

**SITE IMPLEMENTATION PLANS**

**RIO GRANDE CANALIZATION PROJECT**  
**RIVER RESTORATION IMPLEMENTATION PLAN**

**UNITED STATES INTERNATIONAL BOUNDARY AND  
WATER COMMISSION**



Prepared for:  
United States Section  
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## EXECUTIVE SUMMARY

The United States Section of the International Boundary and Water Commission (USIBWC) operates and maintains the Rio Grande Canalization Project (RGCP), a narrow river corridor that extends 105.4 miles along the Rio Grande, from below Percha Dam in Sierra County, New Mexico to American Dam in El Paso, Texas. The RGCP was constructed to facilitate water deliveries to the Rincon and Mesilla Valleys in New Mexico, El Paso Valley in Texas, and Juárez Valley in Mexico, and to provide flood control.

The USIBWC currently implements operation and maintenance procedures to enhance ecosystem functions within the RGCP. The USIBWC recognized the need to accomplish flood control, water delivery, and operation and maintenance activities in a manner that enhanced or restored the riparian ecosystem. Thus, the USIBWC developed the Rio Grande Canalization Project Conceptual Restoration Plan (Restoration Plan) with the objective of producing enhanced cover and in-channel aquatic diversity, restoring healthy riparian function, enhancing natural riverine processes, and improving terrestrial wildlife habitat at approximately 30 sites within the USIBWC floodway.

USIBWC contracted TRC Environmental Corporation (TRC) to collect additional site-specific data and prepare site-specific implementation plans at selected restoration sites. Site-specific data included soil surveys, information on groundwater depths, cultural resources surveys, and Southwestern willow flycatcher (WIFL) and yellow-billed cuckoo (YBCU) bird surveys. WIFL is a listed endangered species, and YBCU is a candidate for listing. This report summarizes the findings of the surveys and presents the implementation plans for each site. Site-specific implementation plans have been prepared for 23 sites.

In the bird surveys, WIFL was observed at four sites, three of which have implementation plans. YBCU was observed at five sites, four of which have implementation plans. Other birds protected under the Migratory Bird Treaty Act (MBTA) were also observed at all sites. Special notes regarding protection of WIFL, YBCU, and MBTA birds have been added to the site-specific implementation plans as appropriate.

Findings of the cultural resources survey suggest the proposed river restoration activities will have no adverse effect on cultural resources (prehistoric and historic) within the area of potential effect.

The soils survey determined that soils in the sites investigated comprise Agua variant (loamy, sandy) 50%, Brazito (sandy) 40%, Belen variant (clayey, also intermixed with Agua variant soils) 10%, and Anapra (clay loam) 1%. Agua soils dominate in the southern part of the project area and Brazito soils occur mostly in the northern part of the project area. Salinity levels may be of some concern at a few sites, but there was no confirmed evidence of consistent high salinity at any sites. In general, the soils are suitable for the desired species of plantings.

Depth to groundwater at the time of the soils survey was less than five feet and generally suitable for survival of the desired species at all sites for which plantings are proposed except possibly Site 19 – Clark Lateral. Supplemental irrigation is planned for that site. There is an estimated net

increase in average annual evapotranspiration losses of 13.1 acre-feet at Clark Lateral and 277 acre-feet per year over all the sites.

Approximately 18,000 cubic yards of soil are to be excavated at the sites. It is unlikely the soil can be discharged into the Rio Grande under a USACE Nationwide Permit. In most cases, excess excavated soil is to be removed from the floodplain and taken to an upland location, although at selected sites it is to be placed at the toe of the levee to shore up the levee.

Most sites require some brush removal, particularly exotic vegetation such as salt cedar. The recommended disposal method is on-site chipping with the chips to be used as mulch for the tree and shrub plantings.

The total estimated construction cost of the implementation plans for the 23 sites is \$4.2 million.

## 1.0 INTRODUCTION

The United States Section of the International Boundary and Water Commission (USIBWC) operates and maintains the Rio Grande Canalization Project (RGCP), a narrow river corridor that extends 105.4 miles along the Rio Grande, from below Percha Dam, which is two miles downstream of Caballo Reservoir dam in Sierra County, New Mexico, to American Dam, which is 140 feet upstream of where the Rio Grande becomes the U.S.-Mexico border in El Paso, Texas. The RGCP, completed in 1943, was constructed to facilitate water deliveries to the Rincon and Mesilla Valleys in New Mexico, El Paso Valley in Texas, and Juárez Valley in Mexico, and to provide flood control. A levee system for flood control extends 57 and 74 miles over the right and left stream banks, respectively.

