

**Final Report
December 2023**

**New Mexico Rapid Assessment Method for Headwater
Slope Wetlands, and USACE NMRAM Phase 3**

New Mexico

Assistance Agreement No. CD-01F46701 (FY 2018)



Headwater Slope Wetlands at Comanche Creek, Valle Vidal, New Mexico

**New Mexico Environment Department
Surface Water Quality Bureau
Wetlands Program**

Project Goals and Objectives

This rapid assessment project is designed to develop and test metrics that will assess the ambient condition of a subset of the Slope Class of wetlands (Brinson et al. 1993) located in the headwaters of perennial streams in Northern New Mexico. The Headwater Slope Wetlands subclass of the Slope Class of wetlands are generally situated at the tops of watersheds and are critical to the functioning of entire river systems due to influences on downslope rivers and floodplains. Headwater slope wetlands are characterized by soils high in organic matter important to the capture of water and storage of baseflow, providing unidirectional dispersed (rather than concentrated) flow from snowmelt and runoff spreading across the wetland surface, a groundwater component that safeguards wetland stability during drought, and palustrine emergent (marshy/wet meadow) vegetation. It is estimated that many high-elevation headwater valleys may have been characterized by expansive slope wetland marshes and meadows with unidirectional flow without active channels (except for short reaches with steeper elevational differences), and in some places these slope wetland-dominated valleys still exist. Baseflow from headwater slope wetlands often maintains cold temperatures necessary for cold water aquatic life downstream.



Figure 1. Headwater Slope Wetlands on the Tres Piedras Ranger District, Carson National Forest

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Final Report

December 2023

Headwater slope wetlands in New Mexico are impacted and threatened by flow regulation by dams, livestock grazing, hoof shear and trailing, major wildfires, agriculture and development, invasion of non-native species and encroachment of upland species, off-road vehicle ruts, and roads. Legacy mining, logging, and grazing have impaired headwater slope wetlands from untreated headcuts, gullies, roads and trails, and vegetation removal that have dried out, continue to dry out, and in some cases obliterated these important wetland resources. Headwater slope wetlands that are impaired are more vulnerable to the impacts of flooding, fire and other extreme events associated with drought and a changing climate. The highest priority of the SWQB Wetlands Program is to develop methods for assessment that lead to protection, provide a benchmark for restoration of the State's wetlands resources, and prevent further losses of wetlands.

This Project is a continuation of the development of wetlands rapid assessment methods for New Mexico with a focus on headwater slope wetlands in montane regions of the state. The project resulted in the development of NMRAM Headwater Slope Wetlands Field Guide Version 1.0 that provides specific protocols for evaluating ten wetland ecological condition metrics using a combination of Geographic Information System (GIS)-based measurement and field surveys. Fillable data collection worksheets were also developed to support efficient data collection. These can be found at SWQB Wetlands Program Rapid Assessment Methods webpage at <https://www.env.nm.gov/surface-water-quality/wetlands-rapid-assessment-methods/>. Of the ten metrics used for evaluating Headwater Slope Wetlands, eight are new and exclusive to this subclass.

Headwater Slope Wetlands NMRAM Metric List

Landscape Context Metrics
L4. Surrounding Land Use (SLU) evaluates conditions within an area (Land Use Zone (LUZ) that extends out 250 m from the SA perimeter. L9. Wetland and Aquatic Area Abundance (WAAA) evaluates the abundance of wetland and aquatic areas within which the SA is embedded.(NEW)
L10. Wetland Corridor Connectivity (WCC) evaluates disruptions to the hydrologic connectivity of the wetland within 250 m from the SA perimeter.(NEW)
Biotic Metrics
B5. Invasive Exotic Plant Species Cover based on the New Mexico list of noxious weeds. B11. Relative Obligate Wetland Size based on the relative abundance of Obligate Wetland (Figure 7) to Wet Meadow zones within the SA.(NEW) B12. Relative Abundance of Wetland Plants based on the abundance of plants within groups of specific wetland status measured via aerial cover.(NEW)
Abiotic Metrics

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Final Report

December 2023

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| <p>A14. Wetland Surface Condition evaluates wetland surface damage based on a list of potential surface impacts measured within the SA.(NEW)</p> <p>A15. Fen Status estimates the quantity and quality of fens within the SA based on the thickness and composition of organic soils within the obligate wetland vegetation zone.(NEW)</p> <p>A16. Historic Obligate Wetland Loss estimates obligate wetland conversion to wet meadow based on measure of remnant peat soils in the wet meadow vegetation zone.(NEW)</p> <p>A16. Obligate Wetland Saturation Status estimates water table depth based on a measure of the average depth to water saturation in the soil profile of the obligate wetlands.(NEW)</p> |
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Another goal was to update and improve the NMRAM Manual to include a description and the rationale for Headwater Slope Wetlands metrics and to include any new or updated metrics and the updated stressor checklist from past NMRAM development. The NMRAM Manual 2.1 is the overarching document that explains the goals and objectives of NMRAM, provides information about the subclasses of wetlands for which NMRAM is currently developed, and explains the approach for NMRAM development. The updated NMRAM Manual Version 2.1 is available on the SWQB Wetlands Program Rapid Assessment Methods webpage.

This Project included the continued enhancements of the SWQB Surface Water Quality Bureau Information Database (SQUID) Temporary Wetlands Database to accept and store NMRAM data. Six New Mexico Wetlands Roundtables, maintained by the SWQB Wetlands Program, were conducted in the fall 2020 and spring 2021 under this project - three for the northern part of the state and three for Southern New Mexico. Due to Covid restrictions, the Roundtables were conducted as virtual WEBEX meetings.

In addition to the development of NMRAM for Headwater Slope Wetlands, work was conducted on a regulatory version of NMRAM for United States Department of the Army Corps of Engineers' (USACE) use (Phase 2). This work was conducted in conjunction with the Albuquerque District of the Corps of Engineers. Under this grant, a draft NMRAM Riverine Wetlands Regulatory Version 1.2 Field Guide was reviewed by the USACE Engineer Research and Development Center with favorable results and the comments were incorporated into the Field Guide. A field training was conducted in 2019 for both USACE and SWQB staff to test metrics in the field, and a half day training was also conducted for the regulated community. Draft electronic data collection worksheets were developed, and Version 1.3 was updated to increase utility.

The installation of piezometers and sample acquisition was continued from a previous project, (CD #01F10901-C), to understand the groundwater component of headwater slope wetlands, principally to collect isotope data that provides age dating of groundwater that support headwater slope wetlands and their component springs and fen wetlands.

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Final Report

December 2023

Project Outputs

Through this project nine major outputs were accomplished:

- 1) Data collection, analysis, and validation for the innovative Headwater Slope Wetlands NMRAM including the development of a Field Guide 1.0 and electronic data collection worksheets Version 1.0;
- 2) Update of Version 2.1 of the NMRAM Manual to cover all field guides and metrics developed to date;
- 3) Formation of a Technical Advisory Committee which met two times to provide input to NMRAM Headwater Slope Wetlands metric development;
- 4) A Multi-metric Analysis using geomorphological, vegetation, soils and other field data collected at 44 headwater slope wetlands Sample Areas (SAs);
- 5) Updates to NMRAM Riverine Wetlands Regulatory Version 1.3 and draft electronic data collection worksheets Version 1.3;
- 6) One NMRAM Headwater Slope Wetlands training for potential end-users which included a Botany Booster;
- 7) Vegetation classification of 44 headwater slope wetlands SAs;
- 8) New Mexico Wetlands Roundtables maintained for the northern and southern parts of the state four times per year for a total of six times under this project, two fall Roundtables in 2020, and two Spring and two Fall Roundtables in 2021 - the meetings focused on the objectives established by the group;
- 9) The development of NMRAM has been shared locally and nationally through presentations, and public events.



Figure 2. Headwater Slope Wetlands at Valles Caldera National Preserve.

