GROUP A. PROJECT MANAGEMENT

A1. Title and Approval Sheet

Quality Assurance Project Plan

Lower Cow Creek Phase III Water Quality Improvement Project

Submitted by:

New Mexico Environment Department
Surface Water Quality Bureau

APPROVAL SIGNATURES

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John Moeny
Project Officer, SWQB — Date

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3/22/2022

Nelly Smith
Chief, State and Tribal Programs Section, WDAS, EPA Region 6 — Date

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Acronyms

ACOE	United States Army Corps of Engineers
CWA	Clean Water Act
DQO	Data Quality Objectives
EPA	United States Environmental Protection Agency
NMED	New Mexico Environment Department
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
SOP	Standard Operating Procedures
SWQB	Surface Water Quality Bureau
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
UPWA	Upper Pecos Watershed Association
WDAS	U.S EPA Water Division, Assistance Programs Branch, State and Tribal Programs Section
WQPD	Water Quality Protection Division

A3. Distribution List

Table 1 below contains the distribution list, and project roles and responsibilities for this project. The QA Officer (QAO) will ensure that copies of this QAPP and any subsequent revisions are distributed to individuals who have signature authority to approve this QAPP. This QAPP refers to the SWQB Project Officer as "Project Officer" for this project. The Project Officer will ensure that copies of the approved QAPP and any subsequent revisions are distributed to all other project personnel listed in Table 1. All members of the distribution list who do not have signature authority to approve this QAPP will review the QAPP and sign the Acknowledgment Statement prior to initiating any work for this project. The signed Acknowledgement Statements (electronic or hard copy) will be collected by the Project Officer and will be given to the QAO for filing with the original approved QAPP.

Table 1. Distribution List, Project Roles, and Responsibilities

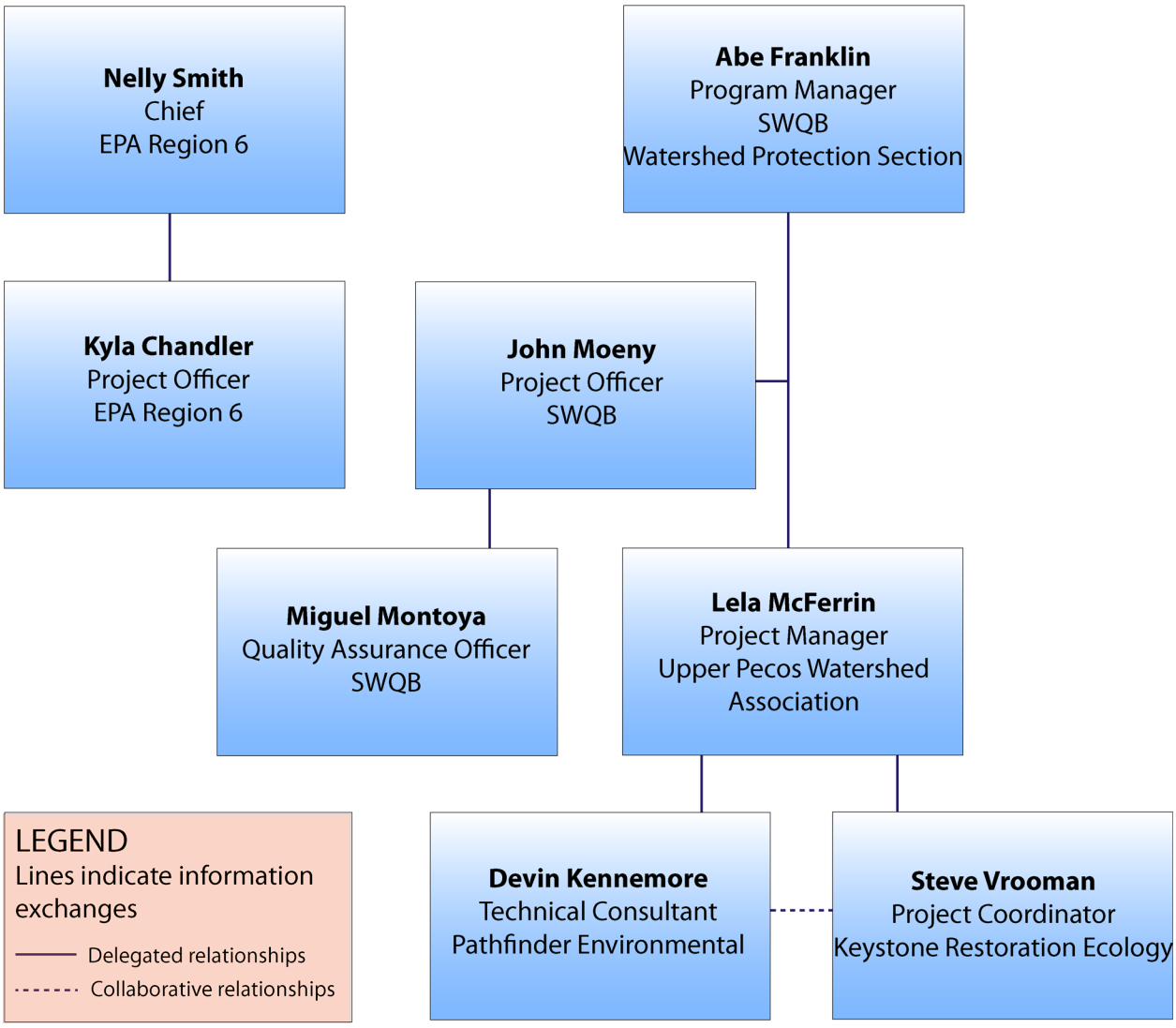
Name	Organization	Title/Role	Responsibility	Contact Information
Abraham Franklin	SWQB	Program Manager	Reviewing and approving QAPP, managing project personnel and resources	(505) 946-8952 Abraham.franklin@state.nm.us
Miguel Montoya	SWQB	QAO	Reviewing and approving QAPP	(505) 819-9882 Miguel.Montoya@state.nm.us
John Moeny	SWQB	Project Officer	Preparing QAPP, project reporting, coordinating with contractors, EPA reporting	(505) 819-9868 John.Moeny@state.nm.us
Lela McFerrin	UPWA	Project Manager	Project oversight	(505) 470-3235 lelamcferrin3@gmail.com
Devin Kennemore	Pathfinder Environmental, LLC	Technical Consultant	Field monitoring, data collection, record keeping, and submitting reports	(505) 699-5175 devin@pathfinderenvironmental.com
Steve Vrooman	Keystone Restoration Ecology, Inc.	Project Coordinator	Project design and implementation, construction oversight	(505) 490-0594 stevevrooman@gmail.com
Kyla Chandler	EPA	State & Tribal Grants Project Officer	Reviewing and approving QAPP	(214) 665-2166 chandler.kyla@epa.gov
Nelly Smith	EPA	Chief, State and Tribal Programs Section Water Division, Region 6	Reviewing and approving QAPP	(214) 665- 7109 smith.nelly@epa.gov

A4. Project Organization

The SWQB Quality Management Plan (NMED/SWQB 2021c) documents the independence of the Quality Assurance Officer (QAO) from this project. The QAO is responsible for maintaining the official approved

QAPP. Figure 1 presents the organizational structure for the Lower Cow Creek Phase II Water Quality Improvement Project.

Figure 1. Organization Chart



A5. Problem Definition /Background

The purpose of this Quality Assurance Project Plan (QAPP) is to define the methodology for monitoring the effectiveness of the Lower Cow Creek Phase II Water Quality Improvement Project. This QAPP refers to the project as the "Lower Cow Creek Project." The Lower Cow Creek Project is being managed by the Upper Pecos Watershed Association (UPWA).

EPA funding under Section 319 of the Clean Water Act provides resources to implement activities described in the document: New Mexico Nonpoint Source Management Plan, 2019. The plan states, "The SWQB established an effectiveness monitoring program in 2008, with the goal of documenting effects on water quality resulting from projects implemented with Section 319 funds, or '319 Projects.'"

Section 7.3 of the plan, titled Program Effectiveness Monitoring, states that "effectiveness monitoring will be conducted within each selected project area at least twice (before and after project implementation) in a three year period."

This QAPP is a companion document to the SWQB QAPP for Water Quality Management Programs (NMED/SWQB 2021b or most current version). The SWQB SOPs (Standard Operating Procedures - https://www.env.nm.gov/surface-water-quality/sop/) are incorporated in the SWQB Quality Assurance Project Plan for Water Quality Management Programs by reference. All of the policies and procedures specified in the SWQB QMP and QAPP will be followed for the Lower Cow Creek Project, unless otherwise specified.

When changes affect the scope, implementation, or assessment of the outcome, this QAPP will be revised to keep project information current. The Project Officer, with the assistance of the QAO, will determine the effects of any changes to the scope, implementation, or assessment of the outcome on the technical and quality objectives of the project. This Project Plan will be reviewed annually by the Project Officer to determine the need for revision.

Objective

The objectives of the environmental monitoring component of the Lower Cow Creek Project are to assess the baseline water temperature condition of Lower Cow Creek and to identify the temperature reduction in the Lower Cow Creek Watershed (USGS HUC 130600010104), where the restoration project will be implemented. The secondary objective of the monitoring is the assessment of shade improvements over the creek as a result of implementation of the Cow Creek Project (see Appendix for approved scope of work from Response to Proposal).

Background

The New Mexico 2020-2022 Clean Water Act Section §303(d)/§305(b) Integrated Report, Appendix A recognizes four stream segments in the Upper Pecos watershed as being impaired for temperature (Table 2) with the probable sources of impairment including: highway/road/bridge runoff (non-construction related), loss of riparian habitat, rangeland grazing, stream bank modifications/destabilization, and watershed runoff following forest fire (NMED/SWQB 2005). The temperature listings for the first three segments were first reported in the 1998-2004 §303(d)/§305(b) Integrated Reports. The fourth segment was first reported in the 2020-2022 §303(d)/§305(b) Integrated Report.

