Town Branch Urban Trail
Riparian Evaluation Project
Monitoring Quality Assurance Project Plan
(QAPP)
Contract No. 18-80212

City of Lockhart
308 W. San Antonio St.
Lockhart, Texas 78644

Funding Source:

Nonpoint Source (NPS) Program CWA §319(h)
Prepared in cooperation with the Texas Commission on Environmental Quality
and the U.S. Environmental Protection Agency
Federal ID # 99614622
QTRAK # _____

Effective Period: Three years from date of final approval
Questions concerning this QAPP should be directed to:
Vance Rodgers
City Manager
City of Lockhart
P.O. Box 239
Lockhart, Texas 78644
(512) 398-3461
vRodgers@lockhart.tx.org

A1 APPROVAL PAGE

By signing this document, signatories acknowledge their respective organizations' awareness of and adherence to requirements contained in this QAPP in accordance with roles and responsibilities as described in Section A4 Project/Task Organization and throughout.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Monitoring Division
Laboratory and Quality Assurance Section

_____
Sharon R. Coleman, TCEQ Quality Assurance (QA) Manager Date

_____
Sandra Arismendez Date
Lead NPS QA Specialist
Quality Assurance Team

Water Quality Planning Division

_____
Faith Hambleton, Team Leader Date
NPS Program

_____
Jessica Uramkin, NPS QA Coordinator Date

_____
Bill Carter, TCEQ NPS, Project Manager Date
NPS Program

City of Lockhart

12-26-17

Vance Rodgers, Project Manager and QA Officer Date

Nueces River Authority (Riparian Contractor)

12-26-17
Date

Sky Jones-Lewey, Data Manager and Field Supervisor

The City of Lockhart will secure written documentation from additional project participants (e.g., riparian evaluation partners), if any, stating the organization's awareness of and commitment to requirements contained in this QAPP and any amendments or revisions of this plan. The City of Lockhart will maintain this documentation as part of the project's quality assurance records. This documentation will be available for review. Copies of this documentation will also be submitted as deliverables to the TCEQ NPS Project Manager within 30 days of final TCEQ approval of the QAPP.

A2 TABLE OF CONTENTS

A3 DISTRIBUTION LIST

The Lead NPS QA Specialist will provide approved versions of this QAPP and any amendments or revisions to the TCEQ NPS Project Manager and the City of Lockhart Project Manager. The TCEQ NPS Project Manager will provide approved copies to the TCEQ Data Management and Analysis Team Leader and EPA Project Officer within two weeks of approval. The TCEQ Data Management and Analysis team needs searchable .pdf files of finalized QAPPs that are small enough to upload into SWQMIS. There is a limit on file size of 15 MB. The TCEQ NPS Project Manager will document transmittal of the plan and maintain this documentation as part of the project's quality assurance records. This documentation will be available for review.

U.S. Environmental Protection Agency Region 6
Water Quality Protection Division
Assistance Program Branch
1445 Ross Avenue
Suite # 1200
Dallas, TX 75202-2733

Anthony Suttice, Project Officer
(214) 665-8590

The City of Lockhart will provide copies of this project plan and any amendments or revisions of this plan to each project participant defined in the list below. The City of Lockhart will document receipt of the plan by each participant and maintain this documentation as part of the project's quality assurance records. This documentation will be available for review.

City of Lockhart
P.O. Box 239
Lockhart, TX 78644
Vance Rodgers
Project Manager
Quality Assurance Officer
(512) 398-3461

Nueces River Authority
P.O. Box 349
Uvalde, TX 78801
Sky Jones-Lewey
Data Manager
Field Supervisor
(830) 278-2025

A4 PROJECT/TASK ORGANIZATION

TCEQ
Monitoring Division

Sandra Arismendez
Lead NPS QA Specialist
Assists the TCEQ NPS Project Manager in QA related issues. Participates in the planning, development, approval, implementation, and maintenance of the QAPP. Determines conformance with program quality system requirements. Coordinates or performs audits, as deemed necessary and using a wide variety of assessment guidelines and tools. Concurs with proposed corrective actions and verifications. Provides technical expertise and/or consultation on quality services. Recommends to TCEQ management that work be stopped to safe guard project and programmatic objectives, worker safety, public health, or environmental protection.

Water Quality Planning Division

Faith Hambleton, Team Leader
NPS Program
Responsible for management and oversight of the TCEQ NPS Program. Oversees the development of QA guidance for the NPS program to be sure it is within pertinent frameworks of the TCEQ. Monitors the effectiveness of the program quality system. Reviews and approves all NPS projects, internal QA audits, program corrective actions, work plans, and contracts. Enforces program corrective action, as required. Ensures NPS personnel are fully trained and adequately staffed.

Bill Carter
TCEQ NPS Project Manager
Maintains a thorough knowledge of work activities, commitments, deliverables, and time frames associated with projects. Develops lines of communication and working relationships between the contractor, the TCEQ, and the EPA. Tracks deliverables to ensure that tasks are completed as specified in the contract. Responsible for ensuring that the project deliverables are submitted on time and are of acceptable quality and quantity to achieve project objectives. Serves on planning team for NPS projects. Provides contractor with most recent version of QAPP shell document. Participates in the development, approval, implementation, and maintenance of the QAPP. Conducts independent technical review of the QAPP to ensure compliance with project needs/requirements. Responsible for verifying that the approved QAPP is implemented by the contractor. Notifies the Lead NPS QA Specialist of particular circumstances which may adversely affect the quality of data derived from the collection and analysis of samples. Monitors and enforces corrective action.

Jessica Uramkin
NPS Quality Assurance Coordinator
Assists Lead NPS QA Specialist with NPS QA management. Serves as liaison between NPS management and Agency QA management. Responsible for NPS guidance development related to program quality assurance. Assists with development and maintenance of data management-related standard operating procedures (SOP) for NPS data management. Participates in the development, approval, implementation, and maintenance of the QAPP. Provides input and oversight regarding corrective actions. Maintains record of corrective actions.

City of Lockhart

City of Lockhart, Vance
Rodgers Project Manager
Responsible for ensuring tasks and other requirements in the contract are executed on time and are of acceptable quality. Monitors and assesses the quality of work. Coordinates attendance at conference calls, training, meetings, and related project activities with the TCEQ. Responsible for verifying the QAPP is followed and the project is producing data of known and acceptable quality. Ensures adequate training and supervision of all monitoring and data collection activities. Complies with corrective action requirements.

City of Lockhart, Vance
Rodgers Quality Assurance
Officer
Responsible for coordinating development and implementation of the QA program. Responsible for ensuring the most recent version of the NPS QAPP shell document is acquired from the TCEQ NPS Project Manager and used for writing and maintaining the QAPP. Responsible for maintaining records of QAPP distribution, including appendices and amendments. Responsible for maintaining written records of sub-tier commitment to requirements specified in this QAPP. Responsible for identifying, receiving, and maintaining project quality assurance records. Responsible for coordinating with the TCEQ NPS Manager to resolve QA-related issues. Notifies the City of Lockhart Project Manager and TCEQ NPS Project Manager and documents particular circumstances which may adversely affect the quality of data. Responsible for validation and verification of all data collected and acquired. Coordinates the research and review of technical QA material and data related to water quality monitoring system design and analytical techniques. Facilitates, conducts, and documents readiness reviews, monitoring, and/or technical systems audits.

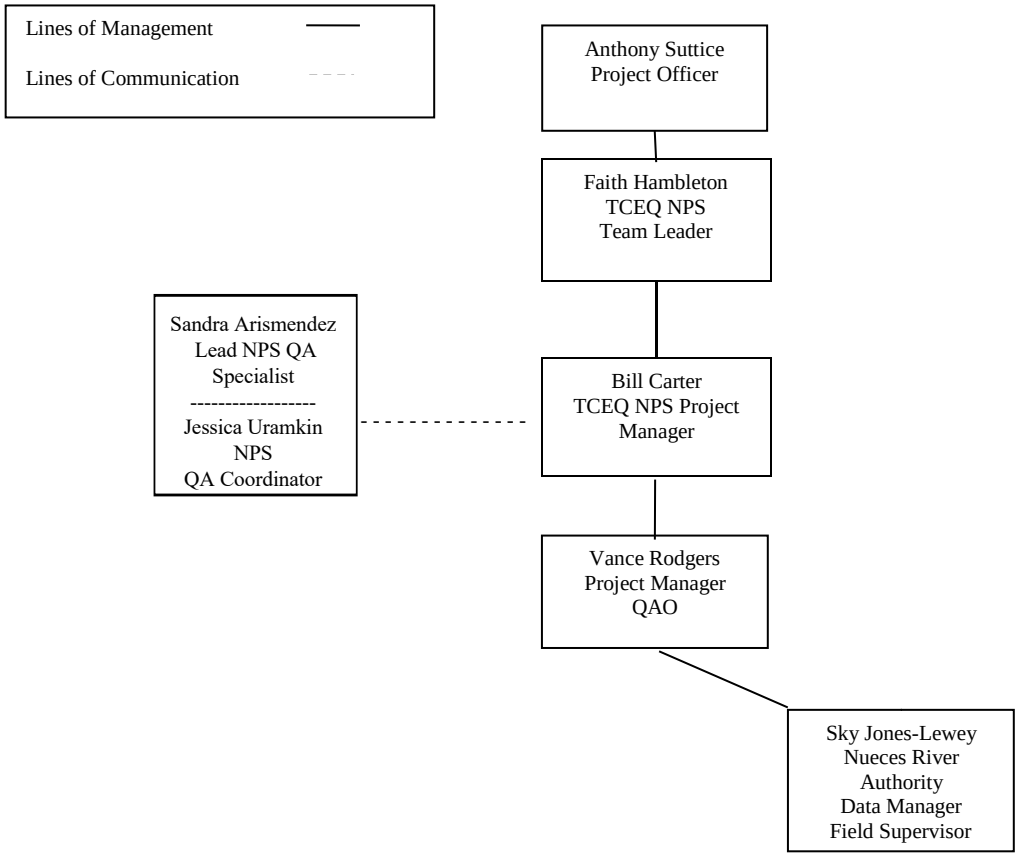
Nueces River Authority, Sky Jones-Lewey
Data Manager
Responsible for the acquisition, verification, and transfer of data to the TCEQ. Oversees data management for the QAPP. Performs data quality assurances prior to transfer of data to TCEQ. Ensures data are submitted according to QAPP and work plan specifications. Provides the point of contact for the TCEQ NPS Data Manager to resolve issues related to the data.

Nueces River Authority, Sky Jones-Lewey
Field Supervisor
Responsible for supervising all aspects of the visual riparian evaluation to meet the quality objectives specified in Section A7, as well as the requirements of Sections B1 through B8. Responsible for field scheduling, staffing, and ensuring that staff is appropriately trained as specified in Section A8. Responsible for adhering to SWQM Procedures and all updates as appropriate.

U.S. EPA Region 6

Anthony Suttice
EPA Project Officer
Responsible for managing the CWA Section 319 funded grant on behalf of EPA. Assists the TCEQ in approving projects that are consistent with the management goals designated under the State's NPS management plan and meet federal guidance. Coordinates the review of project work plans, draft deliverables, and works with the State in making these items approvable. Meets with the State at least annually to evaluate the progress of each project and, when conditions permit, participates in project site visits. Fosters communication within EPA by updating management and others, both verbally and in writing, on the progress of the State's program and on other issues as they arise. Assists in grant close-out procedures ensuring all deliverables have been satisfied prior to closing a grant.

Figure A4.1. Organization Chart - Lines of Communication



A5 PROBLEM DEFINITION/BACKGROUND

According to the 2014 Texas Integrated Report prepared by the TCEQ, Plum Creek, segment 1810_02, is impaired for elevated bacteria concentrations (category 4b) and exhibits concerns for impaired habitat, nitrate, and total phosphorus. Town Branch, segment 1810A, a tributary of Plum Creek, was newly listed in the 2014 Texas Integrated Report with concerns for bacteria, depressed dissolved oxygen, and nitrate. Pollutant sources identified in the Plum Creek WPP include urban storm water runoff, pet waste, failing or inadequate on-site sewage facilities, wastewater treatment facilities, livestock, wildlife, invasive species (feral hogs), and oil and gas production.

In recent years, the City's ongoing management and functionality of the Creek has been impacted by changing environmental conditions. These changes include: 1) increased use from expanding urbanization and recreational activities, and 2) extreme weather over the past ten years that brought dangerous drought conditions from 2010 – 2014 followed by flood events in 2014 - 2016.
The following significant ecological challenges have been observed by the City at Town Branch since the increased development:

- Noncontiguous areas of excessive dense vegetation comprised of invasive exotic species.
- Areas of channel aggradation reflecting increased sediment from storm water runoff at road crossings/culverts and nearby commercial staging areas for transportation projects.
- Areas of low energy dissipation and excessive erosion resulting from the lack of established vegetation and cover - possibly resulting from excessive site management.
- Areas of excessive algae growth due to increased nitrogen in the creek.

As of May 2016, the most recent 2-year geometric mean for E. coli at the CRP routine monitoring station located in Lockhart's City Park was 998 MPN/100mL, up 200% from the previous 2-year figure. The station is located immediately downstream of the proposed LID and riparian enhancement project area. A preliminary survey of the project area determined that critical sections of Town Branch along Lockhart's Urban Trail are highly sensitive to erosion, sedimentation, and urban nonpoint source pollution possibly influenced by improperly managed riparian zones.

This QAPP is reviewed and approved by the TCEQ to help ensure that environmental data generated for the purposes described above are of known and documented quality, deemed acceptable for their intended use.

A6 PROJECT/TASK DESCRIPTION
RIPARIAN EVALUATION

This project will evaluate the riparian functional conditions of Town Branch in the City of Lockhart and will identify opportunities for improved function. The project study area includes all of Town Branch (Segment 1810A), extending from the confluence with Plum Creek upstream to about 0.58 of a mile north of the crossing at SH 130 northwest of the City of Lockhart. The area is approximately 5.6 miles long. For this evaluation the riparian area extends 300 feet on each side of Town Branch and 150 feet on each side of one known, but unnamed tributary. The City of Lockhart has identified this area as the riparian area of

interest for its potential contribution to water quality in Town Branch. The project study area has been divided into 5 named reaches for evaluation.

The City of Lockhart, through their Riparian Contractor, will conduct an aerial and a ground evaluation of the functional condition of potential riparian areas along Town Branch. The aerial evaluation will gather information on the entire creek to be used in performing the ground evaluation. Aerial photography will be used to identify potential on-the-ground evaluation sites, record riparian conditions, and locate opportunity areas for improved function.

The Bull's Eye evaluation method (described in Your Remarkable Riparian Field Guide pages 25-45 and attached here as Attachment 2) will be applied on the ground within the five reaches at sites identified during an aerial survey.

Aerial Evaluation

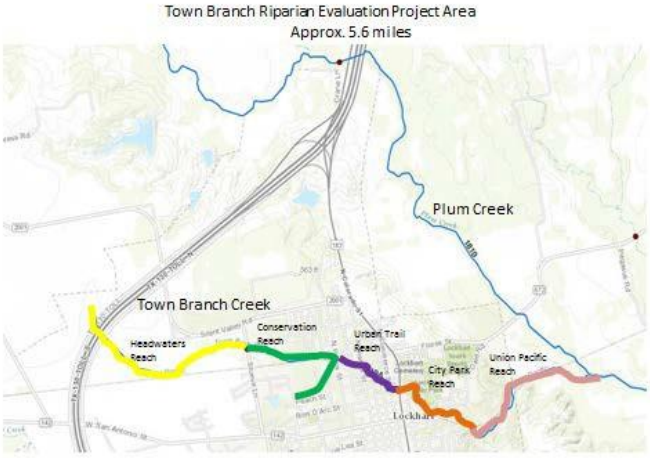
Overall riparian conditions along Town Branch will be evaluated once by helicopter during early summer of 2018. Riparian indicators like floodplain access; energy dissipation; new plant colonization; presence, vigor and diversity of stabilizing vegetation; water storage; channel and bank erosion; and sediment deposition will be considered and documented through description and/or images. Benefits of aerial evaluation include the ability to see the expanse of vegetative cover, areas accessible for ground evaluation and identify overall potential for function and opportunities for improvement.

On-the-Ground Evaluation

At least one on-the-ground riparian evaluation will be conducted within each of the five reaches. The sites for these on-the-ground evaluations will be all the accessible areas where the aerial survey is not conclusive regarding their functional status. The on-the-ground evaluation of the City Park and Urban Trail Reaches will cover their entirety because they have no areas of restricted access, and because they are the focus of active riparian improvement projects.

