GROUP A. PROJECT MANAGEMENT AND INFORMATION/DATA QUALITY OBJECTIVES

A1. Title Page

Quality Assurance Project Plan

A Wetlands Action Plan for the Santa Cruz River in Northern New Mexico: Community-Based Planning for Enhancing Wetland and Riparian Ecosystem Functions

Revision 0

Funding Source:
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Submitted by:
New Mexico Environment Department
Surface Water Quality Bureau

September 22, 2026

A2. Approval Page

Approval Signatures

Zach.Shephard
Digitally signed by Zach.Shephard
Date: 2026.09.22 10:26:12 -06'00'

Zach Shephard
SWQB Project Officer

Emily Miller
Digitally signed by Emily Miller
Date: 2026.09.22 11:00:44 -06'00'

Emily Miller
SWQB Quality Assurance Officer

Kate Lacey-Younge
Digitally signed by Kate Lacey-Younge
Date: 2026.09.22 10:58:16 -06'00'

Kate Lacey-Younge
SWQB Watershed Protection Section, Program Manager

KYLA CHANDLER
Digitally signed by KYLA CHANDLER
Date: 2026.11.04 09:58:30 -06'00'

Kyla Chandler
U.S. EPA Region 6, WPDG, Project Officer

DANIEL LANDEROS
Digitally signed by DANIEL LANDEROS
Date: 2026.11.04 09:08:42 -06'00'

Technical Coordinator
U.S. EPA Region 6

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Acronyms

DQO	Data Quality Objectives
EPA	United States Environmental Protection Agency
GIS	Geographic Information System
GPS	Global Positioning System
GSA	Geosystems Analysis inc.
NCDE	Natural Channel Design & Engineering
NMED	New Mexico Environment Department
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
SOP	Standard Operating Procedures
UAV	Uncrewed Aerial Vehicle
sUAS	small uncrewed aircraft system
SWQB	Surface Water Quality Bureau
WAP	Wetlands Action Plan

A4. Project Purpose, Problem Definition, Background

Project Purpose and Problem Definition

The purpose of this Quality Assurance Project Plan (QAPP) is to provide management guidelines for the riparian areas of the Santa Cruz. This QAPP refers to the project as the Santa Cruz NM WAP. The Santa Cruz NM WAP is being managed by the GeoSystems Analysis, Inc.

The overall purpose of the project is for the development of a Wetlands Action Plan (WAP) for the Santa Cruz River in Northern New Mexico: Community-Based Planning for Enhancing Wetland and Riparian Ecosystem Functions. The plan goal is to provide guidelines to protect, restore, and sustain wetland and riparian ecosystems along about 7.6 miles of Santa Cruz riparian/floodplain corridor. GeoSystems Analysis, Inc. is partnering with community organizers and scientists from the Alamosa Land Institute and Natural Channel Design and Engineering on this proposal to develop a scientifically-based and community supported WAP for the watershed.

The environmental information operations covered by this QAPP are limited to Uncrewed Aerial Vehicle (UAV)/drone imagery collection, associated photogrammetric and geospatial products, and a field reconnaissance to document the density and distribution of invasive riparian vegetation within a representative reach of the Santa Cruz River. UAV data collection will consist of acquisition of high-resolution aerial imagery using a small uncrewed aircraft system (sUAS) operated in accordance with FAA regulations. Imagery will be collected using automated flight missions with consistent flight altitude, image overlap, and camera settings to support development of georeferenced orthomosaics and other planning-level geospatial products. The information will be used to characterize existing riparian and floodplain conditions, document invasive-species management concerns, and support WAP-level recommendations for future restoration, protection, and invasive-species management.

The broader Santa Cruz NM WAP is intended to develop a collaborative and comprehensive planning approach to protect, restore, and sustain wetland and riparian ecosystems along the Santa Cruz riparian and floodplain corridor. This QAPP covers a focused data collection effort intended to provide planning-level information that can help identify restoration constraints, invasive-species management needs, and future survey or design needs.

Invasive woody and herbaceous species can reduce native riparian plant diversity, alter floodplain function, complicate access and maintenance, and affect the feasibility and sequencing of future restoration actions. Existing regional datasets and aerial imagery provide useful background information, but project-specific high-resolution imagery and field-based visual confirmation are needed to support WAP-level recommendations. The primary project questions are: (1) Where are visible invasive-species management concerns apparent within the representative reach? (2) What riparian/floodplain conditions are observable from UAV imagery and field reconnaissance? (3) What management recommendations should be considered for future planning, restoration prioritization, and implementation funding?

Background

The Río Santa Cruz is a historically and culturally important watershed in northern New Mexico, with a landscape shaped for centuries by Pueblo communities, Spanish settlement, acequia irrigation, and agriculture. The river and its tributaries support riparian areas, wetlands, agricultural lands, and communities from the upper watershed through Chimayó and Santa Cruz to the Río Grande. Today, wetlands and riparian areas along the Río Santa Cruz face altered hydrology, channel incision and floodplain disconnection, drought and climate change, erosion and sedimentation, invasive species, and agricultural and grazing pressures. The data collected in this project will support a WAP that will help communities provide guidelines to protect, restore, and sustain wetland and riparian ecosystems within the watershed. This planning project will complement a recently awarded EWRP restoration implementation grant awarded to Acequia del Llano and the Northern New Mexico Acequia Association (NMAA) currently in the contract phase for restoration work on the Santa Cruz.

A5. Project Task Description

Description

UAV imagery will be collected using automated flight missions designed to achieve consistent image quality suitable for photogrammetric processing. Combined with field observations, these data improve identification of invasive vegetation, channel characteristics, floodplain connectivity, and restoration opportunities.

UAV imagery will be used to develop geospatial products such as an orthomosaic and, if feasible and needed, surface/elevation products suitable for planning-level interpretation. Photogrammetric processing will include automated image alignment, point cloud generation, orthomosaic production, and generation of digital surface models where appropriate. All products will undergo quality review for image alignment, seamline artifacts, spatial completeness, distortion, and consistency with field observations prior to use in project analyses.