Table 2. Temperature Impaired Stream Segments in the Upper Pecos Watershed

Impaired stream segments	Cause for impairment
Cow Creek (Bull Creek to headwaters) 24.84 miles length	Temperature
Cow Creek (Pecos River to Bull Creek) 16.1 miles length	Temperature
Pecos River (Cañon de Manzanita to Alamitos Canyon) 5.74 miles length	Temperature
Pecos River (Alamitos Canyon to Jack's Creek) 21.83 miles length	Temperature

The overarching goal of this project is to produce measurable reductions in water temperature at the lower end of an approximately 0.8-mile-long segment of Cow Creek (Pecos River to Bull Creek, AU NM-2214.A_090) and contribute to the temperature load reduction goals for the upper Pecos watershed outlined in the 2005 Pecos Headwaters TMDL (Table 3) (NMED/SWQB 2005). A TMDL for Pecos River (Alamitos Canyon to Jack's Creek) has not yet been published.

Table 3. Needed Temperature Reductions and Increases as Calculated from the 2005 Pecos Headwaters TMDL

Stream reach	Temperature reduction	Shade increase	Load reduction ($j/m^2/s$)
Cow Creek (Bull Cr. to headwaters)	2.5 degrees C.	25%	17.61
Cow Creek (Pecos River to Bull Cr.)	0.9 degrees C.	8%	48.71
Pecos River (Alamitos Cr. to Cañon de Manzanita)	5.8 degrees C.	38%	100.84

For the Cow Creek (Pecos River to Bull Creek) Assessment Unit, the water quality standard for temperature is achieved when the percent total shade is increased to 61 percent, although the actual Load Allocation (LA) (which includes a margin of safety) of 73.0 j/m2/s is achieved when shade is further increased to 65 percent.

Thus, the goal for this project is to increase canopy cover along a 0.8-mile long segment of Lower Cow Creek (Pecos River to headwaters) by 8 percent and to produce a corresponding estimated reduction in temperature of 0.07 degrees C by 2025. This stated goal might not be achieved until the planted vegetation along the reach matures and begins trapping sediment and reducing erosion; however (all other factors being held constant), UPWA anticipates some measurable progress will be made by 2023 that demonstrates a trend towards achievement of the temperature reduction goal. More immediately, an important project goal is to create cold water refugia at constructed pools, locations will be finalized in project restoration design. The current channel morphology has been simplified due to past land use, and this project will increase the longitudinal complexity, including addition of cold water refugia through the implementation of a restoration techniques that will help maintain base flow and lower stream temperatures.

A6. Project/Task Description

Description

The Lower Cow Creek Project will monitor stream temperature. Acquisition of these data will occur before implementation of restoration activities to establish pre-treatment (baseline) conditions. Post-construction monitoring of temperature will occur to determine load reductions achieved by the project. These activities will occur independently from restoration activities.

The study design consists of three temperature monitoring sites, one upstream of the restoration project area, one in the middle of the restoration project reach, and one site downstream of the restoration project to determine reductions in temperature after project implementation. Exact

locations will be determined in the field by the Technical Consultant, Devin Kennemore, with the assistance of the Project Coordinator, Steve Vrooman based on professional judgement within the area identified in Figure 2. The monitoring site locations shown in Figure 2 are approximations at this time.

Pathfinder Environmental will be responsible for temperature data, percent canopy cover and photo-documentation.

Temperature data will be collected with temperature data loggers and will be deployed to capture the period of maximum expected temperature. In New Mexico this is generally from June through August. The deployment has been extended through September to account for any unforeseen events that may delay retrieval of temperature data loggers.

Percent canopy cover data and photo-documentation will be conducted at or in close proximity to restoration implementation areas. Percent canopy cover and photo-documentation will be used as ancillary data to demonstrate changes of water temperatures at the lower end of Cow Creek.
KRE will be responsible for the collection of stream channel morphology data. Steam channel morphology will be conducted where channel restoration is planned according to final restoration design. Channel morphology will be collected to demonstrate the success of the channel manipulation techniques applied to the creek.

Schedule
Baseline data collection for stream temperature, percent canopy cover, photo-documentation and channel morphology will be conducted during the summer of 2022.

Temperature data loggers will be deployed in May and will record data during the warm season, from June 1 through September 30, to capture temperatures at 15 minute intervals, 24 hours per day. Data from the data loggers will be downloaded twice during the monitoring season at approximately 40 day intervals.

Percent canopy cover and photo-documentation will be conducted at planned restoration sites pre- and post-implementation of restoration measures.

Channel morphology will be conducted at restoration sites prior to channel construction and again after channel construction to demonstrate the success of the channel manipulation techniques applied to the creek.

Post-construction monitoring (stream temperature, percent canopy cover, photo-documentation and channel morphology) is planned for the summer of 2023-2025 on the same timeline as baseline data from 2022. These data will be examined at the end of the project and compared to the pre-treatment data from 2022 to determine the load reduction achieved by the Lower Cow Creek Project.

Table 4. Project Implementation Schedule

Task/Responsible Party	Start Date	Completion Date
1. Project Management/UPWA	11/2/2021	9/30/2025
2. Project Administration and Reporting/UPWA	11/2/2021	9/30/2025

Task/Responsible Party	Start Date	Completion Date
3. Development of QAPP/Pathfinder Environmental	11/2/2021	3/31/2022
4. Environmental Baseline Data Collection and Monitoring (temperature, percent canopy cover, and photo-documentation)/Pathfinder Environmental	6/1/2022	9/30/2022
5. Pre-Construction Channel Morphology/KRE	5/1/2022	12/31/2022
6. Biological and Archaeological Surveys and Reporting, NEPA, CWA Permitting/Pathfinder Environmental	1/1/2022	9/30/2022
7. Project Design/Keystone Restoration Ecology	11/2/2021	9/30/2022
8. Clean Water Act Sections 404 & 401 Compliance/Pathfinder Environmental, Keystone Restoration Ecology	9/1/2022	12/31/2022
9. On the ground implementation/Keystone Restoration Ecology	1/1/2023	4/31/2023
10. Post-construction channel morphology/KRE	5/1/2023	6/30/2025
11. Post-construction monitoring for temperature, percent canopy cover, and photo-documentation/Pathfinder Environmental	5/1/2023	8/30/2025
12. ACOE Monitoring Reports/Pathfinder Environmental	11/15/2023	9/30/2025
13. Landowner Meetings/Educational Outreach	1/1/2022	6/30/2025
14. Watershed-wide UPWA Operations	11/2/2021	9/30/2025

Project Area

The project area is located entirely on private land along a 1.3-mile segment of the Cow Creek Assessment Unit (Pecos River to Bull Creek, NM-2214.A_090), mostly upstream of North San Ysidro, within the 12-digit Hydrologic Unit Code (HUC) number 130600010104 (Figure 2). This priority reach is near the lower end of approximately 15.57 impaired stream miles in total (2016-2018 Clean Water Act Section §303(d)/§305(b) Integrated Report). This Assessment Unit encompasses 22,253 acres in total. The project area consists of approximately 0.8 mile of Cow Creek and approximately 9.7 acres of land area, assuming an average 100-foot corridor width where the project will be implemented.

From a qualitative standpoint, this reach is in “good” to “fair” condition in most locations. Entrenchment to bedrock is common through the project area. Riverbank erosion is scattered and unevenly distributed throughout the project area. Shade over the stream is good in most places, although frequently threatened by erosion and landowner activities and absent in areas with the highest erosion. Agricultural practices continue to plague this reach of the creek. Local landowners have taken significant measures to protect the stream bank in a number of locations by constructing stacked rock walls along the bank, but these “fixes” have subsequently led to unanticipated consequences downstream.

Figure 2. Lower Cow Creek Project Area

Location Selection Criteria

The Contractor's rationale for selecting this project was based on three considerations: First, our goal is to implement and complete an on-the-ground project that achieves some measure of water-temperature load reduction in the Cow Creek Assessment Unit as described in Chapter 5 – Management Measures, Restoration Techniques (pages 62-65) of the Upper Pecos WBP. The second consideration is to implement a project that will improve riparian habitat in the near-term (within the 4-year project life) and to use the project to showcase and promote the use of similar restoration techniques to landowners along the Pecos River and Cow Creek in future public outreach and education work. Third, the Cow Creek project area is a prime example of an area where the benefits of the proposed restoration would serve as a demonstration and model for other landowners upstream and downstream within the Assessment Unit. The benefits of reducing erosion along this reach using the techniques described in the Upper Pecos WBP and employed by this project would be quickly realized by the public and contribute to meeting our goals of engaging and involving the public as described in Chapter 9 – Outreach and Community Involvement of the Upper Pecos WBP (pages 107-108).

Restoration Activities

In this project, the Contractor will: 1) improve floodplain access and create floodplains; 2) improve in-stream geometry; 3) plant vegetation to stabilize banks and lower stream temperatures; 4) work with the landowners to provide them with sustainable management techniques for long-term restoration success.

These activities are aimed at reducing temperatures in the creek by addressing the previously mentioned probable sources of impairment, including: highway/road/bridge runoff (non-construction related), loss of riparian habitat, rangeland grazing, streambank modifications/destabilization, and watershed runoff following forest fire.