A Bull's Eye Evaluation worksheet will be completed during the summer of 2018 for each on-the-ground evaluation site using the form at the end of Attachment 2. A ground-level photo will be taken associated with each on-the-ground evaluation.

Project Area Diagram –



Hindrance and Opportunity Identification

Both aerial and on-the-ground evaluation activities will include visual appraisal of existing functional conditions indicated by the factors previously listed, identification of hindrances, and notation of opportunities for enhanced function. A hindrance is any activity or situation that interferes with natural riparian recovery and healthy function and is usually the result of human or animal activity. Hindrances can often be identified through close observation of the riparian vegetation. By addressing an identified hindrance, riparian function may be improved.

The following are common hindrances observed in Texas riparian areas:

- Farming, mowing, or spraying weeds or brush too close to the bank
- Logging and related timber harvest activities adjacent to the creek
- Manicured or altered residential or park landscapes next to the creek
- Prolonged grazing concentrations in creek areas
- Excessive populations of deer, exotics, or feral hogs in creek areas
- Burning in riparian area
- Removal of large dead wood and downed trees
- Artificial manipulation of banks, channels or sediment (bulldozing)
- Physical alteration of floodplain
- Excessive vehicle traffic in creek area
- Excessive recreational activity or foot traffic in creek area Excessive alluvial pumping or other withdrawals
- In some cases, the excessive growth of invasive species that inhibit the ability of native riparian plants to do their job
- Low water dams and large reservoirs
- Poorly designed road crossings and bridges

Evaluation activities, both aerial and on-the-ground, will identify observable hindrances limiting riparian recovery. The Town Branch riparian evaluation report will provide a foundation for further decision-making and for implementing urban riparian practices. It will help guide construction and maintenance of planned LID BMPs, such as rain gardens, and it will help build riparian understanding among stakeholders.

Project-related work tasks:

Subtask 2.4: Monitoring QAPP — The Performing Party, in consultation with the TCEQ Project Manager, Quality Assurance staff, and contractors will develop and submit to TCEQ a QAPP with project-specific DQOs and other components consistent with the following documents:

TCEQ NPS QAPP Shell
EPA Requirements for QAPPs (QA/R5)

The Performing Party will submit the QAPP to TCEQ within 120 days prior to the scheduled initiation of environmental data operations. The QAPP must be signed/fully approved by TCEQ and, if necessary, EPA, before any environmental data operations begin.

Task 4.2: Assessment Report ***(****Riparian Evaluation, identification of hindrances, and opportunities of enhanced function.)* The Performing Party, in coordination with project partners, will develop an Assessment Report (i.e. riparian evaluation) to document functional/dysfunctional areas along creek, and evaluate the water and sediment conditions in the project area. The report will consider floodplain access, energy dissipation, new plant colonization, stabilized vegetation, age diversity of vegetation, species diversity of vegetation, plant vigor, water storage, channel and bank erosion, and sediment deposition.

Amendments

Amendments to the QAPP must be approved to reflect changes in project organization, tasks, schedules, objectives, and methods; address deficiencies and non-conformances; improve operational efficiency; and accommodate unique or unanticipated circumstances. Requests for amendments are directed from the City of Lockhart Project Manager to the TCEQ NPS Project Manager in writing using the QAPP Amendment shell. The changes are effective immediately upon approval by the TCEQ QA Manager, TCEQ NPS Project Manager, TCEQ NPS Data Manager, and Lead NPS Quality Assurance Specialist, or their designees.

Amendments to the QAPP and the reasons for the changes will be documented, and full copies of amendments will be forwarded to all persons on the QAPP distribution list by the City of Lockhart QAO. Amendments shall be reviewed, approved, and incorporated into a revised QAPP during the annual revision process or within 120 days of the initial approval in cases of significant changes.

Annual QAPP Reviews and Revisions

This QAPP shall be reviewed in its entirety and certified annually by the City of Lockhart Project Manager and NPS Project Manager. A letter certifying this annual review must be submitted to the TCEQ NPS Project Manager no later than 90 days prior to the QAPP anniversary date to prevent QAPP expiration and interruption in work due to issuance of stop work order. Amendments approved since QAPP approval (or most recent annual review, if applicable) should be included as an attachment along with the letter. Only non-substantive changes not affecting the project design or quality or quantity of work to be performed can be included in the annual certification letter. This includes organizational changes or schedule changes based on a contract amendment that do not impact data deliverables. If changes beyond these are necessary, a QAPP amendment must be submitted and approved before the changes are implemented and before the annual review may be certified. The TCEQ NPS Project Manager is required to review the QAPP and provide certification of annual reviews to the TCEQ QA Manager and EPA Region 6 Project Officer no later than 30 days before QAPP anniversary date. If the QAPP expires, work described within this document must be halted.

If the project will extend beyond the third QAPP anniversary date, a full QAPP revision is required. This is accomplished by submitting a cover letter, a document detailing changes made if any, and three copies of the fully updated QAPP (including three sets of signature pages).

A7 QUALITY OBJECTIVES AND CRITERIA

The Bull's Eye Riparian evaluation is a method of evaluating riparian function by observation of 10 factors. The method is not quantitative; it is qualitative by nature. In the Town Branch project, the investigator carrying out the evaluations, a riparian professional under contract with the City of Lockhart, will serve as both Field Supervisor and Data Manager. Others, including City staff, volunteers and stakeholders may participate in riparian evaluation activities for outreach, education and capacity building purposes. The observations of others will only be used to call the investigator's attention to things that might otherwise have been missed, and the investigator will directly confirm/verify all such input before using it in reports.

Table A7.1 – Measurement Performance Specifications for Riparian Evaluation Using the Bull's Eye Evaluation tool.

PARAMETER	UNITS	MATRIX	METHOD
Active floodplain presence	Inner Bull's-eye = Functional Middle Bull's-eye = At risk Outer Bull's-eye = Dysfunctional	Riparian Habitat	*Your Remarkable Riparian Field Guide*, NRA 2016. "Learning to See" section. (pages 25-29; 30)
Energy dissipation	Inner Bull's-eye = Functional Middle Bull's-eye = At risk Outer Bull's-eye = Dysfunctional	Riparian Habitat	*Your Remarkable Riparian Field Guide*, NRA 2016. "Learning to See" section. (pages 25-29; 31)
New plant colonization	Inner Bull's-eye = Functional Middle Bull's-eye = At risk Outer Bull's-eye = Dysfunctional	Riparian Habitat	*Your Remarkable Riparian Field Guide*, NRA 2016. "Learning to See" section. (pages 25-29; 32)
Stabilized riparian vegetation presence	Inner Bull's-eye = Functional Middle Bull's-eye = At risk Outer Bull's-eye = Dysfunctional	Riparian Habitat	*Your Remarkable Riparian Field Guide*, NRA 2016. "Learning to See" section. (pages 25-29; 33)
Age diversity	Inner Bull's-eye = Functional Middle Bull's-eye = At risk Outer Bull's-eye = Dysfunctional	Riparian Habitat	*Your Remarkable Riparian Field Guide*, NRA 2016. "Learning to See" section. (pages 25-29; 34)
Species diversity	Inner Bull's-eye = Functional Middle Bull's-eye = At risk Outer Bull's-eye = Dysfunctional	Riparian Habitat	*Your Remarkable Riparian Field Guide*, NRA 2016. "Learning to See" section. (pages 25-29; 35)
Plant vigor	Inner Bull's-eye = Functional Middle Bull's-eye = At risk Outer Bull's-eye = Dysfunctional	Riparian Habitat	*Your Remarkable Riparian Field Guide*, NRA 2016. "Learning to See" section. (pages 25-29; 36)
Water storage	Inner Bull's-eye = Functional Middle Bull's-eye = At risk Outer Bull's-eye = Dysfunctional	Riparian Habitat	*Your Remarkable Riparian Field Guide*, NRA 2016. "Learning to See" section. (pages 25-29; 38)
Bank and channel erosion	Inner Bull's-eye = Functional Middle Bull's-eye = at risk Outer Bull's-eye = Dysfunctional	Riparian Habitat	*Your Remarkable Riparian Field Guide*, NRA 2016. "Learning to See" section. (pages 25-29; 39)
Sediment deposition	Inner Bull's-eye = Functional Middle Bull's-eye = At risk Outer Bull's-eye = Dysfunctional	Riparian Habitat	*Your Remarkable Riparian Field Guide*, NRA 2016. "Learning to See" section. (pages 25-29; 40)

Table A7.1 References:

- Riparian Bull's Eye Evaluation method and worksheet (Attachment 2)
- Nueces River Authority: *Your Remarkable Riparian Field Guide to Riparian Plants Found Within Most of Texas,* Third Edition, NRA 2016.

Precision

The Bull's Eye Riparian evaluation method has been shown to be effective in guiding local decision making to address identified hindrances and enhance riparian functional conditions.

Accuracy

The Bull's Eye Riparian evaluation method is a guided observation tool, subjective by nature and not quantitative.

Representativeness

No sampling is involved in this project. All data/observations are based on the entire area being evaluated. Representativeness does not apply as there is no extrapolation from areas actually observed to a larger area. No projection is being made from the time frame of the observations.

Completeness

The goal of this project is to observe and photo-document 100% of the study area from the air and 100% of the sites selected for on-the-ground observation as presented in A6 and B1. Evaluation will place special focus on the Urban Trail reach and the City Park reach which are of particular interest for the City of Lockhart.

Comparability

Riparian areas across the country operate in the same way in terms of physical processes. Functional conditions within riparian areas can be compared between and among diverse landscapes and climates. The subjective nature of the evaluation tool introduces evaluator bias, but comparability is possible using the same 10 parameters of which any that are not applicable may be ignored without consequence.

A8 SPECIAL TRAINING/CERTIFICATION

Not applicable

A9 DOCUMENTS AND RECORDS

Records and Documents Retention Requirements

The documents that describe, specify, report, or certify activities are listed. Electronic records are backed up at least every 30 days and are kept on multiple computers.

Document/Record	Location	Retention	Form
Complete original data sets (physical submission)	City of Lockhart	7 years	Electronic
Corrective Action Documentation	City of Lockhart	7 years	Electronic
QAPP, amendments, appendices	TCEQ/City of Lockhart	7 years	Electronic
QAPP distribution documentation	City of Lockhart	7 years	Electronic

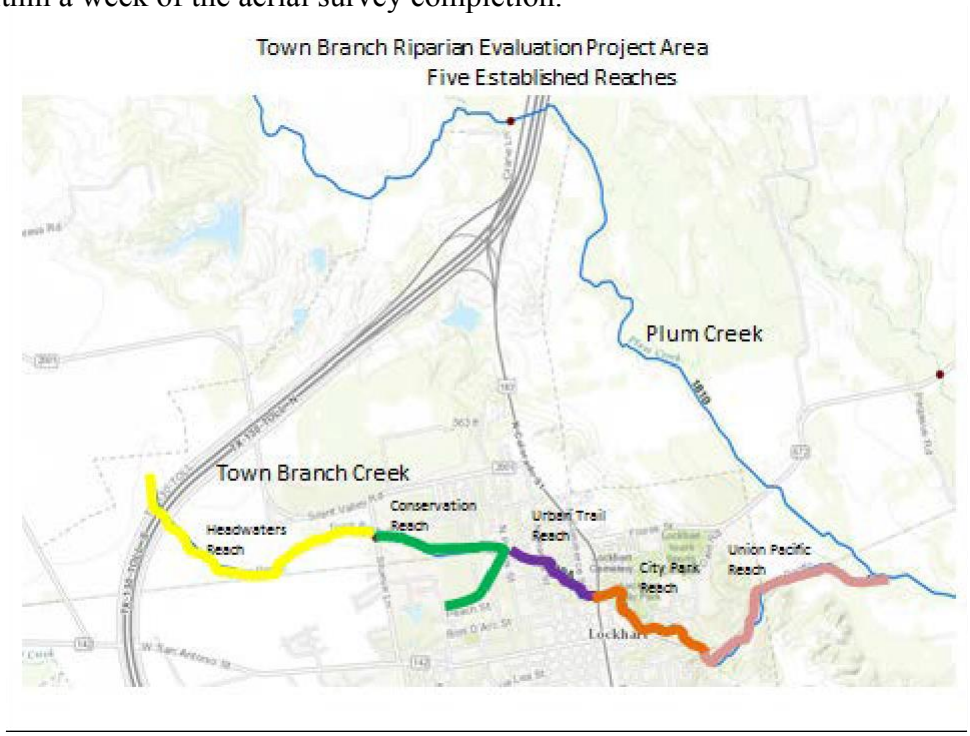
Electronic Data
Data will be submitted to the TCEQ NPS Project Manager in a report format.

Records and Documents Retention Requirements

Document/Record	Location	Retention	Form
QAPP, amendments, annual certifications, and appendices	Org.	5 years	Paper
QAPP distribution documentation	Org.	5 years	Paper
Training records	Org.	5 years	Paper
Field notebooks or field data (Bull's-eye)sheets/ photos	Org.	5 years	Paper
Corrective action documentation	Org.	5 years	Paper
Progress report/final report	Org.	5 years	Paper

B1 STUDY DESIGN AND METHODS

Riparian conditions along Town Branch (1810A) will be evaluated both aerially and on-the-ground. For the purpose of describing riparian functional conditions and identifying opportunities for improved function, Town Branch project study area has been defined and divided into five reaches. The project area begins about 0.58 miles north of SH 130 and ends with the creek's confluence with Plum Creek. The area is approximately 5.6 miles long. No GIS mapping is planned in association with this project, but Google Earth Pro 7.3.1.4507 (32-bit) will be used to make measurements and locate sites. The length of each reach will be measured in Google Earth Pro, and the size of the riparian area evaluated in this study will be calculated based on 300 feet on each side of the channel of the creek and 150 feet on each side or the unnamed tributary. The metadata for the Google Earth Pro imagery for this area of Lockhart is from Landsat/Coperniucus on 1/21/2018. If more recent imagery is available, it will be downloaded within a week of the aerial survey completion.



Aerial evaluation

The investigator will use a licensed helicopter service to conduct an aerial survey of the riparian area. This survey will include a continuous stream of photographs of the entire length of Town Branch from its headwater near SH 130 to its confluence with Plum Creek. The aerial evaluation will provide a general overview of the creek's riparian functional condition.

Ground evaluation

Following the aerial evaluation, the investigator will identify at least one on-the-ground riparian evaluation site within each of the five reaches. An on-the-ground evaluation site may include all of the riparian area for a reach or may be a smaller section within a reach. On-the-ground evaluations will be made in all accessible areas where the aerial survey is inconclusive regarding the functional condition and potential hindrances in an area. At least one photograph will be taken at each on-the- ground site during the evaluation. The sites will be evaluated using the qualitative tool, The Riparian Bull's Eye Evaluation Worksheet at the end of Attachment 2, which contains relevant excerpts from *Your Remarkable Riparian Field Guide to Riparian Plants Found Within Most of Texas*, Third Edition, NRA 2016. This method offers a way of evaluating the riparian zones of perennial or seasonal creeks and rivers in a uniform manner.

Each evaluation record consists of a circular "target" chart containing three concentric rings, representing 3 possible levels of riparian functional status:

- poor health and function (outer ring),
- at risk (middle ring), or
- healthy and functioning (inner ring).

The investigator completes the chart for each site by placing a mark in the "target" to indicate the status of the site with regard to each of the 10 indicators listed below and by marking a checklist to identify activities that may be hindering the natural riparian recovery process. The investigator also records detailed observations relevant to rating the site and evaluating the nature and significance of potential hindrances.

