Pueblo of Sandia Projects 16-01, 16-02a, 16-02b, 16-03, 16-04, 16-05

Post-treatment Monitoring Report

2021

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Contents

Acronyms and Abbreviations

Acronym, Abbreviation, or Term	Explanation or Definition as used by NMFWRI
AGL	above ground level; GIS term
BBIRD plots	Breeding Biology Research and Monitoring Database, larger circular plot types
BEMP plots	Bosque Ecosystem Monitoring Program, small rectangular plot types
FEAT	Fire Ecology Assessment Tool
FFI	FEAT/ FIREMON Integrated
FIREMON	Fire Effects Monitoring and Inventory System
FSA	Farm Service Agency, a department of the USDA
GIS	Geographic Information Systems

GRGWA	Greater Rio Grande Watershed Alliance
LiDAR	Light detecting and ranging, a remote sensing technique using light to gather elevation data
NAIP	National Agriculture Imagery Program (aerial imagery)
NHNM	Natural Heritage New Mexico
NMDGF	New Mexico Department of Game and Fish
NMED SWQB	New Mexico Environment Department Surface Water Quality Bureau
NMFWRI	New Mexico Forest and Watershed Restoration Institute
NMHU	New Mexico Highlands University
NMRAM	New Mexico Rapid Assessment Method, version 2.1
NRCS	Natural Resource Conservation Service
PC	Plot center
PoS	Pueblo of Sandia
RGIS	Resource Geographic Information System
SWCD	Soil and Water Conservation District
TIFF	Tagged image file format
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WQCC	Water Quality Control Commission
WSS	Web Soil Survey, a soils database of the NRCS

Purpose of Report

This report covers the low-intensity pre-treatment vegetation monitoring assessments performed on five non-native phreatophyte removal projects submitted by the Pueblo of Sandia Environment Department Bosque Program and the Coronado SWCD to the Greater Rio Grande Watershed Alliance in 2016. Following a discussion of the ecological context, and our monitoring methods, we present pertinent background, observations, and assessment results for each project.

Ecological Context of Bosque Restoration

Neither the challenges nor the importance of working in the bosque and other riparian areas in New Mexico today should be underestimated. According to the New Mexico Department of Game and Fish Conservation Division, wetlands and riparian areas comprise approximately 0.6 percent of all land in New Mexico (2012). Despite this small percentage, estimates of New Mexican vertebrate species depending on wetland and riparian habitat for their survival ranges from 55% (New Mexico Department of Game and Fish Conservation Services Division, 2012) to 80% (Audubon New Mexico, 2013). These areas also provide flood mitigation, filtration of sediment and pollutants, and water for a variety of purposes including groundwater recharge (Audubon New Mexico, 2013). In addition, native vegetation such as cottonwoods have cultural significance to many communities.

As much as these areas are disproportionately important to ecosystems and human communities, they are equally disproportionately impacted by disturbance. Anthropogenic impacts with major consequences for our riparian areas include dams, reservoirs, levees, channelization, acequias and ditches, jetty jacks, riprap and Gabion baskets, urbanization, removal of native phreatophytes, grazing by domestic livestock, excessive grazing pressure by native ungulate populations absent natural predation cycles, beaver removal, logging, mining, recreation, transportation, introduction and spread of invasive exotic species, groundwater extraction, altered fire and flood regimes drought and climate change (Committee on Riparian Zone Functioning and Strategies for Management, et al., 2002). Statewide, it is estimated that as much as 90% of New Mexico's historical riparian areas have been lost (Audubon New Mexico, 2013), and approximately 39% of our remaining perennial stream miles are impaired (New Mexico Department of Game and Fish Conservation Services Division, 2012).

New Mexico *is* fortunate enough to have the Middle Rio Grande Bosque, the largest remaining bosque in the Southwest (USDA USFS, 1996). However, over the past two decades, the number of fires in the bosque has been increasing. Historically, the primary disturbance regime in the bosque has been flooding, not fire, which means the system is not fire-adapted. In fact, native species like cottonwood resprout from their roots after floods and need wet soils to germinate from seed. Flooding also promotes decomposition of organic material and keeps the soil moist which reduces the likelihood of fire. Today, overbank flow is uncommon in many areas of the Rio Grande due to the heavy alteration of the channel and flow regimes (two obvious examples are the structures defining the upper and lower extent of the Middle Rio Grande: Cochiti Dam and Elephant Butte Reservoir). This has led to low fuel moisture content and high fuel loads, as well as increased human presence in the riparian area. As a result, bosque fires are more common and more severe: they kill cottonwoods and other native species, creating spaces which are filled by non-native species such as salt cedar, Russian olive, Siberian elm, and Tree-of-Heaven. We are constantly learning more about how these species can exploit and encourage a riparian fire regime, in addition to many other changes they bring to ecosystems.

Efforts geared toward the removal of these nonnative species can help to reduce fire risk, preserve native vegetation, and be part of a larger effort to restore the bosque and the watershed as a whole to a more natural and functional ecosystem. The Greater Rio Grande Watershed Alliance (GRGWA) has been working on these issues with a variety of collaborating organizations and agencies within the Rio Grande basin for several years. Since 2013, the New Mexico Forest and Watershed Restoration Institute (NMFWRI) has been working with GRGWA and the Claunch-Pinto Soil and Water Conservation District (SWCD) to begin construction of a geodatabase for all of GRGWA's non-native phreatophyte removal projects as well as to perform the formal pre- and post-treatment monitoring, utilizing the field methods explained below as well as LiDAR analysis where appropriate and available.

Monitoring and Field Methods

Low-intensity Field Methods

Low intensity pre-treatment vegetation monitoring was done using an adapted version of the biotic portion of the New Mexico Rapid Assessment Method (NMRAM), v 2.1, updating recommendations made in the Field Manual for Greater Rio Grande Watershed Alliance (GRGWA) Riparian Restoration Effectiveness Monitoring and the GRGWA Monitoring Plan, developed by Lightfoot & Stropki of SWCA Environmental Consultants in 2012. (For a brief overview of both low and high intensity monitoring methods used by the NMFWRI on GRGWA projects, please see Appendix III.)

For those not familiar, NMRAM was developed by the New Mexico Environment Department Surface Water Quality Bureau Wetlands Program and Natural Heritage New Mexico as a "cost effective, yet consistent and meaningful tool" (Muldavin, 2011) for wetland ecological condition assessment in terms of anthropogenic disturbance as negatively correlated with quality and functionality. The portions of NMRAM we utilized are Level 2 "semi-quantitative" field measurements taken at less detail than plot level (Muldavin, 2011).

Measurements taken included relative native plant community composition, vegetation horizontal patch structure, vegetation vertical structure, native riparian tree regeneration, and invasive exotic plant species cover. The underlying method for these biotic assessments was a version of the 1984 Hink and Ohmart vertical structure classification system, modified for use in the NMRAM for Montane Riverine Wetlands version 2.1 (see Appendix IV). First, vegetation communities were mapped out by patch (polygon) according to the Hink and Ohmart system. Next, the presence of (state-listed) invasives, wetland species, and the two dominant species in each strata ("tree" >15 ft, "shrub" 4.5-15 ft, and "herbaceous" <4.5 ft) were recorded for each plant community. The native/exotic ratio in each of the patches was scored and weighted based on the percent of the project area each patch comprised. These scores were then combined with the additional biotic metrics of vertical and horizontal diversity, native tree regeneration, and overall (listed) invasive presence. The NMRAM rating system is based, on all levels, on a scale of 1 to 4, where 4 is considered excellent condition, 3 good, 2 fair, and 1 poor.

We also assessed soil surface condition, which is a metric typically included in the abiotic section of the NMRAM, as well as the presence of surface fuels, which is not part of the NMRAM. Unlike the other 6 metrics we used, surface fuels were recorded on a rating scale from 0 to 1.0 where 1.0 is a continuous fuel matrix.

Photopoints were established to capture images where vegetation shifts were observed. Waypoints were marked with a Garmin GPS unit and named sequentially by site. Photos were taken in the direction that most effectively captured the diverse vegetation community(ies). Where appropriate, one waypoint was used for photos taken in multiple directions.

Prior to entering the field, we created a map with the project boundaries as provided by GRGWA. We combined these polygons with recent aerial imagery and identified relevant roads and other landscape features. Once on the ground, the vegetation community polygons (as determined by the modified Hink and Ohmart classification system) were hand-drawn onto this map and served as the basis for other biotic metric assessments. Upon return to the office, this polygon map and the photopoints were digitized by the monitoring technician and/or specialist.

Personnel Involved

2021 New Mexico Forest and Watershed Restoration Institute Monitoring Team:

- Kathryn R Mahan, Monitoring Department Manager
- Carmen Briones, Crew Logistics Support/ Assistant Manager
- Raymundo Melendez, Ecological Monitoring Technician
- Alex Makowicki, Ecological Monitoring Technician

2021 New Mexico Forest and Watershed Restoration Institute GIS Team:

- Patti Dappen, GIS Program Manager
- Katie Withnall, GIS Specialist

Other persons contacted:

- Michael Scialdone, Bosque Project Manager, Pueblo of Sandia Environment Department Bosque Program
- Fred Rossbach, Field Coordinator, Greater Rio Grande Watershed Alliance

Pueblo of Sandia Projects

The Pueblo of Sandia is a 39 square mile reservation located north of Albuquerque and south of Bernalillo, New Mexico, at the base of the Sandia Mountains. The Rio Grande is the historical western boundary of the Pueblo, and today the Pueblo is the steward of one of the largest remaining intact stretches of Rio Grande bosque in the area. The bosque has a long history of ecological and cultural importance for the Pueblo, but in recent years it has been subject to the same stressors discussed above, especially drought, the impact of the 2011 Las Conchas fire, and fires on Pueblo lands (e.g. the 2012 Romero Fire). Human modifications to the river are easily observed on aerial maps – side channels including the Albuquerque Main Canal, the Corrales Main Canal, the Albuquerque Riverside Drain, the Alameda Drain, the Bernalillo Interior Drain, the Atrisco Feeder Canal, and the Sandia Acequia, among others intersect and diverge from the river throughout the western side of the Pueblo (MRGCD, n.d.).

Particularly in the last decade or two, a number of bosque restoration efforts have been led by the Pueblo’s Environment Department in collaboration with agencies and organizations including the Bureau of Reclamation, the Middle Rio Grande Conservancy District, the US Army Corps of Engineers and the Greater Rio Grande Watershed Alliance.