Digital surface models and related elevation products may be generated where vegetation density, image quality, and project objectives support reliable photogrammetric reconstruction. These products are intended for planning-level interpretation and are not intended to replace conventional land surveying.

Field reconnaissance will consist of a planning-level survey of invasive riparian vegetation conducted by qualified ecologists. Observations will be recorded using GPS-enabled field mapping software and supplemented with georeferenced photographs. Individual infestations will be documented as points, lines, or polygons, as appropriate to their spatial extent. For each observation, field crews will record the invasive species observed (where confidently identified), estimated density class, approximate infestation extent, dominant vegetation, photo reference, and relevant management observations.

We will conduct several cross section and longitudinal profiles through riffles sections of the channel using laser level and tape methods to determine active channel dimensions. Cross section data will be analyzed

in a 1D hydraulic analysis software to estimate frequency of floodplain access during higher flows. The information collected under this QAPP will be used to support WAP-level resource analysis, restoration/protection prioritization, and management recommendations. It will not be used as regulatory compliance monitoring, formal vegetation trend monitoring, or post-restoration effectiveness monitoring.

The survey is intended to identify readily observable invasive vegetation visible during the survey period. Small seedlings, sparse understory vegetation obscured by canopy, and species that cannot be confidently identified during the survey season may not be detected.

Schedule

The project will begin with administrative and planning activities, including contract procurement, an initial field site visit, and development and approval of the Quality Assurance Project Plan (QAPP). These activities will occur during the initial project period, with QAPP approval anticipated by September 2026. Field data collection will occur primarily during Months 3–6 and will include cross-section surveys, UAV imagery and photogrammetry, field notes and photographs, and planning-level invasive vegetation observations. Survey data will support 1D hydraulic analysis, while UAV and field data will support mapping and evaluation of invasive vegetation and other site conditions. Following field work, the project team will conduct geospatial analysis and develop planning-level invasive-species management recommendations for incorporation into the draft and final Wetlands Action Plan (WAP). GSA will provide monthly reports, data submittals, and invoices to SWQB throughout the project. NMED will complete semi-annual and final reporting to EPA, with EPA reporting continuing through June 2028. Table 1 summarizes the anticipated schedule, responsible parties, and major project products.

Table 1. Project Task, products, responsible party, timeline (use as applicable)

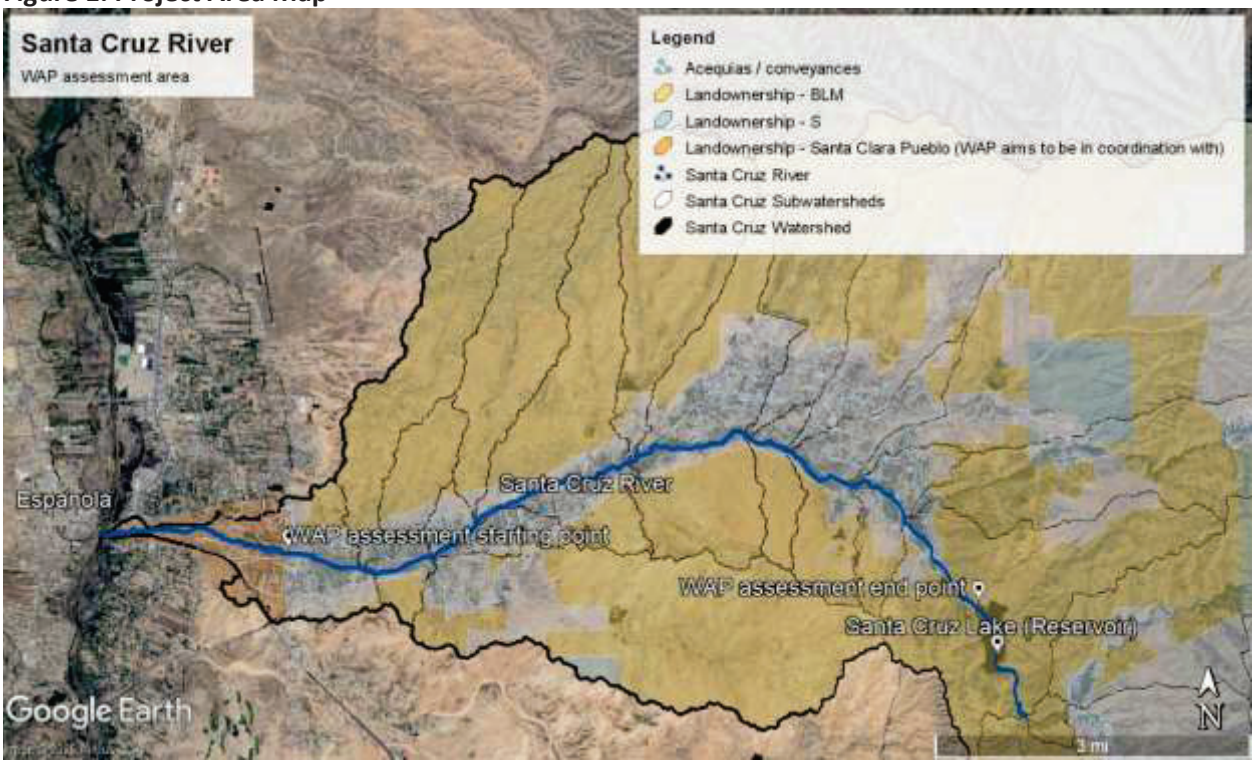
Task	Product	Responsible Party	Approximate State Date	Approximate Completion Date
Administrative	Procurement for contract	NMED	11/1/2024	12/9/2024
Planning	Field site visit (no data collection)	GSA, ALI, NCDE		Month 1-3
Quality Assurance Project Plan	Approved QAPP	GSA, ALI, NCDE	July 2026	September 2026
Cross section survey	Survey data in .xls format	NCDE		Month 3-6
1D hydraulic analysis	Use flood frequency analysis and channel capacity to estimate floodplain access	NCDE		Month 3-6