The following are indicators of riparian function considered in the Bull's Eye evaluation method:

1. Active Floodplain. Does floodwater have access to a floodplain? Floodplain access gives floodwater a place to spread out and slow down. Sediment deposition associated with the slow down offers increased water storage. Areas with good floodplain access will have debris or silt deposits where the vegetation is thick in the floodplain.
2. Energy Dissipation. Is there enough "stuff" in channels, on banks, and in the floodplain to dissipate flood energy. Signs include vegetation, rocks, or dead wood in the flood plain to help slow down floodwaters. Slowing down floodwaters is essential for healthy functioning riparian areas.
3. New Plant Colonization. Is trapped sediment being successfully colonized by new plants? Look for growth in newly deposited sediment. New plants stabilize the floodplain and allow for more water storage.
4. Stabilizing Vegetation. Are banks covered with strong stabilizing plants? Strong-rooted plants are needed to withstand the energy of floodwaters. Plants are rated for their ability to withstand floods with a stability rating (SR). SR1 is bare ground and SR10 is equivalent to the strength to anchored rock. SR6/7 is considered the minimum SR necessary for adequate bank stability. These ratings are based on the information published in *USDA TR47: Monitoring Vegetation Resources in Riparian Areas*, A. Winward, 2000, and have been adjusted by Steve Nelle based on his observations across Texas. A majority of plants with an average of SR6/7 and/or the presence of large wood or boulders will result in Bull's eye scores.
5. Age Diversity. Are young, middle-aged, and mature riparian plants present? Age diversity of riparian plants is an indicator of health. Different aged plants offer stability during fluctuations in flow and climactic conditions. A range of young to old plants is indicative of a Bull's eyescore.
6. Species Diversity. Are several key, native riparian plant species present? Diversity contributes to system stability and resilience. Various species of native trees, sedges, and grasses can be identified using the Remarkable Riparian field guide
7. Plant Vigor. Are riparian plants vigorous and healthy? Plants that are continuously browsed, mowed, or grazed can have compromised root systems, and might not be able to dissipate flood energy and stabilize banks. Plants with leaves intact and for plants that are not stunted or scarred can indicate Bull's eye conditions.
8. Water Storage. Are the banks and floodplain storing water? Using the wetland indicator status based on the U. S. Fish and Wildlife Service's Wetland Plant List (1988), for Obligate (OBL) and Facultative Wetland (FACW) plants which indicate water storage.
9. Bank and Channel Erosion. Is bank and channel erosion balanced with deposition on point bars? Creation and maintenance of meander banks help dissipate energy and

compensate for erosion through deposition. Meander bends where point bars are being formed with the eroded material downstream of cut banks can indicate balance. Out of balanced bank and channel erosion will show down-cut channels or incised channels that resemble drainage ditches.

10. Sediment Deposition. Is sediment being deposited in a balanced way? If there is not enough water to process large amounts of sediment being moved downstream, sediment can build up in mid-channel and in other illogical places. Heaps and piles of sediment in the channel, or mounds of sediment trapped behind a structure with unnatural erosion below, show out of balance conditions.

B2 SAMPLING METHODS

Field Sampling Procedures

During the aerial evaluation of the entire length of Town Branch, the investigator will observe riparian conditions in general with an eye for indicators of health and opportunities for enhancement. Aerial photographs will be taken with a GPS-equipped Sony Cyber-shot DSC- HX400V camera with 16.2 megapixels resolution. Photographs covering the project area will be plotted on satellite imagery by their location using Adobe Photoshop Lightroom 5.7. The accuracy of the latitude and longitudes plotted from some photos may vary by up to 50'. This variability is compatible with accurately locating the area on Google Earth. A GoPro® Hero 3 Black Edition will be used to record a stream of still photographs.

The investigator will then use the Bull's Eye worksheets, field notes, and photographic records to prepare a Field Data Reporting Form (Appendix D) for each site and reach evaluated. For ground observation sites within each of the five identified reaches, the investigator will visually observe the entire site and rate it in regard to the riparian evaluation indicators on a Bull's Eye evaluation worksheet. The Bull's Eye method is described in Attachment 2. Field observations will initially be recorded on Bull's Eye worksheets, included in the final two pages of Attachment 2, together with descriptive field notes for each site. The investigator will use this worksheet to rate each site in regard to each of the previously described indicators on a three-band circular chart representing approximate distance from an ideal condition. Each on-the-ground site will be photographed. The investigator will identify and describe the observable hindrances to riparian recovery for each site.

For the purposes of this section all field personnel should follow the basic rules for recording information as documented below:

- Loose-leaf field notes and field forms may be recorded legibly in indelible ink (preferred) or pencil with no erasures, modifications, write-overs, or multi-line cross-outs. Bound field notes and forms and in-house field and lab records (multiprobe calibration logs, bench logs, etc.,) must be recorded in indelible ink with no modifications, write-overs or multi-line cross-outs.
- Errors are to be corrected with a single line-through followed by initials and a date.
- Close-out incomplete pages with an initialed and dated diagonal line

The investigator will draw upon the information generated in the aerial evaluation as a reference in completing the ground evaluations as well as in preparing overall evaluations for each reach. An evaluation report will summarize aerial and ground observations of Town Branch riparian function and will identify activities that may be hindering the natural riparian recovery process as well as opportunities for improved function.

Sample Containers

N/A

Processes to Prevent Contamination
N/A

Documentation of Field Sampling Activities
N/A

Recording Data
Riparian evaluation and observation data are collected in accord with the protocol described in Attachment 2 and recorded on the Bull's-Eye Worksheet in Attachment 2, on the Field Data Reporting Form in Appendix D, and in associated field notes.

B3 SAMPLE HANDLING AND CUSTODY
N/A

B4 ANALYTICAL METHODS
N/A

B5 QUALITY CONTROL
Field work sheets, a.k.a. Bull's eye evaluation forms, may be handwritten or typed on a field laptop by the evaluator. If handwritten, sheets will be scanned to preserve original character. Evaluation reports will be typed by the evaluator upon returning to office in Microsoft Word.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE
Camera equipment, including battery life, will be inspected and confirmed to be in operating order according to manufacturer's specifications, prior to the helicopter survey. Extra batteries will be included for use if needed during the survey.

B7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY
N/A

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES
N/A

B9 NON-DIRECT MEASUREMENTS
N/A

B10 DATA MANAGEMENT

Data Management Process
The investigator, who serves as field supervisor and data manager, will conduct all observations and photography, prepare the Bull's Eye worksheets, field notes, and Field Data Reporting Forms, and report the finding in the evaluation report.

See Appendix E for the Data Management Process Flow Chart.

Record-keeping and Data Storage
Photographs, Bull's Eye worksheets, field notes, Field Data Reporting Forms, and reports will be stored in the City of Lockhart offices in accordance with the record-retention schedule in Section A9.

Archives/Data Retention
Complete original paper copies of photographs, Bull's Eye worksheets, Field Data Reporting Forms, and reports will be retained on-site by the City of Lockhart for a retention period specified in section A9.

Data Verification/Validation
N/A

Forms and Checklists
Riparian Bull's-Eye Evaluation Worksheet (See end of Attachment 2) Field Data Reporting Forms (see Appendix D)

Data Dictionary
N/A

Data Handling
The investigator will measure the length of each of the 5 reaches with the polygon tool in Google Earth Pro. The riparian area examined in this study will be defined as the zone extending 300 feet on each side of the channel of the creek and 150 feet on each side of the channel of the unnamed tributary. The Google Earth Pro tool will also tell the measurement of the project area in square miles.

Each geo-referenced photo will be loaded into Adobe Photoshop Lightroom 5.7 for presentation purposes and for guiding the ground surveys based on the aerial photos.

Hardware and Software Requirements
Hardware to be used:
Dell™ desktop computer, Dell™ laptop computer, Sony™ Cyber-shot camera, GoPro™ Hero 3 camera
Software to be used:
Adobe Photoshop Lightroom 5.7, Microsoft Word, Microsoft Excel, Adobe Acrobat Standard DC, Google Earth Pro

Information Resource Management Requirements
Contractor provides all information to project manager in the previously specified format.

Quality Assurance/Control
See Section D of this QAPP

C1 ASSESSMENTS AND RESPONSE ACTIONS

The following table presents the types of assessments and response action for data collection activities applicable to the QAPP.

Table C1.1 Assessments and Response Requirements

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	City of Lockhart Project Manager	Monitoring of the project status and records to ensure QAPP requirements are being fulfilled.	Report to TCEQ in Quarterly Progress Reports
Review of Field Data Sheets	Within 30 days of the first survey event	City of Lockhart Project Manager TCEQ NPS Project Manager	The City of Lockhart Project Manager will submit field sheets from the first survey event within 30 days of the event. The TCEQ NPS Project Manager will review the data for conformance with the QAPP.	The City of Lockhart Project Manager has 14 days to respond to TCEQ NPS Project Manager comments. If needed, Corrective Action Plans will be provided within 30 days.
Site Visit	Dates to be determined by TCEQ	TCEQ PM	Status of activities. Overall compliance with work plan and QAPP	As needed
Monitoring Systems Audit	Dates to be determined by TCEQ	TCEQ QAS	The assessment will be tailored in accordance with objectives needed to assure compliance with the QAPP. Field sampling, handling and measurement; facility review; field instrument calibration logs; and data management as they relate to the NPS Project.	30 days to respond in writing to the TCEQ to address corrective actions

Corrective Action Process for Deficiencies and Nonconformances

Deficiencies are any unauthorized deviations from the approved QAPP and procedures referenced in the QAPP. Deficiencies may invalidate resulting data. All deficiencies from the QAPP require documentation of the nonconformance and corrective action. Deficiencies must be documented in a corrective action plan and corrected in a timely manner. Corrective action may include discarding survey data and conducting additional surveys. Deficiencies are documented in logbooks, field data sheets, etc. by field staff. It is the responsibility of the City of Lockhart Project Manager, in consultation with the City of Lockhart QAO, to ensure that the actions and resolutions to the problems are documented and that records are maintained in accordance with this QAPP. Nonconformances and corrective actions will be conveyed to the TCEQ NPS Project Manager, in a manner fitting the severity of the deficiency:

- **For deficiencies that impact the quality or quantity of data:** If the City of Lockhart Project Manager, in consultation with project staff, determines that the deficiency can have serious effect on the validity, integrity, quality, or quantity of the data, then a non-conformance must be communicated to the TCEQ NPS Project Manager and Lead NPS QAS immediately in writing. A Corrective Action Plan Form (See Appendix G for the form and an example) must be submitted to the TCEQ NPS Project Manager and Lead NPS QAS within 14 days of the deficiency occurring.
- **For deficiencies that do <u>not</u> impact the quality or quantity of data:** If the City of Lockhart Project Manager, in consultation with project staff, determines that the deficiency will not have a serious effect on the validity, integrity, quality, or quantity of

the data, then the nonconformance and corrective action must be documented in a timely manner. The deficiency will be communicated to the TCEQ NPS Project Manager through the Corrective Action Status Table (see Appendix F for the table and an example) to be included with the quarterly progress report.

The City of Lockhart Project Manager is responsible for implementing and tracking corrective actions. All Corrective Action Plans will be documented on the Corrective Action Status Table, which will be submitted to the TCEQ NPS Project Manager with the quarterly progress report for review and approval. Records of TCEQ audit findings and corrective actions are maintained by both the TCEQ and the City of Lockhart QAO. Documentation of corrective action to address audit findings will be submitted to the TCEQ within 30 days of receipt of audit report.

If audit findings and corrective actions cannot be resolved, then the authority and responsibility for terminating work are specified in the TCEQ QMP and in agreements in contracts between participating organizations.

Corrective Action Plans

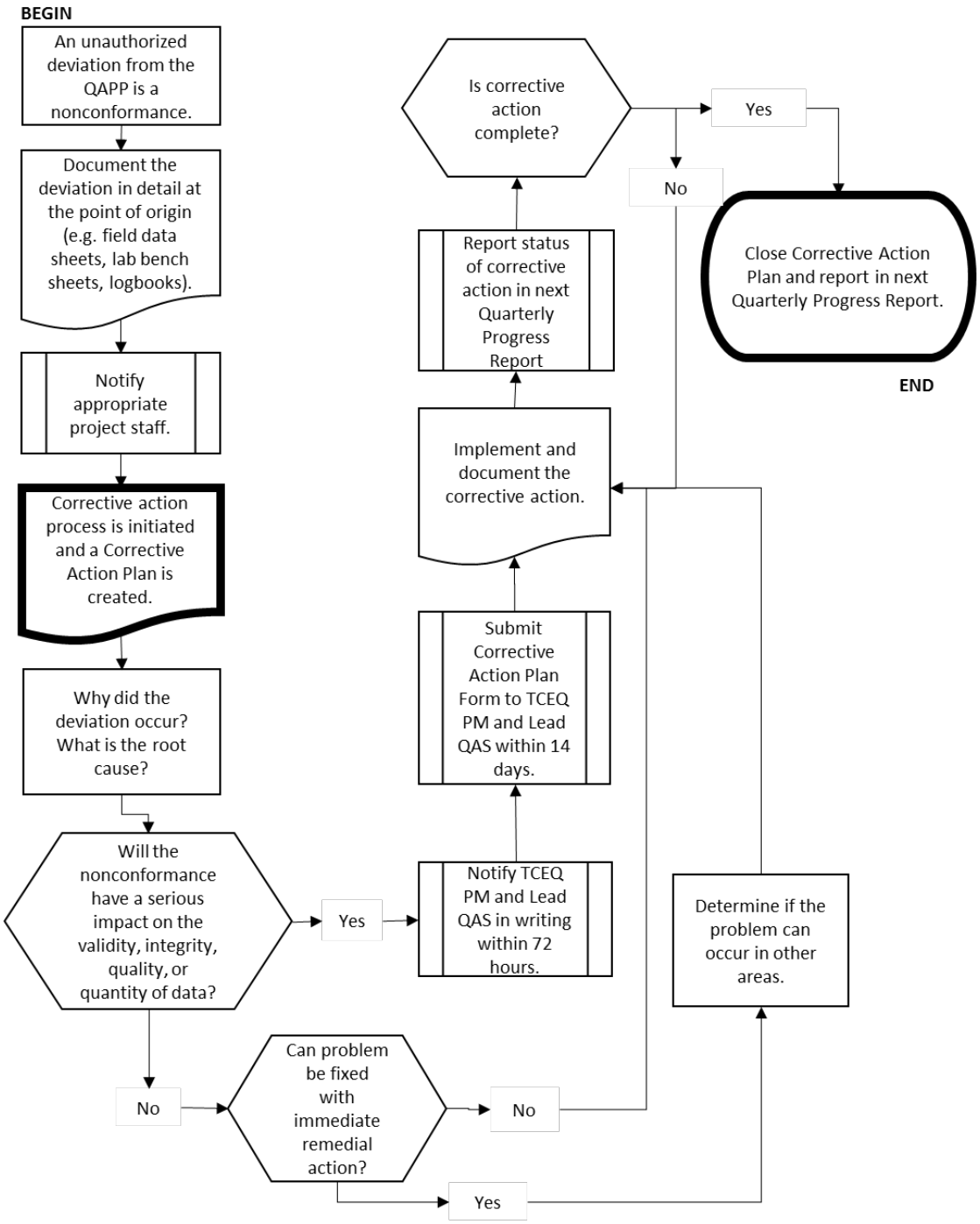
Corrective Action Plans should:

- Identify and describe the deficiency, problem, nonconformity, or undesirable situation
- Identify the underlying cause(s) of the problem
- Identify programmatic impact of the deficiency
- Identify whether the problem is likely to recur, or occur in other areas
- Identify immediate remedial actions if possible
- Include a description of the need for Corrective Action
- Include a description of cause(s), determine solution, and propose an action plan
- Establish timelines and provide a schedule
- Identify personnel responsible for action
- Document the corrective action

To facilitate the process a flow chart has been developed (see figure C1.1: Corrective Action Process for Deviations).

Corrective Action for Deviations

Figure C1.1 Corrective Action Process for Deviations



C2 REPORTS TO MANAGEMENT

Reports to TCEQ Project Management

All reports detailed in this section are contract deliverables and are transferred to the TCEQ in accordance with contract requirements and the contract schedule of deliverables.

Quarterly Progress Report - Summarizes the City of Lockhart's activities for each task; reports monitoring status, problems, delays, and corrective actions; and outlines the status of each task's deliverables.

Assessment Report (Subtask 4.2) Presents the results of the riparian assessment, including a list of prioritized dysfunctional conditions and areas of the creek with photos and documentation.

Final Project Report - Summarizes the City of Lockhart's activities for the entire project period including a description and documentation of major project activities; evaluation of the project results and environmental benefits; and a conclusion.

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

For the purposes of this document, data verification is a systematic process for evaluating performance and compliance of a set of data to ascertain its completeness, correctness, and consistency using the methods and criteria defined in the QAPP. Validation means those processes taken independently of the data-generation processes to evaluate the technical usability of the verified data with respect to the planned objectives or intention of the project. Additionally, validation can provide a level of overall confidence in the reporting of the data based on the methods used.

All data obtained from field measurements will be reviewed and verified by the City of Lockhart QAO for conformance to project requirements, and then validated against the data quality objectives which are listed in Section A7. Only those data which meet the measurement performance specification defined in this QAPP will be considered acceptable and submitted to the TCEQ.