2016 is the fourth year the Pueblo of Sandia has collaborated on nonnative phreatophyte removal projects with the GRGWA. In 2013, project numbers 13-02, 13-03 and 13-04 worked on restoration after the Romero Fire; in 2014, project 14-01 worked at Sandia Lakes; projects 14-03 and 14-04 worked in the Bosquecito, projects 14-05 and 14-06 worked in the Sandia Wash area, and project 14-07 worked in the Riverside Drain. In 2015, projects 15-01 through 15-05 were distributed the length of the Pueblo; this is similar to this year, where projects 16-01 through 16-05 are planned throughout the bosque.

The elevation at the Village of Sandia Pueblo is just over 5,000 feet. The area receives an average of 10 inches of rainfall per year, with temperatures ranging from an average high of 91 degrees Fahrenheit in July to an average low of 20 degrees Fahrenheit in January (City Stats, 2016). According to the NRCS Web Soil Survey there are several soil map units in the area of the Pueblo of Sandia, but most soils are sand and clay loams; the dominant ecological sites are R042XA057NM Bottomland and R042XA055NM Salty Bottomland (USDA NRCS, 2013).

The Bottomland ecological site is dominated by either giant sacaton or alkali sacaton. Vinemesquite grass and sideoats grama may also be present. Reduced cover and hummocking of these grasses characterize initial stages of degradation, typically due to overgrazing and/or changes in hydrology. Transitions to first tobosa- and then to burrograss-dominated states may occur in response to the redistribution of run-in water from overgrazing and subsequent erosion and gullying. Shrub invasion is not usually observed (USDA NRCS n.d.)

Salty Bottomland can support a range of plant communities which typically include cottonwood, salt cedar, mixed exotics (dominated by Russian olive/ Russian knapweed/ etc.), saltgrass and saltgrass-sacaton, and bottomland grassland (possibly dominated by saltgrass, giant sacaton, dropseed, muhly, burrograss, alkali sacaton, galleta, vinemesquite, and/or tobosa). Typically, the vegetation consists of a shrub/grass mixture characterized by fourwing saltbush and greasewood. Tall, mid-grass, and short grasses are present. Blue grama, foxtail, sand dropseed, spike dropseed, giant dropseed, New Mexico feathergrass and tansymustard are common. When the plant community deteriorates, there is an increase in amounts of shrubs and short grasses (USDA NRCS n.d.)

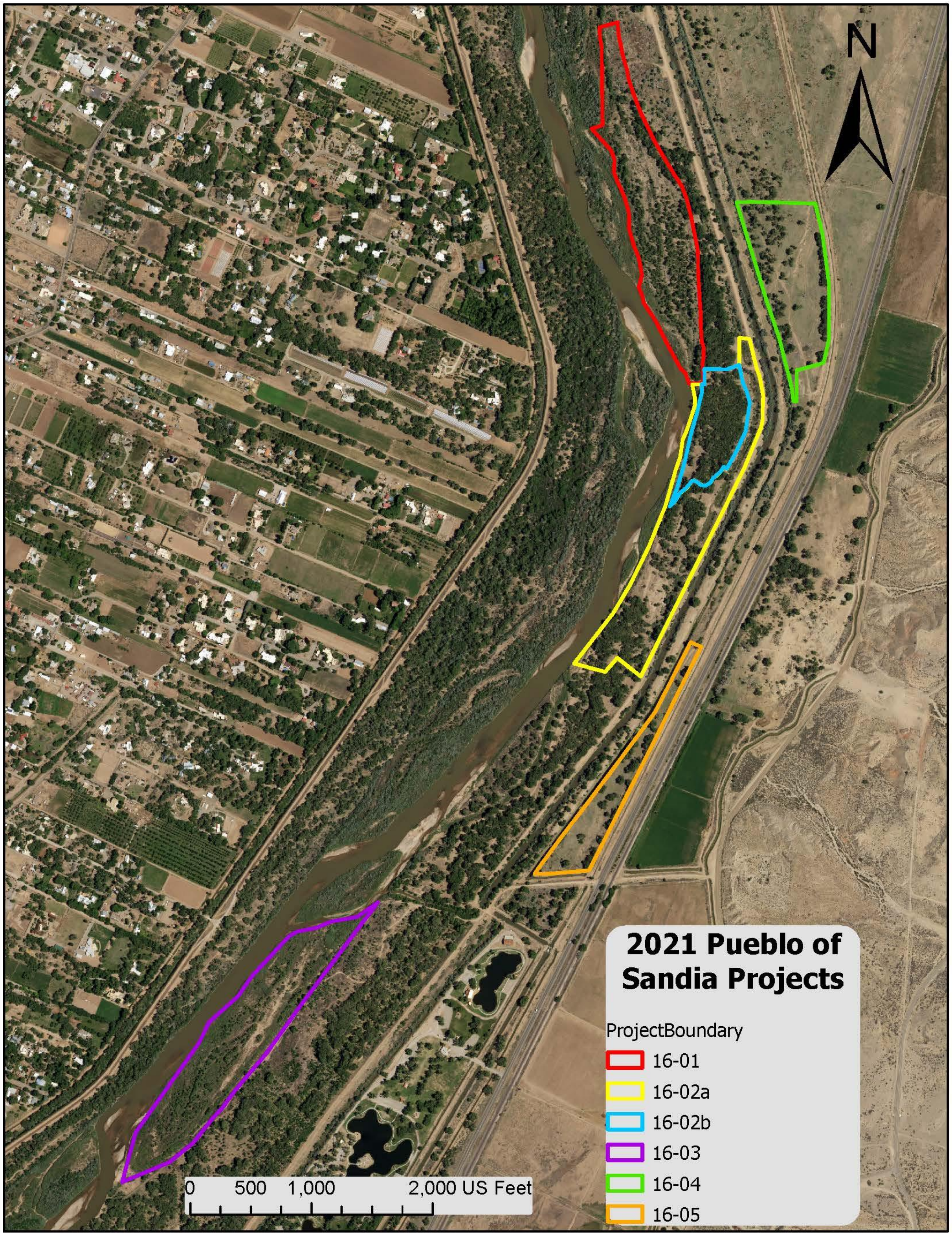

Figure 1. 2016 Pueblo of Sandia projects.

Project 16.01 – Point Bar North

Low-intensity pre-treatment monitoring was conducted at this 24.9-acre site on October 14, 2016 as part of a restoration project targeting non-native phreatophytes scheduled for 2016-2017. The project is located on the Pueblo of Sandia in Sandoval County, three miles south of Bernalillo. The project is bounded by the Rio Grande on the west and a fenceline on the east. The 2012 Romero Fire impacted the northern portion of the project. The Coronado Soil and Water Conservation District (CSWCD) and the Pueblo of Sandia Environment Department Bosque Program sponsored the project. Planned treatment includes removal of Russian olive, Siberian elm, and salt cedar. Tree-of-heaven is present on-site but may or may not be treated. A portion of the project, from the old riverbank to the fence, is a retreatment. Restoration goals include returning the bosque to a more natural state, promoting native plant species and minimizing impacts to native species and soils during treatment.

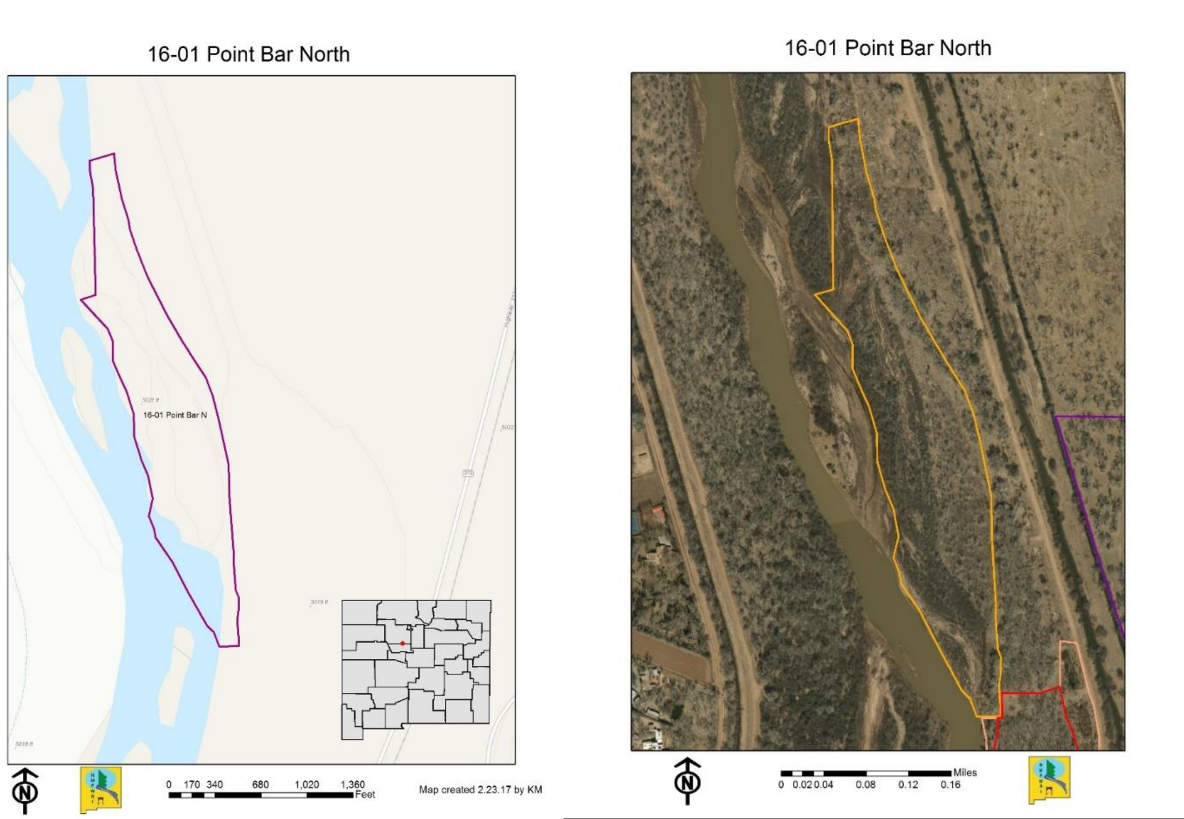

Figure 2. 16.01 in geographic context.