UAV imagery collection, photogrammetry	Flight logs, raw imagery, field notes, photo documentation	GSA	Month 3–6, pending access and suitable weather	Month 3–6
UAV image processing	Orthomosaic; optional DEM/DSM or point cloud if produced; processing metadata; QA/QC notes	GSA	Following UAV flights	Prior to WAP analysis
Planning-level invasive vegetation survey and mapping	GPS-referenced observations, photos, invasive-species notes, planning-level map products	GSA	Concurrent with or shortly after UAV flights	Prior to WAP analysis
Geospatial analysis and planning-level management recommendations	Planning-level invasive-species/management concern map; summary of observations and recommendations for WAP	GSA Team	After field data collection	Draft WAP phase
Reporting/data submittal	Data package and summary for SWQB Project Officer; relevant information incorporated into WAP	GSA	Ongoing with monthly reporting	Final WAP
Reporting to SWQB Project Officer	Monthly with activities, and accompanying invoices	GSA	Ongoing with monthly reporting	Final WAP
Reporting to EPA	Semi-annual and Final Report to EPA	NMED	June 2026	June 2028

Project Area

The project area for the broader WAP includes the Santa Cruz River riparian and floodplain corridor in northern New Mexico. The environmental information operations covered by this QAPP will occur within a representative reach of the Santa Cruz River, approximately 1.5 miles long, selected to support WAP-level assessment and management recommendations. The specific reach will be selected based on access permission, safe UAV operation, ability to represent relevant riparian/floodplain conditions, and usefulness for developing management recommendations.

Figure 1. Project Area Map



Monitoring Location Selection Criteria

The representative reach will be selected based on the following criteria: landowner/access permission; safe and legal UAV flight conditions; visibility of riparian, wetland, and floodplain features; presence or suspected presence of invasive vegetation management concerns; and relevance to WAP-level restoration and protection recommendations. The reach is not intended to statistically represent the entire Santa Cruz corridor. Rather, it is intended to provide focused, planning-level environmental information that can support identification of management needs, future survey priorities, and conceptual restoration/protection recommendations. Selection also considered inclusion of representative channel morphology, riparian vegetation structure, invasive vegetation occurrence, and restoration opportunity to maximize the usefulness of planning-level observations.

Figure 2. Project Area with Monitoring Locations

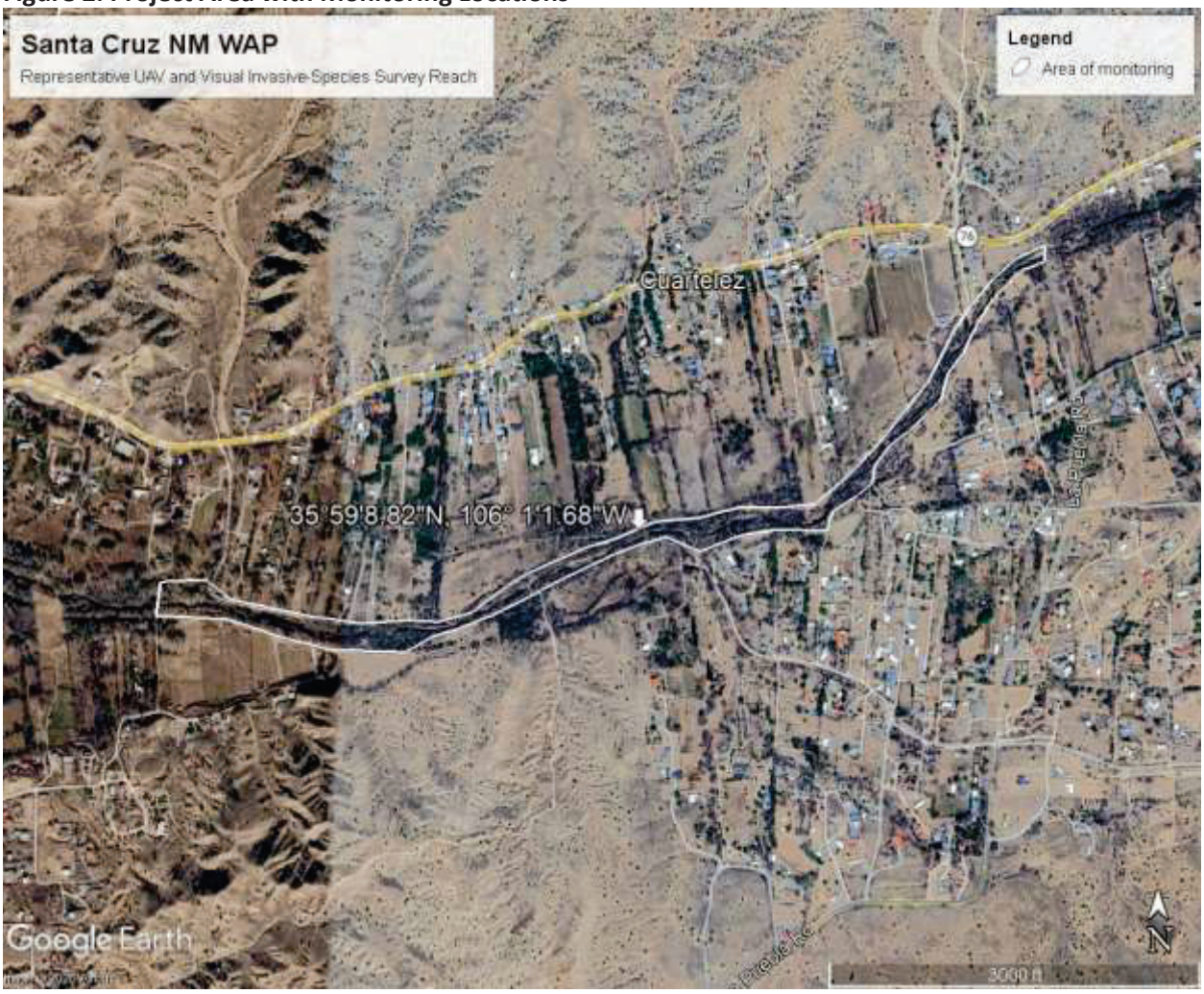


Table 2. Waterbody Attributes for the Project

Monitoring Station ID	WQS Citation	Assessment Unit ID	12-Digit HUC or Latitude and Longitude
Santa Cruz River (Santa Clara Pueblo bnd to Santa Cruz Dam)	20.6.4.114	NM-2111_50	35°59'8.82"N, 106° 1'1.68"W

