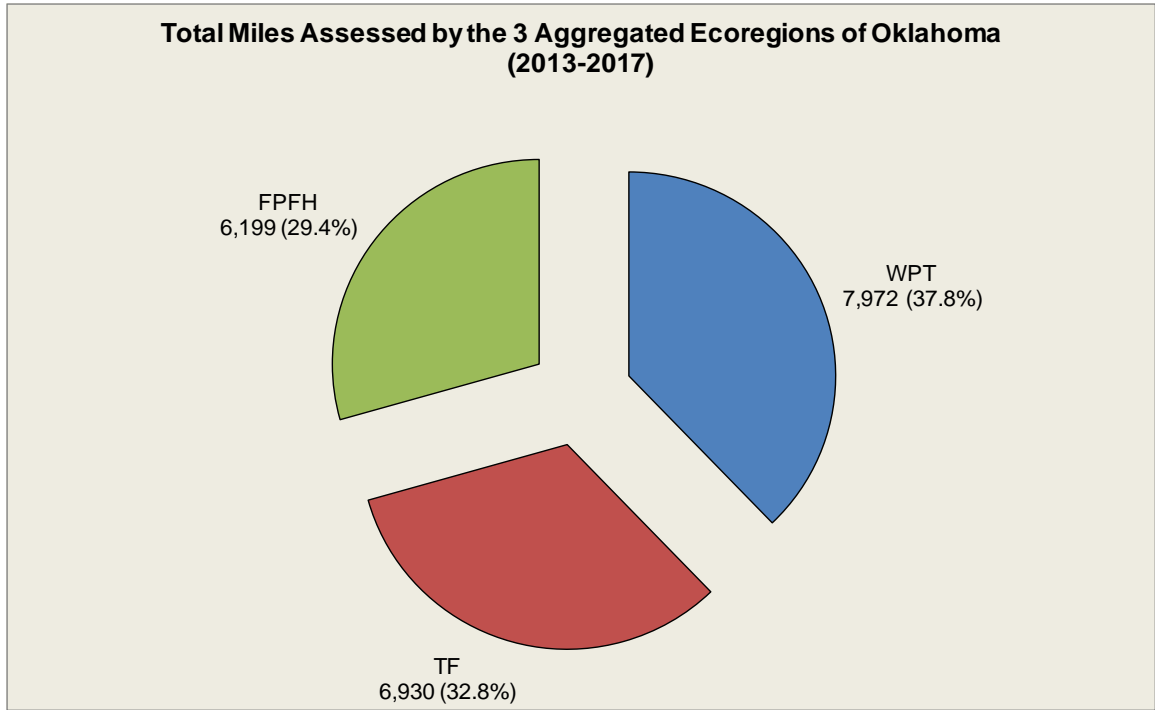


Figure 6. Total Miles Assessed and Percentages of Total Miles for the Three Aggregated Ecoregions of Oklahoma.

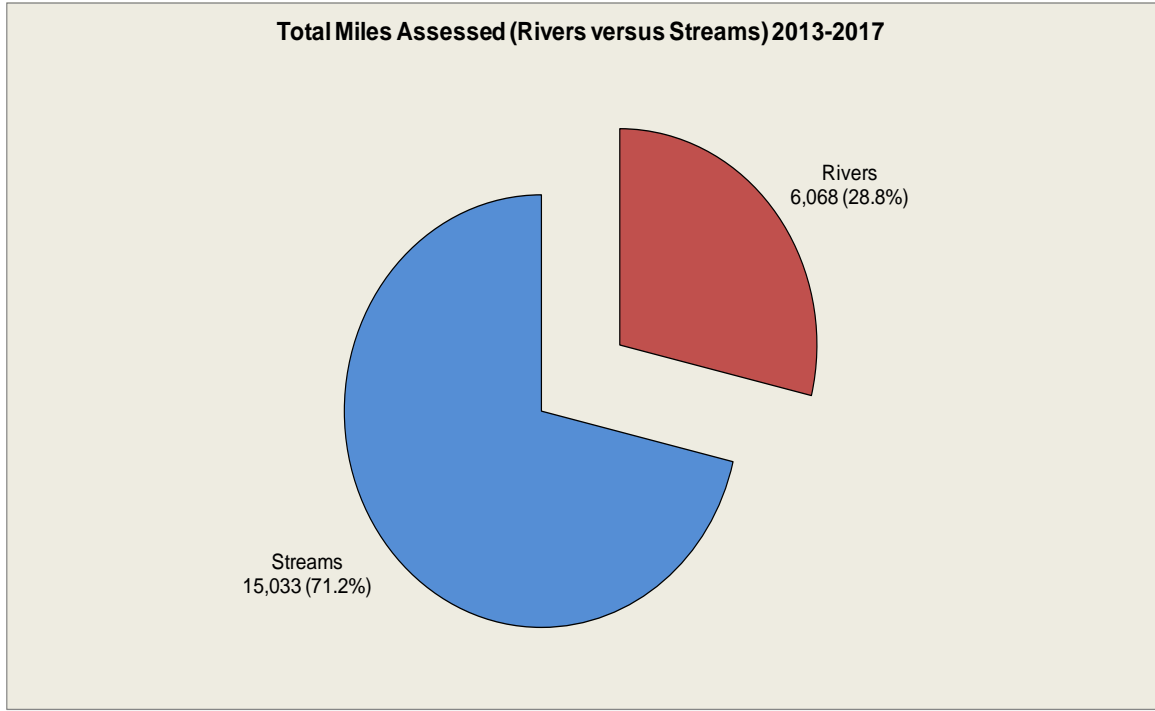


Figure 7. Total Miles Assessed and Percentages of Total Miles for Rivers and Streams.

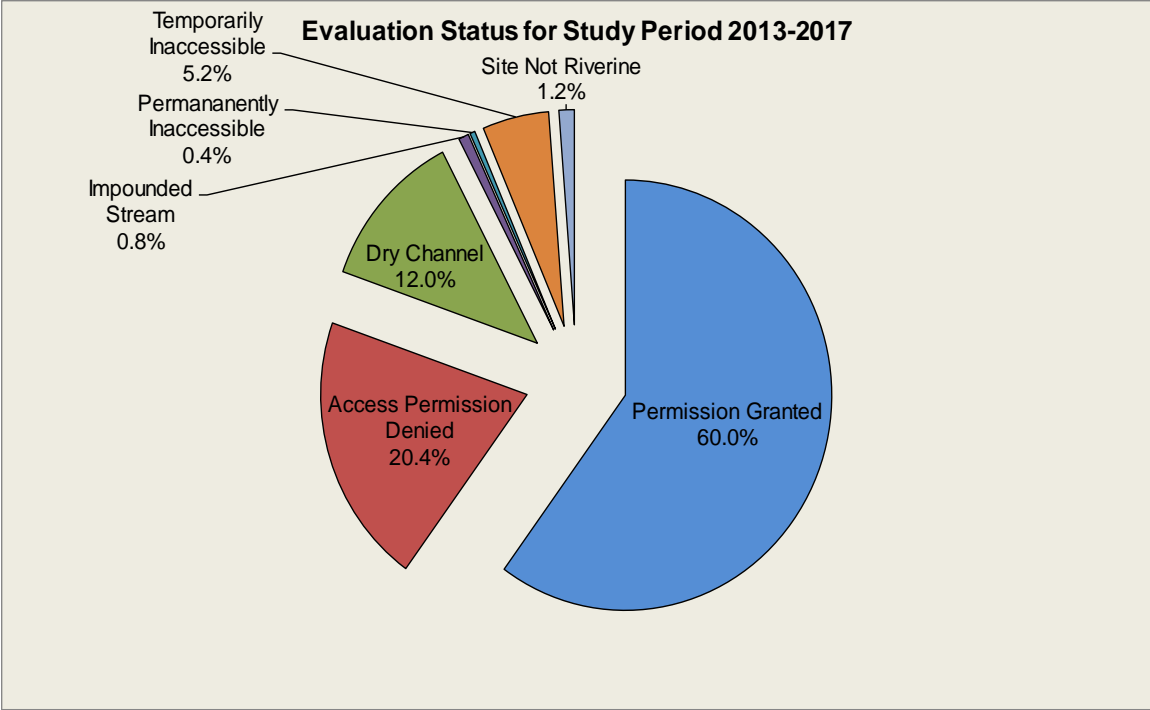


Figure 8. Site Evaluation Status for Study Period 2013-2017. Total Sites Evaluated was 250. Total Sites Sampled was 150.

### **Biological Indicator Condition Extent**

Statewide condition extent estimates were made for benthic macroinvertebrates (aquatic bugs), fish, sestonic algae, and periphyton (benthic algae). For each biotic assemblage, the indicator condition was categorized as good, fair, or poor based on methodology described in the “Methods” section, and percentages for each condition category are based on “percent of total miles”. For data that were not collected or not assessed for other reasons, a fourth category was created and named as Not Assessed in all graphics of this report. In Figure 9, good/fair/poor estimates are grouped for each indicator (fish, bugs, benthic algae, and sestonic algae) for the entire five-year study. In Figures 10-17, yearly and bi-yearly extent estimates for each biological indicator are depicted with standard error for each classification. For figures 18-20, indicator extent data for waterbody size comparisons are presented (rivers versus streams). Figures 21-23 show indicator extent data for the three aggregated ecoregions of Oklahoma.

For fish extent, the stream miles in good condition was above 50% for every year of this study except for 2013 (Figure 10). For the 2013-2017 study 55.8% of total miles were in good condition for fish compared to 58% in the 2008-2011 report (OWRB, 2013). Nearly 16% of total stream/river miles were classified in poor condition for fish for the 2013-2017 study (Figure 9).

For bugs nearly 23% of stream miles were classified in poor condition ( Figure 9). In SY 2013 macroinvertebrate poor condition on rivers and streams was approaching 47% of total miles (Figure 11). River miles in poor condition was substantially higher than stream miles in poor condition for macroinvertebrates from 2013-2017.

A relatively small percentage of miles are classified in poor condition for benthic algae (benthic chlorophyll *a*). For the five year study period, approximately 10% of miles are in poor condition, with 53% of miles in good condition ( Figure 9). In the 2008-2011 study period these values were 10% and 75% indicating no change in benthic algae for poor condition stream miles and a major decline in the number of stream miles in good condition (OWRB, 2013). Benthic algae condition (when compared to sestonic algae condition) was much more consistent when comparing rivers and streams data. For rivers 59% of stream miles were in good condition for benthic algae compared to 50.7% for streams (Figure 20).

For sestonic algae (sestonic chlorophyll *a*), the percentage of total miles in poor condition was 24% from the 2013-2017 study ( Figure 9). This percentage was nearly the same in the 2008-2011 study (OWRB, 2013). For the 2013-2017 study 61.6% of total miles were in good condition for sestonic algae compared to 55% for the 2008-2011 study. Sestonic algae condition was highly variable among rivers and streams. Approximately 43% of river miles are in poor condition for sestonic algae as compared to 16% of stream miles (Figure 20).

As a general trend, the WPT aggregated ecoregions of Oklahoma, which resides in western Oklahoma, when compared to the other two aggregated ecoregions (FPFH and TF of eastern Oklahoma) tends to have more miles in poor condition for all indicators (fish, bugs, benthic algae, and sestonic algae) (Figures 21- 23). These differences could be attributed to a variety of factors including climatological and land use variability between the three aggregated ecoregions.

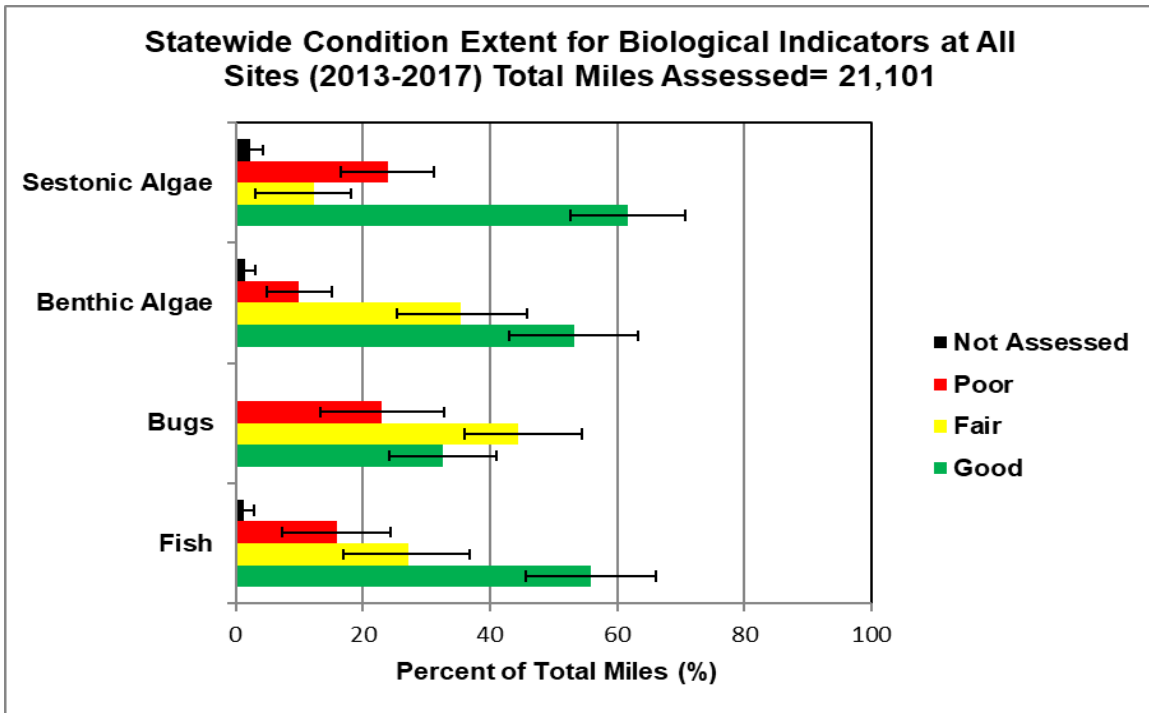


Figure 9. Biological Indicator Condition Extent for All Sites Statewide from 2013-2017. Upper and Lower Confidence Bounds Represent a 95% Confidence Interval.

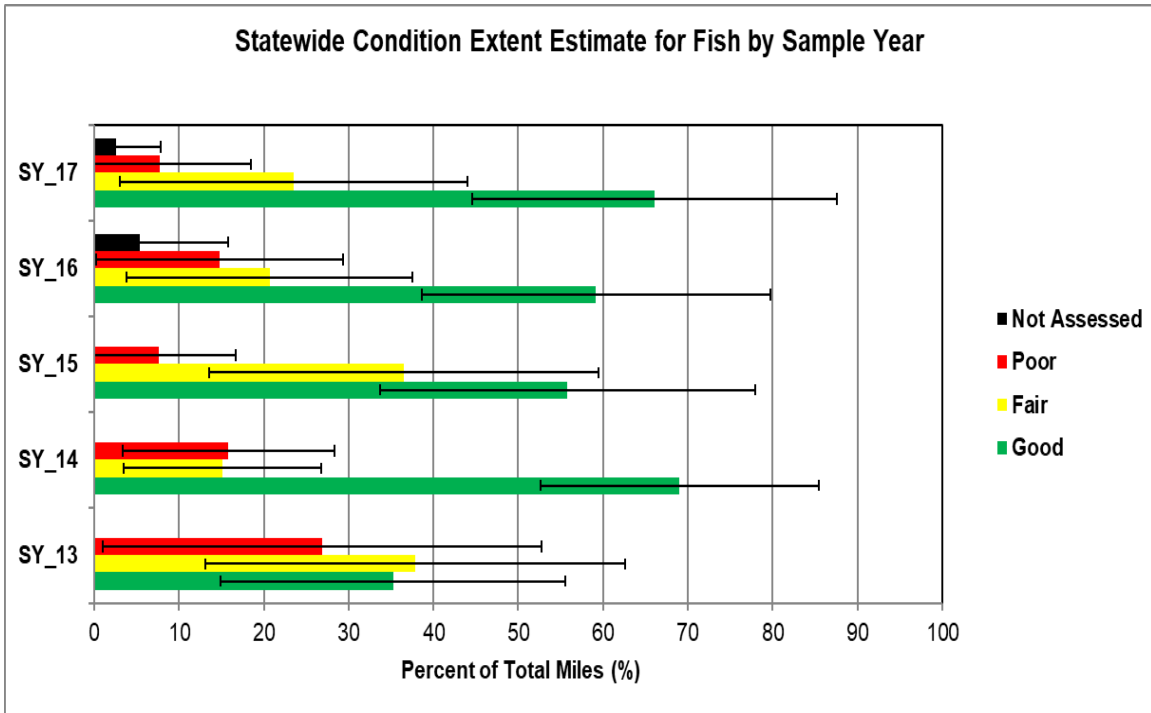


Figure 10. Fish Condition Extent Estimated Statewide for Oklahoma (2013-2017). Upper and Lower Confidence Bounds Represent a 95% Confidence Interval

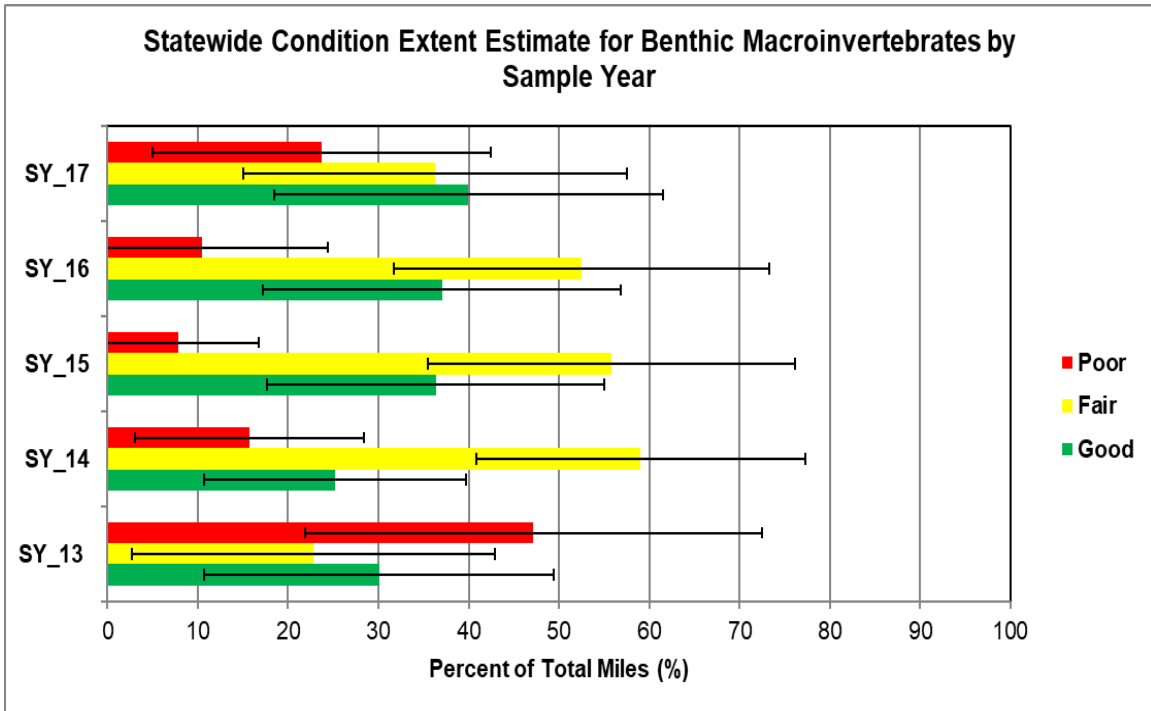


Figure 11. Benthic Macroinvertebrates Condition Extent Estimated Statewide for Oklahoma (2013-2017). Upper and lower confidence bounds represent a 95% confidence Interval.

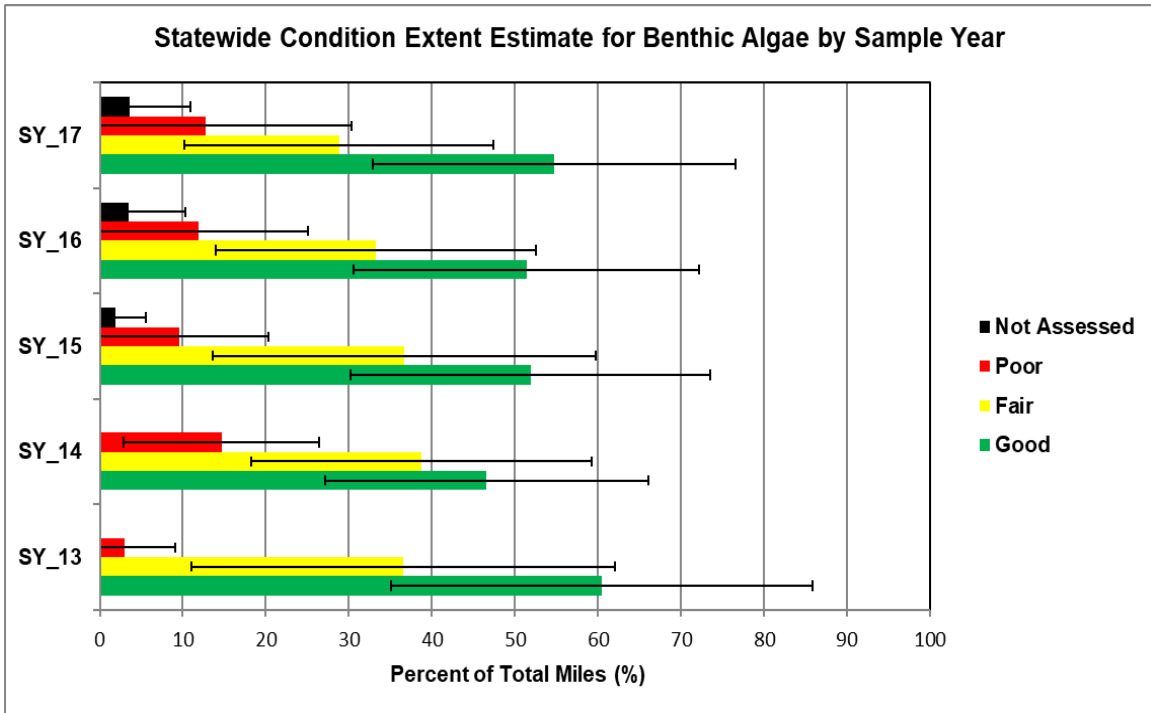


Figure 12. Benthic Algae Condition Extent Estimated Statewide for Oklahoma (2013-2017). Upper and lower confidence bounds represent a 95% confidence Interval.

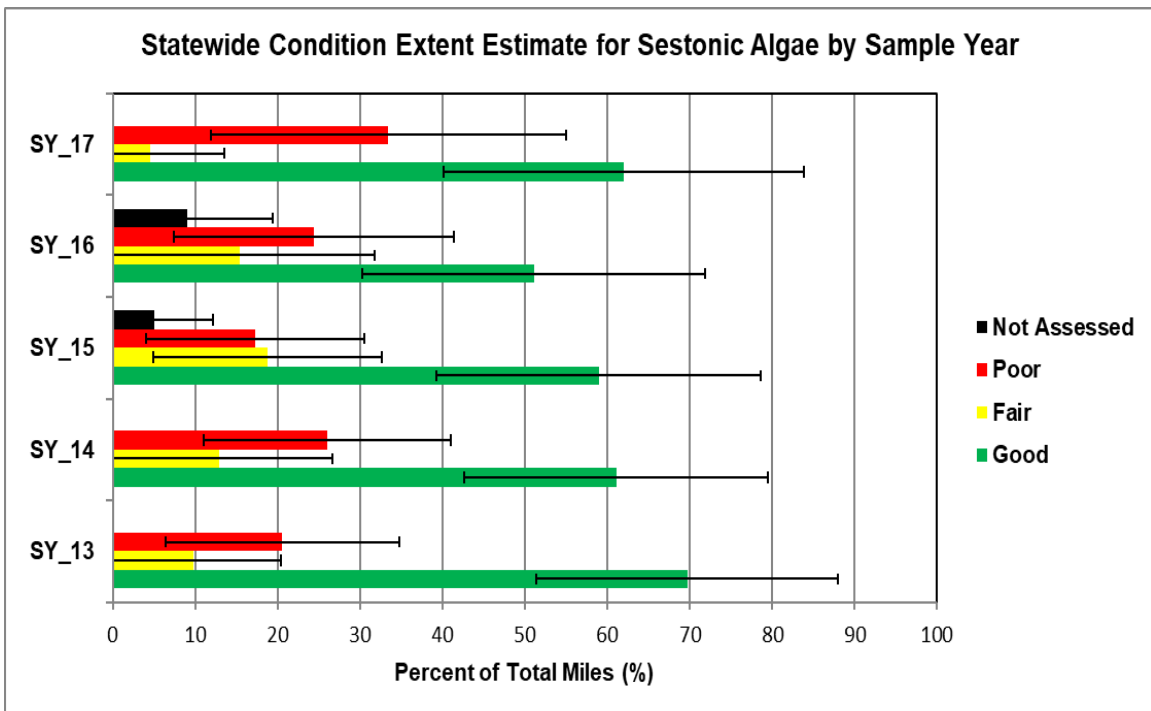


Figure 13. Sestonic Algae Condition Extent Estimated Statewide for Oklahoma (2013-2017). Upper and lower confidence bounds represent a 95% confidence Interval.

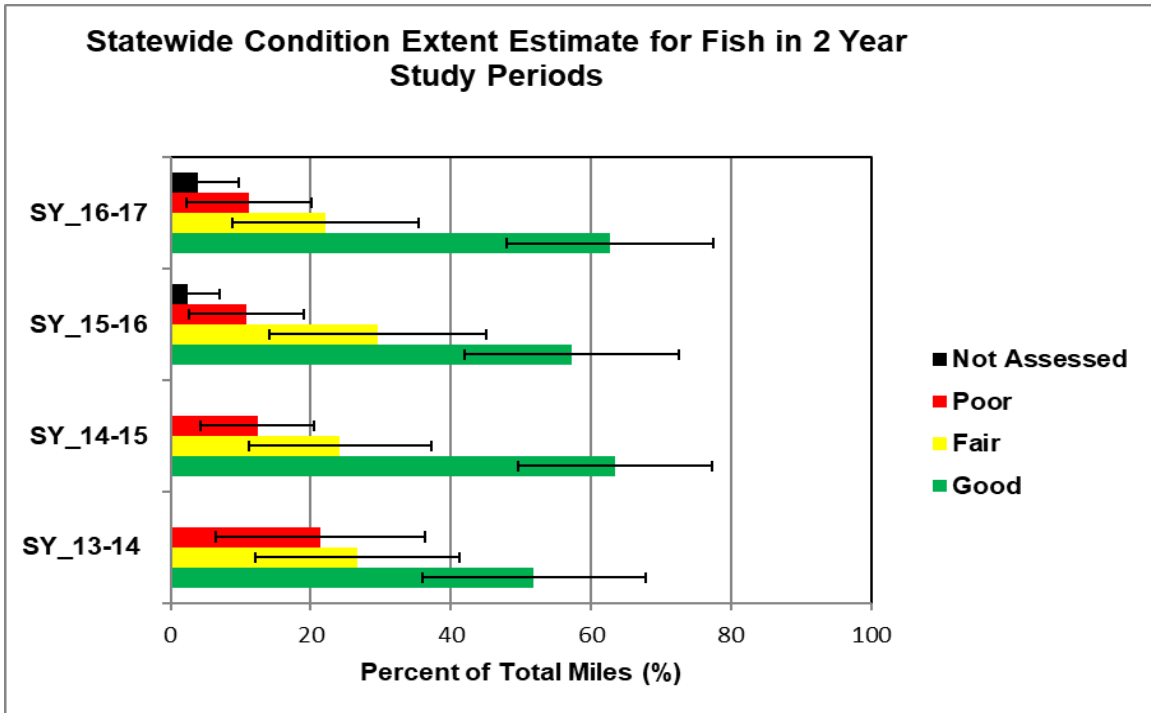


Figure 14. Fish Condition Extent Estimated Statewide by 2 Year Study Periods for Oklahoma (2013-2017). Upper and Lower Confidence Bounds Represent a 95% Confidence Interval.

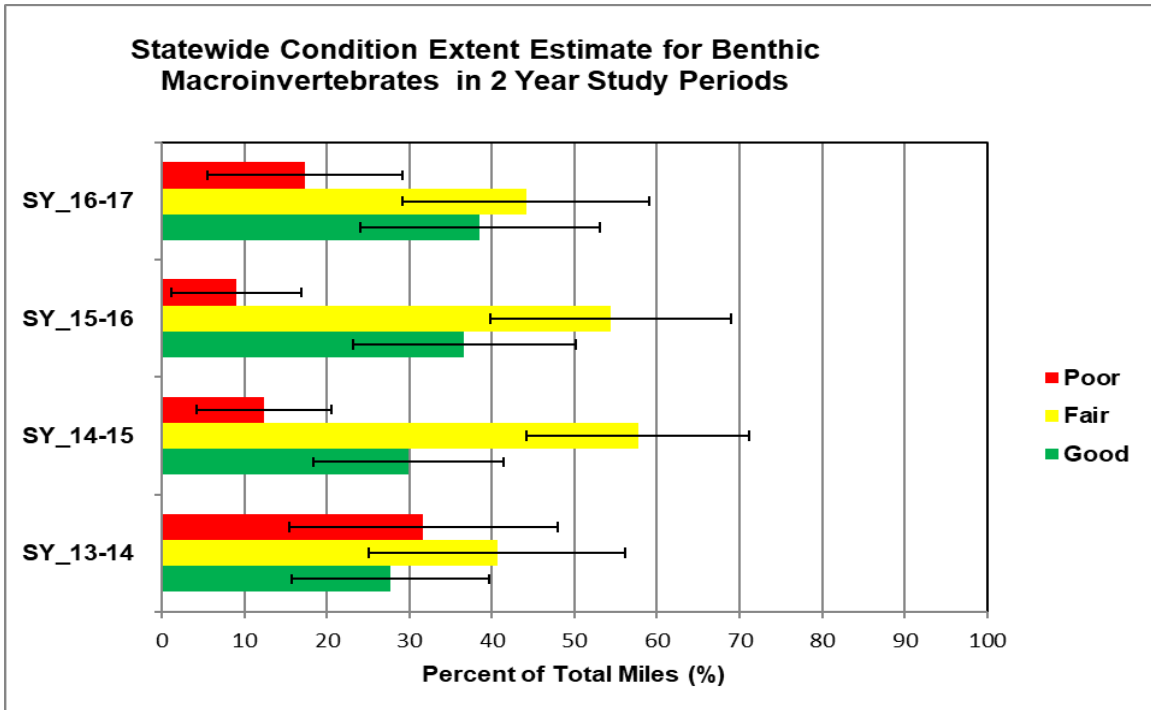


Figure 15. Benthic Macroinvertebrate Condition Extent Estimated Statewide by 2 Year Study Periods for Oklahoma (2013-2017).

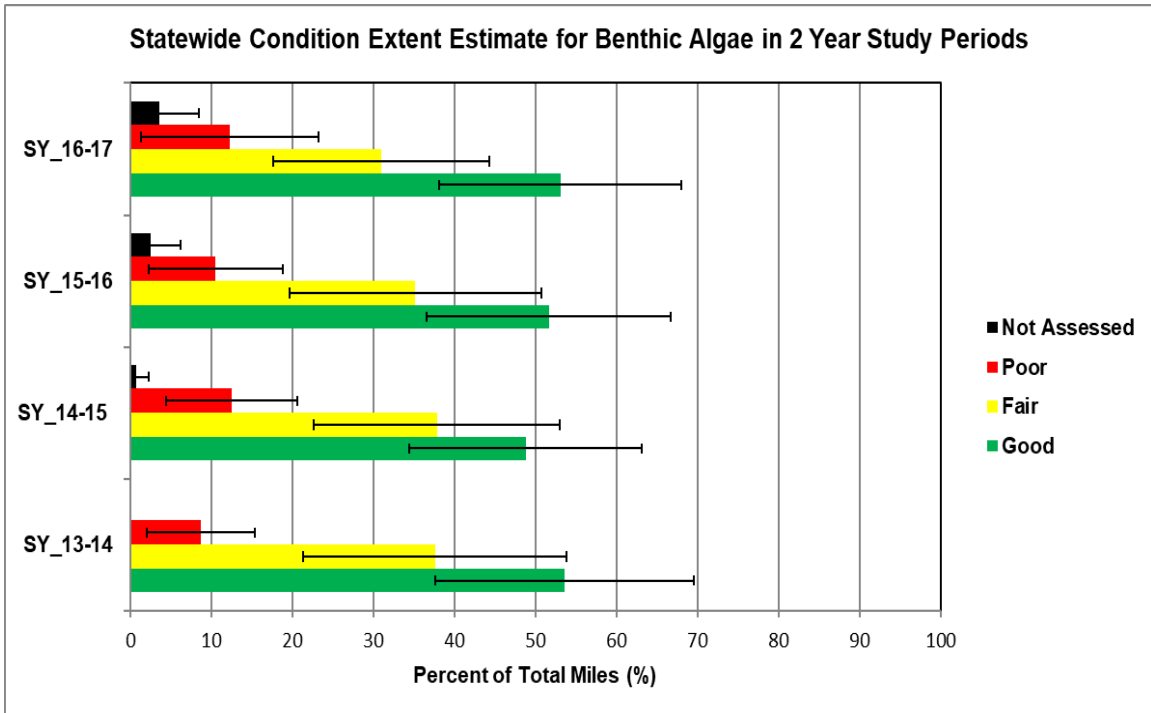


Figure 16. Biological Indicator Condition Extent Estimated Statewide for Benthic Algae for 2 Year Study Periods. Upper and Lower Bounds Represent a 95% Confidence Interval.

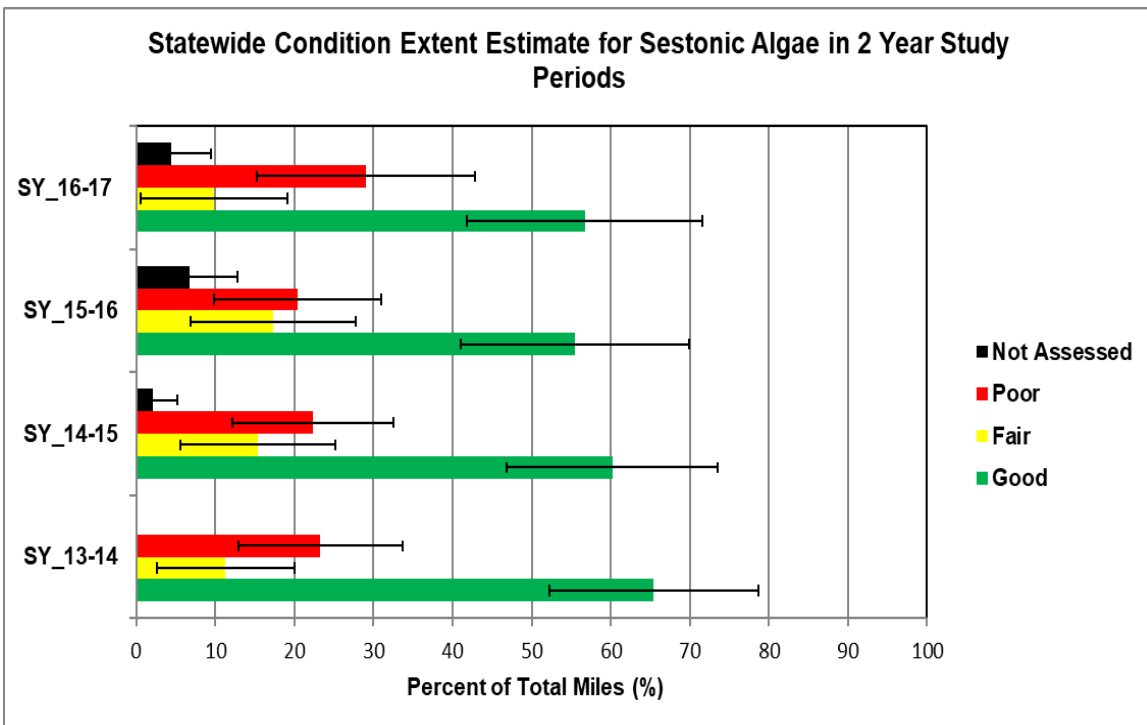


Figure 17. Biological Indicator Condition Extent Estimated Statewide for Sestonic Algae for 2 Year Study Periods. Upper and Lower Bounds Represent a 95% Confidence Interval.

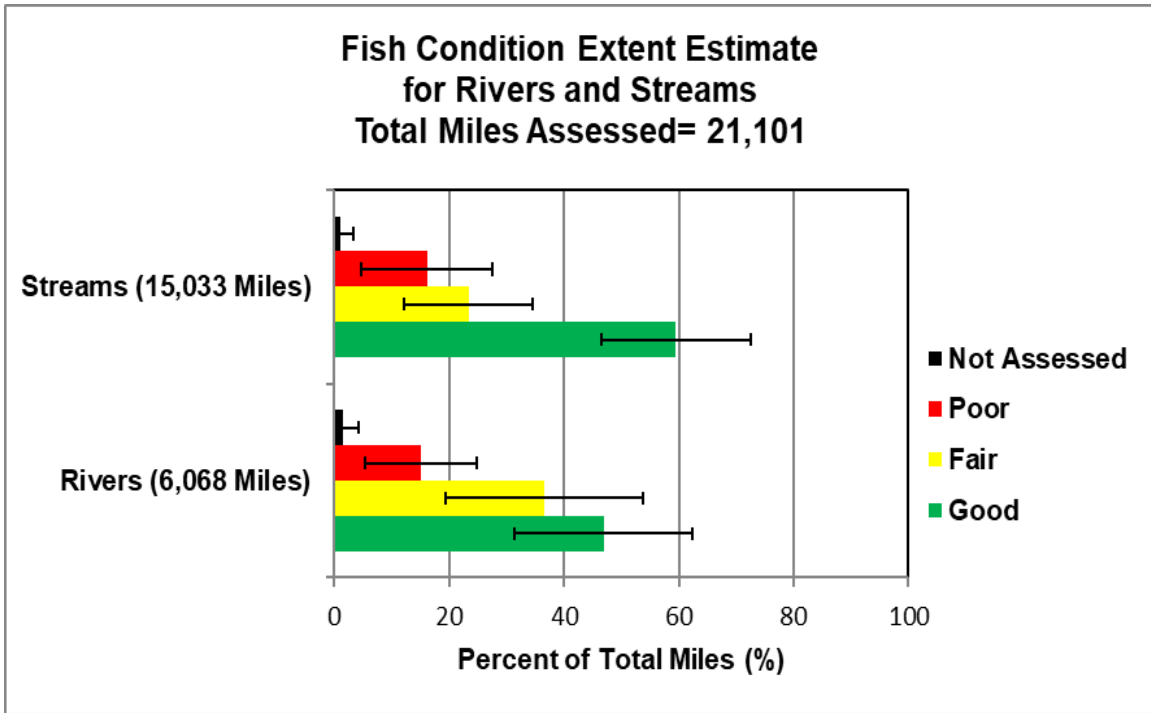


Figure 18. Fish Condition Extent Estimated Statewide for the Rivers (N=58) and Streams (N=92) of Oklahoma for Sample Years 2013-2017. Upper and Lower Bounds Represent a 95% Confidence Interval.

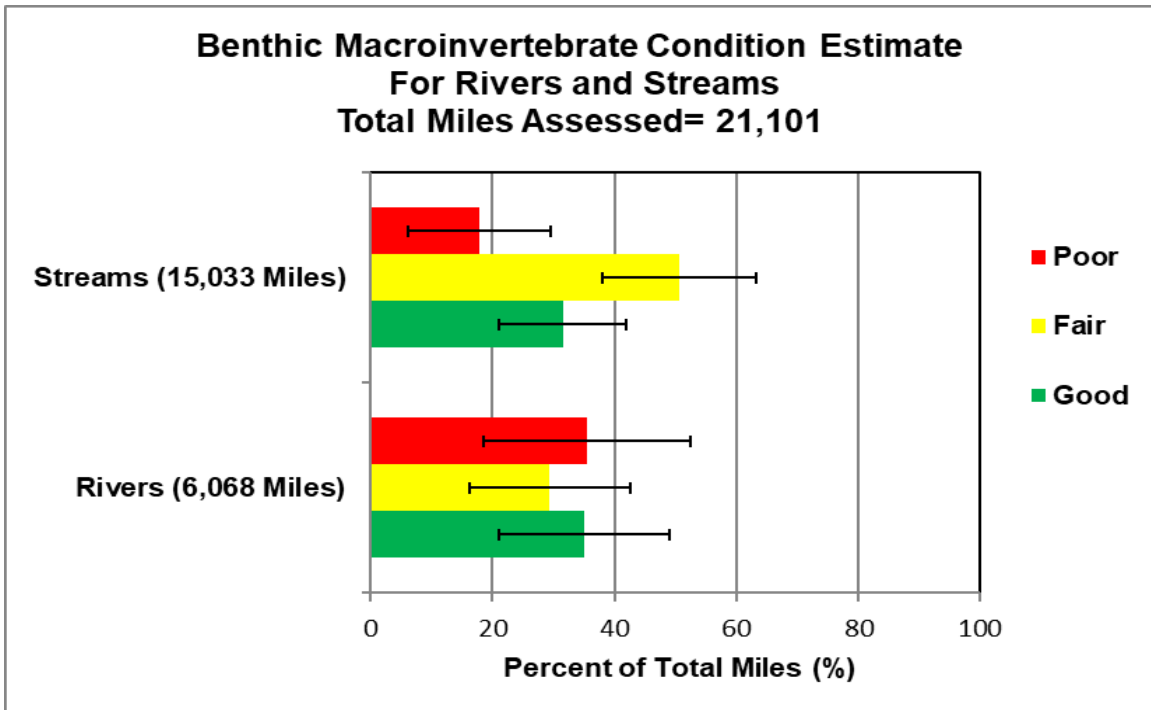


Figure 19. Benthic Macroinvertebrate Condition Extent Estimated Statewide for Oklahoma Rivers(N=58) and Streams(N=92) for Sample Years 2013-2017.

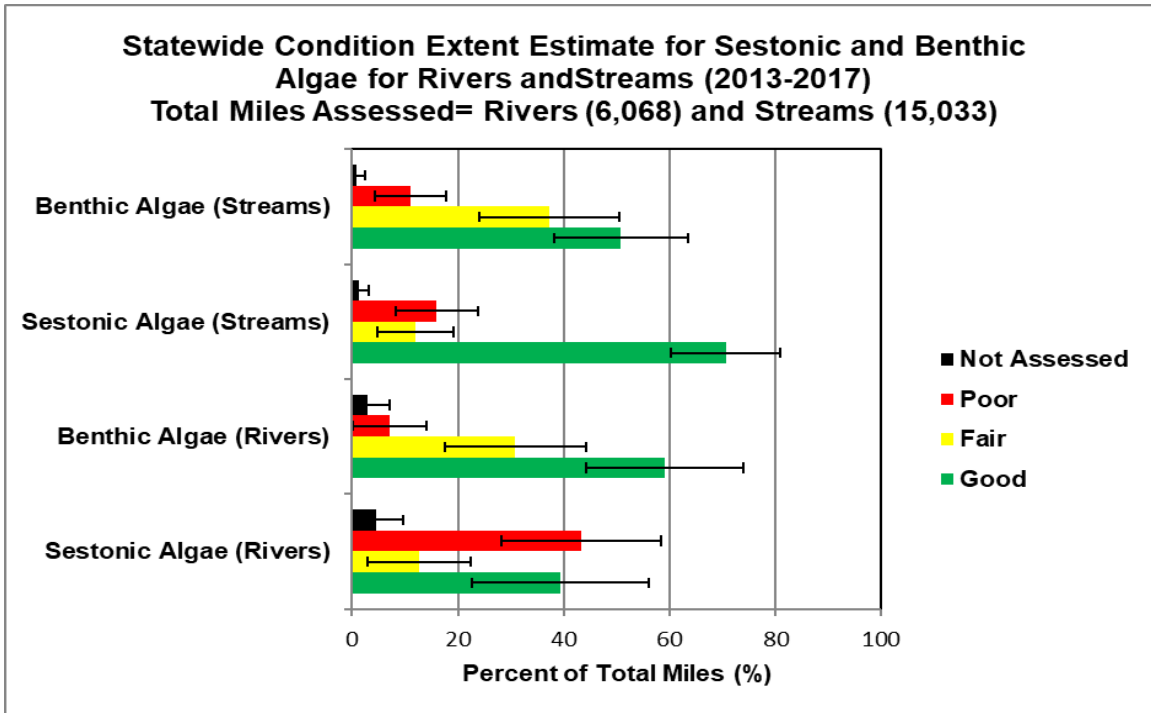


Figure 20. Biological Indicator Condition Extent Estimated Statewide for Sestonic and Benthic Algae for all Rivers and Streams (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

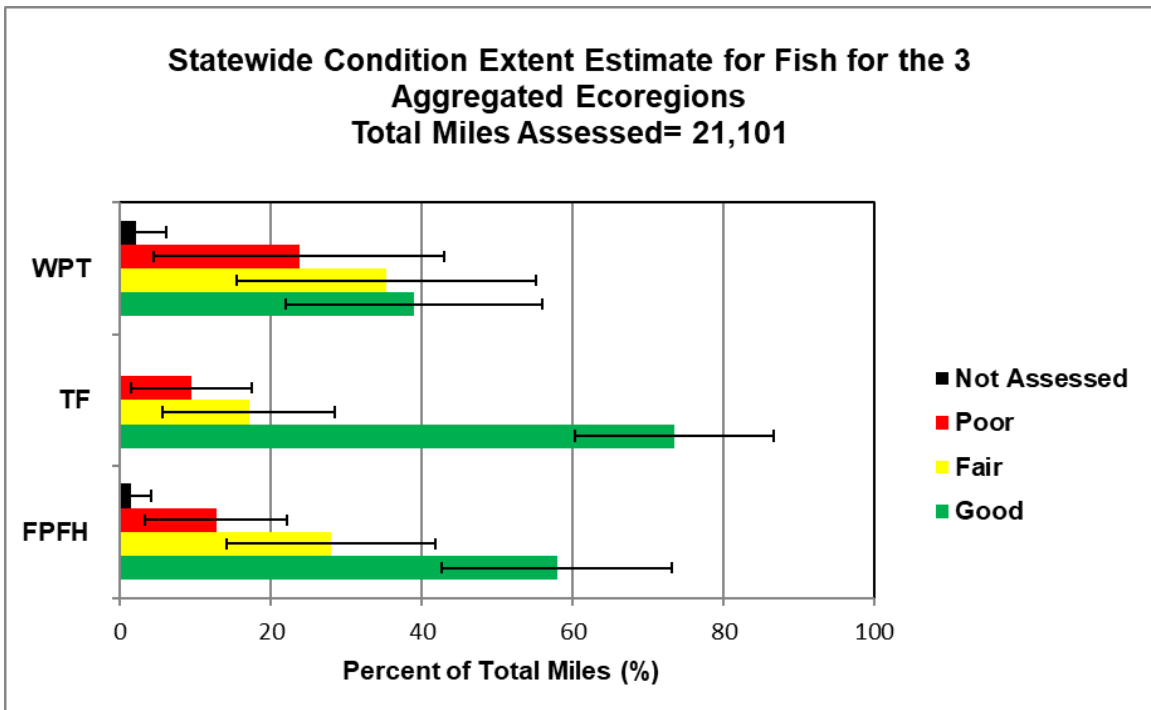


Figure 21. Fish Condition Extent Estimated Statewide for the 3 Aggregated Ecoregions of Oklahoma from 2013-2017. Upper and Lower Bounds Represent a 95% Confidence Interval.