Planting/transplanting appropriate native tree and shrub species, such as cottonwood and willow, in open areas along the bank will contribute to a reduction in water temperatures over time as canopy cover develops and the vegetation matures. Revegetation of eroded riparian areas with trees and native herbaceous species will also reduce stream bank erosion and attenuate flood peaks as water spreads and flows across the floodplain. Restoration of channel geometry will raise the water table and improve the hydrologic connection between the creek and the riparian zone, which should result in higher flows later in the late summer and fall months when stream flow is lowest (and therefore temperatures are highest). A higher water table will also have the beneficial effect of encouraging the conditions for riparian vegetation. The text on pages 62-63 (Chapter 5 – Management Measures, Restoration Techniques) of the Upper Pecos WBP describes the accrued benefits of planting native trees, shrubs, and riparian plants such as sedges, rushes, and grasses to hold soils and stabilize stream banks.

Stream Restoration Techniques – Stream channel restoration will include the installation of grade control structures to reconnect the creek with the floodplain. In other areas where the bank is being eroded, the top will be laid back, the floodplain widened, native riparian vegetation will be established, and pools and riffles will be created. These improvements will have a positive beneficial effect on aquatic habitat diversity (page 63-64, Upper Pecos WBP).

Sediment Control – The benefits of planting vegetation along exposed, eroded stream banks and manipulating channel morphology also extend to more effective control of sediment production, transport, and entrainment. This is discussed on pages 64-65 of the Upper Pecos WBP. Landowners will

be taught to leave a band of dense riparian vegetation along the stream bank in the project area to slow surface runoff from their cultivated fields and trap sediment before it reaches the creek.

A7. Quality Objectives and Criteria for Measurements

Question/Decision

The data collection and monitoring components of the Lower Cow Creek Project are intended to answer the following questions: 1) What is the stream temperature load reduction as a result of implementing the Lower Cow Creek Project in the Upper Pecos Watershed? 2) What is the improvement in riparian shade over the creek as a result of implementing the Lower Cow Creek Project in the Upper Pecos Watershed?

Stated as a decision: 1) The information gathered as part of the Lower Cow Creek Project will be used to determine the temperature load reduction resulting from implementation of the project. 2) The information gathered as part of the Lower Cow Creek Project will be used to determine the riparian shade improvement resulting from implementation of the project.

Data Quality Objective (DQO)

The quality of the data will be adequate to provide a high level of confidence in determining temperature load reduction and changes in the vegetative canopy coverage in the Lower Cow Creek Watershed.

Measurement Quality Objectives

The measurement quality objectives will be sufficient to achieve the Data Quality Objective (DQO) and will be in conformance with those listed in the SWQB's QAPP (NMED/SWQB 2021b). The Data Quality Indicators (DQI) listed in the SWQB's QAPP and applicable to the data collected for this project are accuracy, precision, bias, completeness, and sensitivity. Following the SWQB's SOPs for collecting percent canopy cover and for thermograph calibration checks, deployment, and data collection will ensure the temperature and canopy cover data meet the needs for the DQOs. Measurement Quality Objectives (MQOs) are stated in the SWQB SOPs for thermograph calibration checks and deployment procedures to ensure the necessary sensitivity of the thermographs and accuracy of temperature data points. MQOs are also inherent in the SOPs for precision and completeness through thermograph deployment procedures. The MQOs for canopy cover measurement that address all DQIs are inherent in the procedures described in the SWQB SOP for Physical Habitat Measurements specially for Percent Canopy Cover.

Data Quality Indicators (DQIs) for Channel Morphology

DQI	Determination Methodologies
Precision	will be ensured by following the procedures identified in this QAPP and having two monitoring participants present during all data collection activities.
Bias	the basis for determining accuracy will be staff's expertise of the survey method for collecting data and ensuring the accuracy of the equipment being used is within the required range of a particular survey

Accuracy	location of Rosgen Level II sites will be monumented and GPS'd so that data is consistent and repeatable.
Representative	pre-construction monitoring sites will be determined in areas anticipated where channel work is planned. Post-construction Rosgen Level II data will be collected at restoration implementation sites.
Comparability	monitoring locations at restoration implementation sites will be monumented for repeat sampling events to compare data. Methods listed under this QAPP for data collection are standardized and reproducible with the intent to be comparable to other studies.
Completeness	surveys and methodologies will be completed in their entirety as identified in this QAPP.
Sensitivity	Sensitivity of metrics used will be analyzed during analysis and recalibration of data and instruments.

A8. Special Training/Certification

No special certification is required to implement this QAPP. Baseline data collection and monitoring for this project will be implemented by Pathfinder Environmental with field assistance from UPWA volunteers and technical assistance and oversight from SWQB personnel. Pathfinder Environmental has been deploying and collecting the same type of data for other UPWA projects for five years and is now thoroughly familiar with calibration, deployment, data collection, and shade measurement techniques as described in the SWQB SOPs. Volunteer assistance will be trained and supervised at all times by Pathfinder Environmental personnel in the field during deployment and data collection (both temperature and shade) efforts.

Data collection for channel morphology will be primarily implemented by Steve Vrooman of KRE. KRE is a Santa Fe New Mexico consulting firm founded in 2001. KRE specializes in the ecosystem restoration of natural and man-made landscapes using the sciences of ecology and geomorphology. Mr. Vrooman along with his associates at KRE have extensive experience in watershed assessment, water-harvesting road design, stream and wetlands restoration, and rangelands monitoring in New Mexico, Colorado, Arizona, and Texas.

Steven Vrooman has worked throughout the southwest with an emphasis on high desert environmental restoration of riparian and upland ecosystems. He has as BS in Biology from New Mexico Tech and a MS in Biology from University of Nevada specializing in plant community ecology.

A9. Documents and Records

The Project Officer will make copies of this QAPP and any subsequent revisions available to all individuals on the distribution list who do not have signature authority to approve this QAPP.

Project documents include this QAPP, field notebooks, calibration records, validation and verification records, recorded field data, records of analytical data in hard copy or in electronic form, and QC records. Also included are project interim and final reports. All field sheets will be verified before leaving the field, any data captured on a global positioning system (GPS), camera, smart phone, tablet, or laptop will be downloaded to a Pathfinder Environmental computer or an external hard drive at the end of each day. Copies will be made of all data and stored separately from the original data. Data will be submitted to SWQB Project Officer. Data obtained under this QAPP will also be submitted to NMED SWQB for consideration of water quality assessment purposes. These activities will be completed by Devin Kennemore of Pathfinder Environmental.

All digital project data will be kept in a project file on Pathfinder Environmental laptop computers and on a separate external backup online via Pathfinder Environmental's Dropbox file system. Hard copy documents, such as field data sheets, will be kept in a project folder in a steel file cabinet in the Pathfinder Environmental office. These hard copy documents will be digitized and stored on Pathfinder Environmental laptop computers and external online backup drive (see Table 5). All project data will be kept through contract completion and then turned over in full to UPWA for indefinite storage on an UPWA computer. Copies of the data will be distributed by Pathfinder Environmental to the Project Officer at the end of the project in 2025 using the SWQB Data Submittal Process.

Table 5. Data Records for the Lower Cow Creek Project

Document	Form	Field Sheet Used
QAPP	Electronic (.doc) & Hard Copy	N/A
Calibration Records	Electronic (.doc) & Hard Copy	N/A
Thermograph Deployment Form	Hard Copy	Thermograph Deployment/Retrieval Form. Found under "Related SOP forms for SOP 6.3 Temperature Data Loggers. Located at: https://www.env.nm.gov/surface-water-quality/sop/
Temperature Data	Electronic Excel Files and HOBOware files	N/A
Temperature Effectiveness Analysis	Electronic Excel Macro files	Ancovinator & Thermonator Excel forms. Available from Dan Guevara, NMED SWQB
Canopy Cover Data	Electronic (.xls) & Hard Copy	Habitat Field Sheets-Percent Canopy Cover Field Form. Found under "Related SOP forms for SOP 5.0 Physical Habitat Measurements. Located at: https://www.env.nm.gov/surface-water-quality/sop/
Photo-documentation	Electronic (.jpg)	Field Notebook and Photo-documentation Form
Channel Morphology	Electronic (.xls) and hard copy	Rosgen Level II field sheets and field notebook
Interim and Final Reports	Electronic (.doc) & Hard Copy	N/A

GROUP B: DATA GENERATION AND ACQUISITION

B1. Sampling Plan

Waterbody attributes and monitoring station locations for the Lower Cow Creek Project are presented in Tables 6 and 7, respectively. Figures 3 and 4 show the approximate locations of the thermograph stations on Lower Cow Creek in the Cow Creek watershed.

Table 6. Waterbody Attributes for the Cow Creek Project

Waterbody	Assessment Unit ID	12-Digit HUC	12-Digit HUC Name
Cow Creek	NM-2214.A_090	130600010104	Lower Cow Creek

Table 7. Lower Cow Creek Project Monitoring Stations established for the Project

Station	Location	Monitoring
Lower Cow Creek Upper	Between the end of the fenceline on river left and the rock wall on river right at the upper end of the project area	Temperature
Lower Cow Creek Middle	Centered in the middle of the project area where the big bend in the creek and the last house at the end of the road meet	Temperature
Lower Cow Creek Lower	At the lower end of the project area where the creek runs into the base of the mesa and makes a hard left turn	Temperature

Temperature monitoring will be conducted at locations representative of ambient stream conditions, generally in the transitional area between a riffle/run and a pool, or at the toe of a pool, rather than in shallow riffles or deep pools.

Percent canopy cover and photo-documentation will be conducted at restoration site where canopy is expected to increase and will be measured during the growing season using both a spherical densiometer and a digital camera. Photo-documentation will be conducted at established photopoints to allow for valid comparisons over time; and will be taken before and after additional vegetation is planted or other restoration work begins.

The field season is between June 1 and September 30 of each year but is subject to change based on unforeseen events. All temperature data collection, percent canopy cover monitoring and photo-documentation will occur during this time.