The project area contains an existing NMED monitoring station located at approximately 35°59’8.82”N, 106°11’1.68”W (Figure 2; Table 2). Although the monitoring station and the reach immediately surrounding it are not necessarily the primary target area for UAS flights, data previously collected at this location will provide valuable baseline context for developing Wetlands Action Plan (WAP) recommendations for wetland protection and restoration along the approximately 7.6-mile Santa Cruz

riparian and floodplain corridor. UAS flights may be conducted at suitable locations anywhere within the WAP assessment area between the starting and ending points identified in Figure 1.

No restoration implementation activities are covered under this QAPP. Information collected under this QAPP may be used to support future management recommendations, restoration prioritization, invasive-species treatment concepts, or future funding applications. Any future restoration implementation or effectiveness monitoring requiring additional environmental information operations would be addressed under a separate or revised QAPP, as applicable.

A6. Information/Data Quality Objectives and Performance/Acceptance Criteria

Data Quality Objective (DQO)

The quality of the environmental information collected under this QAPP will be adequate to provide a high level of confidence for WAP-level interpretation of riparian/floodplain conditions, visible invasive-species management concerns, and planning-level channel/floodplain-access conditions within a representative reach of the Santa Cruz River. The data are intended to support planning-level recommendations, not regulatory determinations, laboratory analysis, formal vegetation monitoring, or quantitative treatment-effectiveness evaluation.

Data Quality Indicators

The measurement quality objectives will be sufficient to achieve the DQO and will be in conformance with those listed in the SWQB's QAPP. The Data Quality Indicators listed in the SWQB's QAPP and applicable to the data collected for this project are precision, accuracy, representativeness, comparability, completeness, and sensitivity.

DQI	Determination Methodologies
Precision	UAV imagery will be collected using flight altitude, overlap, camera settings, and flight planning parameters will be maintained as consistently as practicable throughout data collection. Automated flight planning will be used whenever feasible to improve repeatability, including planned overlap, flight altitude, and image acquisition procedures appropriate for orthomosaic development. Visual invasive-species observations will use consistent field categories, such as species observed, general density/extent class, photo number, and GPS location.
Accuracy	UAV products will be evaluated for positional consistency, image alignment, visible distortion, seamline artifacts, spatial completeness, and consistency with recognizable ground features and field observations. Image quality issues that materially affect interpretation will be documented and, where practical, corrected through reprocessing or reflights. Field observations will be recorded by qualified personnel familiar with common riparian invasive species in northern New Mexico. Uncertain species identifications will be noted as uncertain or grouped at the appropriate taxonomic level.

Representative	The reach will be selected to provide useful WAP-level information about riparian/floodplain condition and invasive-species management concerns. The data will be described as representative of the surveyed reach only and will not be generalized as a quantitative estimate for the entire Santa Cruz corridor. Because the survey reach is intentionally selected rather than randomly sampled, project conclusions will remain limited to planning-level interpretation.
Comparability	Data will be maintained in standard formats where practicable, including georeferenced imagery, GIS files, GPS-referenced observations, field notes, and photo documentation. Methods and limitations will be documented so the information can be compared with existing aerial imagery, wetland mapping, and future field assessments. Standard coordinate systems, metadata, naming conventions, and GIS formats will be maintained to facilitate future comparison with subsequent imagery and other geospatial datasets.
Completeness	The data package will be considered complete if UAV imagery covers the selected representative reach sufficiently to support planning-level interpretation, field observations document the major visible invasive-species concerns encountered, and associated metadata, photos, and notes are stored in the project file. Data completeness will be considered acceptable when greater than 95% of the planned flight area is successfully imaged without significant gaps that would impair interpretation.
Sensitivity	The UAV imagery and visual reconnaissance are expected to identify visible riparian vegetation patterns and invasive-species management concerns at a planning scale. The methods are not intended to detect seedlings, low-density understory species hidden by canopy, or small patches not visible during field reconnaissance or imagery interpretation.

A7. Distribution List

The QA Officer will ensure that copies of this QAPP and any subsequent revisions are distributed to members who have signature authority to approve this QAPP. The SWQB Project Officer will ensure that copies of the approved QAPP and any subsequent revisions are distributed to the Project Manager. The Project Manager will distribute to all other project personnel listed below. 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 will be collected by the SWQB Project Officer and will be given to the QA Officer for filing with the original approved QAPP.

New Mexico Environment Department Surface Water Quality Bureau
Wetlands Program Coordinator: Zach Shephard, (505) 618-0375
Program Manager: Kate Lacey-Younge, (505) 946-8863
Quality Assurance Officer: Emily Miller, (505) 660-3534

Organization Name
Senior Scientist: Todd Caplan, GeoSystems Analysis (GSA), (505) 980 - 0336
Project Planner: Connie Maxwell Alamosa Land Institute (ALI), (575) 740-1099

President: Allen Haden, Natural Channel Design, (928) 600-6649

U.S. Environmental Protection Agency Region 6
Project Officer: Kyla Chandler, Region 6 State and Tribal Programs (214) 665-2166

A8. Project Organization

The table below lists all staff involved in EIO and describes their roles and responsibilities. The Project Officers will ensure that any staff responsible for conducting work in accordance with this QAPP will be provided a copy to read and acknowledge the QAPP requirements by signing the Acknowledgement Statement.