Project Outcomes

- The SWQB Wetlands Program and partners are providing wetland assessment capability to require better wetlands protection, restoration, and mitigation.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

- This project creates a new tool for evaluating the condition of New Mexico's headwater slope wetlands in comparison to a level of human disturbance and that is relevant to New Mexico.
- NMRAM is filling a critical piece of an integrated and comprehensive approach to wetlands protection by SWQB and its partners.
- NMRAM will provide the supporting data and information needed to develop water quality standards for subclasses of New Mexico's wetlands resources.
- The NMRAM can be used to identify reference standard wetlands in need of special protection, and to identify those that are particularly impacted and those that can be restored.
- Working collaboratively with USACE, the development of NMRAM Riverine Wetlands Regulatory Version 1.3 increases the capacity of both agencies to require better and more equitable mitigation and protection of scarce wetland resources in New Mexico.
- As future wetlands subclasses are described and assessed, an iterative monitoring program linked to water quality assessments by watershed will continue to be developed and will increase the capacity and understanding of ecological linkages, natural variability and changes that result from human activities.
- Through our development of an integrated SQUID database at SWQB, wetlands assessment data will be available for inclusion in CWA Section 305(b) reports, increasing access to stakeholders and decision makers to improve their knowledge and understanding of wetlands issues.
- The oversight of NMRAM wetlands data at NMED will provide the capability to combine wetlands data and results with other SWQB water quality programs that will result in overall improvement to water resources of the State.
- Expanding and maintaining the New Mexico Wetlands Roundtable in Southern and Northern New Mexico including meetings especially located, designed and planned to inform partners relevant to their region, establishes and solidifies new partnerships, increases the capacity of the Wetlands Program to reach a variety of stakeholders with relevant and up-to-date information and data-sharing regarding wetlands in New Mexico.

Project Location

The Reference Domain for NMRAM for the development of headwater slope wetlands includes high-altitude broad valleys in the Jemez Mountains Valles Caldera National Preserve, the Upper Rio Grande in the Southern Rockies, the Tres Piedras Ranger District, Questa Ranger District, and

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

the Valle Vidal on the Carson National Forest and private lands including Philmont Scout Ranch and the Vermejo Park Ranch in northern New Mexico (Figure 4). The results of this project have statewide application for headwater slope wetlands in mountainous regions in New Mexico and throughout the Rocky Mountain region. The NMRAM for Riverine Wetlands Regulatory Version has Statewide application to both Montane and Lowland subclasses of riverine wetlands and can be applied to montane and lowland unconfined river systems in the arid west.

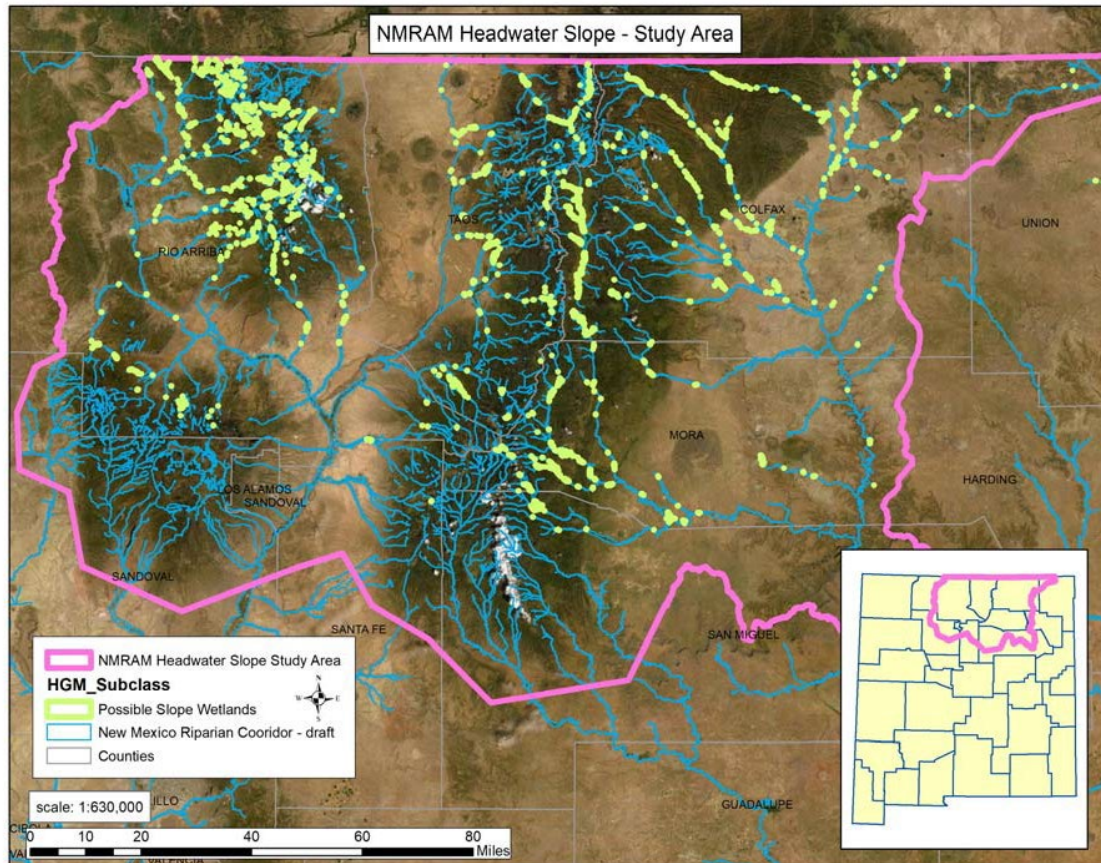


Figure 4. Headwater Slope Wetlands Study Area in Northern New Mexico.

