Aquatic Resources Delineation Report

Bridge M-21-C

Prepared By:
Stanley Consultants, Inc.
8000 South Chester St, Ste 500
Centennial, Colorado 80112

Prepared For:
Colorado Department of Transportation, Region 2
5615 Wills Blvd.
Pueblo, Colorado 81008

FINAL
January 2021

Stanley Consultants INC.
A Stanley Group Company
Engineering, Environmental and Construction Services - Worldwide

Executive Summary

Stanley Consultants, Inc. (Stanley) has prepared an aquatic resources delineation for the proposed replacement of a bridge structure on U.S. Highway (US) 350 about 5.5 miles southwest of Timpas, Colorado, known as the M-21-C Bridge Replacement Project (Project). The purpose of the delineation is to identify any wetlands and potential waters of the U.S. (WOTUS) present within the Project Area. The delineation was conducted in accordance with the *1987 Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Great Plains Region* (Version 2.0) (U.S. Army Corps of Engineers [USACE] 2010). For non-wetland waters, *Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (Curtis and Lichvar 2010) was used.

This Aquatics Resource Report provides the findings at the CDOT bridge M-21-C survey area (12.0 acres), where the OHWM for an ephemeral drainage (R6: 0.58 acres and 635 linear feet) was identified. The drainage is known as the Hoe Ranch Arroyo and drains to the north and into the Timpas Creek, which connects to the Arkansas River. No wetlands were identified in the surveyed area.

The delineation findings presented in this report will be used to assess potential Project impacts to surface water resources. The findings may be used to develop Project designs that minimize or avoid impacts to surface waters resources or, if impacts to these resources are unavoidable, to understand the total anticipated impacts that would need to be approved or permitted by the USACE. Depending on the level of impacts, the Project would likely require permitting under the Nationwide Permit (NWP) program or through an Individual Permit (IP). The NWP program is available for projects with relatively minor impacts (the exact nature of the impacts and acreage thresholds depend on the applicable NWP), while IPs are required for projects with larger impacts and can involve a lengthy permitting process.

Table of Contents

TABLES

APPENDICES

Appendix A – Aquatic Resources Delineation Maps

Appendix B – Supporting Maps and Documents

Appendix C – Arid West OHWM Data Sheet

Appendix D – Photo Inventory

Appendix E – Signed Property Access Letter (not included; needs to be obtained prior to permitting efforts)

Acronyms and Abbreviations

CDOT	Colorado Department of Transportation
CO	Colorado State Highway
CWA	Clean Water Act
IP	Individual Permit
MP	Mile Post
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
NWP	Nationwide Permit
NWPL	National Wetland Plant List
OHWM	ordinary high water mark
PIA	Potential Impact Area
PSS	palustrine scrub-shrub
ROW	right-of-way
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WOTUS	water of the United States

1. Introduction

On behalf of the Colorado Department of Transportation (CDOT), Stanley Consultants, Inc. (Stanley) has prepared an aquatic resources delineation for the proposed replacement of a bridge structure on U.S. Highway (US) 350 about 5.5 miles southwest of Timpas, Colorado, known as the M-21-C Bridge Replacement Project (Project). The purpose of the delineation is to identify any potential waters of the U.S. (WOTUS), including wetlands, present within the area of potential Project impacts.

The presence of wetlands and other waters were assessed within the vicinity of the proposed Project construction. The boundaries of the wetlands and other waters were then delineated to determine the extent of potential WOTUS subject to regulation under the Clean Water Act (CWA) within the area of potential Project impacts. The purpose of this delineation report is to facilitate efforts to:

- Avoid or minimize impacts to aquatic resources during the design process.
- Document aquatic resource boundary determinations for review by regulatory authorities.

Field investigations were conducted on August 26, 2020, by wetland biologists for Stanley Consultants, Inc.

Contact Information for the Applicant and Land Owner are as follows:

Applicant
Jennifer Sparks
Region 2 Resident Engineer

Colorado Department of Transportation
5615 Wills Blvd.
Pueblo, CO 81008

Office: (719) 546-5753
Fax: (719) 546-5414
jennifer.sparks@state.co.us

Land Owner
Colorado Department of Transportation

Agent:
Amber Billings, ROW Supervisor
5615 Wills Blvd.
Pueblo, CO 81008

Office: (719) 546-5413
Fax: (719) 546-5414
amber.billings@state.co.us

2. Location and Project Description

2.1 Location

The surveyed Potential Impact Area (PIA) is approximately 12.0 acres and includes the CDOT right-of-way (ROW) along with an expanded limit of disturbance to account for a possible detour or other work. The existing bridge is located approximately 5.5 miles southwest of Timpas, Colorado and 22.8 miles southwest of La Junta, Colorado (37.758789/-103.8398), in both Section 30, Township 26S, Range 57W and Section 25, Township 26S, Range 58W (6th Principal Base and Meridian). A map of the PIA is located in the Aquatic Resources Delineation Map in Appendix A.

2.2 Purpose and Need

The three-span concrete on I-beam bridge (Structure M-21-C) was built in 1937 on US 350 which is a key north-south corridor connecting residents and tourists from La Junta and the Arkansas River Valley to Trinidad and the Rocky Mountains. The structure is in poor condition, requiring frequent inspection and repair from issues such as cracking of the abutments and wing walls and deterioration of the deck ends with holes developing. This bridge is well past its replacement life and is not up to current construction and safety standards and must be replaced to prevent potential failure.

2.3 Project Description

The CDOT Region 2 Bridge Bundle Design Build Project consists of the replacement of a total of nineteen (19) structures bundled together as a single design-build project. These structures are rural bridges on essential highway corridors (US 350, US 24, Colorado State Highway [CO] 239 and CO 9) in southeastern and central Colorado. These key corridors provide rural mobility, intra- and interstate commerce, movement of agricultural products and supplies, and access to tourist destinations. The design build project has two funding sources; Bridge M-21-C will be jointly funded by the USDOT FHWA Competitive Highway Bridge Program grant and the Colorado Bridge Enterprise (Project No. 23558).

Bridge M-21-C is located on US 350 at milepost 50.58, approximately 5.5 miles southwest of Timpas, Colorado. The bridge is a concrete deck on steel I-beam girder (33.5 feet [ft] wide by 126 ft long) that crosses over an ephemeral wash (Hoe Ranch Arroyo). The Project will replace this bridge with similarly sized concrete or steel bridge.

As stated by the CDOT grant application, the roadway shall not be closed for construction. Two other alternatives were investigated:

Alternative 1: Phasing the constructions to keep one lane open. To meet all typical CDOT roadway phased construction criteria, this alternative will require overbuilding the proposed bridge on one side. The width of the proposed structure is contingent upon the girder type and width and will vary from Alternative 2.