Table 3. Project Roles and Responsibilities

Name	*Organization*	*Title/Role*	*Responsibility*	*Contact Information*
Kate Lacey-Younge	SWQB	Program Manager	Reviewing and approving QAPP, managing project personnel and resources	(505) 946-8863 kathryn.lacey@env.nm.gov
Emily Miller	SWQB	QA Officer	Reviewing and approving QAPP	(505) 660-3534 emily.miller@env.nm.gov
Zach Shephard	SWQB	Program Coordinator	Preparing and revising QAPP, distribution of QAPP, project reporting, coordinating with contractors, oversight of data collection, and EPA reporting	zach.shephard@env.nm.gov (505) 618-0375
Todd Caplan	GeoSystems Analysis (GSA)	Senior Scientist	Project oversight, data management, and submittal of quarterly reports	Cell: 505.980.0336 todd@gsanalysis.com
Chad McKenna	GeoSystems Analysis (GSA)	Remote sensing analysis	Remote sensing analysis	Cell: 505.274.0126 chad@gsanalysis.com
Connie Maxwell	Alamosa Land Institute (ALI)	Project Planner	Project community outreach	575.740.1099; cmaxwell@alamosadesign.com
Richard Davidson	ALI	Project Designer	Design of project plans / scenarios	575-740-2349; rdavidson@alamosadesign.com
Allen Haden	Natural Channel Design	President	civil/environmental engineering and natural-resource technical partner	c: 928-600-6649 allen@naturalchanneldesign.com
Kyla Chandler	EPA	State and Tribal Grants Project Officer, Water Division	Reviewing and approving QAPP	chandler.kyla@epa.gov (214) 665-2166

A9. QAO Independence

The QAO shall maintain independence in all QA matters and has the ability to directly and independently interact and initiate communication with technical staff and management. This direct access allows the QAO to independently elevate critical, quality-related issues to the attention of the Bureau Chief at their discretion without challenge or section approval. The QAO communicates with NMED senior management

through the Bureau Chief and the Standards, Planning, and Reporting Team Supervisor. The SWQB Quality Management Plan (NMED/SWQB 2024) further documents the independence of the Quality Assurance Officer (QAO) from this project. The QAO is responsible for maintaining the official approved QAPP.