According to the NRCS Web Soil Survey, the project area is comprised of about 4% Peralta loam, 1 to 3 % slopes, unprotected, and 96% water. This information is included only for reference, as the soil survey is not accurate at this scale, and the fact that the river moves should be considered. Ecological sites within this project include water and R042XA057NM Bottomland (USDA NRCS, 2016).

This site was observed to have beaver sign and cottonwood seedlings. Native vegetation including Rio Grande cottonwood, black willow, seepwillow, and coyote willow was noted in abundance; some cottonwoods appeared to have been burned in the Romero Fire and a patch of high mortality among willows, cottonwoods and salt cedar was observed near the Bureau of Reclamation fenceline. The reason for this mortality was unclear at the time of the site visit. An old channel was present on site with wetland characteristics; the western edges of the project had the most hydrophilic vegetation. Sunflowers were abundant in the burned areas. In general, overstory was somewhat sparse, resulting in patchy shade. Other native species observed included New Mexico olive, dropseed grass, rough cocklebur and silverleaf nightshade. Exotic species observed on the site included Russian thistle (tumbleweed), Russian olive, salt cedar, tree-of-heaven, and sacred datura.

Metrics for 16.01 (October 19-26, 2021)	**2021 Score**	**2016 Score**
Relative Native Plant Community Composition	2	2
Vegetation Horizontal Patch Structure	2	3
Vegetation Vertical Structure	2	2
Native Riparian Tree Regeneration	1	4
Exotic Invasive Plant Species Cover	1	1
Project Biotic Score (based on above ratings)	1.7	2.2
Project Biotic Rating	D/Poor	C/Fair
Soil Surface Condition	3	2
Surface Fuels	.5	0.60

In 2021 the only metric which dropped in rating was Native Riparian Tree Regeneration. No young riparian trees were observed in 2021. In 2016 more than 5% of the sample area had riparian tree saplings on site, in 2021 high cottonwood mortality was noted in the sample area. Invasive species cover dropped from 70% to 25%, due to the vegetation treatment, though patches of dense invasive species were noted where cottonwood mortality had created light gaps. From 2015 to 2021 there was a loss of high structure forests, and this can be attributed to cottonwood mortality which was represented by down woody debris scattered across the site. Tall shrub vegetation was the dominant vegetation type for both years the site was monitored. Overall, the site score went down from 2015, from a “C” or “Fair” to a “D” “Poor”.

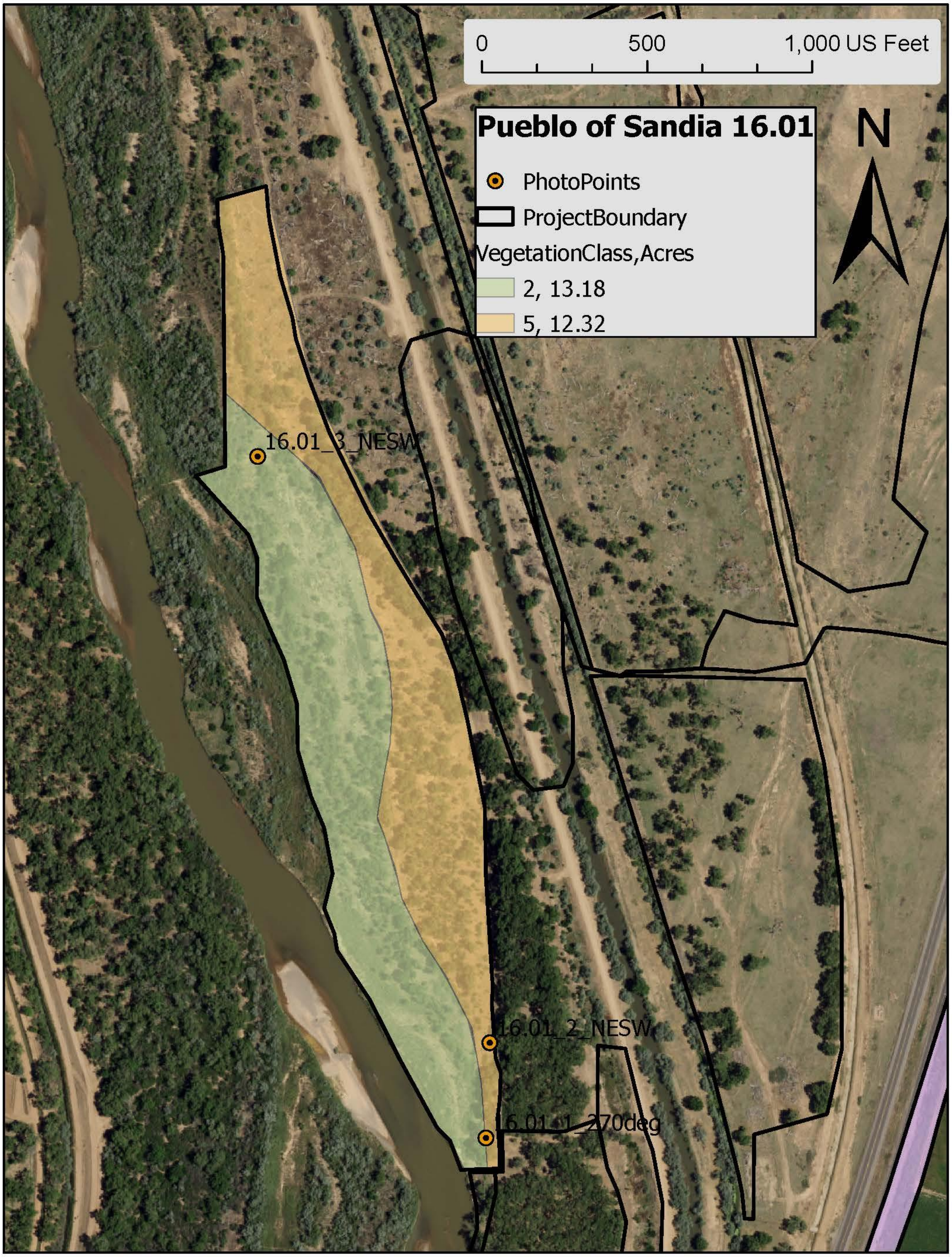

Figure 3. 16.01 Vegetation polygons and photopoints.

Project 16.02a, Riverside Retreat

Low-intensity pre-treatment monitoring was conducted at this 21.8-acre site on October 14, 2016 as part of a restoration project targeting non-native phreatophytes scheduled for 2016-2017. The project is located on the Pueblo of Sandia in Sandoval County. The project boundaries include the Rio Grande on the west and by a spoil bank levee and levee road on the east. Several artificial ponds, originally borrow pits for levee material, are present in the eastern portion of the project. The north end of the project surrounds 16-02b Hand spray area. The Coronado Soil and Water Conservation District (CSWCD) and the Pueblo of Sandia Environment Department Bosque Program sponsored the project. Planned treatment includes removal of Russian olive, Siberian elm, and salt cedar. This project is a retreatment and aims to compliment 2006 Bureau of Reclamation mastication and hand-spray restoration efforts in the area. Restoration goals include returning the bosque to a more natural state, promoting native plant species and minimizing impacts to native species and soils during treatment. Following treatment, the Pueblo will seed with upland grass and sandy soil seed mixes.

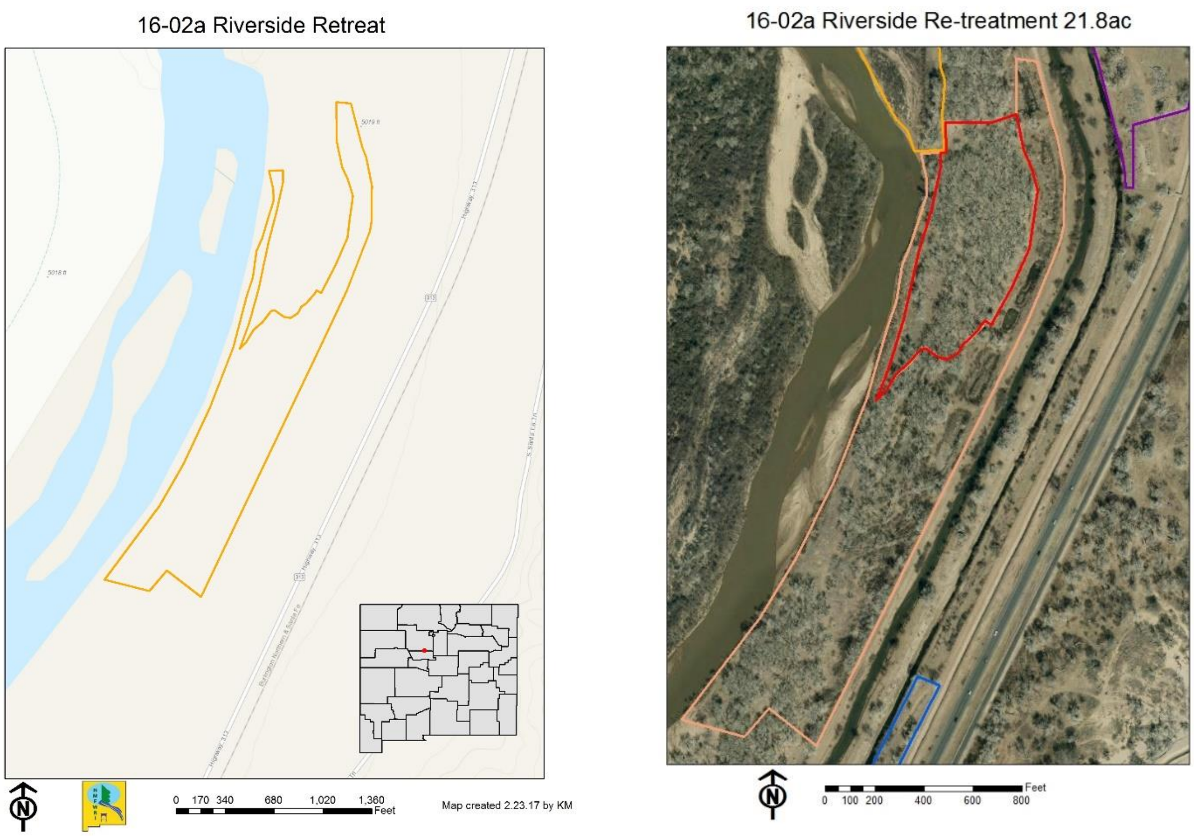

Figure 4. 16-02a in geographic context.