Alternative 2: Building a two-lane shoofly on one side of the existing bridge with a temporary pipe placed for drainage. The existing ROW provides enough clearance to construct a shoofly on either side of the bridge. However, due to the relatively long existing bridge structure and consistently high existing vertical clearance under the bridge, this alternative is considered to be less cost effective than Alternative 1.

Alternative 1 was identified as a preferred traffic alternative for this structure. More information on traffic detour options can be found in the Traffic Design Memorandum for this structure. Once the bridge is complete and ready for use, any disturbed areas will be restored to original contours and reseeded.

2.4 Directions to the Site

The PIA is accessible from Pueblo, Colorado, by taking the I-25 S exit towards Trinidad, Colorado. At Trinidad, take exit 15, US 160 E (Goddard Ave.), and head east on the US 160 Highway Bypass for approximately 1 mile to US 350. At US 350, head north for approximately 55.7 miles until Structure M-21-C. Pull off onto the vegetated shoulder just before the bridge and on the right side of the road (north-bound) to access the Project.

3. Methods

3.1 Regulatory Context

Section 404 of the Clean Water Act (CWA) regulates the discharge of dredged or fill material into WOTUS and is administered by the U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (EPA). The definition of WOTUS has been in flux in recent years, with the latest definition published by the EPA in the Navigable Waters Protection Rule, which went into effect on June 22, 2020, in 49 states. Due to an injunction issued by a federal court in Colorado, the Navigable Waters Protection Rule has not gone into effect in Colorado, and instead the state remains under the post-*Rapanos v. United States* (Rapanos) guidance (USACE and EPA 2008). The potential for WOTUS within the PIA therefore will be evaluated per the definition in the Rapanos guidance. Since the WOTUS definition under Rapanos is more expansive than the Navigable Waters Protection Rule, assessing the PIA under Rapanos ensures that no additional revaluation is likely to be required in the event CWA applicability changes in Colorado during the period of Project construction.

The Rapanos guidance defines WOTUS as traditional navigable waters (TNWs), relatively permanent waters, and their adjacent wetlands.[1] Additionally, the Rapanos guidance includes all tributaries with a bed and bank or ordinary highwater mark (OHWM) that have a significant nexus to a Traditionally Navigable Water, as well as wetlands, ponds, impoundments, and lakes located adjacent to said tributaries. Under Section 404 of the CWA, the OHWM defines the lateral extent of federal jurisdiction in non-tidal WOTUS (absent adjacent wetlands) (33 U.S.C. 1251). Per the regional guidance developed by the Corps (Mersel and Lichvar 2014), OHWM in Colorado is considered to be the "physical

[1] Adjacent is defined as "bordering, contiguous, or neighboring" in the Rapanos guidance.

and biological signature established and maintained at the boundaries of the active channel." Mersel and Lichvar (2014) state the OHWM identification in non-perennial streams is based on three primary physical or biological indicators—topographic break in slope, change in sediment characteristics, and change in vegetation characteristics.

3.2 Wetland Delineations

All wetland delineations were conducted in accordance with the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and the Regional Supplement to the *Corps of Engineers Wetlands Delineation Manual: Great Plains Region (Version 2.0)* (USACE 2010). Survey areas were assessed by the biologists to determine the presence or absence of wetland features. Locations that contained some potential as a wetland based on surface conditions such as the presence of dominant hydrophytic vegetation or surface hydrology were investigated more closely with a sampling point containing a soil pit, a delineation field form, and photo documentation.

Sources of information used in this Aquatic Resources investigation could include:

- Web Soil Survey (See Appendix B, Custom Soil Resource Report)
- Aerial photography of the PIA from the National Agriculture Imagery Program (NAIP) taken in 2017, and from aerial drone photography collected by Stanley.
- National Wetland Plant List, version 3.4 (USACE 2018)
- Munsell Soil-Color Charts (Munsell Color 2009)
- National Wetland Inventory (NWI) Map (See Appendix B, NWI Mapping)

3.3 Non-Wetland Waters Delineation

Delineations of non-wetland waters were conducted using the *Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (Curtis and Lichvar 2010). The project specific PIA was examined for any potential OHWM supporting features, such as root exposure, water staining, silt deposits, litter removal, etc. (Mersel and Lichvar 2014, USACE 2005), that might provide information interpreting recent flow levels (e.g., drift/wrack deposits or headcutting) or that might eliminate or reinforce potential OHWM locations. Stanley also examined aerial photography and hydrologic data to support the Section 404 CWA assessment. The boundaries of any non-wetland water features were identified by the OHWM indicators and recorded using a Trimble sub-meter GPS antenna connected to a tablet or smart phone.

4. Existing Conditions

4.1 Topography

The PIA is located on the edge of the eastern plains of Colorado including the Purgatoire River Valley and the distant Arkansas River Valley to the north. To the west is the foothills of the Front Range of the Rocky Mountains, and to the south and east is the Purgatoire River Valley. The elevation at the site is approximately 4,570±10 ft above sea level. Land use in the area is agricultural and open space, with a few residential properties farther to the north in Timpas. The highway and bridge structure were constructed in 1937, with fill being built up for the roadway with a gap where the Hoe Ranch Arroyo flows, and the bridge was constructed across the arroyo.

4.2 Climate

The PIA (as measured from La Junta, Colorado the closest station with complete data) has an average maximum temperature of 69.4° F and average minimum temperature of 39.1° F. The average annual precipitation is 11.5 inches, with an average snowfall of 20.7 inches (CCC 2020a). Normal monthly precipitation average for August is 1.6 inches, but during this past August (when the field survey was conducted) the rainfall was measured at 0.38 inches, which is below normal (CCC 2020b).

4.3 NWI Mapping

National Wetlands Inventory (NWI) data indicated that no wetlands exist within the PIA. Only one water was classified as riverine (Appendix B, Supporting Maps and Documents, NWI Mapping).

4.4 Plant Communities

The plant communities in the PIA consisted of dry wash and disturbed roadway edges. The dry wash plants included species such as rabbit brush (*Chrysothamnus viscidiflorus*), four-wing saltbush (*Atriplex canescens*), salt cedar (*Tamarix ramosissima*), five-horn smotherweed (*Bassia hyssopifolia*), wheatgrasses (*Elymus* spp.), and a few scattered annual weeds. Roadways were not extensively sampled but contained some of the same upland grass species found in the dry wash areas, along with other species likely seeded by CDOT or blown in from other upland areas.

4.5 Hydrology

The dominant hydrological feature at this site is the Hoe Ranch Arroyo, where surrounding sheet flow and roadway run-off collect and flow to the north. As the name implies, Hoe Ranch Arroyo is an ephemeral wash, dry at the time of survey but with indications of regular, scouring flows present. Hoe Ranch Arroyo flows north for approximately 0.6 miles from the M-21-C bridge where it drains into Timpas Creek. Timpas Creek flows northeast to its confluence with the Arkansas River by the town of Swink, Colorado. From there, the

Arkansas River flows east, then southeast to the Mississippi River and south to the Gulf of Mexico.