The USIBWC currently implements operation and maintenance procedures to enhance ecosystem functions within the RGCP. However, the river and floodway remained highly altered from events related to RGCP construction. The USIBWC recognized the need to accomplish flood control, water delivery, and operation and maintenance activities in a manner that enhanced or restored the riparian ecosystem. Thus, the USIBWC and U.S. Army Corps of Engineers (USACE) developed the Rio Grande Canalization Project Conceptual Restoration Plan (Restoration Plan) with the objective of producing enhanced cover and in-channel aquatic diversity, restoring healthy riparian function, enhancing natural riverine processes, and improving terrestrial wildlife habitat at sites within the USIBWC floodway (USACE, 2009).

The Restoration Plan is the result of a three-year collaborative effort between USIBWC, Elephant Butte Irrigation District (EBID), the World Wildlife Fund (WWF), and other key stakeholders. The plan allows for better integration of river management options along the 105-mile reach of the Rio Grande for habitat, flood control, and water deliveries. Analyses included evaluation of restoration potential at over 30 sites including modeling of potential restoration flows and opportunities to enhance river-floodplain hydrologic connectivity.

As part of the *Final Environmental Impact Statement River Management Alternatives for the USIBWC Rio Grande Canalization Project*, the Record of Decision identified a phased implementation approach for restoration measures. Phase I measures include the collection of additional site-specific data; site-specific implementation plans; land acquisition; development of an Interagency Agreement between the USIBWC and the United States Fish and Wildlife Service (USFWS) for implementation of pilot restoration projects; and development of a Memorandum of Agreement between USIBWC, USFWS, and the National Fish and Wildlife Foundation for a water rights transaction program. Phase II measures require additional execution of voluntary leases and water rights acquisition and adaptive management measures for implementation of the remaining restoration projects and measures.

USIBWC contracted TRC Environmental Corporation (TRC) to collect additional site-specific data and prepare site-specific implementation plans at selected restoration sites. Site-specific data included soil surveys, information on groundwater depths, cultural resources surveys, and Southwestern willow flycatcher (WIFL) and yellow-billed cuckoo (YBCU) bird surveys. WIFL is a listed endangered species, and YBCU is a candidate for listing. This report summarizes the findings of the surveys and presents the implementation plans for each site. The individual site-

specific implementation plans are contained in Appendix A. A list of all sites and the work performed at each site is presented in Table 1-1. Twenty-three sites have implementation plans. Site locations are shown in Figures 1-1 and 1-2.

**Table 1-1. Restoration Sites – Work Performed**

<u>Site No.</u>	<u>River Mile-Bank</u>	<u>Site Name</u>	<u>Acres</u>	<u>Work Performed</u>			
				<u>Soil/ Groundwater Survey</u>	<u>Cultural Resources Survey</u>	<u>Bird Surveys</u>	<u>Implementation Plan</u>
1	103-W	Trujillo	14.0	X	X	X	X
2	94.9-E	Jaralosa	4.7	X	X		X
3	94-W	Yeso Arroyo	22.4	X	X		X
4	93.7-E	Yeso East	9.7	X	X		X
5	93.5-W	Yeso West	1.7	X	X		X
6	92-E	Crow Canyon A	89.9	X	X		
7	90.5-E	Crow Canyon B	25.7	X	X	X	
8	85-W	Placitas Arroyo	48.2	X	X		X
9	82.5-E	Rincon Siphon A&B	16.3	X	X	X	X
10	90-W	Angostura Arroyo	42.3	X	X		X
11	71.5-E	Lack Property	51.0				X
12	69.5-E	Pasture 18	51.8				
New*	67.7-W	Broad Canyon	25.8		X	X**	
15	66-E	Selden Point Bar	6.9		X	X	X
16	64-E	Bailey Point Bar	16.6			X	X
17	50.5-E	Shalem Colony	14.2	X	X		X
18	47.8-E	Leasburg Extension Lateral Wasteway 8	4.1	X	X	X	
19	43.5-E	Clark Lateral	6.1	X	X	X	X
20	41.5-W	Mesilla Valley Bosque State Park	31.8	X	X		
21	41-E	Mesilla East	15.9	X	X	X	X
22	25.5-W	Berino West	10.3	X	X	X	X
23	24.8-E	Berino East	9.5	X	X	X	X
24	17-W	Vinton A	14.7	X	X		X
25	16-W	Vinton B	20.0	X	X		X
26	9-W	Valley Creek	22.0	X	X		X
27	7-W	Nemexas Siphon	16.7	X	X	X	X
28	6.8-E	Country Club East	29.0	X	X		X
29	4-E	Sunland Park	28.8	X	X	X**	X

<u>Site No.</u>	<u>River Mile-Bank</u>	<u>Site Name</u>	<u>Acres</u>	<u>Work Performed</u>			
				<u>Soil/ Groundwater Survey</u>	<u>Cultural Resources Survey</u>	<u>Bird Surveys</u>	<u>Implementation Plan</u>
30	3-E	Anapra Bridge	11.1	X	X		X
Total Acres			661.3				

\* Site added by USIBWC after Sites 13/14-Broad Canyon Ranch ownership was transferred to NM State Parks.