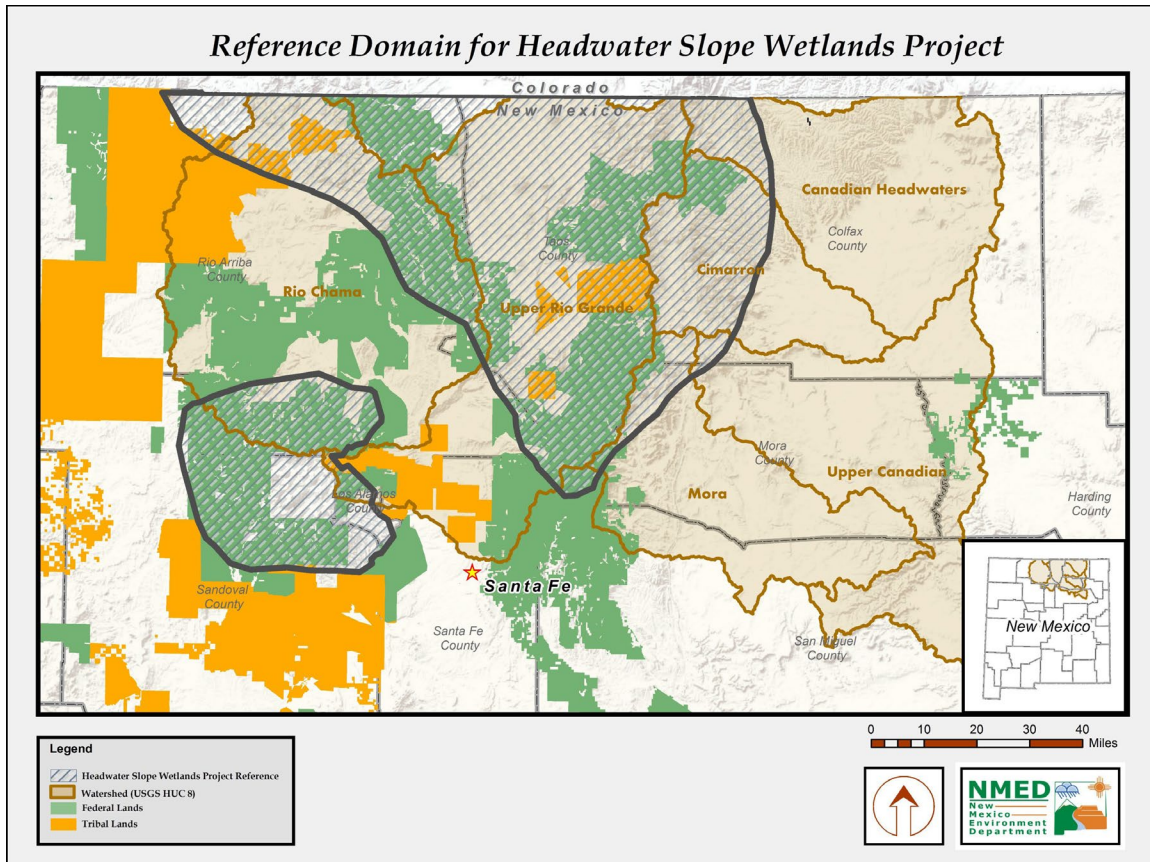


Figure 5. Reference Domain for NMRAM for Headwater Slope Wetlands Project

Original Timeframe

Wetlands Program Development Grant CD #01F46701 was awarded on August 9, 2018, and with a start date of October 1, 2018, and with an end date of October 1, 2021. A no-cost extension for CD #01F46701 to extend the grant period to December 31, 2023, was awarded by EPA on July 27, 2020. This was to accommodate the longer than anticipated approval of the MOA with University of New Mexico Natural Heritage New Mexico and because of delays caused by Covid -19 travel restrictions affecting data collection. The stated goals and objectives of the project remained the same, as well as the key project Tasks and deliverables.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023



Figure 5. Headwater Slope Wetlands at Vermejo Park Ranch in northern New Mexico at the headwaters to Comanche Creek, a tributary of the Rio Grande.

Partners Involved

UNM Natural Heritage New Mexico was the principal contractor in partnership with SWQB Wetlands Program in developing the Headwater Slope Wetlands NMRAM 1.0 for this Project and for the NMRAM Manual Version 2.1 update. TEKSystems, Inc. is responsible for developing the interactive data collection worksheets for both Headwater Slope Wetlands data collection and for the NMRAM Riverine Wetland Regulatory Version, 1.4 and for enhancements to the SQUID Wetlands Temporary Database to accept NMRAM data. Deanna Cummings, USACE, co-authored the NMRAM Riverine Wetland Regulatory Version, 1.4 along with Maryann McGraw (SWQB WPC) Esteban Muldavin and Elizabeth Milford (UNM Nat Her). USEPA Region 6 (Sharon Daugherty, Leslie Rauscher, Kyla Chandler, and Sondra McDonald) provided project progress guidance and technical assistance.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

SWQB Wetlands Program was involved in every aspect of project and co-authored the Field Guides Version 1.0 and NMRAM Manual Version 2.1 along with UNM Natural Heritage New Mexico (co-authors: Esteban Muldavin, Elizabeth Milford, and Maryann McGraw). The Project involved a Technical Advisory Committee whose members are as follows:

Technical Advisory Committee Members

Name	Organization
Aaron Miller	NRCS National Technical Committee for Wetland Soils
Amy Urbanovsky	Natural Heritage New Mexico
Becky Pierce	CO Department of Transportation
Brianna Wadley	EPA Region 6
Cameron Weber	Rio Grande Return
Charlie Cassagnol	Western Ecology, LLC
Daniel Guevara	NMED SWQB
Daniel Valenta	NMED SWQB
Dave Pittenger	Valles Caldera National Preserve
Diane Van Hoy	NMED SWQB
Dustin Nelson	NMED SWQB
Elizabeth Milford	Natural Heritage New Mexico
Emile Sawyer	NMED SWQB
Esteban Muldavin	Natural Heritage New Mexico
Jason Martinez	NMED SWQB
Jason Smith	NM Department of Transportation
Jeff Cervantes	US Forest Service, Cibola National Forest
Jeff Ogburn	NM Department of Game and Fish
Jennifer Muus	NMED SWQB
Jillian Sanders	SWCA
Jocelyn Harimon	NMED SWQB
Joneen Cockman	Retired BLM-AZ
Karen Menetrey	Rio Grande Return
Katherine Ottmers	Quivira Coalition
Kathryn Lacey	NMED SWQB
Kyla Chandler	EPA Region 6
Lindsey Teunis	SWCA
Linnea Spears-Lebrun	SWCA
Livia Crowley	US Forest Service, Cibola NF

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

Lucas Graunke	NMED SWQB
Maryann McGraw	NMED SWQB
Meredith Zeigler	NMED SWQB
Michael Baca	NMED SWQB
Miguel Montoya	NMED SWQB
Mike Freehling	Consultant
Peter Callen	Albuquerque Wildlife Federation
Rachel Jankowitz	NMED SWQB
Reid Whittlesey	Rio Grande Return
Roy Jemison	US Forest Service
Santiago Misquez	NRCS
Sarah Griffin	SWCA
Sarah Hall	Valles Caldera National Preserve
Sara Holm	Vermejo Park Ranch
Sarah Pearce	SFEI
Seth Mangini	Philmont Scout Ranch
Steven Fry	Amigos Bravos
Tiffany Anders	NMED SWQB

Independent Reviewers of the NMRAM Regulatory Field Guide and Data Collection worksheets:

Bruce A. Pruitt	U.S. Army Corps of Engineers, Engineering Research and Development Center
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NMRAM for Headwater Slope Wetlands Technical Team (data collection)

Amy Urbanovski	Natural Heritage New Mexico
Yvonne Chauvin	Natural Heritage New Mexico
Emile Sawyer	NMED/SWQB
Dustin Nelson	NMED/SWQB
Codie Vilen	NMED/SWQB
Tiffany Anders	NMED/SWQB
Grace McCarthy	Natural Heritage New Mexico

New Mexico Wetlands Roundtables

The New Mexico Wetlands Roundtables pivoted to Virtual meetings using WEBEX during the Covid-19 pandemic. This was due to travel and in-person meeting restrictions. Using the virtual format allowed the SWQB Wetlands Program to reach more interested participants than ever before with attendance more than doubling for the Wetlands Roundtables and the opportunity to hear from out-of state speakers. Six Wetlands Roundtables were conducted in 2020 and 2021 as part of the outreach task for this project. The entities providing presentations at each Roundtable are listed below:

The Fall 2020 Wetlands Roundtables were conducted on November 24, 2020 (Northern Wetlands Roundtable) and December 10, 2020 (Southern Wetlands Roundtable). Part of both the meetings focused on the effects of the new Waters of the US (WOTUS) rule on protection of waters and wetlands in New Mexico.

Northern New Mexico Wetlands Roundtable Presenters, November 24, 2020 (128 attendees): EPA Region 6, NM Department of Transportation, Christina Selby, Independent Journalist, Pitchfork Ranch, Eco-Asset Solutions and Innovations LLC, and University of California-Berkeley, US Army Corps of Engineers, Native Plant Society of NM – Albuquerque Chapter.

Southern New Mexico Wetlands Roundtable Presenters, December 10, 2020 (125 attendees): US Forest Service – Lincoln National Forest, NMED Surface Water Quality Bureau, US Forest Service – Gila National Forest, US Army Corps of Engineers, CEHMM, Keystone Restoration Ecology, Natural Heritage New Mexico.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

Northern New Mexico Wetlands Roundtable Presenters, March 24, 2021 (140 attendees): Santa Fe Indian School, NM Department of Game and Fish, Rice University, Houston Texas, NMED Surface Water Quality Bureau, Ecotone Landscape Planning, US Army Corps of Engineers, Hydra Aquatic.

Southern New Mexico Wetlands Roundtable Presenters, April 8, 2021 (131 attendees): Norm Gaume, former state engineer (ret), National Cave and Karst Institute, NM Department of Game and Fish, Defenders of Wildlife, US Army Corps of Engineers, NM Water Resources Research Institute, Bosque del Apache National Wildlife Refuge.

Southern New Mexico Wetlands Roundtable Presenters, November 17, 2021 (130 attendees): U.S Forest Service, White Sands National Park, Trout Unlimited, US Army Corps of Engineers, Playa Lakes Joint Venture, UNM Natural Heritage, and Hydra Aquatic.