According to the NRCS Web Soil Survey, the project area is comprised of 2.5% water, 8.9% Trail loamy sand, 1 to 3 percent slopes, unprotected, 12% Trail loam, 1 to 3 percent slopes, unprotected, 16% Peralta loam, moderately saline, sodic, 1 to 3 percent slopes, and 60% Peralta loam, 1 to 3 percent slopes, unprotected. Ecological sites within this project include water, R042XA055NM Salty Bottomland, and R042XA057NM Bottomland (USDA NRCS, 2016).

Field crew observations on this site included the presence of salt cedar and Russian olive trees, mostly under 8 feet tall. Native vegetation including Rio Grande cottonwood, dropseed grass, scratchgrass, and buffalo bur. Cattail was observed at some of the ponds. Exotic species observed included salt cedar, Russian olive, Siberian elm, and Russian thistle.

Metrics for 16.02a (November 2-3, 2021)	**2021 Score**	**2016 Score**
Relative Native Plant Community Composition	2	1
Vegetation Horizontal Patch Structure	3	3
Vegetation Vertical Structure	2	3
Native Riparian Tree Regeneration	1	2
Exotic Invasive Plant Species Cover	1	1
Project Biotic Score (based on above ratings)	1.9	1.9
Project Biotic Rating	C/Fair	C/Fair
Soil Surface Condition	3	2
Surface Fuels	0.35	0.60

The site score remained the same as observed in 2016, though there were small changes in significant areas of the monitoring. These significant areas of change were Native Riparian Tree Regeneration and Relative Native Plant Community Composition. In 2016 a small amount of native tree saplings was found in the sample area; this observation was not made in 2021. This means the area lacks the next generation of native trees required to maintain a healthy ecosystem and ensure the survival of the species in the area. Native species, such as New Mexico Olive and Seep Willow were observed in areas that previously contained Tamarisk and Russian Olive. This could be correlated with the dominance of low structure forest vegetation type within the sample area that was once dominated by high-structure forest. Overall. the site has improved in quality due to the reduction in invasive species cover (70% from 2016 to 40% in 2021).

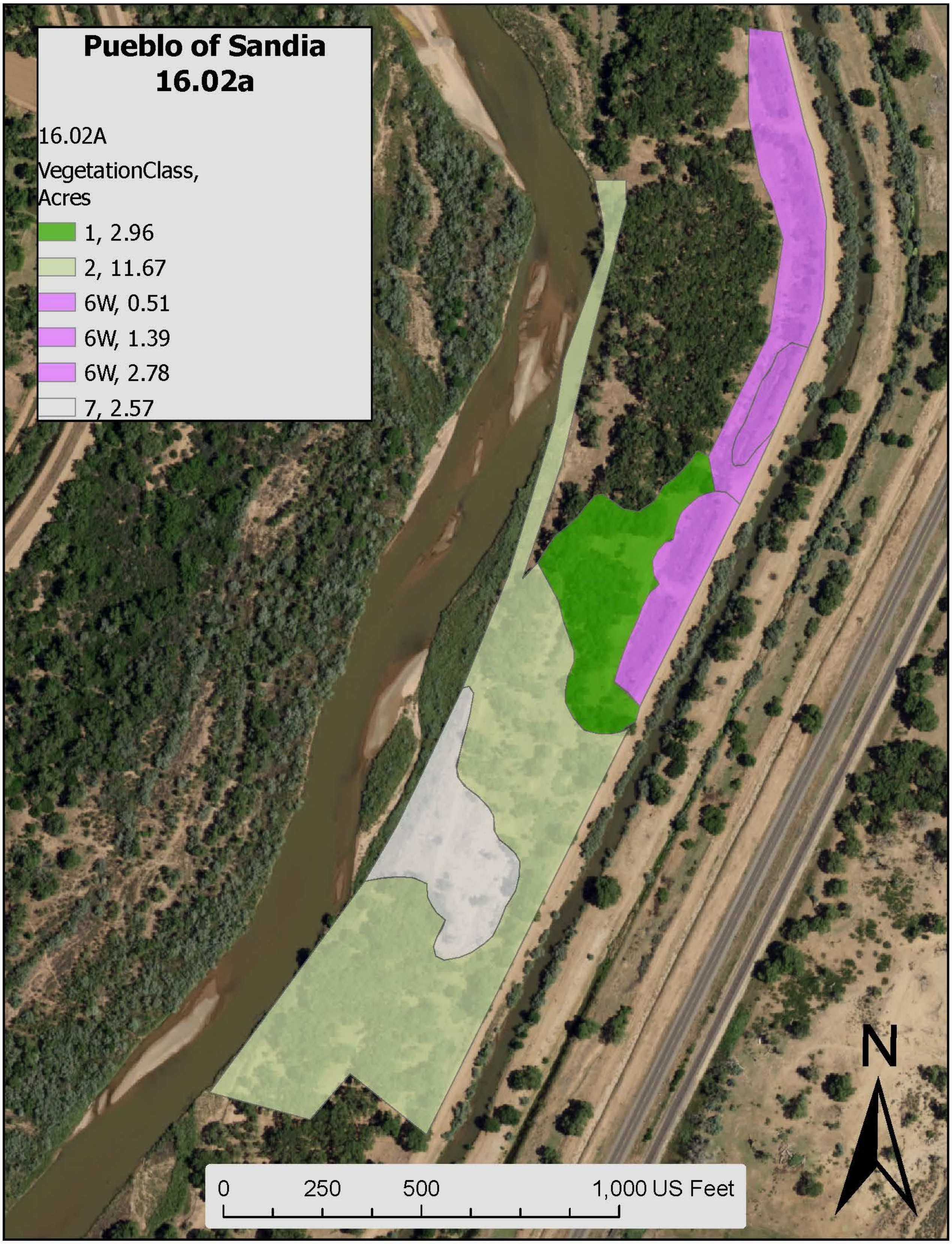

Figure 5. 16.02a Vegetation polygon and photopoints.

Project 16.02b, Riverside Hand Spray

Low-intensity pre-treatment monitoring was conducted at this 8.4-acre site on October 14, 2016 as part of a restoration project targeting non-native phreatophytes scheduled for 2016-2017. The project is located on the Pueblo of Sandia in Sandoval County. The project boundaries are between the west fence line, project roads and the artificial ponds contained in project 16-02a. The Coronado Soil and Water Conservation District (CSWCD) and the Pueblo of Sandia Environment Department Bosque Program sponsored the project. Planned treatment includes herbicide treatment of Russian olive, Siberian elm, salt cedar, and tree-of-heaven. This project is a retreatment and aims to compliment 2006 Bureau of Reclamation mastication and hand-spray restoration efforts in the area. Restoration goals include returning the bosque to a more natural state, promoting native plant species and minimizing impacts to native species and soils during treatment. Following treatment, the Pueblo will seed with upland grass and sandy soil seed mixes.

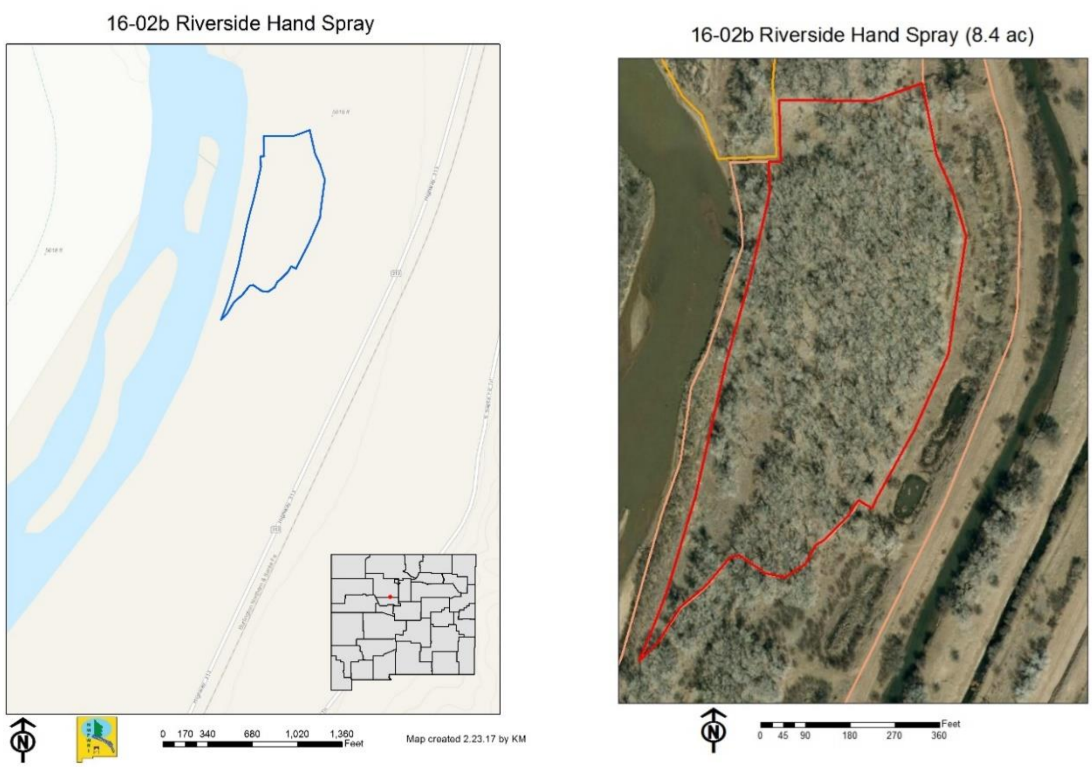

Figure 6. 16.02b in geographic context.

According to the NRCS Web Soil Survey, the project area is comprised of 100% Peralta loam, 1 to 3 percent slopes, unprotected. Ecological sites within this project include R042XA057NM Bottomland (USDA NRCS, 2016).

Field crew observations on this site included the presence of Rio Grande cottonwood, New Mexico olive, juniper, dropseed and scratchgrass. Exotic species included salt cedar, Russian olive and a few Siberian elm, primarily as seedlings and saplings.