In the PIA, no surface water was present and soils surrounding the ephemeral channel appeared very dry. Given the width of the channel and the surrounding vegetation, some seasonal and storm event flows must occur, but not enough to support any wetland conditions.

4.6 Soils

Two soils were identified in the PIA (see Appendix B, Custom Soil Resource Report), Manzanola silty clay loam, dry, saline, 0-2% slopes, and Minnequa-Manvel silt loams, 1-6% slopes, dry, and both are considered non-hydric. As no wetland conditions were observed, no soil pits were investigated.

5. Aquatic Resource Results

The OHWM data forms reflect the conditions as observed at the time of investigation and can be found in Appendix C. Associated photos of the sample points can be found in Appendix D. No soil sample points were taken though an OHWM profile was conducted (See Appendix C). The following subsections summarize the results of the delineation including a description of any waters delineated, justification for the boundaries, and classification of the waters. Feature details are summarized in Table 1 (Aquatic Resources within the PIA).

Table 1. Aquatic Resources within the PIA

Aquatic Resource Name	Aquatic Resources Classification		Size (ac)	Length (ft)
	Cowardin	Location (Lat/Long)		
Non-Wetland Waters				
Hoe Ranch Arroyo	R6	37.758789/-103.8398	0.58	635
		Totals	**0.58**	**635**

5.1 Hoe Ranch Arroyo

The Hoe Ranch Arroyo is an ephemeral drainage (0.58 acres and 635 linear ft) flowing through the PIA from south to north. The watershed for the drainage is a shallow valley southeast of US 350 and is approximately 21.7 mi^2 in size (based on USGS Streams Stats calculation [USGS 2020]). After crossing under the M-21-C bridge, the Hoe Ranch Arroyo flows north and into Timpas Creek approximately 3,300 ft downstream of the bridge. Timpas Creek flows northeast until its confluence with the Arkansas River, in Swink, Colorado, approximately 22 river miles downstream of the PIA.

The channel area is wide (40 to 50 ft) and eroded in places, with near vertical banks in locations where the channel cuts into the hillside, suggesting occasional high flows in a highly erodible soil. Although vegetation exists in places along the banks, it can be very sparse or absent within portions of the PIA. A few annual weedy plant species appear to be able to grow adjacent to or even within the OHWM, suggesting little to no flows during a large part of the growing season (see above in Section 4.4 Plant Communities). However, strong flows occur consistently enough to prevent perennial and woody plant species from growing below the OHWM.

The OHWM was observed as a fully developed bed and bank with scour, eroded benches, sedimentation, and debris wracking. The channel varies some and is a little wider under the bridge and upstream (see Figure 2: Aquatic Delineation Map, Hoe Ranch Arroyo, and Appendix D: Photo Inventory). The channel was very dry at the time of investigation, but likely has sporadic seasonal flows and/or after storm events.

6. Interstate Commerce

Federal authority to regulate waters within the United States is primarily derived from the Commerce Clause, which gives Congress the power to regulate interstate commerce. Section 404 of the Clean Water Act defines the limits of jurisdiction as encompassing navigable waters and WOTUS including, among other water bodies, “waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce” (40 CFR § 120.2(1)(i)).

This section of the Hoe Ranch Arroyo does not appear to support interstate commerce, although portions of the PIA to be used for livestock grazing and it is unknown if any cattle grazing in this area are shipped out of state for sale. In the event WOTUS within the PIA currently support interstate commerce, however, the replacement of the existing bridge with an updated structure to meet CDOT standards will not affect water flows or alter the ability of the feature to support any future interstate commerce.

7. Summary

One ephemeral drainage, the Hoe Ranch Arroyo (0.58 acres and 635 linear ft), was identified and delineated within the PIA.

7.1 Anticipated Impacts

In the event that the selected Project design will impact any potential WOTUS delineated in this report, the impacts to these resources would need to be approved or permitted by the USACE. Depending on the level of impacts, the Project would likely require permitting under the Nationwide Permit (NWP) program. The NWP program is available for projects with relatively minor impacts (the exact nature of the impacts and acreage thresholds depend on the applicable NWP). An Individual Permit (IP) would be required for projects with larger impacts to WOTUS and can involve a lengthy permitting process.

7.2 Avoidance and Mitigation Measures

Measures to avoid, minimize, or mitigate for potential impacts to WOTUS include:

- Tailoring design to avoid or minimize impacts as much as possible given structural constraints.

- Having construction methods and equipment that can avoid or minimize temporary impacts by reducing footprint of machines used or accessing work from roadway fill or other uplands.

- Developing compensatory mitigation measures, if permanent impacts are not avoidable. These measures would be a part of the permitting process with the USACE.

- Developing a detailed and thorough construction plan which includes best management practices. An example is a Stormwater Pollution Prevention Plan that incorporates measures to protect sensitive resources from stormwater run-off, pollutants, etc., due to construction activities.

8. References

Colorado Climate Center (CCC), Colorado State University. 2020a. Access Colorado Data for TRINIDAD PERRY STOKES AP Station. https://climate.colostate.edu/data_access.html. Accessed November 16.

_____. 2020b. Access Colorado Water Year Precipitation Data for TRINIDAD PERRY STOKES AP Station. https://climate.colostate.edu/wy_data.html. Accessed November 16.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. Office of Biological Services, U.S. Department of the Interior, FWS/OBS-79/31.

Curtis, K.E. and R.W. Lichvar. 2010. Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States. ERDC/CRREL TN-10-1. Hanover, NH: U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Engineer Waterways Experimental Station, Vicksburg, MS.

Mersel, Matthew K. and Robert W. Lichvar. 2014. “A Guide to Ordinary High Water Mark (OHWM) Delineation for Non-Perennial Streams in the Western Mountains, Valleys, and Coast Region of the United States.” ERDC/CRREL TR-13-14. Hanover, NH: U.S. Army Engineer Research and Development Center, Wetlands Regulatory Assistance Program.

Munsell Color. 2009. Munsell Soil-Color Charts. Grand Rapids, MI.

U.S. Army Corps of Engineers (USACE). 2005. Regulatory Guidance Letter: Ordinary High Water Mark Identification. RGL-05-05. December 7, 2005.

_____. 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0)*, ed. J.S. Wakeley, R.W. Lichvar, and C.V. Noble. ERDC/EL TR-10-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

_____. 2017 Regional Conditions to Nationwide Permits in the State of Colorado. U.S. Army Corps of Engineers, Albuquerque District, Omaha District, and Sacramento District. January 11, 2017.

_____. 2018. National Wetland Plant List, version 3.4. http://wetland_plants.usace.army.mil/. U.S. Army Corps of Engineers, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, NH.

U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (EPA). 2008. Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States. December 02, 2008.

U.S. Department of Agriculture, National Resources Conservation Service (USDA/NRCS). 2018. Web Soil Survey. Soil Survey Staff, USDA NRCS. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed November 16, 2020.