Northern New Mexico Wetlands Roundtable Presenters, December 7, 2021. (107 attendees): Three presentations focused on wetland restoration in the Middle Rio Grande Bosque: New Mexico Department of Game and Fish, City of Albuquerque, and Aquatic Consultants. Additional presentations were from Rio Grande Return, Keystone Restoration Ecology, New Mexico Highlands University, and US Army Corps of Engineers.

The non- federal attendees' time at all Roundtables are included as match for this project.

Funding

The original Federal amount was \$427,234 and \$163,849 match. The federal amount was underspent by \$76,472 and the final match amount was \$246,959 (**\$83,110 overmatched**). See semi-annual reports for details.

Major Project Highlights and Chronology

- SWQB Wetlands Program was awarded federal assistance for this project. The Cooperative Agreement between NMED and EPA for CD #01F46701 (FY2018) was completed on August 9, 2018 and with a start date of October 1, 2018.
- Maryann McGraw (Wetlands Program Coordinator (WPC)) is the Project Officer for this project.
- The WPC initiated an MOA and Scope of Work with University of New Mexico Natural Heritage New Mexico (NHNM) in order to help perform tasks 2, 3, and 5-13 of this project.
- WPC determined that another entity would be needed to conduct age-dating of groundwater sources in fen wetlands/headwater slope wetland complexes to determine perennial water sources.
- Rio Grande and San Juan River Water Quality Sampling WTUs have been calculated as match for this project.

NMRRAM for Headwater Slope Wetlands, and USACE NMRRAM Phase 3 New Mexico

Final Report

December 2023

- The WPC has developed Amendment #2 for TEKSystems to work on headwater slope wetlands and USACE Phase 3 data collection worksheets and SQUID updates.
- Deanna Cummings transferred to the LA District of the USACE and Justin Riggs of USACE is the new contact for completing the NMRAM Riverine Regulatory Module.
- The WPC attended a 404 permitting for Questa Mine mitigation meeting on site as a wetlands expert at Midnight Meadows headwater slope wetlands on the Carson National Forest on August 16, 2019. The headwater slope wetlands in this area are good candidates for Headwater Slope NMRAM data collection.
- The Field Guide Version 2.0 for NMRAM Riverine Regulatory Module was reviewed by USACE Engineer Research and Development Center (ERDC) and delivered to the SWQB Wetlands Program in November 2019. Updates to the Field Guide will be conducted under this project (Phase 3).
- The WPC contacted Stacy Timmons at New Mexico Tech to conduct age-dating of groundwater sources in fen wetlands/headwater slope wetland complexes to determine perennial water sources.
- The Chevron contractors are installing piezometers at the Questa Mine mitigation site and the data may also be useful for developing NMRAM for headwater slope wetlands.
- The MOA with University of New Mexico Natural Heritage New Mexico (NHNM) to help perform tasks 2, 3, and 5-13 of this project was approved on March 13, 2020 and work has started.
- A project Kick-off meeting with NHNM was conducted on April 9, 2020 to begin project planning, assign tasks and schedule Pilot Study and QAPP development.
- A new Price Agreement has been negotiated and approved for TEKSystems. A new Multi-Bureau Contract under the Price Agreement will include the funds to work on headwater slope wetlands and USACE Phase 3 data collection worksheets and SQUID updates under a Task for SWQB SQUID enhancements.
- Updates to the Field Guide Version 2.0 for NMRAM Riverine Regulatory Module are included in the new MOA with the University of New Mexico, Natural Heritage New Mexico.
- In March 2020, all NMED staff started teleworking under the stay at home order for New Mexico due to Covid-19. Field work for this project that was scheduled for Summer 2020 (ie. Pilot Study) may be delayed.
- On Earth Day, 2020, the WPC attended a webinar presentation by William J. Mitch (Co-author of Wetlands) entitled “Troubled Waters and Troubled Planet: 50 years since the first Earth Day” by NOAA.
- WPO and Davena Crosley, SWQB Supervisor and Headwater Slope Wetlands Data Collection Team Member attended the Association of State Wetland Managers Virtual Annual State and Tribal Coordination Meeting, April 7-9, 2020.
- Elizabeth Milford and the WPC met with Justin Riggs of USACE, who is the new contact for completing the NMRAM Regulatory Module, through a Zoom meeting on June 29, 2020.
- The QAPP for data collection was approved by EPA on July 1, 2020 and is assigned QTRAK #20-304.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

- A no-cost extension for CD #01F46701 to extend the grant period to December 31, 2023 was awarded by EPA on July 27, 2020.
- A Multi-Bureau Contract with TEKsystems was approved on September 16, 2020 and work on the data collection worksheets for USACE NMRAM started on September 21, 2020.
- The Wetlands Team began preparations for two Fall Wetlands Roundtables to be conducted in late 2020.
- To accommodate Covid-19 travel restrictions the Headwater Slope Wetland Pilot Study was scheduled and held on two single days, September 17, 2020, and September 24, 2020.



Figure 6. Pilot Study visit to Headwater Slope Wetlands on the Valles Caldera National Preserve on September 24, 2020.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023



Figure 7. September 24, 2020 Pilot Study at Valles Caldera National Preserve (VCNP) – Fen portion of headwater slope wetland at Valle Santa Rosa.



Figure 8. September 24, 2020 Pilot Study at VCNP - Grazed and drying headwater slope wetland with channel at Valle San Antonio wetland complex.

NMRRAM for Headwater Slope Wetlands, and USACE NMRRAM Phase 3 New Mexico

Final Report

December 2023

- On September 17, 2020 Esteban Muldavin, Elizabeth Milford and the WPC traveled to the Midnight Meadows area in the Carson National Forest to visit three potential sample areas. They were joined in the field by the hydrologist from the Taos Field Office of the Carson National Forest, John Littlefield.
- On September 24, 2020 Esteban Muldavin, Elizabeth Milford, the WPC and Emile Sawyer (WPO) traveled to Valle Caldera National Preserve (VCNP) to review and discuss 4 potential sample areas. In addition to reviewing attributes of this wetland subclass, soil samples were viewed, and plans were made for the installation of piezometers at potential headwater slope wetland sites and requesting data from piezometers already located on the VCNP and Midnight Meadows Chevron site. The Pilot Study questions and notes, and a Pilot Study Report are included as deliverables with this report.



Figure 9. Pilot Study site visit to Carson National Forest Midnight Meadows Chevron Restoration site on September 17, 2020. The headwater slope wetland was heavily grazed with some rewetting structures implemented.



Figure 10. Hummocks and plant pedestals created by ungulate trampling and dewatering of floating sedge mats in headwater slope wetlands at Midnight Meadows Chevron site on the Carson National Forest, September 17, 2020.

- In September and October 2020, Emile Sawyer installed piezometers in headwater slope wetlands in Holman Creek watershed on the Valle Vidal in northern New Mexico. Data from these wells will be used to develop a groundwater metric.
- A Save the Date email for the Fall Wetlands Roundtables was sent to the mailing list on October 9, 2020. The fall Wetlands Roundtables are scheduled for November 24, 2020 (Northern Wetlands Roundtable) and December 10, 2020 (Southern Wetlands Roundtable).
- The WPC worked on the Reg NMRAM Field Guide updates under Version 1.3, and field sheet updates with TEKsystems.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023



Figure 11. Photo of the headwater slope wetland complex in the Holman Watershed where the first set of piezometers are installed to monitor shallow groundwater. Photo by M. Walton for the Keyline Design Project CD #01F10901-C.