Channel morphology will be conducted at restoration sites prior to construction and again after construction to demonstrate the success of the channel manipulation techniques applied to the creek. Channel morphology data collection can include stream channel cross sections, longitudinal profile and plan form measurements. Data collection may occur out of the field season described above, during low flow periods so that channel morphology may be taken more accurately. Channel morphology will be collected during similar conditions and season so that data is consistent and comparable.

All monitoring sites are located on privately owned property with written access permission from the landowners; therefore, unlike projects on public lands, the sites will always be accessible. If sites become permanently inaccessible due to flooding, fire or other similar event the monitoring site will be moved to nearest most representative location available.

Figure 3. Project Area

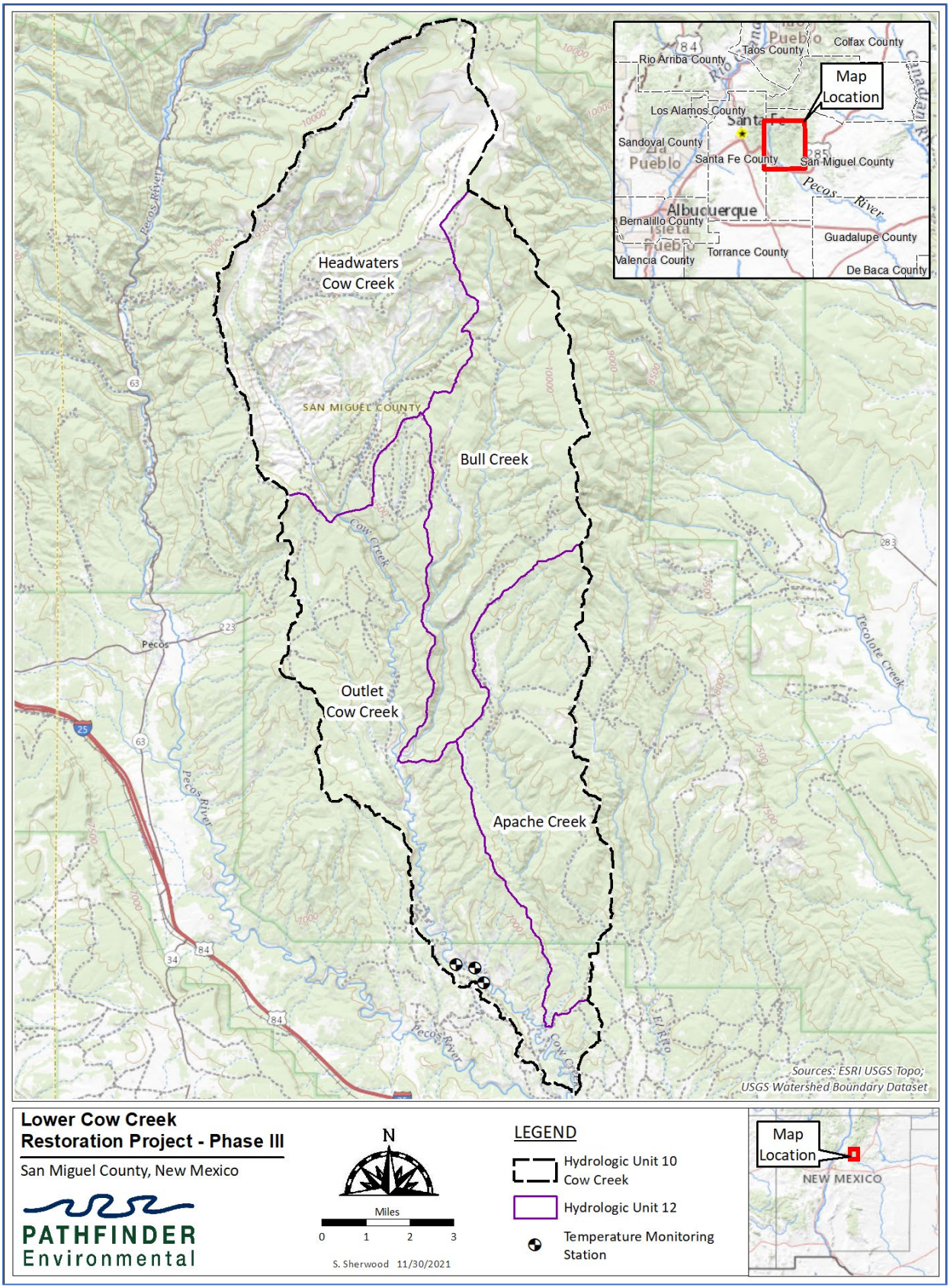
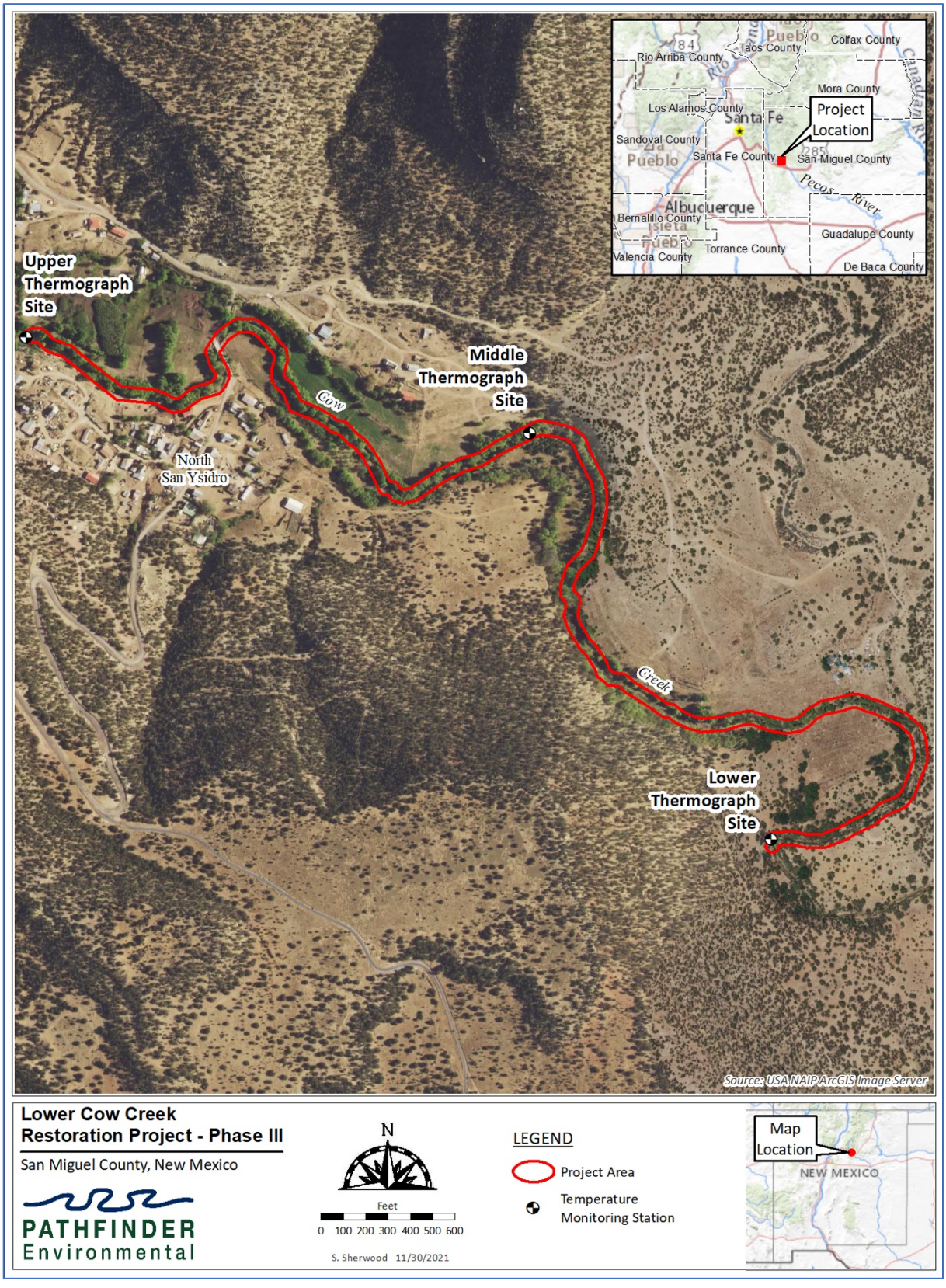


Figure 4. Project Area and General Temperature Data Logger Location



B2. Sampling Methods

This study is intended to measure temperature using recording data loggers. Temperature data logger deployment will be carried out in accordance to the SWQB QAPP using NMED SOP 6.3 Thermographs (NMED/SWQB 2019a). Water temperature will be collected with HOBO Water Temp Pro v2 data loggers (accuracy +/-0.2 °C, resolution 0.02 °C). Data from the data loggers will be downloaded via shuttle approximately every 40 days following deployment to minimize the chance of data losses associated with stochastic events (flooding). Data will be reviewed on a laptop in the field immediately after downloading to identify potential data download problems and take corrective action before leaving the project site. This field data review will also serve to ensure proper functioning and placement of the temperature data loggers, thus providing the opportunity to address such issues while time remains to correct them before the end of the data collection season.

Percent canopy cover measurements will be carried out within the project area in accordance with the Percent Canopy Cover Section of the NMED SWQB SOP 5.0 Physical Habitat Measurements. (NMED/SWQB 2019b). Data will be recorded on the Percent Canopy Field Form found in the Habitat Field Sheets identified in SWQB SOP 5.0.

Table 8. Data Types for the Lower Cow Creek Project

Metric	Method	Tolerances (if applicable)
Temperature	NMED SOP 6.3 Thermographs	accuracy +/-0.5 °C, resolution 0.02 °C
Canopy Cover	NMED SOP 5.0 Physical Habitat Measurements. Percent Canopy Cover Section.	
Stream Channel Morphology	Rosgen Level II according to the River Stability Field Guide and River Stability Forms and Worksheets	± 1.5 mm at 30 m and ± 1/16" at 100 ft

All photo-documentation will be documented in a table that includes the same attributes as the Photo-documentation Form (below). Location of percent canopy cover and photo-documentation sites will be recorded with a GPS so that monitoring is consistent and repeatable.