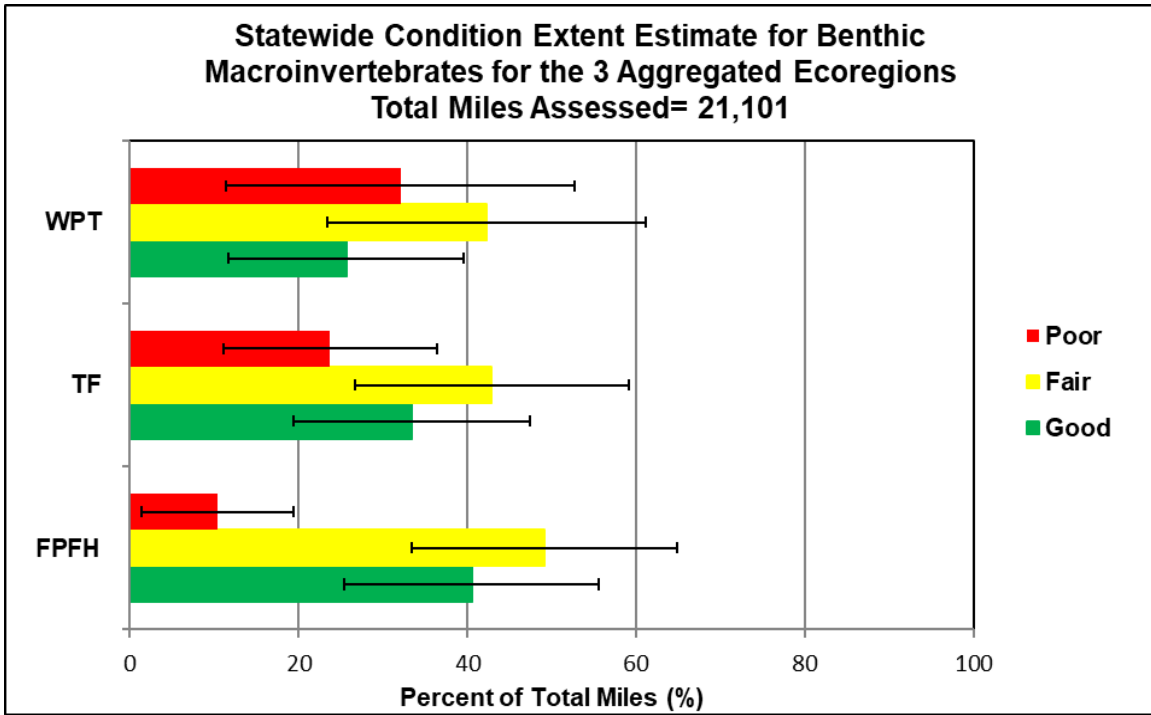


Figure 22. Benthic Macroinvertebrate Condition Extent Estimated Statewide for the 3 Aggregated Ecoregions of Oklahoma from 2013-2017.

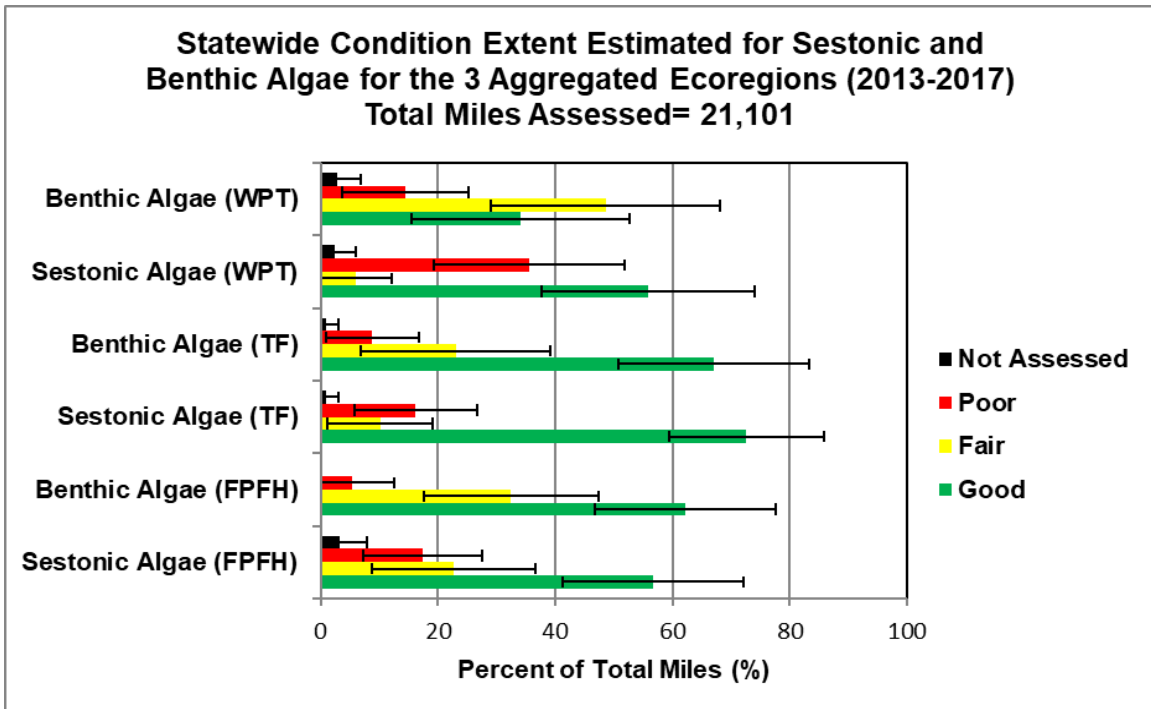


Figure 23. Biological Indicator Condition Extent Estimated Statewide for Sestonic and Benthic Algae in the 3 Aggregated Ecoregions of Oklahoma (2013-2017).

### **Stressor Extent**

Statewide condition extent estimates were made for TP, TN, conductivity, and turbidity. Estimates employed the Omernick level III ecoregion screening levels. For each stressor the condition was categorized as good, fair, or poor based on methodology described in the “Methods” section, and percentages for each condition category are based on “percent of total miles”.

In Figures 24-43, good/fair/poor estimates for nutrients (TP and TN), conductivity and turbidity are grouped for each stressor by all years, individual sample years, two-year study periods, the three aggregated ecoregions, and rivers/streams. From 2013-2017 the total phosphorus extent in poor condition was generally 32-57%, while the percent of total miles in good condition ranged from 12-38% (Figure 24). During the 2008-2011 reporting period 30-40% of total stream/river miles were in poor condition for phosphorus (OWRB, 2013). This demonstrates that phosphorus continues to be a major concern for water quality. When considering stream size, approximately 63% of river miles were in poor condition for TP, which is significantly higher than in streams (38%) (Figure 40).

Total nitrogen extent in good condition ranged from 27% in SY\_16 to 18% in SY\_14 (Figure 25). However, TN poor condition varied greatly from year to year with 19% in SY\_16 and 57% in SY\_13 (Figure 26). During the 2008-2011 reporting period the total nitrogen extent ranged from 25% in 2008-2009 to almost 40% in poor condition from 2010-2011 (OWRB, 2013). Poor condition of TN over the five-year study period in rivers was 49% (Figure 41). During the same five-year period, poor condition of TN in streams was 37%. Along with the aforementioned results for TP, TN data demonstrates that management of both nutrients is necessary to improve water quality.

Although, phosphorus is a primary concern to many water quality managers this demonstrates that nitrogen should be just as big of a concern for degradation of water quality. Excess nutrients continue to be a statewide problem for Oklahoma’s rivers and streams. This is evident by looking at

Figure 36 and Figure 37. These two graphs illustrate that nutrient extent in poor condition remains high in all three of the aggregated ecoregions for both total phosphorus and total nitrogen. More than 50% of total stream/river miles in the WPT and TF were in poor condition for TP. TN ranged between 38-44% in poor condition for the three aggregated ecoregions. Although not explicitly included in this report, excess nutrients in Oklahoma’s flowing waterbodies may eventually lead to eutrophication and poor water quality in Oklahoma’s many lakes.

Conductivity extent in good condition was fairly consistent (25%-44%) for three out of five years in the study (Figure 27). In SY\_15 52% of the stream miles were in good condition for conductivity. This sample year was a major flood year for Oklahoma in which the state set a record for the highest recorded average statewide rainfall amount at 48 inches (Mesonet, 2015). However, poor condition for conductivity ranged from 15-37% for the study. Conductivity extent as a whole was in the worst condition in the Western Plains and Tablelands aggregated ecoregion (Figure 38). This is to be expected because this aggregate of ecoregions is composed of western Oklahoma where naturally high conductivity areas exist on certain rivers and streams (Survey, Oklahoma Geological, 2008). However, not all of western Oklahoma is naturally salty. Some areas have been impacted by anthropogenic activities that have exacerbated the problem. As with nutrients, conductivity condition is significantly different when comparing streams to rivers. The percent of river miles in poor condition was 34% compared to just 19% of stream miles in poor condition (Figure 42).

Turbidity extent was highly variable during the five-year study. During the flood year of 2015 the highest extent of miles in the fair condition was recorded with a staggering 54% (Figure 28). However, at only 29%, SY 2015 did not have the highest percentage of total miles in the good condition. Turbidity extent in poor condition ranged from 14% to 35% while the extent ranged from 19-60% for good condition. Turbidity extent for poor condition was very similar between the 2008-2011 study period and the 2013-2017 study (OWRB, 2013). However, there were major differences for stream miles in the good condition and in the rivers/streams comparison between the 2 studies. For the three aggregated ecoregions, turbidity follows the opposite pattern of conductivity. The Western Plains and Tablelands aggregated ecoregion is in the best condition overall for turbidity extent (Figure 39). During the previous 2008-2011 reporting period rivers (37%) and streams (9%) were quite variable for poor turbidity condition (OWRB, 2013). This pattern was similar but not nearly as variable in the 2013-2017 reporting period (rivers-27%, streams- 18% in poor condition for turbidity) (Figure 43). SY 2017 was the best year for turbidity condition with both the highest percentage of miles in good condition (60%) and the lowest percentage of miles in poor condition (14%) (Figure 28). This will be an interesting trend to track in the next five-year report (2018-2022).

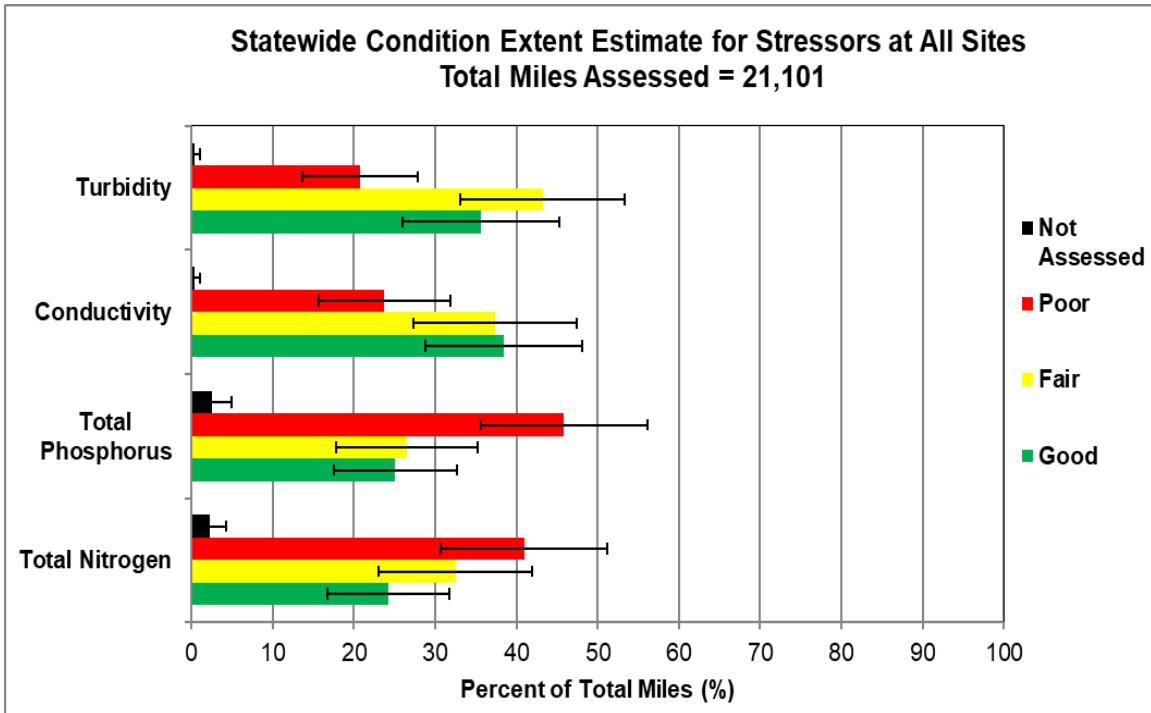


Figure 24. Condition Extent Estimated Statewide for Stressors at All Sites from 2013-2017. Upper and Lower Bounds Represent a 95% Confidence Interval.

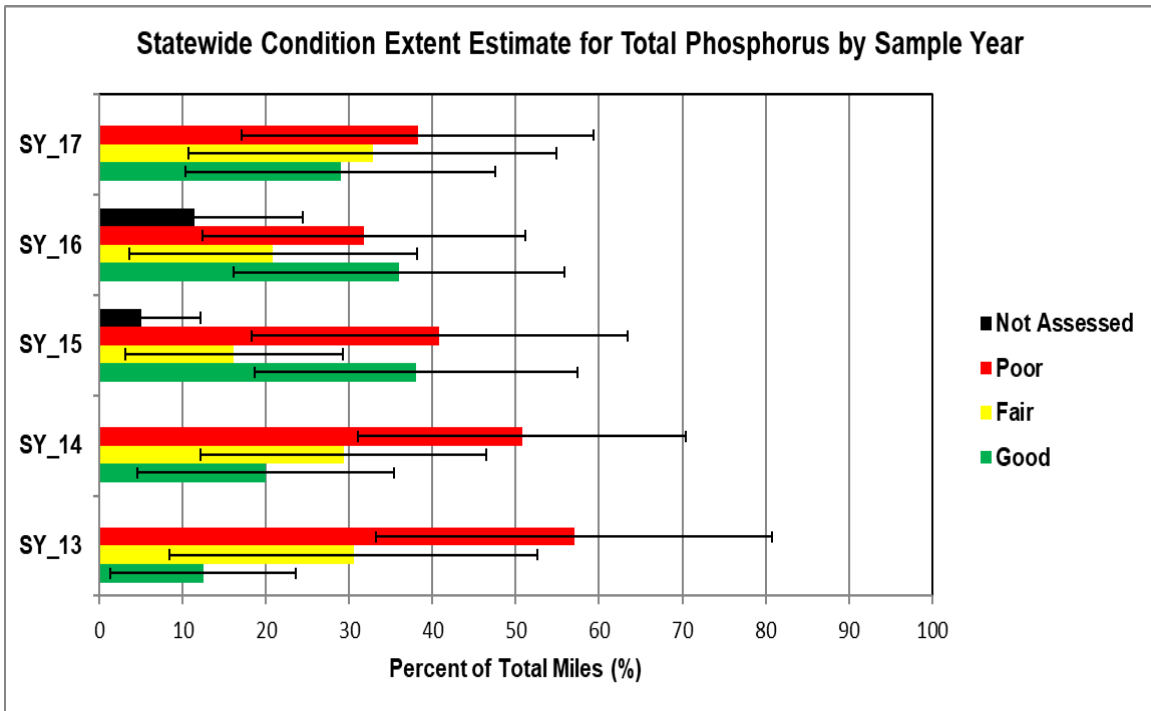


Figure 25. Stressor Extent Estimated Statewide for Total Phosphorus for All Sample Years (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

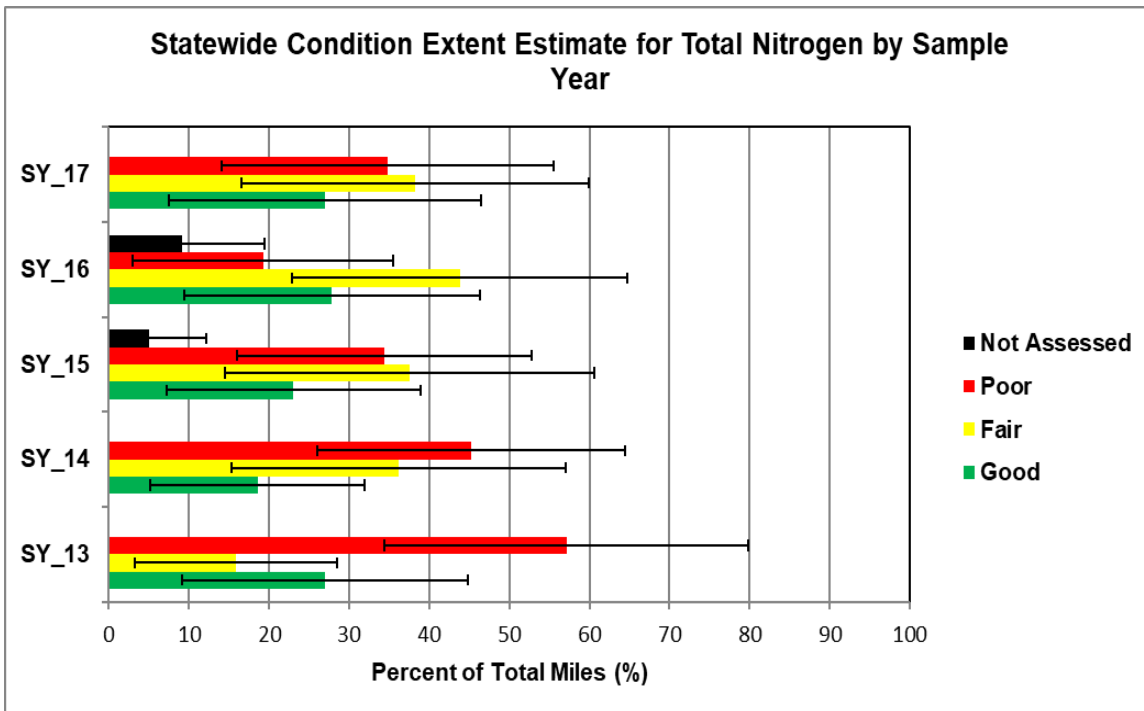


Figure 26. Stressor Extent Estimated Statewide for Total Nitrogen for All Sample Years (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

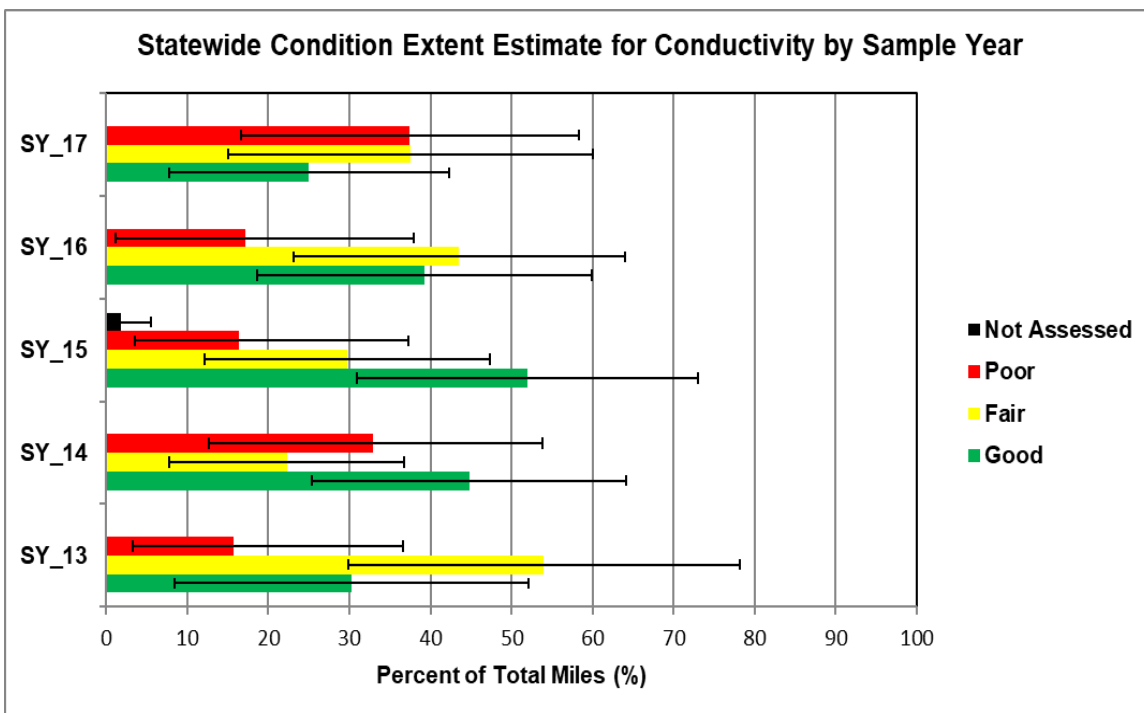


Figure 27. Stressor Extent Estimated Statewide for Conductivity for All Sample Years (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval. SY 2015 was a Major Flood Year for Oklahoma.

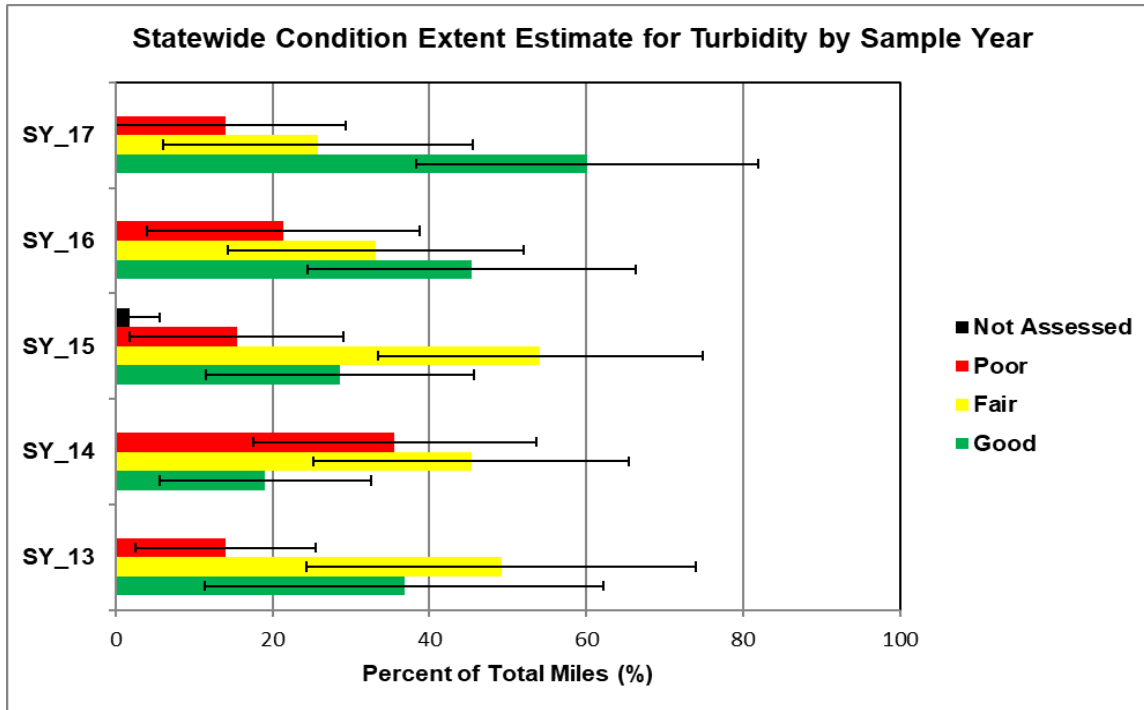


Figure 28. Stressor Extent Estimated Statewide for Turbidity for All Sample Years (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval. SY 2015 was a Major Flood Year for Oklahoma.

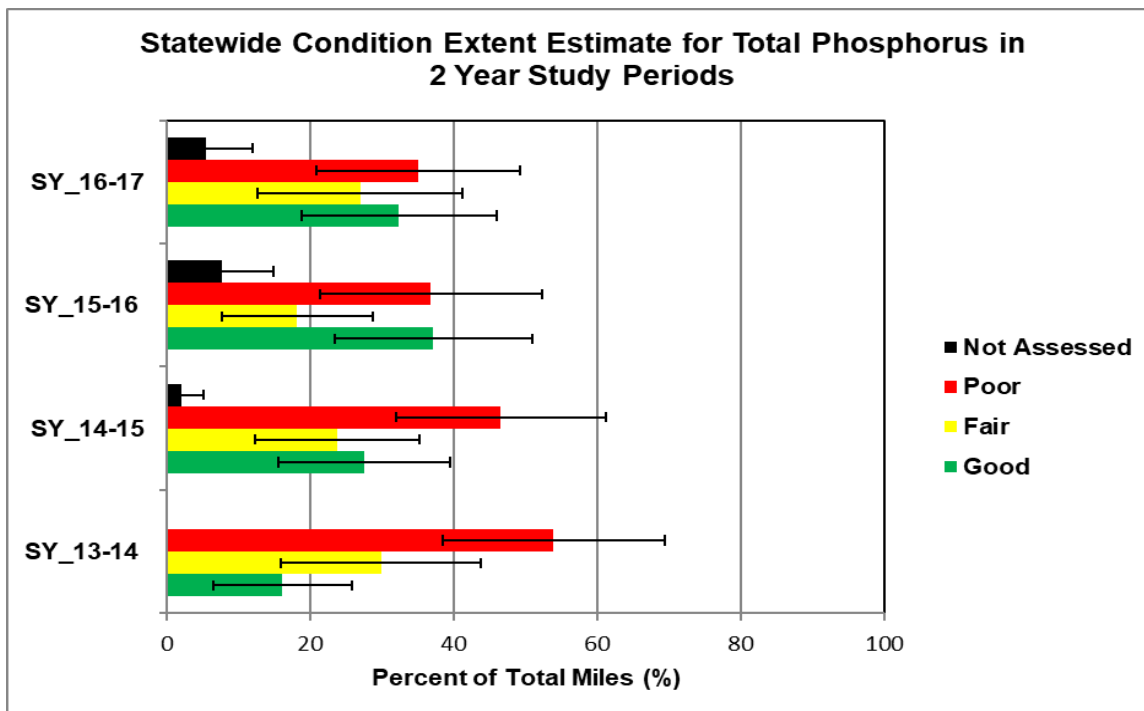


Figure 29. Stressor Extent Estimated Statewide for Total Phosphorus for 2 Year Study Periods. Upper and Lower Bounds Represent a 95% Confidence Interval.

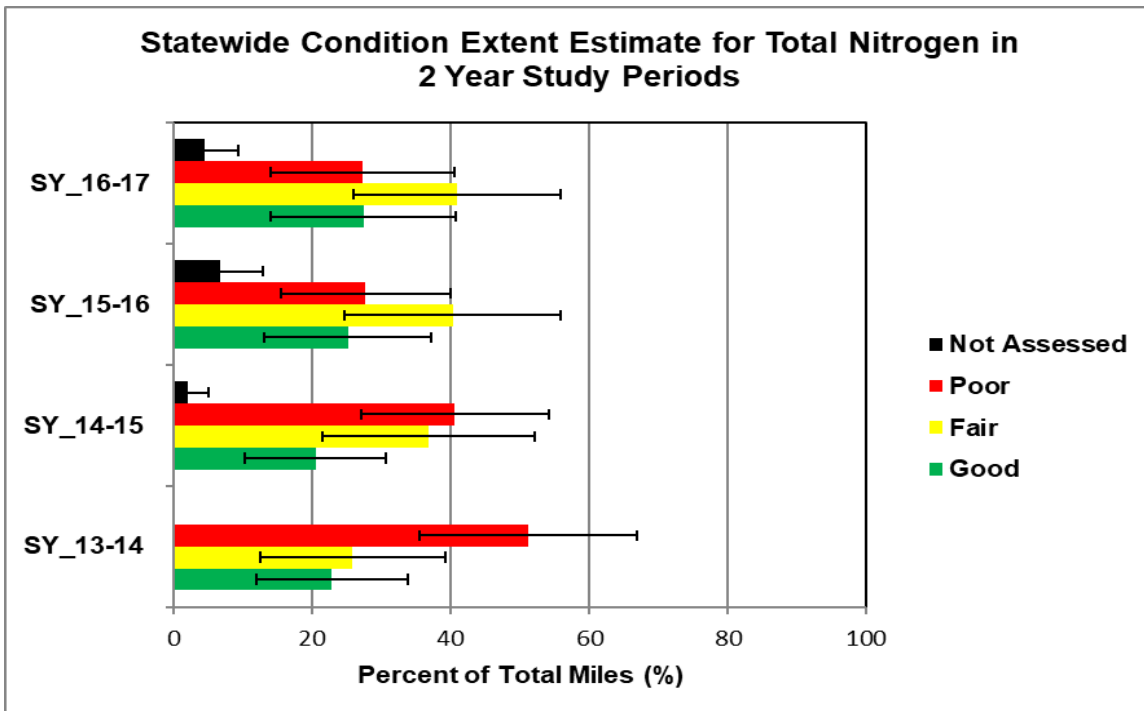


Figure 30. Stressor Extent Estimated Statewide for Total Nitrogen for 2 Year Study Periods. Upper and Lower Bounds Represent a 95% Confidence Interval.

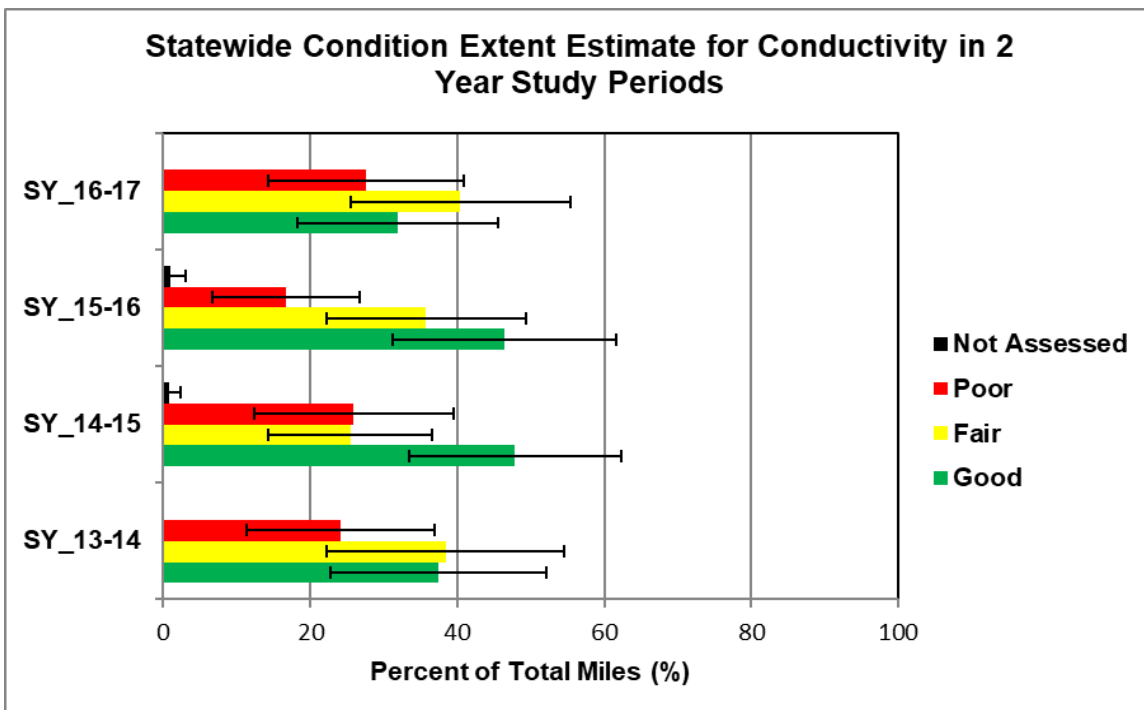


Figure 31. Stressor Extent Estimated Statewide for Conductivity for 2 Year Study Periods. Upper and Lower Bounds Represent a 95% Confidence Interval.

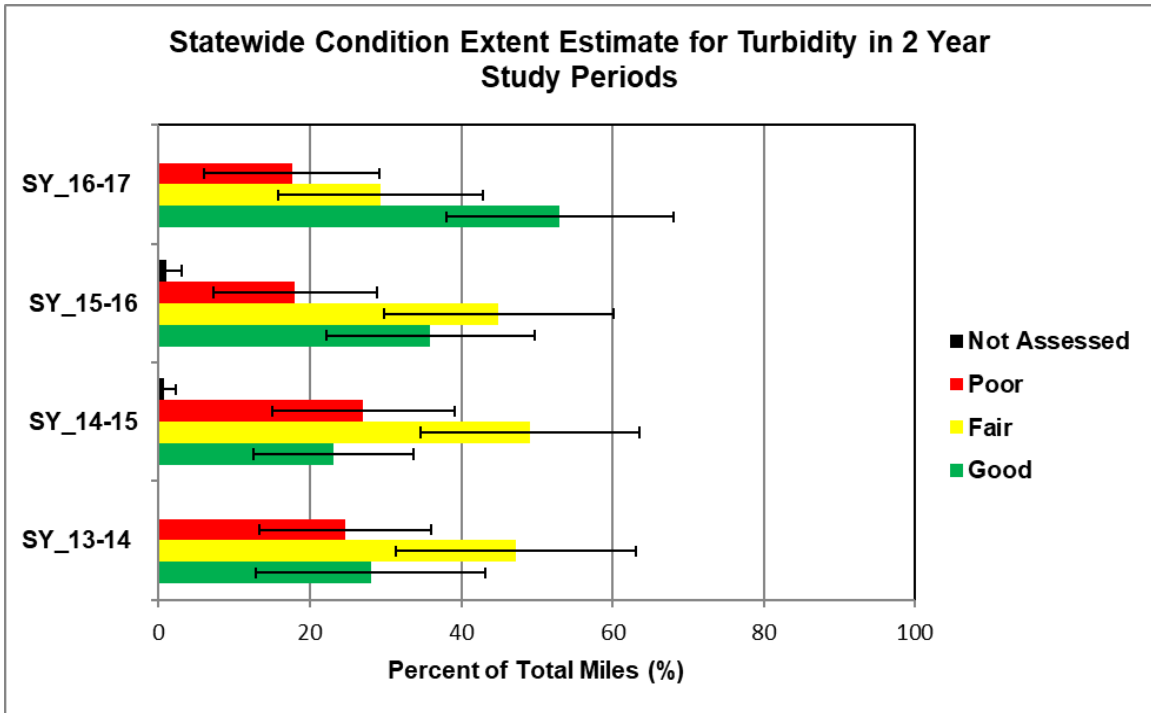


Figure 32. Stressor Extent Estimated Statewide for Turbidity for 2 Year Study Periods. Upper and Lower Bounds Represent a 95% Confidence Interval.

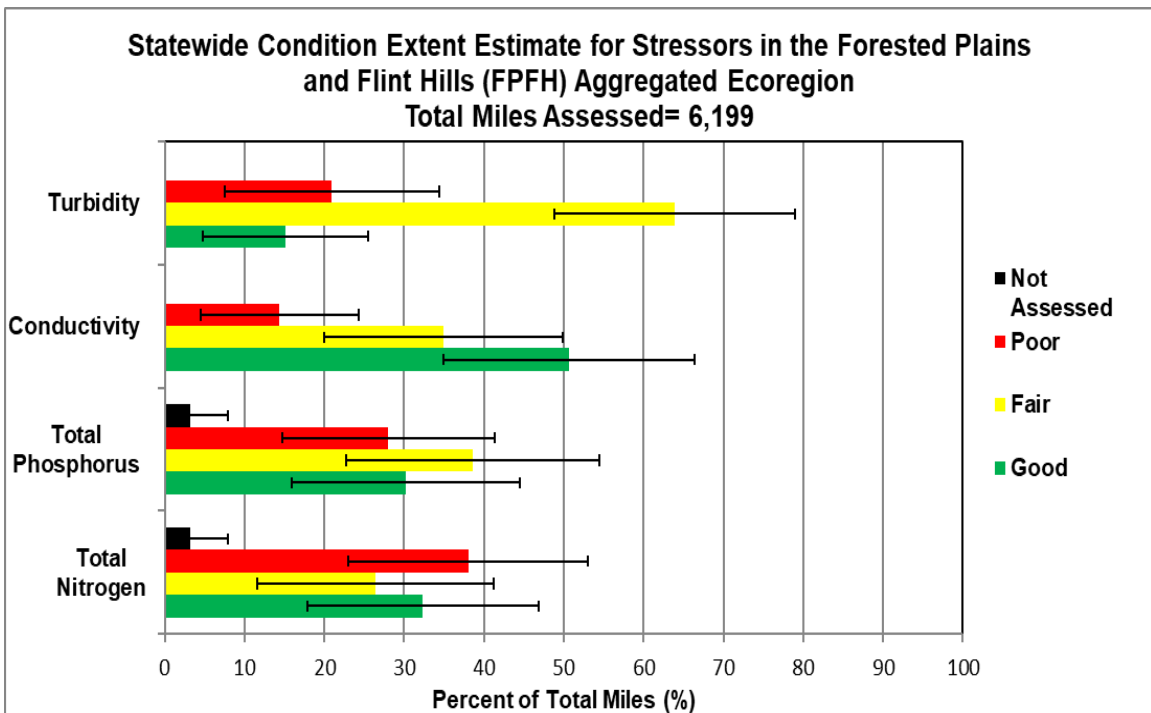


Figure 33. Stressor Condition Extent Estimated Statewide for the Forested Plains and Flint Hills Aggregated Ecoregion of Oklahoma (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

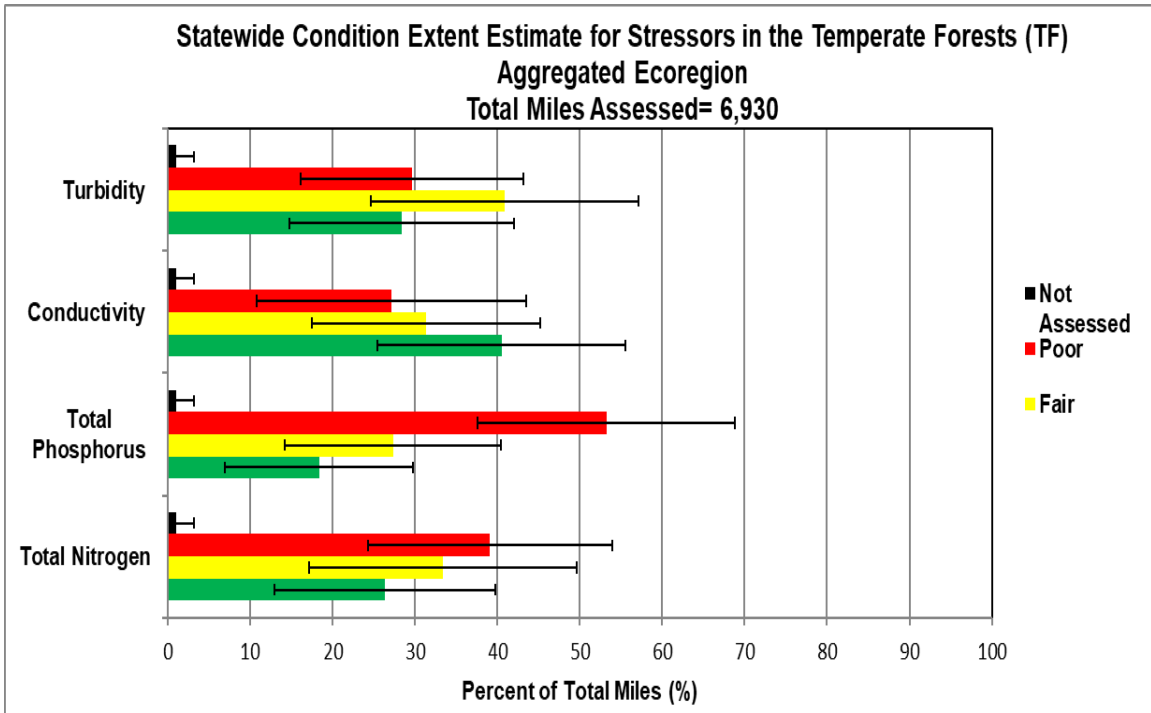


Figure 34. Stressor Condition Extent Estimated Statewide for the Temperate Forests Aggregated Ecoregion of Oklahoma (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

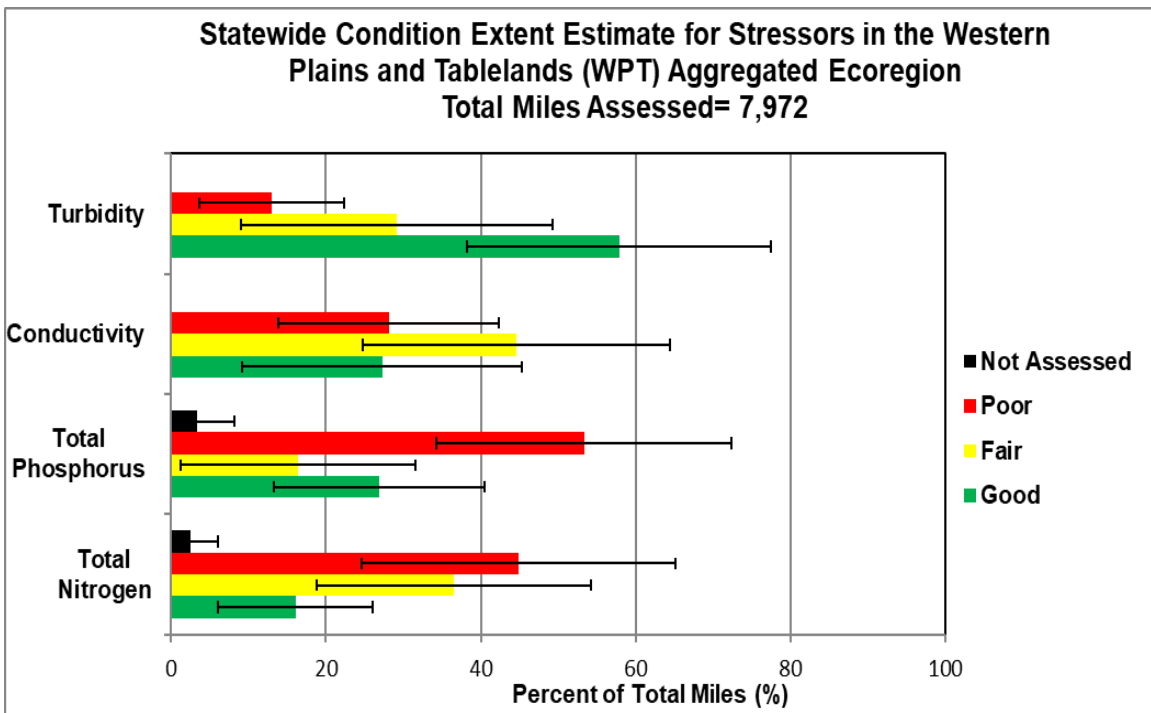


Figure 35. Stressor Condition Extent Estimated Statewide for the Western Plains and Tablelands Aggregated Ecoregion of Oklahoma (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

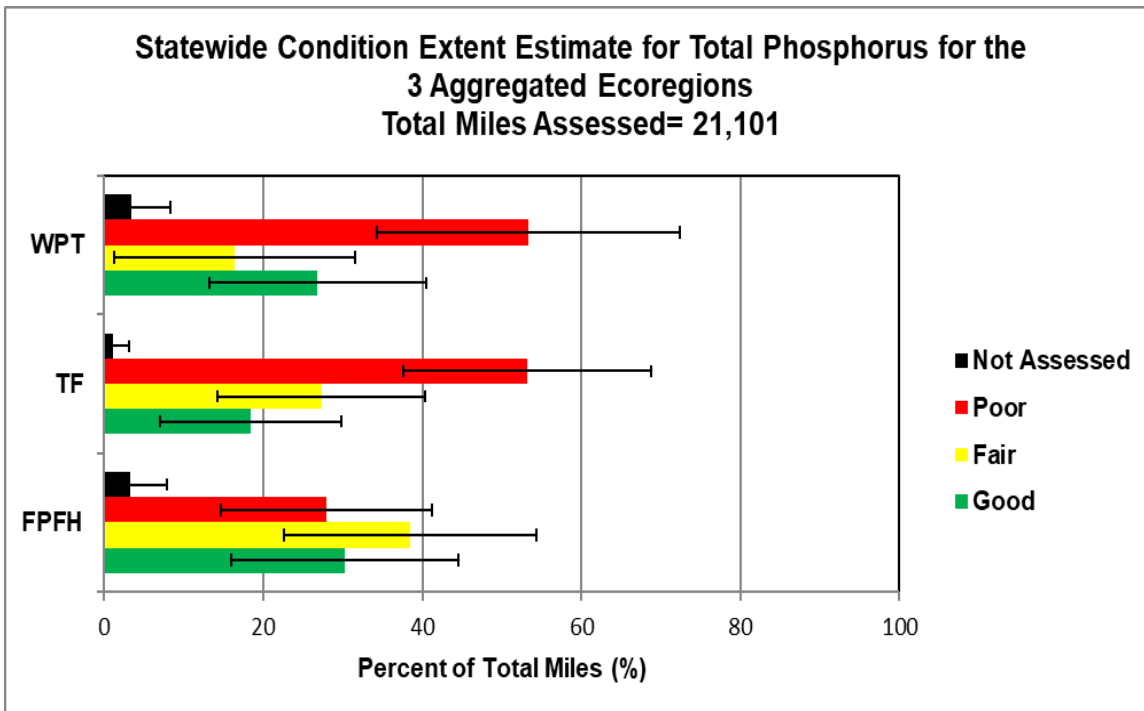


Figure 36. Condition Extent Estimated Statewide for Total Phosphorus in the 3 Aggregated Ecoregions of Oklahoma (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

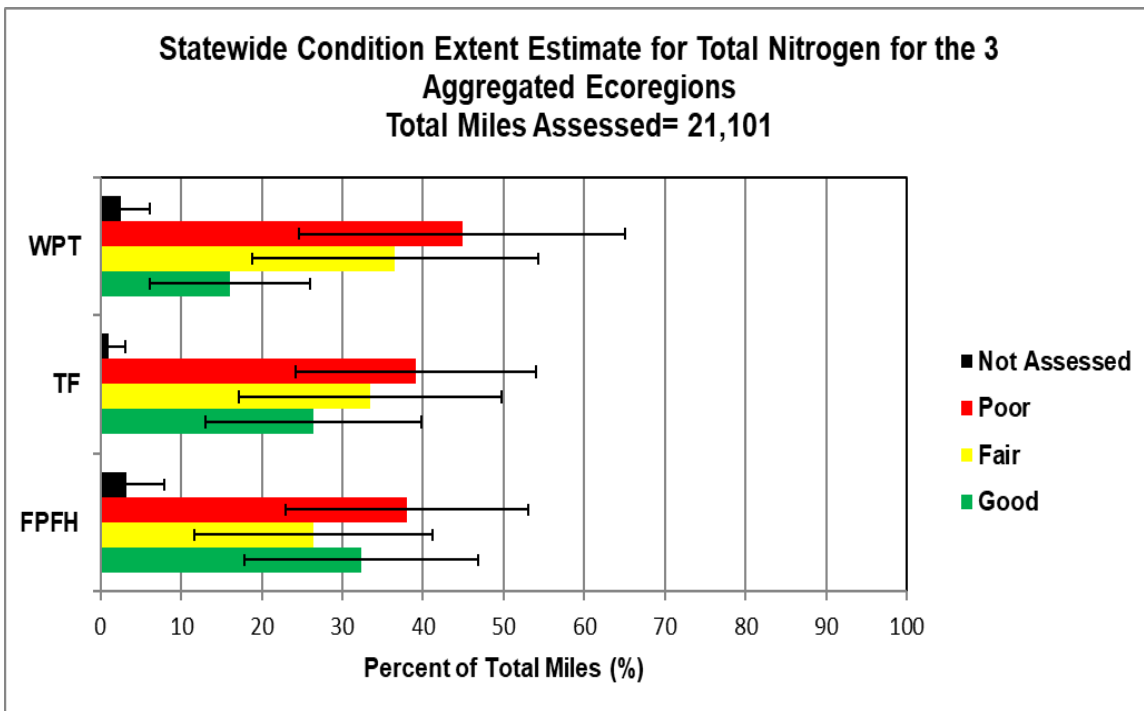


Figure 37. Condition Extent Estimated Statewide for Total Nitrogen in the 3 Aggregated Ecoregions of Oklahoma (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

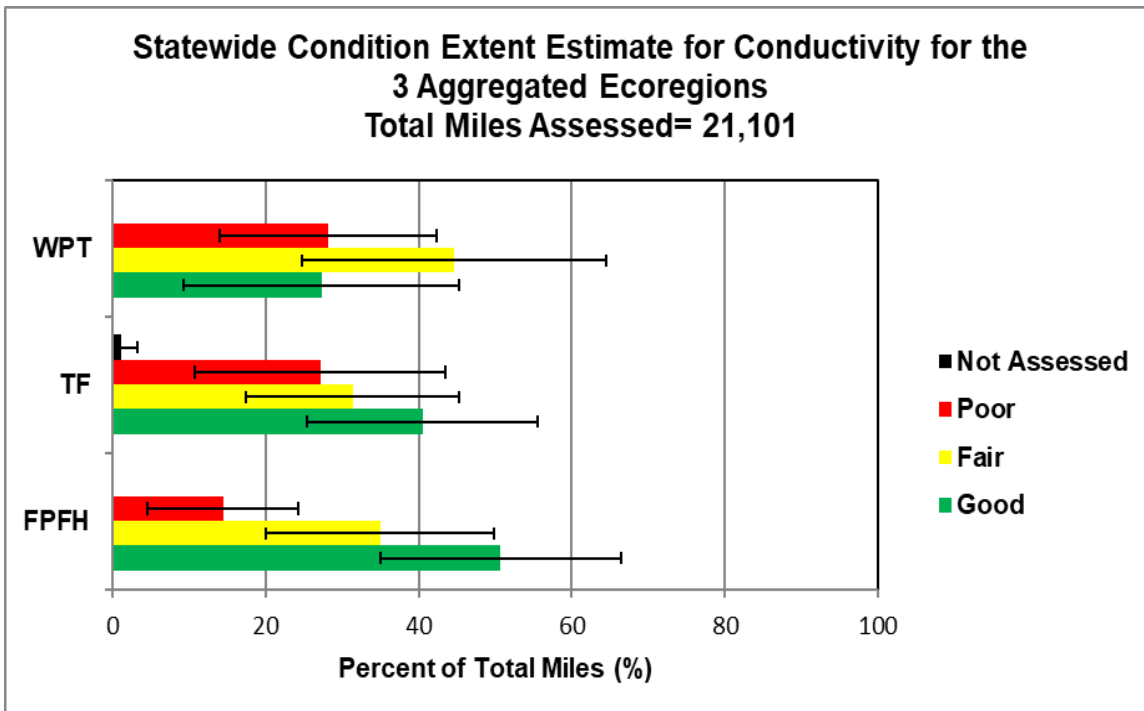


Figure 38. Condition Extent Estimated Statewide for Conductivity in the 3 Aggregated Ecoregions of Oklahoma (2013-2017).