\*\*Surveyed only in 2011.

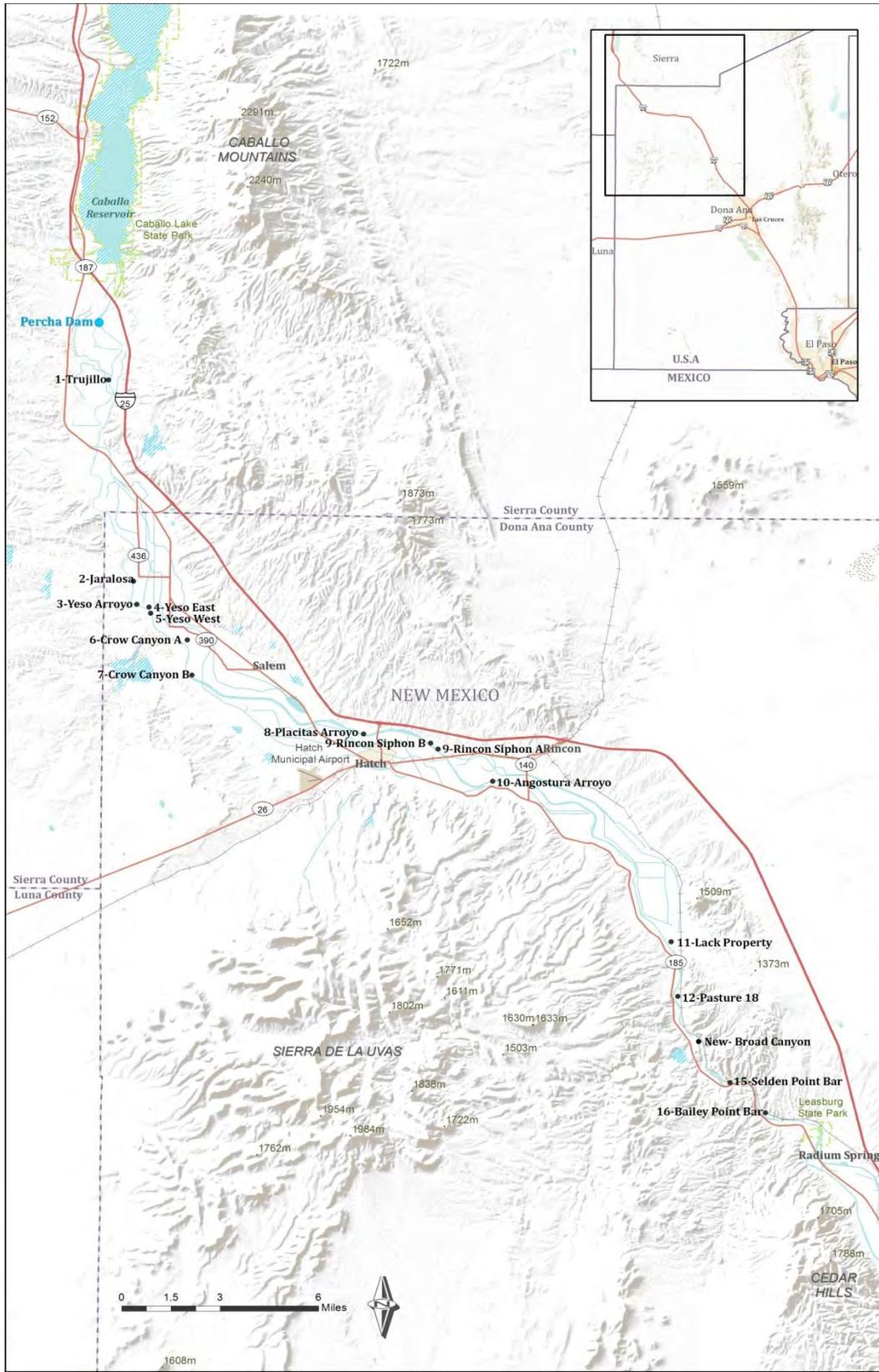


Figure 1-1. Location of Restoration Sites along the Rio Grande – North

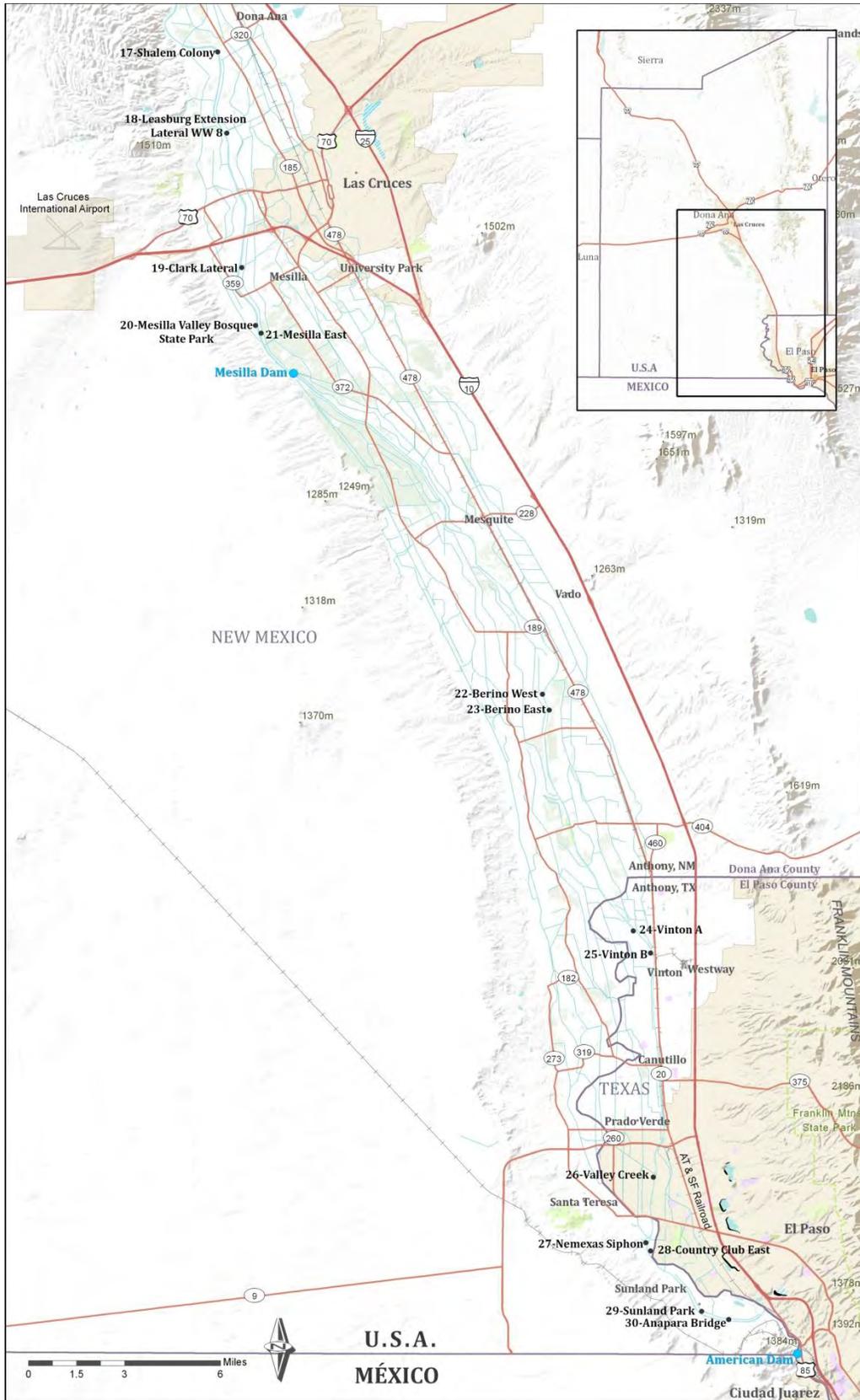


Figure 1-2. Location of Restoration Sites along the Rio Grande – South

## 2.0 BIRD SURVEYS SUMMARY

Surveys for birds were conducted in 2010 (11 restoration sites) and 2011 (13 restoration sites), as shown in Table 1-1, on three separate occasions between May 15 and July 17 of each year (TRC, September 2011). Data collection included Southwestern willow flycatcher (“WIFL” – *Empidonax traillii extimus*) and yellow-billed cuckoo (“YBCU” – *Coccyzus americanus occidentalis*) surveys, with additional observations of other species noted. WIFL was observed at four sites, three of which have implementation plans. YBCU was observed at five sites, four of which have implementation plans. Locations of WIFL and YBCU observed in 2010 and 2011 at the restoration sites are presented in Table 2-1.