Photo-Documentation Form

Photo Point # and Site Location	Northing (GPS location)	Easting (GPS location)	Description	Comments

Channel morphology that could include the collection of cross-sections, longitudinal profiles and plan-form measurements data similar to Rosgen Level II, will be conducted according to the River Stability Field Guide and River Stability Forms and Worksheets (Harrell et al. 1994).

There are no plans to collect samples that would require outside analysis.

B3. Sample Handling Custody

Because there are no plans to collect samples for laboratory analysis, there are no handling requirements.

B4. Analytical Methods

Because there are no plans to collect samples, no analytical methods are needed.

B5. Quality Control

The chief source of data is measurements of temperature using data loggers, GPS and laser level for collection of channel morphology. The QC activities relating to equipment utilized for data measurements are described in this Section and in Sections B.6 and B.7 below.

Temperature quality control will be assured by verifying deployment locations are well submerged and not subject to erroneous air temperature readings. Loggers will also be checked for accuracy prior to deployment in, and retrieval from, the field as described in the Bureau SOP (NMED/SWQB 2019a). Temperature data collected with Hobo Water Temp Pro V2 data loggers will utilize SWQB SOP 6.4 Long-term Deployment Data Logger Quality Assurance (NMED/SWQB 2021a). The purpose of the SOP is to describe the procedures for: (1) retrieving recorded data from sondes and data loggers; (2) qualifying datasets retrieved from sondes and data loggers; (3) standardizing data formatting in Excel. The QA procedure will be conducted by Technical Consultant (Devin Kennemore) of Pathfinder Environmental with assistance and guidance for the SWQB. If QA procedure cannot be conducted by the Technical Consultant, the SWQB will ensure data are managed using SWQB SOP 6.4 before utilization of data by the SWQB for purposes other than stated by this QAPP.

Canopy coverage data has the greatest potential for observer error and bias. Quality control will be strengthened by following the procedures described in the Percent Canopy Cover Section of the SWQB Bureau SOP 5.0 Physical Habitat Measurements and having the same observer take measurements at each location. This reduces the bias affect and increases the precision of each measurement.

In order for the channel morphology data to be defensible and usable, quality control will be assured by the extensive experience of Steve Vrooman of KRE. Channel morphology data collection will be implemented by Steve Vrooman who is experienced watershed restoration specialist Steve will ensure equipment used for data collection of channel morphology are up to manufacture specifications before data collection as described in B6 and B7 of this QAPP.

Other actions that will assure the collection of quality channel morphology data are listed below.

- Data will be recorded on forms that identify the location, date, and description of observations for Rosgen Level II measurements
- KRE personnel will be familiar with the general principles of Rosgen Level II surveying and specific requirements of this QAPP. Site maps, flagging, and GPS locations will ensure the monitoring sites are relocated.
- KRE personnel will be knowledgeable of the monitoring protocol for Rosgen Level II surveying and will be able to identify changes to, or caused by, implementation of restoration techniques.
- The data will be recorded on specialized data sheets (see Methods section of this QAPP) and transferred to electronic spreadsheets for analysis.

- The field data sheets for channel morphology will be archived by the KRE and sent to SWQB Project Officer, if needed.

B6. Instrument/Equipment Testing, Inspection and Maintenance

The primary equipment needing maintenance, testing, and inspection are temperature data loggers. Hobo Water Temp Pro V2 data loggers will be tested before and after each field season according to the Accuracy Procedure as detailed in SOP 6.3 Temperature Data Loggers. The densiometer, GPS, camera will be inspected prior to use by the Technical Consultant, Devin Kennemore prior to each monitoring event. If equipment shows signs to be faulty the equipment will not be used for data collection.

If there is reasonable evidence that the laser level, or GPS has been damaged or is not up to manufacture specification, KRE will ensure that the equipment will not be used for data collection activities for this Project. There are no other supplies or consumables that could affect the quality of data related to this project.

List of Equipment and Supplies

- Laser Level
- GPS
- Camera
- Tape Measure
- Computers
- Machinery
- Temperature Data Loggers
- Spherical densiometer

B7. Instrument/Equipment Calibration and Frequency

It should be possible to show that all data was collected with monitoring devices that can be shown to have been properly calibrated. For this project, specific calibration requirements apply to temperature data loggers and the laser level. The densiometer does not require calibration other than inspection by field personnel prior to each use. The calibration of temperature data loggers will be checked annually (before deployment and after retrieval) using the methodology described in the NMED SWQB Standard Operation Procedures (SOP) 6.3 (NMED/SWQB. 2019a). Documentation of calibration and verification will be maintained by Technical Consultant, Devin Kennemore at the Pathfinder Environmental office. The GPS used for photo-documentation will also be checked to ensure unit is recoding data as described by manufacture specifications. The make and model of GPS used to record field measurements will be noted on field forms. Note will include accuracy specification of GPS unit.

Steve Vrooman of KRE will ensure laser level is calibrated to factory specifications before data collection. The laser level factory specification will be checked according to manufacture calibrations frequency.

B8. Inspection/Acceptance for Supplies and Consumables.

If there is reasonable evidence that the temperature data loggers, densiometer, gps or laser level have been damaged or are not up to specification as described in B6 and B7 the equipment will not be used to collect data measurements. There are no other supplies or consumables that could affect the quality of data related to this project.

B9. Non-Direct Measurements

There are no non-direct measurements used during the course of this project that will affect the quality of data related to this project.

Data and reports from previous project Phases (I-II) conducted in Cow Creek may be utilized by the current project, these projects were conducted under Section 319 of the Clean Water Act and required a QAPP before implementation.

Google earth and other aerial imagery software/application may also be used to realized critical landscapes elements and water quality information that will better inform the project. Data used from imagery software/application will be referenced and will be usable on a case by case basis, if the imagery software/application have undergone their own quality assurance process.

B10. Data Management.

Technical Consultant, Devin Kennemore of Pathfinder Environmental will be responsible for data management. Data will be sent to the Project Officer, John Money. All data will be converted to electronic format; hard copies of field sheets will be maintained in a project folder by Pathfinder Environmental. Electronic data will be organized by assessment and date and will be stored and backed up on Pathfinder Environmental and UPWA computers and external backup hard drives, respectively. Upon receiving reports and data, the SWQB Project will store data on SWQB network drive in project specific folder for the "Lower Cow Creek Phase II" Project. The SWQB network drive is backed up daily and maintained by the NMED Office of Information Technology. Electronic data files will be stored on the SWQB network drive in accordance with 1.21.2 NMAC, Retention and Disposition of Public Records

GROUP C: ASSESSMENT AND OVERSIGHT

C1. Assessment and Response Actions

The Project Officer will provide project oversight by periodically assisting with and/or reviewing data collection efforts. A review of the data collection and monitoring efforts by the Project Officer will take place at the end of each monitoring season. The Project Officer will assess project progress to ensure the QAPP is being implemented, including periodic audits by the QAO, as needed. Any problems encountered during the course of this project will be immediately reported to the Project Officer who will consult with appropriate individuals to determine appropriate action. Should the corrective action impact the project or data quality, the Project Officer will alert the QAO. If it is discovered that monitoring methodologies must deviate from the approved QAPP, a revised QAPP must be approved before work can be continued. All problems and adjustments to the project plan will be documented in the project file and included in the final report.

C2. Reports to Management

Semi-Annual reports will be submitted by the UPWA Project Manager, Lela McFerrin, to the Project Officer and will include progress of project implementation and any available data. Printouts, status reports or special reports for SWQB or EPA will be prepared upon request. The final report will be submitted to the SWQB Project Office by the end of the grant period as indicated in the final, signed Intergovernmental Agreement. The Project Officer will be responsible for submitting semi-annual reports, annual load reduction estimates, and a final report to EPA through their Grants Reporting Tracking System.

GROUP D: DATA VALIDATION AND USABILITY

D1. Data Review, Verification and Validation

Data will be reviewed by the contractor prior to demobilization from the field site. Data will be considered usable if the requirements of this QAPP were followed and the data is within acceptable range limits as defined under this QAPP. Data that appears incomplete or questionable for the parameter will be flagged for review. Flagged data will be discussed with the SWQB Project Officer to determine the potential cause and usability. If a reasonable justification for use of the data cannot be attained, those data will be not used in analysis and implementation of restoration activities unless the data can be recollected and assessed for usability

D2. Validation and Verification Methods

The Technical Consultant (Devin Kennemore) will ensure that valid and representative temperature, percent canopy and photo-documentation data are acquired under this QAPP for the Lower Pecos Phase II Project. Verification of temperature data results will be performed by the Technical Consultant, and will occur in the review of data. In the event questionable data are found, Technical Consultant will contact the Project Officer and the Project Officer will consult with project personnel to determine the validity of the data. Results of the verification process will be included in the final reports. Data verification procedures will be used by Technical Consultant, Devin Kennemore, and reviewed by the Project Officer, as described in NMED SWQB SOP 15.0 “Data Verification and Validation” (2019c). The validation of temperature data will occur after review of data by the SWQB. A verification and validation worksheet will be submitted by the Project Officer (or applicable SWQB staff) to the QAO before data will be considered for assessment of water quality standards in the development of the Integrated Report and List.

The Steve Vrooman of KRE will ensure that valid and representative data are acquired for channel morphology data. Verification and validation of data will occur daily after data collection (Rosgen Level II measurements). A verification and validation checklist will be used to document the verification and validation process. In the event questionable data are found, the SWQB Project Officer will notified by either Steve Vrooman or Devin Kennemore and will consult appropriate personnel to determine the validity of the data. Results of the verification and validation process will be included in the final reports.