- A Save the Date email for the Fall Wetlands Roundtables was sent to the mailing list on October 9, 2020. The fall Wetlands Roundtables are scheduled for November 24, 2020 (Northern Wetlands Roundtable) and December 10, 2020 (Southern Wetlands Roundtable).
- The Wetlands Team conducted two Fall New Mexico Wetlands Roundtables in November and December 2020, and two Spring New Mexico Wetlands Roundtables in March and April 2021.
- UNM created a geodatabase of headwater slope wetland potential sample areas and forwarded it to SWQB Wetlands Program for site verification.
- Field supplies for groundwater wells for headwater slope wetland sites were purchased under this project by Emile Sawyer who is leading the installation and monitoring of these wells.
- The WPC worked with TEKSystems on updates to the Reg NMRAM interactive datasheets to be updated to Version 1.4. The WPC and UNM are currently on hold working with the USACE due to changes in WOTUS rules occupying the time of USACE staff. Currently the Reg NMRAM will still apply to WOTUS for the wetlands still under protection as Waters of the US.
- The WPC viewed a virtual video presentation about carbon sequestration, carbon markets and wetlands by Jim Baker of Rice University who was then invited to speak at the March Wetlands Roundtable.
- All in-person REG NMRAM training has been put on hold due to Covid guidelines. In addition, potential training sites may not be available due to restrictions for the indoors portions of the trainings.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

- A second Headwater Slope Wetland Pilot Study was conducted on August 29-31, 2021, at the Vermejo Park Ranch and at Philmont Scout Ranch, private ranches in Northern New Mexico.
- The set a draft metrics that can be potentially used for Headwater Slope Metrics was updated and questions were formulated for the August 2021 Pilot Study. Elizabeth Milford obtained permission to enter and take soil samples from the Pilot Study sites.
- Four staff from UNM and two staff from NMED (Maryann McGraw and Emile Sawyer) conducted the Pilot Study following Covid-19 protocols. Aaron Miller, Wetlands Soil Scientist from NRCS, joined the group for one day at Vermejo Park Ranch sites.

Figure 12. Sample overview map of Vermejo Park Ranch. Blue areas are Pilot Study headwater slope wetland areas of interest.

Final Report



Figure 13. Two of the sites at Vermejo Park Ranch that were visited during the second Pilot Study.



Figure 14. Headwater Slope Wetland site at Vermejo Park Ranch August 30, 2021.



Figure 15. Soil Sample from wet meadow portion of Headwater Slope Wetland site at Vermejo Park Ranch August 30, 2021.

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NMRRAM for Headwater Slope Wetlands, and USACE NMRRAM Phase 3 New Mexico

Final Report

December 2023

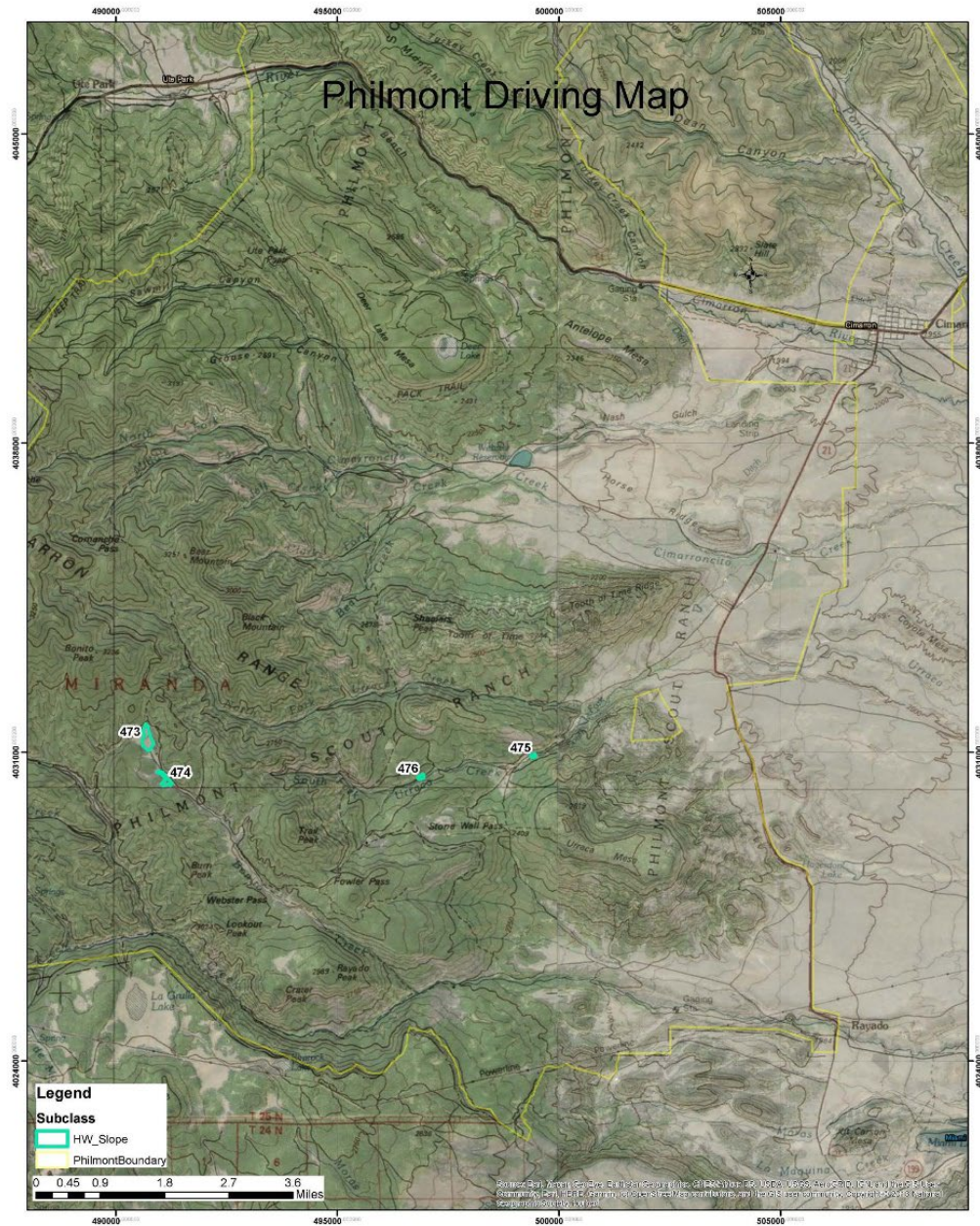


Figure 16. Overview map of Headwater Slope Wetland sites at Philmont Scout Ranch.

NM RAM for Headwater Slope Wetlands, and USACE NM RAM Phase 3 New Mexico

Final Report

December 2023



Figure 17. Degraded fen wetland site at Philmont Scout Ranch, August 31, 2021.

- On November 9, 2021, Pilot Study participants from UNM, the WPC and WPO, and NRCS soil scientist Aaron Miller joined a Zoom follow-up call to discuss what was learned during the Pilot Study. Pilot Study participants conducted additional literature review as needed after second pilot study in preparation for revision of SA definition to exclude riverine channels adjacent to the Headwater Slope systems and to refine selection and development of abiotic metrics.
- One finding is if channels are cutting through histic wetland soils then it is degrading and dewatering the system because those are not typical soils that you would find in a stream system and are characteristic of fen soil development.



Figure 18. Small forested Headwater Slope Wetland at Philmont Scout Ranch



Figure 19. Forested Headwater Slope Wetland Complex with floating fen in tributary to Bonito Creek at Philmont Scout Ranch in Northern NM.