U. S. Fish and Wildlife Service (USFWS). 2020. National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. http://www.fws.gov/wetlands/. Accessed November 16, 2020.

U.S. Geological Survey (USGS). 2020. StreamStats website. http://streamstats.usgs.gov/ss/. Accessed November 16, 2020.

List of Preparers

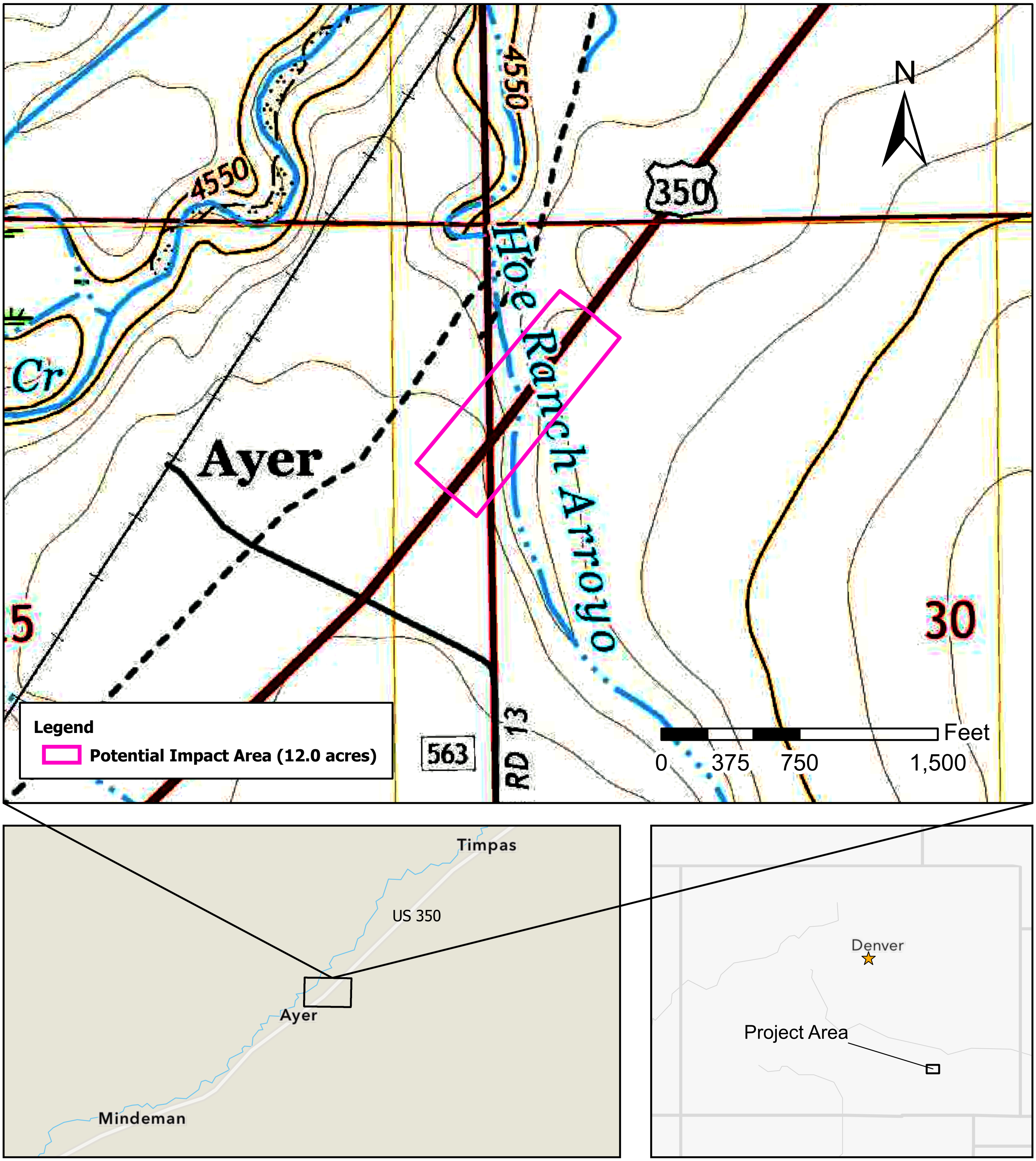
Trent Toler, Senior Scientist
Stanley Consultants, Inc.
6975 Union Park Ave., Ste 300
Cottonwood Heights, Utah 84047
Main: (801) 559-4612
TolerTrent@stanleygroup.com

Claire Phillips, Environmental Scientist
Stanley Consultants, Inc.
8000 South Chester St., Ste. 500
Centennial, Colorado 80112
Main: (303) 799-5091
PhillipsClaire@stanleygroup.com

Rick Black, Principal Ecologist
Stanley Consultants, Inc.
8000 South Chester St., Ste. 500
Centennial, Colorado 80112
Main: (303) 799-5091
Cell: (801) 559-4610
BlackRick@stanleygroup.com