**Table 2-1. Summary of Observed Locations of Southwestern Willow Flycatcher (WIFL) and Yellow-billed Cuckoo (YBCU)**

Site	WIFL 2010			WIFL 2011			YBCU 2010	YBCU 2011
	Resident	Nest	Migrant	Resident	Nest	Migrant		
1-Trujillo	0	0	0	0	0	0	1	0
7-Crow Canyon B	7	1	0	5	0	1	0	0
9-Rincon Siphon A	0	0	0	0	0	1	0	0
9-Rincon Siphon B	0	0	0	0	0	3	1	1
New-Broad Canyon	-	-	-	0	0	0	-	1
16-Bailey Point Bar	1	0	0	1	0	5	0	0
27-Nemexas Siphon	0	0	0	0	0	0	1	2
29-Sunland Park	-	-	-	0	0	4	-	3

Source: TRC, September 2011

The largest number of WIFL observed, including the only nest, was at Site 7, which is not a site where an implementation plan has been prepared. At the other WIFL sites, the implementation plans note the species’ presence and restrictions on activities with the following statement:

“This site is known habitat for the southwestern willow flycatcher (WIFL), an endangered species. Vegetation removal will conform with U.S. Fish & Wildlife Service requirements and restrictions. No construction activities will occur within ¼ mile of any identified WIFL nests.”