- Groundwater well transducer installment for headwater slope wetland sites on Holman Creek in the Valle Vidal were completed by Emile Sawyer who is leading the installation and monitoring of these wells.
- The invitation to the Fall Wetlands Roundtables went out on September 27, 2021. The Roundtables are scheduled for November 17, 2021, and December 7, 2021 and will be virtual.
- Metric development meetings began on January 21, 2022 with UNM. The WPC met with Este Muldavin and Elizabeth Milford to discuss subclass definitions, SA boundaries and review the list of potential metrics. The UNM Team selected potential metrics for the first TAC meeting based on the results of the Pilot Studies.
- A No-Cost Amendment #1 for UNM MOA #20-667-2060-0005 UNM was approved on April 20, 2022.
- Emile Sawyer sent piezometer locations, and a list of samples for hydrogen/oxygen isotope data to determine the age of the groundwater to UNM for possible development of a groundwater metric. The samples are being analyzed by New Mexico Tech.
- The first data collection field work is scheduled for Summer 2022.
- The first NMRAM for Headwater Slope Wetlands Technical Advisory Committee meeting was held virtually on June 28, 2022 with 36 attendees.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

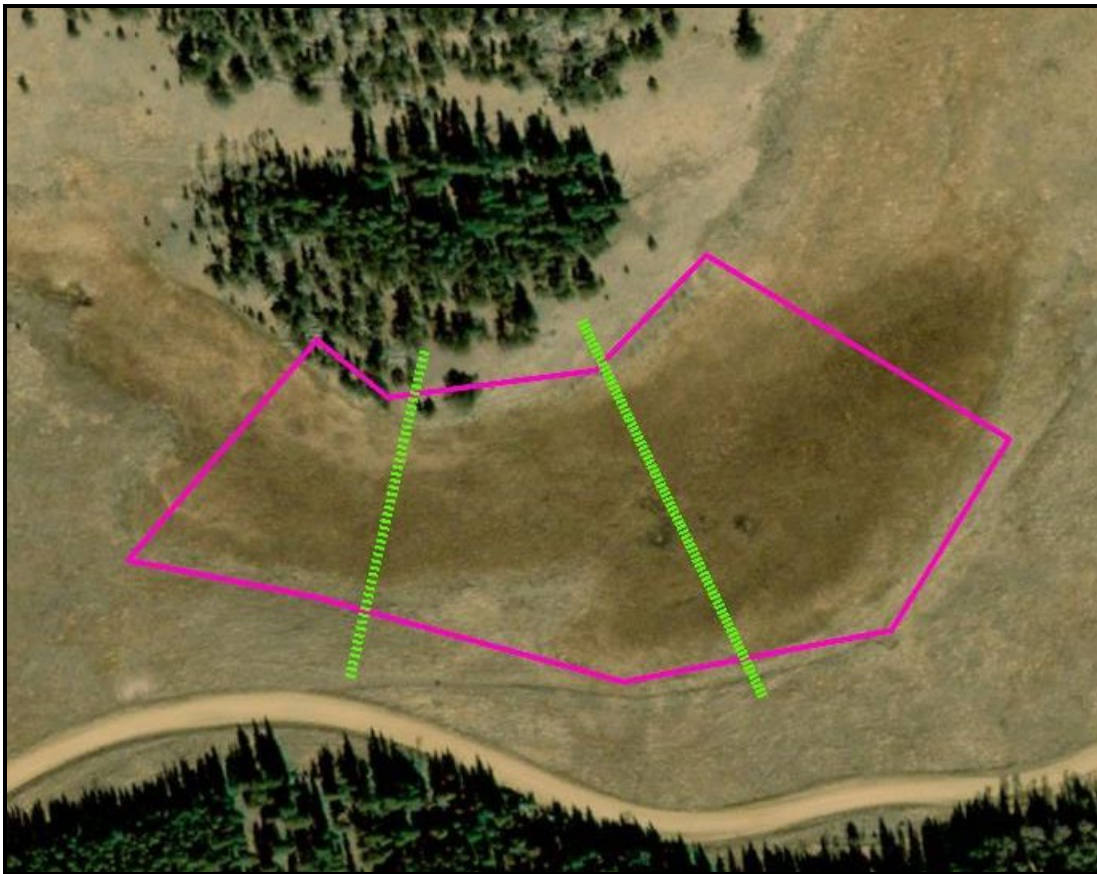


Figure 20. Because of the size and extent of some headwater slope wetlands, using cross-sections to collect data was proposed during the first NMRAM for Headwater Slope Wetlands Technical Advisory Committee meeting conducted on June 28, 2022.



Figure 21. Slide from Technical Advisory Committee meeting describing subclass features.

- The WPC worked with NHHM staff to select sites for the first NMRAM Headwater Slope Wetlands data collection effort.
- The QAPP for this project was updated and approved by EPA on June 17, 2022 and is filed under QTRAK 22-281.
- After the TAC meeting in June, the WPC met with NHHM staff to review draft metrics and protocols for field sampling on July 25, 2022.
- A field training for the NHHM/SWQB Wetlands Program data collection team was conducted on August 1 and 2, 2022 by NHHM and SWQB Wetlands Program staff to ensure quality data would be collected and protocols were understood.
- The field team consisted of NHHM staff, Amy Urbanovski and Yvonne Chauvin, and SWQB staff Emile Sawyer and Dustin Nelson. Esteban Muldavin, Elizabeth Milford, and Maryann McGraw led the data collection field training which was conducted at Holman Creek headwater slope wetlands on the Valle Vidal in northern New Mexico. Aaron Miller NRCS Wetland Soil Scientist and NRCS soil scientist staff member joined the team to ensure quality soils data collection on the morning of August 1, 2022.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023



Figure 22. Headwater Slope Wetlands soil sampling training August 1, 2022, at Holman Creek headwater slope wetlands degraded site on the Valle Vidal, Carson National Forest. Aaron Miller and NRCS staff member helped the Team develop a protocol for wetland soil cores, especially identifying peat, mucky peat, and muck soil horizons as well as texture, hue, value and color of dark peat soils, and determining sampling depth and placement.



Figure 23. Data Collection Team setting up cross sections for headwater slope wetlands data collection.



Figure 24. Trainers and Data Collection Team discuss where to set up a Sampling Area on degraded headwater slope wetland site on Holman Creek in the Valle Vidal.

- The first field data collection occurred from August 2 through August 20, 2022. Data were collected from 14 Sample Areas (SAs) in the Valle Vidal, Midnight Meadows on the Carson National Forest, and from Vermejo Park Ranch and Philmont Boy Scout Ranch.
- Emile Sawyer (WPO) transferred 13 water samples to New Mexico Tech for analyses of isotopes to age date the water samples. While collecting NMRAM data, Emile also collected 5 of the isotope samples for analyses on August 5, 2022. Emile sent groundwater data for 7 of 10 wells near Holman Creek to Elizabeth Milford (UNM Natural Heritage) on August 31, 2022 for metric development.
- Database entry from the 2022 14 data collection sampling areas (SAs) started in late September 2022 at UNM and continued through November 2022 in preparation for multi-metric evaluations and development of the draft metrics. NHNM staff entered 2022 field data into spreadsheets, the NHNM in-house NMRAM database and the NHNM in-house vegetation database.
- NHNM botanist, Yvonne Chauvin, organized plant specimens and began identification unknowns in the herbarium.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023



Figure 25. Vegetation sampling transect at headwater slope wetlands in Casias Creek headwaters at Vermejo Park Ranch.



Figure 26. Soil sample where peat and mucky peat were located at a headwater slope wetland.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023



Figure 27. Example of a trampled and browsed headwater slope wetland as noted by the hummocky surface condition.

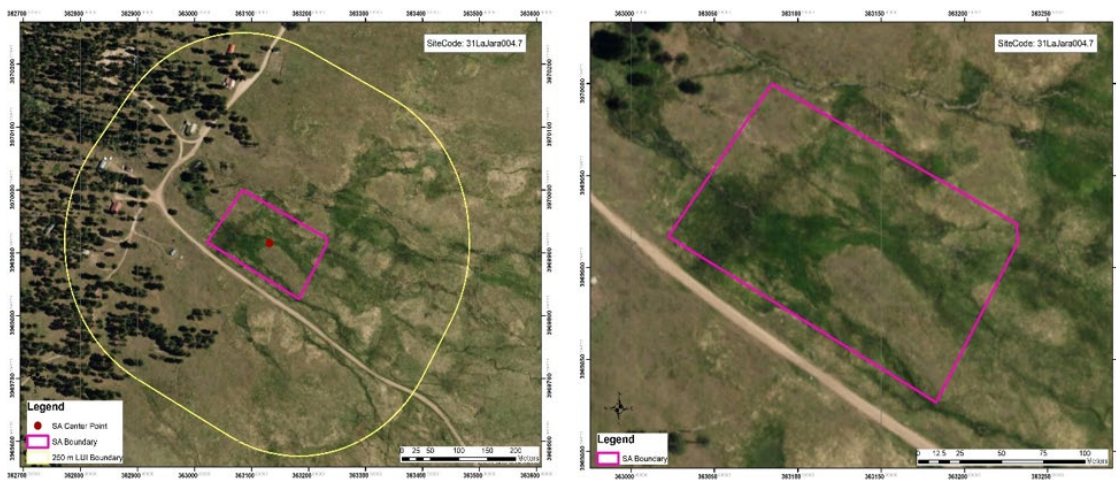


Figure 28. Examples of Landscape and SA field maps. On the left, a landscape-scale map with boundaries for measuring landscape metrics. On the right, a fine-scale SA map for field vegetation and abiotic features mapping.