Appendix A

Aquatic Resources Delineation Maps



Colorado Department of Transportation
R2 Bridges Project - M-21-C

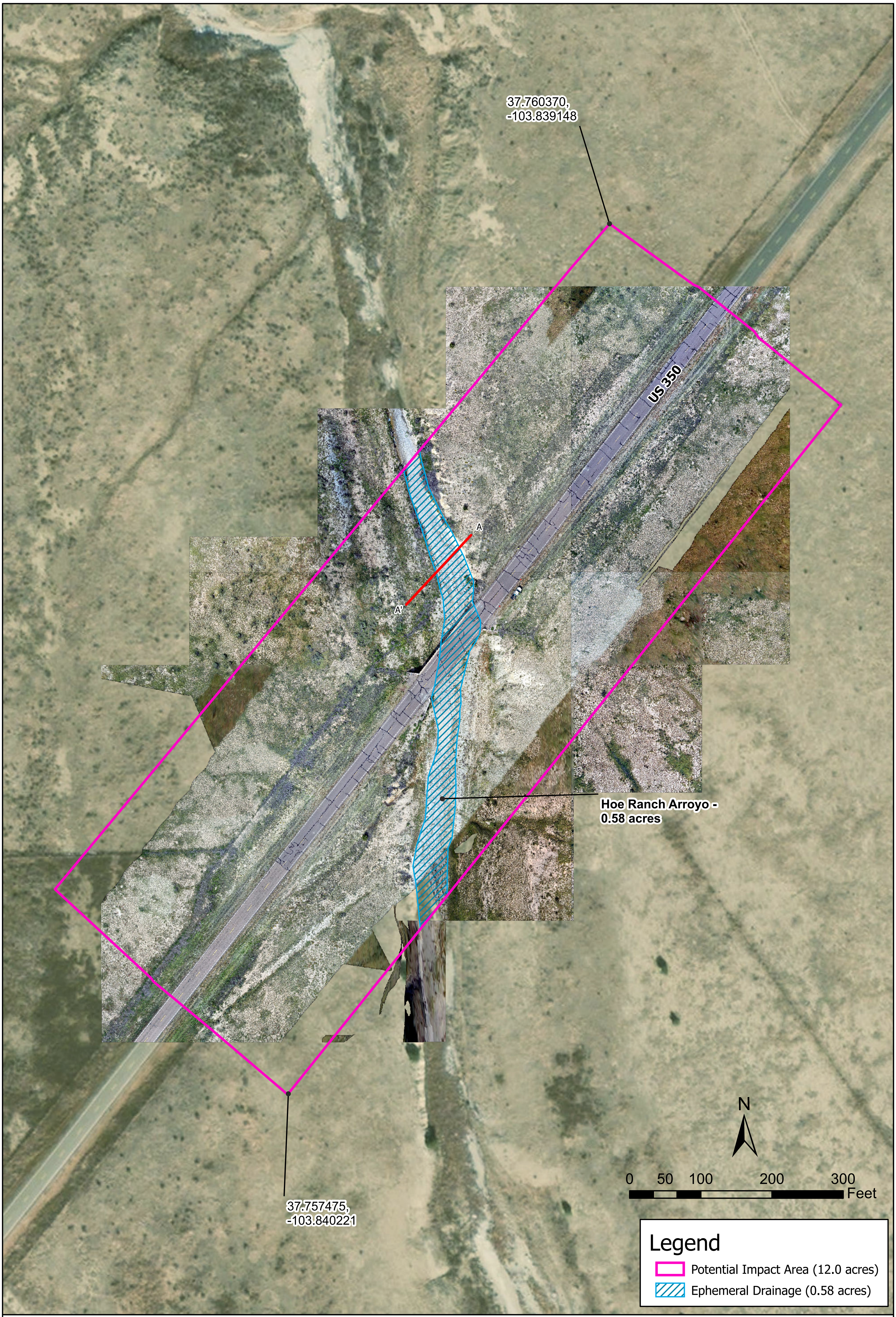
Figure 1
Vicinity Map

Image Source: ArcGIS Online, World Street Map, USGS TopoView
USGS Topo: Timpas, CO
S30, T26S, R57W & S25, T26S, R58W
Bridge Lat/Long: 37.758789/-103.8398

Stanley Consultants INC.

Date Exported: 11/10/2020 2:48 PM

Path: C:\Users\9666\Documents\A_WorkDocs\GIS_files\CDOT\19_Bridges\19-GIS\03-MXDs\M21C_ARDR_Fig1.aprx



Colorado Department of Transportation
R2 Bridges Project - M-21-C

Figure 2: Aquatic Delineation Map

Data Source: Stanley Consultants, Inc.
Image Source: ArcGIS Online, World Imagery, Stanley Drone Aerial Imagery

Coordinate System: NAD 1983
State Plane CO Central FIPS 0502 (US Feet)
Projection: State Plane
Datum: North American 1983
Created: November 13, 2020

Stanley Consultants INC.