At the YBCU sites, the implementation plans have the following statement:

“This site is known habitat for the yellow-billed cuckoo. No work may be done at this site during the breeding season (March-September).”

A total of 106 species of birds were identified in 2010 and 2011, including several at all sites, many of which require protection under the Migratory Bird Treaty Act (MBTA). At all sites, the implementation plans note seasonal restrictions on activities related to the MBTA with the following statement:

“Bird species in the project area that are protected under the Migratory Bird Treaty Act (MBTA) may nest in areas containing trees, grasses, or other suitable habitat. Vegetation clearing activities should be scheduled to occur outside the March through August migratory bird nesting season, when possible. If vegetation clearing activities must occur during the nesting season of birds protected under the MBTA, then the areas proposed for disturbances must be surveyed for nesting birds prior to construction to avoid inadvertent destruction of nests and eggs.”

### **3.0 CULTURAL RESOURCES SURVEYS SUMMARY**

Archaeological pedestrian surveys and architectural surveys were conducted at 26 restoration sites (TRC, March 2011). These surveys were also conducted to consider the effects of the proposed restoration plan on historic properties. The surveys inventoried previously recorded and any newly discovered cultural resources present and determined whether any were eligible for inclusion in the National Register of Historic Places (NRHP).

No previously recorded sites exist within any of the restoration sites, although there are 28 previously recorded sites near 19 of the restoration sites.

One cultural artifact (chert core-reduction flake) was identified within Site 17 – Shalem Colony. One chert bimarginal tool and one chert/limestone hammerstone were identified within Site New – Broad Canyon. These were noted on the ground surface and recorded as isolated occurrences. Other materials were found just outside of Site 27 – Nemexas Siphon.

Findings suggest the proposed river restoration activities will have no adverse effect on cultural resources (prehistoric and historic) within the area of potential effect.

### **4.0 SOILS AND GROUNDWATER SUMMARY**

#### **4.1 SOIL TYPES AT THE RESTORATION SITES**

Soil surveys were conducted at Sites 1-10 and 17-30 (25 sites, totaling 458.1 acres) (TRC, August 2010). Multiple borings to 60 inches were done at each site. In the study area, the most common soil type is the Agua variant, comprising approximately 50% of the soils. Agua variant is somewhat poorly drained with a loamy surface and sandy subsoil, and the depth to a water table ranges from 12 to 42 inches. Major limitations are salinity, wetness, and poor drainage. The next most common is Brazito, comprising approximately 40% of the area. Brazito is well drained, with a sandy surface and sandy subsoil and does not have a water table within 60 inches. The major limitations are rapid permeability, very low water holding capacity and unfavorable rooting zone below a depth of 10-15 inches. The last major soil type is the Belen variant, comprising approximately 10% of the area. Belen variant is poorly drained with a clayey surface and subsoil. It is the only soil mapped that is largely clay. Belen soils are intermixed with Agua soils in this area. The major limitations are salinity, wetness, and poor drainage. Anapra clay loam was also identified on one site, but comprises a small area. Anapra is a deep, well-drained soil. The major limitation is moderate available water holding capacity.

Agua soils dominate in the southern part of the project area. Agua variant soils, moderately wet, are mapped on Sites 7, 18, 20 to 26, and 28 to 30. Brazito soils occur mostly in the northern part of the project area. Brazito loamy fine sand is mapped on Sites 3, 4, 5, 6, 8, 17, and 19. Site 10 is Brazito very fine sand, thick surface. Belen variant intermixed with Agua variant soils are mapped on Sites 9 and 27. Site 2 is Anapra clay loam. Table 4-1 presents a summary of the sites by soil types.

**Table 4-1. Summary of Soil Types at Restoration Sites**

Soil Type	Characteristics	Approx. Percent of Study Area	Sites Where Present
Agua variant	loamy, sandy	50%	1(S), 7, 18, 20-26, 28-30
Brazito	sandy	40%	1(N), 3-6, 8, 10, 17, 19
Belen variant	clayey, also intermixed with Agua variant soils	10%	9, 27
Anapra	clay loam	1%	2

Source: TRC, August 2010

None of the restoration sites was dominated by salt tolerant vegetation that indicated severe salinity issues. All sites except Site 27 had a variety of plant types. Sites with water tables less than 36 inches below the surface normally had 50 to 80 percent or greater cover of grasses, forbs, and woody species. Vegetative cover was usually less than 50 percent when the depth to the water table was greater than 42 inches. Sites without a water table within 60 inches were mostly bare ground with scattered woody species and grass and forb cover of 5 to 35 percent. Where vegetation was sparse, the main limitation is the lack of water. Analysis of the vegetation present and the salt prediction test data indicates salinity issues will not be a severe problem for vegetative establishment on most of the restoration sites. Sites 9, 17, 27, and 30 have both soil and vegetative indicators indicating salinity levels may be of some concern. There was no confirmed evidence of consistent high salinity at any sites, however.