The procedures for verification and validation of data are described in Section D2, below. The City of Lockhart Field Supervisor/Data Manager is responsible for ensuring that field data are properly reviewed and verified for integrity, and for ensuring that all non-qualified data are properly reviewed and verified and submitted in the required format. The City of Lockhart QAO is responsible for validating a minimum of 10% of the data produced in each task. Finally, the City of Lockhart Project Manager, with the concurrence of the City of Lockhart QAO, is responsible for validating that all data to be reported meet the objectives of the project and are suitable for reporting to TCEQ.

D2 VERIFICATION AND VALIDATION METHODS

All field records will be verified to ensure they represent the locations where measurements were made, and that the records conform to project specifications. The staff and management of the respective field and data management tasks are responsible for the integrity, validation, and verification of the records each task generates or handles throughout each process. The field tasks ensure the verification of raw data and electronically generated data.
Verification, validation, and integrity review of data will be performed using self-assessments and peer review, as appropriate to the project task, followed by technical review by the manager of the task. The records to be verified (listed in Table D2.1) are evaluated against project performance specifications (Section A7) and are checked for errors. If a question arises or an error is identified, the issues are corrected and documented electronically or by initialing and dating the associated paperwork. If an issue cannot be corrected, the task manager consults with project management to establish the appropriate course of action, or the records associated with the issue are rejected.

The City of Lockhart Project Manager/QAO is responsible for validating that the verified data meet the data quality objectives of the project and are reportable to TCEQ. One element of the validation process involves evaluating the records again for anomalies. Any suspected errors or anomalous records must be addressed by the investigator before data validation can be completed. A second element of the validation process is consideration of any findings identified during the assessments listed in Table C1.1. Any issues requiring corrective action must be addressed, and the potential impact of these issues on previously collected information will be assessed by the City of Lockhart Project Manager/QAO, who validates that the data meet the data quality objectives of the project and are suitable for reporting to TCEQ.

Table D2.1
Data Verification Procedures

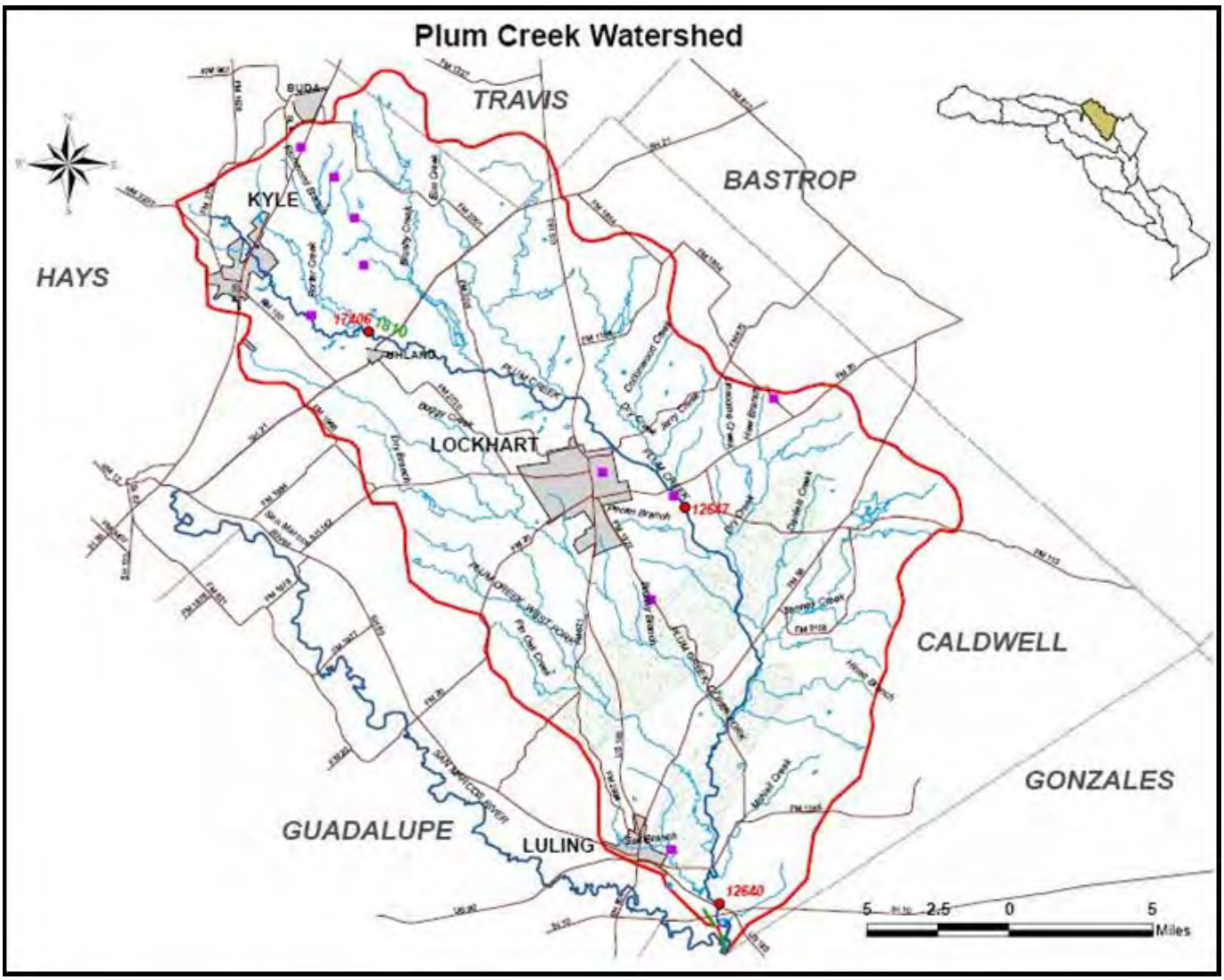
Data to be Verified	Field Task	QAO City of Lockhart Task
Field documentation (e.g., biological, stream habitat) complete	Y	
Results, calculations, transcriptions checked	Y	
Nonconforming activities documented	Y	Y
Reasonableness check performed	Y	
Absence of electronic errors confirmed	Y	Y
10% of data manually reviewed		Y

D3 RECONCILIATION WITH USER REQUIREMENTS

The purpose of this qualitative evaluation is to inform decision-making. The reported findings will contain sufficient detail regarding the indicators of functional status in

specific portions of the study area to provide meaningful guidance in identifying and prioritizing measures to be taken to improve the riparian functional status of the study area.

Appendix A. Area Location Map



Appendix B. Scope of Work

Note: This is the project Scope of Work, modified to incorporate changes introduced by Amendment #1. The Scope of Work references this Monitoring QAPP in Subtask 2.4, and only Subtask 4.2 (Riparian Evaluation) and Task 8 (Final Report) are addressed by this QAPP.

This project implements the Plum Creek WPP. The best management practices (BMPs) will be installed in the City of Lockhart along Town Branch Creek (segment 1810A), a tributary of Plum Creek. Town Branch Creek is identified in the *2014 Texas Integrated Report of Surface Water Quality* with concerns for bacteria, depressed dissolved oxygen, and nitrate.

The BMPs in this project include a rain garden and riparian improvements which will reduce the volume of project area stormwater runoff and bacteria, sediment, and nutrient loads. The development and adoption of operation and maintenance (O and M) for the BMPs is also included.

To engage the local residential and commercial community, activities that promote feedback and interest in improving water quality conditions at Town Branch Creek will be implemented. A communication campaign including website updates and flyers will educate the public on nonpoint source (NPS) pollution. Improving the park grounds will engage the public at the riparian improvement site.

Task 1: Project Administration

Objective: To effectively administer, coordinate, and monitor all work performed under this project including technical and financial supervision and preparation of status reports.

Subtask 1.1: Project Oversight — The Performing Party will provide technical and fiscal oversight of the staff and/or subgrantee(s)/ subcontractor(s) to ensure Tasks and Deliverables are acceptable and completed as scheduled and within budget. With the TCEQ Project Manager's authorization, the Performing Party may secure the services of subgrantee(s)/ subcontractor(s) Project oversight status will be provided to TCEQ with the Quarterly Progress Reports (QPRs).

Subtask 1.2: QPRs — The Performing Party will submit QPRs to the TCEQ Project Manager by the 15th of the month following each state fiscal quarter for review by the TCEQ Project Manager and incorporation into the United States Environmental Protection Agency (EPA)'s Grant Reporting and Tracking System (GRTS). QPRs will include reporting on status of Deliverables and proposed revisions to due dates, narrative description of progress by Task, and status of nonconformances/corrective actions. A template for the QPR will be provided to the Performing Party by the TCEQ Project Manager.

Subtask 1.3: Reimbursement Forms — The Performing Party will submit Reimbursement Forms to the TCEQ Contract Manager in accordance with the Special Terms and Conditions Number 4 Cost Budget, Article B. Invoice Submittal.

Subtask 1.4: Contract Communication — The Performing Party will participate in a post-award orientation meeting with TCEQ within 30 days of Contract execution.

The Performing Party will maintain regular telephone and/or e-mail communication with the TCEQ Project Manager regarding the status and progress of the project in regard to any matters that require attention between QPRs. This will include a quarterly conference call to discuss Project Tasks, financial status, QAPP and correction actions, and any other matters that require attention. The TCEQ Project Manager may request additional information from the Performing Party prior to the call or meeting. The Performing Party will submit meeting notes (action items at a minimum) to the TCEQ Project Manager within seven days.

The quarterly conference call held the first quarter of each fiscal year of the project will be used to discuss, at a minimum, any staff changes, the previous year's performance, budget estimates, invoicing issues, quality assurance issues, overall project progress, and a plan for the current fiscal year. The Performing Party will submit meeting notes (action items at a minimum) to the TCEQ Project Manager within seven days.

Matters that must be communicated to the TCEQ Project Manager include, but are not limited to:

- Notification a minimum of 14 days before the Performing Party has scheduled public meetings or events, initiation of construction, or other major Task activities.
- Notification within 48 hours regarding events or circumstances that may require changes to the Budget, Scope of Work, or Schedule of Deliverables.

Subtask 1.5: Coordination Meeting with EPA — The Performing Party will attend a project update and coordination meeting with EPA in Dallas upon request by TCEQ and EPA to share progress on goals, measures of success, challenges, and opportunities.

Subtask 1.6: Annual Report Article — The Performing Party will provide an article for the NPS Annual Report upon request by TCEQ. The article will include a brief summary of the project and describe the activities of the past fiscal year.

Subtask 1.7: Contract Budget Updates — The Performing Party will discuss annual fiscal year budgets with the TCEQ Project Manager on a quarterly basis. Starting in the second year of the project, the Performing Party will provide an Annual Budget Update that details state fiscal year spending projections as associated with planned project activities. These updates will be discussed quarterly at a minimum. They will be revised when fiscal year spending projections change by 10% or more, or upon request by the TCEQ Project Manager. The update in the final year of the project will include a budget for all remaining project activities. The template for the annual budget update will be provided by the TCEQ Project Manager.

Deliverables:

- QPRs
- Reimbursement Forms
- Post-award Meeting Notes with action items
- Conference calls, meeting notes and action items
- Coordination meeting with EPA (upon request)
- Annual Report Article and pictures (upon request)
- Contract Budget Updates
- Annual Budget Updates

Task 2: Quality Assurance and Load Reduction Estimation

Objective: To refine, document, and implement data quality objectives (DQOs) and quality assurance/quality control (QA/QC) activities that ensure data of known and acceptable quality are generated by this project.

Subtask 2.1: QAPP Planning Meetings — The Performing Party will schedule a QAPP planning meeting with the TCEQ Project Manager, Quality Assurance staff, technical staff, and contractors within 30 days of Contract execution, to implement a systematic planning process based on the elements in the TCEQ NPS QAPP Shell. The information developed during this meeting will be incorporated into a QAPP. The storage location of data records, and how data should be coded, if applicable, will also be determined during these meetings. The Performing Party may conduct additional meetings to determine whether changes to an existing QAPP are needed.

Subtask 2.2: Modeling QAPP — The Performing Party will develop and submit to TCEQ a QAPP with project-specific DQOs consistent with the EPA Requirements for QAPP for Modeling QA/G-5M format 120 days or more prior to the scheduled initiation of environmental data operations associated with modeling activities. The QAPP will be developed by The Performing Party in consultation with the TCEQ Project Manager, QA staff, technical staff, and contractors. The QAPP must be signed/fully approved by TCEQ, and if necessary, EPA, before any environmental data operation begins.

Activities covered under this QAPP:
Modeling project BMPs for the purpose of estimating load reductions achieved.

Tasks covered under this QAPP:

- Task 2, 8

Tasks NOT covered under this QAPP:

- All other tasks

Subtask 2.3: Estimation of Load Reductions – The Performing Party will submit a draft report on the use of the approved model to estimate the pollutant load reductions achieved by the project BMPs using the initial BMP design data, and a final report using the as-built BMP designs when they are completed.

Subtask 2.4: Monitoring QAPP — The Performing Party, in consultation with the TCEQ Project Manager, Quality Assurance staff, and contractors, will develop and submit a QAPP with project-specific DQOs and other components consistent with the following documents:

TCEQ NPS QAPP Shell
EPA Requirements for QAPPs (QA/R5)

The Performing Party will submit the QAPP to TCEQ within 120 days prior to the scheduled initiation of environmental data operations. The QAPP must be signed/fully approved by TCEQ and, if necessary, EPA, before any environmental data operations begin.

Tasks covered under this QAPP:

- Tasks 4 (Riparian Evaluation) and 8 (Final Report)

Tasks NOT covered under this QAPP:

- All other tasks

Subtask 2.5: QAPP Annual Reviews and Revisions — The Performing Party will submit documentation certifying its annual review of both QAPPs no less than 90 days prior to the QAPP anniversary date. Amendments approved since the initial QAPP approval or a subsequent certified annual review (if applicable) must be submitted along with the certification. If extensive changes to a QAPP are necessary, a full revision is required. Once TCEQ certifies the annual review or approves the full revision, the QAPP effective period is extended an additional year. No work described in a QAPP shall be conducted outside the effective period for the QAPP.

Subtask 2.6: QAPP Amendments — The Performing Party will submit Amendments when changes to either of the QAPPs are necessary. Amendments should be submitted within 90 days prior to the scheduled initiation of changes. A justification, summary of changes, and detail of changes must be provided with the Amendment. The Performing Party will ensure that changes conveyed within Amendments are not implemented until the Amendment is fully approved by TCEQ.

Deliverables:

- QAPP Planning Meeting Notes
- Draft and Final Modeling QAPPs
- Draft and Final Reports on Pollutant Load Reductions
- QAPP Annual Reviews and Revisions
- Draft and Final QAPP Amendments

Task 3: Subcontractors for Grant Administration

Objective: To hire a contractor for grant and contract administration.

Subtask 3.1: Obtain Bids and Hire Subcontractor — The Performing Party will develop and secure bids to hire a subcontractor to administer grant and contract management functions which will be consistent with federal and state requirements consistent with EPA's general grant regulations at 40 CFR parts 31 *(Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments).*

Deliverables:

- Documentation of bid solicitation
- Documentation a subcontractor is hired

Task 4: Riparian Evaluation and BMP Plan

Objective: To evaluate current impaired conditions in the Town Branch Creek riparian zone and plan BMPs to address them.

Subtask 4.1: Hire Subcontractor — The Performing Party will obtain bids and hire a contractor for riparian zone evaluation to determine where imbalances occur and improvements are necessary.

Subtask 4.2: Assessment Report — The Performing Party, in coordination with project partners, will develop an Assessment Report to document functional/dysfunctional areas along creek, and assess the water and sediment conditions in the project area. The report will address floodplain clearance, energy dissipation, new plant colonization, stabilized vegetation, age diversity of vegetation, species diversity of vegetation, plant vigor, water storage, channel and bank erosion, and sediment deposition.

Subtask 4.3: BMP Report — The Performing Party, in coordination with project partners, will develop a plan for addressing riparian zone imbalances to ensure stable and methodical changes to the ecosystem. The plan will evaluate appropriate areas for use of riparian BMPs such as removal of invasive plants from creek channels, planting trees, litter removal, landscape and maintenance controls, streambank stabilization, buffers, landscaping in an active floodplain, and designating human access points to the creek which rotate throughout the year.