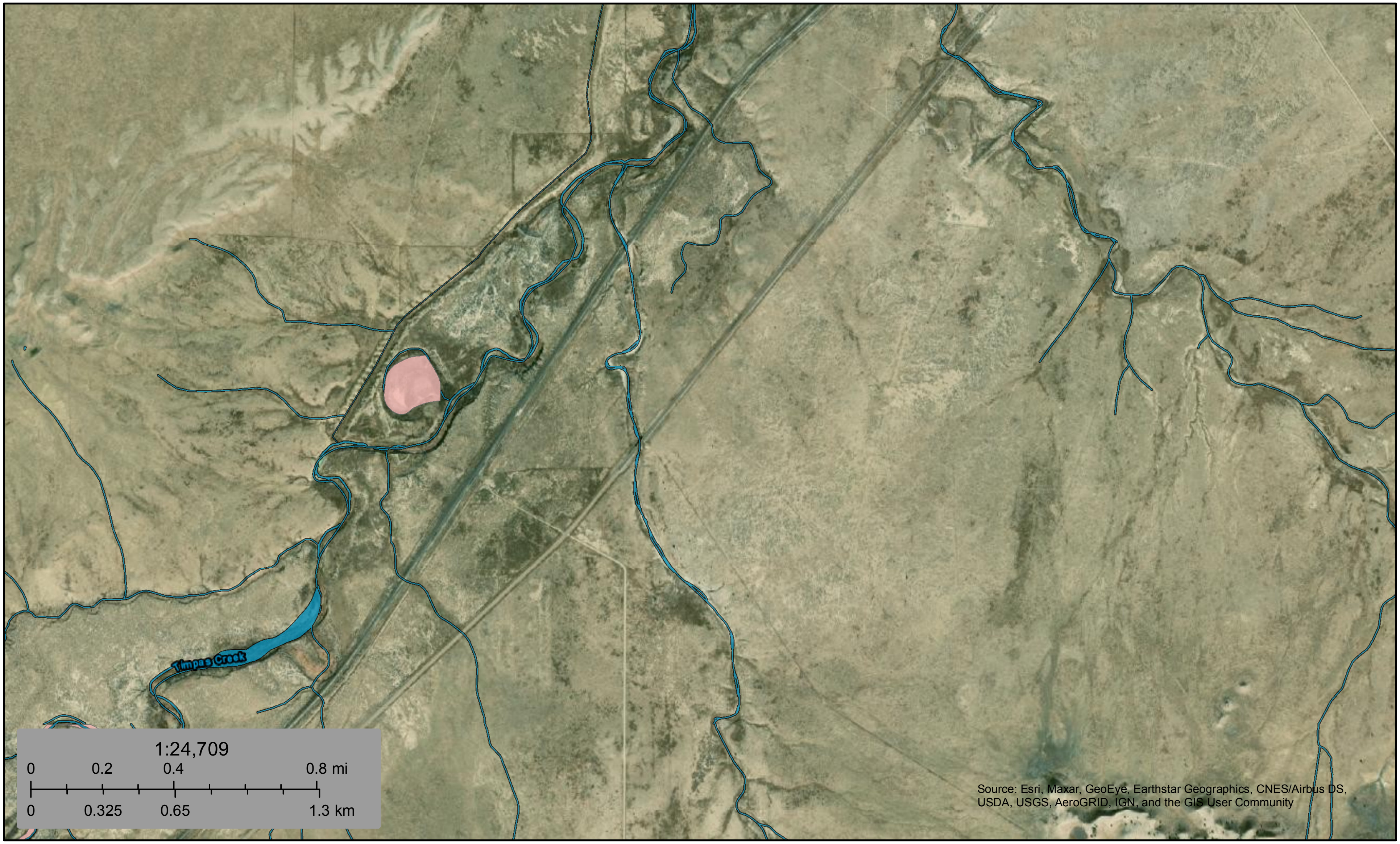
Appendix B

Supporting Maps and Documents

U.S. Fish and Wildlife Service

National Wetlands Inventory

CDOT R2 Bridges - M-21-C



November 16, 2020

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

United States Department of Agriculture

NRCS

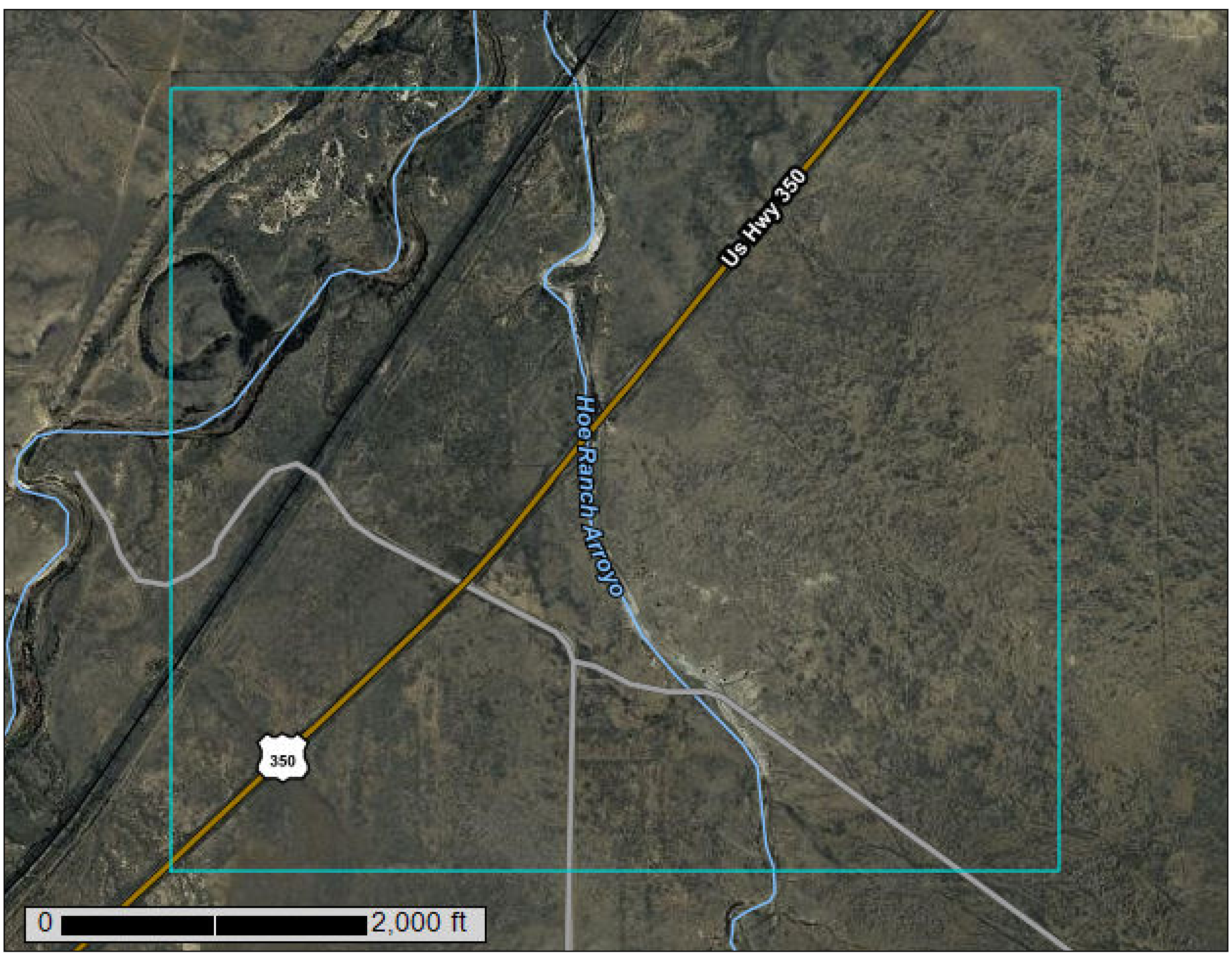
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Otero County, Colorado

CDOT R2B2 M-21-C



November 16, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

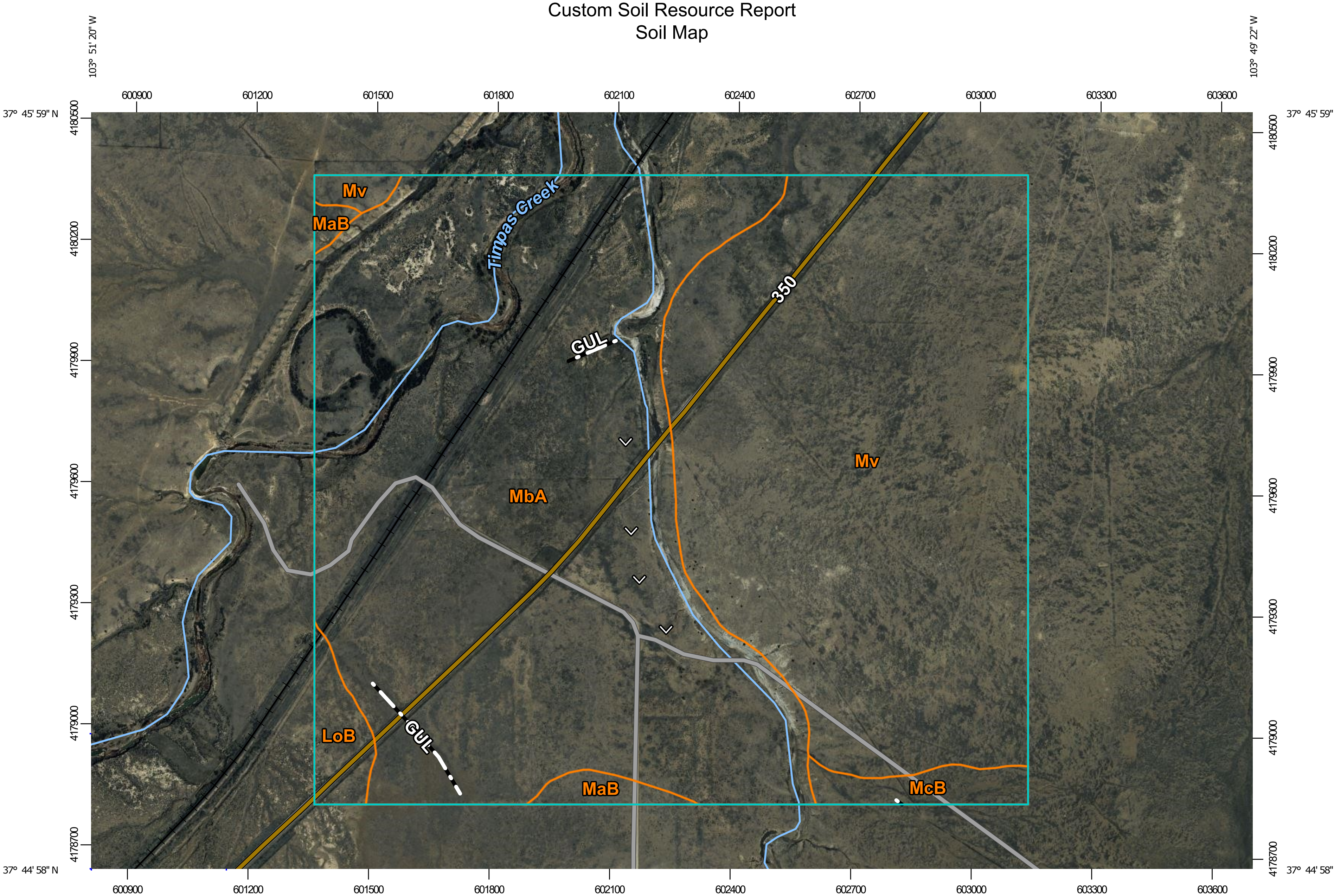
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:13,200 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 150, 300, 600, 900