The primary vegetation types proposed to be planted as part of the restoration plan are trees (willows and cottonwoods), longstem riparian shrubs, and grasses. The Agua variant, Brazito, and Anapra clay loam soils would all be suitable for those plantings. However, the Belen variant soils are clayey and are less likely to be suitable for the trees and shrubs.

Table 4-2 presents information on soil types identified at each boring on the sites.

**Table 4-2. Summary of Soils and Groundwater Investigation**

Site No. – Boring No.	Map Unit Symbol	Map Unit Name	Water Table Depth (in)
1-1	AJ	Agua variant soils, moderately wet	14

Site No. – Boring No.	Map Unit Symbol	Map Unit Name	Water Table Depth (in)
1-2	AJ	Agua variant soils, moderately wet	30
1-3	Br	Brazito loamy fine sand	<60 (hole collapsed)
2-1	Ao	Anapra clay loam	38
2-2	Ao	Anapra clay loam	45
2-3	Ao	Anapra clay loam	43
2-4	Ao	Anapra clay loam	40
3-1	Br	Brazito loamy fine sand	>60
3-2	Br	Brazito loamy fine sand	>60
3-3	Br	Brazito loamy fine sand	>60
4-1	Br	Brazito loamy fine sand	50
4-2	Br	Brazito loamy fine sand	42
4-3	Br	Brazito loamy fine sand	43
5-1	Br	Brazito loamy fine sand	>60 (est.)
5-2	Br	Brazito loamy fine sand	>60 (est.)
5-3	Br	Brazito loamy fine sand	>60 (est.)
6-1	Br	Brazito loamy fine sand	>60
6-2	Bs	Brazito very fine sandy loam, thick surface	>60
6-3	Br	Brazito loamy fine sand	54
6-4	Br	Brazito loamy fine sand	>60
6-5	Br	Brazito loamy fine sand	43

Site No. – Boring No.	Map Unit Symbol	Map Unit Name	Water Table Depth (in)
6-6	Br	Brazito loamy fine sand	42
6-7	Br	Brazito loamy fine sand	44
6-8	Br	Brazito loamy fine sand	48
6-9	Br	Brazito loamy fine sand	46
7-1	AJ	Agua variant soils, moderately wet	6 plus
7-2	AJ	Agua variant soils, moderately wet	19
7-3	AJ	Agua variant soils, moderately wet	24
7-4	Br	Brazito loamy fine sand	>60
8-1	Bs	Brazito very fine sandy loam, thick surface	>60
8-2	Br	Brazito loamy fine sand	>60
8-3	Br	Brazito loamy fine sand	>60
8-4	Bs	Brazito very fine sandy loam, thick surface	>60
8-5	Br	Brazito loamy fine sand	>60
9-1	AK	Agua variant and Belen variant soils	47
9-2	AK	Agua variant and Belen variant soils	47
9-3	AK	Agua variant and Belen variant soils	9
9-4	AK	Agua variant and Belen variant soils	42
9-5	AK	Agua variant and Belen variant soils	23
9-6	AK	Agua variant and Belen variant soils	20
9-7	AK	Agua variant and Belen variant soils	20

Site No. – Boring No.	Map Unit Symbol	Map Unit Name	Water Table Depth (in)
9-8	AK	Agua variant and Belen variant soils	21
9-9	AK	Agua variant and Belen variant soils	37
9-10	AK	Agua variant and Belen variant soils	21
9-11	AK	Agua variant and Belen variant soils	20
9-12	AK	Agua variant and Belen variant soils	22
10-1	Bs	Brazito very fine sandy loam, thick surface	>60
10-2	Bs	Brazito very fine sandy loam, thick surface	>60
10-3	Bs	Brazito very fine sandy loam, thick surface	>60
10-4	Br	Brazito loamy fine sand	>60
10-5	Ao	Anapra clay loam	>60
17-1	Br	Brazito loamy fine sand	47
17-2	Bs	Brazito very fine sandy loam, thick surface	48
17-3	Br	Brazito loamy fine sand	>60
18-1	AJ	Agua variant soils, moderately wet	42
18-2	AJ	Agua variant soils, moderately wet	42
18-3	AJ	Agua variant soils, moderately wet	27
18-4	AJ	Agua variant soils, moderately wet	27
18-5	AJ	Agua variant soils, moderately wet	27
18-6	AJ	Agua variant soils, moderately wet	27
19-1	Br	Brazito loamy fine sand	49