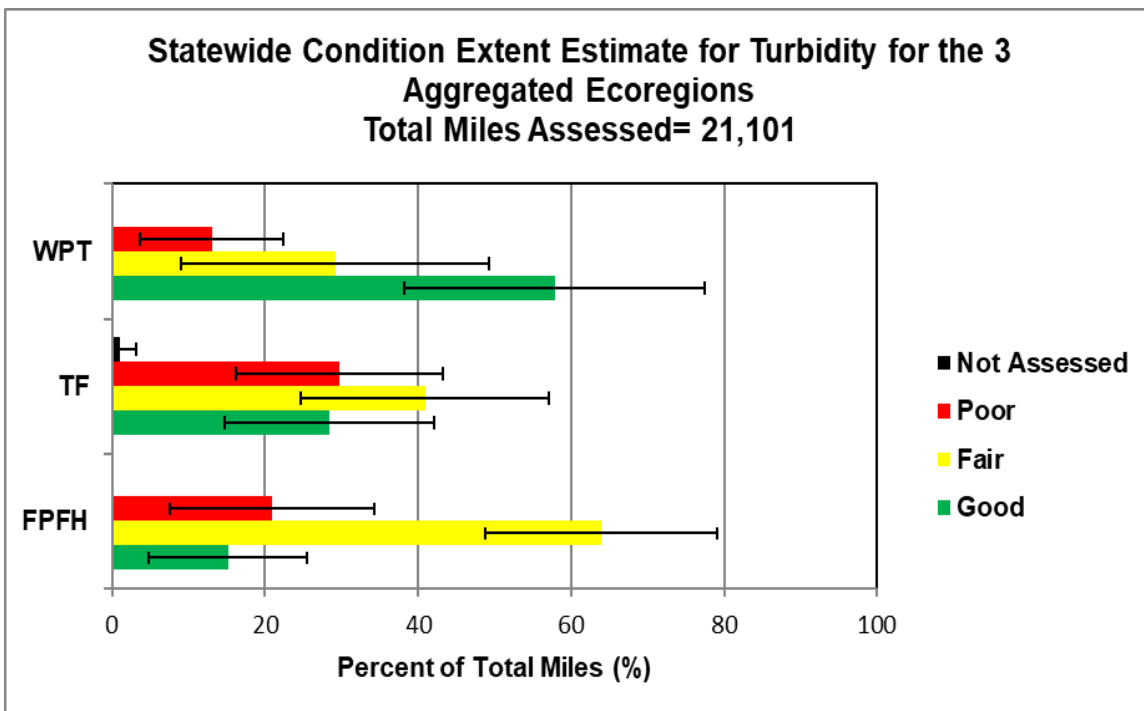


Figure 39. Condition Extent Estimated Statewide for Turbidity in the 3 Aggregated Ecoregions of Oklahoma (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

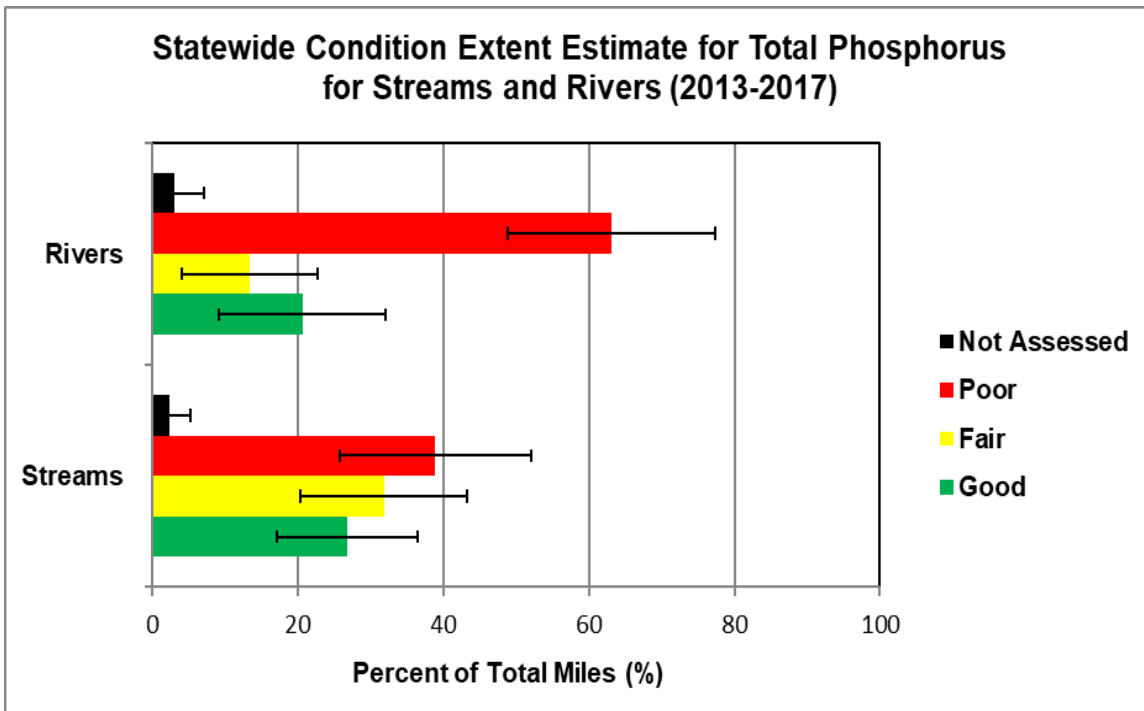


Figure 40. Stressor Extent Estimated Statewide for Total Phosphorus for Streams and Rivers (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

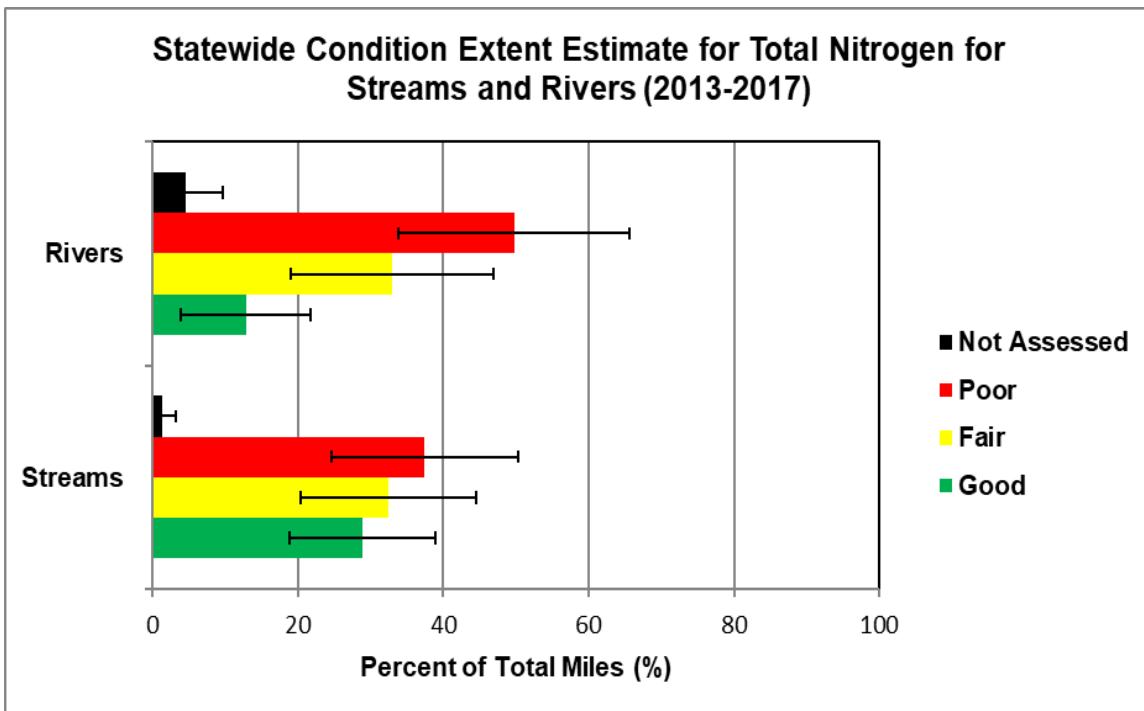


Figure 41. Stressor Extent Estimated Statewide for Total Nitrogen for Streams and Rivers (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

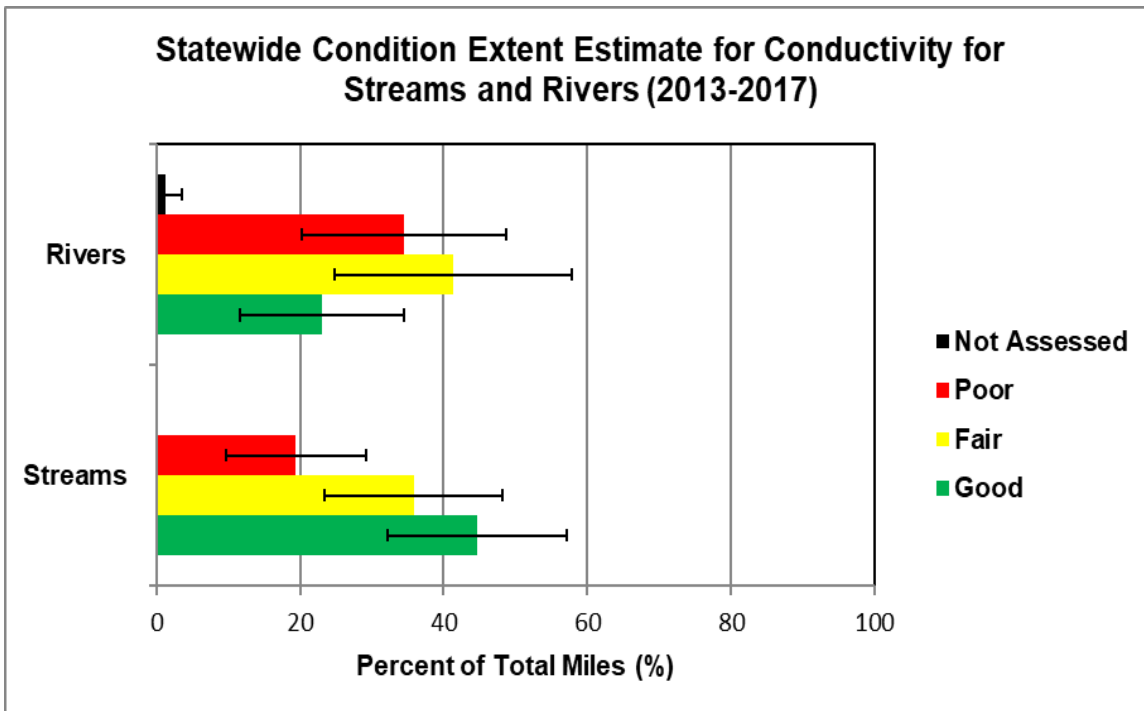


Figure 42. Stressor Extent Estimated Statewide for Conductivity for Streams and Rivers (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

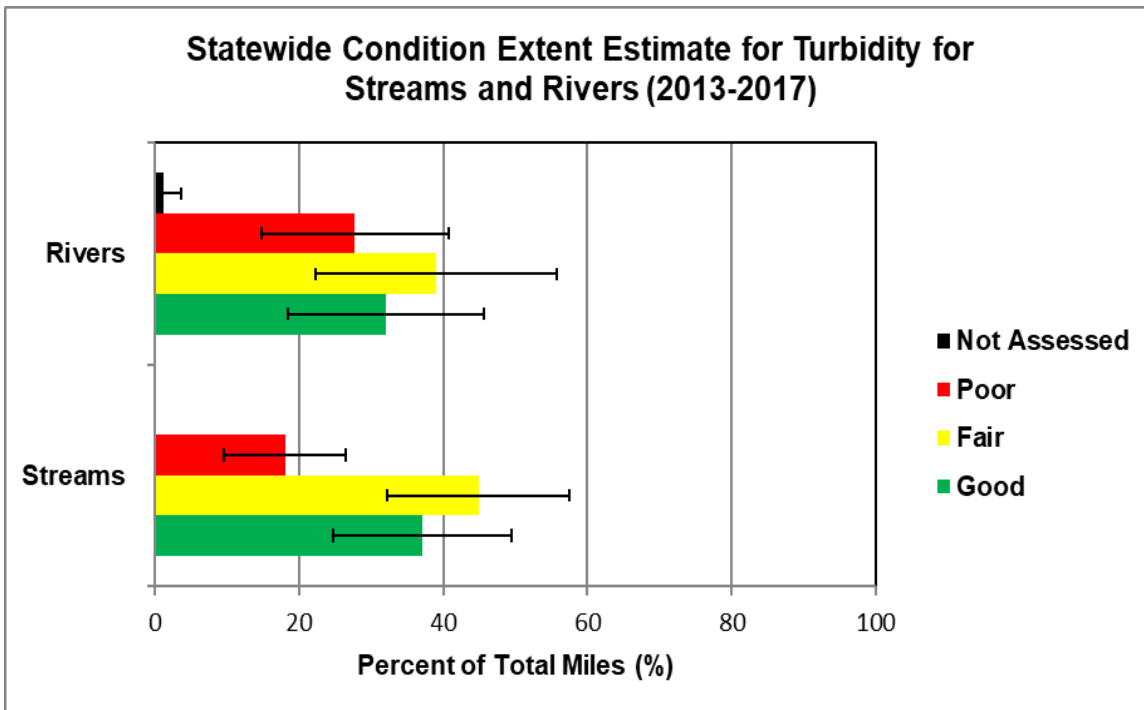


Figure 43. Stressor Extent Estimated Statewide for Turbidity for Streams and Rivers (2013-2017). Upper and Lower Bounds Represent a 95% Confidence Interval.

## **RESULTS—RELATIVE RISK**

### **Relative Risk Methodology**

The concept of using relative risk to develop a relationship between biological condition and stressor extent was developed initially for the USEPA's National WSA (USEPA, 2006). Van Sickle et al. (2006) drew upon a practice commonly used in medical sciences to determine the relationship of a stressor (e.g., high cholesterol) to a medical condition (e.g., heart disease). The method calculates a ratio between the number of streams with poor biological condition/high stressor concentration and those with poor biological condition/low stressor concentration. If the ratio is above one, it indicates that biological condition is likely affected by high stressor concentrations (i.e., concentrations above a preset level). As the ratio increases beyond one, the relative risk of the stressor increases (Van Sickle, J., 2004).

The following analyses include a comparison of a variety of stressors to biological conditions for fish, macroinvertebrates, and algal biomass (sestonic and benthic). For each stressor, relative risk is determined for the entire five-year statewide study, for the three aggregated ecoregions, and for two waterbody sizes (rivers versus streams comparison). The analysis uses a binomial designation of good/poor for condition and high/low for stressor concentration. These binomial designations are then placed in a two-way contingency table to determine relative risk. Two initial ratios are determined. The ratio for poor condition with high stressor concentration is compared to the total number of sites having high stressor concentration, regardless of condition. Likewise, the ratio for poor condition with low stressor concentration is compared to the total number of sites having low stressor concentrations, regardless of condition. These two ratios are then used to calculate relative risk. For each indicator and stressor, the good and fair conditions were collapsed into a good condition for purposes of calculating relative risk. Significant relative risk will be determined by applying a 95% confidence, which must remain above one for risk to be considered significant. Relative risk was not determined for all categories. Some categories did not have any sites in poor condition.

### **Relative Risk to Fish Condition**

The relative risks of various stressors to fish condition are represented in Figures 44-47. The relative risk of poor fish condition is generally greater than one when most stressors are in poor condition. However, very few of these relationships are significant for relative risk. For the 2013-2017 study period, the nutrients (total phosphorus and total nitrogen) showed a significant relative risk to poor fish condition (Figure 44 & Figure 45). For instance, if total phosphorus is in poor condition the risk of poor fish condition is 4.2 times greater for all streams (Figure 44). Likewise, if total nitrogen is in poor condition, the risk of poor fish condition is 4.2 times greater for the Western Plains and Tablelands Aggregated Ecoregion and 2.9 times greater for all streams (Figure 45). However, the risk for poor fish condition related to poor condition of conductivity and/or turbidity was not significant (Figure 46 & Figure 47).

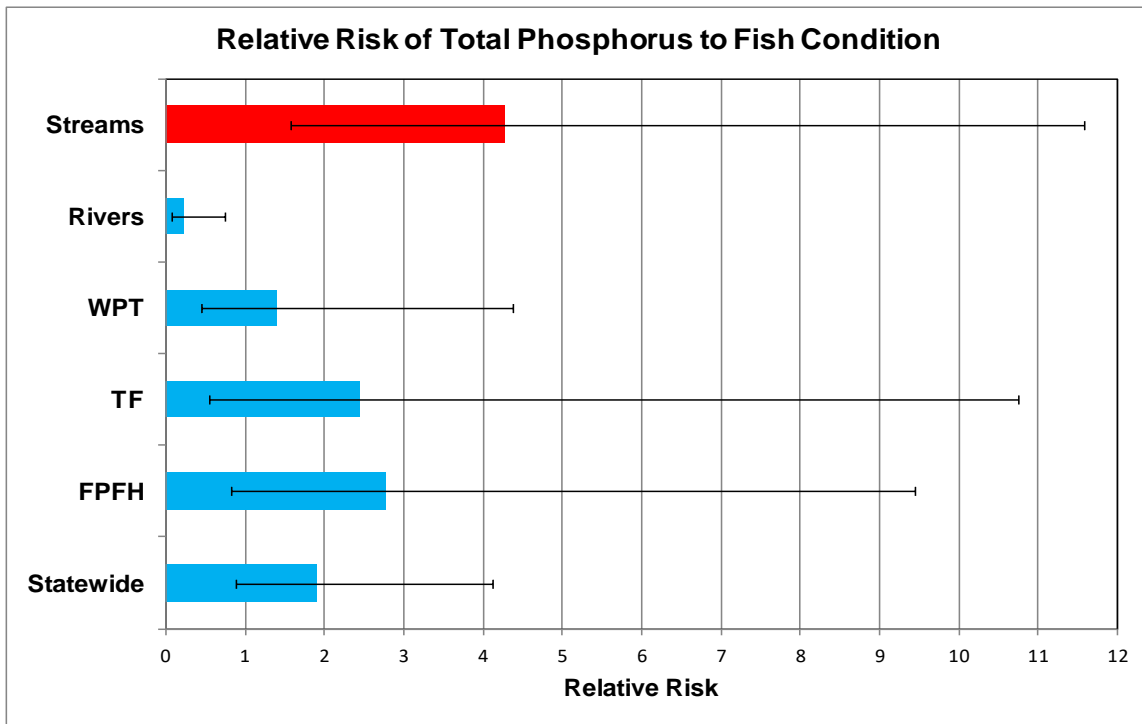


Figure 44. Relative Risk of Total Phosphorus as a Stressor Affecting Poor Fish Condition. Upper and Lower Bounds Represent a 95% Confidence Interval.

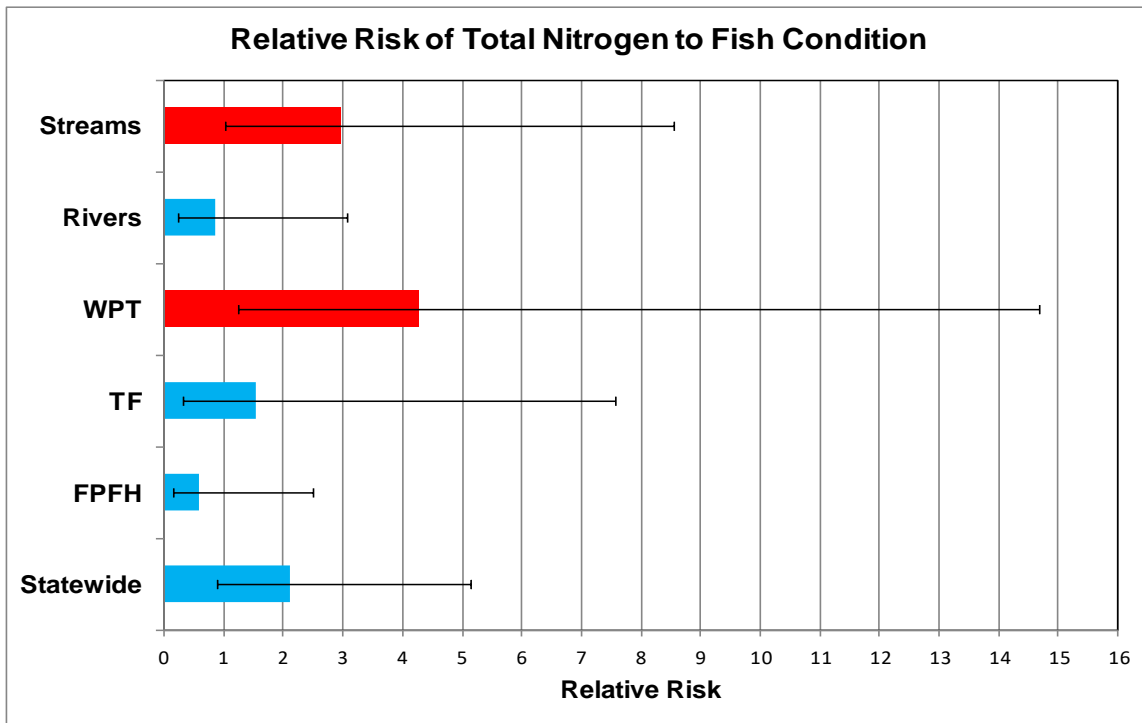


Figure 45. Relative Risk of Total Nitrogen as a Stressor Affecting Poor Fish Condition. Upper and Lower Bounds Represent a 95% Confidence Interval.

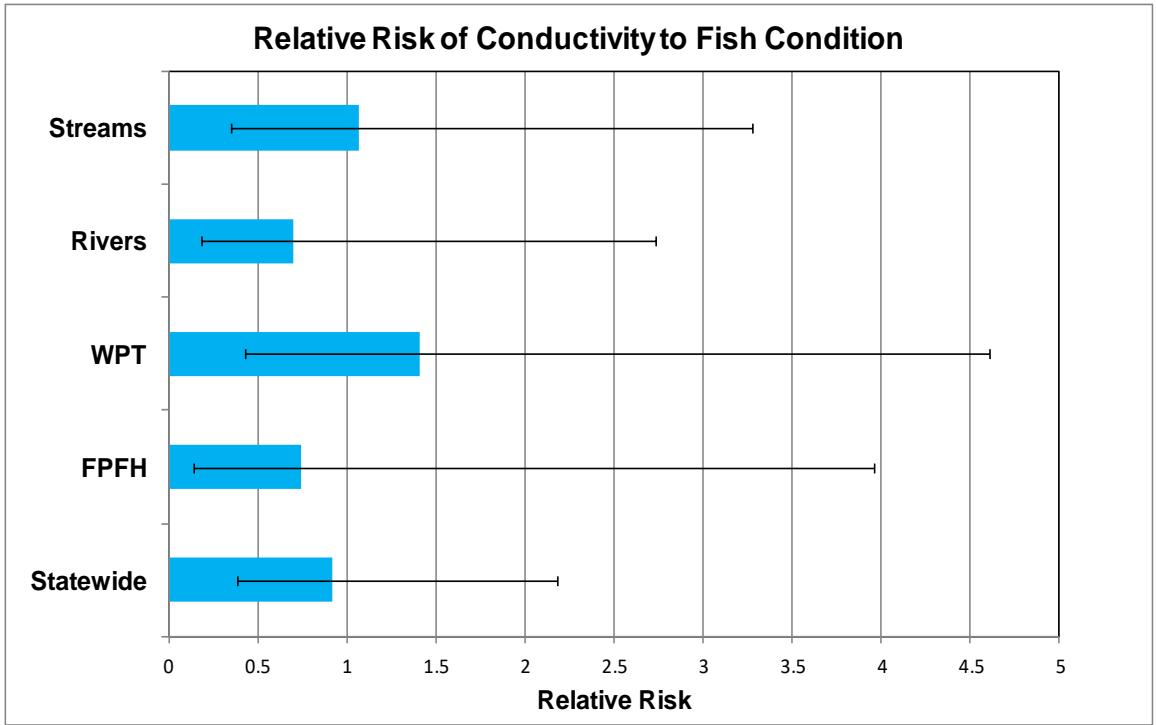


Figure 46. Relative Risk of Conductivity as a Stressor Affecting Poor Fish Condition. Upper and Lower Bounds Represent a 95% Confidence Interval.

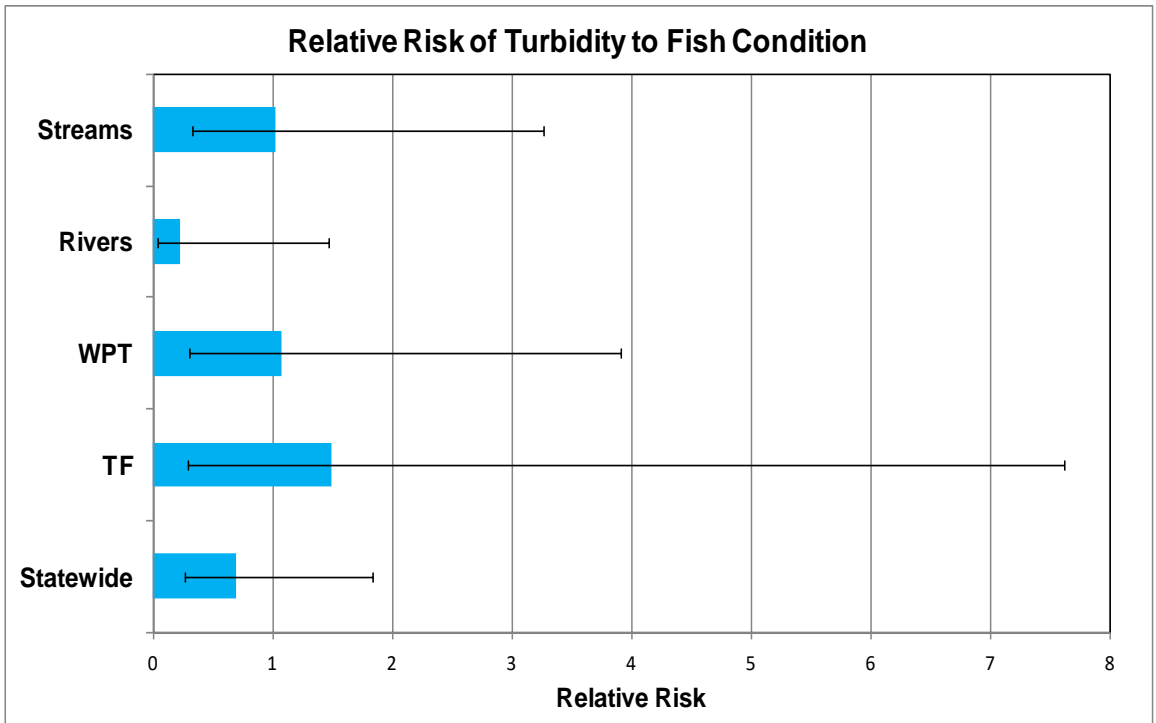


Figure 47. Relative Risk of Turbidity as a Stressor Affecting Poor Fish Condition. Upper and Lower Bounds Represent a 95% Confidence Interval.

### **Relative Risk to Macroinvertebrate Condition**

The relative risks of various stressors to macroinvertebrate condition are shown in Figures 48-51. As with fish, the relative risk of poor macroinvertebrate condition is generally greater than 1 when most stressors are in poor condition, but unlike fish, many of the stressors demonstrate significant risk. During the 2013-2017 study period, the risk of poor macroinvertebrate condition is 5.1 to 7.8 times greater with poor total phosphorus condition for all stream sites as well as two out of the three aggregated ecoregions (TF = 3.4, WPT = 7.8) (Figure 48). Additionally, there is a general statewide risk to macroinvertebrates of greater than 5 times when total phosphorus (TP) is in poor condition.

Total nitrogen shows a similar pattern of relative risk. For all sites, streams, and the Temperate Forests (TF) aggregated ecoregion risk for poor macroinvertebrate condition is 2.8 to 4.4 times greater with poor total nitrogen condition (statewide = 2.8 , streams = 4.3, TF = 4.4) (Figure 49). For conductivity and turbidity the relative risk of poor macroinvertebrate condition is limited to certain aggregated ecoregions ( Figure 50 & Figure 51). When conductivity is in poor condition, the risk of macroinvertebrate poor condition for the Forested Plains and Flint Hills aggregated ecoregion is 11.9 times more likely ( Figure 50). Turbidity demonstrates a relative risk of 3.4 to poor macroinvertebrate condition for the TF aggregated ecoregion (Figure 51).

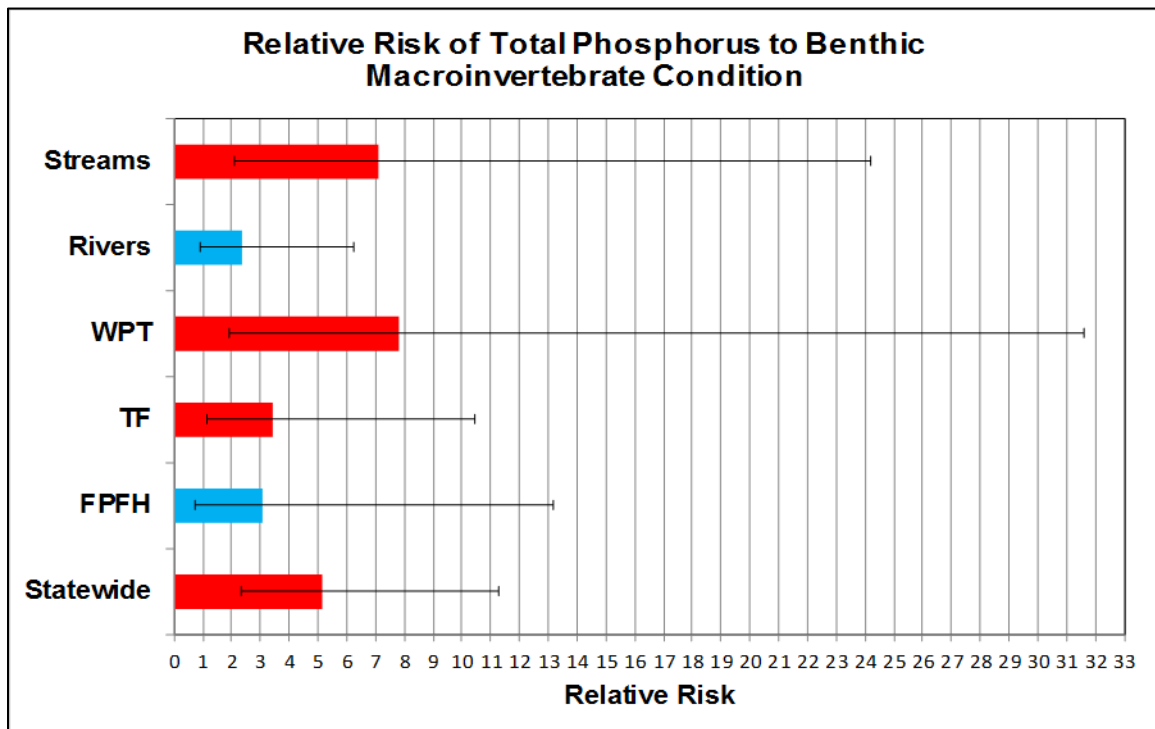


Figure 48. Relative Risk of Total Phosphorus as a Stressor Affecting Poor Condition of Benthic Macroinvertebrates. Upper and Lower Bounds Represent a 95% Confidence Interval.

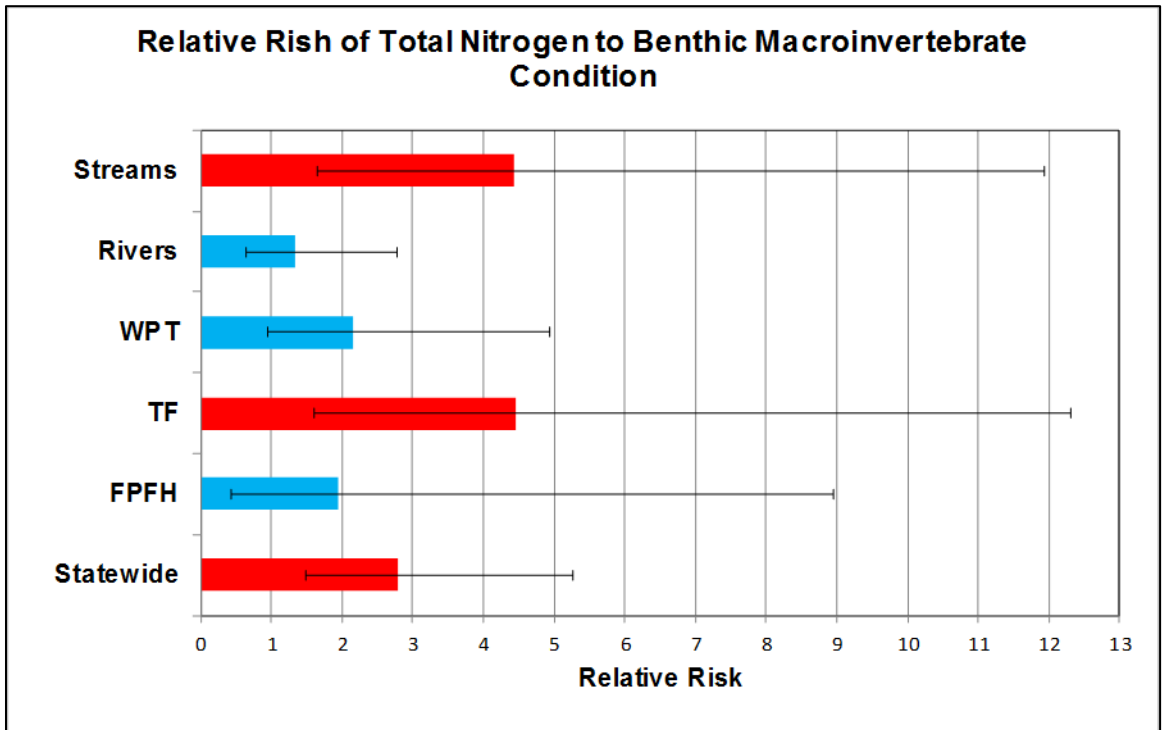


Figure 49. Relative Risk of Total Nitrogen as a Stressor Affecting Poor Condition of Benthic Macroinvertebrates. Upper and Lower Bounds Represent a 95% Confidence Interval.

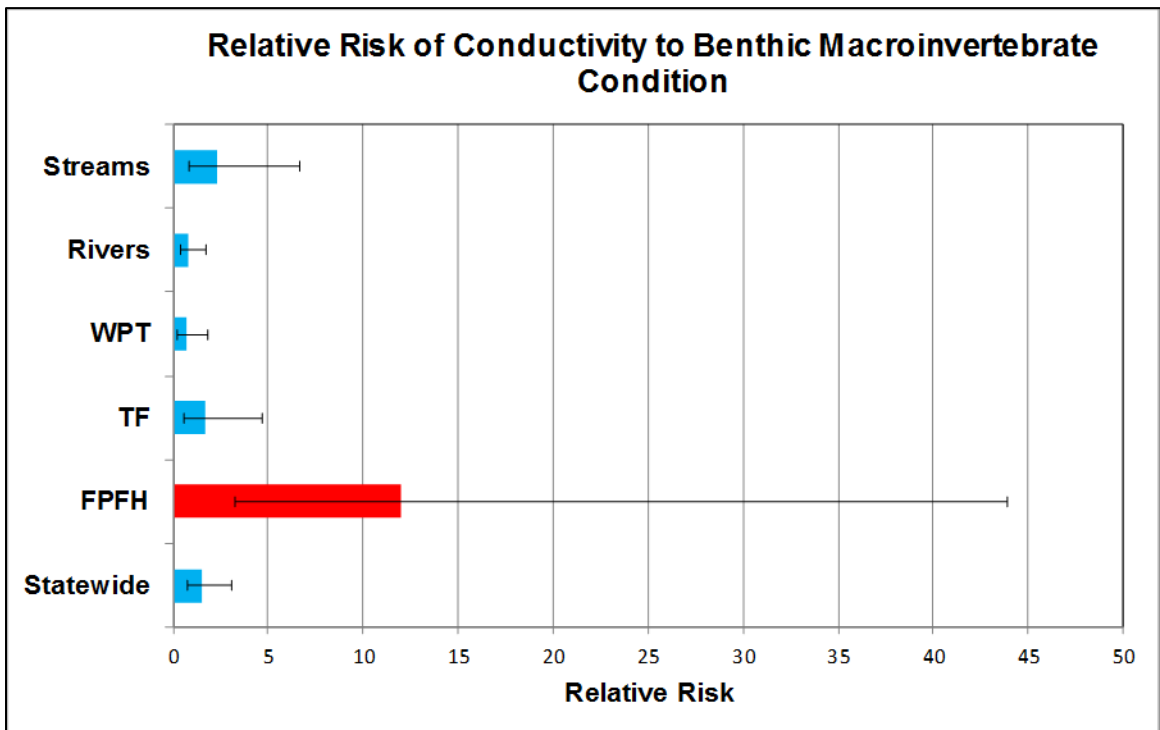


Figure 50. Relative Risk of Conductivity as a Stressor Affecting Poor Condition of Benthic Macroinvertebrates. Upper and Lower Bounds Represent a 95% Confidence Interval.

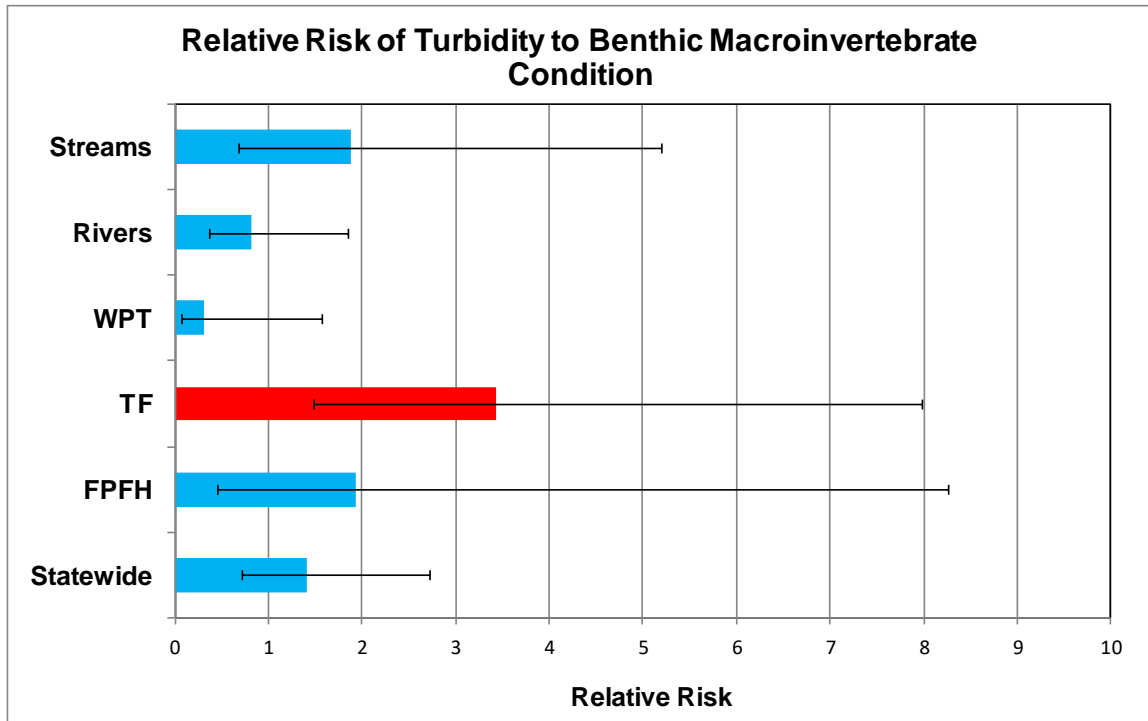


Figure 51. Relative Risk of Turbidity as a Stressor Affecting Poor Condition of Benthic Macroinvertebrates. Upper and Lower Bounds Represent a 95% Confidence Interval.

**Relative Risk to Sestonic Algae Condition**

The relative risks of various stressors to sestonic algae condition are represented in Figures 52-55. Sestonic algae show greater significant relative risk than do benthic algae. For the statewide assessment category, the risk of poor sestonic algae condition was significant for all stressors (TP, TN, conductivity, and turbidity) (Figures 52- 55). For instance, when total nitrogen is in poor condition in the FPFH aggregated ecoregion the risk of poor sestonic algae condition is an astounding 18 times greater (Figure 53). Also, when total phosphorus is in poor condition in the FPFH aggregated ecoregion the risk is nearly 6. Poor conductivity condition was 1.9 to 3.9 times more likely to lead to poor sestonic algae condition in the statewide category, as well as for rivers (1.9), and in two out of the three aggregated ecoregions (WPT = 2.2, TF = 3.9) (Figure 54). Likewise poor turbidity condition showed a similar significant relative risk to poor sestonic algae condition; and the risk was 1.8 to 2.3 times more likely for the statewide category (1.8), for rivers (2.2), and for the WPT (2.3) aggregated ecoregion (Figure 55).