Deliverables:

- Documentation of bid solicitation
- Documentation a subcontractor is hired
- Assessment Report - List of prioritized dysfunctional conditions and areas of the Creek, including photos and documentation
- BMP Report - List of BMPs to be used in specific locations to remedy riparian zone impairments, including short and long term timeline

Task 5*:* Construction and Maintenance of Urban Riparian BMPs

Objective: To construct riparian improvements using BMPs including but not limited to creating human access points to the creek which rotate throughout the year, removal of invasive plants from creek channels [Ex. Elephant Ear (Colocasia esculenta) and Giant Reed (Arundo donax)], planting trees, litter removal, landscape and maintenance controls, streambank stabilization, buffers, vegetative practices and other landscaping in an active floodplain.

Subtask 5.1: Hire Subcontractor — The Performing Party will secure and manage contractors/subcontractors, utilize City in-kind services and volunteer labor to construct/implement BMPs repairs for Lockhart Riparian Zone for Town Branch Creek.

Subtask 5.2: Urban Riparian BMPs 75% and Final Design — The Performing Party will submit (a) a 75% complete design report to ensure design meets all project goals, specifications and BMP placement prior to final design and construction, and (b) a final design report for all BMPs. Design reports will include drawings and an explanation of possible impact that promotes load reduction.

Subtask 5.3: Install and Construct BMP Solutions for the Creek — The Performing Party, in coordination with project partners, will construct the potential riparian improvements using BMPs including but not limited to removal of invasive plants from creek channels, planting trees, litter removal, landscape and maintenance controls, streambank stabilization, buffers, vegetative practices and other landscaping in an active floodplain, and creating human access points to the creek natural values at rotating locations throughout the year. Documentation of completed BMPs will include photos and record drawings.

Subtask 5.4: Supplemental BMP Solutions for the Creek — The Performing Party, in coordination with project partners, will perform supplemental BMP solutions for the creek including but not limited to the removal of some invasive plants from creek channels, planting trees, litter removal during the annual fall cleanup and lawn mowing/weed eating primarily with volunteer labor.

Subtask 5.5: Write and Adopt O&M Procedures — The Performing Party will write, adopt, and implement operations and maintenance procedures for all BMPs under this task. Documentation of implementation will include completed inspection forms and other documentation of O&M activities provided for in the Procedures.

Subtask 5.6: Ongoing Maintenance of BMPs — The Performing Party will ensure the ongoing management and maintenance by city management and park staff for mowing/weed eating for access/view areas. Follow schedules and design for rotating areas along Creek side to provide interactive experiences for park.

Deliverables:

- Documentation of Bid Solicitations
- Documentation of when subcontractors hired
- Urban Riparian BMP Design Report, including timeline for construction
- Documentation of completion of BMPs including photo documentation and record drawings
- Annual Volunteer and BMP Maintenance Report
- O&M Procedure Report

Task 6: Construction and Maintenance of LID BMPs

Objective: To install LID features including a rain garden to control volume and flow of stormwater runoff in order to reduce bacteria, depressed dissolved oxygen and nitrate at the project site.

Subtask 6.1: Hire LID Feature Subcontractors — The Performing Party will secure contractors/subcontractors to construct/implement BMPs repairs for LID.

Subtask 6.2: LID BMPs 75% and Final Design — The Performing Party will submit (a) a 75% complete design report and (b) a final design report for all rain garden BMPs. Design reports will include drawings and an explanation of possible impacts that promote load reduction.

Subtask 6.3: Install 2,000 sq ft Rain Garden and Native Vegetation —
The Performing Party will install at least 2,000 sq ft of rain garden to control high volume stormwater flow and establish native vegetation cover at the park entrance at N. Commerce Street.

Subtask 6.4: Ongoing Maintenance of BMPs — The Performing Party will ensure the ongoing management and maintenance by city management and park staff for maintaining rain garden at N. Commerce Street.

Subtask 6.5: Write and Adopt O&M Procedures — The Performing Party will write, adopt, and implement operations and maintenance procedures for all BMPs under this task. Documentation of implementation will include completed inspection forms and other documentation of O&M activities provided for in the Procedures.

Deliverables:

- Documentation of Bid Solicitations
- Documentation of when subcontractors hired
- LID BMP Design Report, including timeline for construction
- Documentation of LID Feature Construction, including “as-built” or record drawings and photos of the completed features
- Annual BMP Maintenance Report
- O&M Procedure Report

Task 7: Education of Riparian Zone at Town Branch Creek

Objective: To develop a sustainable riparian zone by engaging the local residential and commercial community in activities that promote feedback and interest in improving water quality conditions at Town Branch Creek.

Subtask 7.1: Public Outreach and Education — The Performing Party will develop a communication campaign informing the public of activities to improve water quality. This will include updating websites, creating flyers for residential and commercial display on bulletin boards advertising monthly park events that promote riparian preservation and educational tours at the creek. The campaign will educate the public about the significance of native flora and fauna, impacts of invasive species, pet waste disposal impacts, litter control, and will define the role of protected interactive creek viewing areas. Draft educational materials will be sent to TCEQ for review and approval before dissemination.

Subtask 7.2: City Park Grounds Process Improvements — The Performing Party will increase buffer area around the Creek when mowing, by creating no-mow areas, develop and implement a rotation schedule for cleared interactive protected public viewing areas along the creek to prevent over use of access points. The Performing Party will provide evaluation options for the public including website and questionnaires from educational tours to determine success of program.

Subtask 7.3: Signage — The Performing Party will create and install signs along the urban trail identifying and explaining functional purpose of protected interactive viewing areas along the Creek. Other signs will be used to define and explain the balance needed for maintaining a healthy riparian area including importance of maintaining a cleared channel, removing invasive plants, proper disposal of pet waste, increased buffer areas, and planting native plants. URL for the City's website with information on the project will be listed on signage. Draft language and layout will be sent to TCEQ for review and approval before signage is manufactured.

Subtask 7.4: Education Task Report — The Performing Party will submit a report summarizing activities completed under this task.

Deliverables:

- Draft and Final communication campaign
- Draft and Final publications to disseminate (flyers, billboard information, educational brochures)
- Documentation of the dissemination of these materials
- Documentation of website updates, as needed
- Documentation of no-mow areas and rotation schedule
- Evaluation results from website and questionnaires
- Draft and Final signage
- Photo documentation of signage installation
- Draft Task Report
- Final Task Report

Task 8: Final Report

Objective: The Performing Party will produce a Final Report that summarizes all activities completed and conclusions reached during the project. The Final Report must describe project activities, and identify and discuss the extent to which project goals and purposes have been achieved, and the amount of funds actually spent on the project. The report should emphasize successes, failures, lessons learned, and should include analyses estimating the projects' water quality improvements and/or load reductions, if applicable. The Final Report must summarize all the Task Reports in either the text or as appendices.

Subtask 8.1: Draft Final Report — At least 30 days prior to submitting the Final Report, the Performing Party will provide a Draft Final Report summarizing all project activities, findings, and the contents of all Deliverables, referencing and/or attaching them as web links or appendices. This comprehensive report should document all Deliverables under this Scope of Work. The report should be structured per the following outline:

- Title
- Table of Contents
- Project Background
- Study Area Summary of all Task Reports and final approved QPR
- Amount of project funding and amount spent
- Discussion; include deliverables not completed, lessons learned, recommendations
- Water quality results achieved /estimated load reductions (if applicable to project)Appendices (if needed)

Subtask 8.2: Final Report — The Performing Party will revise the Draft Final Report to address comments provided by the TCEQ Project Manager and the EPA. At least two weeks before the expiration of the Contract, the Performing Party will submit the Final Report to the TCEQ Project Manager, who will subsequently submit it to EPA.

Deliverables:

- Draft Final Report
- Address TCEQ/EPA comments
- Final Report

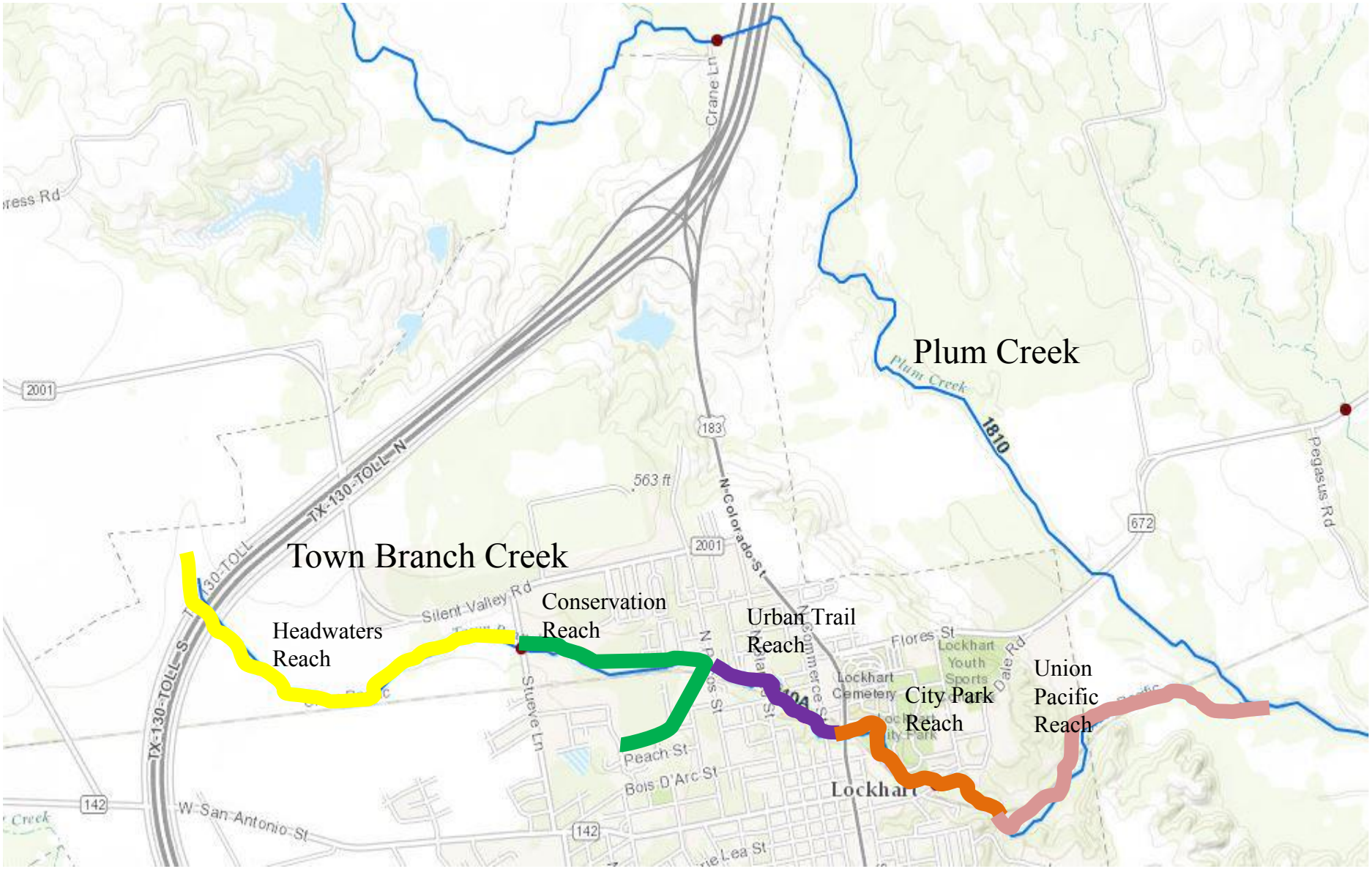
Schedule of Deliverables

Task No.	Task Deliverable	Due Date
1 Project Administration		
1.2	QPRs	The 15th of the month following each state fiscal quarter
1.3	Reimbursement Forms	See the Special Terms and Conditions
1.4	Post-Award Orientation meeting notes with action items	Meeting within 30 days of Contract execution, notes within 7 days of the meeting
1.4	Conference Call meeting notes with action items	Quarterly; notes within 7 days of call
1.5	EPA coordination meeting	Upon request
1.6	Annual Report Article	Upon request
1.7	Contract Budget Updates	Discussed quarterly and updated as needed
1.7	Annual Budget Updates	Quarters 5 and 9
2 Quality Assurance		
2.1	QAPP planning meeting	Meeting within 30 days of Contract execution
2.2	Draft Modeling QAPP	Quarter 3
2.2	Final Modeling QAPP	Quarter 4
2.3	Draft Pollutant Load Reduction Report	Quarter 5
2.3	Final Pollutant Load Reduction Report	Quarter 12
2.4	Draft Monitoring QAPP	Quarter 1
2.4	Final Monitoring QAPP	Quarter 1
2.5	Annual QAPP Review and Revision	No less than 90 days prior to the QAPP anniversary date
2.6	Draft QAPP Amendments	No less than 90 days prior to the scheduled initiation of changes or additions to activities listed in the current QAPP
2.6	Final QAPP Amendments	Within 30 days of receipt of TCEQ comments
3 Subcontractor for Grant Administration		
3.1	Documentation of bid solicitation	Quarter 1, Month 1

Task No.	Task Deliverable	Due Date
3.1	Documentation a subcontractor is hired	Quarter 1
4 Riparian Survey and Plan		
4.1	Documentation of bid solicitation	Quarter 1
4.1	Documentation a subcontractor is hired	Quarter 2
4.2	Assessment Report	Quarter 3
4.3	BMP Report	Quarter 4
5 Construction and Maintenance of Urban Riparian BMPs		
5.1	Documentation of bid solicitation	Quarter 5
5.1	Documentation a subcontractor is hired	Quarter 5
5.2	Urban Riparian BMP Design Report	Quarter 6
5.3	Documentation of BMP completion, including photo documentation	Quarter 11
5.4	Draft and Final O and M Procedures	Quarters 8 and 12
5.5	Annual Volunteer and BMP Maintenance Report	Quarters 8 and 12
6 Construction and Maintenance of LID BMPs		
6.1	Documentation of bid solicitation	Quarter 3
6.1	Documentation a subcontractor is hired	Quarter 3
6.2	LID BMP Design Report	Quarter 4
6.3	Documentation of LID BMP construction, including “as-built” drawings and photos	Quarter 8
6.4	Draft and Final O and M Procedures	Quarters 8 and 12
6.5	BMP Maintenance Report	Quarters 12
7 Education of Riparian Zone at Town Branch Creek		
7.1	Draft Communication Campaign	Quarter 2
7.1	Final Communication Campaign	Quarter 2
7.1	Draft and Final public information materials, including flyers, billboard information, educational brochures	Ongoing, two weeks prior to dissemination
7.1	Documentation of dissemination of public information materials	Quarterly

Task No.	Task Deliverable	Due Date
7.1	Documentation of website updates	Quarters 2, 4, 6, 8, 10, 12
7.2	Documentation of designation of no-mow areas and rotation schedule	Quarter 8
7.2	Evaluation of results of customer survey regarding protected rotating viewing areas	Quarter 11
7.3	Draft and Final signage design	Quarter 9
7.3	Photo documentation of signage installation	Quarter 11
7.4	Draft Education Task Report	Quarter 12, Month 1
7.4	Final Education Task Report	At least two weeks prior to the end of the Contract
8 Final Report		
8.1	Draft Final Report to TCEQ	Quarter 12, Month 1
8.2	Address TCEQ/EPA comments	Within 30 days of TCEQ comments
8.2	Final Report	At least two weeks prior to the end of the Contract.