Site No. – Boring No.	Map Unit Symbol	Map Unit Name	Water Table Depth (in)
19-2	Br	Brazito loamy fine sand	>60
19-3	Br	Brazito loamy fine sand	52
19-4	Br	Brazito loamy fine sand	<60 (hole collapsed)
20-1	AJ	Agua variant soils, moderately wet	33
20-2	AJ	Agua variant soils, moderately wet	42
20-3	AJ	Agua variant soils, moderately wet	30
20-4	AJ	Agua variant soils, moderately wet	25
20-5	AJ	Agua variant soils, moderately wet	20
20-6	AJ	Agua variant soils, moderately wet	46
20-7	AJ	Agua variant soils, moderately wet	37
20-8	AJ	Agua variant soils, moderately wet	32
21-1	Br	Brazito loamy fine sand	42
21-2	Br	Brazito loamy fine sand	42
21-3	Br	Brazito loamy fine sand	42
22-1	AJ	Agua variant soils, moderately wet	47
22-2	AJ	Agua variant soils, moderately wet	45
22-3	AJ	Agua variant soils, moderately wet	23
22-4	AJ	Agua variant soils, moderately wet	50
23-1	AJ	Agua variant soils, moderately wet	42
23-2	AJ	Agua variant soils, moderately wet	42

Site No. – Boring No.	Map Unit Symbol	Map Unit Name	Water Table Depth (in)
23-3	AJ	Agua variant soils, moderately wet	44
24-1	AJ	Agua variant soils, moderately wet	24
24-2	AJ	Agua variant soils, moderately wet	17
24-3	AJ	Agua variant soils, moderately wet	17
24-4	AJ	Agua variant soils, moderately wet	20
24-5	AJ	Agua variant soils, moderately wet	24
24-6	AJ	Agua variant soils, moderately wet	24
25-1	AJ	Agua variant soils, moderately wet	28
25-2	AJ	Agua variant soils, moderately wet	32
25-3	AJ	Agua variant soils, moderately wet	29
26-1	AJ	Agua variant soils, moderately wet	30
26-2	AJ	Agua variant soils, moderately wet	30
26-3	AJ	Agua variant soils, moderately wet	40
27-1	AK	Agua variant and Belen variant soils	31
27-2	AK	Agua variant and Belen variant soils	28
27-3	AK	Agua variant and Belen variant soils	28
27-4	AK	Agua variant and Belen variant soils	42
27-5	AK	Agua variant and Belen variant soils	30
27-6	AK	Agua variant and Belen variant soils	>60
27-7	AK	Agua variant and Belen variant soils	19

Site No. – Boring No.	Map Unit Symbol	Map Unit Name	Water Table Depth (in)
27-8	AK	Agua variant and Belen variant soils	30
28-1	AJ	Agua variant soils, moderately wet	54
28-2	AJ	Agua variant soils, moderately wet	60
28-3	AJ	Agua variant soils, moderately wet	32
28-4	AJ	Agua variant soils, moderately wet	42
28-5	AJ	Agua variant soils, moderately wet	36
29-1	AJ	Agua variant soils, moderately wet	40
29-2	AJ	Agua variant soils, moderately wet	>60
29-3	AJ	Agua variant soils, moderately wet	50
29-4	AJ	Agua variant soils, moderately wet	40
29-5	AJ	Agua variant soils, moderately wet	39
30-1	AJ	Agua variant soils, moderately wet	47
30-2	AJ	Agua variant soils, moderately wet	61
30-3	AJ	Agua variant soils, moderately wet	34
30-4	AJ	Agua variant soils, moderately wet	46

Source: TRC, August 2010

#### 4.2 GROUNDWATER AT THE RESTORATION SITES

As part of the soils survey, groundwater depths were noted at each boring, if encountered. Additional groundwater information from published sources was investigated, but it was inadequate to provide any supplemental information on the individual sites. Depths to groundwater at each soil boring are presented in Table 4-2. These observations were made in June and July 2010. Groundwater depths could be different at different times in response to drought or other hydrologic conditions.

In summary, average groundwater depth was greater than five feet at Sites 3, 5, 8, and 10 and less than five feet at all other sites. Depths ranged from four to greater than five feet at Site 19. (TRC, October 2010)

## 5.0 RESTORATION PLANTINGS

Most of the restoration sites are proposed to have exotic vegetation removed and native plantings done, primarily to enhance terrestrial wildlife habitat for various species, including WIFL and YBCU.