Feet: 0, 500, 1000, 2000, 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Otero County, Colorado
Survey Area Data: Version 18, Jun 5, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 31, 2020—Apr 7, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
LoB	Limon silty clay, 0 to 3 percent slopes	11.2	1.6%
MaB	Manvel silt loam, dry, 0 to 2 percent slopes	7.6	1.1%
MbA	Manzanola silty clay loam, dry, saline, 0 to 2 percent slopes	367.9	53.5%
McB	Manzanola clay loam, dry, 0 to 3 percent slopes	11.3	1.6%
Mv	Minnequa-Manvel silt loams, 1 to 6 percent slopes, dry	289.1	42.1%
Totals for Area of Interest		**687.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Otero County, Colorado

LoB—Limon silty clay, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 35kz
Elevation: 3,000 to 6,000 feet
Mean annual precipitation: 11 to 14 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Limon and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Limon

Setting

Landform: Flood plains, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from shale

Typical profile

A - 0 to 12 inches: silty clay
C1 - 12 to 40 inches: silty clay
C2 - 40 to 68 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water capacity: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: R069XY033CO - Salt Flat LRU's A & B
Other vegetative classification: Salt Flat (069AY033CO_1)
Hydric soil rating: No

Minor Components

Haverson

Percent of map unit: 1 percent
Hydric soil rating: No

Manzanola

Percent of map unit: 1 percent
Hydric soil rating: No

Rocky ford

Percent of map unit: 1 percent
Hydric soil rating: No

MaB—Manvel silt loam, dry, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2rgqh
Elevation: 3,700 to 6,400 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Manvel, dry, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manvel, Dry

Setting

Landform: Interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess

Typical profile

A - 0 to 7 inches: silt loam
Bk1 - 7 to 25 inches: silt loam
Bk2 - 25 to 49 inches: silt loam
Bk3 - 49 to 79 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Very slightly saline (2.0 to 3.9 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Very high (about 12.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6c
Hydrologic Soil Group: B
Ecological site: R069XY006CO - Loamy Plains, LRU's A & B 10-14 Inches, P.Z.
Hydric soil rating: No

Minor Components

Wilid, dry

Percent of map unit: 5 percent
Landform: Interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY006CO - Loamy Plains, LRU's A & B 10-14 Inches, P.Z.
Hydric soil rating: No

Minnequa, dry

Percent of map unit: 5 percent
Landform: Pediments, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear, convex
Ecological site: R069XY006CO - Loamy Plains, LRU's A & B 10-14 Inches, P.Z.
Hydric soil rating: No

MbA—Manzanola silty clay loam, dry, saline, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2rgrd
Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Manzanola, dry, saline, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manzanola, Dry, Saline

Setting

Landform: Terraces, drainageways, fan remnants, interfluves
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Side slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from shale

Typical profile

A - 0 to 4 inches: silty clay loam
Bt1 - 4 to 11 inches: clay loam
Bt2 - 11 to 20 inches: clay loam
Bky - 20 to 33 inches: silty clay loam
By - 33 to 79 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 14 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Moderately saline (8.0 to 15.0 mmhos/cm)
Sodium adsorption ratio, maximum: 12.0
Available water capacity: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6c
Hydrologic Soil Group: C
Ecological site: R069XY037CO - Saline Overflow LRU's A & B
Hydric soil rating: No

Minor Components

Haversid

Percent of map unit: 5 percent
Landform: Drainageways, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY037CO - Saline Overflow LRU's A & B
Hydric soil rating: No

Aguilar

Percent of map unit: 5 percent
Landform: Fan remnants
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear

Across-slope shape: Linear
Ecological site: R069XY033CO - Salt Flat LRU's A & B
Other vegetative classification: Salt Flat #33 (069AY033CO_2), Sodic, Sodic/Saline (G069XW027CO)
Hydric soil rating: No

McB—Manzanola clay loam, dry, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2rgrf
Elevation: 3,800 to 4,700 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Manzanola, dry, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manzanola, Dry

Setting

Landform: Terraces, drainageways, fan remnants, interfluves
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from shale

Typical profile

A - 0 to 4 inches: clay loam
Bt - 4 to 10 inches: clay loam
Btk1 - 10 to 21 inches: clay
Btk2 - 21 to 36 inches: silty clay loam
Btk3 - 36 to 46 inches: clay loam
Bkz - 46 to 79 inches: clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Gypsum, maximum content: 2 percent

Maximum salinity: Nonsaline to slightly saline (1.0 to 6.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6c
Hydrologic Soil Group: C
Ecological site: R069XY042CO - Clayey Plains LRU's A & B
Other vegetative classification: LOAMY PLAINS (069XY006CO_1)
Hydric soil rating: No

Minor Components

Fort, dry

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY006CO - Loamy Plains, LRU's A & B 10-14 Inches, P.Z.
Other vegetative classification: Loamy Plains #6 (069XY006CO_2), Loamy (G069XW017CO)
Hydric soil rating: No

Wilid, dry

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY006CO - Loamy Plains, LRU's A & B 10-14 Inches, P.Z.
Other vegetative classification: Loamy Plains #6 (069XY006CO_2), Loamy (G069XW017CO)
Hydric soil rating: No

Manvel, dry

Percent of map unit: 5 percent
Landform: Interfluves, fan remnants
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R069XY006CO - Loamy Plains, LRU's A & B 10-14 Inches, P.Z.
Hydric soil rating: No

Mv—Minnequa-Manvel silt loams, 1 to 6 percent slopes, dry

Map Unit Setting

National map unit symbol: 2rgqm
Elevation: 4,000 to 6,000 feet

Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Minnequa, dry, and similar soils: 55 percent
Manvel, dry, and similar soils: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Minnequa, Dry

Setting

Landform: Pediments, ridges
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear, convex
Parent material: Slope alluvium and/or residuum weathered from limestone and shale