Metrics for 16.02b (November 2-3, 2021)	2021 Score	2016 Score
Relative Native Plant Community Composition	2	1
Vegetation Horizontal Patch Structure	2	1
Vegetation Vertical Structure	3	3
Native Riparian Tree Regeneration	1	1
Exotic Invasive Plant Species Cover	2	1
Project Biotic Score (based on above ratings)	2.1	1.5
Project Biotic Rating	C/Fair	D/Poor
Soil Surface Condition	3	3
Surface Fuels	0.30	0.77

Scores for the sample area remained similar to those observed in 2016, with changes occurring in the Invasive Exotic Plant Species Cover and Native Plant Community Composition. Invasive Exotic Plant Species Cover score improved from 2016 to 2021, coverage went from 40% in 2016 to 10% in 2021. Low scores for Native Plant Community Composition in 2016 can be attributed to Tamarisk occupying significant portions of their vegetation community. In 2021 more native species such as New Mexican Olive and Desert Saltgrass were observed which contributed to a higher scoring. An increase in native shrubs and grass could be due to reduced competition from plants such as Tamarisk and Russian Olive which were removed during treatment. The amount of surface fuels observed in 2021 was also lower than in 2016 and this could be a result of less Tamarisk present to produce flammable leaf litter.

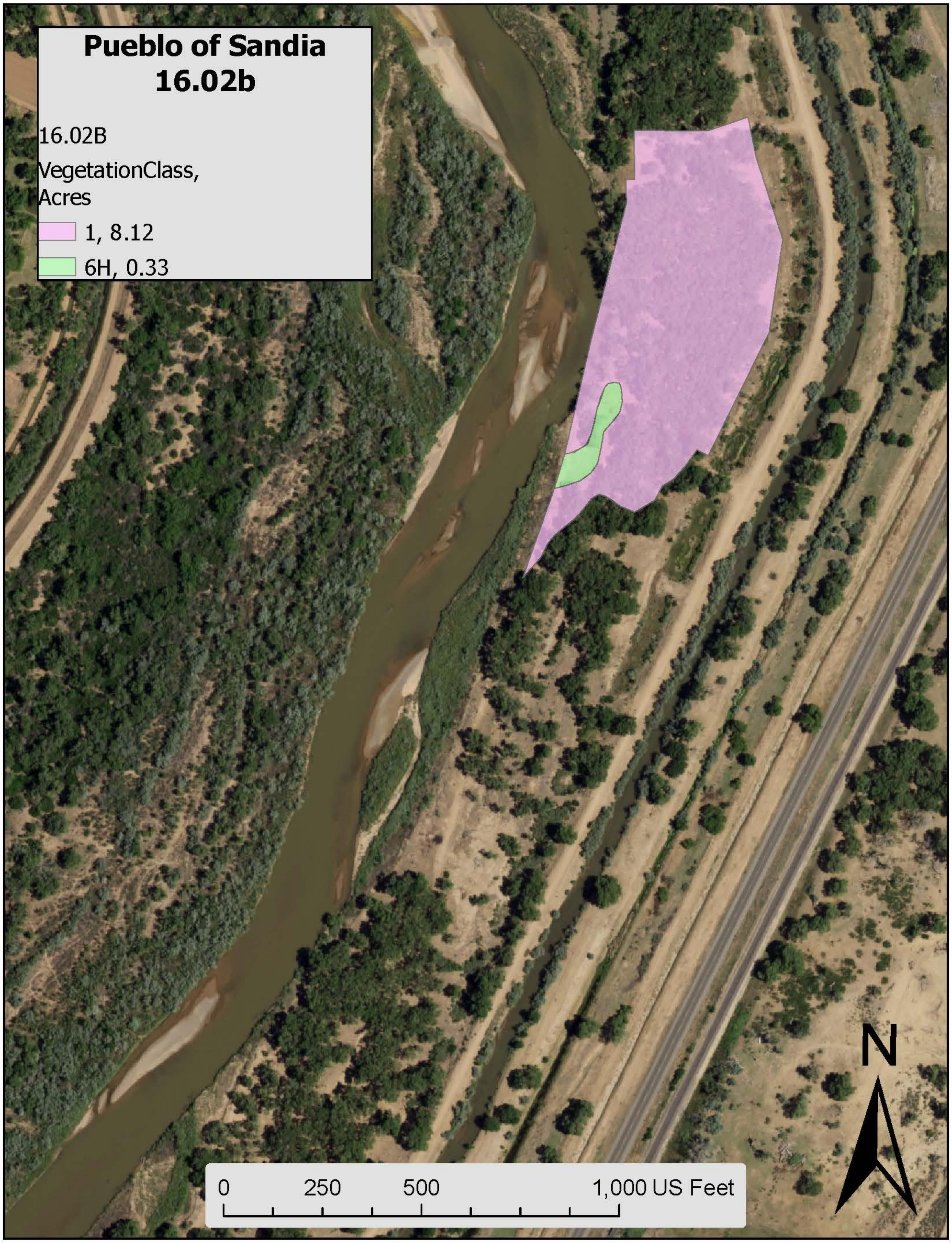

Figure 7. 16.02b Vegetation polygons.

Project 16.03, Point Bar South

Low-intensity pre-treatment monitoring was conducted at this 26.3-acre site on October 14, 2016 as part of a restoration project targeting non-native phreatophytes scheduled for 2016-2017. The project is located on the southern portion of the Pueblo of Sandia in Sandoval County. The project boundaries are between the bank of the Rio Grande on the west and the fence line on the east. The Coronado Soil and Water Conservation District (CSWCD) and the Pueblo of Sandia Environment Department Bosque Program sponsored the project. Planned treatment includes removal of Russian olive, Siberian elm, salt cedar, and tree-of-heaven (unless mechanically treated). This project is a retreatment and aims to compliment 2011 Bureau of Reclamation wetland restoration efforts in the area. Restoration goals include returning the bosque to a more natural state, promoting native plant species and minimizing impacts to native species and soils during treatment.

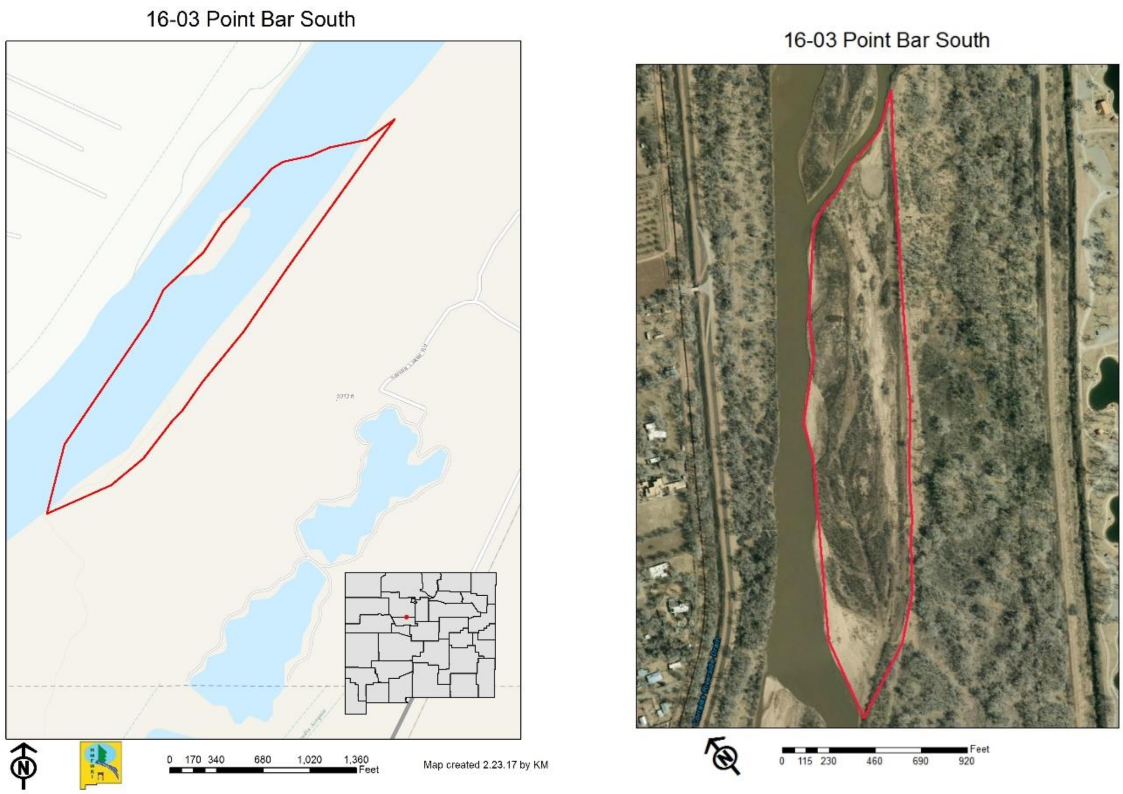

Figure 8. 16.03 in geographic context.

According to the NRCS Web Soil Survey, the project area is comprised of 3.7 % Trail loam, 1 to 3 percent slopes, unprotected, 10% Trail loamy sand, 1 to 3 percent slopes, unprotected, and 86% water. It is worth noting the Web Soil Survey may not be accurate at this scale, and that the river moves over time. Ecological sites within this project include R042XA057NM Bottomland (USDA NRCS, 2016).

Native species observed by the field crew included Rio Grande cottonwood, coyote willow, horseweed, horsetail, as well as other forbs and grasses. Exotic species included Siberian elm, Russian olive, salt cedar, and Russian thistle.

Metrics for 16.03 (October 26, 2021)	2021 Score	2016 Score
Relative Native Plant Community Composition	3	1
Vegetation Horizontal Patch Structure	2	2
Vegetation Vertical Structure	2	2
Native Riparian Tree Regeneration	1	4
Exotic Invasive Plant Species Cover	2	1
Project Biotic Score (based on above ratings)	2.2	1.7
Project Biotic Rating	C/Fair	D/Poor
Soil Surface Condition	4	4
Surface Fuels	0.26	0.25

The lowest score came in Native Riparian Tree Regeneration while the Relative Native Plant Community Composition score increased. In 2016 it was noted that native riparian tree saplings were 'well represented, displayed obvious regeneration, and covered more than 5% of the sample area'. In 2021 none of this was observed. Cottonwoods were observed within the sample area during 2021 monitoring but were not the dominant vegetation and therefore were not recorded as a significant species present. Instead, coyote and black willows, both native species, were present and dominant enough to positively affect the Native Plant Community Composition Rating.