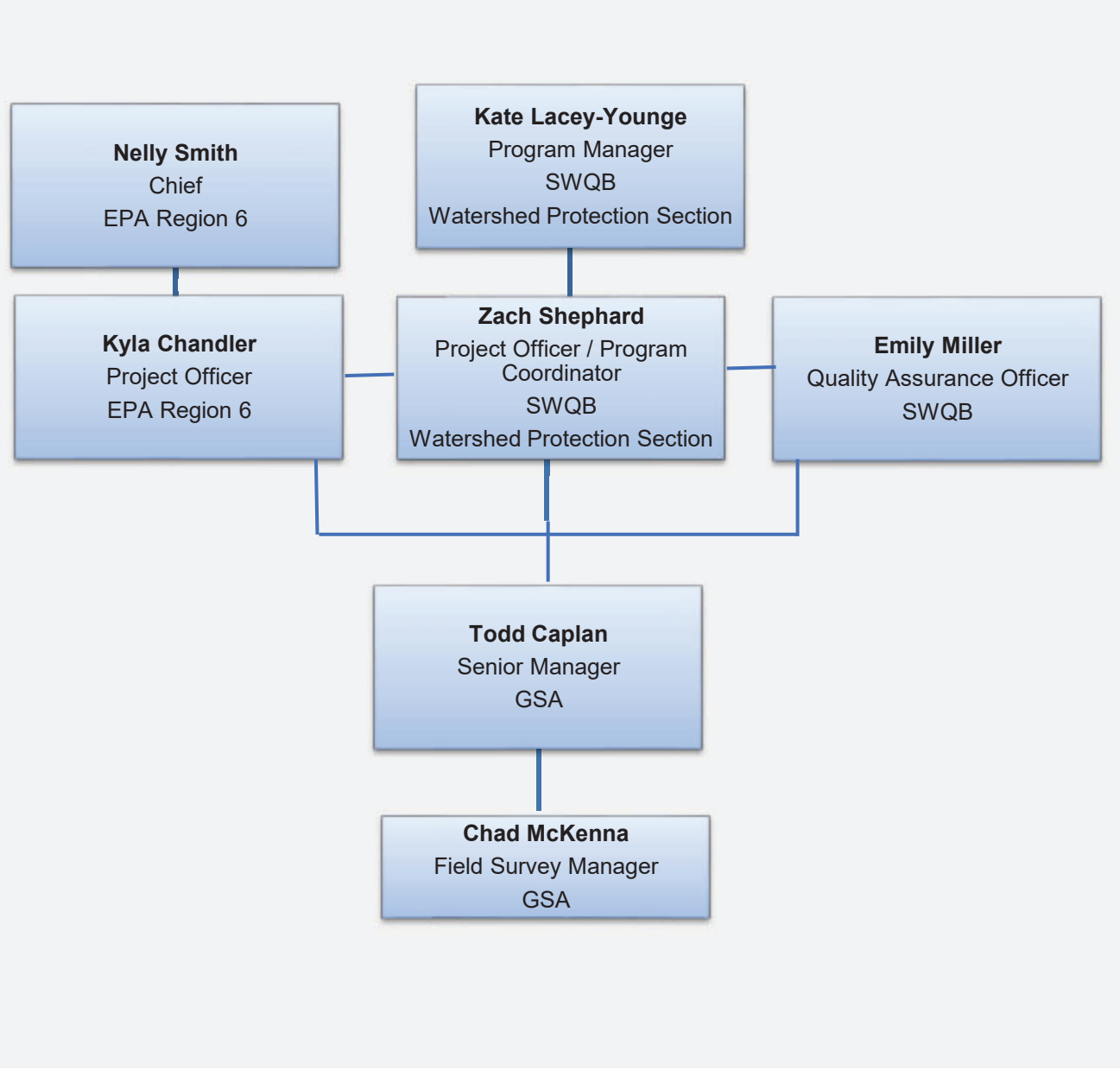
A10. Project Organization

Project communication will follow the lines of responsibility shown in Figure 3. The SWQB Project Officer will serve as the primary point of contact between NMED/SWQB, EPA Region 6, and the contractor team. GeoSystems Analysis, Inc. (GSA), as the prime contractor, will coordinate day-to-day communication among GSA staff, Alamosa Land Institute (ALI), Natural Channel Design & Engineering (NCDE), and other project participants, as applicable. The GSA Project Manager will communicate with the SWQB Project Officer regarding project schedule, field activities, data collection status, data quality concerns, and deliverables. ALI and NCDE will communicate through the GSA Project Manager for project activities covered under this QAPP unless direct communication with SWQB is requested or authorized by the SWQB Project Officer.

Any discrepancies, QAPP non-conformances, data quality concerns, or proposed changes to approved methods will be reported to the GSA Project Manager and elevated to the SWQB Project Officer. The SWQB Project Officer will consult with the SWQB QAO and EPA Region 6, as needed, to determine whether corrective action, data qualification, or a QAPP revision is required.

Figure 3 presents the organizational structure for the project.

Figure 3. Organizational Chart



A11. Personnel Training/Certification

This project will be primarily implemented by GSA (Chad McKenna), operate with oversight from the SWQB Project Officer. Data collection and monitoring for this project will be implemented by Brennan Davis, William Widener, and Matthew Betlej with technical assistance and oversight from the SWQB Project Officer. Volunteers will be trained by Brennan Davis and supervised at all times by Todd Caplan in the field during vegetation data collection efforts. Any individual conducting work for the project will review this QAPP and sign the acknowledgment statement prior to initiating any work for this project. The singed acknowledgment statements will be kept on file with original QAPP by the QAO.

Brennan Davis is an ecologist and GIS analyst with over 10 years of experience working in New Mexico. His experience ranges from public land management and planning to hydrological and botanical surveys, as well as GIS and remote sensing analyses.

William Widener is a biologist with over 10 years of experience in environmental consulting specializing in botany and plant taxonomy. Will also has extensive experience performing botanical and biological inventories associated with habitat restoration, rangeland management, mine land reclamation, energy development and transportation planning projects. He routinely performs vegetation monitoring studies, threatened and endangered plant and animal surveys, wildlife presence/absence surveys, wetland determinations and delineations, and noxious weed inventories.

Matthew Betlej is a geospatial Field/Lab Technician at GSA. He has received GIS/remote sensing/GPS training through CNM's GIT program and holds an FAA Part 107 Remote Pilot Certificate.

Todd Caplan is a senior ecologist with GSA. He has been working nearly 30 years integrating scientific disciplines of vegetation ecology, soil science and hydrology in the design, implementation, monitoring and adaptive management of large-scale river and arid-land restoration programs. Prior to working as a consultant, Todd served as the Natural Resources Director for a 37,000-ha American Indian reservation where he initiated and managed grant funded watershed restoration programs.

GSA has demonstrated experience applying UAS and geospatial technologies to riverine and ecological monitoring in New Mexico. GSA will follow and train necessary staff in established UAS data-collection and processing procedures similar to those documented the 2021 RiverEyes Monitoring Report (McKenna, 2022). These procedures include standardized flight planning and image acquisition, geotagging and spatial management of imagery, photogrammetric/image processing, and evaluation of UAS-derived observations against field observations.

A12. Documents and Records

The SWQB Project Officer will make copies of this approved QAPP and any subsequent revisions available to the Project Manager. The Project Manager will distribute to all individuals on the distribution list who do not have signature authority for approving the QAPP. When changes affect the scope, implementation, or assessment of the outcome, this QAPP will be revised to keep project information current. The SWQB 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 SWQB Project Officer to determine the need for revision.

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. Data captured on a global positioning system (GPS), camera, smart phone, tablet, or laptop will be downloaded to an ALI 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.

All digital project data will be kept in a project file both in an online shared folder and on an ALI computer and on a separate external backup hard drive at the ALI office. Hard copy project documents will be kept in a project folder in a file cabinet at the ALI office. All hard copy documents will be digitized and stored on an ALI computer and backup hard drive (see Table 4). Copies of the data will be distributed by ALI to GSA to NMED SWQB Project Officer after each field season, typically at the end of November. More detail on the management of project information is covered in B7. Environmental Information Management.

Table 4. Data Records for the Project

Document	Type of Form	Storage Location	Field Sheet Used
QAPP	Electronic (.doc) & Hard Copy	NMED Website	Quality Assurance Project Plan Standard. CIO 2105-S-02.1. Located at: https://www.epa.gov/system/files/documents/2024-04/quality_assurance_project_plan_standard.pdf
UAV raw imagery	Electronic image files	ALI project folder and backup	NA
UAV flight logs/metadata	Electronic and/or hard copy	ALI project folder and backup	UAV flight log or equivalent
Orthomosaic and GIS products	GeoTIFF, shapefile/geodatabase, PDF map exports	ALI project folder and backup	NA
Visual invasive-species observations	Electronic GIS/GPS files, field notes, photos	ALI project folder and backup	Field notes or digital form

Photo documentation	Electronic photo files	ALI project folder and backup	Photo log or geotagged photos
QA/QC summary	Electronic memo/table	ALI project folder and backup	NA
Photos	Electronic (.jpg)	ALI project folder and backup	Permanent Photo Point Record. Appendix I *"Let the Water do the Work"*
Interim and Final Reports	Electronic (.doc) & Hard Copy	ALI project folder and backup	NA

GROUP B. IMPLEMENTING ENVIRONMENTAL INFORMATION OPERATIONS

This QAPP was developed following the Quality Assurance Project Plan Standard and QAPP Standard Checklist (EPA, 2023).