Typical profile

A - 0 to 6 inches: silt loam
Bw - 6 to 17 inches: silt loam
Bk - 17 to 35 inches: silty clay loam
Cr - 35 to 60 inches: bedrock

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: 20 to 39 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Nonsaline to slightly saline (0.1 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 8.0
Available water capacity: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R069XY006CO - Loamy Plains, LRU's A & B 10-14 Inches, P.Z.
Forage suitability group: Loamy (G069XW017CO)
Other vegetative classification: Loamy (G069XW017CO)
Hydric soil rating: No

Description of Manvel, Dry

Setting

Landform: Fans, interfluves
Landform position (two-dimensional): Toeslope, footslope

Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Alluvium derived from limestone and shale

Typical profile

A - 0 to 7 inches: silt loam
Bk1 - 7 to 25 inches: silt loam
Bk2 - 25 to 49 inches: silt loam
Bk3 - 49 to 79 inches: silt loam

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Nonsaline to moderately saline (1.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R069XY006CO - Loamy Plains, LRU's A & B 10-14 Inches, P.Z.
Forage suitability group: Loamy, Limy (G069XW022CO)
Other vegetative classification: Loamy Plains #6 (069XY006CO_2), Loamy, Limy (G069XW022CO)
Hydric soil rating: No

Minor Components

Manvel, deep, dry

Percent of map unit: 10 percent
Landform: Fans, interfluves
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Ecological site: R069XY006CO - Loamy Plains, LRU's A & B 10-14 Inches, P.Z.
Other vegetative classification: Loamy Plains #6 (069XY006CO_2), Loamy, Limy (G069XW022CO)
Hydric soil rating: No

Penrose

Percent of map unit: 5 percent
Landform: Hogbacks, hills, scarps
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Ecological site: R069XY058CO - Limestone Breaks LRU's A & B
Other vegetative classification: Limestone Breaks #58 (069XY058CO_2), Not Suited (G069XW000CO)
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix C

OHWM Data Sheet

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: **Project Number:** **Stream:** **Investigator(s):**	**Date:** **Town:** **Photo begin file#:**	**Time:** **State:** **Photo end file#:**

Y ☐ / N ☐ Do normal circumstances exist on the site?	**Location Details:**
Y ☐ / N ☐ Is the site significantly disturbed?	**Projection:** **Datum:** **Coordinates:**

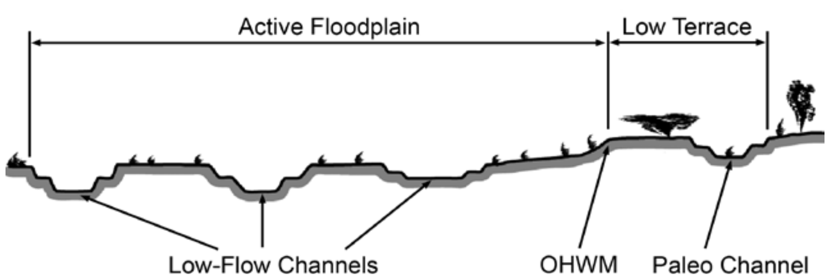
Potential anthropogenic influences on the channel system:

Brief site description:

Checklist of resources (if available):

- ☐ Aerial photography
  Dates:
- ☐ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☐ Mapping on aerial photograph
   - ☐ GPS
   - ☐ Digitized on computer
   - ☐ Other:

Project ID: **Cross section ID:** **Date:** **Time:**

Cross section drawing:

OHWM

GPS point: ____________________________

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:

Average sediment texture: __________________

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

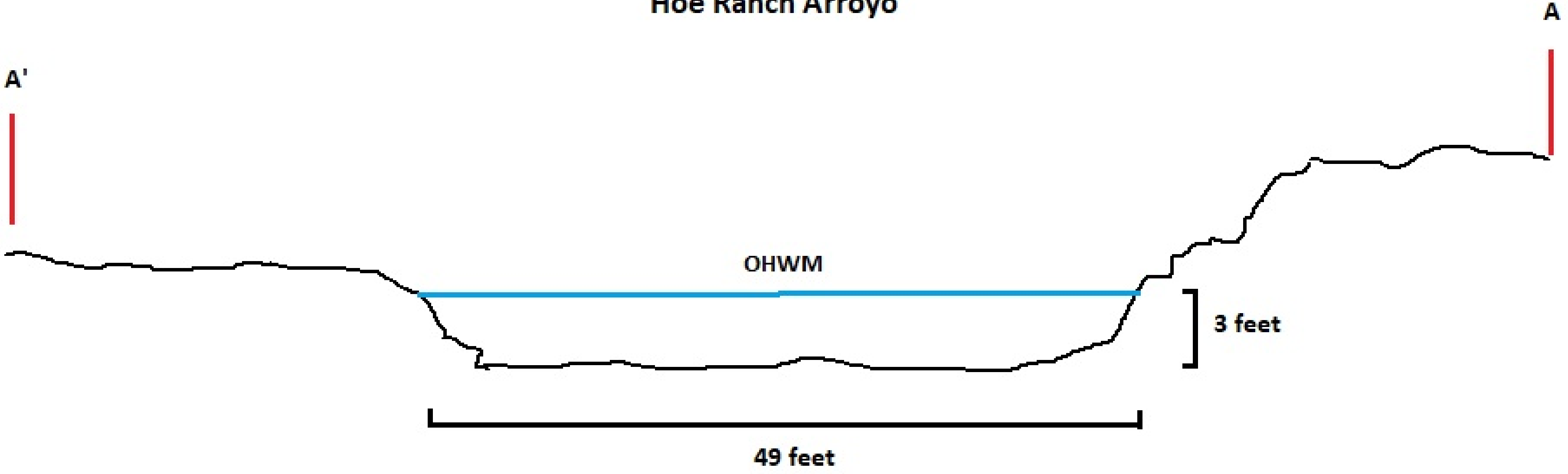
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Hoe Ranch Arroyo



Appendix D

Photo Inventory

Photo 1.
Hoe Ranch Arroyo, looking north and downstream from bridge, at cross section A. OHWM can be seen starting below bankside woody vegetation.

Photo 2.
Hoe Ranch Arroyo, looking south and upstream towards bridge, from cross section A. OHWM is from the bridge abutment (on left) to just outside of the photo on the right.

Photo 3.
Hoe Ranch Arroyo, looking north and under bridge structure. OHWM widens out some due to bridge structure, OHWM touches bridge abutment on the left then bend to contact the abutment on the other side (photo right, in background).

Photo 4.
Hoe Ranch Arroyo, looking south and upstream of bridge. Wide, eroded channel with soil cracking and sediment sorting can be seen.

Photo 5.
Luning Arroyo, looking south and upstream of bridge. Banks widening out some here, then cuts into hillside in background.

Appendix E

Signed Property Access Letter

(not included; needs to be obtained prior to permitting efforts)