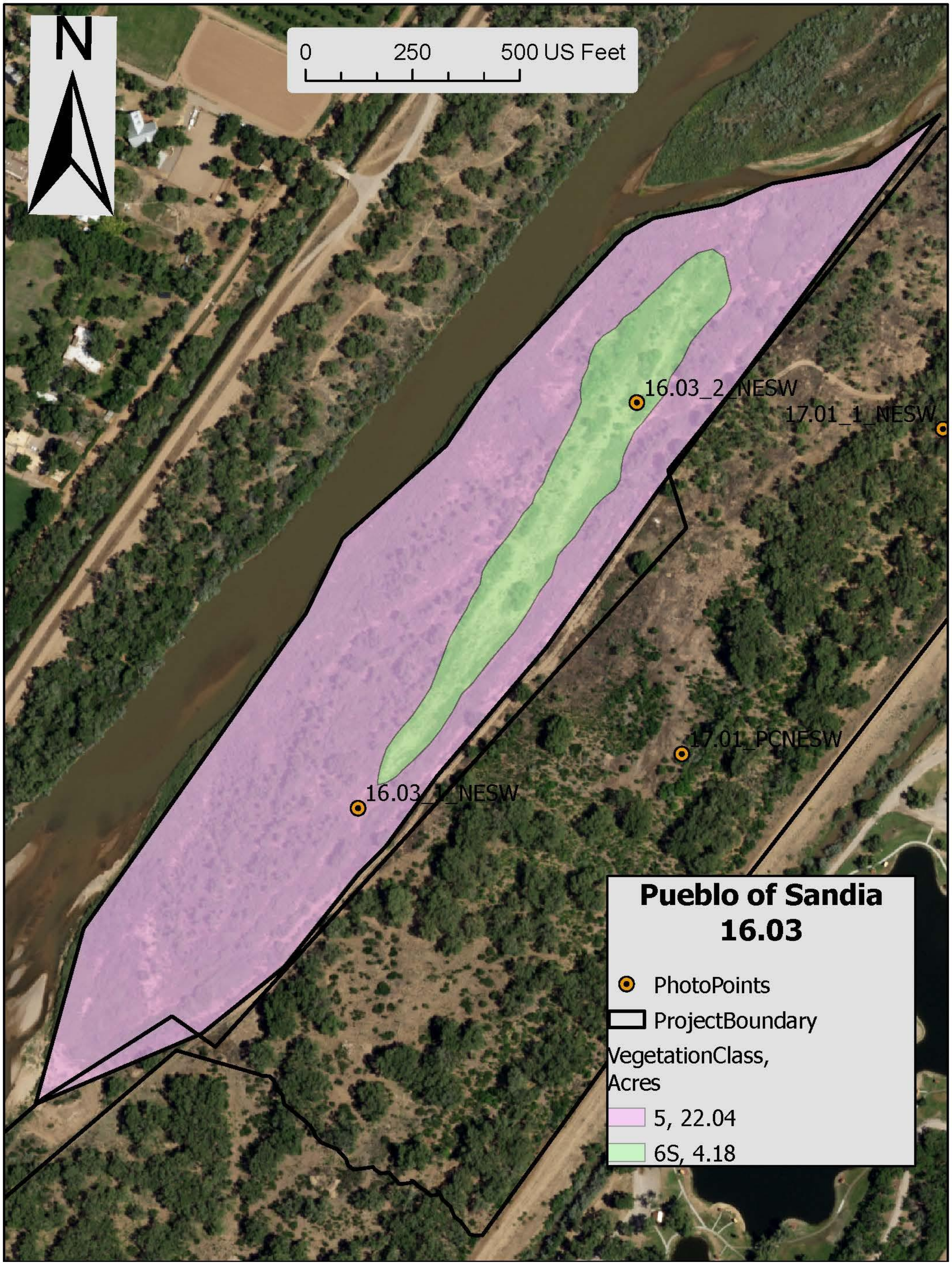

Figure 9. 16.03 Vegetation polygons and photopoints.

Project 16.04, No Name Ditch North

Low-intensity pre-treatment monitoring was conducted at this 16.6-acre site on October 14, 2016 as part of a restoration project targeting non-native phreatophytes scheduled for 2016-2017. The project is located on the Pueblo of Sandia in Sandoval County south of the Romero fire. The project boundaries are between the water surface of the “No Name” ditch on the west and the Albuquerque Main ditch road on the east. The Coronado Soil and Water Conservation District (CSWCD) and the Pueblo of Sandia Environment Department Bosque Program sponsored the project. Planned treatment includes removal of Russian olive, Siberian elm and salt cedar, some of which has been affected by the Tamarisk leaf beetle. Approximately 20% of the Russian olives will be left. This project is a retreatment and aims to compliment 2006 Bureau of Indian Affairs non-native vegetation removal efforts in the area. Restoration goals include returning the bosque to a more natural state, promoting native plant species and minimizing impacts to native species and soils during treatment. Following treatment, the Pueblo will seed with upland grass and sandy soil seed mixes.

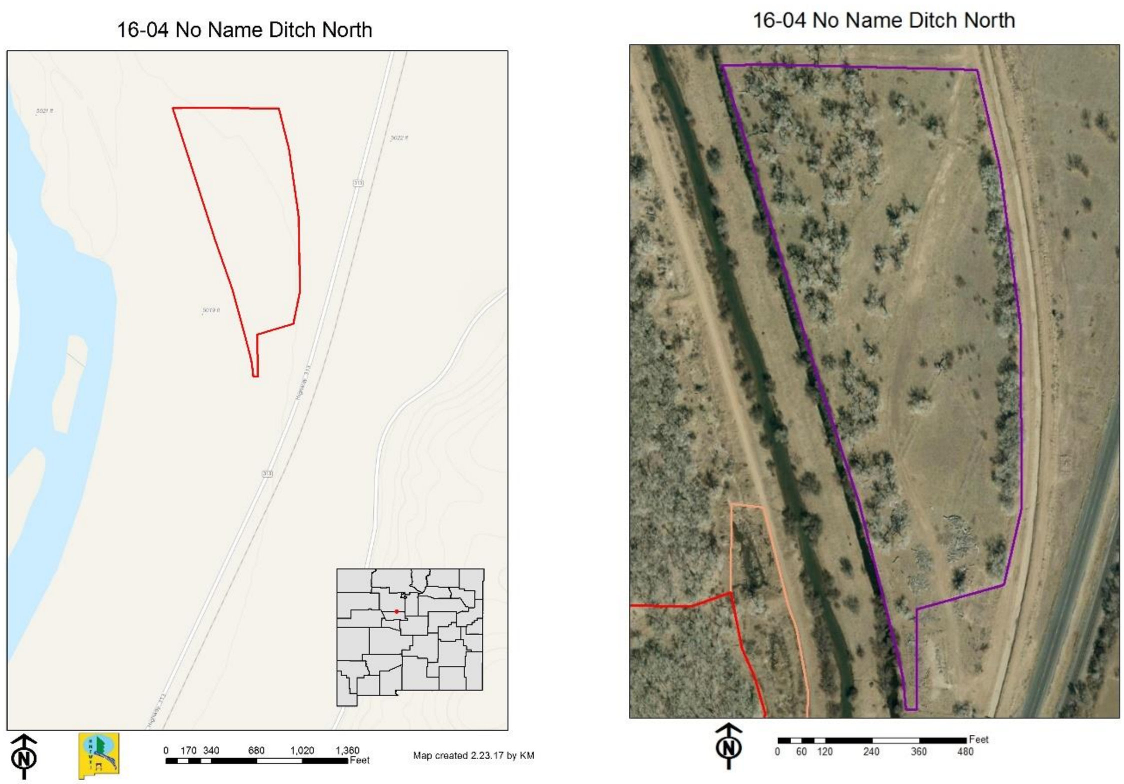

Figure 10. 16.04 in geographic context.

According to the NRCS Web Soil Survey, the project area is comprised of 100% Peralta loam, moderately saline, sodic, 1 to 3 percent slopes. Ecological sites within this project include R042XA055NM Salty Bottomland, and R042XA057NM Bottomland (USDA NRCS, 2016).

At the time of the site visit, large cottonwood pieces from the Sandia Lakes clearing were near the project boundaries. Target species on the project are mostly Russian olive. The Pueblo of Sandia had already begun extracting some Russian olive trees and piling them for the contractor to masticate. Cows were on-site during the pre-treatment monitoring site visit. Native species observed by the field crew included Rio Grande cottonwood, dropseed grass and scratchgrass. Exotic species included Russian olive and Siberian elm.

Metrics for 16.04 (October 14, 2021)	**2021 Score**	**2016 Score**
Relative Native Plant Community Composition	2	2
Vegetation Horizontal Patch Structure	2	2
Vegetation Vertical Structure	2	2
Native Riparian Tree Regeneration	1	1
Exotic Invasive Plant Species Cover	1	1
Project Biotic Score (based on above ratings)	1.7	1.9
Project Biotic Rating	D/Poor	C/Fair
Soil Surface Condition	3	3
Surface Fuels	.40	.20

Low scores for this project were the same as in 2016’s. Five-year post monitoring observed only two vegetation structure types, the same number observed in 2016, though there was a change in which vegetation structure types. As in 2016, Low Structure Forest remained the dominant vegetation structure type, but in 2021 no tall structure forest was observed, instead there was short herbaceous vegetation. This observation makes sense because the sample area was seeded with grass mix after the removal of invasive exotic woody plants. The short herbaceous vegetation type occupied 40% of the sample area; in 2016 Tall Structure Forest occupied 46% of the sample area. Overall, the site scored a “D” or “Poor”.