D3. Reconciliation with User Requirements

The user requirement is a restatement of the data quality objective: The quality of the data will be adequate to provide a high level of confidence of determining whether the Lower Cow Creek Project is meeting the project goals, as stated in the approved scope of work. If the project’s results do not meet this requirement, then additional monitoring may be necessary to fill in data, which may include an extension of the monitoring period to measure effects that were not apparent during the project period. This would require a contract extension from NMED.

REFERENCEES

Harrelson, Cheryl C; Rawlins, C.L.; Potyondy, John P. 1994. Stream channel reference sites: an illustrated guide to field technique. Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest And Range Experiments Station. 61 p.

NMED/SWQB (New Mexico Environment Department/Surface Water Quality Bureau). 2005. Total Maximum Daily Load (TMDL) for Pecos Headwaters Watershed, Ft. Sumner Reservoir to Headwaters. Accessed at: https://www.env.nm.gov/surface-water-quality/tmdl/

NMED/SWQB. Data Submittal Process and Guidelines for Submission of Water Quality Data. Available at: https://www.env.nm.gov/surface-water-quality/data-submittals/

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NMED/SWQB. 2019d. Comprehensive Assessment and Listing Methodology. Procedures for Assessing Water Quality Standards Attainment for the State of New Mexico CWA 303(d)/305(b) Integrated Report: Approved September 03, 2019. Available at: https://www.env.nm.gov/surface-water-quality/calm/

NMED/SWQB. 2020-2022. Clean Water Act Section §303(d)/§305(b) Integrated Report and List. Available at: https://www.env.nm.gov/surface-water-quality/303d-305b/

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NMED/SWQB. 2021b. Quality Assurance Project Plan for Water Quality Management Programs [QAPP]. Approved November 20, 2021. Available at: https://www.env.nm.gov/surface-water-quality/protocols-and-planning/

NMED/SWQB. 2021c. Quality Management Plan for Environmental Data Operations. Available at: https://www.env.nm.gov/surface-water-quality/protocols-and-planning/

Acknowledgement Statement

New Mexico Environment Department Surface Water Quality Bureau

Lower Cow Creek Project Phase III

Quality Assurance Project Plan Acknowledgement Statement

This is to acknowledge that I have received a copy (in hard copy or electronic format) of the "Lower Cow Creek Project" Quality Assurance Project Plan.

As indicated by my signature below, I understand and acknowledge that it is my responsibility to read, understand, become familiar with and comply with the information provided in the document to the best of my ability.

_____
Signature or Electronic Signature (e-certified accepted)

_____
Name (Please Print)

_____
Date
Return to SWQB QAO Miguel Montoya

Workplan

DocuSign Envelope ID: A2DB301A-3475-4157-B804-647AF8C8DA01

Attachment A: Project Work Plan

A. Project Title

Temperature and Erosion Control in Lower Cow Creek – Phase III

B. Applicant Information

Organization:	**Upper Pecos Watershed Association**		
Address:	**PO Box 140, Pecos, NM 87552**		
Contact Person:	**Frank Adelo**	Title:	**President**
Phone:	**505/757-3600 or 404-5429**	Email:	**UPWA@pecoswatershed.org or panchoadelo@hotmail.com**
FED. Tax ID #	20-5654749	Date of Incorporation:	9/15/2006 *(non-profits only)*

C. Project Manager

The project manager is responsible for oversight of the approved project including: administering contracts; ensuring technical viability of the project; ensuring funds expended are within the budget and in accordance with applicable law; and ensuring that quarterly fiscal and technical progress reports, and a final report, are submitted to NMED.

Name:	Lela McFerrin		
Organization:	Upper Pecos Watershed Association		
Phone:	505/757-3050 or 470-3235	Email:	lelamcferrin3@gmail.com

D. Start and End Dates

Planned project start date:	08/01/2021	Planned project end date:	09/30/2025

E. Plan Citation

Plan citation information:	The UPWA Watershed-Based Plan (WBP) titled Upper Pecos Watershed Protection and Restoration Plan was submitted to the Surface Water Quality Bureau (SWQB) NMED and the US

	Environmental Protection Agency (EPA) for review in 2012. EPA's Region 6 office accepted the plan on December 11, 2012. The WBP was updated in 2019 and approved by the NMED on February 18, 2019. The goal of this plan is to reduce and eliminate water pollution by implementing focused restoration projects and other land management activities and conducting education and outreach to remove the Pecos River and its tributaries from the list of impaired waters. Printed copies of the WBP are available for review at the Upper Pecos Watershed Association's office in Pecos, New Mexico, during normal business hours (Monday through Wednesday). An electronic copy of the same plan is available for review at: https://www.env.nm.gov/surface-waterquality/wp-content/uploads/sites/25/2019/12/Upper-Pecos-2019-Watershed-Based-Plan.pdf.

F. Planning Feedback

The Upper Pecos Watershed Association Watershed Based Plan was recently updated and approved by the EPA; therefore, there are no obsolete, inaccurate, or insufficient details that need to be addressed.

G. Project Area

Assessment Unit name and ID:	Cow Creek (Pecos River to Bull Creek), NM-2214.A_090
12-digit Watersheds:	HUC No: 130600010104
Project area (stream miles):	1.3 miles
Project area (upland watershed acres):	Approximately 8 acres
Project area map:	(See Figure 1., map provided at the bottom of this work plan.)

H. Problem Description

Assessment Unit ID	Assessment Unit Name	Impairment Parameters
NM-2214.A_090	Cow Creek (Pecos River to Bull Creek)	Temperature

Assessment Unit or Wetland Narrative

Page 36 of the UPWA WBP cited in Sections E and F, above, provides more information on the water quality problem for the lower reach of Cow Creek.

The temperature impairment within the lower Cow Creek stream segment is particularly worrisome from the standpoint of maintaining fisheries stock, since the stream is one the largest tributaries to the Pecos River within the upper Pecos watershed and provides excellent cold-water fish habitat in northern New Mexico. Sediment production caused by the loss of vegetative cover from the Tres Lagunas fire and the Viveash fire along Cow Creek and continued bank erosion are also a concern, since sediment particles absorb warmth from the sun and increase water temperatures in streams (Hagans et al. 1986) Sediment fills pools causing stream width-to-depth ratios to increase, which in turn facilitate heat exchange (Poole et al. 2000). In addition, fine sediments block the exchanges between surface waters, intragravel flows, and the hyporheic zone – contributing to warming effects on the aquatic biota that depend on this interstitial ecotone between shallow ground water and surface waters (Boulton et al. 1998). This reach of the creek is deeply incised, lacks a connected floodplain and deep pools, and has an overly wide and shallow channel.

UPWA previously completed implementation of a restoration project (Phase I) upstream of this proposed project under a previous Section 319(h) grant. Phase I began 1.3 miles upstream and ended 0.7 mile upstream. UPWA is currently in the process of implementing a second restoration project (Phase II) that begins 0.7 mile upstream from the start point for this proposed project and ends at the start point for this proposed project. This proposed project constitutes the third and final phase of the overall restoration of lower Cow Creek down through the Village of North San Ysidro. The three phases together will comprise a total restoration length of 2.6 miles. Page 77 of the UPWA WBP cites the three projects on lower Cow Creek as its first priority.

References:

Boulton, A.J., S. Findlay, P. Marmonier, E. H. Stanley, and H. M. Valett. 1998. The functional significance of the hyporheic zone in streams and rivers. Ann. Rev. Ecol. Syst. 29:59-81.

Hagans, D. K., W. E. Weaver, and M. A. Madej. 1986. Long term on-site and off-site effects of logging and erosion in the Redwood Creek Basin in Northern California. Technical Bulletin No. 460. national Council of Air and Streams, New York.

I. Goals

Assessment Unit ID	Assessment Unit Name	Current Impairment Parameters	Load Reduction Goals of Proposed Project
NM-2214.A_090	Cow Creek (Pecos River to Bull Creek)	Temperature	0.9 degrees C temperature reduction for the AU; 8% shade increase; 48.71 j/m^2/s load reduction

Goal Narrative

The lower reach of Cow Creek (Pecos River to Bull Creek, AU NM-2214.A_090) is 15.57 miles long. The overarching goal of this project is to implement management measures that will contribute to reduced water temperature at the lower end of an approximately 1.3-mile-long segment of this lower reach of Cow Creek and contribute to the temperature load reduction goals for the upper Pecos watershed outlined in the 2005 Pecos Headwaters TMDL.

For the Cow Creek (Pecos River to Bull Creek) Assessment Unit, the water quality standard for temperature is achieved when the percent total shade is increased by 8 percent, although the actual Load Allocation (LA) of 73.0 j/m2/s is achieved when shade is further increased to 65 percent. This paradox highlights the difficulty in measuring canopy cover and setting a quantitative achievement goal for water temperature reduction. This project proposes to implement restoration on a segment that comprises 8.3 percent of the total reach length.

Thus, our goal for this project is to increase canopy cover along a 1.3-mile long segment of lower Cow Creek (Pecos River to Bull Creek) by 15 percent and to produce an estimated reduction in temperature of 0.13 ^{o}C by 2024. To further enhance the effects of canopy cover, we also plan to address the geomorphology of the creek by excavating pools, installing crossvanes, creating gravel bars to narrow the channel and excavating the bank to create floodplains. Future projects upstream and downstream along this lower reach of Cow Creek would eventually combine with this one to achieve the desired goal for the entire reach of a 0.9 ^{o}C temperature reduction. This stated goal might not be achieved until the planted vegetation along the reach matures and develops a full canopy; however (all other factors being held constant), UPWA anticipates some measurable progress will be made by 2024 that demonstrates a trend towards achievement of the temperature reduction goal. If the temperature modeling is correct, the anticipated increases in canopy cover and shade will certainly achieve the stated goal in water temperature reductions over a longer time frame of 10 to 15 years.