Town Branch Riparian Evaluation Project Area
Approx. 5.6 miles



Note: Map shows an approximation and not an exact map of the riparian study area (300/100 foot margins) for this project

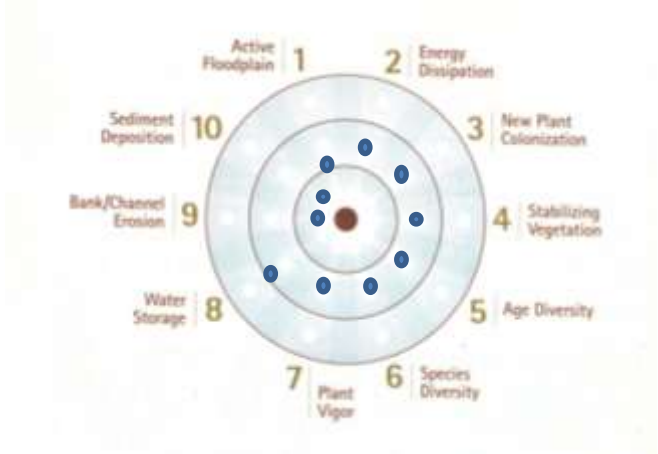
Appendix D. Field Data Reporting Form
(example) Page 1 of 3 pages

Riparian Evaluation Site:
Date:
By:

Riparian Indicators			Notes:
1. Active Floodplain *Look for recently deposited debris or silt. Is it clear that flood flows are able to rise above the channel, spread out on a floodplain, and slow down?*	**Functional** *tending toward At-Risk Condition*	**Floodplain appears to be little too far above channel** or channel is too deep; limited floodplain effectiveness.	**Floodplain is functioning and is wide, measured on Google[tm] earth at about 300 feet across near the Hwy 286 bridge. Still something does not seem right about the floodplain access. Either the floodplain land is built up or the channel has been deepened.**
2. Energy Dissipation in Channel, on Banks or in Floodplain *Is there presence of trees, logs, boulders or dense vegetation to slow water down?*	**At-Risk Condition**	**Only some** energy dissipating features present.	**Floodplain is covered with vegetation but not necessarily in energy dissipating vegetation. Trees and woody debris are sparse and much of the herbaceous vegetation in not riparian.**
3. New Plant Colonization Do you see fresh sediments, deposited during flooding, being colonized by new plants?	**At-Risk Condition**	**Only some** new plant colonization on fresh sediment.	**New sediment entering from banks is being colonized and colonizers are marching into the channel trapping and holding freshly delivered sediment. Flood deposited sediments are not readily apparent.**
4. Stabilizing Vegetation *Is the bank covered with riparian plants and their roots? Do these plants have a stability rating (SR) greater than 6-7*? Refer to RR plant field guide for SR.	**At-Risk Condition**	**Some gaps present** and/or some vegetation lack sufficient stability rating.	**Banks are well covered with vegetation but it is mostly not riparian. Some stabilizing plants are present but their coverage is sparse. Hackberry SR 5/6 Mexican ash SR 6 Ratama SR 6 Spiny aster SR 8**
5. Reproduction of Riparian Plants; Various Ages. *In addition to older plants, are there young and middle-aged riparian plants?*	**At-Risk Condition**	**Few to no old-mature** riparian trees are present.	**Most of the woody vegetation present appears to be of similar age class; young to middle-aged plants. This is causes one to question, what happened to the older trees?**
6. Diversity of Riparian Plants *Using the RR field guide, can you identify different species of native riparian plants?*	**At-Risk Condition**	**Modest diversity** 3-4 species of native riparian trees, shrubs, grasses and sedges	**Only a few native riparian species were observed.**
7. Plant Vigor *Are plants healthy, or do you see signs of grazing, trampling, mowing, browsing, cutting, shredding or bulldozing? Consult your field guide for information about a particular plant's palatability for grazing and browsing. Palatable plants can be sentinels of impaired vigor.*	**At-Risk Condition**	**Low vigor,** woody plants show signs of heavy browsing, hedging or browse line may be present. Grasses and sedges show signs of heavy use, grazing, mowing, and trampling only in places.	**Some Riparian plants are being mowed and others are disturbed by construction activities. Undisturbed plants are healthy and vigorous.**

Appendix D. Field Data Reporting Form
(example) Page 2 of 3 pages

8. Water Storage *Using your field guide, can you locate key Wetland Obligate and Facultative Wetland plants?*	**At-Risk Condition** tending to nonfunctional	**Only a few** OBL and FACW plant species present.	**The riparian vegetation present is mostly indicative of a dry site. Spiny aster, a FACW plant is found in stands along the bank away from the water's edge indicating some water storage.** **Spiny aster FACW** **Morning glory FAC**
9. Bank/Channel Erosion *Do you find signs of bank or channel erosion? Is it in predictable locations, such as on meander bends where point bars are being formed with the eroded material downstream? Does the channel look down-cut or incised like a drainage ditch? If so, it may also lack an active floodplain.*	**High Functional Condition**	**Light bank erosion** on meander bends being compensated by deposition on point bars below. Channel appears to be of size and depth to manage sediment.	**No active erosion from floodwaters is visible. Some erosion from construction site runoff was observed at this site.**
10. Sediment Deposition *Are there signs of sediment deposition on point bars? Is it balanced with erosion, or is sediment piling up mid-channel, creating an overly wide and shallow appearance?*	**High Functional Condition**	**Normal and balanced** sediment deposition.	**Sediment appears to be in balance.**



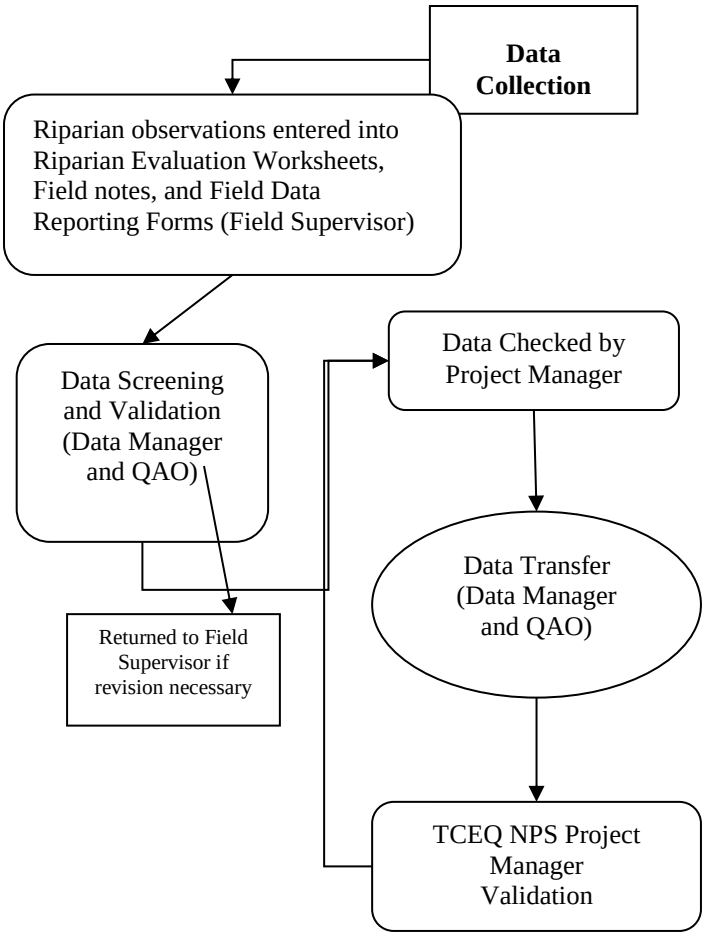
Runoff from bridge construction area observed entering Oso Creek

Appendix D. Field Data Reporting Form
(example) Page 3 of 3 pages

Hindrances to riparian function observed at this site:

- Farming, mowing, or spraying weeds or brush too close to the bank
- Logging and related timber harvest activities adjacent to the creek
- Manicured or altered residential or park landscapes next to the creek
- Prolonged grazing concentrations in creek areas
- Excessive populations of deer, exotics, or feral hogs in creek areas
- Burning in riparian area
- Removal of large dead wood and downed trees
- Artificial manipulation of banks, channels or sediment (bulldozing)
- Physical alteration of floodplain
- Excessive vehicle traffic in creek area
- Excessive recreational activity or foot traffic in creek area Excessive alluvial pumping or other withdrawals
- In some cases, the excessive growth of invasive species that inhibit the ability of native riparian plants to do their job
- Low water dams and large reservoirs
- Poorly designed road crossings and bridges

Appendix E. Data Management Process Flow Chart



Appendix F. Corrective Action Status Table

The Corrective Action Status Table is included as a tab in the quarterly progress report template provided by the TCEQ NPS Project Manager.

Corrective Action #	Date Issued	Description of Deficiency	Action Taken	Date Closed

Corrective Action Status Table (Example)

Corrective Action #	Date Issued	Description of Deficiency	Action Taken	Date Closed
1	7/25/2014	Runoff measured at pavement was greater than total area runoff.	The area is being surveyed to ensure the catchment area size is correct. The monitoring station location is being modified to ensure runoff flows through properly.	
2	8/1/2014	Sample residual insufficient for analysis of TSS.	Data estimated but questionable, not will not be submitted to TCEQ.	8/8/2014

Nonconformance Report and Corrective Action Plan
QAPP Title:_____ **QAPP Contractor:** _____ **Issued by:**_____ **Date of Occurrence:**_____ **Report No.:**_____ **Date Issued:**_____
Description of deficiency
Root Cause of deficiency
Programmatic Impact of deficiency
Does the seriousness of the deficiency require immediate reporting to the TCEQ? If so, when was it reported?
Corrective Action to address the deficiency and prevent its recurrence
Proposed Completion Date for Each Action
Individual(s) Responsible for Each Action
Method of Verification
Date Corrective Action Plan Closed?

Appendix G. Corrective Action Plan Form and Example

Nonconformance Report and Corrective Action Plan

QAPP Title: Watershed Protection Plan Implementation – LID BMP Monitoring QAPP
QAPP Contractor: River Authority
Issued by: Jane Doe **Date of Occurrence:** 7/15/2014
Report No.: 1 **Date Issued:** 7/25/2014

Description of deficiency
The pavement monitoring station at the university is measuring a larger runoff volume than is possible according to estimates. Runoff measured is higher than the total precipitation volume calculated by multiplying the catchment area by the precipitation measured at the site.

Root Cause of deficiency
(1) The drainage area was not measured accurately; it is larger than originally measured.
(2) The outfall of the monitoring station does not adequately allow runoff to flow through causing pooling around the flow-measuring point. The accumulation of non-flowing water is likely confounding the flow meter since its physical principal of measurement is hydrostatic pressure caused by water depth.

Programmatic Impact of deficiency
The illogical results of the pavement runoff measurement indicate that further calibration of the equipment is necessary. Data collected at this event will not be used in analysis or results.

Does the seriousness of the deficiency require immediate reporting to the TCEQ? If so, when was it?
Yes, it was reported to the TCEQ NPS Project Manager via email on 7/18/2014.

Corrective Action to address the deficiency and prevent its recurrence
A survey will be conducted on the site to determine the ridge of the catchment area.
A wider and deeper channel will be dug out at the monitoring point outfall to ensure all the flow drains away from the measuring point. Storm event runoff will not be measured at this site until this work has been completed.

Proposed Completion Date for Each Action
8/15/2014

Individual(s) Responsible for Each Action
David Lopez, Contractor Project Manager

Method of Verification
Results of the catchment area survey will be emailed to the TCEQ NPS Project Manager.
Photos of the modified measurement site will be emailed to the TCEQ NPS Project Manager.

ATTACHMENT 1
Example Letter to Document Adherence to the QAPP

TO: Sky Lewey
Nueces River Authority
P.O. Box 349
Uvalde, TX 78801
slewey@nueces-ra.org

FROM: (name)
(organization)

RE: City of Lockhart, Town Branch Urban Trail Riparian Evaluation Project Monitoring Quality Assurance Project Plan

Please sign and return this form by (date) to:

City of Lockhart
P.O. Box 239
Lockhart, TX 78644

I acknowledge receipt of the Town Branch Urban Trail Riparian Evaluation Project Monitoring Quality Assurance Project Plan. I understand that the document describes quality assurance, quality control, data management and reporting, and other technical activities that must be implemented to ensure the results of work performed will satisfy stated performance criteria.

My signature on this document signifies that I have read and approved the document contents. Furthermore, I will ensure that all staff members participating in activities covered under this QAPP will be required to familiarize themselves with the document contents and adhere to the contents as prescribed.

_____
Signature Date

ATTACHMENT 2

REMARKABLE RIPARIAN EVALUATION GUIDE

The investigator will conduct riparian evaluation in accordance with the Nueces River Authority's Your Remarkable Riparian Field Guide guidance document, sections of which are listed below. The field guide is an extensively illustrated guide to the methodology to be used in this project. The final pages of the guide contain the Bull's Eye Evaluation worksheet, also included herein, which the investigator will use to record the core evaluation of riparian function at each evaluation site in this study.

Page 1-24	– An illustrated primer on riparian function (omitted here)
Page 25-27	– Learning to See the Bull's Eye (included here)
Page 28	– Identifying Hindrances (included here)
Page 29-44	– Bull's Eye Evaluation worksheet explained, with details about each evaluation parameter (included here)
Page 45-160	– Plant identification guide – photos and description of functions (omitted here)
Page 161-164	– Plant list/table (omitted here)
Following 6 pages	– The 2-page Bull's Eye Evaluation worksheet including evaluation criteria (included here)

Learning to See the Bull's-Eye

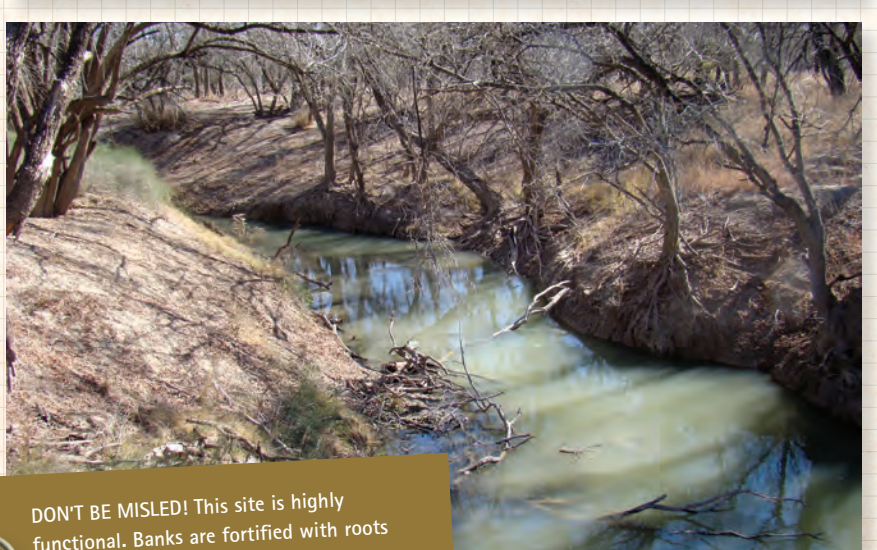
Guided Observation Tools for Evaluating Riparian Areas

This section offers guidance on training your eye to see riparian areas for their function. With an eye for function, it becomes easier to recognize poor health and identify the activities that may be hindering riparian recovery. A new evaluation tool is introduced, the Riparian Bull's-Eye, which uses ten key indicators to plot health on a target. Learning to see in this way can help inform decision-making in favor of riparian function and all the values it can deliver.

Observing Vegetation

The main difference between functional and dysfunctional riparian areas can be evaluated by observing the vegetation. Pictured below are images of functional and dysfunctional riparian areas from across Texas. Look closely at the differences and begin learning a new way to see riparian areas.

FUNCTIONAL



DON'T BE MISLED! This site is highly functional. Banks are fortified with roots and anchored large wood. Signs indicate the floodplain is accessed regularly, and it contains plenty of energy dissipation.

Learning to See

DYSFUNCTIONAL

Photos courtesy of Steve Nelle, Sky Lewey and Kenneth Mayben.

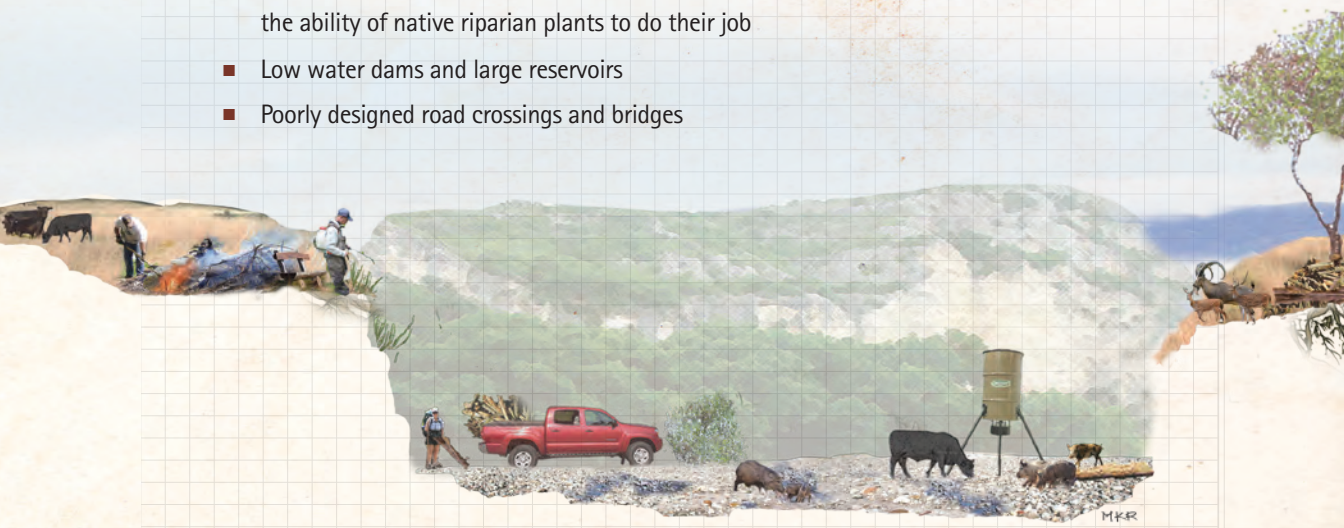
Learning to See

Identify Hindrances

A hindrance is any activity or situation that interferes with natural riparian recovery and healthy function—usually the result of human or animal activity.