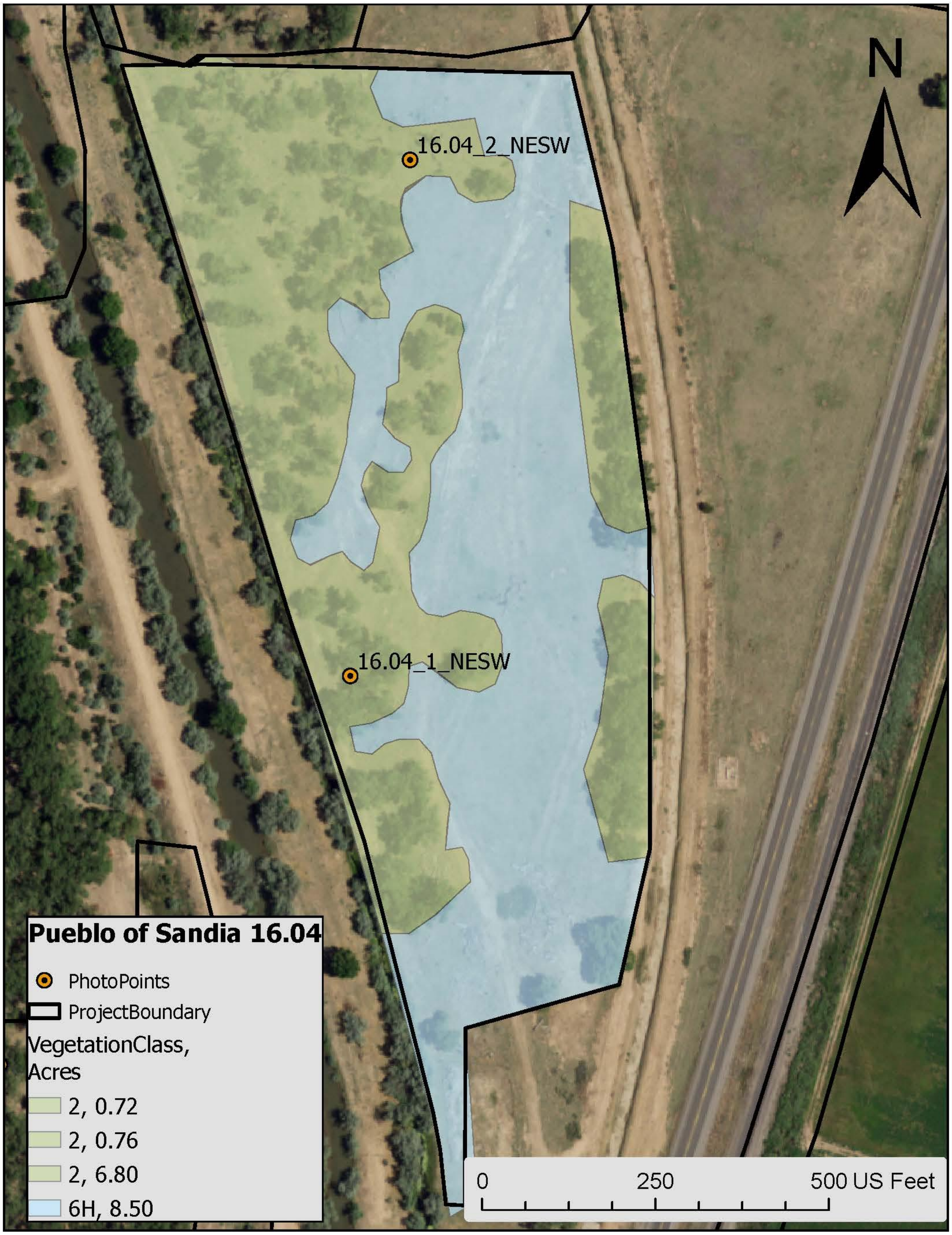

Figure 11. 16.04 Vegetation polygons and photopoints.

Project 16.05, No Name Ditch South

Low-intensity pre-treatment monitoring was conducted at this 9.7-acre site on October 14, 2016 as part of a restoration project targeting non-native phreatophytes scheduled for 2016-2017. The project is located on the Pueblo of Sandia in Sandoval County south of the Romero fire. The project boundaries are between the water surface of the “No Name” ditch on the west and the Albuquerque Main ditch road on the east. The Coronado Soil and Water Conservation District (CSWCD) and the Pueblo of Sandia Environment Department Bosque Program sponsored the project. Planned treatment includes removal of Russian olive, Siberian elm and salt cedar, some of which has been affected by the Tamarisk leaf beetle. Approximately 20% of the Russian olives will be left. This project is considered a retreatment and aims to compliment 2006 Bureau of Indian Affairs non-native vegetation removal efforts in the area. Restoration goals include returning the bosque to a more natural state, promoting native plant species and minimizing impacts to native species and soils during treatment. Following treatment, the Pueblo will seed with upland grass and sandy soil seed mixes.

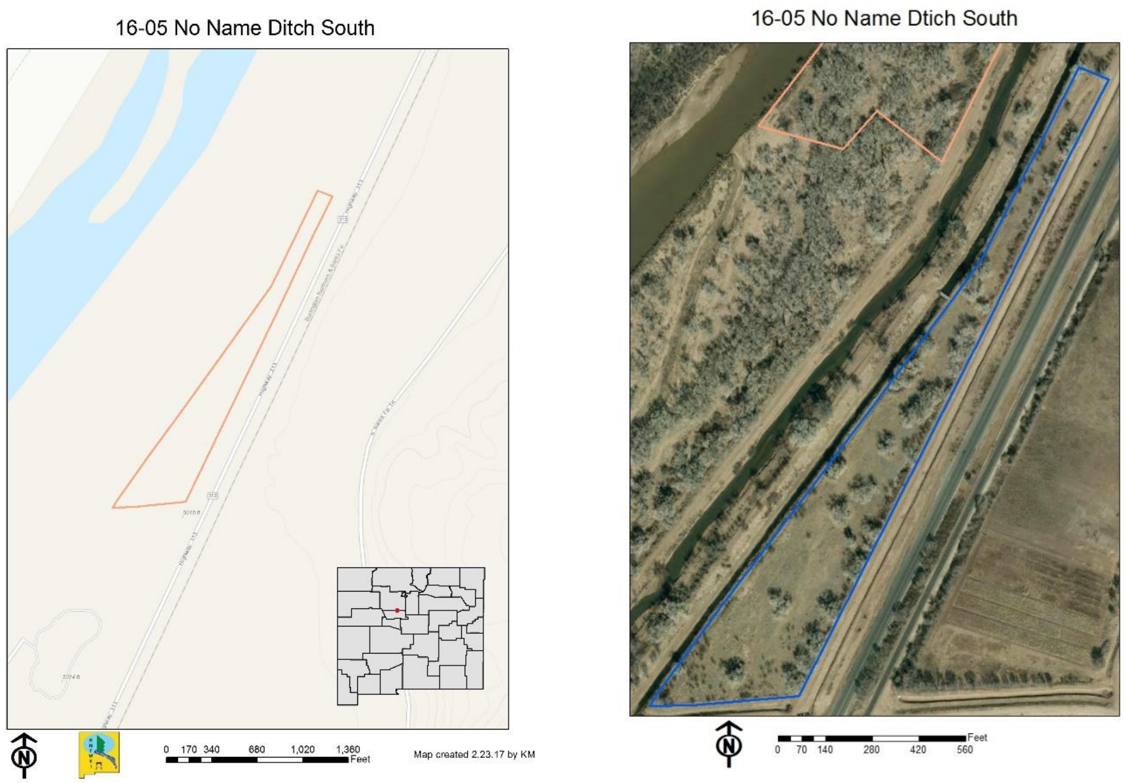

Figure 12. 16.05 in geographic context.

According to the NRCS Web Soil Survey, the project area is comprised of 69% Peralta loam, moderately saline, sodic, 1 to 3 percent slopes, 27% Jocity loam, 0 to 2 percent slopes, and 4.5% Gilco loam, 1 to 4 percent slopes. Ecological sites within this project include R042XA051NM Sandy, R042XA055NM Salty Bottomland, and R042XA057NM Bottomland (USDA NRCS, 2016).

The Sandy ecological site commonly supports black grama, dropseeds, Indian ricegrass or galleta. Heavy grazing leads to reductions of palatable grasses and possibly the persistent loss of black grama, leaving dropseeds, threeawns, and snakeweed. Loamier soils in concave positions that collect surface water runoff may become dominated by burrograss and galleta under continuous grazing. There is evidence that periodic fires may have a characteristic of this state. Grass cover is uniform with bare patches typically > 50cm (20 in) in width. Black grama is dominant and stabilizes much of the soil surface such that there is little evidence of wind erosion. Sand sage and/or mesquite are present, but not abundant (USDA NRCS, 2016). The Bottomland and Salty Bottomland ecological sites have been described in previous sections.

Field crew observations included several Siberian elm seedlings and resprouts as well as trees in banks that were left from a previous treatment. At the time of the site visit, there were signs of recent livestock grazing and a beaver dam was present above the wooden bridge at the north end of the project.

Metrics for 16.05 (October 14, 2021)	**2021 Score**	**2016 Score**
Relative Native Plant Community Composition	2	2
Vegetation Horizontal Patch Structure	2	2
Vegetation Vertical Structure	2	1
Native Riparian Tree Regeneration	1	1
Exotic Invasive Plant Species Cover	1	1
Project Biotic Score (based on above ratings)	1.7	1.7
Project Biotic Rating	D/Poor	D/Poor
Soil Surface Condition	3	4
Surface Fuels	0.30	0.25

Low scores for this project came in Vegetation Horizontal Patch Structure and Invasive Exotic Plant Species Cover. In 2016 two different types of vegetation structure were observed: Tall Shrub structure and herbaceous vegetation. In 2021, only Low Structure Forest vegetation was observed, this could be due to maturing trees in the area shading out smaller plants and keeping the understory clear of growth. Invasive exotic vegetation cover was reduced by 8% from 2016 to 2021 and can be attributed to the removal of these plants during treatment. More surface fuels were observed in 2021 possibly a result of mastication.