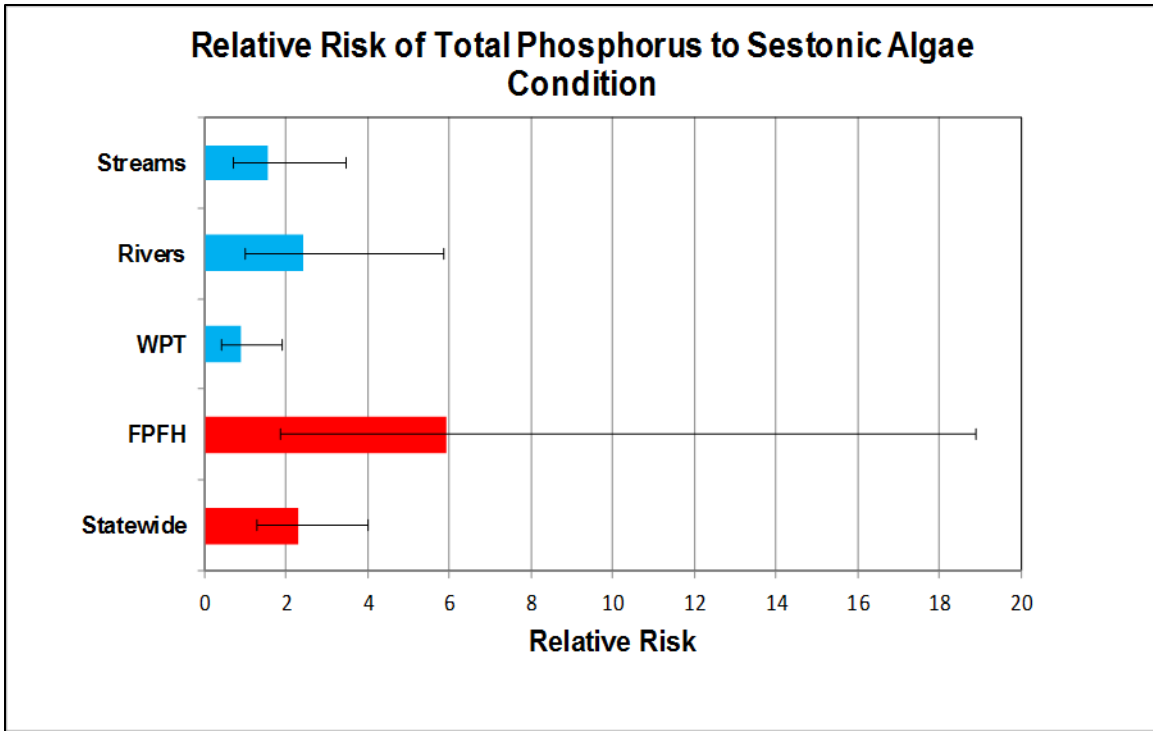


Figure 52. Relative Risk of Total Phosphorus as a Stressor Affecting Poor Sestonic Algae Condition. Upper and Lower Bounds Represent a 95% Confidence Interval.

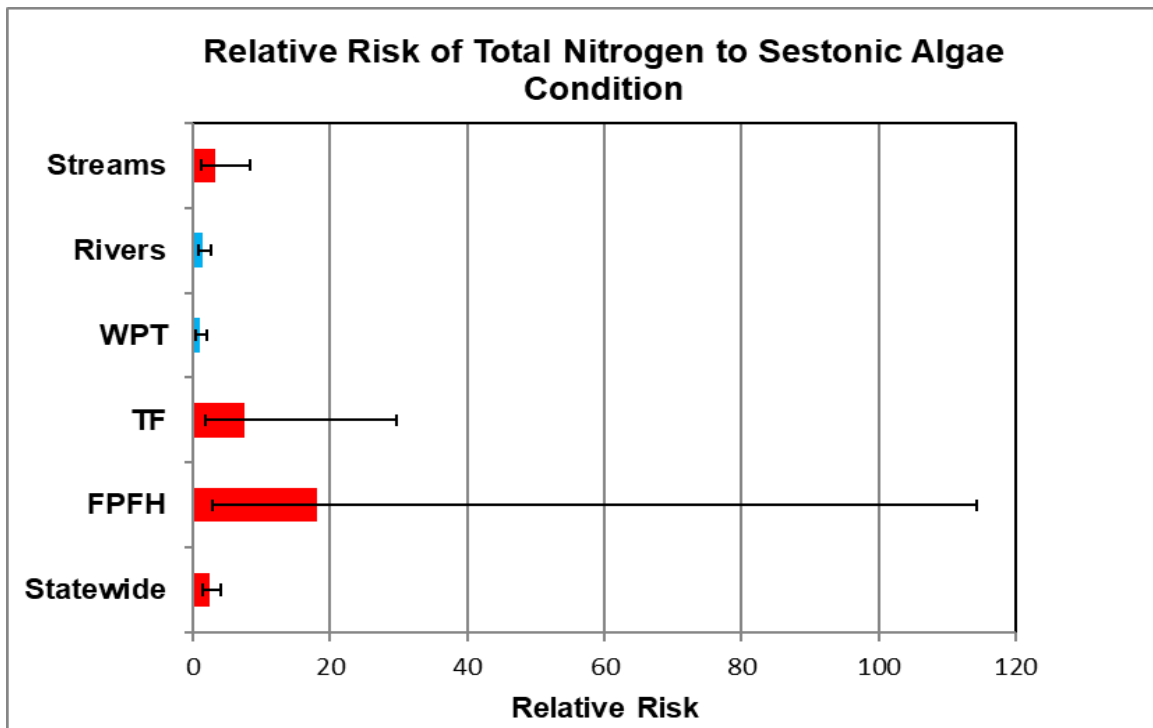


Figure 53. Relative Risk of Total Nitrogen as a Stressor Affecting Poor Sestonic Algae Condition. Upper and Lower Bounds Represent a 95% Confidence Interval.

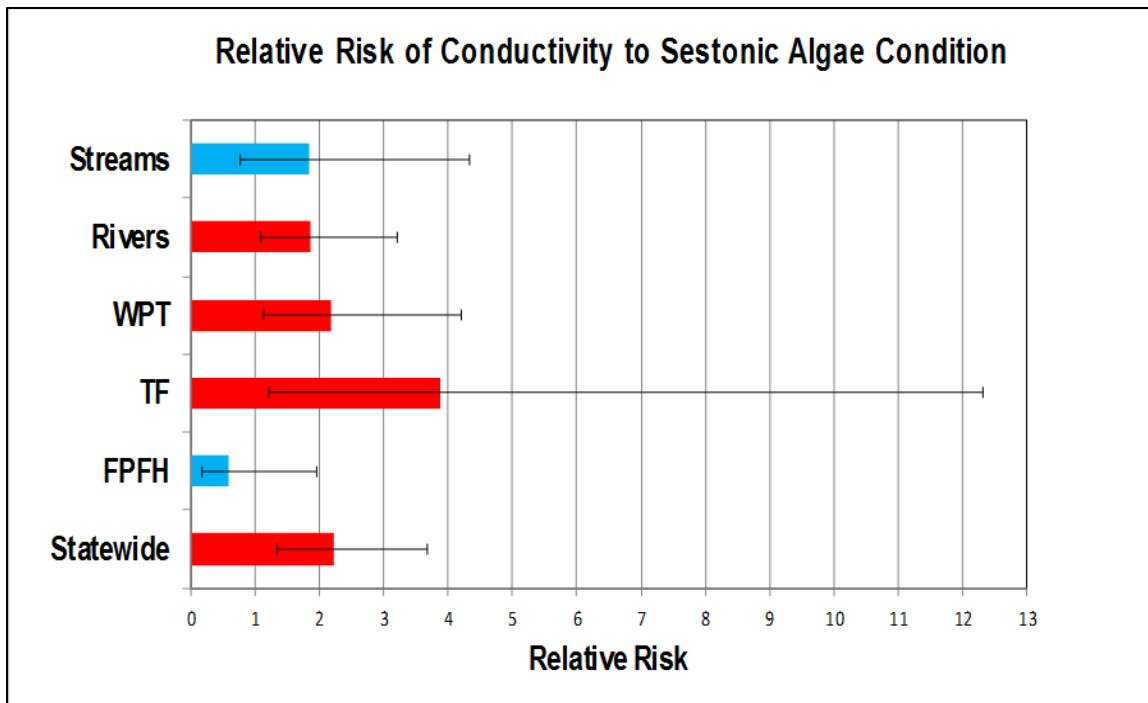


Figure 54. Relative Risk of Conductivity as a Stressor Affecting Poor Sestonic Algae Condition. Upper and Lower Bounds Represent a 95% Confidence Interval.

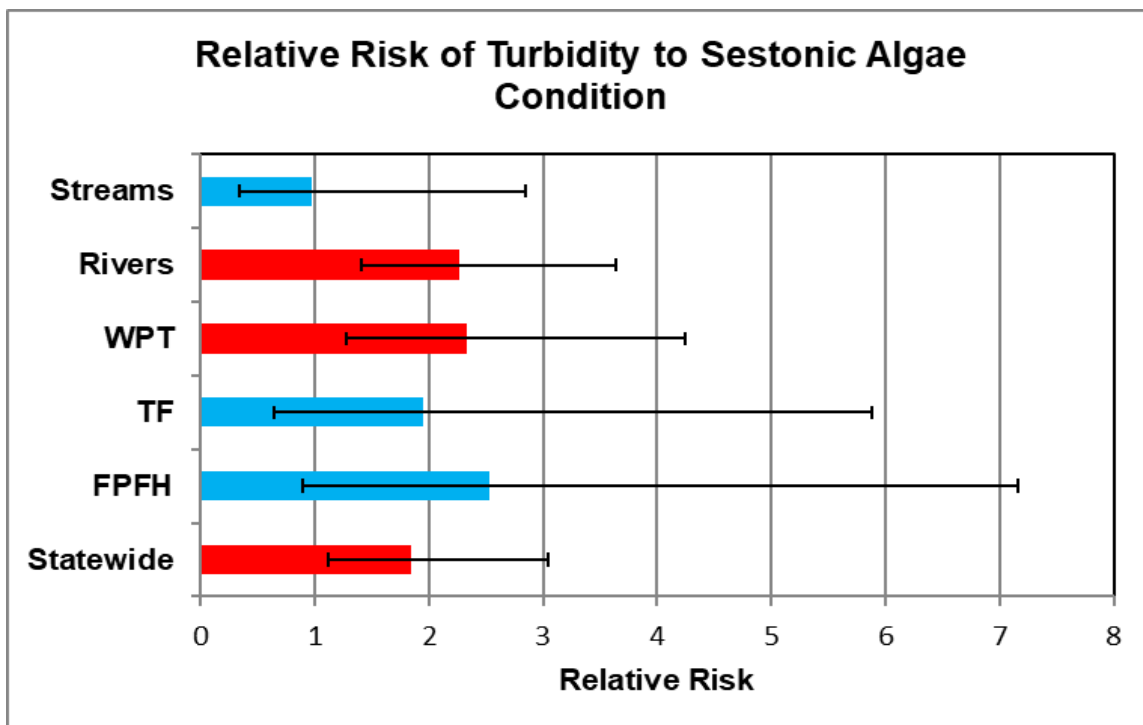


Figure 55. Relative Risk of Turbidity as a Stressor Affecting Poor Sestonic Algae Condition. Upper and Lower Bounds Represent a 95% Confidence Interval.

### **Relative Risk to Benthic Algae Condition**

The relative risks of various stressors to benthic algae condition are represented in Figures 56-59. For the 2013-2017 study, nutrients (TN, TP) demonstrated no relative risk to benthic algae condition (Figure 56 & Figure 57). This is very interesting because nutrients demonstrated high risk in terms of poor sestonic algae condition. This could be indicative of the stressor endpoints used to determine condition for benthic condition. In future iterations, stressor endpoints will be reviewed for ecological relevance and potentially adjusted.

With poor conductivity condition, the risk of poor benthic algae condition increased by 8.3 times in the FPFH aggregated ecoregion (Figure 58). Poor turbidity condition extent increased risk by 6.8 times on rivers (Figure 59). All other stressor risk to benthic algae condition was not significant.

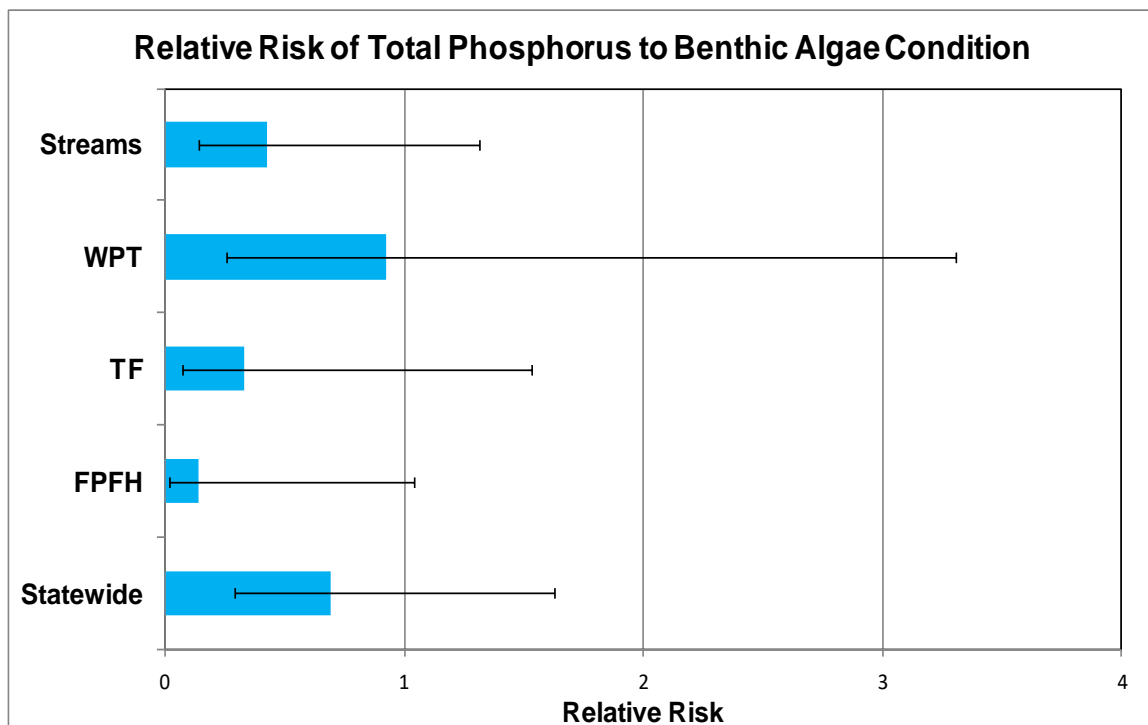


Figure 56. Relative Risk of Total Phosphorus as a Stressor Affecting Poor Benthic Algae Condition. Upper and Lower Bounds Represents a %95 Confidence Interval.

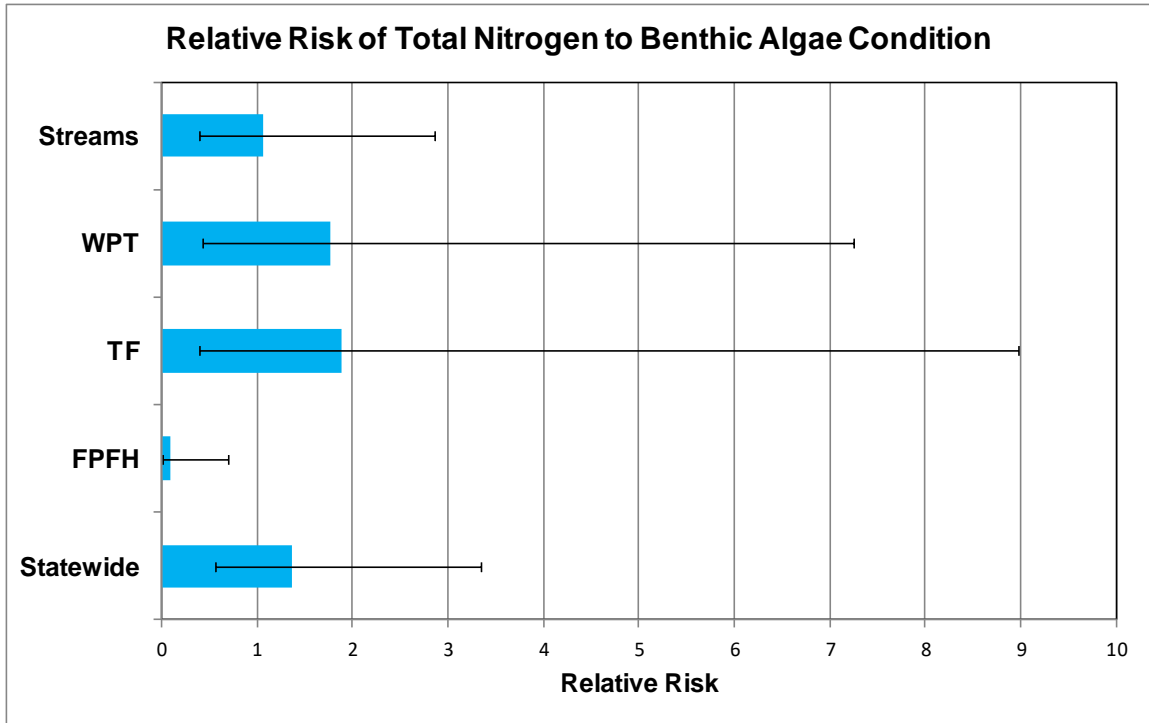


Figure 57. Relative Risk of Total Nitrogen as a Stressor Affecting Poor Benthic Algae Condition. Upper and Lower Bounds Represent a 95% Confidence Interval.

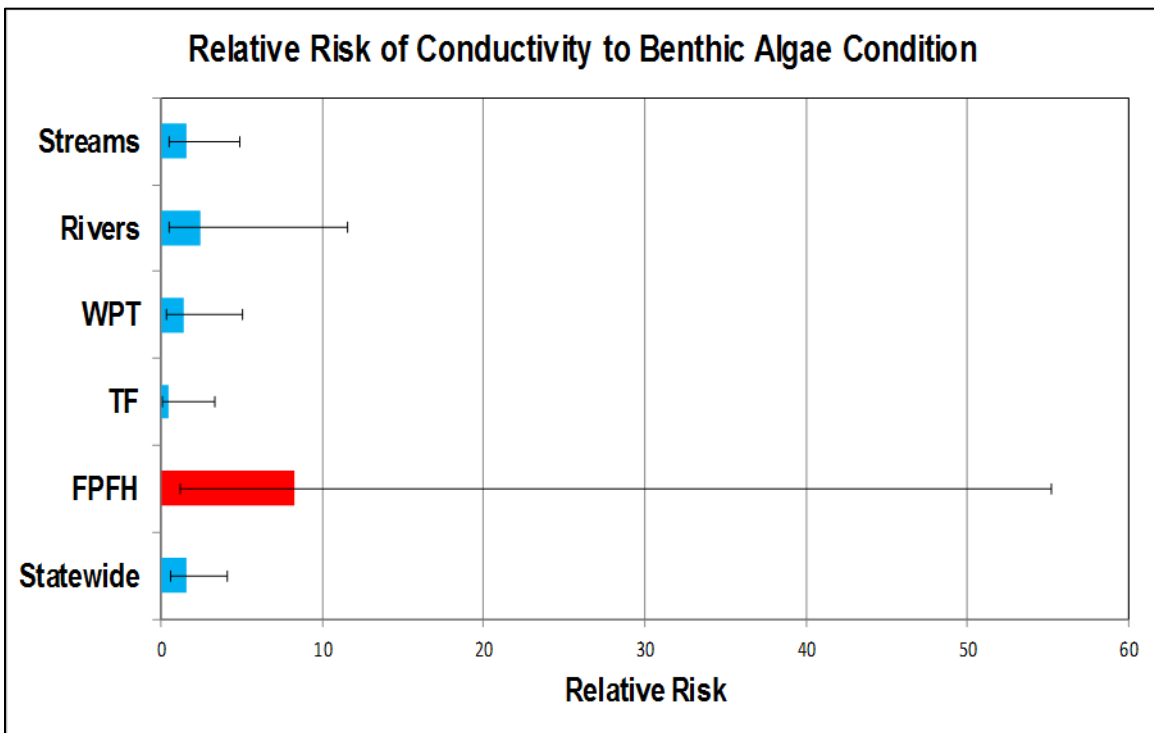


Figure 58. Relative Risk of Conductivity as a Stressor Affecting Poor Benthic Algae Condition. Upper and Lower Bounds Represent a 95% Confidence Interval.

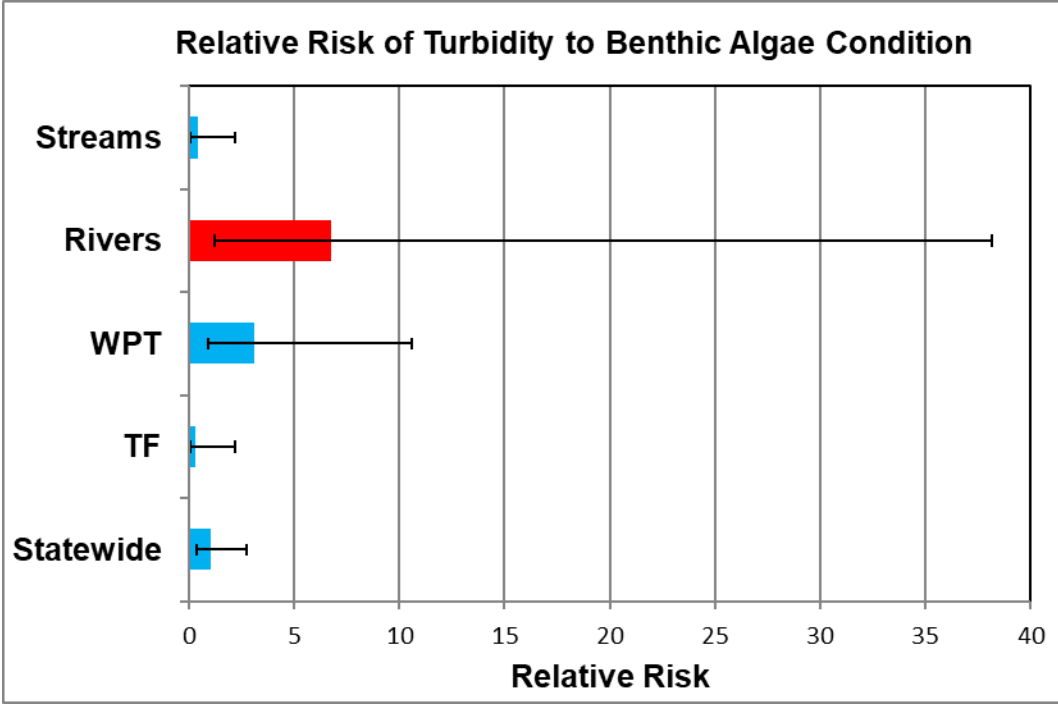


Figure 59. Relative Risk of Turbidity as a Stressor Affecting Poor Benthic Algae Condition. Upper and Lower Bounds Represent a 95% Confidence Interval.

## DISCUSSION AND RECOMMENDATIONS

### Oklahoma's Integrated Water Quality Report

Oklahoma's environmental agencies gather and assess data across the state for a wide variety of biological, chemical, and physical water quality indicators. These data collections meet the federal Clean Water Act requirements to compile a list of impaired waterbodies and determine the condition of all these waters. These reports are compiled in the biannual Oklahoma Water Quality Assessment Integrated Report (ODEQ, 2018).

The 2013-2017 study benefits this report in several ways. First, this report marks Oklahoma's fifth and sixth statistically based assessments on the condition of Oklahoma's lotic waters. The OWRB recommends that this report be adopted into the 305(b) section of the 2020 or 2022 integrated report. Included graphics can be used to show overall statewide and regional condition. Second, individual lotic waterbodies not yet included in Oklahoma's Integrated Report (ODEQ, 2018) now have some level of assessment. The OWRB regularly submits waters for inclusion on Oklahoma's 303(d) list and will do so again in 2020. As a part of OWRB's submission, waterbodies assessed as part of this study will be included for consideration as not only category five (impaired), but as category three (not impaired for some uses). Because of assessment rules housed in Oklahoma's Continuing Planning Process (CPP) (ODEQ, 2012) and USAP (OWRB, 2016c), certain water quality parameters will not be included as part of the assessment. Most of Oklahoma's assessment protocols require that certain data requirements be met including the number of samples required to make an assessment determination. Protocols were developed to either assess short-term or long-term exposure. Short-term exposure protocols are written as percent exceedances, with a minimum of ten samples being required. Long-term exposure protocols are based upon some measure of central tendency, but typically require a minimum number of samples to calculate the applicable descriptive statistic. Some exceptions to these rules include biological assessments, application of the sediment criteria, and a single sample maximum of 200 mg/m<sup>3</sup> for benthic chlorophyll *a*. All other parameters included in this study will not be included in assessments for the impaired waters list but will be made publicly available in the event that another entity can include the data in their assessment. To ensure inclusion of relevant data, stations will be placed in the most current version of the OWRB Assessment Workbook (OWRB, 2016), which is not only used to assess waters for the Oklahoma Integrated Report but for the OWRB's Beneficial Use Monitoring Program (BUMP) (OWRB, 2018).

### Differences in Indicator/Stressor Levels for 2008-2011

In 2013, the Oklahoma Water Resources Board published a report titled "Statewide Stream/River Probabilistic Monitoring Network for the State of Oklahoma from 2008-2011 (OWRB, 2013)." This report was a precursor to this current 2013-2017 report. These past studies have allowed for unique analysis between both study periods and waterbody size. These studies are also useful in change analysis between reporting periods. Differences in poor condition of both indicators and stressors for the 2008-2011 report are presented in **Error! Reference source not found.** The analysis simply compares the differences in percent of total miles in poor condition and establishes significant difference between periods or size. The arrows in the trend column merely indicate the direction of a potential trend.

For indicators, both fish and macroinvertebrates demonstrate a downward change in poor condition between study periods, with only the fish having a significant downward change (**Error! Reference source not found.**). Conversely, both algal indicators show an upward

change, with only the benthic algae trend having significance. Likewise, TN, conductivity, turbidity, and sediment all show an upward change between the two study periods, with only turbidity and sediment having a significant change (**Error! Reference source not found.**). Notably, environmental conditions, particularly drought, became more acute in 2010-2011, and high water was an issue during a portion of the 2009 summer index period.

All indicators and stressors have a larger percentage of river miles in poor condition than stream miles in poor condition. And, apart from sediment, all differences are significant. Likely, this exists for several reasons. Two possible reasons may be that larger rivers and streams carry much heavier pollutant loads because they have a much larger area of input; and secondly, the development and refinement of reference condition, metrics, and stressor criteria/screening limits need continued development at both ecoregion and size scales. Data exists to perform these tasks and would eliminate much of the potential noise that is present in current assessments.

Table 11. The percentage of total miles for indicators and stressors in poor condition compared between two-year study periods, as well as large and small waterbodies for 2008-2011. Arrows show direction of potential change (\*\* = significant at alpha of 0.95).

Indicator/Stressor	2008-09 %Poor	2010-11 %Poor	Change	River %Poor	Stream %Poor	Change
Fish	43.9%	21.7%	↓**	50.1%	30.4%	**
Macroinvertebrates	40.6%	25.7%	↓	62.3%	24.7%	**
Benthic Algae	3.7%	21.3%	↑**	21.7%	5.9%	**
Sestonic Algae	18.2%	28.3%	↑	60.6%	6.8%	**
Conductivity_ECO	10.6%	21.4%	↑	38.5%	5.5%	**
Conductivity_NRSA	16.7%	22.7%	↑	55.0%	5.1%	**
TN_ECO	23.4%	37.5%	↑	40.3%	24.1%	**
TN_NRSA	12.2%	22.3%	↑	31.3%	10.1%	**
TP_ECO	40.7%	36.9%	↓	73.8%	26.2%	**
TP_NRSA	31.0%	40.1%	↑	76.4%	18.3%	**
Turbidity_ECO	11.5%	26.6%	↑**	36.9%	9.5%	**
Sediment	15.8%	51.3%	↑**	34.9%	26.2%	NS

### **Differences in Indicator/Stressor Levels for 2013-2017**

The 2013-2017 study allows for unique analysis between both study periods and waterbody sizes (rivers and streams). Differences in poor condition of both indicators and stressors for the 2013-2017 report are presented in

Table 12. The analysis simply compares the differences in percent of total miles in poor condition and establishes significant difference between time periods or waterbody sizes. The arrows in the change column merely indicate the direction of a potential change.

For indicators, both fish and macroinvertebrates demonstrate a downward change in poor condition between study periods, with neither being significant at the 95% confidence interval (

Table 12). For algae, both sestonic and benthic have an upward trend in poor condition with neither being significant.

For stressors, total nitrogen and total phosphorus both demonstrate a downward change in poor condition between the two study periods (SY 13/14/15, SY 15/16/17). Both trends are statistically significant (\*\*). Notably, environmental conditions, particularly high water levels were an issue during a portion of the 2013 and 2015 index periods. It is important to note that Table 11 is a two year average of poor condition while Table 12 is a three year average. Lastly, for indicators both benthic macroinvertebrates and sestonic algae have much higher percentages of total miles in poor condition for rivers than for streams (

Table 12). This change is statistically significant (\*\*). For stressors, total phosphorus and conductivity have a higher percentage of miles in poor condition for rivers than for streams. These two changes are also statistically significant at the 95% confidence interval.

Table 12. The percentage of total miles for indicators and stressors in poor condition compared between three year study periods, as well as a rivers and streams comparison for 2013-2017. Arrows show direction of potential trend (\*\* = significant at alpha of 0.95).

Indicator/Stressor	2013-15 %Poor	2015-17 %Poor	Change	Rivers %Poor	Streams %Poor	Change
Fish	17.8%	9.8%	↓	15.1%	16.1%	NS
Macroinvertebrates	25.3%	13.7%	↓	35.5%	17.9%	**
Benthic Algae	9.0%	11.3%	↑	7.1%	11.1%	NS
Sestonic Algae	21.7%	24.5%	↑	43.4%	16%	**
Conductivity_ECO	22.1%	23.3%	↑	34.5%	19.4%	**
TN_ECO	46.8%	30.0%	↓**	50.0%	37.4%	NS
TP_ECO	50.5%	37.3%	↓**	63.1%	39.0%	**
Turbidity_ECO	22.2%	16.8%	↓	27.8%	18.0%	NS

### **Indicator/Stressor 10 Year Trend Analysis**

Past and present studies with similar designs allow for trend analysis. Differences in percentages of total miles in poor condition of both indicators and stressors for the 2008-2011 and 2013-2017 reporting periods are presented in **Error! Reference source not found.** Sample year 2012 was a reporting year for the OWRB and no probabilistic monitoring streams sites were sampled in that year.

It is important to note that **Error! Reference source not found.** summarizes the poor condition percentages for the two reporting periods which were different length study periods. The 2008-2011 probabilistic monitoring study lasted four years. The 5<sup>th</sup> year was a reporting year. The 2013-2017 study ran into a 5<sup>th</sup> year of sampling. The original design was to complete all sampling by the end of the 4<sup>th</sup> year. After the 2013-2014 NRSA study, we had to re-evaluate progress. Due to budget constraints, we decided to move sampling into the 5<sup>th</sup> year. This is the

only major difference in the two data sets when utilizing them for comparison and long-term trend analysis.

On a positive note, three out of the four biological indicators are trending downward between study periods. However, only the fish downward trend is significant at the 95% confidence interval (\*\*). Sestonic algae was the only indicator trending upward between the two reporting periods (**Error! Reference source not found.**).

For stressors, the news is not good. All stressors are trending upward (three out of four are significant at alpha of 0.95). This is a major concern for water quality in Oklahoma’s rivers and streams. Specifically, this trend is concerning for nutrients (TN and TP). These two nutrients play a vital role in determining the health of rivers and streams and may result in excess algal growth in Oklahoma’s lakes. This perhaps is why sestonic algae are also trending upward between the two study periods (**Error! Reference source not found.**). Excess algal growth can lead to water quality issues such as low oxygen which may result in fish kills, harmful algal blooms, and degradation of drinking water supplies.

Table 13. The percentage of total miles for indicators and stressors in poor condition compared between reporting periods (2008-2011 compared to 2013-2017). Arrows show direction of potential trend (\*\* = significant at alpha of 0.95).

Indicator/Stressor	2008-11 %Poor	2013-17 %Poor	Trend
Fish	35.5%	15.8%	↓**
Macroinvertebrates	35.1%	23.0%	↓
Benthic Algae	10.2%	10.0%	↓
Sestonic Algae	22.0%	23.9%	↑
Conductivity_ECO	14.6%	23.8%	↑**
TN_ECO	28.6%	41.0%	↑**
TP_ECO	39.3%	45.9%	↑**
Turbidity_ECO	17.1%	20.8%	↑

**Attributable Risk**

To determine the affect a stressor has on a particular biological indicator relative risk analyses were made for each stressor-indicator pair and presented in the results section of this report (Figures 44-59). However, is there a way to determine how much affect a proportional reduction in a stressor would have on the incidence of poor condition in an indicator? Attributable risk provides an elimination scenario to investigate this relationship and potential beneficial outcomes of reduction (Van Sickle, J., and S.G. Paulsen, 2008). Although assailable assumptions are made about causality and the analysis requires elimination of the stressor, it is still a useful extension of the stressor extent and risk models already used in probability assessments. As reported in the draft NRSA report:

“Attributable risk represents the magnitude or importance of a potential stressor and can be used to help rank and set priorities for policymakers and managers. Attributable risk is derived by combining relative extent and relative risk into a single

number for purposes of ranking. Conceptually, attributable risk provides an estimate of the proportion of poor biological conditions that could be reduced if high levels of a particular stressor were eliminated. This risk number is presented in terms of the percent of length that could be improved” (USEPA, 2013-2014 NRSA Draft Report, 2013).

The result of attributable risk for the current Oklahoma study is provided in Figures 60-63. In order to provide a meaningful analysis, an assumption was made that if relative risk was not significant, then calculation of an elimination scenario was not meaningful. Therefore, pollutant elimination analyses were only performed where stressor/indicator relative risk was significant (See Figures 44-59). Confidence intervals were also calculated for each risk analysis, and significant potential reduction only exists where the upper confidence bound does not equal the original percent in poor condition. The original extent is presented in the green colored bars below. The attributable extent is presented in the pink colored bars below. This extent represents the percentage of change in poor condition of an indicator in total miles once the stressor has been eliminated.

Notably, for fish, reduction of TP and TN in streams could result in a significant decrease in poor fish condition (Figure 60). This is also true for TN for the WPT aggregated ecoregion. For macroinvertebrates, elimination of both TP and TN could have a significant effect on poor condition (Figure 61). The elimination of TP in the WPT could result in a 25% lowering of the percent of miles in poor condition. Eliminating conductivity (6.4% reduction, FPFH) and turbidity (10% reduction, TF) in certain aggregated ecoregions can also result in a significant improvement in macroinvertebrate condition. Sestonic algae condition shows potential promise with a variety of pollutant elimination scenarios (Figure 63). Reduction in turbidity, conductivity, and nutrients (TP, TN) all show some significant potential for reduction in poor sestonic algae condition for the statewide analysis. Reduction of TP and TN statewide both show the same amount of positive significance for the potential reduction in sestonic algal growth (8.9%). Benthic algae, on the other hand only respond to reductions in conductivity in the FPFH aggregated ecoregion (2.8%) and turbidity in rivers (4.4%) (Figure 62).

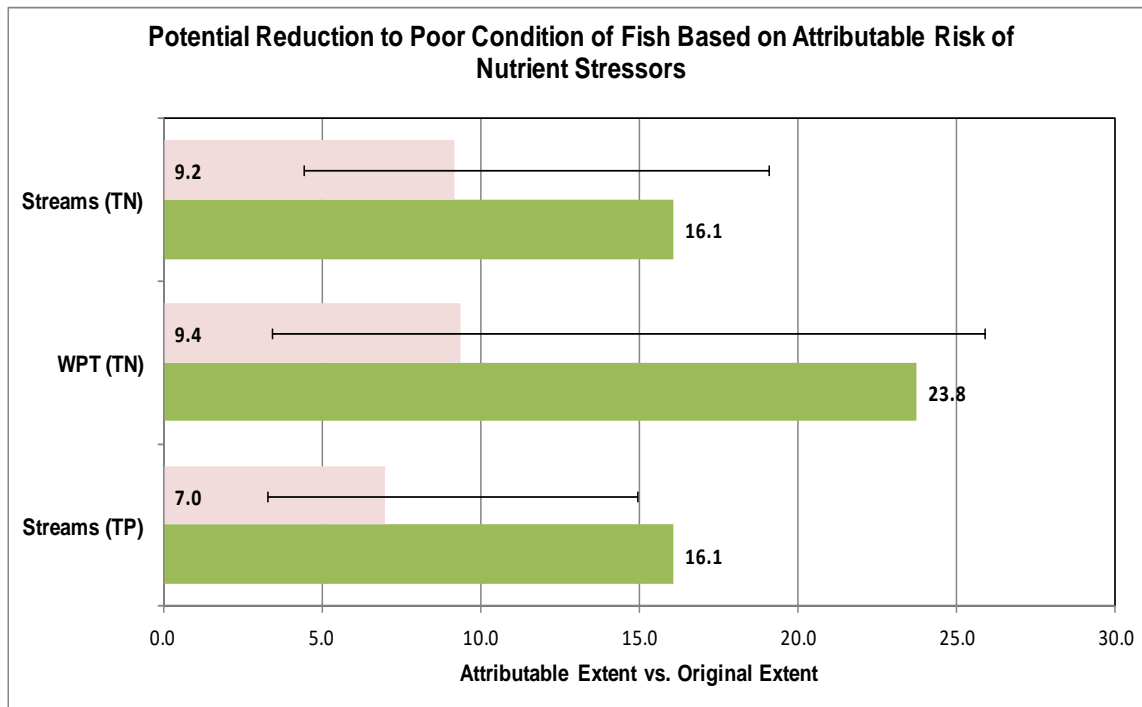


Figure 60. Potential Reduction to Poor Condition of Fish Based on the Attributable Risk of Stressors Having Significant Relative Risk.

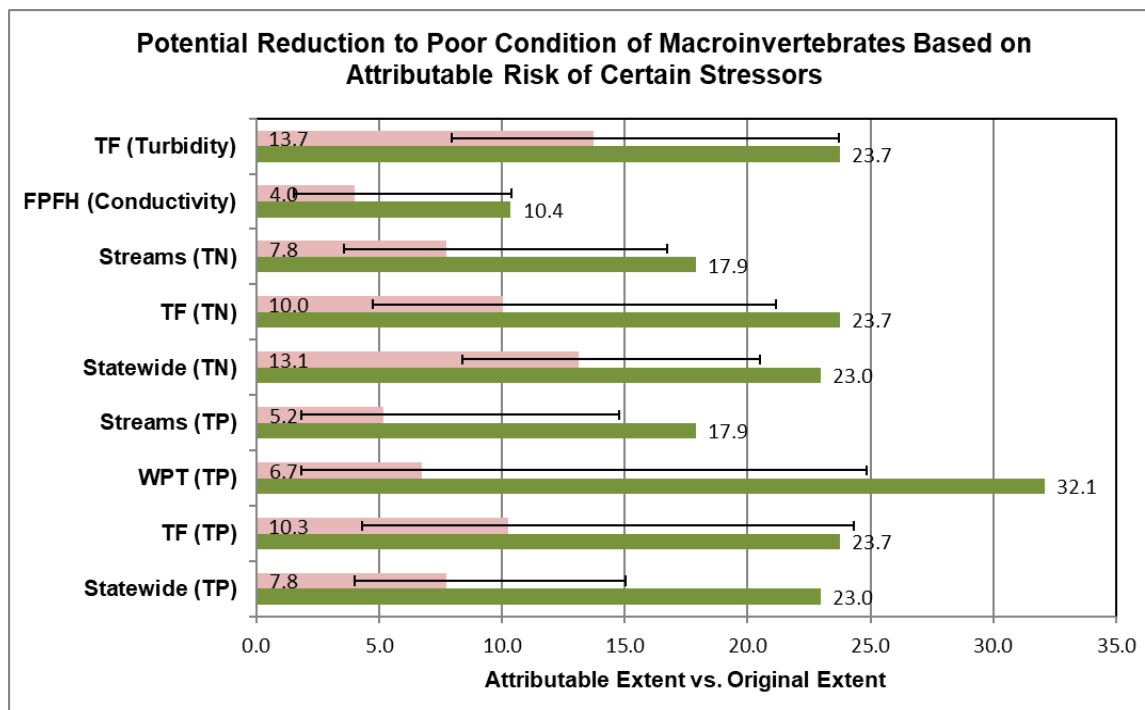


Figure 61. Potential Reduction to Poor Condition of Macroinvertebrates Based on the Attributable Risk of Stressors Having Significant Relative Risk. Upper and Lower Bounds Represent a 95% Confidence Interval.

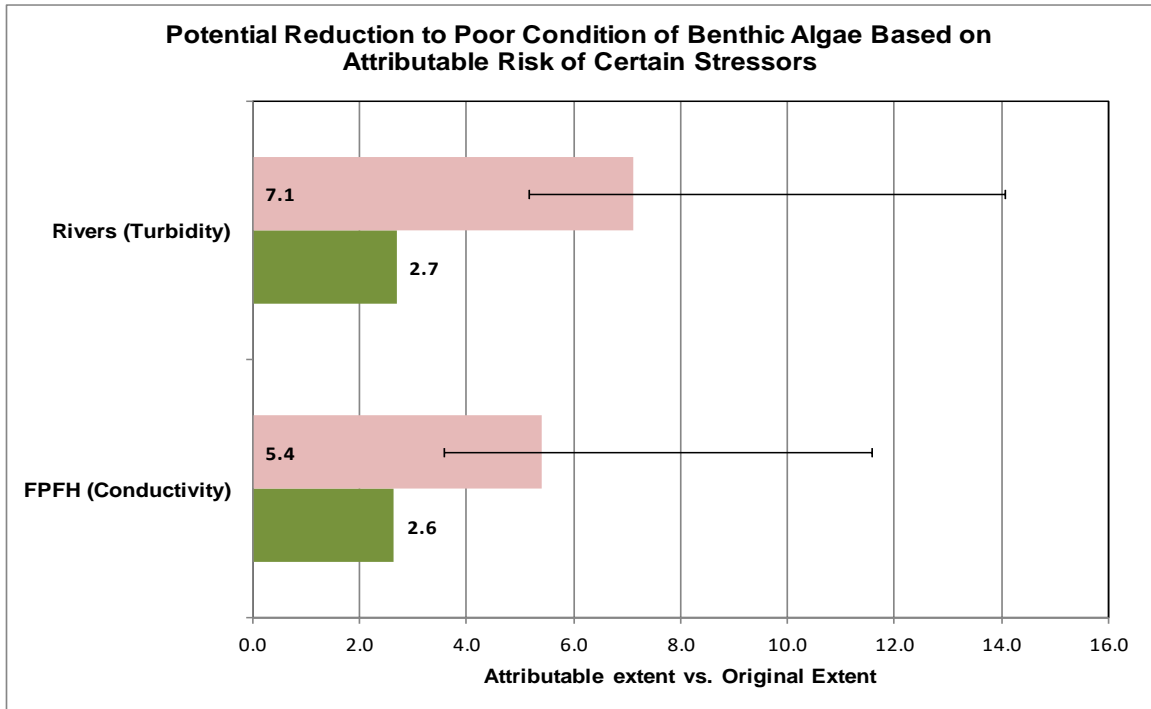


Figure 62. Potential Reduction to Poor Condition of Benthic Algae Based on the Attributable Risk of Stressors Having Significant Relative Risk.

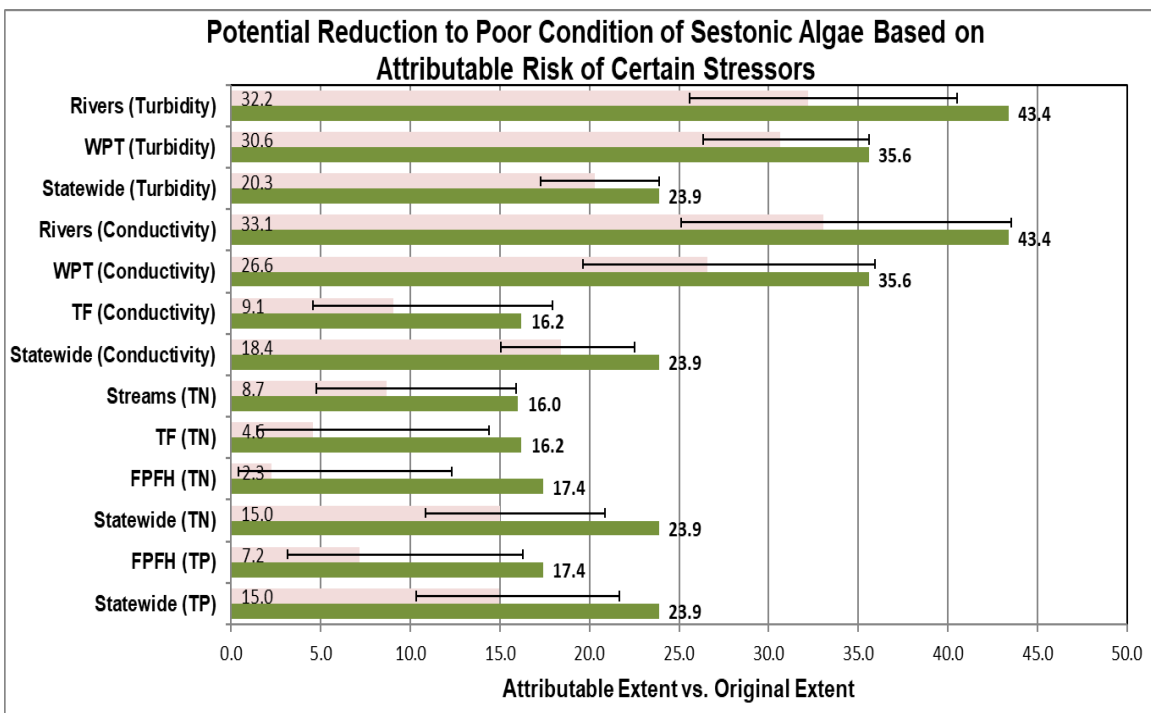


Figure 63. Potential Reduction of Poor Condition of Sestonic Algae Based on Attributable Risk of Stressors Having Significant Relative Risk.

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**APPENDIX A – TARGET STATION METADATA**

Table 14. Appendix A—Metadata for Target Sites.