NM RAM for Headwater Slope Wetlands, and USACE NM RAM Phase 3 New Mexico

Final Report

December 2023

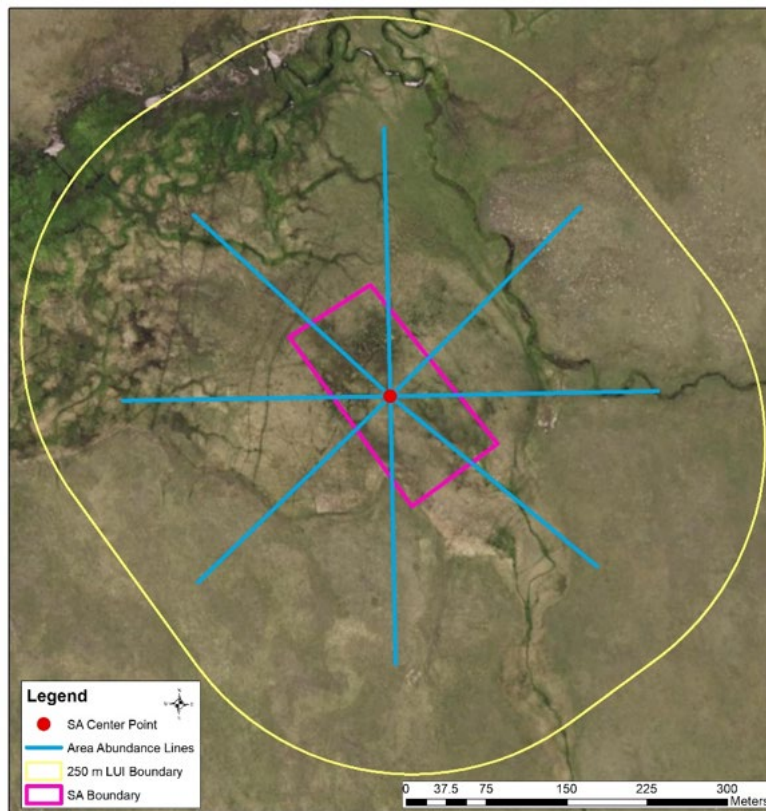


Figure 29. Headwater Slope Wetlands Landscape Context metrics are measured in two zones in and around an SA: the Land Use Zone (LUZ) out to 250 m (yellow line) from the SA perimeter, and the Wetland and Aquatic Area Abundance (WAAA) estimation lines originating from the center of the SA out 250 m in cardinal and quarter-cardinal directions (blue lines). Land Use Index (LUI) and Wetland Corridor Connectivity (WCC) are both evaluated inside the LUZ. WCC is also evaluated within the SA. WAAA is evaluated using the WAAA lines.



Figure 30. Soil and vegetation sampling at headwater slope wetlands.



Figure 31. Dustin Nelson (NMED SWQB) and Emile Sawyer (NMED SWQB) conduct slope measurements during NMRAM data collection.

- The WPC met with NHNM staff Esteban Muldavin, Elizabeth Milford and Amy Urbanovski via Zoom on December 15, 2022, and January 9 and February 17, 2023, to discuss data analyses and revise and create new metrics to be used during the second data collection field season.
- Three new Abiotic metrics use soil core and saturation status to complete data collection for the metrics. Amy Urbanovski created transect diagrams showing elevation and soil data in relation to vegetation zones as an aid to analyses.
- NHNM staff created draft field protocols and data sheets for SA designation, landscape, biotic and abiotic metrics for 2023 data collection to be held in August 2023. The datasheets were transferred to the WPC for review and editing. The WPC also worked with TEKSystems to turn the draft datasheets into interactive datasheets for data collection.
- In December 2023, Kalyani Gandham and Dan Gandhi (TEKSystems) gave an update on the development of the Wetlands Squid database where wetlands data will be stored at SWQB in preparation for integration into the SQUID database at NMED.
- NHNM staff met with WPC and staff via Zoom to discuss data analysis and SA boundaries and rules on April 11 and 27, 2023.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

- Preliminary revisions to the NMRAM Manual Version 2.1 have been started by Esteban Muldavin (NHNM) and discussed with the WPC in April 2023.
- Deanna Cummings, one of Reg NMRAMs authors contacted the WPC to see if we would share Reg NMRAM Field Guide with the Los Angeles District to see if they could use it in Arizona. The Field Guide and data collection worksheets were emailed to Jesse Rice and Deanna Commings of the USACE. The WPC also was encouraged to find another champion at USACE Albuquerque District to continue to use NMRAM Reg in New Mexico.
- The WPC met with NHNM staff Esteban Muldavin, Elizabeth Milford and Amy Urbanovski via Zoom on May 9, May 18, June 8, June 29, July 7 and July 21, 2023, to discuss data analyses and revise and improve metrics before data collection in August.
- Permission was granted from Valles Caldera National Preserve, the Carson National Forest, the Santa Fe National Forest and Vermejo Park Ranch for data collection in August 2023.
- The WPC attended EPA Virtual Training for Subrecipients and Subawards in June 2023 as match for this project.
- Metrics were revised and new datasheets were developed for data collection in 2023.
- A meeting to discuss final field work logistics with the field team was held with NHNM and NMED staff via Zoom on July 21, 2023. Field data collection dates were scheduled and coordinated with the field team and landowners. Field maps were created by NHNM for all potential SAs and printed for field team.
- Training for the data collection team was conducted on August 1, 2023 at the Valles Caldera National Preserve.
- Data was collected from 30 Sampling Areas for a total of 44 sites in 2022 and 2023.
- Data collection for 2023 was conducted during four separate trips in August: August 1-4, 2023 the team collected data from sites on Valles Caldera National Preserve; August 8-11, 2023 the team collected data in the Cruces Basin of the Carson National Forest; August 15-18, 2023 the team collected data from the upper Rio Brazos watershed on the Carson National Forest; August 22-25, 2023 the team collected data from Vermejo Park Ranch.



Figure 32. Example of Soils data collection by Cody Vileno at Headwater Slope Wetlands Sampling Area during the 2023 data collection.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

- Codie Vilen (WPO) helped NHNM enter data in their in-house NMRAM database in August and September 2023. Codie Vilen (WPO) was assigned to helping UNM enter data for two weeks because the project would be ending in December 2023 and the data were needed to complete the metric development for the NMRAM for Headwater Slope Wetlands. NHNM botanist, Yvonne Chauvin, organized plant specimens and began identification unknowns in the herbarium. Database entry was completed in September 2023.
- NHNM provided final comments for the NMRAM Reg Field Guide and data collection worksheets.
- The NMRAM for Headwater Slope Wetlands Short Course was conducted on September 19-21, 2023 at the Valles Caldera National Preserve Field Operations Center with 14 participants attending.
- NHNM Botanist, Grace McCarta, gave a wetlands botany refresher as part of the NMRAM for Headwater Slope Wetlands Short Course.
- Discussions during the trainings and reviewing the data collected led to the decision to develop a Vulnerability Rating for the NMRAM for Headwater Slope Wetlands in include it in the field guide and data collection worksheets.

Vulnerability Rating

The Wetland Vulnerability Rating is based on combined evidence collected during NMRAM survey from multiple metrics. The Wetland Vulnerability Rating sits outside the SA metric roll-up, wetland condition score and rank as an independent index of the vulnerability of the SA wetland to permanent degradation and loss. The Wetland Vulnerability Rating measures persistence based on specific factors and combinations of factors that indicate loss or potential loss of the obligate wetland. The data for the vulnerability rating is synthesized in a unique way between multiple metrics and then rated based on the inferences of wetland stability. The vulnerability rating can be used to compare wetlands relative to their vulnerability independent of condition rating or in combination with condition rating. The key is that it allows the identification of sites that are at high risk of permanent degradation and loss.