B1. Identification of Project Environmental Information Operations

The environmental information operations covered by this QAPP consist of: (1) UAV imagery collection over an approximately 1.5-mile representative reach of the Santa Cruz River; (2) processing of UAV imagery into planning-level geospatial products; (3) visual field reconnaissance of invasive riparian vegetation and related management concerns; and (4) representative cross-section survey and planning-level 1D hydraulic analysis to support interpretation of floodplain access conditions. These activities will be conducted by qualified GSA personnel or GSA Team members. The data will support WAP resource analysis and development of management recommendations. The data will not be used for regulatory compliance determinations, formal wetland delineation, water quality assessment, laboratory analysis, or post-treatment effectiveness monitoring.

Table 5. Project Monitoring Specifics

Responsible Party	Monitoring	Location	Frequency
GSA	UAV imagery collection	Approximately 1.5-mile representative reach of Santa Cruz River	One primary flight event; additional flight only if needed due to incomplete coverage or unusable imagery
GSA	Visual invasive-species reconnaissance and photo documentation	Same representative reach, as access allows	One field reconnaissance event; supplemental visit only if needed
GSA Team	GIS interpretation and planning-level mapping	Office-based review of UAV imagery, field notes, and existing data	Once during WAP development

The UAV imagery, visual reconnaissance, and GIS interpretation will satisfy the project purpose by providing planning-level environmental information on riparian/floodplain conditions and distribution and relative abundance of visible invasive vegetation and associated management concerns. These data

will support WAP-level recommendations for protection, restoration prioritization, invasive-species management, and future survey or design needs.

B2. Methods for Environmental Information Acquisition

Field Activities Environmental Measurements

UAV imagery: UAV imagery will be collected by qualified personnel using a small uncrewed aerial system appropriate for low-altitude riparian imagery collection. Flights will be conducted only where access permission, weather, visibility, airspace requirements, and site safety allow. Flight planning will consider image overlap, ground resolution, lighting conditions, battery capacity, takeoff/landing locations, and avoidance of unsafe conditions. Suitable weather conditions also minimize motion blur and variable lighting. Flights will generally maintain 75–85% forward overlap, 70–80% side overlap, and flight altitudes appropriate to achieve approximately 2–5 cm ground sample distance while maintaining safe operating conditions. High overlap and low flight ensure that the imagery has enough redundancy, consistent coverage, and geometric information to produce an accurate orthomosaic and 3D surface model. The spacing between UAS photographs and flight lines is determined from the ground footprint of each image and the desired overlap. Photo spacing is calculated by multiplying the image footprint in the direction of travel by one minus the desired forward overlap, while flight-line spacing is calculated by multiplying the image footprint perpendicular to the flight path by one minus the desired side overlap.
Required flight altitude for desired ground sample distance is generally calculated as:

$$H=(GSD*F) / p,$$

where GSD = ground sample distance
H = Camera height above the ground
p = physical pixel size of the camera sensor, And
f = focal length

UAV flights will utilize RTK positioning when available to improve positional consistency among image products. Raw imagery, flight logs, and relevant metadata will be retained. Imagery will be processed into an orthomosaic and, if feasible and useful for planning, additional photogrammetric products such as a digital surface model, digital elevation model, or point cloud. Processing outputs will be reviewed for coverage gaps, distortion, alignment problems, and other issues that could affect planning-level interpretation.

Quality control procedures will include pre-flight equipment inspection, verification of GPS reception, battery health checks, review of camera settings, documentation of flight conditions, review of image completeness immediately following each flight, and verification that image overlap and coverage meet project objectives before leaving the field.

Visual invasive-species reconnaissance: visual reconnaissance will be conducted within the representative reach to document visible invasive-species management concerns. Field personnel will record observations using GPS-referenced points, tracks, polygons, notes, and/or geotagged photographs. Observations may include species observed, general location, apparent extent or density class, associated

riparian/floodplain setting, access or treatment constraints, and recommended management considerations. The survey is intended as a planning-level visual assessment and will not constitute a formal vegetation inventory, quantitative cover survey, wetland delineation, or treatment-effectiveness monitoring protocol.

Cross section collection and analysis: representative cross sections will be surveyed using laser level and tape methods to determine channel cross section dimensions and slope. The representative sites will be GPS located. Data will be entered into .xls format and inspected for outlier points and survey error. Each cross section will be photo documented. Cross sections will be analyzed in a 1D cross section analysis tool to determine flow rates that reach floodplain elevation. These flood rates will be compared to flood frequency analysis to estimate frequency of flooding onto floodplain in typical areas.

Laboratory Analyses

No samples will be collected for laboratory analysis under this QAPP. Therefore, laboratory analytical methods, sample containers, preservation, holding times, chain-of-custody procedures, and laboratory accreditation requirements are not applicable.

Existing Information

Existing information may include aerial imagery, available wetland mapping, National Wetlands Inventory data, NRCS soils information, USGS topographic information, prior reports, available plant inventories, and other relevant planning information identified for the WAP. Existing information will be used as supporting context for interpreting UAV imagery and field observations. Existing datasets will be reviewed for source, date, scale/resolution, and relevance, and limitations will be documented where they affect interpretation.

B3. Integrity of Environmental Information

Because no physical or laboratory samples will be collected, sample preservation and custody requirements are not applicable. Environmental information integrity will be maintained through daily download and backup of UAV imagery, GPS files, photographs, and field notes; use of clear file-naming conventions; retention of original raw files; and documentation of any processing steps used to develop derived geospatial products. Original files will not be overwritten. Derived products will be stored separately from raw data.

B4. Quality Control

Quality control (QC) activities are technical activities performed on a routine basis to quantify the variability that is inherent to any environmental data measurement activity. The purpose for conducting QC activities is to understand and incorporate effects the variability may have in the decision-making process. Additionally, the results obtained from the QC analysis, or data quality assessment, may identify areas where the variability can be reduced or eliminated in future data collection efforts, thereby improving the overall quality of the project being implemented.