Agriculture and livestock grazing have significantly affected regrowth of naturally occurring vegetation in the project area. A significant component of this project involves conducting workshops with local landowners, who support this project, to show them how they can better manage their land to reduce erosion and improve water quality in this segment of Cow Creek. Previous discussions with these landowners indicates a strong desire to better

understand the interaction between their land management practices and the creek. The impacts of livestock grazing have typically confined to a few isolated segments of Cow Creek, none of which have been up to now located in the proposed project area. The workshops with the land owners will include a discussion of the impacts of livestock grazing to the creek and the benefits of keeping livestock excluded from the project area.

J. Management Measures

Management Measure #1: Improving floodplain access and creating floodplains
Management Measure #1 Description: Channel incision has disconnected the creek from its floodplain areas due to filling of the floodplain for agriculture (see Figure 2). Over time, this lack of floodplain capacity caused channel incision to bedrock. This restoration project will create new floodplains in critical areas by removing excess sediment, creating bankfull benches and laying back steep banks to stable slopes. Steeper banks will be treated with Toe Wood structures to create bankfull benches and fish habitat in the structure. Where possible, fill will be removed from floodplains (and hauled off-site) to re-create large floodplain areas that will be planted with willows and cottonwoods to provide shading.
Management Measure #2: Improve in-stream geometry
Management Measure #2 Description: The lower reach of Cow Creek in North San Ysidro is a wide and shallow Rosgen F channel with steep banks and little floodplain access. In-stream restoration will focus on creating pool and rifle features and enhancing meandering of the channel. Rock grade control structures such as crossvanes, J-hooks and rock riffles will be constructed to enhance and diversify stream features throughout the project area and create a Rosgen B or C channel. The addition of grade control structures will also re-connect the channel with cobble layers in the floodplain to enhance bank storage. The water stored in the banks will return to the channel downstream and help maintain base flow and lower stream temperatures throughout the reach.
Management Measure #3: Vegetation planting to stabilize banks and lower stream temperatures.
Management Measure #3 Description: The banks of lower Cow Creek are vegetated with box elders and coyote willows. Willows are commonly treated as weeds to be removed, even along the bank of the creek. The riparian bosque consists mostly of box elders due to a lower palatability to livestock than cottonwoods. The newly created floodplains will be planted with coyote willow (Salix exigua), bluestem willow (Salix irrorata) cuttings and cottonwood (Populus deltoides) from nursery stock (1 or 5 gallon trees). In addition, selected non-treated banks will be planted with cottonwoods and managed to support the existing coyote willow thickets. Any disturbed banks or created floodplains will be re-vegetated with a native grass mix and mulched with grama grass straw.
Management Measure #4: Community outreach and workshops

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Management Measure #4: Community outreach and workshops

Management Measure #4 Description:
The incised and over-wide condition of lower Cow Creek is largely due to management of the landscape in order to practice agriculture in this narrow and confined valley. This project will work with local irrigators and landowners to suggest that narrow riparian buffers be left to provide shade and habitat on the floodplain. A riparian planting workshop will be held and will recruit UPWA volunteers and members of the community in order to gain support for changing management practices.

K. Key Persons

Key Person 1:	**Lela McFerrin**	**Upper Pecos Watershed Association**	**Project Manager**
Key Person 1 Qualification Summary:	Lela has been on the UPWA Board for 10 years and was project manager on UPWA's Mora River restoration grant, assisted on the Dalton Day Use Area grant, and worked planting, seeding and mulching on the Upper Cow Creek project; also coordinated the educational seminar for Cow Creek residents on how to manage bank erosion. Professionally, she was a paralegal for 25 years, specializing in environmental and water law, and a business owner for 25 years in Santa Fe and Pecos.		
Contractor?	No.		
Matching effort?	Yes.		
Key Person 2 (if applicable):	**Devin Kennemore**	**Pathfinder Environmental, LLC**	**Assistant Project Manager, Environmental Coordinator**
Key Person 2 Qualification Summary:	Mr. Devin Kennemore (Pathfinder Environmental, LLC) will serve as Assistant Project Manager and Environmental Coordinator. He will manage the day-to-day activities for the project and complete all environmental compliance and monitoring for this project. Mr. Kennemore has 30 years of experience in environmental permitting and compliance and is currently fulfilling the monitoring requirements for UPWA's current 319 grant for a project in Dalton Canyon and two more on lower Cow Creek immediately upstream from this one. Mr. Kennemore has been successfully executing these duties for 6 previous UPWA implementation projects over the last 6 years.		

Contractor?	Yes.		
Matching effort?	Mr. Kennemore will contribute some match time to this project, but most of his work will be reimbursed through this grant.		
Key Person 3 (if applicable):	**Steve Vrooman**	**Keystone Restoration Ecology**	**Project Designer and Construction Manager**
Key Person 3 Qualification Summary:	Mr. Steve Vrooman (MS) of Keystone Restoration Ecology has 23 years of experience in the field of stream and wetland restoration. He has recently co-authored a book with Bill Zeedyk on the "The Plug and Pond Treatment: Restoring Sheetflow to High Elevation Slope Wetlands in New Mexico" about their work at the Valles Caldera for the NMED. Steve has extensive GIS and LIDAR experience and will be using the LIDAR available for the area for assessment and evaluation of restoration options. Steve has constructed a large number of restoration projects in New Mexico with his trained crew at KRE.		
Contractor?	Yes.		
Matching effort?	Mr. Vrooman will contribute some match time to this project, but most of his efforts will be reimbursed through this grant.		
Key Person 4 (if applicable):	**Magda Matecka**	**Upper Pecos Watershed Association**	**Financial Coordinator and Administrative Assistant**
Key Person 4 Qualification Summary:	Magda Matecka (Upper Pecos Watershed Association) will serve as Financial Coordinator for this project and will provide accounting, federal grant administration, and implementation oversight. Ms. Matecka has many years of financial management experience through her former employment in Santa Fe, as well as Bachelor's Degree in Business and Administration with focus on Finances. She has been managing the financial responsibilities at UPWA for the last year. Ms. Matecka has reviewed all the existing contracts and financial records and is familiar with the invoicing process and record-keeping requirements for this grant.		
Contractor?	No.		
Matching effort?	No.		
Key Person 5 (if applicable):	**Dr. Ken Brown**	**Kenneth L. Brown, Archaeologist**	**Cultural Resources**

Key Person 5 Qualification Summary:	Dr. Brown's professional background includes more than 46 years of experience in all phases of cultural resource management. He holds a BA, MA, M.Phil., and Ph.D in Anthropology. He has worked in the Southwest (Arizona, New Mexico), Great Plains (Colorado, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Texas), and Great Basin (California, Nevada, Utah) spending the last 29 years in the Southwest, primarily New Mexico. He has been Principal Investigator and Project Manager for numerous cultural resource projects and is intimately familiar with the National Historic Preservation Act (NHPA) Section 106 process and its association with the National Environmental Policy Act (NEPA). During his 46-year tenure he has participated in more than 650 projects in the Southwest and Great Plains involving cultural resource investigations. Dr. Brown has worked on projects that have involved the U.S. Army Corps of Engineers (ACE), New Mexico and Arizona BLM, BIA, U.S. Forest Service, Bureau of Reclamation (BOR), Federal Highway Administration (FHWA), and New Mexico Department of Transportation (NMDOT).
Contractor?	Yes.
Matching effort?	Yes. Dr. Brown will contribute some match time to the project, but most of his efforts will be reimbursed through this grant.

L. Complementary Programs and Match

All of the proposed match is in the form of in-kind donations of time by volunteers who want to see the project implemented. This match will consist of time donated for project management, public outreach, executive oversight, quality control/quality assurance, QAPP development, monitoring assistance, and revegetation labor. Additional match will be provided in the form of willow stock for planting in the riparian zone of Cow Creek. The Upper Pecos Watershed Association has an active board that will assist in management and coordination for this project. Ms. Lela McFerrin, vice president, will donate her time as the project manager. The UPWA Board will continue to donate their time to assist the organization and this project going forward. Landowners along the creek where the project will take place will meet with Project team members to learn about what they can do to manage their property in ways that are less harmful to the creek and promote a healthy riparian zone. Their time will be donated to the project. Devin Kennemore and Steve Vrooman will donate a portion of their time on this project, primarily in the form of discounted rates. The difference between their standard hourly rates and their discounted rates will be reported to UPWA as match. The Acequia de la Placita Association, which operates the ditch that runs adjacent to this reach of Cow Creek will contribute such resources and assistance as necessary and available to make this project successful. Finally, UPWA conducts events throughout the year

aimed at improving water quality in the watershed and increasing public awareness of the water quality issues facing the watershed. Such events include, but are not limited to: Annual Meeting and Fund-raiser, volunteer spring and fall canyon clean-up events, trout in the classroom at the Pecos School District, Pecos Canyon Collaboration Meetings, Terrero Mine Working Group Coalition Meetings, efforts to have the upper Pecos River designated as an Outstanding National Resource Water, bi-weekly trash collection at Dalton Day Use Area, and other events as opportunities arise.

M. Clearances

A Clean Water Act Section 404 permit/401 water quality certification will be required. This project will be covered under Nationwide Permit 27 Aquatic Habitat Restoration, Establishment, and Enhancement Activities. A monitoring plan that includes pre- and post-construction monitoring will be required by the US Army Corps of Engineers when they issue the permit. Since the project is located entirely on private land, no NEPA compliance will be necessary; however, Section 106 of the National Historic Preservation Act and the Endangered Species Act must both be complied with for the 404 permit and 401 water quality certification.