Site_ID	Waterbody	LAT	LON	Size_Cat	Study_Cat	Strah_Cat	Agg_ECO	WGT13_14	WGT14_15	WGT15_16	WGT16_17	WGT_17	WGT13_17
OKRM-1006	Arkansas River	36.5858	-97.0339	Rivers Major	13-14	8	WPT	93.37	46.68	0.00	0.00	0.00	37.35
OKS9-0932	Bear Creek	35.7493	-97.1343	Streams Revisit	13-14	4	FPFH	145.77	72.88	0.00	0.00	0.00	58.31
OKS9-0938	Big Eagle Creek	34.5313	-94.7144	Streams Revisit	13-14	4	TF	182.64	91.32	0.00	0.00	0.00	73.06
OKRO-1087	Black Fork River	34.8525	-94.6172	Rivers Other	13-14	5	TF	98.54	49.27	0.00	0.00	0.00	39.42
OKLS-1181	Brazil Creek	35.1481	-94.7019	Large Streams	13-14	4	TF	118.40	59.20	0.00	0.00	0.00	47.36
OKS9-0937	Caddo Creek	34.2751	-97.1923	Streams Revisit	13-14	3	FPFH	201.64	100.82	0.00	0.00	0.00	80.66
OKR9-0901	Canadian River	35.9258	-99.5152	Rivers Revisit	13-14	7	WPT	76.36	38.18	0.00	0.00	0.00	30.54
OKR9-0913	Canadian River	35.8145	-98.7021	Rivers Revisit	13-14	7	WPT	76.36	38.18	0.00	0.00	0.00	30.54
OKR9-0902	Chikaskia River	36.9580	-97.4219	Rivers Revisit	13-14	6	WPT	93.37	46.68	0.00	0.00	0.00	37.35
OKR9-0906	Cimarron River	36.0550	-98.1290	Rivers Revisit	13-14	6	WPT	106.71	53.36	0.00	0.00	0.00	42.69
OKR9-0908	Cimarron River	35.9249	-97.8639	Rivers Revisit	13-14	6	WPT	106.71	53.36	0.00	0.00	0.00	42.69
OKRM-1002	Cimarron River	35.9677	-97.1255	Rivers Major	13-14	6	WPT	106.71	53.36	0.00	0.00	0.00	42.69
OKRO-1088	Deep Fork River	35.6855	-96.4149	Rivers Other	13-14	5	FPFH	73.03	36.51	0.00	0.00	0.00	29.21
OKRO-1089	Elm Fork of the Red River	34.8890	-99.3774	Rivers Other	13-14	5	WPT	148.59	74.29	0.00	0.00	0.00	59.44
OKLS-1176	Glover River	34.0670	-94.9053	Large Streams	13-14	4	TF	182.64	91.32	0.00	0.00	0.00	73.06
OKSS-1405	Illinois River	35.9870	-94.9162	Small Streams	13-14	2	TF	167.39	83.70	0.00	0.00	0.00	66.96
OKR9-0907	Kiamichi River	34.6357	-95.1216	Rivers Revisit	13-14	5	TF	72.86	36.43	0.00	0.00	0.00	29.14
OKRM-1008	Kiamichi River	34.2270	-95.4932	Rivers Major	13-14	6	TF	72.86	36.43	0.00	0.00	0.00	29.14
OKS9-0931	Little Tony Creek	34.8393	-98.3060	Streams Revisit	13-14	2	WPT	864.24	432.12	0.00	0.00	0.00	345.69
OKS9-0933	Mud Creek	36.9513	-95.0354	Streams Revisit	13-14	2	FPFH	122.55	61.28	0.00	0.00	0.00	49.02
OKLS-1182	Muddy Boggy River	34.7561	-96.3830	Large Streams	13-14	4	TF	182.64	91.32	0.00	0.00	0.00	73.06
OKRO-1086	Muddy Boggy River	34.1947	-95.8476	Rivers Other	13-14	6	TF	72.86	36.43	0.00	0.00	0.00	29.14
OKR9-0909	Otter Creek	34.5916	-99.0238	Rivers Revisit	13-14	5	WPT	148.59	74.29	0.00	0.00	0.00	59.44
OKS9-0939	Pennington Creek	34.3459	-96.6995	Streams Revisit	13-14	4	FPFH	201.64	100.82	0.00	0.00	0.00	80.66
OKS9-0936	Polecat Creek	35.9655	-96.3681	Streams Revisit	13-14	4	FPFH	78.34	39.17	0.00	0.00	0.00	31.34
OKR9-0912	Red River	33.9122	-95.5494	Rivers Revisit	13-14	7	TF	72.86	36.43	0.00	0.00	0.00	29.14
OKRM-1001	Red River	33.7837	-96.1715	Rivers Major	13-14	7	TF	72.86	36.43	0.00	0.00	0.00	29.14
OKRM-1004	Red River	33.8791	-95.9129	Rivers Major	13-14	7	TF	72.86	36.43	0.00	0.00	0.00	29.14
OKS9-0935	Sergeant Major Creek	35.5454	-99.7227	Streams Revisit	13-14	2	WPT	563.11	281.55	0.00	0.00	0.00	225.24

Site_ID	Waterbody	LAT	LON	Size_Cat	Study_Cat	Strah_Cat	Agg_ECO	WGT13_14	WGT14_15	WGT15_16	WGT16_17	WGT_17	WGT13_17
OKR9-0905	Washita River	35.5300	-99.1302	Rivers Revisit	13-14	6	WPT	596.07	298.03	0.00	0.00	0.00	238.43
OKR9-0911	Washita River	34.2221	-96.7069	Rivers Revisit	13-14	6	FPFH	206.93	103.47	0.00	0.00	0.00	82.77
OKS9-0934	West Fork of Sandy Creek	35.7177	-96.3770	Streams Revisit	13-14	3	FPFH	145.77	72.88	0.00	0.00	0.00	58.31
OKRM-1022	Arkansas River	36.9548	-96.9387	Rivers Major	14-15	7	FPFH	8.92	17.85	8.92	0.00	0.00	7.14
OKS9-0941	Browns Creek	35.7556	-96.2101	Streams Revisit	14-15	3	FPFH	72.88	145.77	72.88	0.00	0.00	58.31
OKRM-1021	Canadian River	35.0258	-97.3541	Rivers Major	14-15	7	WPT	38.18	76.36	38.18	0.00	0.00	30.54
OKSS-1431	Cedar Creek	36.7601	-96.2896	Small Streams	14-15	1	FPFH	61.28	122.55	61.28	0.00	0.00	49.02
OKRO-1102	Clear Boggy Creek	34.0964	-95.8940	Rivers Other	14-15	5	TF	36.43	72.86	36.43	0.00	0.00	29.14
OKSS-1429	Ingersoll Creek	34.5484	-95.8965	Small Streams	14-15	2	TF	78.39	156.78	78.39	0.00	0.00	62.71
OKSS-1430	Little Vian Creek	35.4690	-94.9544	Small Streams	14-15	1	TF	83.70	167.39	83.70	0.00	0.00	66.96
OKRO-1103	Mountain Fork River	34.1366	-94.6823	Rivers Other	14-15	6	TF	36.43	72.86	36.43	0.00	0.00	29.14
OKR9-0904	North Canadian River	35.3994	-95.7926	Rivers Revisit	14-15	6	FPFH	36.51	73.03	36.51	0.00	0.00	29.21
OKRO-1092	North Canadian River	35.5649	-97.9499	Rivers Other	14-15	6	WPT	56.29	112.58	56.29	0.00	0.00	45.03
OKLS-1204	Pine Creek	34.1739	-96.0874	Large Streams	14-15	3	TF	91.32	182.64	91.32	0.00	0.00	73.06
OKR9-0903	Red River	33.8636	-97.0060	Rivers Revisit	14-15	7	FPFH	24.93	49.86	24.93	0.00	0.00	19.94
OKRM-1020	Red River	33.8710	-95.4325	Rivers Major	14-15	7	TF	36.43	72.86	36.43	0.00	0.00	29.14
OKRM-1026	Red River	34.2033	-99.1178	Rivers Major	14-15	7	WPT	74.29	148.59	74.29	0.00	0.00	59.44
OKSS-1444	Roaring Creek	34.8510	-97.9106	Small Streams	14-15	1	FPFH	97.52	195.04	97.52	0.00	0.00	78.01
OKSS-1403	Rock Creek	34.3653	-94.4671	Small Streams	14-15	1	TF	78.39	156.78	78.39	0.00	0.00	62.71
OKLS-1222	Sandy Creek	34.4434	-99.6526	Large Streams	14-15	4	WPT	66.77	133.54	66.77	0.00	0.00	53.42
OKLS-1209	Tenmile Creek	34.3029	-95.6581	Large Streams	14-15	4	TF	91.32	182.64	91.32	0.00	0.00	73.06
OKLS-1203	Wildhorse Creek	35.9251	-96.7199	Large Streams	14-15	3	WPT	59.36	118.71	59.36	0.00	0.00	47.48
OKSS-1408	Alabama Creek	35.3658	-96.1527	Small Streams	14-15	1	FPFH	172.67	345.34	172.67	0.00	0.00	138.14
OKRM-1011	Arkansas River	35.3815	-94.4463	Rivers Major	14-15	9	TF	49.27	98.54	49.27	0.00	0.00	39.42
OKSS-1414	Bad Creek	35.3481	-96.0438	Small Streams	14-15	2	FPFH	172.67	345.34	172.67	0.00	0.00	138.14
OKRV-2013	Baron Fork	35.9511	-94.6582	Revisit Site	14-15	4	TF	59.20	118.40	59.20	0.00	0.00	47.36
OKLS-1201	Butler Creek	35.5911	-95.4229	Large Streams	14-15	3	FPFH	39.17	78.34	39.17	0.00	0.00	31.34
OKSS-1415	Dry Creek	36.8324	-96.4390	Small Streams	14-15	1	FPFH	61.28	122.55	61.28	0.00	0.00	49.02
OKLS-1191	Hickory Creek	36.9895	-96.1073	Large Streams	14-15	3	FPFH	76.10	152.21	76.10	0.00	0.00	60.88

Site_ID	Waterbody	LAT	LON	Size_Cat	Study_Cat	Strah_Cat	Agg_ECO	WGT13_14	WGT14_15	WGT15_16	WGT16_17	WGT_17	WGT13_17
OKRM-1016	Illinois River	35.9379	-94.9195	Rivers Major	14-15	6	TF	49.27	98.54	49.27	0.00	0.00	39.42
OKLS-1190	Little Blue Creek	34.4614	-96.6210	Large Streams	14-15	3	FPFH	39.89	79.79	39.89	0.00	0.00	31.92
OKRV-2001	North Fork of the Red River	35.1033	-99.3977	Revisit Site	14-15	7	WPT	74.29	148.59	74.29	0.00	0.00	59.44
OKRM-1010	Red River	34.0850	-98.5145	Rivers Major	14-15	7	WPT	74.29	148.59	74.29	0.00	0.00	59.44
OKRM-1013	Red River	33.9959	-98.0266	Rivers Major	14-15	7	WPT	74.29	148.59	74.29	0.00	0.00	59.44
OKSS-1447	Rush Creek	34.6921	-97.6668	Small Streams	14-15	2	FPFH	97.52	195.04	97.52	0.00	0.00	78.01
OKLS-1212	Sans Bois Creek	35.0992	-95.3401	Large Streams	14-15	4	TF	59.20	118.40	59.20	0.00	0.00	47.36
OKLS-1185	Snake Creek	35.8481	-95.8879	Large Streams	14-15	4	FPFH	39.17	78.34	39.17	0.00	0.00	31.34
OKLS-1184	Taloka Creek	35.3069	-95.1706	Large Streams	14-15	4	TF	291.23	582.47	291.23	0.00	0.00	232.99
OKRO-1095	Verdigris River	36.3883	-95.6639	Rivers Other	14-15	6	FPFH	42.54	85.08	42.54	0.00	0.00	34.03
OKLS-1188	Wolf Creek	35.4606	-95.8612	Large Streams	14-15	4	FPFH	72.88	145.77	72.88	0.00	0.00	58.31
OKRV-2029	Bird Creek	35.0399	-96.4658	Revisit Site	15-16	1	FPFH	0.00	44.61	89.23	44.61	0.00	35.69
OKRV-2011	Canadian River	35.3464	-97.8572	Revisit Site	15-16	3	WPT	0.00	55.87	111.75	55.87	0.00	44.70
OKRO-1107	Caney River	36.6762	-95.9652	Rivers Other	15-16	6	FPFH	0.00	42.54	85.08	42.54	0.00	34.03
OKRV-2016	Clear Boggy Creek	34.0683	-95.8146	Revisit Site	15-16	5	TF	0.00	36.43	72.86	36.43	0.00	29.14
OKRV-2010	Coal Creek	36.0069	-95.9930	Revisit Site	15-16	2	FPFH	0.00	76.23	152.47	76.23	0.00	60.99
OKRV-2040	Curl Creek	36.5976	-95.8610	Revisit Site	15-16	2	FPFH	0.00	61.28	122.55	61.28	0.00	49.02
OKRV-2035	Deep Fork River	35.6402	-96.9082	Revisit Site	15-16	5	FPFH	0.00	36.51	73.03	36.51	0.00	29.21
OKRV-2014	Holly Creek	34.3519	-95.1133	Revisit Site	15-16	1	TF	0.00	78.39	156.78	78.39	0.00	62.71
OKRV-2034	Jim Creek	35.2193	-97.0668	Revisit Site	15-16	1	FPFH	0.00	44.61	89.23	44.61	0.00	35.69
OKRV-2080	Little Cabin Creek	36.8257	-95.0766	Revisit Site	15-16	2	FPFH	0.00	61.28	122.55	61.28	0.00	49.02
OKRV-2006	Lyon Creek	36.1325	-97.7442	Revisit Site	15-16	4	WPT	0.00	59.36	118.71	59.36	0.00	47.48
OKRV-2074	Madden Creek	36.7031	-95.4182	Revisit Site	15-16	1	FPFH	0.00	61.28	122.55	61.28	0.00	49.02
OKSS-1434	Mill Creek	34.2099	-95.4635	Small Streams	15-16	1	TF	0.00	78.39	156.78	78.39	0.00	62.71
OKRV-2012	Mud Creek	34.1054	-97.6645	Revisit Site	15-16	4	WPT	0.00	66.77	133.54	66.77	0.00	53.42
OKSS-1449	Mud Creek	36.9414	-95.0080	Small Streams	15-16	2	FPFH	0.00	61.28	122.55	61.28	0.00	49.02
OKRO-1106	Muddy Boggy River	33.9415	-95.5992	Rivers Other	15-16	6	TF	0.00	36.43	72.86	36.43	0.00	29.14
OKRV-2019	Neosho River	36.8781	-94.8933	Revisit Site	15-16	7	FPFH	0.00	42.54	85.08	42.54	0.00	34.03
OKRO-1098	North Canadian River	35.3303	-96.0960	Rivers Other	15-16	6	FPFH	0.00	36.51	73.03	36.51	0.00	29.21

Site_ID	Waterbody	LAT	LON	Size_Cat	Study_Cat	Strah_Cat	Agg_ECO	WGT13_14	WGT14_15	WGT15_16	WGT16_17	WGT_17	WGT13_17
OKRV-2004	North Fork of Walnut Creek	35.1620	-97.6089	Revisit Site	15-16	3	WPT	0.00	55.87	111.75	55.87	0.00	44.70
OKSS-1410	Peterson Creek	34.5339	-95.3984	Small Streams	15-16	1	TF	0.00	78.39	156.78	78.39	0.00	62.71
OKRV-2020	Polecat Creek	35.9649	-96.4021	Revisit Site	15-16	4	FPFH	0.00	39.17	78.34	39.17	0.00	31.34
OKRM-1023	Poteau River	34.8775	-94.4742	Rivers Major	15-16	5	TF	0.00	49.27	98.54	49.27	0.00	39.42
OKRM-1017	Red River	33.7242	-97.1539	Rivers Major	15-16	7	FPFH	0.00	24.93	49.86	24.93	0.00	19.94
OKRV-2079	Rock Creek	36.5022	-95.2675	Revisit Site	15-16	1	FPFH	0.00	61.28	122.55	61.28	0.00	49.02
OKRV-2033	Shady Grove Creek	35.4708	-95.4587	Revisit Site	15-16	4	FPFH	0.00	39.17	78.34	39.17	0.00	31.34
OKRV-2007	Sweetwater Creek	35.3072	-99.9551	Revisit Site	15-16	4	WPT	0.00	66.77	133.54	66.77	0.00	53.42
OKSS-1416	Trib. To Fivemile Creek	35.4003	-98.6004	Small Streams	15-16	1	WPT	0.00	281.55	563.11	281.55	0.00	225.24
OKSS-1409	Trib. To Fourteenmile Creek	36.0136	-95.0338	Small Streams	15-16	2	TF	0.00	42.86	85.71	42.86	0.00	34.29
OKRV-2009	Turkey Creek	36.0070	-97.9341	Revisit Site	15-16	4	WPT	0.00	59.36	118.71	59.36	0.00	47.48
OKSS-1436	Unnamed Creek	34.5859	-96.6251	Small Streams	15-16	1	TF	0.00	78.39	156.78	78.39	0.00	62.71
OKRV-2088	Verdigris River	36.1977	-95.7016	Revisit Site	15-16	7	FPFH	0.00	42.54	85.08	42.54	0.00	34.03
OKRV-2068	California Creek	36.8984	-95.7368	Revisit Site	16-17	1	FPFH	0.00	0.00	61.28	122.55	61.28	49.02
OKRV-2102	Canadian River	35.0355	-97.3573	Revisit Site	16-17	4	WPT	0.00	0.00	55.87	111.75	55.87	44.70
OKRO-1111	Caney River	36.4798	-95.8452	Rivers Other	16-17	6	FPFH	0.00	0.00	42.54	85.08	42.54	34.03
OKSS-1439	Carter Creek	34.2436	-94.8326	Small Streams	16-17	2	TF	0.00	0.00	78.39	156.78	78.39	62.71
OKRV-2043	Cimarron River	36.8742	-99.3603	Revisit Site	16-17	7	WPT	0.00	0.00	53.36	106.71	53.36	42.69
OKSS-1472	Dance Creek	35.1882	-96.9581	Small Streams	16-17	2	FPFH	0.00	0.00	44.61	89.23	44.61	35.69
OKRV-2028	Deep Fork River	35.5695	-95.9389	Revisit Site	16-17	6	FPFH	0.00	0.00	36.51	73.03	36.51	29.21
OKSS-1438	Dumpling Creek	34.2297	-95.5825	Small Streams	16-17	2	TF	0.00	0.00	78.39	156.78	78.39	62.71
OKRO-1099	Elk River	36.6406	-94.6455	Rivers Other	16-17	5	TF	0.00	0.00	36.03	72.06	36.03	28.82
OKRO-1099	Elk River (revisit)	36.6406	-94.6455	Rivers Other	16-17	5	TF	0.00	0.00	36.03	72.06	36.03	28.82
OKRV-2026	Fourche Maline visit #1	34.9166	-94.9485	Revisit Site	16-17	5	TF	0.00	0.00	49.27	98.54	49.27	39.42
OKRV-2025	Greenleaf Creek	36.9334	-98.8729	Revisit Site	16-17	2	WPT	0.00	0.00	82.10	164.19	82.10	65.68
OKRV-2044	Julian Creek	34.9697	-96.9740	Revisit Site	16-17	2	FPFH	0.00	0.00	44.61	89.23	44.61	35.69
OKLS-1186	Little Beaver Creek	34.5246	-98.0859	Large Streams	16-17	3	WPT	0.00	0.00	66.77	133.54	66.77	53.42
OKLS-1196	Mt. Fork of Sans Bois Creek	35.0711	-95.1553	Large Streams	16-17	3	TF	0.00	0.00	59.20	118.40	59.20	47.36
OKLS-1193	North Boggy Creek	34.6062	-96.0139	Large Streams	16-17	4	TF	0.00	0.00	91.32	182.64	91.32	73.06

Site_ID	Waterbody	LAT	LON	Size_Cat	Study_Cat	Strah_Cat	Agg_ECO	WGT13_14	WGT14_15	WGT15_16	WGT16_17	WGT_17	WGT13_17
OKRO-1108	Red Rock Creek	36.4882	-97.1008	Rivers Other	16-17	5	WPT	0.00	0.00	46.68	93.37	46.68	37.35
OKLS-1192	Rock Creek	34.0712	-94.4781	Large Streams	16-17	3	TF	0.00	0.00	91.32	182.64	91.32	73.06
OKRV-2027	South Fork of Dirty Creek	35.4529	-95.2145	Revisit Site	16-17	4	FPFH	0.00	0.00	39.17	78.34	39.17	31.34
OKSS-1419	Trib. To Kiamichi River	34.6783	-94.4735	Small Streams	16-17	1	TF	0.00	0.00	78.39	156.78	78.39	62.71
OKRV-2070	Tyner Creek	36.4381	-95.9965	Revisit Site	16-17	2	FPFH	0.00	0.00	61.28	122.55	61.28	49.02
OKRV-2021	Unnamed Creek	36.7534	-98.2483	Revisit Site	16-17	1	WPT	0.00	0.00	82.10	164.19	82.10	65.68
OKSS-1456	Unnamed Creek	35.0408	-96.1825	Small Streams	16-17	1	TF	0.00	0.00	82.99	165.98	82.99	66.39
OKSS-1426	West Terrapin Creek	34.2963	-95.0784	Small Streams	16-17	2	TF	0.00	0.00	78.39	156.78	78.39	62.71
OKSS-1425	Wickliffe Creek (revisit)	36.3250	-95.0646	Small Streams	16-17	1	TF	0.00	0.00	42.86	85.71	42.86	34.29
OKRV-2039	Wolf Creek	36.3505	-99.6982	Revisit Site	16-17	7	WPT	0.00	0.00	53.22	106.43	53.22	42.57
OKRV-2032	Wolf Creek	36.2871	-99.9500	Revisit Site	16-17	7	WPT	0.00	0.00	53.22	106.43	53.22	42.57
OKLS-1198	Big Creek	34.9218	-96.9221	Large Streams	2017	3	FPFH	0.00	0.00	0.00	135.53	271.05	54.21
OKRV-2036	Big Creek	34.7075	-94.5340	Revisit Site	2017	3	TF	0.00	0.00	0.00	59.20	118.40	23.68
OKRV-2015	Bitter Creek	34.7809	-99.3922	Revisit Site	2017	4	WPT	0.00	0.00	0.00	66.77	133.54	26.71
OKRV-2101	Black Bear Creek	36.3452	-97.1905	Revisit Site	2017	4	WPT	0.00	0.00	0.00	82.90	165.81	33.16
OKLS-1197	Black Fork	34.7574	-94.4611	Large Streams	2017	3	TF	0.00	0.00	0.00	59.20	118.40	23.68
OKLS-1197	Black Fork (Revisit)	34.7574	-94.4611	Large Streams	2017	3	TF	0.00	0.00	0.00	59.20	118.40	23.68
OKRV-2061	Blue River	34.0867	-96.3613	Revisit Site	2017	4	FPFH	0.00	0.00	0.00	39.89	79.79	15.96
OKRM-1014	Canadian River	35.8325	-98.7301	Rivers Major	2017	7	WPT	0.00	0.00	0.00	38.18	76.36	15.27
OKRM-1015	Canadian River	35.1467	-95.8999	Rivers Major	2017	7	TF	0.00	0.00	0.00	96.52	193.04	38.61
OKRM-1014	Canadian River (Revisit)	35.8325	-98.7301	Rivers Major	2017	7	WPT	0.00	0.00	0.00	38.18	76.36	15.27
OKRV-2030	Caney River	36.6842	-95.9800	Revisit Site	2017	6	FPFH	0.00	0.00	0.00	42.54	85.08	17.02
OKRV-2022	Caston Creek	34.9600	-94.7384	Revisit Site	2017	4	TF	0.00	0.00	0.00	59.20	118.40	23.68
OKRV-2023	Chikaskia River	36.9097	-97.3654	Revisit Site	2017	6	WPT	0.00	0.00	0.00	46.68	93.37	18.67
OKRV-2098	Cottonwood Creek	35.7684	-97.6306	Revisit Site	2017	4	WPT	0.00	0.00	0.00	59.36	118.71	23.74
OKRO-1105	Elk Creek	35.1752	-99.2801	Rivers Other	2017	5	WPT	0.00	0.00	0.00	74.29	148.59	29.72
OKLS-1213	Gap Creek	35.0840	-94.5408	Large Streams	2017	3	TF	0.00	0.00	0.00	59.20	118.40	23.68
OKSS-1420	Island bayou	33.8328	-96.2577	Small Streams	2017	2	FPFH	0.00	0.00	0.00	72.27	144.54	28.91
OKLS-1194	Little Washita River	34.9567	-97.9265	Large Streams	2017	4	WPT	0.00	0.00	0.00	140.70	281.41	56.28

Site_ID	Waterbody	LAT	LON	Size_Cat	Study_Cat	Strah_Cat	Agg_ECO	WGT13_14	WGT14_15	WGT15_16	WGT16_17	WGT_17	WGT13_17
OKSS-1446	Middle Creek	35.1586	-96.0053	Small Streams	2017	2	TF	0.00	0.00	0.00	82.99	165.98	33.20
OKRV-2037	North Fork of the Red River	34.8671	-99.3123	Revisit Site	16-17	8	WPT	0.00	0.00	0.00	148.59	74.29	59.44
OKRV-2105	Salt Fork of the Arkansas River	36.9436	-98.7743	Revisit Site	2017	5	WPT	0.00	0.00	0.00	46.68	93.37	18.67
OKLS-1238	Salt Fork of the Red River	34.7704	-99.4366	Large Streams	2017	4	WPT	0.00	0.00	0.00	66.77	133.54	26.71
OKLS-1242	Station Creek	34.9875	-99.6686	Large Streams	2017	3	WPT	0.00	0.00	0.00	66.77	133.54	26.71
OKRV-2077	Tomike Creek	34.9253	-97.1586	Revisit Site	2017	2	WPT	0.00	0.00	0.00	16.55	33.10	6.62
OKSS-1466	Turkey Creek North (unnamed)	34.1970	-95.1855	Small Streams	2017	1	TF	0.00	0.00	0.00	78.39	156.78	31.36
OKLS-1227	Unnamed Creek	36.3949	-99.0050	Large Streams	2017	3	WPT	0.00	0.00	0.00	59.36	118.71	23.74

**APPENDIX B – CONDITION CLASSES**

Table 15. Appendix B—Biological Indicator Condition Classes

SITE NAME	SITE_ID	FISH	MACRO	Ses_Algae	Ben_Algae		SITE NAME	SITE_ID	FISH	MACRO	Ses_Algae	Ben_Algae
Arkansas River	OKRM-1006	GOOD	POOR	GOOD	FAIR		Curl Creek	OKRV-2040	GOOD	FAIR	FAIR	GOOD
Bear Creek	OXS9-0932	FAIR	GOOD	GOOD	GOOD		Deep Fork River	OKRV-2035	FAIR	GOOD	GOOD	FAIR
Canadian River	OKRV-2011	FAIR	FAIR	POOR	FAIR		Holly Creek	OKRV-2014	GOOD	GOOD	GOOD	FAIR
Big Eagle Creek	OXS9-0938	FAIR	GOOD	GOOD	GOOD		Jim Creek	OKRV-2034	GOOD	FAIR	GOOD	GOOD
Black Fork River	OKRO-1087	FAIR	POOR	GOOD	GOOD		Little Cabin Creek	OKRV-2080	GOOD	FAIR	GOOD	GOOD
Brazil Creek	OKLS-1181	GOOD	FAIR	POOR	GOOD		Lyon Creek	OKRV-2006	FAIR	POOR	POOR	FAIR
Caddo Creek	OXS9-0937	GOOD	GOOD	GOOD	FAIR		Madden Creek	OKRV-2074	GOOD	FAIR	GOOD	GOOD
Canadian River	OKR9-0901	FAIR	FAIR	GOOD	GOOD		Mill Creek	OKSS-1434	GOOD	FAIR	GOOD	GOOD
Caney River	OKRO-1107	GOOD	GOOD	FAIR	FAIR		Mud Creek	OKRV-2012	GOOD	GOOD	POOR	POOR
Canadian River	OKR9-0913	GOOD	POOR	FAIR	GOOD		Mud Creek	OKSS-1449	GOOD	FAIR	FAIR	GOOD
Chikaskia River	OKR9-0902	FAIR	FAIR	POOR	GOOD		Muddy Boggy River	OKRO-1106	FAIR	FAIR	POOR	GOOD
Coal Creek	OKRV-2010	GOOD	FAIR	GOOD	GOOD		Neosho River	OKRV-2019	FAIR	GOOD	FAIR	GOOD
Cimarron River	OKR9-0906	POOR	POOR	GOOD	GOOD		Unnamed Creek	OKLS-1227	POOR	FAIR	GOOD	GOOD
Cimarron River	OKR9-0908	GOOD	POOR	POOR	FAIR		North Canadian River	OKRO-1098	GOOD	GOOD	POOR	GOOD
Cimarron River	OKRM-1002	GOOD	POOR	POOR	FAIR		North Fork of Walnut Creek	OKRV-2004	GOOD	FAIR	GOOD	FAIR
Deep Fork River	OKRO-1088	FAIR	GOOD	POOR	FAIR		Peterson Creek	OKSS-1410	FAIR	FAIR	GOOD	GOOD
Elm Fork of the Red River	OKRO-1089	POOR	POOR	POOR	FAIR		Polecat Creek	OKRV-2020	POOR	FAIR	GOOD	GOOD
Glover River	OKLS-1176	GOOD	GOOD	GOOD	GOOD		Poteau River	OKRM-1023	GOOD	FAIR	FAIR	GOOD
Illinois River	OKSS-1405	GOOD	GOOD	GOOD	POOR		Red River	OKRM-1017	FAIR	FAIR	POOR	GOOD
Kiamichi River	OKR9-0907	GOOD	FAIR	GOOD	FAIR		Rock Creek	OKRV-2079	FAIR	FAIR	GOOD	POOR
Kiamichi River	OKRM-1008	POOR	POOR	GOOD	GOOD		Shady Grove Creek	OKRV-2033	FAIR	GOOD	GOOD	GOOD
Little Tony Creek	OXS9-0931	POOR	POOR	GOOD	FAIR		Sweetwater Creek	OKRV-2007	POOR	GOOD	FAIR	FAIR
Mud Creek	OXS9-0933	POOR	POOR	POOR	GOOD		Trib. To Fivemile Creek	OKSS-1416	FAIR	FAIR	GOOD	FAIR
Muddy Boggy River	OKLS-1182	FAIR	POOR	FAIR	GOOD		Trib. To Fourteenmile Creek	OKSS-1409	GOOD	GOOD	GOOD	FAIR
Muddy Boggy River	OKRO-1086	POOR	FAIR	POOR	GOOD		Turkey Creek	OKRV-2009	GOOD	GOOD	POOR	POOR
Otter Creek	OKR9-0909	FAIR	POOR	POOR	FAIR		Unnamed Creek	OKSS-1436	GOOD	FAIR	GOOD	GOOD
Pennington Creek	OXS9-0939	GOOD	GOOD	GOOD	FAIR		Verdigris River	OKRV-2088	GOOD	GOOD	GOOD	GOOD
Polecat Creek	OXS9-0936	FAIR	FAIR	GOOD	GOOD		California Creek	OKRV-2068	GOOD	GOOD	NA	GOOD

SITE NAME	SITE_ID	FISH	MACRO	Ses_Algae	Ben_Algae		SITE NAME	SITE_ID	FISH	MACRO	Ses_Algae	Ben_Algae
Red River	OKR9-0912	GOOD	POOR	POOR	GOOD		Canadian River	OKRV-2102	GOOD	GOOD	POOR	POOR
Red River	OKRM-1001	GOOD	FAIR	FAIR	GOOD		Caney River	OKRO-1111	GOOD	GOOD	POOR	GOOD
Red River	OKRM-1004	GOOD	FAIR	POOR	GOOD		Carter Creek	OKSS-1439	FAIR	FAIR	GOOD	GOOD
Sergeant Major Creek	OKS9-0935	FAIR	FAIR	GOOD	GOOD		Cimarron River	OKRV-2043	FAIR	FAIR	POOR	GOOD
Washita River	OKR9-0905	FAIR	FAIR	GOOD	GOOD		Dance Creek	OKSS-1472	POOR	FAIR	GOOD	FAIR
Washita River	OKR9-0911	FAIR	GOOD	FAIR	GOOD		Deep Fork River	OKRV-2028	POOR	GOOD	POOR	GOOD
West Fork of Sandy Creek	OKS9-0934	GOOD	GOOD	GOOD	GOOD		Dumpling Creek	OKSS-1438	GOOD	GOOD	GOOD	POOR
Arkansas River	OKRM-1022	POOR	POOR	POOR	POOR		Elk River	OKRO-1099	GOOD	GOOD	GOOD	FAIR
Salt Fork of the Red River	OKLS-1238	GOOD	FAIR	GOOD	FAIR		Salt Fork of the Arkansas River	OKRV-2105	GOOD	GOOD	GOOD	FAIR
Browns Creek	OKS9-0941	FAIR	FAIR	FAIR	FAIR		Fourche Maline	OKRV-2026	GOOD	FAIR	POOR	GOOD
Canadian River	OKRM-1021	GOOD	POOR	POOR	FAIR		Greenleaf Creek	OKRV-2025	GOOD	GOOD	POOR	FAIR
Cedar Creek	OKSS-1431	POOR	GOOD	GOOD	GOOD		Julian Creek	OKRV-2044	FAIR	FAIR	GOOD	GOOD
Clear Boggy Creek	OKRO-1102	GOOD	GOOD	GOOD	POOR		Little Beaver Creek	OKLS-1186	GOOD	GOOD	GOOD	FAIR
Ingersoll Creek	OKSS-1429	POOR	FAIR	GOOD	GOOD		Mt. Fork of Sans Bois Creek	OKLS-1196	GOOD	FAIR	GOOD	GOOD
Little Vian Creek	OKSS-1430	GOOD	FAIR	GOOD	GOOD		North Boggy Creek	OKLS-1193	POOR	FAIR	FAIR	GOOD
Mountain Fork River	OKRO-1103	POOR	POOR	GOOD	FAIR		Red Rock Creek	OKRO-1108	GOOD	GOOD	NA	POOR
North Canadian River	OKR9-0904	FAIR	FAIR	POOR	GOOD		Rock Creek	OKLS-1192	GOOD	FAIR	GOOD	GOOD
North Canadian River	OKRO-1092	GOOD	GOOD	POOR	FAIR		South Fork of Dirty Creek	OKRV-2027	GOOD	FAIR	NA	FAIR
Pine Creek	OKLS-1204	GOOD	POOR	POOR	FAIR		Trib. To Kiamichi River	OKSS-1419	FAIR	POOR	GOOD	GOOD
Red River	OKR9-0903	FAIR	POOR	POOR	FAIR		Tyner Creek	OKRV-2070	FAIR	POOR	FAIR	FAIR
Red River	OKRM-1020	GOOD	POOR	POOR	GOOD		Unnamed Creek	OKRV-2021	NA	POOR	GOOD	GOOD
Red River	OKRM-1026	FAIR	POOR	POOR	FAIR		Unnamed Creek	OKSS-1456	GOOD	FAIR	FAIR	FAIR
Roaring Creek	OKSS-1444	POOR	FAIR	GOOD	GOOD		West Terrapin Creek	OKSS-1426	GOOD	GOOD	GOOD	GOOD
Rock Creek	OKSS-1403	GOOD	GOOD	GOOD	GOOD		Wickliffe Creek	OKSS-1425	GOOD	GOOD	GOOD	FAIR
Sandy Creek	OKLS-1222	POOR	POOR	POOR	POOR		Wolf Creek	OKRV-2039	GOOD	FAIR	POOR	FAIR
Tenmile Creek	OKLS-1209	GOOD	POOR	GOOD	GOOD		Wolf Creek	OKRV-2032	POOR	FAIR	NA	NA
Wildhorse Creek	OKLS-1203	GOOD	FAIR	FAIR	FAIR		Big Creek	OKLS-1198	FAIR	FAIR	GOOD	GOOD
Alabama Creek	OKSS-1408	GOOD	FAIR	GOOD	FAIR		Big Creek	OKRV-2036	GOOD	GOOD	GOOD	GOOD

SITE NAME	SITE_ID	FISH	MACRO	Ses_Algae	Ben_Algae		SITE NAME	SITE_ID	FISH	MACRO	Ses_Algae	Ben_Algae
Arkansas River	OKRM-1011	FAIR	FAIR	GOOD	POOR		Bitter Creek	OKRV-2015	FAIR	FAIR	POOR	POOR
Turkey Creek North (unnamed creek)	OKSS-1466	GOOD	FAIR	GOOD	GOOD		Black Bear Creek	OKRV-2101	GOOD	FAIR	GOOD	GOOD
Bad Creek	OKSS-1414	GOOD	FAIR	FAIR	GOOD		Tomike Creek	OKRV-2077	GOOD	FAIR	GOOD	GOOD
Baron Fork	OKRV-2013	GOOD	GOOD	GOOD	POOR		Black Fork	OKLS-1197	GOOD	GOOD	GOOD	GOOD
Butler Creek	OKLS-1201	GOOD	FAIR	POOR	FAIR		Blue River	OKRV-2061	GOOD	FAIR	GOOD	FAIR
Dry Creek	OKSS-1415	GOOD	GOOD	GOOD	GOOD		Canadian River	OKRM-1014	GOOD	GOOD	GOOD	GOOD
Hickory Creek	OKLS-1191	GOOD	POOR	POOR	GOOD		Canadian River	OKRM-1015	FAIR	POOR	POOR	GOOD
Illinois River	OKRM-1016	GOOD	GOOD	GOOD	GOOD		Station Creek	OKLS-1242	POOR	FAIR	POOR	FAIR
Little Blue Creek	OKLS-1190	GOOD	GOOD	GOOD	FAIR		Caney River	OKRV-2030	NA	GOOD	POOR	FAIR
North Fork of the Red River	OKRV-2001	POOR	FAIR	GOOD	GOOD		Caston Creek	OKRV-2022	GOOD	GOOD	GOOD	FAIR
Red River	OKRM-1010	FAIR	FAIR	GOOD	GOOD		Chikaskia River	OKRV-2023	GOOD	GOOD	POOR	GOOD
Red River	OKRM-1013	GOOD	GOOD	POOR	POOR		Cottonwood Creek	OKRV-2098	GOOD	GOOD	GOOD	NA
Rush Creek	OKSS-1447	GOOD	POOR	GOOD	POOR		Elk Creek	OKRO-1105	GOOD	GOOD	GOOD	FAIR
Sans Bois Creek	OKLS-1212	GOOD	GOOD	GOOD	GOOD		Gap Creek	OKLS-1213	GOOD	NA	GOOD	GOOD
Snake Creek	OKLS-1185	GOOD	FAIR	FAIR	FAIR		Island bayou	OKSS-1420	GOOD	POOR	GOOD	FAIR
Taloka Creek	OKLS-1184	GOOD	FAIR	GOOD	FAIR		Little Washita River	OKLS-1194	GOOD	GOOD	POOR	POOR
Verdigris River	OKRO-1095	GOOD	GOOD	GOOD	GOOD		Middle Creek	OKSS-1446	FAIR	POOR	POOR	GOOD
Wolf Creek	OKLS-1188	FAIR	FAIR	POOR	GOOD		North Fork of the Red River	OKRV-2037	GOOD	POOR	FAIR	GOOD
Bird Creek	OKRV-2029	POOR	POOR	FAIR	GOOD		Clear Boggy Creek	OKRV-2016	GOOD	GOOD	NA	NA

Table 16. Appendix B—Stressor Indicator Condition Classes

Site_ID	TN_NRSA	TN_ECO	TP_NRSA	TP_ECO	COND_NRSA	COND_ECO	TURB_ECO	Cd	Cu	Pb	Se	Zn	ISC_NRSA	SED_NRSA	RVC_NRSA
OKRM-1006	FAIR	FAIR	POOR	POOR	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD
OKS9-0932	GOOD	GOOD	FAIR	FAIR	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
OKS9-0938	GOOD	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	NA	NA	NA	NA	NA	GOOD	GOOD	GOOD
OKRO-1087	GOOD	FAIR	POOR	GOOD	GOOD	GOOD	FAIR	POOR	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	GOOD
OKLS-1181	FAIR	FAIR	POOR	POOR	GOOD	FAIR	FAIR	NA	NA	NA	NA	NA	GOOD	POOR	GOOD
OKS9-0937	GOOD	GOOD	FAIR	FAIR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
OKR9-0901	GOOD	GOOD	GOOD	GOOD	POOR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD
OKR9-0913	GOOD	GOOD	FAIR	GOOD	POOR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD
OKR9-0902	GOOD	GOOD	POOR	POOR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	POOR	GOOD
OKR9-0906	GOOD	GOOD	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
OKR9-0908	FAIR	FAIR	POOR	POOR	POOR	POOR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
OKRM-1002	FAIR	FAIR	POOR	POOR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD
OKRO-1088	FAIR	POOR	POOR	POOR	GOOD	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD
OKRO-1089	POOR	POOR	FAIR	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	FAIR	GOOD	GOOD
OKLS-1176	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD
OKSS-1405	POOR	POOR	POOR	FAIR	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR
OKR9-0907	FAIR	FAIR	POOR	POOR	GOOD	FAIR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
OKRM-1008	FAIR	POOR	POOR	POOR	GOOD	FAIR	POOR	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	GOOD
OKS9-0931	POOR	POOR	POOR	POOR	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	FAIR	GOOD
OKS9-0933	FAIR	POOR	POOR	POOR	GOOD	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD
OKLS-1182	POOR	POOR	POOR	POOR	FAIR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	POOR	GOOD
OKRO-1086	GOOD	POOR	FAIR	POOR	GOOD	FAIR	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
OKR9-0909	POOR	POOR	POOR	POOR	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD
OKS9-0939	GOOD	GOOD	FAIR	FAIR	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
OKS9-0936	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD

Site_ID	TN_NRSA	TN_ECO	TP_NRSA	TP_ECO	COND_NRSA	COND_ECO	TURB_ECO	Cd	Cu	Pb	Se	Zn	SED	ISC_NRSA	RVC_NRSA
OKR9-0912	GOOD	POOR	POOR	POOR	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	FAIR
OKRM-1001	GOOD	POOR	POOR	POOR	POOR	POOR	POOR	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	GOOD
OKRM-1004	GOOD	FAIR	FAIR	POOR	POOR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	POOR
OKS9-0935	POOR	POOR	POOR	FAIR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
OKR9-0905	POOR	POOR	POOR	POOR	POOR	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	POOR	GOOD
OKR9-0911	FAIR	FAIR	POOR	POOR	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	GOOD
OKS9-0934	GOOD	GOOD	GOOD	FAIR	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
OKRM-1022	POOR	POOR	POOR	POOR	FAIR	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD
OKS9-0941	FAIR	POOR	POOR	POOR	GOOD	GOOD	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	POOR	FAIR	GOOD
OKRM-1021	POOR	POOR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	FAIR
OKSS-1431	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR
OKRO-1102	GOOD	POOR	POOR	POOR	GOOD	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD
OKSS-1429	GOOD	GOOD	POOR	POOR	GOOD	FAIR	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	GOOD
OKSS-1430	GOOD	GOOD	POOR	GOOD	GOOD	FAIR	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
OKRO-1103	FAIR	FAIR	FAIR	FAIR	GOOD	GOOD	GOOD	POOR	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	GOOD
OKR9-0904	FAIR	POOR	POOR	POOR	GOOD	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD
OKRO-1092	FAIR	FAIR	POOR	POOR	GOOD	GOOD	POOR	NA	NA	NA	NA	NA	GOOD	GOOD	GOOD
OKLS-1204	FAIR	POOR	POOR	POOR	FAIR	POOR	FAIR	NA	NA	NA	NA	NA	POOR	FAIR	POOR
OKR9-0903	FAIR	POOR	POOR	POOR	POOR	POOR	FAIR	GOOD	GOOD	GOOD	POOR	GOOD	POOR	GOOD	GOOD
OKRM-1020	GOOD	POOR	POOR	POOR	FAIR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	POOR
OKRM-1026	FAIR	GOOD	POOR	FAIR	POOR	POOR	POOR	GOOD	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD
OKSS-1444	FAIR	FAIR	POOR	POOR	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	POOR	GOOD
OKSS-1403	GOOD	GOOD	FAIR	FAIR	GOOD	GOOD	FAIR	POOR	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	FAIR
OKLS-1222	POOR	POOR	POOR	POOR	POOR	POOR	POOR	GOOD	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD
OKLS-1209	POOR	POOR	POOR	POOR	GOOD	FAIR	POOR	POOR	GOOD	POOR	GOOD	GOOD	GOOD	POOR	GOOD
OKLS-1203	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
OKSS-1408	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	NA	NA	NA

Site_ID	TN_NRSA	TN_ECO	TP_NRSA	TP_ECO	COND_NRSA	COND_ECO	TURB_ECO	Cd	Cu	Pb	Se	Zn	SED	ISC_NRSA	RVC_NRSA
OKRM-1011	POOR	POOR	POOR	POOR	POOR	POOR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKSS-1414	FAIR	POOR	FAIR	FAIR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2013	POOR	FAIR	POOR	FAIR	GOOD	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKLS-1201	GOOD	POOR	GOOD	FAIR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKSS-1415	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKLS-1191	FAIR	POOR	FAIR	FAIR	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRM-1016	POOR	POOR	POOR	FAIR	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKLS-1190	FAIR	FAIR	GOOD	GOOD	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2001	FAIR	FAIR	GOOD	GOOD	POOR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRM-1010	POOR	POOR	POOR	POOR	POOR	POOR	FAIR	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKRM-1013	POOR	POOR	POOR	POOR	POOR	POOR	POOR	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKSS-1447	FAIR	FAIR	FAIR	FAIR	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKLS-1212	POOR	POOR	POOR	POOR	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKLS-1185	FAIR	POOR	FAIR	FAIR	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKLS-1184	POOR	FAIR	POOR	POOR	POOR	POOR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRO-1095	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKLS-1188	POOR	POOR	POOR	POOR	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2029	GOOD	GOOD	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKRV-2011	FAIR	FAIR	FAIR	GOOD	POOR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRO-1107	GOOD	POOR	GOOD	FAIR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2016	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OKRV-2010	GOOD	FAIR	GOOD	GOOD	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2040	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2035	POOR	POOR	POOR	POOR	FAIR	POOR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2014	FAIR	FAIR	POOR	POOR	GOOD	GOOD	POOR	POOR	GOOD	POOR	GOOD	GOOD	NA	NA	NA
OKRV-2034	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA

Site_ID	TN_NRSA	TN_ECO	TP_NRSA	TP_ECO	COND_NRSA	COND_ECO	TURB_ECO	Cd	Cu	Pb	Se	Zn	SED	ISC_NRSA	RVC_NRSA
OKRV-2080	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2006	POOR	POOR	POOR	POOR	POOR	FAIR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKRV-2074	GOOD	POOR	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKSS-1434	POOR	POOR	POOR	POOR	GOOD	FAIR	FAIR	POOR	GOOD	POOR	GOOD	GOOD	NA	NA	NA
OKRV-2012	FAIR	GOOD	FAIR	GOOD	POOR	FAIR	FAIR	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKSS-1449	GOOD	POOR	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRO-1106	GOOD	POOR	FAIR	POOR	FAIR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2019	GOOD	FAIR	FAIR	POOR	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRO-1098	FAIR	POOR	POOR	POOR	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2004	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKSS-1410	GOOD	GOOD	FAIR	FAIR	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2020	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRM-1023	POOR	POOR	POOR	FAIR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRM-1017	FAIR	POOR	POOR	POOR	POOR	POOR	FAIR	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKRV-2079	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2033	GOOD	GOOD	GOOD	GOOD	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2007	POOR	POOR	POOR	POOR	POOR	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKSS-1416	FAIR	FAIR	POOR	POOR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKSS-1409	FAIR	FAIR	POOR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2009	POOR	POOR	POOR	POOR	FAIR	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKSS-1436	GOOD	GOOD	FAIR	GOOD	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2088	GOOD	FAIR	GOOD	FAIR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2068	NA	NA	NA	NA	GOOD	GOOD	GOOD	NA	NA	NA	NA	NA	NA	NA	NA
OKRV-2102	POOR	POOR	POOR	POOR	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRO-1111	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKSS-1439	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	POOR	GOOD	GOOD	NA	NA	NA
OKRV-2043	GOOD	GOOD	FAIR	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA

Site_ID	TN_NRSA	TN_ECO	TP_NRSA	TP_ECO	COND_NRSA	COND_ECO	TURB_ECO	Cd	Cu	Pb	Se	Zn	SED	ISC_NRSA	RVC_NRSA
OKSS-1472	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2028	FAIR	POOR	POOR	POOR	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKSS-1438	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRO-1099	POOR	FAIR	POOR	FAIR	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2026	POOR	POOR	POOR	POOR	GOOD	FAIR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2025	FAIR	FAIR	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKRV-2044	GOOD	GOOD	GOOD	GOOD	FAIR	POOR	FAIR	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKLS-1186	FAIR	GOOD	GOOD	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKLS-1196	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	FAIR	POOR	POOR	POOR	GOOD	GOOD	NA	NA	NA
OKLS-1193	POOR	POOR	POOR	POOR	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRO-1108	NA	NA	POOR	POOR	GOOD	GOOD	POOR	#NA	NA	NA	NA	NA	NA	NA	NA
OKLS-1192	FAIR	FAIR	POOR	POOR	GOOD	FAIR	GOOD	POOR	GOOD	POOR	GOOD	GOOD	NA	NA	NA
OKRV-2027	NA	NA	NA	NA	GOOD	FAIR	FAIR	#NA	NA	NA	NA	NA	NA	NA	NA
OKSS-1419	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD	POOR	POOR	GOOD	POOR	GOOD	GOOD	NA	NA	NA
OKRV-2070	GOOD	POOR	FAIR	POOR	GOOD	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2021	FAIR	FAIR	NA	NA	POOR	POOR	GOOD	#NA	NA	NA	NA	NA	NA	NA	NA
OKSS-1456	POOR	FAIR	POOR	FAIR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKSS-1426	FAIR	FAIR	FAIR	FAIR	GOOD	FAIR	FAIR	POOR	GOOD	POOR	GOOD	GOOD	NA	NA	NA
OKSS-1425	POOR	FAIR	POOR	FAIR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2039	FAIR	FAIR	FAIR	POOR	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2032	NA	NA	NA	NA	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKLS-1198	GOOD	GOOD	FAIR	FAIR	GOOD	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2036	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR	POOR	GOOD	POOR	GOOD	GOOD	NA	NA	NA
OKRV-2015	POOR	POOR	POOR	FAIR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKRV-2101	FAIR	FAIR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKLS-1197	GOOD	GOOD	POOR	FAIR	GOOD	GOOD	FAIR	POOR	GOOD	POOR	GOOD	GOOD	NA	NA	NA
OKLS-1197	GOOD	GOOD	POOR	FAIR	GOOD	GOOD	FAIR	POOR	GOOD	POOR	GOOD	GOOD	NA	NA	NA

Site_ID	TN_NRSA	TN_ECO	TP_NRSA	TP_ECO	COND_NRSA	COND_ECO	TURB_ECO	Cd	Cu	Pb	Se	Zn	SED	ISC_NRSA	RVC_NRSA
OKRV-2061	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRM-1015	POOR	POOR	POOR	POOR	FAIR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRM-1014	GOOD	GOOD	GOOD	GOOD	POOR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2030	POOR	POOR	POOR	POOR	GOOD	GOOD	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2022	POOR	POOR	POOR	GOOD	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2023	FAIR	FAIR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2098	FAIR	GOOD	POOR	POOR	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKRO-1105	FAIR	FAIR	POOR	FAIR	FAIR	FAIR	GOOD	NA	NA	NA	NA	NA	NA	NA	NA
OKLS-1213	POOR	FAIR	POOR	POOR	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKSS-1420	POOR	POOR	POOR	POOR	FAIR	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKLS-1194	FAIR	FAIR	POOR	FAIR	POOR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKSS-1446	POOR	POOR	POOR	POOR	GOOD	FAIR	FAIR	POOR	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKRV-2037	FAIR	FAIR	FAIR	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKRV-2105	GOOD	GOOD	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKLS-1238	FAIR	FAIR	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKLS-1242	POOR	POOR	FAIR	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKRV-2077	FAIR	FAIR	FAIR	FAIR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	POOR	GOOD	NA	NA	NA
OKSS-1466	POOR	POOR	POOR	POOR	GOOD	FAIR	GOOD	POOR	GOOD	GOOD	GOOD	GOOD	NA	NA	NA
OKLS-1227	FAIR	FAIR	GOOD	GOOD	POOR	POOR	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	NA	NA	NA

**APPENDIX C – DATA**

Table 17. Appendix C—Fish Assessment Information

Site_ID	Final_Fish_Cond	NRSA_Cond	OKFIBI_Score	OKFIBI_Class	OKFIBI_Cond	OCCFIBI_Score	OCCFIBI_Class	OCCFIBI_Cond
OKRM-1006	FAIR	FAIR	33	Supporting	GOOD	93	EXCELLENT	GOOD
OKS9-0932	FAIR	POOR	28	No Crit	ND	68	FAIR	FAIR
OKS9-0938	FAIR	POOR	33 (CWAC)	No Crit	ND	68	FAIR	FAIR
OKRO-1087	POOR	POOR	39	Supporting	GOOD	93	EXCELLENT	GOOD
OKLS-1181	GOOD	POOR	37	Supporting	GOOD	93	EXCELLENT	GOOD
OKS9-0937	GOOD	FAIR	30	No Crit	ND	78	GOOD	GOOD
OKR9-0901	FAIR	POOR	19	Undetermined	FAIR	78	GOOD	GOOD
OKR9-0913	GOOD	POOR	27	Supporting	GOOD	78	GOOD	GOOD
OKR9-0902	GOOD	POOR	26	Supporting	GOOD	70	FAIR	FAIR
OKRM-1002	GOOD	POOR	26	Supporting	GOOD	78	GOOD	GOOD
OKR9-0908	GOOD	POOR	26	Supporting	GOOD	78	GOOD	GOOD
OKR9-0906	POOR	NA	19	Undetermined	FAIR	56	POOR	POOR
OKRO-1088	GOOD	POOR	24	No Crit	ND	91	EXCELLENT	GOOD
OKRO-1089	POOR	NA	19	Undetermined	FAIR	48	POOR	POOR
OKLS-1176	GOOD	GOOD	39 (CWAC)	No Crit	ND	93	EXCELLENT	GOOD
OKSS-1405	GOOD	NA	41 (CWAC)	Supporting	GOOD	89	GOOD	GOOD
OKRM-1008	POOR	POOR	32	Undetermined	FAIR	70	FAIR	FAIR
OKR9-0907	GOOD	FAIR	41	Supporting	GOOD	100	EXCELLENT	GOOD
OKS9-0931	POOR	POOR	12	Not Supporting	POOR	30	VERY POOR	POOR
OKS9-0933	POOR	POOR	20	Not Supporting	POOR	56	POOR	POOR
OKRO-1086	POOR	POOR	30	No Crit	ND	60	POOR	POOR
OKLS-1182	GOOD	POOR	28	No Crit	ND	92	EXCELLENT	GOOD
OKR9-0909	FAIR	POOR	24	Supporting	GOOD	56	POOR	POOR
OKS9-0939	GOOD	GOOD	37 (CWAC)	No Crit	ND	ND (CWAC), 108 (WWAC, Arbucks)	EXCELLENT	GOOD
OKS9-0936	FAIR	FAIR	26	No Crit	ND	68	FAIR	FAIR
OKR9-0912	GOOD	GOOD	34	No Crit	ND	84	GOOD	GOOD
OKRM-1004	GOOD	GOOD	26	No Crit	ND	68	FAIR	FAIR
OKRM-1001	GOOD	GOOD	24	No Crit	ND	68	FAIR	FAIR
OKS9-0935	FAIR	GOOD	27 (HLAC)	No Crit	ND	74	FAIR	FAIR

Site_ID	Final_Fish_Cond	NRSA_Cond	OKFIBI_Score	OKFIBI_Class	OKFIBI_Cond	OCCFIBI_Score	OCCFIBI_Class	OCCFIBI_Cond
OKR9-0911	FAIR	POOR	22	No Crit	ND	65	FAIR	FAIR
OKR9-0905	FAIR	POOR	22	Supporting	GOOD	70	FAIR	FAIR
OKS9-0934	GOOD	GOOD	33	No Crit	ND	92	EXCELLENT	GOOD
OKSS-1408	GOOD	NA	37	No Crit	ND	100	EXCELLENT	GOOD
OKRM-1011	FAIR	NA	32.5	Undetermined	FAIR	70	FAIR	FAIR
OKSS-1414	GOOD	NA	35	No Crit	ND	92	EXCELLENT	GOOD
OKRV-2013	GOOD	NA	43 (CWAC)	Supporting	GOOD	94	EXCELLENT	GOOD
OKLS-1201	GOOD	NA	31	Supporting	GOOD	84	GOOD	GOOD
OKSS-1415	GOOD	NA	35	No Crit	ND	85	GOOD	GOOD
OKLS-1191	GOOD	NA	28	No Crit	ND	92	EXCELLENT	GOOD
OKRM-1016	GOOD	NA	41 (CWAC)	Supporting	GOOD	88	GOOD	GOOD
OKLS-1190	GOOD	NA	41	No Crit	ND	116	EXCELLENT	GOOD
OKRV-2001	POOR	NA	13	Not Supporting	POOR	48	POOR	POOR
OKRM-1010	FAIR	NA	19	Undetermined	FAIR	78	GOOD	GOOD
OKRM-1013	GOOD	NA	27	Supporting	GOOD	85	GOOD	GOOD
OKSS-1447	GOOD	NA	29	No Crit	ND	84	GOOD	GOOD
OKLS-1212	GOOD	NA	37	Supporting	GOOD	85	GOOD	GOOD
OKLS-1185	GOOD	NA	29	No Crit	ND	92	EXCELLENT	GOOD
OKLS-1184	GOOD	NA	35	Supporting	GOOD	78	GOOD	GOOD
OKRO-1095	GOOD	NA	35	Supporting	GOOD	92	EXCELLENT	GOOD
OKLS-1188	FAIR	NA	32	No Crit	ND	76	FAIR	FAIR
OKRM-1022	POOR	POOR	28	Undetermined	FAIR	78	GOOD	GOOD
OKS9-0941	FAIR	FAIR	24	No Crit	ND	63	FAIR	FAIR
OKRM-1021	GOOD	FAIR	22	Supporting	GOOD	70	FAIR	FAIR
OKSS-1431	POOR	GOOD	16	No Crit	ND	60	POOR	POOR
OKRO-1102	GOOD	FAIR	39	No Crit	ND	108	EXCELLENT	GOOD
OKSS-1429	POOR	NA	15	Not Supporting	POOR	56	POOR	POOR
OKSS-1430	GOOD	POOR	41 (CWAC)	No Crit	ND	ND (CWAC), 107 (WWAC, AV)	EXCELLENT	GOOD
OKRO-1103	POOR	POOR	35 (Trout Fishery)	No Crit	ND	81	GOOD	GOOD

Site_ID	Final_Fish_Cond	NRSA_Cond	OKFIBI_Score	OKFIBI_Class	OKFIBI_Cond	OCCFIBI_Score	OCCFIBI_Class	OCCFIBI_Cond
OKRO-1092	GOOD	FAIR	29	Supporting	GOOD	85	GOOD	GOOD
OKR9-0904	FAIR	POOR	30	No Crit	ND	65	FAIR	FAIR
OKLS-1204	GOOD	POOR	33	No Crit	ND	108	EXCELLENT	GOOD
OKR9-0903	FAIR	POOR	31	No Crit	ND	74	FAIR	FAIR
OKRM-1020	GOOD	GOOD	30	No Crit	ND	84	GOOD	GOOD
OKRM-1026	FAIR	NA	21	Undetermined	FAIR	78	GOOD	GOOD
OKSS-1444	POOR	NA	21	No Crit	ND	56	POOR	POOR
OKSS-1403	GOOD	FAIR	31	Undetermined	FAIR	92	EXCELLENT	GOOD
OKLS-1222	POOR	NA	18	Not Supporting	POOR	60	POOR	POOR
OKLS-1209	GOOD	POOR	35	Supporting	GOOD	100	EXCELLENT	GOOD
OKLS-1203	GOOD	FAIR	26	Supporting	GOOD	91	EXCELLENT	GOOD
OKRV-2029	POOR	NA	18	No Crit	ND	44	POOR	POOR
OKRV-2011	FAIR	NA	28	Supporting	GOOD	56	POOR	POOR
OKRO-1107	GOOD	NA	35	Supporting	GOOD	92	EXCELLENT	GOOD
OKRV-2016	GOOD	NA	37	No Crit	ND	92	EXCELLENT	GOOD
OKRV-2010	GOOD	NA	30	Supporting	GOOD	84	GOOD	GOOD
OKRV-2040	GOOD	NA	33	Supporting	GOOD	92	EXCELLENT	GOOD
OKRV-2035	FAIR	NA	30	No Crit	ND	74	FAIR	FAIR
OKRV-2014	GOOD	NA	25	Undetermined	FAIR	100	EXCELLENT	GOOD
OKRV-2034	GOOD	NA	22	No Crit	ND	92	EXCELLENT	GOOD
OKRV-2080	GOOD	NA	35	Supporting	GOOD	92	EXCELLENT	GOOD
OKRV-2006	FAIR	NA	24	Supporting	GOOD	65	FAIR	FAIR
OKRV-2074	GOOD	NA	27	Undetermined	FAIR	78	GOOD	GOOD
OKSS-1434	GOOD	NA	39	Supporting	GOOD	108	EXCELLENT	GOOD
OKRV-2012	GOOD	NA	24	Supporting	GOOD	76	FAIR	FAIR
OKSS-1449	GOOD	NA	31	Supporting	GOOD	84	GOOD	GOOD
OKRO-1106	FAIR	NA	30	No Crit	ND	76	FAIR	FAIR
OKRV-2019	FAIR	NA	29	Undetermined	FAIR	76	FAIR	FAIR
OKRO-1098	GOOD	NA	32	No Crit	ND	83	GOOD	GOOD

Site_ID	Final_Fish_Cond	NRSA_Cond	OKFIBI_Score	OKFIBI_Class	OKFIBI_Cond	OCCFIBI_Score	OCCFIBI_Class	OCCFIBI_Cond
OKRV-2004	GOOD	NA	26	Supporting	GOOD	91	EXCELLENT	GOOD
OKSS-1410	FAIR	NA	21	Not Supporting	POOR	68	FAIR	FAIR
OKRV-2020	POOR	NA	26	No Crit	ND	60	POOR	POOR
OKRM-1023	GOOD	NA	39	Supporting	GOOD	93	EXCELLENT	GOOD
OKRM-1017	FAIR	NA	30	No Crit	ND	74	FAIR	FAIR
OKRV-2079	FAIR	NA	24	Undetermined	FAIR	78	GOOD	GOOD
OKRV-2033	FAIR	NA	26	Undetermined	FAIR	76	FAIR	FAIR
OKRV-2007	POOR	NA	20	Undetermined	FAIR	52	POOR	POOR
OKSS-1416	FAIR	NA	20	Undetermined	FAIR	65	FAIR	FAIR
OKSS-1409	GOOD	NA	43 (CWAC)	Supporting	GOOD	89	GOOD	GOOD
OKRV-2009	GOOD	NA	22	Supporting	GOOD	92	EXCELLENT	GOOD
OKSS-1436	GOOD	NA	35	Supporting	GOOD	93	EXCELLENT	GOOD
OKRV-2088	GOOD	NA	31	Supporting	GOOD	76	FAIR	FAIR
OKRV-2068	GOOD	NA	35	Supporting	GOOD	100	EXCELLENT	GOOD
OKRV-2102	GOOD	NA	24	Supporting	GOOD	91	EXCELLENT	GOOD
OKRO-1111	GOOD	NA	30	Supporting	GOOD	92	EXCELLENT	GOOD
OKSS-1439	FAIR	NA	23 (CWAC)	No Crit	ND	64	FAIR	FAIR
OKRV-2043	FAIR	NA	19	Undetermined	FAIR	48	POOR	POOR
OKSS-1472	POOR	NA	24	No Crit	ND	44	POOR	POOR
OKRV-2028	POOR	NA	24	No Crit	ND	48	POOR	POOR
OKSS-1438	GOOD	NA	37	No Crit	ND	108	EXCELLENT	GOOD
OKRO-1099	GOOD	NA	39 (CWAC)	Supporting	GOOD	88	GOOD	GOOD
OKRV-2026	GOOD	NA	41	Supporting	GOOD	107	EXCELLENT	GOOD
OKRV-2025	GOOD	NA	23	Supporting	GOOD	91	EXCELLENT	GOOD
OKRV-2044	FAIR	NA	20	No Crit	ND	68	FAIR	FAIR
OKLS-1186	GOOD	NA	26	Supporting	GOOD	91	EXCELLENT	GOOD
OKLS-1196	GOOD	NA	33	Undetermined	FAIR	93	EXCELLENT	GOOD
OKLS-1193	POOR	NA	24	Not Supporting	POOR	70	FAIR	FAIR
OKRO-1108	GOOD	NA	26	Supporting	GOOD	85	GOOD	GOOD

\*No fish collected during sampling- very salty site. \*\*Site not sampled for fish-unable to launch boat.

Site_ID	Final_Fish_Cond	NRSA_Cond	OKFIBI_Score	OKFIBI_Class	OKFIBI_Cond	OCCFIBI_Score	OCCFIBI_Class	OCCFIBI_Cond
OKLS-1192	GOOD	NA	39	Supporting	GOOD	108	EXCELLENT	GOOD
OKRV-2027	GOOD	NA	35	Supporting	GOOD	92	EXCELLENT	GOOD
OKSS-1419	FAIR	NA	21	Not Supporting	POOR	76	FAIR	FAIR
OKRV-2070	FAIR	NA	25	Undetermined	FAIR	68	FAIR	FAIR
OKRV-2021*	ND	NA	ND	ND	ND	ND	ND	ND
OKSS-1456	GOOD	NA	39	Supporting	GOOD	86	GOOD	GOOD
OKSS-1426	GOOD	NA	33	Undetermined	FAIR	108	EXCELLENT	GOOD
OKSS-1425	GOOD	NA	33	Supporting	GOOD	82	GOOD	GOOD
OKRV-2039	GOOD	NA	29	No Crit	ND	109	EXCELLENT	GOOD
OKRV-2032	POOR	NA	22	No Crit	ND	57	POOR	POOR
OKLS-1198	FAIR	NA	19	No Crit	ND	76	FAIR	FAIR
OKRV-2036	GOOD	NA	35 (CWAC)	No Crit	ND	81	GOOD	GOOD
OKRV-2015	FAIR	NA	16	Not Supporting	POOR	74	FAIR	FAIR
OKRV-2101	GOOD	NA	22	Supporting	GOOD	83	GOOD	GOOD
OKLS-1197	GOOD	NA	36 (CWAC)	No Crit	ND	87	GOOD	GOOD
OKRV-2061	GOOD	NA	37	No Crit	ND	109	EXCELLENT	GOOD
OKRM-1014	GOOD	NA	24	Supporting	GOOD	78	GOOD	GOOD
OKRM-1015	FAIR	NA	30	Undetermined	FAIR	63	FAIR	FAIR
OKRV-2030**	ND	NA	ND	ND	ND	ND	ND	ND
OKRV-2022	GOOD	NA	37	Supporting	GOOD	93	EXCELLENT	GOOD
OKRV-2023	GOOD	NA	29	Supporting	GOOD	85	GOOD	GOOD
OKRV-2098	GOOD	NA	29	Supporting	GOOD	100	EXCELLENT	GOOD
OKRO-1105	GOOD	NA	24 (HLAC)	No Crit	ND	78	GOOD	GOOD
OKLS-1213	GOOD	NA	37	Supporting	GOOD	85	GOOD	GOOD
OKSS-1420	GOOD	NA	27	Supporting	GOOD	ND	ND	ND
OKLS-1194	GOOD	NA	26	Supporting	GOOD	100	EXCELLENT	GOOD
OKSS-1446	FAIR	NA	32	Undetermined	FAIR	70	FAIR	FAIR
OKRV-2037	GOOD	NA	25	Supporting	GOOD	78	GOOD	GOOD
OKRV-2105	GOOD	NA	27	Supporting	GOOD	93	EXCELLENT	GOOD

Site_ID	Final_Fish_Cond	NRSA_Cond	OKFIBI_Score	OKFIBI_Class	OKFIBI_Cond	OCCFIBI_Score	OCCFIBI_Class	OCCFIBI_Cond
OKLS-1238	GOOD	NA	26	Supporting	GOOD	91	EXCELLENT	GOOD
OKLS-1242	POOR	NA	16	Not Supporting	POOR	57	POOR	POOR
OKRV-2077	GOOD	NA	24	Supporting	GOOD	65	FAIR	FAIR
OKSS-1466	GOOD	NA	35	Supporting	GOOD	100	EXCELLENT	GOOD
OKLS-1227	POOR	NA	20	Undetermined	FAIR	57	POOR	POOR

Table 18. Appendix C—Macroinvertebrate Assessment Information (2013-2014 NRSA samples not included)

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M01724	OKRM-1006	LRF	SUB	10.00	1.00	1.82%	59.09%	3.41	6.40	64.86	Slightly Impaired
M01725	OKRM-1006	LRF	THAB	17.00	4.00	14.91%	34.21%	2.50	6.52	97.30	Non-Impaired
M01898	OKRM-1006	LRF	THAB	16.00	5.00	20.91%	57.27%	2.78	6.69	115.56	Reference
M01709	OKS9-0932	RBP	Woody	19.00	3.00	8.02%	69.14%	2.34	7.52	56.76	Slightly Impaired
M01710	OKS9-0932	RBP	SSV	15.00	4.00	19.27%	51.38%	2.97	7.02	94.74	Non-Impaired
M01875	OKS9-0932	RBP	Woody	16.00	4.00	34.86%	50.46%	3.06	6.76	74.58	Slightly Impaired
M01876	OKS9-0932	RBP	SSV	19.00	3.00	16.36%	56.36%	2.84	7.22	58.06	Slightly Impaired
M01929	OKS9-0932	RBP	Woody	24.00	8.00	40.52%	34.48%	3.83	6.28	108.47	Reference
M01930	OKS9-0932	RBP	SSV	22.00	5.00	22.12%	45.13%	3.24	6.55	70.97	Slightly Impaired
M01895	OKS9-0938	RBP	Riffle	25.00	10.00	65.29%	45.45%	3.50	4.56	91.84	Non-Impaired
M01896	OKS9-0938	RBP	SSV	22.00	10.00	25.66%	50.44%	3.35	5.65	81.25	Slightly Impaired
M01991	OKS9-0938	RBP	Riffle	18.00	11.00	30.56%	66.20%	2.48	5.26	83.87	Non-Impaired
M01992	OKS9-0938	RBP	SSV	32.00	11.00	22.41%	39.66%	3.95	6.31	109.76	Reference
M01755	OKRO-1087	LRC	COMP	15.00	4.00	20.49%	67.21%	2.46	7.30	89.19	Non-Impaired
M01756	OKRO-1087	RBP	Riffle	25.00	9.00	35.90%	29.49%	3.70	5.19	128.30	Reference
M01917	OKRO-1087	LRC	COMP	37.00	7.00	10.08%	33.61%	3.03	6.85	90.32	Slightly Impaired
M01918	OKRO-1087	RBP	Riffle	17.00	8.00	27.03%	55.86%	4.53	5.74	81.25	Non-Impaired
M01752	OKLS-1181	RBP	SSV	17.00	1.00	11.20%	56.80%	2.81	7.29	71.05	Slightly Impaired
M01753	OKLS-1181	RBP	Riffle	24.00	4.00	23.26%	46.51%	3.53	4.88	90.57	Non-Impaired
M01754	OKLS-1181	RBP	Woody	22.00	4.00	3.97%	69.05%	2.73	7.12	81.08	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M01901	OKLS-1181	RBP	SSV	23.00	8.00	11.82%	50.00%	3.36	6.76	75.00	Slightly Impaired
M01902	OKLS-1181	RBP	Riffle	17.00	6.00	66.48%	64.25%	2.56	4.80	87.50	Non-Impaired
M01903	OKLS-1181	RBP	Woody	28.00	12.00	29.06%	40.17%	3.71	6.30	87.50	Non-Impaired
M01926	OKS9-0937	RBP	Woody	26.00	4.00	28.32%	31.86%	4.06	6.61	81.36	Slightly Impaired
M01927	OKS9-0937	RBP	SSV	30.00	6.00	11.68%	51.09%	3.37	7.39	77.42	Slightly Impaired
M01976	OKS9-0937	RBP	Woody	11.00	2.00	1.89%	82.08%	1.56	5.58	47.37	Moderately Impaired
M01980	OKS9-0937	RBP	SSV	21.00	1.00	0.92%	55.05%	3.11	5.98	58.54	Slightly Impaired
M02129	OKS9-0937	RBP	Woody	19.00	2.00	3.17%	30.16%	3.69	6.41	78.95	Slightly Impaired
M02130	OKS9-0937	RBP	SSV	16.00	0.00	0.00%	60.36%	2.68	6.73	58.54	Slightly Impaired
M01825	OKR9-0901	LRF	THAB	22.00	2.00	9.91%	28.83%	3.91	7.00	97.78	Non-Impaired
M01824	OKR9-0901	LRF	SUB	9.00	2.00	5.71%	88.57%	1.57	5.93	53.33	Moderately Impaired
M01837	OKR9-0901	LRF	THAB	19.00	4.00	10.89%	52.48%	3.25	6.70	106.67	Reference
M01838	OKR9-0901	LRF	SUB	9.00	3.00	22.92%	50.00%	2.74	6.47	88.89	Non-Impaired
M01855	OKR9-0901	LRF	THAB	18.00	5.00	23.15%	39.81%	3.29	6.91	124.44	Reference
M01857	OKR9-0901	LRF	SUB	8.00	1.00	1.59%	61.90%	2.28	5.60	53.33	Moderately Impaired
M01773	OKR9-0901	LRF	THAB	28.00	2.00	3.74%	33.64%	4.07	6.31	81.08	Slightly Impaired
M01774	OKR9-0901	LRF	SUB	3.00	0.00	0.00%	66.67%	1.58	5.67	48.65	Moderately Impaired
M01864	OKR9-0913	LRF	THAB	17.00	6.00	26.71%	56.16%	2.94	6.22	115.56	Reference
M01866	OKR9-0913	LRF	SUB	14.00	4.00	13.76%	72.48%	2.49	6.50	97.78	Non-Impaired
M01973	OKR9-0913	LRF	THAB	18.00	3.00	29.29%	45.71%	2.89	6.76	97.78	Non-Impaired
M01974	OKR9-0913	LRF	SUB	19.00	1.00	10.37%	31.85%	3.55	6.35	97.78	Non-Impaired
M02140	OKR9-0913	LRF	THAB	17.00	1.00	4.24%	42.37%	3.27	6.25	71.11	Slightly Impaired
M02141	OKR9-0913	LRF	SUB	19.00	1.00	3.42%	40.17%	3.48	6.42	71.11	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M01820	OKR9-0902	LRF	THAB	14.00	1.00	3.70%	69.44%	3.11	7.88	71.11	Slightly Impaired
M01868	OKR9-0902	LRF	THAB	14.00	1.00	5.26%	72.93%	1.95	7.79	62.22	Slightly Impaired
M01967	OKR9-0902	LRF	THAB	29.00	9.00	23.93%	28.21%	4.17	6.57	142.22	Reference
M01808	OKR9-0902	LRF	SUB	13.00	1.00	5.77%	50.96%	3.14	7.71	64.86	Slightly Impaired
M01809	OKR9-0902	LRF	THAB	12.00	1.00	2.84%	70.45%	2.11	7.60	56.76	Slightly Impaired
M01821	OKR9-0902	LRF	SUB	11.00	1.00	19.66%	71.79%	2.21	6.26	71.11	Slightly Impaired
M01704	OKR9-0906	LRF	THAB	10.00	0.00	0.00%	62.73%	2.30	6.13	56.76	Slightly Impaired
M01705	OKR9-0906	LRF	SUB	7.00	0.00	0.00%	85.61%	1.55	5.97	48.65	Moderately Impaired
M01869	OKR9-0906	LRF	SUB	5.00	0.00	0.00%	89.22%	1.44	7.30	44.44	Moderately Impaired
M01870	OKR9-0906	LRF	THAB	7.00	0.00	0.00%	88.46%	1.23	6.23	44.44	Moderately Impaired
M01715	OKR9-0908	LRF	SUB	7.00	0.00	0.00%	91.98%	1.17	5.98	40.54	Moderately Impaired
M01716	OKR9-0908	LRF	THAB	12.00	0.00	0.00%	71.17%	2.39	5.72	56.76	Slightly Impaired
M01865	OKR9-0908	LRF	THAB	19.00	5.00	16.51%	63.30%	2.92	6.59	106.67	Reference
M01867	OKR9-0908	LRF	SUB	15.00	2.00	2.59%	64.66%	2.41	7.59	62.22	Slightly Impaired
M01707	OKRM-1002	LRF	THAB	10.00	2.00	1.85%	69.44%	2.35	6.76	56.76	Slightly Impaired
M01708	OKRM-1002	LRF	SUB	10.00	0.00	0.00%	54.46%	2.86	6.06	64.86	Slightly Impaired
M01871	OKRM-1002	LRF	SUB	7.00	1.00	0.74%	80.74%	1.82	6.93	53.33	Moderately Impaired
M01878	OKRM-1002	LRF	THAB	8.00	2.00	25.34%	67.81%	2.09	6.17	71.11	Slightly Impaired
M01706	OKRO-1088	RBP	Woody	20.00	6.00	10.75%	36.56%	3.64	5.58	113.51	Reference
M01900	OKRO-1088	RBP	Woody	19.00	11.00	85.32%	47.71%	3.14	5.61	94.92	Non-Impaired
M01797	OKRO-1089	LRC	COMP	8.00	0.00	0.00%	79.28%	1.94	6.53	48.65	Moderately Impaired
M01839	OKRO-1089	RBP	SSV	6.00	0.00	0.00%	78.95%	2.07	7.74	41.38	Moderately Impaired
M01841	OKRO-1089	RBP	Woody	7.00	0.00	0.00%	84.82%	1.48	7.80	32.79	Moderately Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M01893	OKLS-1176	RBP	Riffle	15.00	7.00	62.99%	31.50%	2.96	4.69	73.47	Slightly Impaired
M01894	OKLS-1176	LRC	COMP	28.00	8.00	32.43%	22.52%	4.35	5.02	100.00	Non-Impaired
M01915	OKLS-1176	LRC	COMP	32.00	11.00	30.16%	38.10%	4.05	5.86	100.00	Non-Impaired
M02085	OKLS-1176	RBP	Riffle	22.00	12.00	33.06%	46.28%	3.46	5.54	85.71	Non-Impaired
M02086	OKLS-1176	LRC	COMP	30.00	7.00	30.48%	29.52%	4.20	5.74	93.75	Non-Impaired
M01728	OKSS-1405	RBP	Riffle	28.00	11.00	48.19%	63.13%	2.91	5.15	105.66	Reference
M01729	OKSS-1405	LRC	COMP	16.00	7.00	13.95%	75.19%	1.87	5.84	89.19	Non-Impaired
M01968	OKSS-1405	LRC	COMP	34.00	15.00	38.33%	23.33%	4.57	5.52	115.91	Reference
M01969	OKSS-1405	RBP	Riffle	20.00	13.00	45.79%	46.73%	3.82	4.17	93.75	Non-Impaired
M01913	OKR9-0907	RBP	Riffle	20.00	8.00	59.47%	40.78%	2.98	4.64	87.50	Non-Impaired
M01914	OKR9-0907	LRC	COMP	33.00	10.00	30.30%	31.06%	4.26	6.22	106.67	Reference
M02026	OKR9-0907	LRC	COMP	29.00	11.00	28.70%	33.33%	4.04	5.36	100.00	Non-Impaired
M02027	OKR9-0907	RBP	Riffle	21.00	7.00	19.27%	52.29%	3.07	5.11	85.71	Non-Impaired
M01879	OKRM-1008	LRC	COMP	22.00	6.00	11.32%	54.72%	3.42	6.74	56.25	Slightly Impaired
M02028	OKRM-1008	LRC	COMP	24.00	4.00	9.82%	66.96%	2.96	6.16	50.00	Moderately Impaired
M01842	OKS9-0931	RBP	Woody	13.00	0.00	0.00%	70.07%	2.48	7.84	45.90	Moderately Impaired
M01843	OKS9-0931	RBP	SSV	10.00	0.00	0.00%	75.86%	1.76	7.71	41.38	Moderately Impaired
M02103	OKS9-0931	RBP	SSV	14.00	0.00	0.00%	59.41%	2.67	6.10	71.11	Slightly Impaired
M02104	OKS9-0931	RBP	Woody	12.00	0.00	0.00%	76.00%	2.14	6.22	62.22	Slightly Impaired
M01908	OKS9-0933	RBP	SSV	9.00	0.00	0.00%	89.47%	1.04	7.93	34.48	Moderately Impaired
M01909	OKS9-0933	RBP	Woody	10.00	0.00	0.00%	77.57%	1.90	7.97	42.86	Moderately Impaired
M02093	OKS9-0933	RBP	Woody	14.00	0.00	0.00%	62.81%	2.79	7.67	64.86	Slightly Impaired
M01810	OKLS-1182	RBP	Woody	21.00	1.00	0.87%	51.30%	3.16	6.04	64.86	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M01811	OKLS-1182	RBP	SSV	11.00	0.00	0.00%	68.64%	2.34	6.33	55.26	Slightly Impaired
M01925	OKLS-1182	RBP	Woody	21.00	2.00	35.71%	41.96%	3.57	6.88	75.00	Slightly Impaired
M01761	OKRO-1086	RBP	SSV	20.00	1.00	3.33%	60.83%	2.94	7.01	63.16	Slightly Impaired
M01762	OKRO-1086	RBP	Woody	26.00	4.00	3.08%	56.92%	3.14	6.93	81.08	Slightly Impaired
M01923	OKRO-1086	LRF	SUB	21.00	5.00	10.29%	41.18%	3.62	5.98	70.97	Slightly Impaired
M01924	OKRO-1086	LRF	THAB	23.00	4.00	4.39%	48.25%	3.44	6.48	51.61	Moderately Impaired
M01791	OKR9-0909	RBP	SSV	23.00	1.00	3.01%	47.59%	3.43	7.34	63.16	Slightly Impaired
M01792	OKR9-0909	RBP	Woody	18.00	0.00	0.00%	47.27%	3.16	7.72	64.86	Slightly Impaired
M01840	OKR9-0909	RBP	Woody	22.00	1.00	1.85%	25.93%	3.85	8.00	72.13	Slightly Impaired
M01766	OKS9-0939	RBP	Woody	23.00	5.00	30.38%	43.46%	3.47	5.95	113.51	Reference
M01767	OKS9-0939	RBP	SSV	26.00	9.00	29.95%	37.43%	3.61	5.60	118.42	Reference
M01768	OKS9-0939	RBP	Riffle	13.00	4.00	72.22%	76.98%	1.96	4.43	75.47	Slightly Impaired
M01860	OKS9-0939	RBP	Woody	21.00	6.00	18.60%	55.04%	3.10	5.91	81.36	Slightly Impaired
M01861	OKS9-0939	RBP	Riffle	35.00	13.00	51.49%	51.26%	3.32	5.00	88.89	Non-Impaired
M01862	OKS9-0939	RBP	SSV	29.00	5.00	22.65%	34.81%	3.82	5.93	83.87	Non-Impaired
M01806	OKS9-0936	RBP	SSV	22.00	1.00	7.46%	39.30%	3.11	6.91	71.05	Slightly Impaired
M01807	OKS9-0936	RBP	Woody	8.00	2.00	6.09%	80.87%	1.64	5.94	48.65	Moderately Impaired
M01897	OKS9-0936	RBP	SSV	26.00	2.00	26.12%	42.54%	3.53	6.68	70.97	Slightly Impaired
M01899	OKS9-0936	RBP	Woody	18.00	5.00	64.75%	70.49%	2.16	6.83	74.58	Slightly Impaired
M01910	OKR9-0912	LRF	THAB	11.00	2.00	1.74%	62.61%	2.53	7.53	53.33	Moderately Impaired
M02123	OKR9-0912	LRF	SUB	13.00	2.00	3.28%	60.66%	2.66	7.30	53.33	Moderately Impaired
M02124	OKR9-0912	LRF	THAB	10.00	3.00	12.70%	78.57%	1.74	6.10	46.67	Moderately Impaired
M01931	OKRM-1001	LRF	THAB	10.00	0.00	0.00%	75.00%	1.97	7.61	40.00	Moderately Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02117	OKRM-1001	LRF	THAB	22.00	3.00	5.17%	43.10%	3.58	6.55	60.00	Slightly Impaired
M02118	OKRM-1001	LRF	SUB	20.00	7.00	14.29%	48.05%	3.41	6.86	80.00	Slightly Impaired
M01928	OKRM-1004	LRC	COMP	16.00	2.00	1.90%	75.71%	3.11	7.81	53.33	Moderately Impaired
M02131	OKRM-1004	LRF	SUB	20.00	5.00	11.82%	55.45%	3.08	7.22	73.33	Slightly Impaired
M02132	OKRM-1004	LRF	THAB	17.00	6.00	12.96%	53.09%	2.86	6.47	80.00	Slightly Impaired
M01817	OXS9-0935	RBP	SSV	15.00	1.00	1.87%	50.94%	2.75	6.59	57.14	Slightly Impaired
M01836	OXS9-0935	RBP	SSV	20.00	3.00	3.95%	69.74%	2.26	6.56	45.65	Moderately Impaired
M01777	OKR9-0905	RBP	SSV	29.00	6.00	4.85%	34.80%	3.92	6.59	102.63	Reference
M01778	OKR9-0905	RBP	Woody	21.00	4.00	7.14%	43.65%	3.39	6.20	81.08	Slightly Impaired
M01844	OKR9-0905	RBP	Woody	21.00	4.00	6.25%	76.39%	1.95	7.45	52.46	Moderately Impaired
M01845	OKR9-0905	RBP	SSV	10.00	1.00	8.62%	78.16%	1.63	7.58	41.38	Moderately Impaired
M01757	OKR9-0911	LRF	SUB	14.00	2.00	1.79%	63.39%	2.38	7.70	56.76	Slightly Impaired
M01758	OKR9-0911	LRF	THAB	13.00	1.00	1.77%	56.64%	2.75	7.26	64.86	Slightly Impaired
M01863	OKR9-0911	LRF	THAB	14.00	6.00	43.93%	39.25%	3.06	6.73	118.42	Reference
M01803	OXS9-0934	RBP	Riffle	9.00	1.00	0.50%	96.02%	1.18	5.99	37.74	Moderately Impaired
M01804	OXS9-0934	RBP	SSV	15.00	1.00	0.90%	62.16%	2.70	7.34	63.16	Slightly Impaired
M01805	OXS9-0934	RBP	Woody	16.00	2.00	1.44%	55.40%	2.65	6.48	64.86	Slightly Impaired
M01904	OXS9-0934	RBP	Woody	30.00	5.00	13.51%	34.46%	4.02	7.06	81.36	Slightly Impaired
M01905	OXS9-0934	RBP	SSV	31.00	3.00	4.20%	26.05%	4.28	7.18	70.97	Slightly Impaired
M02302	OKRM-1022	LRF	THAB	10.00	3.00	40.18%	63.39%	2.23	5.85	64.29	Slightly Impaired
M02333	OKRM-1022	LRF	SUB	12.00	2.00	3.45%	72.41%	2.06	6.22	50.00	Moderately Impaired
M02334	OKRM-1022	LRF	THAB	9.00	2.00	3.77%	82.08%	1.48	6.13	35.71	Moderately Impaired
M02014	OXS9-0941	RBP	Woody	13.00	1.00	6.09%	72.17%	2.36	7.86	55.26	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02201	OKS9-0941	RBP	Woody	16.00	2.00	2.91%	68.93%	2.43	6.32	47.46	Moderately Impaired
M02224	OKS9-0941	RBP	Woody	18.00	1.00	0.75%	76.87%	1.87	6.31	47.46	Moderately Impaired
M01975	OKRM-1021	LRF	THAB	13.00	3.00	7.76%	67.24%	2.52	7.14	80.00	Slightly Impaired
M01979	OKRM-1021	LRF	SUB	8.00	0.00	0.00%	45.45%	2.85	7.64	62.22	Slightly Impaired
M02155	OKRM-1021	LRF	THAB	18.00	4.00	8.47%	49.15%	2.98	7.00	97.78	Non-Impaired
M02156	OKRM-1021	LRF	SUB	14.00	4.00	6.17%	66.67%	2.60	7.62	97.78	Non-Impaired
M02047	OKSS-1431	RBP	SSV	27.00	8.00	22.03%	43.22%	3.72	5.41	102.44	Reference
M02048	OKSS-1431	RBP	Riffle	20.00	8.00	28.87%	43.81%	3.40	5.27	83.87	Non-Impaired
M02182	OKSS-1431	RBP	SSV	24.00	5.00	8.40%	52.67%	3.30	6.73	58.06	Slightly Impaired
M02082	OKRO-1102	RBP	Woody	14.00	3.00	2.54%	87.29%	1.58	5.91	46.67	Moderately Impaired
M02083	OKRO-1102	RBP	SSV	18.00	4.00	5.04%	68.91%	2.74	6.03	57.14	Slightly Impaired
M02084	OKRO-1102	RBP	Riffle	17.00	4.00	7.05%	63.46%	2.72	5.94	64.29	Slightly Impaired
M02240	OKRO-1102	RBP	Woody	20.00	9.00	43.97%	32.76%	3.73	4.55	100.00	Non-Impaired
M02241	OKRO-1102	RBP	SSV	28.00	9.00	38.32%	38.32%	3.88	4.80	100.00	Non-Impaired
M02133	OKSS-1429	RBP	Riffle	18.00	2.00	15.97%	46.22%	3.23	5.03	55.10	Slightly Impaired
M02134	OKSS-1429	LRC	COMP	12.00	4.00	28.95%	79.82%	1.96	5.26	50.00	Moderately Impaired
M02098	OKSS-1430	RBP	SSV	20.00	2.00	2.80%	53.27%	3.11	6.83	50.00	Moderately Impaired
M02099	OKSS-1430	RBP	Riffle	17.00	5.00	7.14%	80.00%	1.69	5.93	43.75	Moderately Impaired
M02100	OKSS-1430	RBP	Woody	13.00	1.00	6.25%	75.00%	2.29	6.73	45.16	Moderately Impaired
M02207	OKSS-1430	RBP	Woody	15.00	5.00	12.50%	55.36%	2.95	6.17	75.00	Slightly Impaired
M02208	OKSS-1430	RBP	Riffle	15.00	8.00	41.44%	59.46%	2.70	5.05	87.50	Non-Impaired
M02209	OKSS-1430	RBP	SSV	26.00	7.00	16.17%	44.91%	3.52	7.11	81.25	Slightly Impaired
M02121	OKRO-1103	RBP	Riffle	32.00	12.00	28.85%	56.73%	3.11	5.57	79.59	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02122	OKRO-1103	LRC	COMP	16.00	5.00	5.83%	74.17%	1.88	7.48	43.75	Moderately Impaired
M01730	OKR9-0904	LRF	THAB	18.00	2.00	3.59%	64.07%	2.59	7.68	64.86	Slightly Impaired
M01731	OKR9-0904	LRF	SUB	13.00	0.00	0.00%	81.25%	1.82	7.40	56.76	Slightly Impaired
M02303	OKR9-0904	LRF	THAB	15.00	4.00	3.03%	73.33%	2.23	7.13	71.05	Slightly Impaired
M01823	OKRO-1092	RBP	SSV	4.00	0.00	0.00%	89.47%	1.35	5.81	44.44	Moderately Impaired
M01822	OKRO-1092	RBP	Woody	12.00	1.00	11.43%	70.48%	2.35	6.39	71.11	Slightly Impaired
M02197	OKRO-1092	RBP	Woody	22.00	9.00	23.36%	68.22%	2.65	5.76	85.25	Non-Impaired
M02198	OKRO-1092	RBP	SSV	19.00	7.00	47.06%	48.74%	3.21	5.60	96.55	Non-Impaired
M02227	OKRO-1092	RBP	Woody	24.00	8.00	13.39%	69.29%	2.45	6.03	72.13	Slightly Impaired
M02228	OKRO-1092	RBP	SSV	29.00	10.00	50.36%	39.57%	3.78	6.26	110.34	Reference
M02114	OKLS-1204	RBP	Woody	13.00	1.00	1.16%	51.16%	2.86	6.85	53.33	Moderately Impaired
M02127	OKR9-0903	LRF	SUB	8.00	0.00	0.00%	84.86%	1.33	7.35	39.47	Moderately Impaired
M02128	OKR9-0903	LRF	THAB	11.00	1.00	2.10%	88.11%	1.66	7.23	47.37	Moderately Impaired
M02299	OKR9-0903	LRF	THAB	12.00	4.00	8.11%	68.47%	2.17	7.12	71.05	Slightly Impaired
M02125	OKRM-1020	LRF	THAB	12.00	5.00	41.44%	55.86%	2.65	5.66	86.67	Non-Impaired
M02126	OKRM-1020	LRF	SUB	16.00	6.00	17.28%	50.62%	3.04	6.73	80.00	Slightly Impaired
M02112	OKRM-1026	LRF	THAB	4.00	0.00	0.00%	77.59%	1.67	6.22	53.33	Moderately Impaired
M02113	OKRM-1026	LRF	SUB	6.00	0.00	0.00%	68.57%	1.98	5.99	53.33	Moderately Impaired
M02262	OKRM-1026	LRF	SUB	14.00	3.00	32.50%	45.00%	3.25	7.81	106.67	Reference
M02263	OKRM-1026	LRF	THAB	10.00	1.00	0.95%	83.81%	1.45	6.25	53.33	Moderately Impaired
M02101	OKSS-1444	RBP	Woody	25.00	4.00	11.82%	32.73%	3.89	5.75	102.63	Reference
M02102	OKSS-1444	RBP	SSV	26.00	6.00	14.52%	33.87%	3.76	6.15	102.44	Reference
M02157	OKSS-1444	RBP	Woody	27.00	4.00	8.33%	40.83%	3.81	5.78	61.02	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02252	OKSS-1403	RBP	Riffle	21.00	11.00	59.81%	39.25%	3.51	4.60	97.96	Non-Impaired
M02253	OKSS-1403	RBP	SSV	23.00	7.00	22.41%	50.00%	3.31	5.60	81.25	Slightly Impaired
M02318	OKSS-1403	RBP	SSV	26.00	10.00	39.62%	39.62%	3.79	4.75	100.00	Non-Impaired
M02319	OKSS-1403	RBP	Riffle	29.00	11.00	44.92%	28.81%	4.09	3.95	97.96	Non-Impaired
M02260	OKLS-1222	RBP	Woody	15.00	1.00	2.72%	79.89%	1.98	6.53	45.90	Moderately Impaired
M02261	OKLS-1222	RBP	SSV	14.00	0.00	0.00%	52.08%	2.53	7.03	55.17	Slightly Impaired
M02339	OKLS-1222	RBP	Woody	10.00	0.00	0.00%	87.40%	1.26	7.79	53.33	Moderately Impaired
M02340	OKLS-1222	RBP	SSV	13.00	0.00	0.00%	72.12%	2.34	7.72	62.22	Slightly Impaired
M02029	OKLS-1209	RBP	Woody	12.00	2.00	8.04%	58.04%	2.68	6.83	43.75	Moderately Impaired
M02030	OKLS-1209	RBP	Riffle	25.00	6.00	14.68%	39.45%	4.02	5.51	67.35	Slightly Impaired
M02031	OKLS-1209	RBP	SSV	24.00	2.00	3.60%	46.85%	3.33	6.85	50.00	Moderately Impaired
M02176	OKLS-1209	RBP	Riffle	29.00	10.00	22.22%	41.98%	3.88	5.18	85.71	Non-Impaired
M02177	OKLS-1209	RBP	SSV	28.00	8.00	24.14%	62.07%	3.06	7.22	81.25	Slightly Impaired
M02178	OKLS-1209	RBP	Woody	22.00	9.00	29.31%	42.24%	3.48	6.83	92.86	Non-Impaired
M02043	OKLS-1203	RBP	SSV	21.00	2.00	17.86%	36.61%	3.51	6.75	97.78	Non-Impaired
M02044	OKLS-1203	RBP	Woody	29.00	4.00	20.00%	32.31%	3.98	7.12	133.33	Reference
M02218	OKLS-1203	RBP	SSV	27.00	6.00	18.94%	43.94%	3.67	7.08	89.66	Non-Impaired
M02219	OKLS-1203	RBP	Woody	26.00	7.00	18.92%	48.65%	3.40	6.80	78.69	Slightly Impaired
M02038	OKSS-1408	RBP	Woody	17.00	1.00	3.64%	49.09%	3.23	7.30	63.16	Slightly Impaired
M02039	OKSS-1408	RBP	SSV	31.00	3.00	12.10%	45.22%	3.73	6.91	73.17	Slightly Impaired
M02040	OKSS-1408	RBP	Riffle	20.00	7.00	35.78%	64.22%	2.66	4.22	83.87	Non-Impaired
M02137	OKSS-1408	RBP	SSV	27.00	3.00	11.65%	22.33%	4.23	6.68	87.80	Non-Impaired
M02138	OKSS-1408	RBP	Riffle	15.00	5.00	45.39%	53.95%	2.73	3.85	64.52	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02139	OKSS-1408	RBP	Woody	26.00	3.00	17.76%	34.58%	3.91	6.80	86.84	Non-Impaired
M02199	OKSS-1408	RBP	Woody	26.00	5.00	10.28%	54.21%	3.46	6.84	67.80	Slightly Impaired
M02200	OKSS-1408	RBP	SSV	20.00	3.00	9.52%	57.94%	2.94	7.47	51.61	Moderately Impaired
M01814	OKRM-1011	LRP	THAB	16.00	2.00	4.39%	50.00%	2.94	7.30	64.86	Slightly Impaired
M01815	OKRM-1011	LRP	SUB	12.00	1.00	0.92%	60.55%	2.55	7.48	64.86	Slightly Impaired
M02211	OKRM-1011	LRC	COMP	19.00	4.00	14.85%	48.51%	3.21	5.71	58.06	Slightly Impaired
M02298	OKRM-1011	LRC	COMP	15.00	4.00	8.04%	57.14%	2.83	6.88	51.61	Moderately Impaired
M02036	OKSS-1414	RBP	Woody	20.00	1.00	24.77%	38.53%	3.49	7.14	86.84	Non-Impaired
M02037	OKSS-1414	RBP	SSV	22.00	3.00	11.57%	50.41%	3.19	7.23	65.85	Slightly Impaired
M02296	OKSS-1414	RBP	SSV	28.00	4.00	6.03%	49.14%	3.74	5.99	58.06	Slightly Impaired
M02297	OKSS-1414	RBP	Woody	21.00	3.00	2.91%	41.75%	3.55	7.29	61.02	Slightly Impaired
M02311	OKRV-2013	RBP	Woody	20.00	6.00	24.53%	66.98%	2.74	5.00	68.18	Slightly Impaired
M02312	OKRV-2013	RBP	SSV	30.00	11.00	47.88%	44.85%	3.58	4.39	91.84	Non-Impaired
M02313	OKRV-2013	RBP	Riffle	20.00	11.00	52.22%	59.11%	3.12	4.06	78.00	Slightly Impaired
M02370	OKRV-2013	RBP	SSV	21.00	8.00	15.05%	63.59%	2.77	5.65	61.22	Slightly Impaired
M02371	OKRV-2013	RBP	Woody	21.00	4.00	10.92%	65.55%	2.74	5.80	61.36	Slightly Impaired
M02372	OKRV-2013	RBP	Riffle	22.00	13.00	56.34%	58.69%	3.04	3.71	84.00	Non-Impaired
M02172	OKRV-2013	RBP	Riffle	20.00	7.00	60.80%	52.00%	3.15	4.88	81.25	Slightly Impaired
M02173	OKRV-2013	LRC	COMP	53.00	14.00	38.77%	36.44%	4.06	5.60	109.09	Reference
M02009	OKLS-1201	RBP	Woody	23.00	2.00	9.35%	40.19%	3.65	7.46	72.97	Slightly Impaired
M02010	OKLS-1201	RBP	SSV	19.00	2.00	2.48%	34.71%	3.50	7.37	78.95	Slightly Impaired
M02210	OKLS-1201	RBP	Woody	17.00	2.00	26.13%	50.45%	2.84	6.82	71.43	Slightly Impaired
M02041	OKSS-1415	RBP	SSV	22.00	5.00	22.32%	45.54%	3.48	6.37	66.67	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02042	OKSS-1415	RBP	Riffle	25.00	7.00	42.17%	32.53%	3.61	4.81	96.77	Non-Impaired
M02183	OKSS-1415	RBP	SSV	20.00	4.00	9.01%	43.24%	3.39	6.64	53.33	Moderately Impaired
M02052	OKLS-1191	RBP	Woody	11.00	2.00	2.68%	89.29%	1.30	7.60	39.47	Moderately Impaired
M02246	OKLS-1191	LRC	COMP	22.00	4.00	16.51%	53.21%	3.23	6.68	86.84	Non-Impaired
M01717	OKRM-1016	LRC	COMP	27.00	13.00	21.76%	58.80%	3.09	5.45	105.41	Reference
M01718	OKRM-1016	RBP	Riffle	28.00	18.00	66.32%	38.54%	3.64	4.94	120.75	Reference
M02166	OKRM-1016	LRC	COMP	23.00	12.00	50.00%	30.56%	3.67	4.89	109.09	Reference
M02074	OKLS-1190	RBP	Riffle	21.00	7.00	35.46%	61.70%	3.00	5.23	90.32	Non-Impaired
M02075	OKLS-1190	RBP	SSV	34.00	8.00	18.24%	29.73%	4.09	6.00	109.76	Reference
M02076	OKLS-1190	RBP	Woody	22.00	8.00	29.09%	33.64%	3.72	5.83	118.42	Reference
M02179	OKLS-1190	RBP	Riffle	28.00	8.00	24.22%	42.19%	3.75	5.60	88.89	Non-Impaired
M02180	OKLS-1190	RBP	Woody	15.00	4.00	31.75%	39.68%	3.27	5.39	81.36	Slightly Impaired
M02181	OKLS-1190	RBP	SSV	21.00	5.00	33.95%	44.95%	3.44	5.45	77.42	Slightly Impaired
M02230	OKRV-2001	RBP	Woody	19.00	3.00	45.45%	60.33%	2.88	6.49	72.13	Slightly Impaired
M02345	OKRV-2001	RBP	Woody	9.00	0.00	0.00%	66.67%	2.41	6.12	53.33	Moderately Impaired
M02346	OKRV-2001	RBP	SSV	15.00	1.00	0.85%	65.81%	2.60	5.83	71.11	Slightly Impaired
M02264	OKRM-1010	LRF	SUB	9.00	2.00	14.29%	50.00%	2.90	5.50	71.11	Slightly Impaired
M02265	OKRM-1010	LRF	THAB	7.00	2.00	3.10%	91.47%	1.11	6.02	44.44	Moderately Impaired
M02309	OKRM-1010	LRF	SUB	17.00	0.00	0.00%	65.69%	2.44	6.18	62.22	Slightly Impaired
M02310	OKRM-1010	LRF	THAB	20.00	1.00	1.48%	44.44%	3.31	6.46	71.11	Slightly Impaired
M02300	OKRM-1013	LRF	THAB	14.00	5.00	13.60%	74.40%	2.12	6.05	97.78	Non-Impaired
M02301	OKRM-1013	LRF	SUB	10.00	3.00	14.56%	64.08%	2.44	7.74	80.00	Slightly Impaired
M02307	OKRM-1013	LRF	THAB	20.00	3.00	14.29%	39.29%	3.44	5.95	97.78	Non-Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02308	OKRM-1013	LRF	SUB	10.00	2.00	2.50%	90.00%	1.00	4.94	44.44	Moderately Impaired
M02342	OKRM-1013	LRF	THAB	12.00	1.00	4.55%	81.82%	1.87	5.90	62.22	Slightly Impaired
M02341	OKRM-1013	LRF	SUB	14.00	1.00	0.82%	66.39%	2.59	6.27	71.11	Slightly Impaired
M02105	OKSS-1447	RBP	SSV	17.00	1.00	29.81%	47.12%	3.20	7.08	73.17	Slightly Impaired
M02106	OKSS-1447	RBP	Riffle	15.00	3.00	9.60%	71.19%	2.29	5.84	45.16	Moderately Impaired
M02184	OKSS-1447	RBP	SSV	24.00	6.00	19.41%	62.76%	2.57	7.01	77.42	Slightly Impaired
M02202	OKLS-1212	RBP	SSV	12.00	2.00	22.64%	47.17%	2.99	6.33	56.25	Slightly Impaired
M02203	OKLS-1212	RBP	Woody	22.00	6.00	26.17%	39.25%	3.66	5.74	93.75	Non-Impaired
M02204	OKLS-1212	RBP	Riffle	14.00	6.00	39.47%	61.40%	2.58	4.54	87.50	Non-Impaired
M02034	OKLS-1212	RBP	Woody	24.00	6.00	22.06%	40.44%	3.45	6.28	77.42	Slightly Impaired
M02035	OKLS-1212	RBP	SSV	25.00	5.00	19.05%	55.78%	3.18	6.40	56.25	Slightly Impaired
M02011	OKLS-1185	RBP	Woody	5.00	1.00	3.51%	93.86%	1.03	5.91	39.47	Moderately Impaired
M02096	OKLS-1185	RBP	Woody	12.00	2.00	6.03%	63.79%	2.49	5.91	55.26	Slightly Impaired
M02097	OKLS-1185	RBP	SSV	14.00	1.00	2.33%	86.63%	1.79	5.97	51.22	Moderately Impaired
M02229	OKLS-1185	RBP	Woody	19.00	4.00	35.83%	58.33%	3.04	6.15	74.58	Slightly Impaired
M02077	OKLS-1184	RBP	Riffle	15.00	3.00	36.16%	58.19%	2.61	5.93	68.75	Slightly Impaired
M02078	OKLS-1184	RBP	SSV	17.00	3.00	15.53%	40.78%	3.34	6.77	56.25	Slightly Impaired
M02079	OKLS-1184	RBP	Woody	18.00	3.00	16.07%	55.36%	2.97	7.04	58.06	Slightly Impaired
M02205	OKLS-1184	RBP	Riffle	13.00	3.00	48.91%	81.39%	1.96	5.11	56.25	Slightly Impaired
M02206	OKLS-1184	RBP	Woody	23.00	4.00	18.24%	52.20%	3.38	5.88	68.75	Slightly Impaired
M02089	OKRO-1095	LRC	COMP	25.00	8.00	25.00%	37.04%	3.99	6.31	121.62	Reference
M02090	OKRO-1095	RBP	Riffle	15.00	8.00	39.47%	70.18%	2.49	4.92	98.11	Non-Impaired
M02220	OKRO-1095	RBP	Riffle	10.00	6.00	12.99%	91.60%	0.69	4.29	51.61	Moderately Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02221	OKRO-1095	LRC	COMP	9.00	6.00	14.07%	91.11%	0.93	4.45	64.86	Slightly Impaired
M02144	OKLS-1188	LRF	SUB	15.00	2.00	5.68%	54.55%	3.09	7.47	63.16	Slightly Impaired
M02145	OKLS-1188	LRF	THAB	14.00	2.00	1.83%	83.49%	1.42	7.82	47.37	Moderately Impaired
M02174	OKLS-1188	LRF	SUB	11.00	3.00	10.87%	56.52%	2.74	7.69	63.16	Slightly Impaired
M02175	OKLS-1188	LRF	THAB	20.00	4.00	10.38%	70.75%	2.26	7.53	78.95	Slightly Impaired
M02549	OKRV-2029	RBP	SSV	12.00	1.00	0.91%	79.09%	1.74	7.77	38.71	Moderately Impaired
M02646	OKRV-2029	RBP	SSV	17.00	2.00	76.22%	81.62%	1.60	6.90	73.17	Slightly Impaired
M02320	OKRV-2011	RBP	Woody	12.00	2.00	6.09%	73.04%	2.00	6.23	62.22	Slightly Impaired
M02321	OKRV-2011	RBP	SSV	15.00	2.00	2.42%	55.15%	2.86	6.36	71.11	Slightly Impaired
M02550	OKRV-2011	LRF	THAB	17.00	9.00	16.73%	77.70%	2.25	6.56	97.78	Non-Impaired
M02551	OKRV-2011	LRF	SUB	18.00	7.00	36.54%	55.77%	3.06	6.45	124.44	Reference
M02330	OKRO-1107	LRF	SUB	12.00	2.00	12.73%	60.00%	2.70	6.09	72.97	Slightly Impaired
M02331	OKRO-1107	LRF	THAB	14.00	3.00	6.15%	66.15%	2.61	6.06	64.86	Slightly Impaired
M02332	OKRO-1107	RBP	Riffle	13.00	7.00	37.07%	48.28%	2.79	5.23	98.11	Non-Impaired
M02538	OKRO-1107	RBP	Riffle	21.00	12.00	75.32%	42.13%	3.33	4.56	90.32	Non-Impaired
M02536	OKRO-1107	LRF	THAB	15.00	5.00	10.22%	70.07%	2.21	7.23	89.19	Non-Impaired
M02537	OKRO-1107	LRF	SUB	26.00	10.00	41.28%	28.44%	4.09	5.94	137.84	Reference
M02472	OKRV-2016	LRF	SUB	19.00	10.00	78.48%	60.76%	2.71	3.17	80.00	Slightly Impaired
M02473	OKRV-2016	LRF	THAB	20.00	10.00	60.53%	31.58%	3.69	4.48	106.67	Reference
M02578	OKRV-2016	RBP	Woody	14.00	7.00	70.34%	45.52%	2.77	4.85	87.50	Non-Impaired
M02672	OKRV-2016	RBP	Woody	21.00	9.00	53.64%	42.73%	3.52	4.27	93.33	Non-Impaired
M02360	OKRV-2010	RBP	Woody	17.00	3.00	4.46%	47.32%	3.10	6.86	64.86	Slightly Impaired
M02361	OKRV-2010	RBP	SSV	18.00	1.00	0.89%	52.68%	3.06	6.63	63.16	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02362	OKRV-2010	RBP	Riffle	13.00	3.00	4.38%	65.69%	2.38	6.48	45.28	Moderately Impaired
M02432	OKRV-2010	RBP	Riffle	14.00	6.00	50.00%	66.46%	2.28	5.90	77.42	Slightly Impaired
M02433	OKRV-2010	RBP	SSV	22.00	4.00	22.81%	42.98%	3.34	7.45	68.97	Slightly Impaired
M02434	OKRV-2010	RBP	Woody	19.00	5.00	17.74%	66.13%	2.73	7.13	85.71	Non-Impaired
M02494	OKRV-2010	RBP	Riffle	14.00	7.00	63.19%	47.85%	2.86	4.67	90.32	Non-Impaired
M02495	OKRV-2010	RBP	Woody	17.00	5.00	42.24%	67.24%	2.51	5.64	100.00	Non-Impaired
M02502	OKRV-2040	LRF	THAB	23.00	11.00	51.33%	30.09%	3.84	5.13	129.73	Reference
M02503	OKRV-2040	LRF	SUB	21.00	7.00	42.75%	56.49%	3.12	5.61	113.51	Reference
M02637	OKRV-2040	RBP	Woody	15.00	4.00	10.48%	75.00%	2.36	6.65	81.08	Slightly Impaired
M02576	OKRV-2035	RBP	Woody	11.00	3.00	23.68%	78.07%	2.01	6.70	54.24	Slightly Impaired
M02577	OKRV-2035	RBP	SSV	23.00	7.00	14.88%	73.49%	2.42	6.33	70.97	Slightly Impaired
M02655	OKRV-2035	RBP	SSV	18.00	5.00	21.88%	59.38%	2.93	6.05	87.80	Non-Impaired
M02656	OKRV-2035	RBP	Woody	13.00	5.00	22.94%	49.54%	2.83	6.13	102.63	Reference
M02314	OKRV-2014	RBP	SSV	33.00	12.00	27.03%	27.93%	4.30	5.06	100.00	Non-Impaired
M02315	OKRV-2014	RBP	Woody	29.00	9.00	38.60%	39.47%	3.81	4.95	100.00	Non-Impaired
M02316	OKRV-2014	RBP	Riffle	29.00	9.00	26.59%	32.94%	3.88	4.44	85.71	Non-Impaired
M02383	OKRV-2014	RBP	Riffle	28.00	12.00	49.17%	21.67%	4.21	4.84	104.08	Reference
M02384	OKRV-2014	RBP	Woody	23.00	12.00	40.91%	37.27%	3.72	4.94	114.29	Reference
M02385	OKRV-2014	RBP	SSV	38.00	7.00	12.04%	25.93%	4.63	5.86	93.75	Non-Impaired
M02534	OKRV-2034	RBP	SSV	19.00	7.00	35.96%	45.61%	3.39	6.69	90.32	Non-Impaired
M02535	OKRV-2034	RBP	Riffle	24.00	9.00	25.48%	61.10%	2.63	6.30	82.54	Slightly Impaired
4003500.01RBP-SSV	OKRV-2034	RBP	SSV	31.00	3.00	4.81%	33.65%	4.16	6.44	73.17	Slightly Impaired
4003500.01RBP-Woody	OKRV-2034	RBP	Woody	22.00	4.00	10.91%	37.27%	3.63	6.60	102.63	Reference