Quality control activities will include review of UAV imagery for complete coverage of the representative reach, sufficient image quality, and absence of major processing artifacts that would affect planning-level interpretation. Field notes and photo documentation will be reviewed for completeness before demobilization when practicable. GIS products will be checked for coordinate system consistency, file completeness, and agreement with field observations. Any data limitations, such as inaccessible areas, dense canopy obscuring understory vegetation, uncertain species identifications, incomplete flight coverage, or weather-related image limitations, will be documented in the project file and summarized in the WAP or supporting data summary.

Cross section data will be reviewed for survey busts and compared to photos of the site to ensure accuracy of cross section prior to analysis. Multiple cross sections in the same typical location should show relative conformity of dimensions and bankfull estimates should be comparable with range of variability in regional data sets.

B5. Instrument/Equipment Calibration, Testing, Inspection, and Maintenance

Equipment used for this project may include UAV aircraft, controller, batteries, camera/sensor, GPS-enabled field device, tablet, camera, and computer/software used for image processing and GIS interpretation. Before field deployment, the UAV system will be inspected for safe operation, firmware/software status, camera function, battery condition, memory capacity, and controller connectivity. GPS-enabled devices and cameras will be checked for proper date/time settings, storage capacity, and field readiness. Equipment issues that could affect data quality will be corrected before use where practicable or documented if they affect data usability. No water quality instruments or laboratory equipment will be used under this QAPP.

B6. Inspection/Acceptance of Supplies and Services

Critical supplies and services include UAV equipment, charged batteries, memory cards or storage media, GPS-enabled field devices, field data forms or digital equivalents, photo equipment, and image-processing/GIS software. Supplies will be inspected before field deployment to confirm that they are available and functional. There are no sample bottles, preservatives, reagents, or laboratory consumables associated with this project.

B7. Environmental Information Management

GSA will be responsible for data management for environmental information operations covered by this QAPP. All UAV imagery, GPS files, field notes, photographs, GIS products, processing outputs, and QA/QC documentation will be stored electronically in the GSA project file and backed up. Raw data will be retained separately from processed or interpreted products. GIS products will include coordinate system information and basic metadata sufficient to understand source, date, scale/resolution, and limitations. Data will be sent to the SWQB Project Officer in a mutually acceptable electronic format and summarized in the WAP or supporting documentation.

Data will be sent to the SWQB Project Officer by the end of each field season by GSA. Upon receiving data, the SWQB Project will store data on SWQB network drive. The SWQB will retain project documents in accordance with applicable sections of New Mexico's Disposition of Public Records and Non-Records regulation, codified at 1.13.30 New Mexico Administrative Code (NMAC) and Retention and Disposition of Public Records regulations, codified at 1.21.2 NMAC.

GROUP C. ASSESSMENT, RESPONSE ACTIONS, 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 baseline data collection and monitoring efforts by the SWQB Project Officer will take place at the end of each monitoring season. The SWQB Project Officer will assess project progress to ensure the QAPP is being implemented, including audits by the QAO, as needed. Any problems encountered during the course of this project will be immediately reported to the SWQB Project Officer who will consult with appropriate individuals to determine appropriate action. Should the corrective action impact the project or data quality, the SWQB 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. Oversight and Reports to Management

Annual reports will be submitted by the GSA to the SWQB Project Officer and will include progress of project 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 Officer by July 2027. The SWQB Project Officer will be responsible for submitting the final project deliverables to EPA through their Grants Reporting Tracking System.

GROUP D. ENVIRONMENTAL INFORMATION REVIEW AND USABILITY DETERMINATION

D1. Environmental Information Review

Data will be reviewed by the Field Team Supervisor or designated technical lead for completeness, consistency, and usability. UAV products will be reviewed for adequate coverage, image clarity, geospatial consistency, and processing artifacts. Visual invasive-species observations will be reviewed for complete field notes, photo documentation, GPS/GIS information, and clear notation of uncertain identifications or limitations. Data may be qualified if portions of the reach are inaccessible, obscured by canopy, affected by poor imagery, or otherwise insufficient for interpretation. Qualified data may still be used for planning-level recommendations if limitations are clearly documented. Data will be considered usable if they are adequate to support WAP-level interpretation and management recommendations for the representative reach. Additional field work may be recommended if data gaps prevent reasonable planning-level interpretation.

Validation and Verification Methods

GSA will ensure that valid and representative planning-level information is acquired. Verification and validation will consist of review of raw imagery, processed geospatial products, GPS/GIS files, photographs, field notes, metadata, and QA/QC notes for consistency with this QAPP. In the event questionable data are found, the SWQB Project Officer will be notified and will consult with appropriate personnel to determine data usability. Results of the verification and validation process and any data qualifications will be included in the WAP, final report, or supporting data summary.

D2. Usability Determination

The user requirement is a restatement of the data quality objective: the quality of the environmental information will be adequate to support WAP-level interpretation of riparian/floodplain conditions and visible invasive-species management concerns within the representative reach. If project results do not meet this requirement, then additional imagery collection, field reconnaissance, or future survey recommendations may be needed to fill information gaps before the data are used for management recommendations.

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 at which time the QAPP will be updated and resubmitted for EPA approval.

References

McKenna, C. (2022). *2021 RiverEyes Monitoring Report*. Middle Rio Grande Endangered Species Collaborative Program, U.S. Geological Survey.

Acknowledgement Statement

New Mexico Environment Department Surface Water Quality Bureau

A Wetlands Action Plan for the Santa Cruz River in Northern New Mexico: Community-Based Planning for Enhancing Wetland and Riparian Ecosystem Functions
Quality Assurance Project Plan Acknowledgement Statement

This is to acknowledge that I have received a copy (in hard copy or electronic format) of the "[A Wetlands Action Plan for the Santa Cruz River in Northern New Mexico: Community-Based Planning for Enhancing Wetland and Riparian Ecosystem Functions 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 Emily Miller