N. Measures of Success

An achievement-based monitoring program will be used to determine if an increase in canopy cover of 8 percent and a load reduction of 0.07 degree Celsius in water temperature are achieved. Restoration implementation milestones and achievement criteria are summarized in Table 3 and follow those described in Chapter 8 - Achievement Criteria, Milestones, and Monitoring, Achievement Criteria, page 103 of the UPWA WBP.

Table 3. Measurable Milestones

Indicator: Stream/riparian project undertaken and completed
Milestone or criterion: Project schedule in Watershed-Based Plan

Indicator: Vegetation development in completed project
Milestone or criterion: Appropriate increases in vegetation canopy cover, density, height, vigor, and/or canopy closure as compared to pre-treatment conditions and project-specific desired conditions

Indicator: Water temperature in temperature-impaired stream
Milestone or criterion: Measured to be within standards (achievement criterion)

Temperature - Water temperature will be monitored from the end of May through the end of September using small temperature sensors (HOBO Water Temperature Pro v2 Data Loggers –U22-001 or similar) to record water temperatures every 15 minutes and to provide a temperature log that can be periodically downloaded to a computer on a monthly basis. At least two sensors will be deployed in the stream; one above and one just below the project area.

Channel Morphology - Channel cross sections will be recorded along the stream prior to construction and again after construction to demonstrate the success of the channel manipulation techniques applied to the creek.

Canopy and Shade - Changes in canopy cover and shade will be measured using a spherical densiometer. Photographs will be taken at established photopoints to allow us to make valid comparisons over time; and will be taken before and after additional vegetation is planted or other restoration work begins.

Quality Assurance Project Plan (QAPP) - Prior to initial data collection, UPWA will develop a Quality Assurance Project Plan (QAPP) for the project and submit a draft of this document to the SWQB for review and comment before our project is implemented. The final plan will describe how we collect, record, and evaluate monitoring data, and how we will review our monitoring protocols on a regular basis.

O. Implementation Plan and Schedule

Task Number	Task Title	Key Person	Planned Start Date	Planned End Date	Completion Benchmark
1	Project Management	Lela McFerrin	8/1/2021	7/30/2025	Project implemented, monitoring completed, and final report submitted
2	Project Administration	Magda Matecka	8/1/2021	7/30/2025	Project implemented, monitoring completed, final report submitted, all funds disbursed, match terms met
3	QAPP Development	Devin Kennemore	8/1/2021	3/31/2022	QAPP completed and approved by EPA
4	Environmental Baseline Data Collection	Devin Kennemore	5/1/2022	12/15/2022	First full year of pre-construction monitoring completed
5	Biological and Cultural Resource Surveys and Reports	Devin Kennemore/Ken Brown	8/1/2021	8/1/2022	Reports completed and ready for submission to USACE

Task Number	Task Title	Key Person	Planned Start Date	Planned End Date	Completion Benchmark
6	Project Design	Steve Vrooman	8/1/2021	8/1/2022	Design completed and approved by SWQB
7	Clean Water Act Sections 404 & 401 Compliance	Devin Kennemore	7/1/2022	9/15/2022	CWA 404 & 401 permits obtained
8	On the Ground Project Implementation	Steve Vrooman	9/16/2022	11/30/2022	Project construction completed
8a	Improving Access and Creating Floodplains	Steve Vrooman	9/16/2022	11/30/2022	1 acre of floodplains constructed
8b	Improve In-stream Geometry	Steve Vrooman	9/16/2022	11/30/2022	12 J-hook vanes and One Rock Dams constructed
8c	Vegetation Planting	Steve Vrooman	11/1/2022	11/30/2022	100 willow clumps and 50 cottonwood cuttings planted
8d	Community Outreach and Workshops	Steve Vrooman & Devin Kennemore	9/16/2022	11/30/2022	Before and after walk-throughs with landowners completed
9	Post Construction Monitoring	Devin Kennemore & Steve Vrooman	3/31/2023	6/30/2025	Post construction monitoring completed

Task Number	Task Title	Key Person	Planned Start Date	Planned End Date	Completion Benchmark
10	Monitoring Reports for USACE	Devin Kennemore	11/1/2023	12/31/2025	3 year-end monitoring reports submitted to USACE
11	Landowner Meetings/Educational Outreach	Devin Kennemore & Steve Vrooman	8/1/2021	7/30/2025	Site visits and meetings with each private landowner in the project area completed
12	UPWA Watershed-Wide Operations	Lela McFerrin & Magda Matecka	8/1/2021	10/31/2025	UPWA bi-annual watershed clean-up events, annual meeting and fund-raising event, other events held to promote water quality throughout the watershed

Task Number	Task Title	Task Description
1	Project Management	Developing and overseeing contracts, communication with agencies and subcontractors.
2	Project Administration	Reimbursement requests, writing reports.

3	QAPP Development	A project Quality Assurance Project Plan will be developed for vegetation and water quality monitoring activities.
4	Environmental Baseline Data Collection	Pathfinder Environmental will collect water temperature and canopy cover data prior to construction. KRE will take cross sections of the creek where channel work is planned.
5	Biological and Archaeological Survey Reports	Pathfinder Environmental will complete necessary surveys and reports to obtain state and federal clearances.
6	Project Design	A Rosgen Level II survey will be performed over the project reach with at least 10 channel cross sections. This information will be used to create the design. Final design document will include priority areas with proposed treatments, stream channel longitudinal and cross section profiles. Materials list, cut and fill volumes, construction and implementation schedule will be included.
7	Clean Water Act Sections 404 & 401 Compliance	Pathfinder Environmental will complete Clean Water Act Sections 404 and 401 compliance with a USACE Pre-Construction Notification under NWP 27.
8	On the Ground Project Implementation	KRE will implement restoration project design with a tracked excavator and tracked skidsteer loader and labor.
8a	Improving Access and Creating Floodplains	1 acre added to floodprone area as measured by cross sections
8b	Improve In-stream Geometry	12 J-hook vanes constructed; 12 one rock dams constructed
8c	Vegetation Planting	At least 100 willow clumps and 50 cottonwood cuttings planted and surviving
8d	Community Outreach and Workshops	A pre-project and post-project walk thru will be performed for property owners and village residents to provide information on riparian corridor management and gain local input on project design.
9	Post Construction Monitoring	Pathfinder Environmental will continue to collect temperature and canopy cover data for at least 3 years following construction, per USACE requirements.

10	Monitoring Reports for USACE	KRE will perform follow-up Rosgen Level II surveys to monitor if project geomorphology goals are being met. Pathfinder Environmental will prepare the annual reports required by the USACE and submit to the USACE at the end of each year for at least 3 years.
11	Landowner Meetings/Educational Outreach	Pathfinder Environmental and KRE will meet with local landowners at least twice on their land to discuss the measures they can take managing their land to promote the long-term stability of the creek.
12	Watershed-Wide UPWA Operations	UPWA has ongoing year round efforts to improve water quality throughout the watershed. These efforts are described in more detail in Section L. Complementary Programs and Match.

P. Budget

BUDGET CATEGORIES	CWA 319 Funds	Cash or In-Kind MATCH	TOTAL
Personnel: (Rates do not exceed $656.92 per day or $82.11 per hour.)			
Project Manager – Lela McFerrin (288 hrs. @ $82/hr.)		$23,616	$23,616
Project Administrator – Magda Matecka (288 hrs. @ $32/hr.)	$9,216		$9,216
UPWA Board of Directors: 720 hrs. @$47.00/hr (6 members x 2.5 hrs./mo. x 12 mo. x 4 yrs. x rate)		$33,840	$33,840
Travel: (If applicable, enter one or more rows for per diem, mileage, lodging, and/or meals, using rates in accordance with your organization's written travel reimbursement policies, or use the rates applicable to New Mexico state employees, at 2.42.2 NMAC).			
Mileage reimbursement (at the 2020 Federal mileage rate of $0.575/mi)			
Mileage for Pathfinder Environmental	$1,000		$1,000
Mileage for Keystone Restoration Ecology	$1,550		$1,550
Mileage for UPWA staff		$300	$300
Mileage Match for Volunteers		$400	$400
Supplies:			

BUDGET CATEGORIES	CWA 319 Funds	Cash or In-Kind MATCH	TOTAL
Monitoring supplies (individual items under $5,000 each) – **Laptop, Thermographs (Pathfinder)**		$640	$640
Materials donations – **Willows, rocks, locally obtained, donated by landowners**		$25,000	$25,000
Contractual – Direct Labor, Outside Services: (State number of hours and hourly rate for each person and type of equipment. Hourly salaries must not exceed $656.92 per day or $82.11 per hour.)			
Pathfinder Environmental, LLC – Biological, Archaeological, CWA 404/401 permitting, QAPP development, PM assistance, landowner coordination/workshops, pre- and post-construction monitoring, annual reporting to USACE (480 hrs. @ $100/hr.)	$39,360	$8,640	$48,000
Keystone Restoration Ecology – Initial geomorphology, project design, meetings & coordination, pre- and post-construction surveys, as-built plans (400 hrs. @ $100/hr.)	$32,800	$7,200	$40,000
Keystone Restoration Ecology – On the ground project construction (1000 hrs. labor @ $100/hr. + 1000 hrs. excavator rental @ $68hr.)	$150,000	$18,000	$168,000
Keystone Restoration Ecology – On the ground project construction management (80 hrs. @ $100/hr.)	$6,560	$1,440	$8,000
Gross receipts tax	$17,154		$17,154
Other:			
UPWA Operational Expenses and Volunteer events under Task 12 (Volunteer rate = $20/hr.)		$53,000	$53,000
TOTAL	$257,640	$172,076	$429,716
% of Total	60%	40%	100%

Figure 1. Project Area Map