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02324	OKRV-2080	RBP	SSV	21.00	1.00	13.19%	57.64%	3.00	6.84	71.05	Slightly Impaired
M02325	OKRV-2080	RBP	Woody	22.00	2.00	20.47%	36.84%	3.41	7.25	89.19	Non-Impaired
M02326	OKRV-2080	RBP	Riffle	11.00	2.00	13.28%	74.22%	2.22	6.17	52.83	Moderately Impaired
M02498	OKRV-2080	RBP	Woody	17.00	4.00	12.04%	62.96%	2.59	7.38	71.43	Slightly Impaired
M02499	OKRV-2080	RBP	SSV	20.00	2.00	9.09%	40.91%	3.45	7.78	55.17	Slightly Impaired
M02377	OKRV-2006	RBP	SSV	12.00	0.00	0.00%	77.68%	1.98	6.59	41.38	Moderately Impaired
M02378	OKRV-2006	RBP	Woody	12.00	1.00	0.85%	79.49%	1.65	6.31	45.90	Moderately Impaired
M02365	OKRV-2006	RBP	Woody	7.00	0.00	0.00%	91.23%	0.96	6.78	44.44	Moderately Impaired
M02322	OKRV-2074	RBP	Woody	14.00	1.00	8.84%	64.09%	2.20	6.30	56.76	Slightly Impaired
M02323	OKRV-2074	RBP	SSV	20.00	3.00	6.84%	53.75%	2.87	6.71	78.95	Slightly Impaired
M02401	OKRV-2074	RBP	SSV	11.00	4.00	10.00%	50.00%	2.65	5.69	55.17	Slightly Impaired
M02402	OKRV-2074	RBP	Woody	13.00	6.00	24.77%	62.39%	2.54	5.64	92.86	Non-Impaired
M02349	OKSS-1434	RBP	SSV	26.00	4.00	15.22%	33.33%	3.92	6.36	68.75	Slightly Impaired
M02350	OKSS-1434	RBP	Woody	34.00	6.00	11.71%	38.74%	4.12	6.51	68.75	Slightly Impaired
M02351	OKSS-1434	RBP	Riffle	18.00	3.00	11.71%	54.95%	2.69	5.48	55.10	Slightly Impaired
M02386	OKSS-1434	RBP	Woody	9.00	4.00	35.00%	72.50%	2.21	5.39	64.29	Slightly Impaired
M02387	OKSS-1434	RBP	SSV	25.00	4.00	8.62%	60.34%	3.13	7.58	50.00	Moderately Impaired
M02306	OKRV-2012	RBP	Woody	13.00	0.00	0.00%	55.24%	2.73	7.65	71.11	Slightly Impaired
M02474	OKRV-2012	RBP	Woody	22.00	8.00	40.68%	39.83%	3.59	6.74	104.92	Reference
M02493	OKSS-1449	RBP	SSV	16.00	2.00	26.73%	42.57%	3.36	7.13	68.97	Slightly Impaired
M02496	OKSS-1449	RBP	Woody	24.00	4.00	15.50%	48.84%	3.30	7.44	71.43	Slightly Impaired
M02358	OKRO-1106	LRF	THAB	16.00	1.00	4.10%	53.28%	2.92	6.97	53.33	Moderately Impaired
M02359	OKRO-1106	LRF	SUB	20.00	2.00	1.77%	54.87%	3.01	7.39	53.33	Moderately Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02560	OKRO-1106	LRF	SUB	17.00	3.00	2.70%	43.24%	3.06	6.87	53.33	Moderately Impaired
M02561	OKRO-1106	LRF	THAB	18.00	5.00	14.29%	48.57%	3.29	7.57	73.33	Slightly Impaired
M02335	OKRV-2019	LRC	COMP	28.00	5.00	4.35%	50.43%	3.38	6.93	89.19	Non-Impaired
M02369	OKRV-2019	LRF	SUB	22.00	3.00	3.51%	44.74%	3.24	6.62	64.86	Slightly Impaired
M02435	OKRV-2019	LRF	THAB	13.00	5.00	14.55%	77.27%	1.67	7.29	89.19	Non-Impaired
M02436	OKRV-2019	LRF	SUB	17.00	4.00	9.46%	43.24%	3.40	7.89	81.08	Slightly Impaired
M02544	OKRV-2019	LRF	SUB	14.00	3.00	29.21%	56.18%	2.83	6.12	81.08	Slightly Impaired
M02545	OKRV-2019	LRF	THAB	19.00	8.00	24.55%	57.27%	2.78	6.55	105.41	Reference
M02368	OKRV-2019	LRF	THAB	19.00	3.00	5.13%	70.09%	2.57	7.12	64.86	Slightly Impaired
M02570	OKRO-1098	LRF	SUB	13.00	5.00	22.02%	60.55%	3.01	7.18	102.63	Reference
M02571	OKRO-1098	LRF	THAB	14.00	5.00	34.04%	58.16%	2.58	6.17	110.53	Reference
M02649	OKRO-1098	LRF	THAB	12.00	3.00	37.84%	74.77%	2.26	5.52	78.95	Slightly Impaired
M02650	OKRO-1098	LRF	SUB	7.00	2.00	9.38%	78.13%	1.94	6.34	47.37	Moderately Impaired
M02375	OKRV-2004	RBP	SSV	11.00	3.00	7.21%	66.67%	2.55	6.70	62.07	Slightly Impaired
M02376	OKRV-2004	RBP	Woody	12.00	4.00	5.50%	71.56%	2.01	7.00	52.46	Moderately Impaired
M02304	OKRV-2004	RBP	Woody	24.00	1.00	0.83%	34.71%	3.70	6.97	88.89	Non-Impaired
M02305	OKRV-2004	RBP	SSV	19.00	2.00	5.61%	34.58%	3.65	6.86	88.89	Non-Impaired
M02352	OKSS-1410	RBP	Woody	17.00	6.00	12.32%	68.84%	2.50	5.60	56.25	Slightly Impaired
M02353	OKSS-1410	RBP	SSV	19.00	7.00	10.97%	68.35%	2.65	5.62	62.50	Slightly Impaired
M02354	OKSS-1410	RBP	Riffle	12.00	6.00	22.32%	61.61%	2.51	5.25	55.10	Slightly Impaired
M02415	OKSS-1410	RBP	Riffle	25.00	8.00	43.52%	26.85%	4.18	5.10	97.96	Non-Impaired
M02418	OKSS-1410	RBP	SSV	18.00	4.00	28.70%	50.93%	3.01	6.28	62.50	Slightly Impaired
M02403	OKRV-2020	RBP	SSV	19.00	5.00	21.74%	50.43%	3.19	6.69	70.97	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02404	OKRV-2020	RBP	Woody	15.00	7.00	28.19%	63.76%	2.46	6.83	81.36	Slightly Impaired
M02657	OKRV-2020	RBP	SSV	17.00	4.00	74.64%	76.09%	1.95	6.73	80.49	Slightly Impaired
M02658	OKRV-2020	RBP	Woody	21.00	7.00	45.69%	52.59%	3.11	6.45	110.53	Reference
M02355	OKRM-1023	RBP	Riffle	21.00	10.00	24.11%	45.39%	3.46	5.56	81.25	Slightly Impaired
M02356	OKRM-1023	LRF	SUB	36.00	8.00	6.21%	32.77%	3.97	6.33	83.87	Non-Impaired
M02357	OKRM-1023	LRF	THAB	21.00	4.00	3.13%	44.38%	3.36	6.08	51.61	Moderately Impaired
M02598	OKRM-1023	RBP	Riffle	19.00	7.00	26.42%	54.72%	2.78	6.35	81.25	Slightly Impaired
M02597	OKRM-1023	LRC	COMP	25.00	3.00	6.73%	43.27%	3.74	6.29	58.06	Slightly Impaired
M02574	OKRM-1017	LRF	THAB	11.00	5.00	18.52%	78.52%	1.68	7.40	78.95	Slightly Impaired
M02575	OKRM-1017	LRF	SUB	11.00	3.00	7.53%	77.42%	2.27	8.22	47.37	Moderately Impaired
M02666	OKRM-1017	LRF	SUB	15.00	2.00	6.73%	37.50%	3.26	6.22	71.05	Slightly Impaired
M02665	OKRM-1017	LRF	THAB	17.00	3.00	15.74%	39.81%	3.25	6.68	78.95	Slightly Impaired
M02317	OKRV-2079	RBP	Woody	19.00	2.00	3.25%	66.67%	2.74	7.06	64.86	Slightly Impaired
M02429	OKRV-2079	RBP	SSV	18.00	3.00	47.17%	59.43%	3.00	7.14	75.86	Slightly Impaired
M02430	OKRV-2079	RBP	Woody	22.00	5.00	38.94%	45.13%	3.50	6.39	107.14	Reference
M02431	OKRV-2079	RBP	Riffle	22.00	4.00	31.72%	56.55%	3.00	6.84	70.97	Slightly Impaired
M02568	OKRV-2033	RBP	Woody	24.00	8.00	20.95%	39.05%	3.75	6.79	107.14	Reference
M02569	OKRV-2033	RBP	SSV	16.00	4.00	17.92%	35.85%	3.18	7.10	68.97	Slightly Impaired
M02653	OKRV-2033	RBP	SSV	18.00	3.00	49.54%	68.81%	2.62	7.10	102.63	Reference
M02654	OKRV-2033	RBP	Woody	16.00	5.00	37.29%	58.47%	2.62	6.62	113.51	Reference
M02347	OKRV-2007	RBP	Woody	14.00	0.00	0.00%	41.07%	3.13	6.67	71.11	Slightly Impaired
M02348	OKRV-2007	RBP	SSV	24.00	0.00	0.00%	38.41%	3.59	7.09	88.89	Non-Impaired
M02388	OKRV-2007	RBP	Woody	16.00	7.00	70.59%	49.67%	2.83	5.11	91.80	Non-Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02389	OKRV-2007	RBP	SSV	17.00	4.00	41.59%	47.79%	3.19	6.20	96.55	Non-Impaired
M02379	OKSS-1416	RBP	Woody	15.00	1.00	1.42%	75.18%	2.24	6.96	45.90	Moderately Impaired
M02380	OKSS-1416	RBP	SSV	19.00	2.00	3.39%	61.86%	2.78	7.04	55.17	Slightly Impaired
M02343	OKSS-1416	RBP	Woody	14.00	2.00	4.46%	61.61%	2.61	6.24	71.11	Slightly Impaired
M02344	OKSS-1416	RBP	SSV	20.00	3.00	4.72%	66.04%	2.82	6.23	97.78	Non-Impaired
M02336	OKSS-1409	RBP	Woody	21.00	12.00	31.97%	53.28%	3.14	3.72	95.45	Non-Impaired
M02337	OKSS-1409	RBP	Riffle	30.00	16.00	68.53%	25.87%	4.28	3.04	96.00	Non-Impaired
M02338	OKSS-1409	RBP	SSV	28.00	10.00	26.32%	38.60%	3.88	6.09	91.84	Non-Impaired
M02500	OKSS-1409	RBP	Woody	22.00	8.00	29.17%	44.79%	3.43	5.97	86.67	Non-Impaired
M02501	OKSS-1409	RBP	Riffle	20.00	9.00	68.09%	43.62%	3.32	4.48	87.50	Non-Impaired
M02363	OKRV-2009	RBP	SSV	20.00	2.00	2.10%	56.64%	2.97	7.25	71.11	Slightly Impaired
M02364	OKRV-2009	RBP	Woody	22.00	4.00	4.92%	59.84%	3.14	7.58	97.78	Non-Impaired
M02390	OKRV-2009	RBP	Woody	19.00	10.00	69.23%	61.54%	2.94	5.20	91.80	Non-Impaired
M02327	OKSS-1436	RBP	SSV	15.00	2.00	18.09%	59.57%	2.76	5.00	56.25	Slightly Impaired
M02328	OKSS-1436	RBP	Woody	17.00	1.00	5.50%	44.95%	3.19	5.20	51.61	Moderately Impaired
M02329	OKSS-1436	RBP	Riffle	16.00	2.00	21.50%	39.25%	3.19	5.20	68.75	Slightly Impaired
M02416	OKSS-1436	RBP	Riffle	14.00	4.00	13.19%	58.24%	2.73	6.33	56.25	Slightly Impaired
M02419	OKSS-1436	RBP	SSV	19.00	2.00	5.77%	46.15%	3.37	6.52	50.00	Moderately Impaired
M02366	OKRV-2088	LRF	THAB	13.00	1.00	0.87%	80.00%	1.83	6.32	56.76	Slightly Impaired
M02367	OKRV-2088	LRF	SUB	21.00	2.00	6.31%	34.23%	3.58	6.87	81.08	Slightly Impaired
M02437	OKRV-2088	LRF	THAB	10.00	5.00	34.78%	60.87%	2.64	6.82	113.51	Reference
M02438	OKRV-2088	LRF	SUB	8.00	0.00	0.00%	89.74%	1.07	7.91	40.54	Moderately Impaired
M02634	OKRV-2068	RBP	Riffle	15.00	5.00	17.75%	58.44%	2.72	5.83	90.57	Non-Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02635	OKRV-2068	RBP	Woody	17.00	6.00	8.73%	57.94%	2.68	6.61	89.19	Non-Impaired
M02727	OKRV-2068	RBP	SSV	20.00	3.00	3.97%	52.38%	3.23	6.39	55.17	Slightly Impaired
M02728	OKRV-2068	RBP	Woody	33.00	8.00	18.26%	32.17%	4.25	6.68	100.00	Non-Impaired
M02732	OKRV-2102	LRF	SUB	9.00	2.00	5.61%	64.49%	1.95	7.42	53.33	Moderately Impaired
M02733	OKRV-2102	LRF	THAB	10.00	4.00	2.57%	95.72%	1.23	7.17	80.00	Slightly Impaired
4003504.01LRF-Sub	OKRV-2102	LRF	SUB	12.00	3.00	16.96%	44.64%	2.90	6.79	88.89	Non-Impaired
4003504.01LRF-Thab	OKRV-2102	LRF	THAB	24.00	5.00	3.20%	63.64%	2.77	7.72	97.78	Non-Impaired
4003525.01LRF-Sub	OKRV-2102	LRF	SUB	17.00	1.00	0.89%	56.25%	2.72	7.53	71.11	Slightly Impaired
4003525.01LRF-Thab	OKRV-2102	LRF	THAB	21.00	4.00	7.73%	53.04%	3.29	6.89	97.78	Non-Impaired
M02638	OKRO-1111	LRF	THAB	24.00	9.00	33.03%	33.94%	3.82	5.89	129.73	Reference
M02639	OKRO-1111	LRF	SUB	21.00	3.00	9.01%	36.94%	3.59	6.38	81.08	Slightly Impaired
M02716	OKRO-1111	RBP	Woody	21.00	8.00	36.51%	40.48%	3.56	6.12	107.14	Reference
M02669	OKSS-1439	RBP	Riffle	12.00	6.00	64.08%	73.94%	2.09	3.39	42.86	Moderately Impaired
M02670	OKSS-1439	RBP	SSV	16.00	6.00	40.71%	61.06%	2.93	4.93	68.75	Slightly Impaired
M02671	OKSS-1439	RBP	Woody	18.00	8.00	60.91%	49.09%	3.07	4.64	81.25	Slightly Impaired
M02741	OKSS-1439	RBP	SSV	24.00	3.00	2.63%	42.98%	3.63	7.34	56.25	Slightly Impaired
M02742	OKSS-1439	RBP	Riffle	23.00	8.00	40.57%	35.85%	3.81	4.54	91.84	Non-Impaired
M02630	OKRV-2043	LRF	THAB	9.00	1.00	0.57%	87.36%	1.40	5.91	44.44	Moderately Impaired
M02631	OKRV-2043	LRF	SUB	4.00	0.00	0.00%	97.08%	0.33	6.00	44.44	Moderately Impaired
M02700	OKRV-2043	LRF	SUB	4.00	0.00	0.00%	90.57%	0.68	5.68	44.44	Moderately Impaired
M02701	OKRV-2043	LRF	THAB	13.00	0.00	0.00%	64.55%	3.15	7.55	71.11	Slightly Impaired
M02737	OKSS-1472	RBP	Woody	14.00	3.00	29.63%	67.59%	2.45	7.13	61.02	Slightly Impaired
4003501.01RBP-Woody	OKSS-1472	RBP	Woody	24.00	7.00	28.42%	33.33%	3.76	6.44	118.42	Reference

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02659	OKRV-2028	RBP	Woody	18.00	8.00	27.43%	48.67%	3.22	5.87	102.63	Reference
M02715	OKRV-2028	RBP	Woody	16.00	6.00	40.15%	60.61%	2.74	5.43	94.92	Non-Impaired
M02757	OKSS-1438	RBP	SSV	29.00	5.00	10.69%	41.98%	3.73	6.72	62.50	Slightly Impaired
M02758	OKSS-1438	RBP	Riffle	21.00	6.00	29.79%	43.26%	3.37	5.12	81.25	Slightly Impaired
4003522.01RBP-SSV	OKSS-1438	RBP	SSV	26.00	11.00	25.86%	37.93%	3.95	5.94	107.14	Reference
4003522.01Riffle	OKSS-1438	RBP	Riffle	34.00	13.00	45.09%	39.27%	3.88	4.66	107.14	Reference
M02645	OKRO-1099	LRC	COMP	27.00	12.00	35.14%	29.73%	4.05	5.27	115.91	Reference
M02695	OKRO-1099	LRC	COMP	22.00	7.00	21.50%	41.12%	3.54	6.14	88.64	Non-Impaired
M02723	OKRO-1099	LRC	COMP	24.00	8.00	30.77%	38.46%	3.79	5.86	109.09	Reference
M02724	OKRO-1099	RBP	Riffle	20.00	10.00	66.45%	36.84%	3.67	4.93	100.00	Non-Impaired
M02719	OKRV-2026	RBP	SSV	22.00	7.00	28.68%	31.01%	3.82	6.40	93.75	Non-Impaired
M02720	OKRV-2026	RBP	Woody	26.00	10.00	55.36%	56.25%	3.30	5.14	87.50	Non-Impaired
M02721	OKRV-2026	RBP	Riffle	25.00	9.00	52.53%	72.05%	2.37	4.92	81.25	Slightly Impaired
4003509.01RBP-SSV	OKRV-2026	RBP	SSV	22.00	5.00	8.85%	35.40%	3.71	6.09	62.50	Slightly Impaired
4003509.01RBP-Woody	OKRV-2026	RBP	Woody	30.00	4.00	13.11%	34.43%	3.95	6.57	70.97	Slightly Impaired
4003509.01Riffle	OKRV-2026	RBP	Riffle	19.00	6.00	10.22%	62.77%	2.72	5.63	68.75	Slightly Impaired
4003531.01RBP-SSV	OKRV-2026	RBP	SSV	22.00	3.00	2.94%	48.53%	3.31	6.74	50.00	Moderately Impaired
4003531.01RBP-Woody	OKRV-2026	RBP	Woody	29.00	4.00	10.08%	50.39%	3.49	7.07	58.06	Slightly Impaired
4003531.01Riffle	OKRV-2026	RBP	Riffle	20.00	2.00	4.13%	49.59%	3.43	5.48	50.00	Moderately Impaired
M02628	OKRV-2025	RBP	Woody	18.00	3.00	43.29%	66.46%	2.67	6.62	106.67	Reference
M02629	OKRV-2025	RBP	SSV	17.00	3.00	39.81%	49.07%	3.04	7.08	124.44	Reference
M02698	OKRV-2025	RBP	SSV	18.00	3.00	25.57%	54.79%	2.94	7.42	82.76	Slightly Impaired
M02699	OKRV-2025	RBP	Woody	18.00	4.00	53.96%	61.87%	2.70	6.82	78.69	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02647	OKRV-2044	RBP	SSV	15.00	2.00	73.91%	79.13%	1.77	6.89	73.17	Slightly Impaired
M02648	OKRV-2044	RBP	Woody	14.00	3.00	27.78%	60.49%	2.59	6.94	78.95	Slightly Impaired
M02693	OKRV-2044	RBP	SSV	17.00	4.00	34.86%	52.29%	3.02	6.66	70.97	Slightly Impaired
M02694	OKRV-2044	RBP	Woody	15.00	5.00	33.33%	37.96%	3.33	6.23	88.14	Non-Impaired
M02756	OKLS-1186	RBP	Woody	19.00	8.00	65.63%	44.53%	3.35	4.77	91.80	Non-Impaired
4003515.01RBP-SSV	OKLS-1186	RBP	SSV	22.00	4.00	18.35%	48.62%	3.45	6.34	106.67	Reference
4003515.01RBP-Woody	OKLS-1186	RBP	Woody	16.00	4.00	6.36%	60.91%	2.86	6.15	97.78	Non-Impaired
M02660	OKLS-1196	RBP	SSV	27.00	9.00	46.43%	52.68%	3.50	5.35	87.50	Non-Impaired
M02661	OKLS-1196	RBP	Riffle	22.00	10.00	26.78%	73.56%	2.19	5.20	75.00	Slightly Impaired
M02711	OKLS-1196	RBP	SSV	30.00	5.00	29.91%	37.38%	4.04	5.92	81.25	Slightly Impaired
M02712	OKLS-1196	RBP	Riffle	19.00	7.00	13.76%	43.12%	3.66	5.44	81.25	Slightly Impaired
M02718	OKLS-1193	RBP	Woody	26.00	6.00	24.55%	41.82%	3.51	6.80	87.50	Non-Impaired
4003523.01RBP-Woody	OKLS-1193	RBP	Woody	24.00	2.00	1.79%	41.07%	3.55	7.39	58.06	Slightly Impaired
M02731	OKRO-1108	RBP	Woody	24.00	4.00	5.00%	65.00%	2.98	6.57	59.02	Slightly Impaired
4003528.01RBP-SSV	OKRO-1108	RBP	SSV	23.00	3.00	9.76%	47.15%	3.42	6.87	97.78	Non-Impaired
4003528.01RBP-Woody	OKRO-1108	RBP	Woody	18.00	3.00	9.91%	57.66%	2.97	6.65	80.00	Slightly Impaired
M02667	OKLS-1192	RBP	Riffle	21.00	8.00	54.05%	32.43%	3.46	4.53	79.59	Slightly Impaired
M02668	OKLS-1192	RBP	SSV	25.00	7.00	32.41%	29.66%	3.82	5.57	93.75	Non-Impaired
M02706	OKLS-1192	RBP	SSV	18.00	2.00	6.73%	31.73%	3.68	6.41	62.50	Slightly Impaired
M02707	OKLS-1192	RBP	Riffle	20.00	6.00	34.45%	35.29%	3.59	5.42	79.59	Slightly Impaired
M02651	OKRV-2027	RBP	SSV	17.00	3.00	7.47%	65.52%	2.68	6.75	78.95	Slightly Impaired
M02652	OKRV-2027	RBP	Woody	15.00	2.00	17.43%	56.88%	2.83	7.01	72.97	Slightly Impaired
M02729	OKRV-2027	RBP	SSV	22.00	1.00	1.68%	50.42%	3.22	6.08	55.17	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02730	OKRV-2027	RBP	Woody	24.00	4.00	9.35%	30.84%	3.78	7.20	78.57	Slightly Impaired
M02675	OKSS-1419	RBP	Riffle	29.00	20.00	87.40%	28.35%	3.94	1.97	85.71	Non-Impaired
M02740	OKSS-1419	RBP	Riffle	8.00	6.00	10.26%	93.16%	0.78	3.93	30.61	Moderately Impaired
M02636	OKRV-2070	RBP	Woody	15.00	0.00	0.00%	60.00%	2.81	7.35	64.86	Slightly Impaired
M02717	OKRV-2070	RBP	Woody	10.00	0.00	0.00%	55.75%	2.37	7.81	42.86	Moderately Impaired
4003512.01LRF-SUB	OKRV-2021	LRF	SUB	6.00	2.00	12.50%	75.00%	2.00	5.40	62.22	Slightly Impaired
M02702	OKRV-2021	LRF	SUB	0.00	0.00	0.00%	0.00%	0.00	0.00	44.44	Moderately Impaired
4003524.01RBP-Woody	OKSS-1456	RBP	Woody	23.00	3.00	5.75%	40.23%	3.72	7.22	58.06	Slightly Impaired
M02734	OKSS-1456	RBP	SSV	27.00	4.00	5.29%	42.94%	3.63	7.29	56.25	Slightly Impaired
M02673	OKSS-1426	RBP	Riffle	24.00	13.00	45.32%	42.45%	3.59	4.42	91.84	Non-Impaired
M02674	OKSS-1426	RBP	Woody	34.00	14.00	51.38%	23.85%	4.51	4.66	106.25	Reference
M02708	OKSS-1426	RBP	SSV	35.00	4.00	6.36%	35.45%	4.34	5.85	62.50	Slightly Impaired
M02640	OKSS-1425	RBP	Riffle	30.00	14.00	52.15%	29.23%	4.03	4.25	102.00	Reference
M02641	OKSS-1425	RBP	SSV	21.00	9.00	29.46%	40.18%	3.61	5.26	79.59	Slightly Impaired
M02642	OKSS-1425	RBP	Woody	24.00	13.00	52.07%	33.88%	3.91	4.08	109.09	Reference
M02696	OKSS-1425	RBP	Woody	18.00	7.00	27.88%	46.15%	3.30	6.55	86.67	Non-Impaired
M02697	OKSS-1425	RBP	Riffle	16.00	6.00	41.43%	36.67%	3.41	5.27	81.25	Slightly Impaired
M02676	OKSS-1425	RBP	Riffle	36.00	14.00	48.67%	35.90%	3.87	4.36	96.00	Non-Impaired
M02677	OKSS-1425	RBP	Woody	25.00	11.00	45.05%	30.63%	4.07	4.61	109.09	Reference
M02722	OKSS-1425	RBP	Woody	21.00	4.00	34.12%	35.29%	3.59	5.50	86.67	Non-Impaired
M02624	OKRV-2039	RBP	Woody	28.00	6.00	17.19%	50.78%	3.46	6.56	92.31	Non-Impaired
M02625	OKRV-2039	RBP	SSV	18.00	4.00	8.11%	57.66%	3.07	6.77	57.14	Slightly Impaired
M02703	OKRV-2039	RBP	SSV	20.00	7.00	28.04%	65.42%	2.60	6.87	84.78	Non-Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
M02704	OKRV-2039	RBP	Woody	18.00	5.00	23.02%	61.11%	2.78	6.83	83.87	Non-Impaired
M02632	OKRV-2032	RBP	SSV	18.00	2.00	19.85%	47.06%	3.07	6.98	64.29	Slightly Impaired
M02633	OKRV-2032	RBP	Woody	15.00	2.00	3.70%	41.36%	3.14	7.22	61.54	Slightly Impaired
M02705	OKRV-2032	RBP	SSV	15.00	2.00	37.93%	63.79%	2.69	7.32	71.74	Slightly Impaired
4003505.01RBP-SSV	OKLS-1198	RBP	SSV	13.00	2.00	18.80%	54.70%	2.65	6.57	65.85	Slightly Impaired
4003505.01RBP-Woody	OKLS-1198	RBP	Woody	9.00	1.00	10.28%	58.88%	2.56	6.57	63.16	Slightly Impaired
4003579.01RBP-SSV	OKLS-1198	RBP	SSV	16.00	4.00	60.87%	54.35%	2.87	6.55	64.52	Slightly Impaired
4003534.01Riffle	OKRV-2036	RBP	Riffle	27.00	13.00	28.33%	56.11%	3.15	6.41	79.59	Slightly Impaired
4003576.01RBP-SSV	OKRV-2036	RBP	SSV	22.00	8.00	28.70%	36.52%	3.72	5.01	93.75	Non-Impaired
4003576.01Riffle	OKRV-2036	RBP	Riffle	24.00	9.00	67.42%	50.76%	3.35	4.02	85.71	Non-Impaired
4003517.01RBP-Woody	OKRV-2015	RBP	Woody	10.00	2.00	4.09%	89.09%	1.58	6.11	62.22	Slightly Impaired
4003593.01RBP-SSV	OKRV-2015	RBP	SSV	15.00	3.00	7.03%	65.63%	2.70	6.62	68.97	Slightly Impaired
4003529.01RBP-SSV	OKRV-2101	RBP	SSV	16.00	1.00	0.83%	57.02%	2.63	7.39	71.11	Slightly Impaired
4003529.01RBP-Woody	OKRV-2101	RBP	Woody	16.00	1.00	3.70%	36.11%	3.12	7.03	80.00	Slightly Impaired
4003571.01RBP-Woody	OKRV-2101	RBP	Woody	16.00	6.00	56.03%	53.19%	3.04	5.63	91.80	Non-Impaired
4003535.01RBP-SSV	OKLS-1197	RBP	SSV	27.00	9.00	29.52%	43.81%	3.76	5.99	87.50	Non-Impaired
4003535.01RBP-Woody	OKLS-1197	RBP	Woody	32.00	9.00	19.27%	38.53%	3.93	6.03	87.50	Non-Impaired
4003535.01Riffle	OKLS-1197	RBP	Riffle	29.00	10.00	37.82%	39.10%	4.21	4.20	85.71	Non-Impaired
4003577.01RBP-SSV	OKLS-1197	RBP	SSV	15.00	5.00	33.33%	64.81%	3.12	4.70	75.00	Slightly Impaired
4003577.01Riffle	OKLS-1197	RBP	Riffle	28.00	13.00	57.06%	25.15%	4.09	4.51	104.08	Reference
4003605.01RBP-SSV	OKLS-1197	RBP	SSV	35.00	12.00	21.80%	40.60%	4.40	4.87	87.50	Non-Impaired
4003605.01Riffle	OKLS-1197	RBP	Riffle	17.00	6.00	50.56%	33.71%	3.40	4.39	67.35	Slightly Impaired
4003502.01LRF-Sub	OKRV-2061	LRF	SUB	22.00	2.00	1.67%	48.33%	3.24	6.82	63.16	Slightly Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
4003502.01LRF-Thab	OKRV-2061	LRF	THAB	24.00	7.00	16.91%	27.94%	4.05	6.74	118.42	Reference
4003580.01RBP-Woody	OKRV-2061	RBP	Woody	24.00	4.00	29.25%	37.74%	3.92	5.24	81.36	Slightly Impaired
4003580.01RBP-SSV	OKRV-2061	RBP	SSV	29.00	4.00	12.84%	26.61%	4.30	5.63	77.42	Slightly Impaired
4003506.01LRF-Sub	OKRM-1015	LRF	SUB	10.00	1.00	0.65%	61.44%	2.30	7.67	38.71	Moderately Impaired
4003506.01LRF-Thab	OKRM-1015	LRF	THAB	17.00	3.00	9.09%	58.74%	2.73	7.23	51.61	Moderately Impaired
4003582.01LRF-SUB	OKRM-1015	LRF	SUB	15.00	6.00	15.45%	67.48%	3.31	7.50	70.97	Slightly Impaired
4003582.01LRF-THAB	OKRM-1015	LRF	THAB	11.00	4.00	7.35%	90.20%	1.29	6.05	38.71	Moderately Impaired
4003533.01LRF-Sub	OKRM-1015	LRF	SUB	9.00	1.00	0.88%	79.82%	1.63	7.64	38.71	Moderately Impaired
4003533.01LRF-Thab	OKRM-1015	LRF	THAB	14.00	3.00	9.73%	46.90%	3.06	6.94	51.61	Moderately Impaired
4003520.01LRF-Thab	OKRM-1014	LRF	THAB	16.00	4.00	12.15%	50.47%	3.16	6.06	106.67	Reference
4003520.01LRF-SUB	OKRM-1014	LRF	SUB	11.00	2.00	8.57%	48.57%	2.85	6.52	71.11	Slightly Impaired
4003588.01LRF-SUB	OKRM-1014	LRF	SUB	12.00	8.00	85.59%	63.96%	2.37	5.83	115.56	Reference
4003588.01LRF-THAB	OKRM-1014	LRF	THAB	23.00	11.00	78.91%	46.09%	3.31	5.88	124.44	Reference
4003618.01RBP-SSV	OKRM-1014	RBP	SSV	28.00	10.00	36.82%	44.28%	3.36	6.02	96.55	Non-Impaired
4003530.01LRF-SUB	OKRV-2030	LRF	SUB	26.00	8.00	30.46%	40.40%	3.71	5.98	118.42	Reference
4003530.01LRF-Thab	OKRV-2030	LRF	THAB	22.00	8.00	20.83%	60.00%	2.95	5.88	102.63	Reference
4003570.01RBP-Woody	OKRV-2030	RBP	Woody	16.00	6.00	51.89%	61.32%	2.84	5.24	94.92	Non-Impaired
4003508.01RBP-SSV	OKRV-2022	RBP	SSV	26.00	4.00	11.45%	48.09%	3.61	6.78	62.50	Slightly Impaired
4003508.01RBP-Woody	OKRV-2022	RBP	Woody	23.00	5.00	12.32%	45.65%	3.39	7.05	64.52	Slightly Impaired
4003508.01Riffle	OKRV-2022	RBP	Riffle	37.00	5.00	32.79%	45.90%	3.15	6.60	68.75	Slightly Impaired
4003587.01RBP-SSV	OKRV-2022	RBP	SSV	28.00	10.00	38.25%	46.77%	3.22	5.46	87.50	Non-Impaired
4003587.01RBP-Woody	OKRV-2022	RBP	Woody	19.00	8.00	29.94%	55.41%	3.13	5.63	81.25	Slightly Impaired
4003587.01Riffle	OKRV-2022	RBP	Riffle	27.00	10.00	41.59%	59.88%	3.08	5.75	87.50	Non-Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
4003527.01LRF-SUB	OKRV-2023	LRF	SUB	21.00	5.00	8.00%	60.00%	2.90	6.14	97.78	Non-Impaired
4003527.01LRF-THAB	OKRV-2023	LRF	THAB	11.00	1.00	0.92%	69.72%	2.17	6.39	62.22	Slightly Impaired
4003572.01RBP-SSV	OKRV-2023	RBP	SSV	22.00	8.00	38.30%	47.52%	3.24	5.75	96.55	Non-Impaired
4003572.01RBP-Woody	OKRV-2023	RBP	Woody	24.00	10.00	55.40%	41.01%	3.60	5.55	98.36	Non-Impaired
4003572.01Riffle	OKRV-2023	RBP	Riffle	15.00	8.00	84.62%	77.40%	2.09	4.84	83.87	Non-Impaired
4003513.01RBP-SSV	OKRV-2098	RBP	SSV	18.00	2.00	38.06%	67.16%	2.68	6.78	97.78	Non-Impaired
4003513.01RBP-Woody	OKRV-2098	RBP	Woody	15.00	2.00	43.65%	54.76%	2.80	6.79	97.78	Non-Impaired
4003596.01RBP-Woody	OKRV-2098	RBP	Woody	23.00	7.00	29.91%	40.17%	3.68	6.30	91.80	Non-Impaired
4003521.01RBP-SSV	OKRO-1105	RBP	SSV	17.00	4.00	8.98%	53.52%	2.75	6.58	97.78	Non-Impaired
4003521.01RBP-Woody	OKRO-1105	RBP	Woody	8.00	4.00	20.49%	65.57%	2.08	5.89	97.78	Non-Impaired
4003569.01RBP-SSV	OKRO-1105	RBP	SSV	19.00	5.00	47.89%	53.52%	2.99	5.69	96.55	Non-Impaired
4003569.01RBP-Woody	OKRO-1105	RBP	Woody	9.00	5.00	64.94%	62.99%	2.13	5.38	78.69	Slightly Impaired
4003510.01RBP-SSV	OKLS-1213	RBP	SSV	23.00	4.00	7.45%	61.49%	3.07	6.87	50.00	Moderately Impaired
4003510.01RBP-Woody	OKLS-1213	RBP	Woody	24.00	2.00	3.36%	46.22%	3.54	7.31	58.06	Slightly Impaired
4003584.01RBP-SSV	OKLS-1213	RBP	SSV	15.00	3.00	21.93%	58.77%	2.63	6.65	62.50	Slightly Impaired
4003519.01RBP-SSV	OKSS-1420	RBP	SSV	17.00	2.00	8.11%	31.08%	3.56	6.69	62.50	Slightly Impaired
4003519.01RBP-Woody	OKSS-1420	RBP	Woody	20.00	5.00	11.29%	64.52%	2.58	7.03	56.25	Slightly Impaired
4003585.01RBP-SSV	OKSS-1420	RBP	SSV	18.00	3.00	6.76%	64.19%	2.79	5.62	50.00	Moderately Impaired
4003585.01RBP-Woody	OKSS-1420	RBP	Woody	21.00	6.00	8.87%	70.97%	2.46	7.15	50.00	Moderately Impaired
4003514.01RBP-Woody	OKLS-1194	RBP	Woody	17.00	2.00	13.93%	52.46%	2.99	5.80	80.00	Slightly Impaired
4003589.01RBP-SSV	OKLS-1194	RBP	SSV	30.00	7.00	23.58%	36.59%	3.95	6.29	103.45	Reference
4003589.01RBP-Woody	OKLS-1194	RBP	Woody	21.00	9.00	51.83%	37.17%	3.32	5.13	98.36	Non-Impaired
4003507.01RBP-Woody	OKSS-1446	RBP	Woody	16.00	3.00	2.13%	63.30%	2.44	7.85	45.16	Moderately Impaired