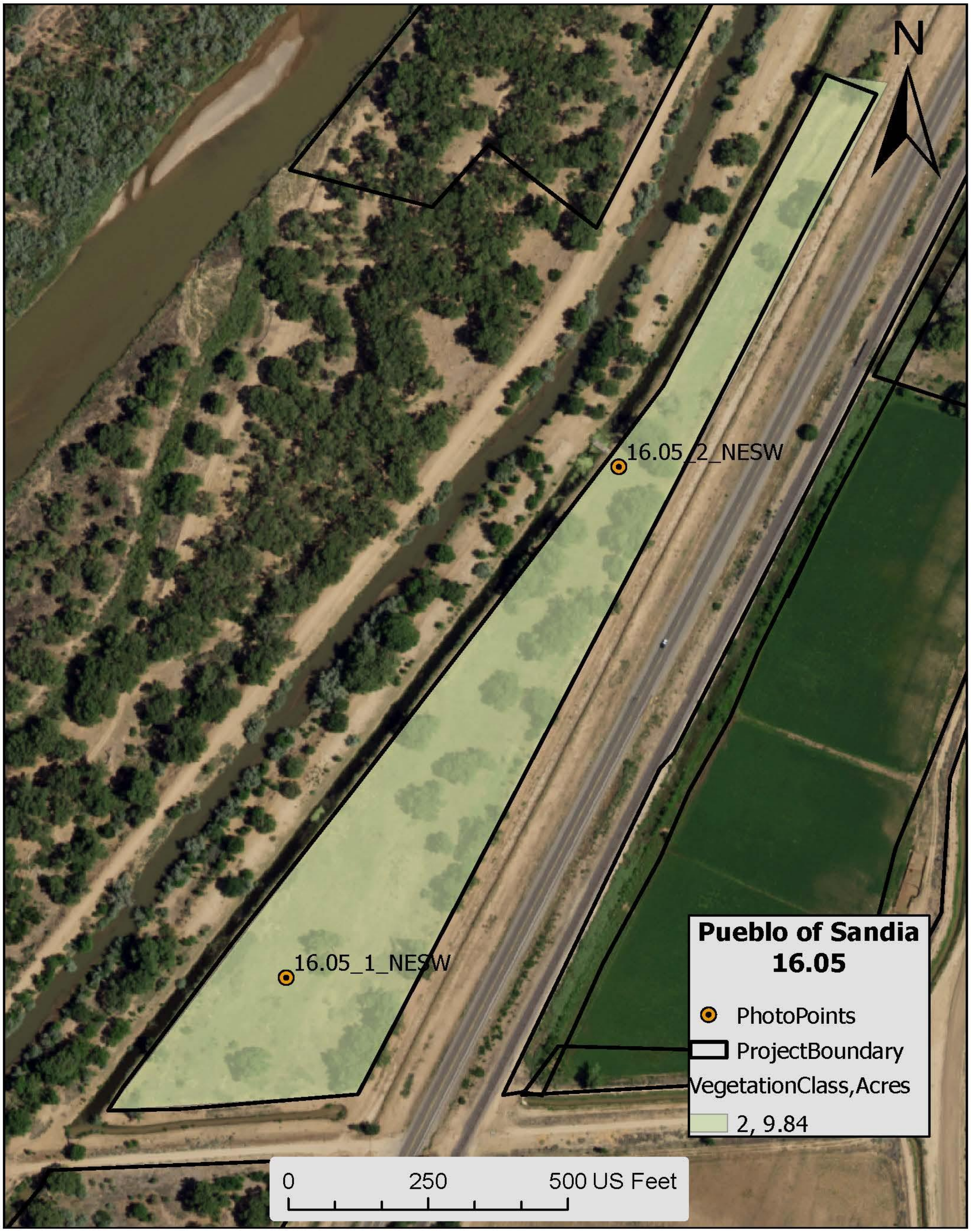

Figure 13. 16.05 Vegetation polygons and photopoints.

Discussion

We would like to clarify that we are adapting these NMRAM metrics for our own purposes. That is, we are using them both inside and outside their intended site ranges, including on larger sites (NMRAM is designed to handle a site around 100 x 200 meters), sites further from the river (NMRAM is currently in use primarily for assessing riverine wetlands), and sites defined by exotic vegetation presence rather than hydrologic boundaries and upland vegetation indicators/apparent wetland extent. Site delineation and size is likely to be variable for a number of other reasons, including landowner participation, available funds, proposals received from contractors, etc – many of which cannot be directly correlated to site disturbance or ecological function. For this reason, we do not use the entire NMRAM assessment, or place confidence in the weighted score roll-ups that are typically part of an NMRAM report. Should one be interested, rationale for the weighting in the NMRAM score roll-up can be found in the yet-to-be-published field manual for version 2.1. For more information, contact Maryann McGraw of the NMED or NMFWRI.

While we provide a biotic site score and rating for your reference, we recommend comparisons be done with individual metrics from pre-treatment and post-treatment assessment from the same site, rather than across multiple sites. Also of note is that statistical analysis is not appropriate for NMRAM, or other low intensity, rapid field methods.

Please note that should the project area change significantly from what was originally proposed and monitored, all metrics will lose some amount of confidence on comparison as it is impractical to re-examine the original site assessment scores using new boundaries. This is an issue of concern of which GRGWA should be aware. We recommend that GRGWA attempt to minimize alterations in project boundaries once pre-treatment monitoring data has been approved for collection. Another, somewhat alternative, recommendation is that the initial monitoring regime include high-intensity modified BEMP-type plots which could be repeated in their exact initial locations, allowing collection of comparable data regardless of boundary change. We recognize that this is not always practical: boundaries change for a number of reasons and time and cost constraints can necessitate the sole use of a rapid assessment method for monitoring. We have reason to hope our outlined assessment method will still be a satisfactory indicator for site function improvement or degradation primarily because metrics in rapid assessment methods such as this are set up to have relatively low sensitivities (i.e. for a change to be reflected in the metrics, either positive or negative, disturbance on site has to be significantly altered).

From here on out, the goal of GRGWA/ NMFWRI is that all sites will be revisited for post-treatment monitoring in 5-year intervals. It is our intention and expectation that the data collected in these intervals will reflect any significant changes in disturbance and ecological function of the site.

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Appendix III: All current bosque monitoring options

Low-intensity methods

- Where: happens on all sites with GRGWA projects
- Method name: NMRAM (New Mexico Rapid Assessment Method v 2.1)
- Time required: 3 hours – half day/ site
- Repeat: done once pre-treatment and in 4-5 year intervals post-treatment
- Basics: mapping vegetation communities (by vertical and horizontal structure), recording dominant vegetation in each strata (trees, shrubs, herbaceous), assessing fuel load, noting soil surface condition and native/exotic ratio at all vegetation levels, photo points
- Any on-site impacts or materials: none

High-intensity methods

- Where: happens on select sites, in addition to low-intensity monitoring

Submethod name 1: BBIRD/ BEMP vegetation plots (depends on treatment area size)

- Time required: approx. 2 hours/site
- Repeat: both pre-treatment and in 4-5 yr intervals post-treatment
- Basics: larger plots and transects documenting vegetation, photo points
- On-site impacts or materials: rebar and cap

Submethod name 2: Brown's transects

- Time required: 1-1.5 hours/site
- Repeat: both pre-treatment and in 4-5 yr intervals post-treatment
- Basics: transects to calculate fuel loading and fire behavior, photo points
- On-site impacts or materials: rebar and cap

Submethod name 3: BEMP-adapted Groundwater Well Monitoring

- Time required:
    - Initial installation: 1-2 hours/ well (ideally 2+ wells/site)
        - Repeat: maintenance as needed, should be minimal
    - Data offloading: 10-20 minutes/well
        - Repeat: at least annually (this is when we anticipate datalogger will be full and batteries will need to be changed)
- Basics: install a well with a sensor which records groundwater level and temperature once an hour year round; this will reflect changes due to seasonal variation, vegetation growth, irrigation, etc.
- On-site impacts or materials: shallow monitoring well (consists of capped PVC pipe extending into the ground about 3 feet below the water table and above ground approx. 2 feet (can be painted earth tones); well contains a datalogger (pressure transducer) suspended on a cable into the water); well should be protected from cattle grazing (so may require rebar around pvc visible above ground)

Appendix IV: Modified Hink and Ohmart categories, from NMRAM

The following is pages 39-41 in Muldavin et al.'s 2014 NMRAM for Montane Riverine Wetlands v 2.0 Manual (draft, not yet published)

Vegetation Vertical Structure Type Definitions for NMRAM

Multiple-Story Communities (Woodlands/Forests)

Type 1 – High Structure Forest with a well-developed understory.

Tall mature to intermediate-aged trees (>5 m [>15 feet]) with canopy covering >25% of the area of the community (polygon)and understory layer (0-5 m [0-15 feet]) covering >25% of the area of the community (polygon). Substantial foliage is in all height layers. (This type incorporates Hink and Ohmart structure types 1 and 3.) Photograph on Gila River by Y. Chauvin, 2012.

Type 2 - Low Structure Forest with little or no understory.

Tall mature to intermediate-aged trees (>5 m [>15 feet]) with canopy covering >25% of the area of the community (polygon) and understory layer (1-5 m [3-15 feet]) covering <25% of the area of the community (polygon). Majority of foliage is over 5 m (15 feet) above the ground. (This type incorporates Hink and Ohmart structure types 2 and 4.) Photograph on Diamond Creek by Y. Chauvin, 2012.

Single-story Communities (Shrublands, Herbaceous and Bare Ground)

Type 5 - Tall Shrub Stands.

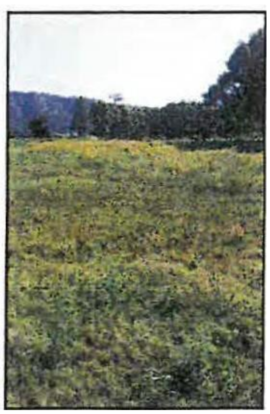
Young tree and shrub layer only (15-5 m [4.5-15 feet]) covering >25% of the area of the community (polygon). Stands dominated by tall shrubs and young trees, may include herbaceous vegetation underneath the woody vegetation. Photograph on San Francisco River by Y. Chauvin, 2012.

Type 6S- Short Shrub Stands.

Short stature shrubs or very young shrubs and trees (up to 1.5 m [up to 4.5 feet]) covering >10% of the area of the community (polygon). Stands dominated by short woody vegetation, may include herbaceous vegetation underneath the woody vegetation. Photograph on Lower Pecos River by E. Lindahl, 2008.

Type 6W- Herbaceous Wetland.

Herbaceous wetland vegetation covering >10% of the area of the community (polygon). Stands dominated by obligate wetland herbaceous species. Woody species absent, or <10% cover. Photograph of *Carex nebrascensis* meadow on upper Rio Santa Barbara by Y. Chauvin, 2009.



Type 6H- Herbaceous.

Herbaceous vegetation covering >10% of the area of the community (polygon). Stands dominated by herbaceous vegetation of any type except obligate wetland species. Woody species absent or <10% cover. Photograph on Diamond Creek by Y. Chauvin, 2012.

Type 7–Sparse Vegetation/Bare Ground.

Bare ground, may include sparse woody or herbaceous vegetation, but total vegetation cover <10%. May be natural in origin (cobble bars) or anthropogenic in origin (graded or plowed earth) Photograph on Lower Gila River by Y. Chauvin,2012.