Following are common hindrances observed in Texas riparian areas.

- Farming, mowing, or spraying weeds or brush too close to the bank
- Logging and related timber harvest activities adjacent to the creek
- Manicured or altered residential or park landscapes next to the creek
- Prolonged grazing concentrations in creek areas
- Excessive populations of deer, exotic hoofstock, or feral hogs in creek areas
- Burning in riparian area
- Removal of large dead wood and downed trees
- Artificial manipulation of banks, channels or sediment (bulldozing)
- Physical alteration of floodplain
- Excessive vehicle traffic in creek area
- Excessive recreational activity or foot traffic in creek area
- Excessive alluvial pumping or other withdrawals
- In some cases, the excessive growth of invasive species that inhibit the ability of native riparian plants to do their job
- Low water dams and large reservoirs
- Poorly designed road crossings and bridges

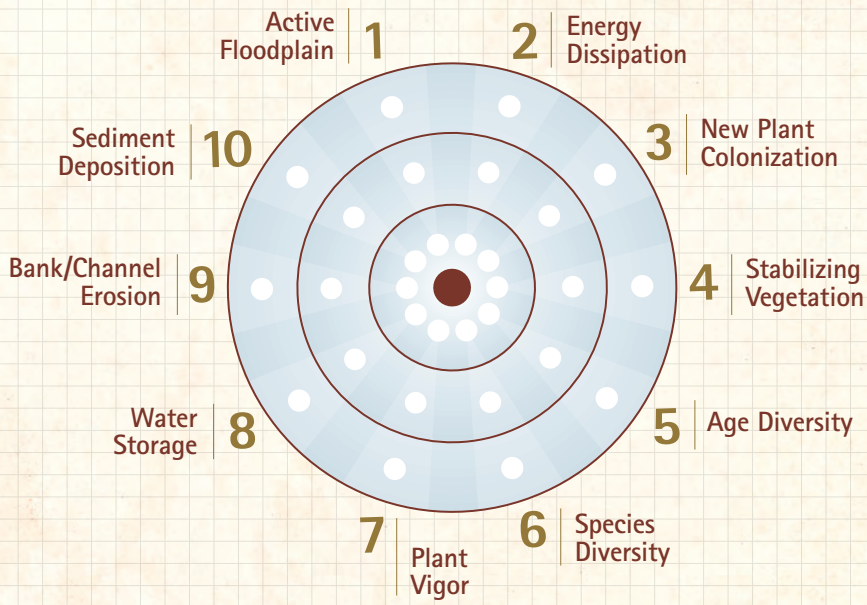


Activities on the land are reflected in the water quality and quantity of our creeks and rivers, and no piece of land has a more direct connection to water quality and quantity than the remarkable riparian area.

Con Mims, Executive Director, Nueces River Authority

The Riparian Bull's-Eye Evaluation

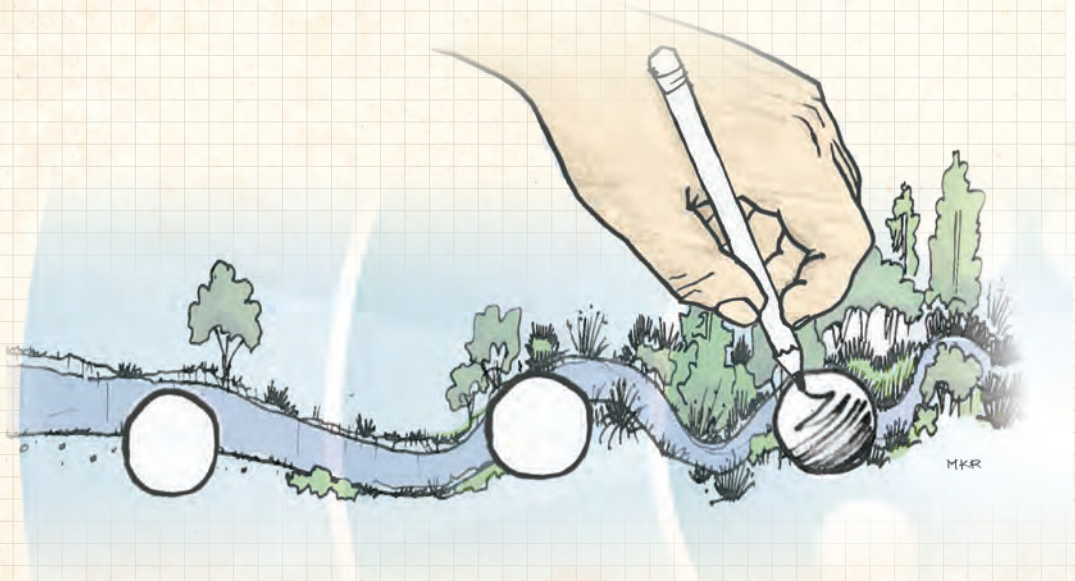
Using the Riparian Bull's-Eye evaluation can help you see riparian areas for their function and identify activities that may be hindering the natural riparian recovery process. Consistent notation of your observations with this guide, combined with photo-point images collected over time, are key to monitoring riparian health.



Not all of the parameters will be appropriate for all channel types. Leaving some portions of the target blank will not detract from your evaluation. Most of the ten parameters will not apply to ephemeral streams. Likewise, some of the indicators will be difficult to evaluate on tidal-influenced segments of coastal streams. Most of the ten parameters are associated with plants and can be evaluated using the plant information contained within this field guide.

Steve Nelle created the Bull's-Eye Evaluation Tool in 2015 as a simple way to quickly evaluate riparian conditions. It is an adaptation of the range-monitoring tool developed by Todd Graham of Ranch Advisory Partners and Kirk Gadzia of Resource Management Services for the Quivira Coalition.

Learning to See



The bull's-eye area in the center of the target represents optimal function and the outermost ring of the target represents dysfunction. The middle ring of the target represents an at-risk condition, a kind of riparian health danger zone.

Ten Indicators of Riparian Bull's-Eye Evaluation

The ten indicators are pictorially described here to help you set your eye for evaluating sites on your own. An evaluation example follows illustrating how each indicator is rated in proximity to the bull's-eye on the target. Riparian Bull's-Eye evaluation forms are at the back of this book. Additional forms can be found at RemarkableRiparian.org.

1. Active Floodplain

Does floodwater have access to a floodplain?

Why is this important?

Access to a floodplain is essential to give floodwater a place to spread out and slow down. When streams are confined by roads or cement embankments, or if they are down-cut and lack access to a floodplain, it is difficult for them to heal, and other problems ensue. Floodplains allow floodwaters to slow down and deposit their sediment—a necessary component of water storage in riparian areas. Organic matter, contained in most flood sediment, is known to increase the water-holding capacity of soils, sands and gravels. Riparian areas can support stream flows during dry times by releasing stored water.

How to see it.

To evaluate if a stream has access to its floodplain, look for debris or silt deposited from a recent flood event. You will likely notice that where vegetation is thick in the floodplain, new sediment, such as sand, fine gravels or "flood mud," have been trapped. Look closely at that sediment and you may find pieces of leaves, tree bark, seed hulls, and other tiny bits of organic matter.

Learning to See

Good floodplain access

Floodplain is not very accessible

2. Energy Dissipation

Is there enough "stuff" in channels, on banks and in the floodplain to dissipate flood energy?

Why is this important?

Floodwaters carry a lot of energy. If enough vegetation, rocks, or large dead wood are present, then floodwaters will be slowed down and their energy will be dissipated, or spread out, across the rough surfaces of these items. Slowing water down and dissipating energy is essential for healthy functioning riparian areas.

How to see it.

Look for an unkempt array of natural "stuff."

Good energy dissipation

Not much energy dissipation

Photos courtesy of Steve Nelle and Kenneth Mayben.

The above photos are of the same riparian site. Only a few energy-dissipating features remain in 2015. Often, well-meaning but uninformed landowners clear key riparian features in a misguided effort to "help" the creek.

Learning to See

3. New Plant Colonization

Are trapped sediment being successfully colonized by new plants?

Why is this important?

If floodwaters are being slowed down and sediment trapped, then those sediment need to be colonized by new plants in order to become stabilized and incorporated into the floodplain, eventually adding to the water storage capacity.

How to see it.

Look for new young plants or runners from existing plants growing on newly deposited sediment. This may be most apparent on a point bar where new sediment have been dropped at the edge of the channel. Plants that are good at this are called colonizers. They may lack strong stabilizing roots, but they are able to grow quickly and create conditions for other, stronger plants to follow.

Learning to See

plants colonizing fresh sediments

No new plant colonization here.

No new plant colonization is visible on the point bars along this creek. Looking closely can usually reveal why; something may be hindering new plant colonization.
Photos courtesy of Steve Nelle.

4. Stabilizing Vegetation

Are banks covered with strong stabilizing plants?

Why is this important?

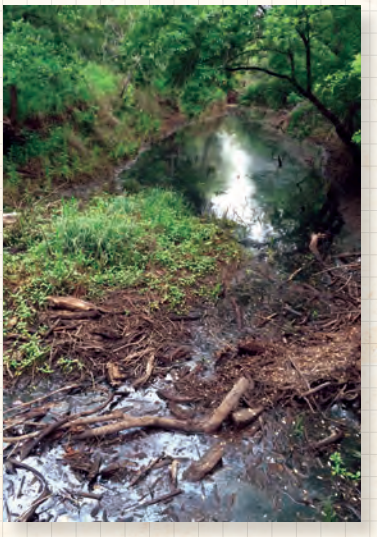
It takes strong-rooted vegetation to withstand the energy of floodwater. Plants are rated for their ability to withstand floods with a stability rating (SR) number. SR1 is bare ground, and SR10 is equivalent in strength to anchored rock.

Good coverage with plants having SR ratings of six or higher is usually a minimum for weathering floods. When deep-rooted plants and high-stability plants are mixed with low-stability plants or large wood or boulders, the community stability is greatly enhanced as roots are often interlocked and incorporate the wood and rock material.

How to see it.

Using your Field Guide, identify riparian plants and look up their stability ratings. You want to see good coverage in the riparian landscape of plants with an average of SR6/7 (or greater) and/or the presence of large wood or boulders.

Good stabilizing cover



San Miguel Creek, Frio County
Mexican ash, SR6
Wafer ash, SR5/6
Plus large wood

Lelia Lake Creek, Donley County
Bulrush, SR8/9
Indian grass, SR7
Spikerush, SR6
Switchgrass, SR8/9

Learning to See

Poor stabilizing cover

Photos courtesy of Steve Nelle and Kenneth Mayben.

5. Age Diversity

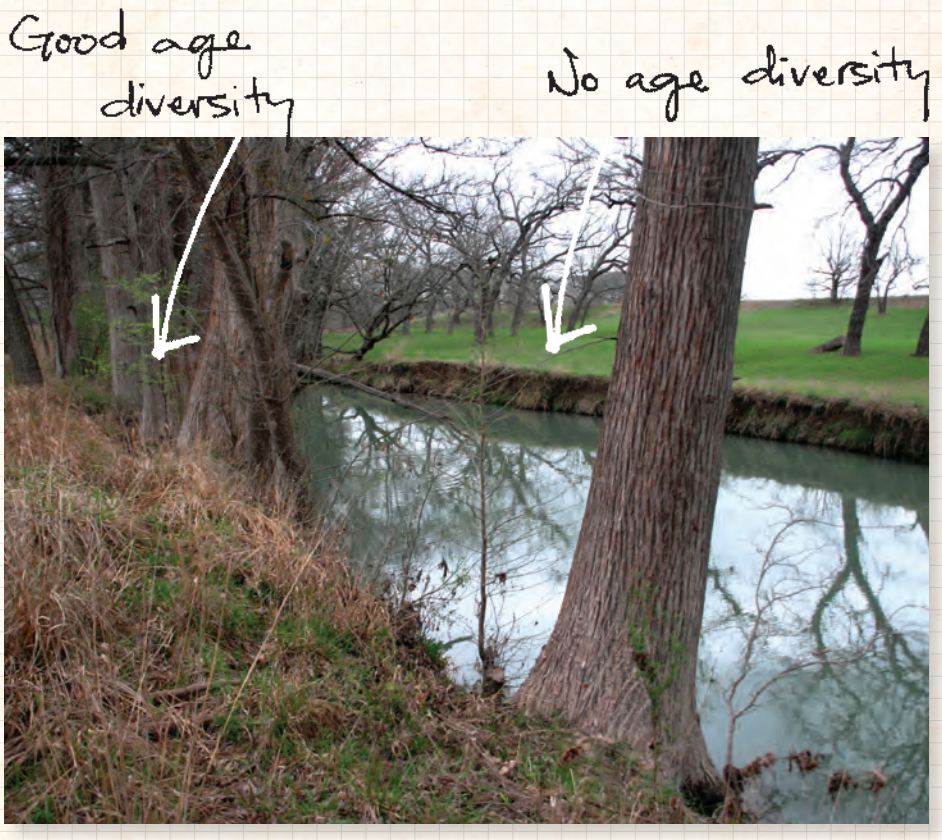
Are young, middle-aged and mature riparian plants present?

Why is this important?

Age diversity of riparian plants is an indicator of health. Plants of different ages can help provide stability during fluctuations in flow and climatic conditions. The presence of both young and old palatable plants can indicate that past and present grazing and browsing have not hindered function.

How to see it.

Identify riparian plants using this Field Guide, and look for young and middle-aged, as well as older mature examples. Both of the images below show diversity and also a lack of diversity. Can you see it?



Photos courtesy of Steve Nelle and Kenneth Mayben.

Learning to See

6. Species Diversity

Are several key, native riparian plant species present?

Why is this important?

In nature, diversity contributes to system stability and resilience. This is also true in riparian systems where the diversity of riparian plant species can help lead to better functional conditions. A diverse group of riparian plants creates a plant community that is more durable and functional than any single species could be on its own. This is especially important underground where an interlaced series of diverse roots can interlock to hold channels in place, even elevating them to create more water storage across an entire valley.

How to see it.

Identify riparian plants using your Field Guide. Look closely for a group of high stability native plants that can indicate a functional plant community. You may find only grasses and sedges or only woody riparian plants or some of both, but the important thing is to look for diversity within the groups.

Learning to See

Good species diversity

Good plant diversity on a Canadian River tributary in the Rolling Plains on the eastern side of the Texas Panhandle. Visible in this photograph are:
- Eastern gamma, FAC, SR9
- Indian grass, FACU, SR7
- Bulrush, OBL, SR8/9
- Cattail, OBL, SR9
- Spikerush, OBL, SR6/7
- Cottonwood, FAC, SR7

In this image from Medina River, Bexar County, below San Antonio, you can see a typical Rio Grande Plain channel type, held together mostly by trees and understory.
- Bald cypress, OBL, SR9
- Mexican ash, FAC, SR6
- Cedar elm, FAC, SR6
- Pecan, FAC, SR6
- Red mulberry, FACU, SR6
- Box elder maple, FACW, SR6
- Rough leaf dogwood, FAC, SR6

Poor species diversity

Little plant diversity here. The riparian area pictured is dominated by bald cypress, OBL, SR9. It is very stable, but a single species is not a safe situation in nature. These cypress trees need some woody understory and some herbaceous cover to support them.

7. Plant Vigor

Are riparian plants vigorous and healthy?

Why is this important?

Riparian plants that are browsed, mowed or grazed short continuously can become unhealthy. Unhealthy plants can have compromised root systems and may not be able to provide energy dissipation and bank stabilizing functions. If vigor is compromised, it is time to do something different, such as removing the hindrance causing the problem.

How to see it.

Look for plants that have their leaves intact. Over time, heavy browsing, grazing, and mowing that cuts leaves and stems can cause plants to develop scabs and a stunted or scarred appearance. Once you have trained your eye to see stunted plants or recognize a browse line, you can easily spot this hindrance.