Sample ID Number	Site ID	Sample_Type	Habitat	Sp_Rich	EPT_Rich	%EPT	%DOM	S-D	HBI	%REF	Classification
4003586.01RBP-Woody	OKSS-1446	RBP	Woody	14.00	3.00	3.17%	82.54%	1.98	7.77	43.75	Moderately Impaired
M02621	OKRV-2037	LRF	SUB	6.00	0.00	0.00%	88.18%	1.22	6.09	44.44	Moderately Impaired
M02622	OKRV-2037	LRF	THAB	8.00	0.00	0.00%	72.55%	2.03	6.28	53.33	Moderately Impaired
M02623	OKRV-2037	RBP	Riffle	7.00	0.00	0.00%	80.97%	1.57	6.04	52.17	Moderately Impaired
4003594.01LRF-SUB	OKRV-2037	LRF	SUB	10.00	2.00	1.75%	69.30%	2.23	6.37	62.22	Slightly Impaired
4003594.01LRF-THAB	OKRV-2037	LRF	THAB	12.00	1.00	2.41%	43.98%	2.86	6.62	71.11	Slightly Impaired
M02662	OKRV-2037	LRF	SUB	9.00	0.00	0.00%	78.75%	1.83	6.19	53.33	Moderately Impaired
M02663	OKRV-2037	LRF	THAB	9.00	0.00	0.00%	87.36%	1.46	6.09	44.44	Moderately Impaired
M02664	OKRV-2037	RBP	Riffle	6.00	0.00	0.00%	94.13%	1.05	6.02	43.48	Moderately Impaired
4003526.01RBP-SSV	OKRV-2105	RBP	SSV	19.00	5.00	9.68%	68.28%	2.52	5.97	97.78	Non-Impaired
4003573.01RBP-SSV	OKRV-2105	RBP	SSV	18.00	7.00	60.21%	61.78%	2.85	4.99	89.66	Non-Impaired
4003516.01RBP-SSV	OKLS-1238	RBP	SSV	16.00	5.00	23.94%	59.86%	2.71	5.87	115.56	Reference
4003591.01RBP-SSV	OKLS-1238	RBP	SSV	19.00	7.00	18.98%	68.98%	2.29	5.76	75.86	Slightly Impaired
4003591.01RBP-Woody	OKLS-1238	RBP	Woody	16.00	7.00	27.27%	65.34%	2.19	5.54	78.69	Slightly Impaired
4003518.01RBP-SSV	OKLS-1242	RBP	SSV	18.00	2.00	14.75%	40.98%	3.25	7.08	80.00	Slightly Impaired
4003592.01RBP-SSV	OKLS-1242	RBP	SSV	15.00	4.00	17.86%	55.71%	2.93	6.60	82.76	Slightly Impaired
4003503.01RBP-SSV	OKRV-2077	RBP	SSV	8.00	2.00	2.10%	74.83%	1.94	7.63	53.33	Moderately Impaired
4003503.01RBP-Woody	OKRV-2077	RBP	Woody	12.00	1.00	1.75%	64.04%	2.35	7.46	62.22	Slightly Impaired
4003595.01RBP-SSV	OKRV-2077	RBP	SSV	15.00	3.00	10.87%	57.97%	2.83	7.08	75.86	Slightly Impaired
4003595.01RBP-Woody	OKRV-2077	RBP	Woody	13.00	3.00	23.36%	65.42%	2.29	6.92	59.02	Slightly Impaired
4003532.01RBP-SSV	OKSS-1466	RBP	SSV	28.00	5.00	26.92%	32.05%	4.05	6.54	75.00	Slightly Impaired
4003532.01RBP-Woody	OKSS-1466	RBP	Woody	25.00	5.00	38.39%	53.57%	3.30	6.79	68.75	Slightly Impaired
4003532.01Riffle	OKSS-1466	RBP	Riffle	24.00	12.00	34.12%	35.91%	3.63	4.73	97.96	Non-Impaired
4003511.01RBP-SSV	OKLS-1227	RBP	SSV	22.00	2.00	7.21%	58.56%	2.98	7.44	71.11	Slightly Impaired
4003590.01RBP-SSV	OKLS-1227	RBP	SSV	22.00	3.00	13.46%	60.58%	2.86	7.46	75.86	Slightly Impaired

Table 19. Appendix C—Habitat Assessment Information (Statewide Probabilistic Monitoring Sites Only)

Station_ID	Station_Name	%LBM	%EMB	%DP	Class	Total Points
OKLS-1184	Taloka Creek	92.00%	96.20%	52.00%	FAIR	104.0
OKLS-1185	Snake Creek	100.00%	100.00%	20.00%	POOR	81.7
OKLS-1186	Little Beaver Creek	96.00%	94.80%	0.00%	POOR	88.1
OKLS-1190	Little Blue Creek	26.00%	41.90%	48.00%	FAIR	105.3
OKLS-1191	Hickory Creek	72.00%	81.90%	80.00%	FAIR	89.1
OKLS-1192	Rock Creek	0.00%	26.90%	52.00%	GOOD	109.0
OKLS-1193	North Bogy Creek	60.00%	62.60%	80.00%	FAIR	90.9
OKLS-1194	Little Washita River	52.00%	51.90%	0.00%	FAIR	97.6
OKLS-1196	Mt. Fork of Sans Bois Creek	0.00%	22.60%	28.00%	FAIR	115.3
OKLS-1197	Black Fork	0.00%	6.20%	28.00%	GOOD	103.6
OKLS-1198	Big Creek	94.00%	92.80%	0.00%	POOR	103.6
OKLS-1201	Butler Creek	100.00%	100.00%	40.00%	FAIR	87.6
OKLS-1212	Sans Bois Creek	30.00%	37.20%	52.00%	FAIR	104.8
OKLS-1213	Gap Creek	23.00%	33.10%	44.00%	GOOD	106.8
OKLS-1227	Unnamed Creek	100.00%	99.50%	60.00%	FAIR	95.1
OKLS-1238	Salt Fork of the Red River	100.00%	100.00%	0.00%	POOR	97.8
OKLS-1242	Station Creek	94.00%	95.50%	4.00%	POOR	87.5
OKRM-1010	Red River	100.00%	100.00%	0.00%	NA**	75.4
OKRM-1013	Red River	99.00%	100.00%	8.00%	NA**	90.3
OKRM-1014	Canadian River	100.00%	100.00%	0.00%	POOR	106.2
OKRM-1015	Canadian River	100.00%	100.00%	0.00%	POOR	88.5
OKRO-1098	North Canadian River	97.00%	96.20%	4.00%	POOR	104.6
OKRO-1105	Elk Creek	69.00%	84.50%	0.00%	FAIR	111.1
OKRO-1108	Red Rock Creek	89.00%	93.30%	80.00%	FAIR	96.7
OKRV-2001	North Fork of the Red River	100.00%	100.00%	0.00%	FAIR	84.5
OKRV-2004	North Fork of Walnut Creek	86.00%	84.50%	40.00%	FAIR	109.8
OKRV-2006	Lyon Creek	58.00%	63.20%	36.00%	GOOD	94.3
OKRV-2007	Sweetwater Creek	100.00%	100.00%	36.00%	FAIR	125.3
OKRV-2009	Turkey Creek	86.00%	79.80%	36.00%	FAIR	118.8
OKRV-2010	Coal Creek v1	0.00%	16.40%	56.00%	GOOD	112.8 (v1), 93.1 (v2)

Station_ID	Station_Name	%LBM	%EMB	%DP	Class	Total Points
OKRV-2011	Canadian River	100.00%	100.00%	0.00%	POOR	110.0
OKRV-2012	Mud Creek	100.00%	100.00%	0.00%	NA**	87.9
OKRV-2013	Baron Fork	5.00%	26.00%	44.00%	FAIR	112.5
OKRV-2014	Holly Creek	5.00%	26.40%	4.00%	FAIR	105.3
OKRV-2015	Bitter Creek	94.00%	97.30%	8.00%	POOR	87.1
OKRV-2016	Clear Boggy Creek	78.00%	83.10%	16.00%	POOR	111.7
OKRV-2020	Polecat Creek	98.00%	100.00%	8.00%	POOR	117.6
OKRV-2021	Unnamed Creek	100.00%	100.00%	0.00%	POOR	61.4
OKRV-2022	Caston Creek	35.00%	50.50%	40.00%	FAIR	118.5
OKRV-2023	Chikaskia River	75.00%	81.20%	12.00%	POOR	106.7
OKRV-2025	Greenleaf Creek	52.00%	80.20%	8.00%	FAIR	88.4
OKRV-2026	Fourche Maline v1	17.00%	36.70%	56.00%	GOOD	124.8
OKRV-2027	South Fork of Dirty Creek	80.00%	94.70%	72.00%	FAIR	107.7
OKRV-2029	Bird Creek	100.00%	100.00%	0.00%	POOR	88.6
OKRV-2032	Wolf Creek	99.00%	99.90%	72.00%	GOOD	102.0
OKRV-2033	Shady Grove Creek	90.00%	88.00%	56.00%	FAIR	90.2
OKRV-2034	Jim Creek	95.00%	94.50%	0.00%	POOR	90.1
OKRV-2035	Deep Fork River	99.00%	100.00%	4.00%	POOR	99.8
OKRV-2036	Big Creek	0.00%	17.90%	12.00%	GOOD	116.8
OKRV-2037	North Fork of the Red River	90.00%	94.80%	36.00%	GOOD	114.9
OKRV-2039	Wolf Creek	98.00%	98.80%	0.00%	FAIR	111.4
OKRV-2040	Curl Creek	27.00%	32.40%	60.00%	GOOD	109.2
OKRV-2043	Cimarron River	98.00%	98.20%	0.00%	FAIR	78.3
OKRV-2044	Julian Creek	100.00%	99.50%	0.00%	POOR	94.7
OKRV-2068	California Creek	40.00%	57.70%	24.00%	FAIR	97.0
OKRV-2070	Tyner Creek	99.00%	95.00%	36.00%	FAIR	79.5
OKRV-2074	Madden Creek	15.00%	29.80%	28.00%	GOOD	98.7
OKRV-2077	Tomike Creek	100.00%	100.00%	0.00%	POOR	82.0
OKRV-2079	Rock Creek	6.00%	27.40%	52.00%	GOOD	100.6
OKRV-2080	Little Cabin Creek	4.00%	7.10%	16.00%	GOOD	94.4
OKRV-2098	Cottonwood Creek	96.00%	95.00%	12.00%	POOR	99.4

Station_ID	Station_Name	%LBM	%EMB	%DP	Class	Total Points
OKRV-2101	Black Bear Creek	79.00%	84.40%	0.00%	POOR	89.7
OKRV-2102	Canadian River	100.00%	100.00%	4.00%	POOR	100.0
OKRV-2105	Salt Fork of the Arkansas River	100.00%	100.00%	0.00%	POOR	110.5
OKSS-1408	Alabama Creek	61.00%	75.70%	52.00%	FAIR	97.5
OKSS-1409	Trib. To Fourteenmile Creek	0.00%	16.20%	16.00%	GOOD	110.0
OKSS-1410	Peterson Creek	0.00%	36.40%	0.00%	FAIR	71.7
OKSS-1414	Bad Creek	83.00%	99.50%	52.00%	FAIR	87.1
OKSS-1415	Dry Creek	69.00%	79.05%	52.00%	FAIR	102.9
OKSS-1416	Trib. To Fivemile Creek	95.00%	84.30%	16.00%	POOR	85.7
OKSS-1419	Trib. To Kiamichi River	0.00%	56.40%	0.00%	FAIR	91.2
OKSS-1420	Island bayou	100.00%	100.00%	80.00%	FAIR	107.1
OKSS-1425	Wickliffe Creek (Revisit)	1.00%	20.50%	12.00%	FAIR	98.1
OKSS-1426	West Terrapin Creek	0.00%	11.70%	20.00%	FAIR	98.0
OKSS-1434	Mill Creek	1.00%	35.70%	24.00%	GOOD	99.3
OKSS-1436	Unnamed Creek	1.00%	24.50%	4.00%	FAIR	95.1
OKSS-1438	Dumpling Creek	10.00%	45.20%	28.00%	FAIR	101.8
OKSS-1439	Carter Creek	9.00%	40.70%	0.00%	FAIR	80.9
OKSS-1447	Rush Creek	98.00%	98.10%	4.00%	POOR	86.7
OKSS-1449	Mud Creek	2.00%	1.10%	8.00%	GOOD	69.0
OKSS-1456	Unnamed Creek	45.00%	66.40%	8.00%	POOR	81.4
OKSS-1466	Turkey Creek North (unnamed creek)	13.00%	29.50%	24.00%	FAIR	102.6
OKSS-1472	Dance Creek	98.00%	96.70%	0.00%	POOR	97.7
OKLS-1188	Wolf Creek	ND	ND	ND	ND*	ND
OKRM-1011	Arkansas River v1	ND	ND	ND	ND*	ND
OKRM-1016	Illinois River	ND	ND	ND	ND*	ND
OKRM-1017	Red River	ND	ND	ND	ND*	ND
OKRM-1023	Poteau River	ND	ND	ND	ND*	ND
OKRO-1095	Verdigris River	ND	ND	ND	ND*	ND
OKRO-1099	Elk River	ND	ND	ND	ND*	ND

<b>Station_ID</b>	<b>Station_Name</b>	<b>%LBM</b>	<b>%EMB</b>	<b>%DP</b>	<b>Class</b>	<b>Total Points</b>
OKRO-1106	Muddy Boggy River	ND	ND	ND	ND*	ND
OKRO-1107	Caney River	ND	ND	ND	ND*	ND
OKRO-1111	Caney River	ND	ND	ND	ND*	ND
OKRV-2019	Neosho River v1	ND	ND	ND	ND*	ND
OKRV-2028	Deep Fork River	ND	ND	ND	ND*	ND
OKRV-2030	Caney River	ND	ND	ND	ND*	ND
OKRV-2061	Blue River	ND	ND	ND	ND*	ND
OKRV-2088	Verdigris River	ND	ND	ND	ND*	ND
OKSS-1446	Middle Creek	ND	ND	ND	ND*	ND

\*Denotes non-wadeable site.

\*\*No scoring criteria available.

Table 20. Appendix C---Chemistry, Chlorophyll, and Metals Data

Source	Station ID	Sample date	N, Total (mg/L)	P, Total (mg/L)	SpC (uS/cm2)	Turbidity (NTU)	Ses_Chla (mg/m3)	Ben_Chla (mg/m2)	Cd, Dis (ug/L)	Cu, Dis (ug/L)	Pb, Dis (ug/L)	Se, TR (ug/L)	Zn, Dis (ug/L)
NRSA	OKRM-1006	7/16/2013	1.016	0.176	1019	4	7.960	50.310	1.000	1.000	1.000	2.400	5.000
NRSA	OKS9-0932	7/8/2013	0.453	0.059	740	13.3	2.010	37.580	0.180	1.650	0.220	1.000	5.000
NRSA	OKS9-0938	7/15/2013	0.178	0.024	49	3.0	0.564	24.545	1.000	1.000	1.000	1.000	5.000
NRSA	OKRO-1087	8/5/2013	0.28	0.0418	57	12	6.743	32.724	1.000	1.000	1.000	1.000	5.000
NRSA	OKLS-1181	7/17/2013	0.499	0.07	251	16.5	68.000	20.966	#N/A	N/A	N/A	1.000	NA
NRSA	OKS9-0937	8/12/2013	0.345	0.054	513	9.33	2.030	90.266	1.000	1.000	1.000	1.000	6.900
NRSA	OKR9-0901	6/18/2013	0.246	0.037	2519	3	0.440	10.740	0.180	1.480	0.120	1.000	5.000
NRSA	OKR9-0913	6/25/2013	0.596	0.069	2726	4	10.667	18.093	0.180	4.200	0.250	1.000	5.000
NRSA	OKR9-0902	7/1/2013	0.645	0.149	683	30.3	27.200	24.540	0.180	0.860	0.160	1.000	5.000
NRSA	OKR9-0906	7/2/2013	0.596	0.052	23390	4.0	9.640	23.894	0.180	3.800	0.140	1.000	5.000
NRSA	OKR9-0908	6/26/2013	1.358	0.223	9457	32	50.885	53.998	0.180	2.630	0.240	2.000	5.000
NRSA	OKRM-1002	7/9/2013	1.104	0.218	5903	10	22.971	91.050	0.180	2.470	0.230	1.300	5.000
NRSA	OKRO-1088	7/15/2013	0.953	0.223	916	193.3	23.480	74.883	1.000	1.600	1.000	1.000	5.100
NRSA	OKRO-1089	6/12/2013	2.168	0.083	43767	15.89	28.267	50.606	0.180	6.200	0.120	10.000	7.100
NRSA	OKLS-1176	8/6/2013	0.224	0.0404	64	6	4.312	30.640	1.000	1.000	1.000	1.000	5.000
NRSA	OKSS-1405	9/17/2013	1.511	0.065	306	3	1.784	152.671	1.000	1.000	1.000	1.000	5.000
NRSA	OKR9-0907	8/6/2013	0.303	0.0691	136	18	9.234	48.024	1.000	1.000	1.000	1.000	5.000
NRSA	OKRM-1008	7/8/2013	0.461	0.073	236	17	6.224	14.915	0.180	1.040	0.620	1.000	5.000
NRSA	OKS9-0931	6/10/2013	2.433	1.082	1260	11.7	1.851	46.001	0.180	1.600	0.310	1.500	5.000
NRSA	OKS9-0933	7/30/2013	2.775	0.635	221	7.0	21.120	21.314	1.000	6.100	1.000	1.000	5.200
NRSA	OKLS-1182	8/13/2013	0.795	0.178	524	94.66	16.000	27.167	1.000	2.600	1.000	1.000	5.000
NRSA	OKRO-1086	8/12/2013	0.916	0.093	273	18	47.652	44.094	1.000	1.000	1.000	1.000	5.000
NRSA	OKR9-0909	6/11/2013	3.41	0.829	630	433.33	151.200	59.590	1.000	1.000	1.000	1.000	7.600
NRSA	OKS9-0939	6/25/2013	0.586	0.056	695	10.33	3.136	64.532	0.180	0.630	0.120	1.000	5.000
NRSA	OKS9-0936	7/17/2013	0.61	0.051	477	42.7	5.208	22.589	1.000	1.000	1.000	1.000	5.000

Source	Station ID	Sample date	N, Total (mg/L)	P, Total (mg/L)	SpC (uS/cm2)	Turbidity (NTU)	Ses. Chla (mg/m3)	Ben. Chla (mg/m2)	Cd, Dis (ug/L)	Cu, Dis (ug/L)	Pb, Dis (ug/L)	Se, TR (ug/L)	Zn, Dis (ug/L)
NRSA	OKR9-0912	7/30/2013	0.786	0.113	967	6	21.440	21.291	1.000	1.000	1.000	1.000	5.000
NRSA	OKRM-1001	8/20/2013	0.759	0.115	1842	28	13.029	27.024	1.000	1.000	13.900	1.400	5.000
NRSA	OKRM-1004	8/13/2013	0.626	0.095	1554	23.66	20.320	18.616	1.000	1.000	1.000	2.900	5.000
NRSA	OKS9-0935	6/4/2013	2.368	0.111	614	25	1.984	36.000	0.180	0.280	0.120	2.060	5.000
NRSA	OKR9-0905	6/18/2013	1.686	0.246	2295	27.66	9.953	37.059	0.180	6.900	0.180	1.900	5.000
NRSA	OKR9-0911	6/26/2013	0.755	0.194	866	38.3	18.571	20.919	0.180	2.700	0.200	1.100	5.000
NRSA	OKS9-0934	7/23/2013	0.58	0.045	711	10.66	4.095	35.465	1.000	1.000	1.000	1.000	5.000
NRSA	OKRM-1022	9/24/2014	2.52	0.594	1470	36.7	199.800	120.624	0.500	1.300	0.500	3.200	5.000
NRSA	OKS9-0941	7/22/2014	1.223	0.116	442	31.7	18.060	79.260	1.000	1.000	1.000	1.100	5.000
NRSA	OKRM-1021	6/2/2014	2.209	0.718	916	20.3	150.300	72.898	1.000	1.300	1.000	2.700	5.000
NRSA	OKSS-1431	6/23/2014	0.49	0.047	231	7.3	6.960	35.822	1.000	1.000	1.000	1.000	5.000
NRSA	OKRO-1102	7/29/2014	0.759	0.168	326	62.7	7.730	107.035	1.000	1.600	1.000	1.000	5.000
NRSA	OKSS-1429	7/8/2014	0.141	0.042	69	3.0	7.510	16.555	1.000	1.000	1.000	1.000	5.000
NRSA	OKSS-1430	7/9/2014	0.215	0.04	191	3.0	4.220	38.620	1.000	1.000	1.000	1.000	5.000
NRSA	OKRO-1103	8/12/2014	0.358	0.019	35	4.0	0.950	47.173	0.500	1.000	0.500	1.000	1.000
NRSA	OKR9-0904	9/23/2014	1.449	0.395	699	59.0	38.100	45.686	0.500	1.400	0.500	2.300	5.000
NRSA	OKRO-1092	6/30/2014	1.134	0.242	858	68.3	47.830	86.062	NA	NA	NA	NA	NA
NRSA	OKLS-1204	6/16/2014	1.093	0.156	513	13.23	28.320	84.740	NA	NA	NA	NA	NA
NRSA	OKR9-0903	9/15/2014	0.991	0.131	2928	40.0	43.240	59.521	0.500	1.400	0.500	5.100	5.000
NRSA	OKRM-1020	8/11/2014	0.861	0.143	868	43.7	38.720	41.816	0.500	1.400	0.500	1.900	5.000
NRSA	OKRM-1026	8/19/2014	0.809	0.11	12430	66.3	26.320	83.864	0.500	6.700	0.500	13.600	6.100
NRSA	OKSS-1444	6/3/2014	0.721	0.238	792	7.3	1.110	45.370	1.000	1.000	1.000	2.000	5.000
NRSA	OKSS-1403	8/4/2014	0.085	0.023	36	8.3	0.730	28.701	1.000	1.000	1.000	1.000	5.000
NRSA	OKLS-1222	8/20/2014	2.034	0.187	10610	86.0	106.840	134.232	0.500	7.800	0.500	19.200	8.100
NRSA	OKLS-1209	6/16/2014	0.729	0.103	102	43.3	1.350	21.979	1.000	2.400	1.000	1.000	28.400
NRSA	OKLS-1203	7/14/2014	0.656	0.067	507	58.3	13.470	50.905	1.000	1.000	1.000	1.000	1.000
OWRB	OKSS-1408	7/9/2014	0.81	0.028	257	60.0	8.550	50.100	1.000	1.000	1.000	1.000	5.000

Source	Station ID	Sample date	N, Total (mg/L)	P, Total (mg/L)	SpC (uS/cm2)	Turbidity (NTU)	Ses_Chla (mg/m3)	Ben_Chla (mg/m2)	Cd, Dis (ug/L)	Cu, Dis (ug/L)	Pb, Dis (ug/L)	Se, TR (ug/L)	Zn, Dis (ug/L)
OWRB	OKRM-1011	7/15/2014	0.78	0.08	1028	9.3	9.580	269.000	1.000	1.000	1.000	1.700	5.000
OWRB	OKSS-1414	9/8/2014	1.09	0.057	438	37.3	16.600	7.400	0.500	1.700	0.500	1.700	5.000
OWRB	OKRV-2013	6/10/2014	1.12	0.041	253	1.0	0.930	188.000	1.000	1.000	1.000	1.000	5.000
OWRB	OKLS-1201	7/16/2014	1.3	0.105	348	30.3	23.200	82.100	1.000	1.000	1.000	1.000	5.000
OWRB	OKSS-1415	6/24/2014	0.69	0.012	456	35.7	4.600	21.500	1.000	1.000	1.000	1.000	5.000
OWRB	OKLS-1191	8/5/2014	1.36	0.061	372	73.3	19.600	40.200	1.000	1.000	1.000	1.000	5.000
OWRB	OKRM-1016	6/10/2014	1.61	0.037	308	3.0	1.410	44.415	1.000	1.000	1.000	1.100	5.000
OWRB	OKLS-1190	6/18/2014	0.8	0.022	597	10.0	1.000	55.800	1.000	1.000	1.000	1.000	5.000
OWRB	OKRV-2001	7/29/2014	1.13	0.034	2657	6.3	7.200	22.500	1.000	2.300	1.000	3.200	5.000
OWRB	OKRM-1010	8/18/2014	1.94	0.183	11570	40.0	8.990	41.500	0.500	6.300	0.500	8.200	5.000
OWRB	OKRM-1013	9/16/2014	2.49	0.195	5954	99.7	148.000	494.000	0.500	3.500	0.500	6.900	5.000
OWRB	OKSS-1447	6/4/2014	0.73	0.054	1799	3.7	1.700	129.000	1.000	1.200	1.000	6.400	10.400
OWRB	OKLS-1212	7/7/2014	0.93	0.092	137	34.3	3.590	11.400	1.000	2.300	1.000	1.000	11.900
OWRB	OKLS-1185	7/22/2014	1.19	0.076	302	99.7	12.400	58.900	1.000	1.300	1.000	1.000	5.000
OWRB	OKLS-1184	7/8/2014	0.66	0.154	1335	16.7	4.390	87.700	1.000	1.300	1.000	1.000	9.300
OWRB	OKRO-1095	7/22/2014	0.81	0.065	374	9.0	0.430	17.500	1.000	1.400	1.000	1.900	5.000
OWRB	OKLS-1188	6/18/2014	1.82	0.195	224	47.3	168.000	24.900	1.000	2.700	1.000	1.000	8.200
OWRB	OKRV-2029	8/24/2015	0.48	0.02	9844	3.0	13.600	13.644	0.500	1.100	0.500	62.300	5.000
OWRB	OKRV-2011	8/25/2015	1.25	0.081	2023	12.3	27.300	90.434	0.500	1.400	0.500	2.500	5.000
OWRB	OKRO-1107	8/17/2015	1.52	0.134	434	32.3	10.400	49.475	0.500	1.600	0.500	1.700	11.300
OWRB	OKRV-2016	9/1/2015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OWRB	OKRV-2010	7/13/2015	0.78	0.044	694	19.0	3.350	20.512	0.500	2.400	0.500	2.700	5.000
OWRB	OKRV-2040	8/11/2015	0.64	0.054	443	19.0	14.100	19.195	0.500	1.200	0.500	1.000	5.000
OWRB	OKRV-2035	8/31/2015	3.64	0.666	1114	9.3	8.710	82.401	0.500	2.000	0.500	3.900	5.000
OWRB	OKRV-2014	6/16/2015	0.32	0.031	36	13.3	1.110	56.400	0.500	1.000	0.500	1.000	5.000
OWRB	OKRV-2034	8/18/2015	0.29	0.008	582	7.0	1.640	26.575	0.500	1.300	0.500	1.800	6.700
OWRB	OKRV-2080	8/5/2015	1.3	0.081	365	29.7	9.340	9.221	0.500	2.200	0.500	1.800	5.000
OWRB	OKRV-2006	6/8/2015	2.83	0.153	2812	3.0	19.600	51.400	0.500	2.200	0.500	8.800	5.000

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OWRB	OKRV-2074	6/30/2015	1.2	0.025	3548	3.0	1.390	29.840	0.500	1.000	0.500	157.000	43.200
OWRB	OKSS-1434	6/15/2015	0.61	0.035	110	9.0	7.000	21.900	0.500	1.000	0.500	1.000	5.000
OWRB	OKRV-2012	7/27/2015	0.76	0.069	2158	24.0	36.200	116.000	0.500	2.200	0.500	6.800	5.000
OWRB	OKSS-1449	8/4/2015	1.25	0.115	336	7.0	14.800	13.481	0.500	1.400	0.500	1.600	5.000
OWRB	OKRO-1106	8/25/2015	0.78	0.09	881	25.3	36.600	18.052	0.500	1.200	0.500	1.200	5.000
OWRB	OKRV-2019	7/20/2015	0.99	0.309	384	72.0	11.900	7.970	0.500	1.400	0.500	1.000	5.000
OWRB	OKRO-1098	8/31/2015	1.2	0.186	808	28.3	28.500	42.595	0.500	1.400	0.500	2.200	5.000
OWRB	OKRV-2004	6/10/2015	1.03	0.052	867	11.0	8.950	97.400	0.500	1.000	0.500	1.200	7.300
OWRB	OKSS-1410	7/7/2015	0.18	0.02	45	11.7	1.840	41.774	0.500	1.000	0.500	1.000	12.700
OWRB	OKRV-2020	6/29/2015	0.66	0.024	774	9.3	1.800	21.184	0.500	1.400	0.500	2.500	16.200
OWRB	OKRM-1023	9/22/2015	0.73	0.053	152	10.0	11.500	9.330	0.500	1.000	0.500	1.000	5.000
OWRB	OKRM-1017	9/2/2015	1.11	0.117	7392	30.0	42.400	34.993	0.500	3.600	0.500	9.200	5.400
OWRB	OKRV-2079	7/14/2015	1.09	0.082	417	34.7	0.770	130.000	0.500	1.900	0.500	1.000	5.100
OWRB	OKRV-2033	9/1/2015	0.56	0.009	1387	4.0	2.580	26.316	0.500	1.000	0.500	1.500	37.600
OWRB	OKRV-2007	6/23/2015	2.13	0.237	2719	175.7	13.800	82.500	0.500	2.400	0.500	3.800	5.000
OWRB	OKSS-1416	6/9/2015	1.32	0.16	567	23.7	3.970	56.500	0.500	1.000	0.500	1.000	11.300
OWRB	OKSS-1409	8/10/2015	0.48	0.025	156	1	0.500	55.369	0.500	1.000	0.500	1.100	5.000
OWRB	OKRV-2009	6/22/2015	1.96	0.433	1835	23.0	41.400	522.000	0.500	2.600	0.500	3.400	9.600
OWRB	OKSS-1436	7/6/2015	0.25	0.022	571	2.0	0.490	45.410	0.500	1.000	0.500	1.000	7.600
OWRB	OKRV-2088	7/21/2015	0.77	0.117	331	16.0	4.490	14.092	0.500	1.500	0.500	1.000	5.000
OWRB	OKRV-2068	8/15/2016	N/A	N/A	426	7.3	N/A	39.020	N/A	N/A	N/A	N/A	N/A
OWRB	OKRV-2102	8/22/2016	3.76	0.379	1110	17.3	276	193.152	0.500	1.230	0.500	3.490	11.700
OWRB	OKRO-1111	7/26/2016	0.91	0.078	411	33.0	27.1	45.037	0.500	1.830	0.500	2.350	5.000
OWRB	OKSS-1439	8/31/2016	0	0.01	48	3.0	0.5	17.841	1.000	1.000	1.000	1.000	15.600
OWRB	OKRV-2043	6/28/2016	0.69	0.083	10398	7.0	22.9	22.538	0.500	1.000	0.500	1.240	5.000
OWRB	OKSS-1472	8/24/2016	0.39	0.021	680	9.0	2.33	63.982	0.500	1.000	0.500	1.060	7.870
OWRB	OKRV-2028	7/25/2016	1.17	0.52	593	31.7	37.7	23.181	0.500	1.710	0.500	3.470	5.000
OWRB	OKSS-1438	9/13/2016	0.66	0.046	96	9.3	2.4	103.336	2.24	1.000	1.000	1.070	32.500

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OWRB	OKRO-1099	6/21/2016	1.24	0.032	309	3.0	3.07	69.548	0.500	1.000	0.500	1.850	5.000
OWRB	OKRV-2026	8/2/2016	0.84	0.095	207	46.3	20.5	41.187	1.000	1.000	1.000	1.000	5.000
OWRB	OKRV-2025	6/27/2016	1.01	0.037	3333	6.3	30.5	55.905	0.500	1.150	0.500	27.000	17.900
OWRB	OKRV-2044	6/20/2016	0.31	0.018	1311	4.0	3.08	21.429	0.500	2.690	0.500	12.000	5.290
OWRB	OKLS-1186	9/12/2016	0.79	0.026	1197	5.0	1.2	49.179	1.000	1.000	1.000	5.090	6.490
OWRB	OKLS-1196	7/18/2016	0.25	0.018	86	8.0	3.63	33.742	0.500	3.620	0.770	2.320	5.000
OWRB	OKLS-1193	8/1/2016	1.07	0.152	125	137.7	13.4	18.217	1.000	2.030	1.080	1.000	6.930
OWRB	OKRO-1108	8/17/2016	ND	0.319	680	146.3	ND	105.320	NA	NA	1.000	NA	NA
OWRB	OKLS-1192	7/11/2016	0.4	0.03	66	4.0	9.02	19.559	0.500	1.000	0.500	1.710	5.000
OWRB	OKRV-2027	8/16/2016	NA	NA	850	16.7	NA	51.730	NA	NA	NA	NA	NA
OWRB	OKSS-1419	8/30/2016	0	0.017	24	13.0	0.050	32.901	1.000	1.000	1.000	1.000	9.950
OWRB	OKRV-2070	7/27/2016	1.56	0.265	545	104.7	10.6	63.608	0.500	1.000	0.500	1.980	5.000
OWRB	OKRV-2021	6/28/2016	1.17	ND	123389	13.7	2.96	13.024	NA	NA	NA	302.000	NA
OWRB	OKSS-1456	8/23/2016	0.54	0.05	140	18.3	14.5	65.623	0.500	1.000	0.500	1.000	6.220
OWRB	OKSS-1426	7/12/2016	0.41	0.022	91	6.0	1.04	37.973	0.500	1.000	0.500	1.440	5.000
OWRB	OKSS-1425	6/22/2016	0.85	0.028	214	4.0	0.67	62.238	0.500	1.000	0.500	1.870	5.000
OWRB	OKRV-2039	7/5/2016	0.82	0.095	1555	5.3	25.5	49.853	0.500	1.250	0.550	2.370	14.000
OWRB	OKRV-2032	7/6/2016	NA	NA	1315	4.0	NA	NA	0.500	1.000	0.500	3.740	6.080
OWRB	OKLS-1198	6/5/2017	0.6	0.079	585	23.3	2.78	19.130	1.000	1.000	1.000	1.000	5.000
OWRB	OKRV-2036	7/10/2017	0	0.01	36	7.0	0.92	33.400	1.000	1.830	1.000	1.000	5.000
OWRB	OKRV-2015	6/6/2017	6.84	0.127	5398	19.7	28	148.520	1.000	4.370	1.000	31.800	5.000
OWRB	OKRV-2101	7/31/2017	0.99	0.73	996	18.0	5.15	35.110	1.000	1.580	1.000	3.400	5.000
OWRB	OKLS-1197	7/11/2017	0.23	0.025	43	10.0	5.2	32.350	1.000	1.000	1.000	1.000	7.420
OWRB	OKLS-1197	7/11/2017	0.23	0.025	43	10.0	5.2	32.350	1.000	1.000	1.000	1.000	7.420
OWRB	OKRV-2061	9/5/2017	0.23	0.044	492	12.0	1.93	47.947	1.000	1.000	1.000	1.000	5.000

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OWRB	OKRM-1015	7/18/2017	1.44	0.136	734	23.7	50.4	34.090	1.000	1.120	1.000	1.900	7.520
OWRB	OKRM-1014	6/20/2017	0.61	0.023	2883	11.3	4.89	24.600	1.000	1.000	1.000	1.100	5.000
OWRB	OKRV-2030	8/29/2017	1.68	0.219	390	15.3	19.2	75.500	1.000	3.510	1.000	1.000	5.000
OWRB	OKRV-2022	9/11/2017	7.37	0.028	642	6.0	5.17	48.810	1.000	1.080	1.000	1.600	5.000
OWRB	OKRV-2023	8/2/2017	0.89	0.176	752	13.7	22.6	37.970	1.000	1.060	1.000	3.000	5.000
OWRB	OKRV-2098	6/26/2017	0.73	0.161	1875	11.3	1.17	NA	1.000	1.470	1.000	8.180	5.000
OWRB	OKRO-1105	6/21/2017	1.07	0.117	1470	11.3	3.04	80.180	NA	NA	NA	NA	NA
OWRB	OKLS-1213	8/21/2017	0.63	0.088	94	68.0	4.58	7.150	1.000	1.270	1.000	1.000	5.000
OWRB	OKSS-1420	9/13/2017	3.78	1.01	1016	7.7	1.01	84.740	1.000	2.410	1.000	1.100	5.000
OWRB	OKLS-1194	6/19/2017	1.46	0.1	2124	11.3	39.4	124.550	1.000	1.000	1.000	4.190	5.000
OWRB	OKSS-1446	7/17/2017	1.38	0.152	235	16.7	119	45.800	1.000	1.000	1.000	1.070	5.000
OWRB	OKRV-2037	6/13/2017	1.03	0.057	16413	14.3	15.7	44.615	1.000	4.560	1.000	27.200	7.120
OWRB	OKRV-2105	8/1/2017	0.5	0.031	3724	20.7	4.38	46.100	1.000	2.870	1.000	2.400	5.000
OWRB	OKLS-1238	6/12/2017	0.85	0.013	4242	2.0	3.7	61.980	1.000	2.970	1.000	7.160	5.000
OWRB	OKLS-1242	6/12/2017	1.97	0.074	3767	17.3	23.5	68.590	1.000	2.110	1.000	12.200	5.000
OWRB	OKRV-2077	6/5/2017	1.4	0.094	663	19.7	4.17	24.329	1.000	1.000	1.000	5.210	5.000
OWRB	OKSS-1466	7/25/2017	0.71	0.1	81	2.0	4.5	29.840	1.000	1.000	1.000	1.000	5.000
OWRB	OKLS-1227	7/5/2017	1.28	0.027	3298	4.0	1.89	35.440	1.000	1.690	1.000	4.440	7.590





















