Figure 33. Esteban Muldavin (NHNM) explaining how to describe a soil profile on the soils metrics datasheets at NMRAM for Headwater Slope Wetlands Short Course September 19, 2023.



Figure 34. Breakout groups deciding where to set Sampling Area limits and where to run transects at the NMRAM for Headwater Slope Wetlands Short Course September 19-21, 2023.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023



Figure 35. Setting up the transects for the field portion of NMRAM Short Course at the Valles Caldera National Preserve.



Figure 36. Delineating and describing vegetation for the biotic metrics for NMRAM for Headwater Slope Wetlands at the Short Course.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

- Metrics discussions and reviews continued after data collection to refine metrics and protocols on September 28, 2023.
- An Invitation to the Technical Advisory Committee went out to TAC members and other interested participants for the second Technical Advisory Committee meeting on October 31, 2023. The TAC meeting is planned for November 17, 2023 after the final data collection, downloading of data and proposed revisions to the metrics are completed.
- Esteban Muldavin and Elizabeth Milford reviewed the final version of the NMRAM Reg Field Guide to provide final comments and input to the field guide. TEKsystems provided final updates to the interactive datasheets.
- The Second Technical Advisory Committee meeting was conducted on November 17, 2023 using WEBEX with 23 participants attending the half day meeting. The TAC presentation included the analyses and rationale for the new metrics created for NMRAM for Headwater Slope Wetlands.
- The remainder of 2023 was for NHHM and the WPO completing the Final Field Guide Version 1.0, work on the data collection worksheets version 1.0 with TEKsystems, and completing the updates to the NMRAM Manual.
- The NMRAM Final Field Guide was transferred to NMED from NHHM with final revisions after the grant period ended in March 2024. However, invoices were only for expenses through the term of the MOA, December 15, 2023.
- The NMRAM Manual Version 2.1 was transferred to NMED from NHHM with final revisions after the grant period ended in March 2024. However, invoices were only for expenses through the term of the MOA, December 15, 2023.

List of Major Deliverables

- New Mexico Rapid Assessment Method for Headwater Slope Wetlands Field Guide Version 1.0 (2023) and electronic data collection worksheets Version 1.0.
- Updated NMRAM Manual Version 2.1
- Data collection, NMRAM data sheets, and site photos from 44 SAs for development of the Headwater Slope Wetlands NMRAM.
- Two Pilot Study Reports.
- NMRAM Headwater Slope Wetlands Training Materials, presentations, and sign-in sheets.
- New Mexico Wetlands Roundtable agendas, presentations and attendee lists for six Roundtable Meetings.
- NMRAM Headwater Slope Wetlands outreach presentations.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

- MOA and IT Contracts and amendments.
- QAPP and updated QAPP.
- Rio Grande and San Juan River Water Quality Sampling WTUs calculated as match for this project.
- Geodatabase of headwater slope wetland potential SAs.
- New Mexico Rapid Assessment Riverine Wetlands Regulatory Version 1.4 updates to Field Guide and data collection worksheets.
- Semi-Annual Reports and Final Report, Match reporting.

Lessons Learned

During most of the project period, travel and in-person meetings were restricted due to Covid-19. However, meetings to continue work on this project was conducted using Zoom or Teams while staff at NMED and NHPM were teleworking from home, and day trip travel following state Covid-19 guidelines with attendees in separate vehicles. Work conducted virtually turned out to be cost savings compared to in-person meetings and the Headwater Slope Wetlands Development Team adapted quickly and efficiently to the conditions. However, day trips in separate vehicles were costly and restricted to locations that were accessible in one day. This especially limited the headwater slope wetlands visited during the Pilot Studies.

What made the project successful?

The development of 8 new metrics for NMRAM for Headwater Slope Wetlands required innovative thinking for a novel NMRAM, and significant time and analyses to create the new metrics. In addition, data collection from headwater slope wetlands made us realize that this subclass of wetlands is seriously at risk from climate change and local impacts such as grazing and roads. This led to the development of a separate Vulnerability Rating that was added to the field guide and data collection worksheets. NMRAM is proving to be a successful tool for identifying the condition of wetlands by subclass in New Mexico, identifying their range and abundance, and evaluating their condition. NMRAM adds a useful and versatile tool for the management of the State's wetland resources.

The expansion of the New Mexico Wetlands Roundtable has been invaluable as a change agent for the way the state views its wetlands. Wetlands are now more valued and work on assessment, restoration and protecting wetlands is more common. Wetlands are recognized as an indispensable resource. It has been inspiring to see how the response to requests for speakers is so positive as well as the offers for Roundtable sponsorship.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

The acceptance of SWQB to integrate, expand and maintain wetlands data as part of SQUID database ensures compatibility and integration with other state water quality databases and future EPA databases.

The Sackett Decision in May of 2023 led to the severe reduction of wetlands protected by the Clean Water Act in New Mexico. This event has led to the State willing to create its own state Dredge and Fill program for waters and wetlands of the state. While the Reg NMRAM is available to the Corps for their use in determining the condition of riverine wetlands, it now will be available to the State for determining condition of wetlands before impacts or construction, and for developing meaningful and fair mitigation ratios and to determine the condition of mitigation sites proposed by permittees.

What made the project not so successful?

This project has been overall successful in achieving its goals, even after delays and restrictions due to the Covid pandemic. However, the final push to complete the deliverables was intense due to a compressed final timeline after data collection in Summer 2023.

Technical Transfer

What information can you pass along to other agencies, cooperators, or local landowners in other watersheds about this project?

Agencies, cooperators, and local stakeholders have been invited to participate on the Technical Advisory Committee and to trainings to promote the understanding and use of NMRAM. The NMRAM for Headwater Slope Wetlands Version 1.0 is available on the SWQB website for others to use NMRAM.

Development of the database compatible with SQUID will eventually have a web-access feature so that others can view the results on-line and enter their own data.

The data generated from the use of NMRAM for Headwater Slope Wetlands can fill a wetland data gap in Wetlands Action Plans developed by watershed groups and other entities and can provide a greater understanding of the resource.

EPA Feedback Loop

What would you suggest that EPA do differently to improve the process in regard to this project?

EPA was very supportive in all aspects of this project during the project period, especially allowing grant period extensions to complete high quality and meaningful work during times of uncertainty and change.

Future Activity Recommendations

- The Wetlands Program in cooperation with UNM Natural Heritage are creating training videos for all of the NMRAMS. These videos will be used in conjunction with field training and teams that complete the training will be certified to collect NMRAM data. this will allow expended use of NMRAM at times when cooperators need the data.

NMRAM for Headwater Slope Wetlands, and USACE NMRAM Phase 3 New Mexico

Final Report

December 2023

- Adoption of NMRAM by the Albuquerque District of the Corps of Engineers will increase and improve meaningful mitigation. Additional trainings and outreach regarding the utility of USACE NMRAM should be conducted for USACE staff as well as the regulated community.
- New Mexico is in the process of developing rapid assessment methods (NMRAM) for various wetland subclasses throughout the state. There is a need to continue validation of our landscape and rapid assessment methods using more detailed and intensive methods and indicators, to ensure that NMRAM is providing an accurate picture of wetland condition.
- NMRAM data is providing the basis and justification for development of wetlands water quality standards and designated uses that will enable the state to protect wetlands more comprehensively. NMRAM refines reference standard conditions for each subclass, describes the extent and quantity of the targeted wetland type within a reference domain, and identifies the stressors that are causing wetland decline. These data provide justification for preventing or eliminating stressors that will ultimately lead to increases in wetland quality.
- Timing and requiring wetlands assessment as Waters of the State, with SWQB's rotating basin schedule would ensure the most efficient use of limited resources and integration of wetlands monitoring and results with the monitoring of other State waters.
- Another adaptation will be for the SWQB Wetlands Program to use NMRAM as an iterative tool for long term monitoring of wetlands.



Figure 36. The Assessment Team viewing a Headwater Slope Wetland.