Learning to See

Good plant vigor

Many of the plants shown in these images are palatable grazing and browsing species, yet there are no signs that vigor is impaired by humans or animals. Some of these locations are used for occasional livestock grazing, but with proper management, riparian plant vigor has been maintained. Photos courtesy of Steve Nelle.

Poor plant vigor

This image shows a distinct browse line on riparian trees, indicating a vigor problem. While these trees appear to be healthy, when their trunks are exposed from browsing, their flood resilience is weakened.

Buttonbush, a highly palatable browse plant, is pictured here with signs of heavy and long-term browse.

Bushy bluestem, a moderately palatable grass, shows signs of extreme overgrazing, perhaps by axis deer.

Riparian grasses in this image are vigorous on one bank and impaired by mowing and weed-eating on the opposite bank.

8. Water Storage

Are the banks and floodplain storing water?

Why is this important?

One of the important services provided by riparian areas is the storage of water out-of-sight, below ground, or within the banks for release to the stream during dry times. Water storage capacity is influenced by the volume of organic matter within soils and can be indicated by the presence of water-loving plant species. A plant's wetland indicator status can tell you if water is regularly present below the ground where it is growing.

How to see it.

Using this field guide, look for Obligate (OBL) and Facultative Wetland (FACW) plants.

Good water storage

Good water storage capacity is shown by the presence of:
Black willow (FACW)
Emory sedge (OBL)

No water storage

This photo shows upland species in the riparian area:
Live oak (FACU)
KR bluestem (UPL)

Learning to See

9. Bank and Channel Erosion

Are bank and channel erosion balanced with deposition on point bars?

Why is this important?

Erosion is a natural part of the riparian system, but like most things in nature, balance is needed. Erosion of stream banks should be compensated by deposition in the creation and maintenance of meander bends. Meander bends can aid in energy dissipation within a channel; the more crooked a stream becomes, the lower the gradient or the flatter the slope.

How to see it.

Look for signs of bank or channel erosion. Is it in predictable locations on meander bends where point bars are being formed with the eroded material just downstream? Does the channel look down-cut, or incised like a drainage ditch? If so, it may also lack an active floodplain.

Balanced

Out of balance

Photos courtesy of Steve Nelle.

Learning to See

10. Sediment Deposition

Is sediment being deposited in a balanced way?

Why is this important?

A river moves and processes both sediment and water, and they must be in balance. If too much sediment is being delivered to the channel and there is not enough water energy to process it, sediment can build up in mid-channel and in other illogical places. When water and sediment are in balance, sediment are deposited on point bars and contribute to the natural meander pattern of a waterway. (Revisit the principles of Lane's Balance on page 8.)

How to see it.

If heaps and piles of sediment build up in the channel, or mounds of sediment are trapped behind a structure with unnatural erosion below, these are signs that sediment are not being processed and the stream is not in balance.

Learning to See

Sediment deposition balanced

Nueces River, Uvalde County, 2012

Sediment out of balance

Nueces River, Uvalde County, 2007. Photos by Sky Lewey.

RIPARIAN INDICATORS	OUTER ZONE Poor, Dysfunctional Condition	MID ZONE At-Risk Condition	BULL'S-EYE High Functional Condition
1. Active Floodplain *Does floodwater have access to a floodplain?* Look for recently deposited debris or silt from recent floods.	**Limited or no apparent floodplain** where floodwater can spread out and slow down.	**Floodplain too far above channel** to be very effective.	**Floodplain clearly defined,** allowing for floodwater to overflow channel, spread out, and slow down.
2. Energy Dissipation *Is there enough "stuff" in channels, on banks and in the floodplain to dissipate flood energy?*	**Not many energy dissipating features** in the channel, on the banks, or in the floodplain.	**Only some** energy dissipating features present.	**Abundance** of energy dissipaters present in the channel, on the banks, and in the floodplain.
3. New Plant Colonization *Are new plants successfully colonizing on fresh sediment?*	**Not much colonization;** sediment deposits and point bars are bare.	**Only some** new plant colonization are on fresh sediment.	**Abundance** of new plants colonizing on fresh sediment.
4. Stabilizing Vegetation *Are banks covered with strong stabilizing plants—those with a stability rating (SR) of 6 or greater?*	**Not much** of bank is covered with stabilizing vegetation and tree roots.	**Some gaps present** and/ or some vegetation lacks sufficient stability rating.	**Banks covered** with stabilizing vegetation.
5. Age Diversity *Are young, middle-aged and mature riparian plants present?*	**Few to no** young and middle-age trees, shrubs, riparian grasses or sedges.	**Only a few** young and/ or middle-age riparian plants present.	In addition to older riparian plants, **young and middle-aged plants are abundant.**
6. Species Diversity *Are several key, native riparian plant species present?*	**No or low diversity:** Only 1-2 native species of riparian trees, shrubs, and/or only 1-2 grasses and sedges.	**Modest diversity:** 3-4 species of native riparian trees, shrubs, and/or 3-4 grasses and sedges.	**More than** 5 different species of native riparian trees, shrubs, and/or more than 5 species of grasses and sedges.
7. Plant Vigor *Are riparian plants vigorous and healthy?* Consult your Field Guide for information about a particular plant's palatability for grazing and browsing.	**Unhealthy riparian plants.** Woody plants show signs of heavy or chronic browsing; a severe browse line can be noted. Riparian grasses and sedges compromised by grazing, mowing, or trampling.	**Low vigor:** Woody plants show signs of heavy browsing or hedging; a browse line may be present. Grasses and sedges show signs of heavy use, grazing, mowing, or trampling, only in places.	**Healthy, vigorous riparian plants.** Woody plants show little or no sign of heavy browsing or hedging. Grasses and sedges show little or no sign of heavy grazing, mowing, trampling, or other impairments.
8. Water Storage *Are the banks and floodplain storing water?* Use your Field Guide to identify key Wetland Obligate and Facultative Wetland plants.	**No OBL or FACW** species are present, indicating a lack of water being stored in the riparian area.	**Only a few** OBL and FACW plant species present—and only along the stream's edge.	**Several** wetland plant species present—at water's edge and out on the floodplain too.
9. Bank/Channel Erosion *Are bank and channel erosion balanced with deposition on point bars?*	**Continuous, active and extreme bank erosion** with no apparent balancing by point bar deposition. Channel may appear either too wide or too deep.	**Widespread bank erosion,** beyond meander bends and not balanced by point bar deposition. Channel looks out of balance.	**Light and balanced bank erosion** on meander bends being compensated by deposition on point bars downstream. Channel appears to be of size and depth to manage sediment.
10. Sediment Deposition *Is sediment being deposited in a balanced way—on point bars downstream from eroded banks?*	**Clearly excessive** amounts of sediment, often in middle of the channel.	**Some excessive sediment deposition,** some mid-channel bars, but otherwise sediment is where it should be, on point-bars.	**Normal and balanced** sediment deposition.

Putting it All Together. Observation is a Powerful Tool.

Below is a photo of a riparian site along the South Llano River in Kimble County. Ten years ago the site was a large, naked gravel bar, but it is recovering nicely now. The wide, well-vegetated floodplain has caught enough fine sediment to sustain good plant growth.

Baccharis is the plant that kicked off the recovery, and now there is good diversity of plants with increased stability ratings. The site still lacks strong coverage of switchgrass, emory sedge, and eastern gamagrass; they are present but not yet dominant.

Look closely and you can identify the distinctive water storage zones by the plants growing there. The OBL plants are mostly at water's edge. Bushy bluestem, an FACW, can be seen in the next zone, and FAC plants like baccharis and sycamore are seen higher up on the floodplain. This photo indicates a recovering gravel bar and a narrowing channel.

Following is an observation of the photo using the Riparian Bull's-Eye Evaluation. Note how the ten indicators are assessed and marked appropriately on the target.

Learning to See

1. Floodplain clearly defined and accessible. If you look closely you can see bits of flood debris. **Inner Zone, Bull's-Eye**
2. Only some energy dissipation along the bank and in the channel, but abundant energy dissipation in floodplain. **Inner Zone, Bull's-Eye**
3. Abundant colonization of fresh sediment (water willow and spikerush). **Inner Zone, Bull's-Eye**
4. Some gaps in coverage of stabilizing plant communities (not well enough established yet). **Mid-Zone, At-Risk**

Photo courtesy of Steve Nelle.

5 Abundant reproduction of woody plants (baccharis and sycamore) and/or grasses and sedges (spikerush and bushy bluestem). **Inner Zone, Bull's-Eye**

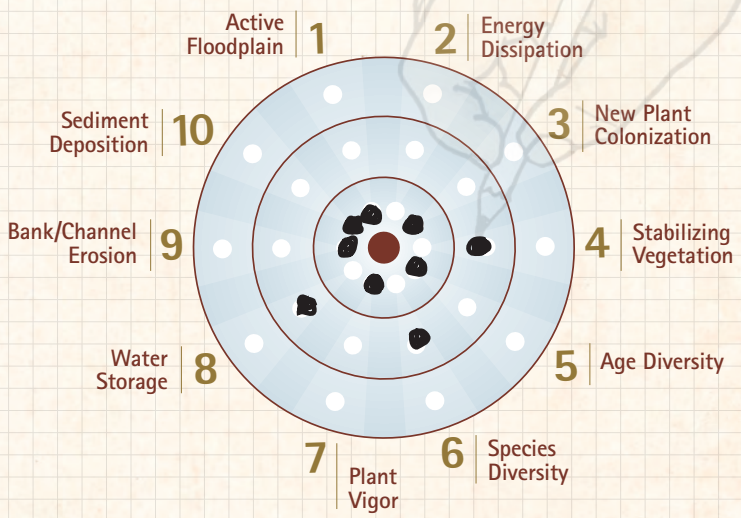
6 Modest diversity of woody plants (baccharis, sycamore, button bush) and modest diversity of grasses and sedges (only four are visible). **Mid-Zone, At-Risk**

7 Woody plant vigor not readily apparent in the photo, but herbaceous plant vigor appears healthy and vigorous. **Inner Zone, Bull's-Eye**

8 OBL and FACW species, indicating water storage, are abundant near the water's edge, but not further back. **Mid-Zone, At-Risk**

9 No excessive bank erosion is visible in the photo. **Inner Zone, Bull's-Eye**

10 Sediment appears normal and balanced in the photo. **Inner Zone, Bull's-Eye**



Learning to See

Riparian Function and Water Quality Connections

The quality of water in our rivers and streams can be influenced either positively by healthy riparian function or negatively by the presence of one or more hindrances. The information below explains how seven common water quality parameters are connected to good riparian function.

Bacteria – E. coli is a type of bacteria found in the large intestines of warm-blooded animals that can cause severe illness to humans if ingested. E. coli is an indicator that disease-causing organisms may be present in the water. When rainfall runs off over the land, it can carry bacteria into streams. Riparian vegetation can slow and filter runoff water before it reaches a stream causing sediment with bacteria particles attached to settle out and be deposited on banks. Microorganisms in riparian soil can destroy harmful bacteria as part of the soil food web.

A healthy, functional riparian system can positively affect both water quality and water quantity.

Total Suspended Solids (TSS) is a measure of materials or particles, like soil and minerals, suspended in water that can be trapped by a filter. Riparian vegetation helps slow runoff and allows for solids to settle out before entering the stream.

Dissolved Oxygen (DO) is vital to almost all aquatic life. Oxygen levels in water vary throughout the day and the seasons and are determined by many factors: temperature, flow, aquatic plants, dissolved or suspended solids, altitude, and human activities. Riparian vegetation helps maintain healthy oxygen levels needed for aquatic life.

Temperature is the controlling factor for the life cycle of aquatic life. It is influenced by time of day, season, shade, water depth, flow rate and altitude. Riparian vegetation, especially tall trees, can help shade streams and regulate fluctuations in water temperature to help maintain healthy fish habitat. Narrow, meandering channels don't get as hot or cold as shallow, flat, or straightened ones.

Clarity of water is a measure of how far light can travel through it. The clearer the water, the farther light can travel, promoting photosynthesis and aquatic plant growth. Clarity can be degraded by the presence of fine sediment within the stream channel. Good riparian vegetation can help trap and stabilize fine sediment before they enter the stream.

Flow, often expressed in cubic feet per second (cfs), is a measurement of the velocity of surface water as it travels across the landscape. Soils, aquatic plants, and tree roots can affect flow rates and contribute to recharge when they capture floodwater and hold it in place for a slow release—helping maintain flow during dry times.

Nutrients like phosphorus and nitrogen can have a major impact on water quality. An increase in either one of these common nutrients, in excess of a stream's natural ability to process them, can cause an overgrowth of algae, which depletes oxygen levels and can cause many other problems. As they start to decay, some types of algae emit toxic oils that can be dangerous to humans and wildlife, and can create taste and odor issues in drinking water. Riparian vegetation can play a huge role in helping to process nutrients before they get out of balance.

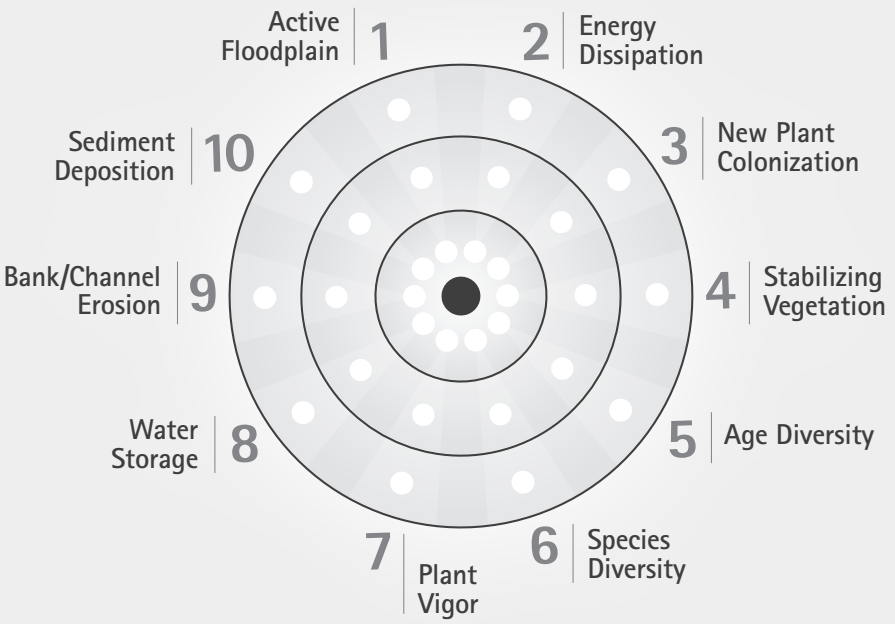
Learning to See

Worksheet page 1 of 2

Riparian Bull's-Eye Evaluation

Bull's-eye scoring is a handy, new method to evaluate the riparian health of a perennial or seasonal creek or river site in a uniform manner. The tool presented here uses ten riparian indicators (see table on back) to guide your eye in assessing riparian landscapes for their function and identifying activities that may be hindering the natural riparian recovery process.

After careful observation, mark your findings in the small white circles on the appropriate ring of the bull's-eye target. The outer ring represents poor health and dysfunction, middle ring warns of at-risk riparian condition, and the inner zone, or bull's-eye, indicates a healthy, functioning riparian area.



Common hindrances:

- Farming, mowing, or spraying weeds or brush too close to the bank
- Logging and related timber harvest activities adjacent to the waterway
- Manicured or altered residential or park landscapes next to the waterway
- Prolonged grazing concentrations in creek areas
- Excessive populations of deer, exotic hoofstock, or feral hogs in creek areas
- Burning in riparian area
- Removal of large dead wood and downed trees
- Artificial manipulation of banks, channels or sediment
- Physical alteration of floodplain
- Excessive vehicle traffic in creek area
- Excessive recreational activity or foot traffic in creek area
- Excessive alluvial pumping or other withdrawals
- Excessive growth of invasive species that inhibit natives
- Low water dams and large reservoirs
- Poorly designed road crossings and bridges

Report your observations!

Complete and submit this form with one to four photos to TexasStreamTeam@txstate.edu, or send by U.S. Postal Service to: Texas Stream Team, 601 University Drive, San Marcos, TX 78666.

Name: _____ Date submitted: _____

Site location/description: _____

Total miles traveled: _____ Time spent monitoring: _____

Number of circles in bull's-eye: _____ Evaluation date: _____

Signature: _____

Worksheet page 2 of 2

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