Guidelines for cutting and planting tree poles/whips and shrubs in riparian areas of the arid Southwest are available from the NRCS Los Lunas Plant Materials Center, Los Lunas, NM <http://plant-materials.nrcs.usda.gov/nmpmc/>. The Center has provided the Southwest with plant solutions for over 70 years, developing new vegetative methods for improving rangeland, native landscaping, riparian restoration, wildlife habitat enhancement, native shrub transplanting, and mine reclamation. The Center has also developed "longstem" container-grown shrubs to facilitate deep planting. Longstem shrubs are recommended for all restoration sites except those with a very shallow depth to the water table (NRCS, undated).

Additional information on Planting Pole Cuttings in Riparian Ecosystems is available from the Arizona Cooperative Extension <http://ag.arizona.edu/pubs/natresources/az1191.pdf> (Schalau, 2010).

### 5.1 SPECIES

According to the Conceptual Restoration Plan (USACE, 2009), the primary desired species are:

- Goodding willow (*Salix gooddingii*)
- Coyote or narrowleaf willow (*Salix exigua*)
- "Longstem" riparian shrubs: coyote willow, seep-willow (*Baccharis salicifolia*), skunkbush sumac (*Rhus trilobata*), pale wolfberry (*Lycium pallidum*), four-wing saltbush (*Atriplex canescens*), screwbean mesquite (*Prosopis pubescens*), etc.
- Rio Grande/Fremont cottonwood (*Populus deltoides* var. *wislizeni*/ *Populus fremontii*)
- Grasses and forbs (alkali sacaton (*Sporobolus airoides*), sand dropseed (*S. cryptandrus*), vine mesquite (*Panicum obtusum*), sunflowers (*Helianthus* spp.), asters (*Aster* spp.), inland saltgrass (*Distichlis spicata* var. *spicata*))

The groundwater and soil conditions desirable or tolerable for these species are summarized below (Horton, *et al*, 2001; Parametrix, 2008; Siegle and Reed, 2007; Stromberg, 1993; Stromberg and Paradzick, 2005; Taylor, undated; USACE, 2009).

#### Goodding Willow

- Moderate groundwater: 3.9 – 10.2 ft
- Sandy – clay loam soil

- Low-moderate salinity: <1.0 – 2.9 dS/m

#### Coyote Willow

- Shallow groundwater: <3-4 ft
- Sandy loam
- Low-moderate salinity: <1.0 – 2.9 dS/m

#### Longstem Riparian Shrubs

- Shallow groundwater: <3-4 ft; except pale wolfberry, four-wing saltbush, and screwbean mesquite (groundwater depth not a factor)
- Variable, mainly sandy loam
- “Salt-tolerant shrubs” such as four-wing saltbush and screwbean mesquite: wide range of soils from clays to sands, high lime or salt content tolerant

#### Cottonwood

- Moderate groundwater: 4.9 – 12.8 ft
- Adaptable: sand, sandy loam, medium loam, clay loam preferred; but also clay, caliche, gravelly
- Low-moderate salinity: <1.0 – 2.5 dS/m

#### Grasses and Forbs

- Wide range of conditions; some tolerate higher salinity
- Loamy and clay soils acceptable

## **5.2 SITE CONDITIONS**

The conditions at the restoration sites as discussed above are summarized below.

#### Soil Types at the Restoration Sites

- Agua variant (50%; Sites 1(S), 7, 18, 20-26, 28-30): loamy, sandy
- Brazito (40%; Sites 1(N), 3-6, 8, 10, 17, 19): sandy
- Belen variant (10%; Sites 9, 27): clayey, also intermixed with Agua variant soils
- Anapra (1%, Site 2): clay loam

#### Soil Salinity at the Restoration Sites

- No sites were dominated by salt-tolerant vegetation.
- Sites 9, 17, 27, and 30 had some elevated salinity levels.

#### Groundwater Depths at the Restoration Sites

- >5 ft avg: Sites 3, 5, 8, 10. Ranged from 4 to >5 at Site 19.
- <5 ft avg: all other sites

### 5.3 CONCLUSIONS

Based on the desired species, their needs, and the site conditions, the following conclusions were reached:

- All desired plants should have acceptable soil types at all sites with the possible exception of portions of Sites 2, 9, and 27.
- Sites 9 and 27 have higher clay content soils (Belen variant) and may be limited to selected shrubs, cottonwood, and grasses. However, the intermixing of Agua variant soils would make selected locations within the sites suitable for willows and other plants, but the level of detail in the mapping does not make it possible to plan this. Some variable plantings are used in different portions of these sites, such as along the banks and in areas where higher salinity was measured.
- Site 2 may not be suitable for coyote willow, but should be suitable for Goodding willow, cottonwood, selected shrubs, and grasses.
- Sites 3, 5, 8, 10, and possibly 19 with deeper yet unknown groundwater depth are not suitable for coyote willow, and it is uncertain whether they are suitable for the other trees and shrubs, although they will likely be suitable for grasses. However, these sites excluding 19 are targeted primarily for aquatic habitat, and no significant plantings are planned at this time. Site 19 will be suitable with supplemental irrigation, which is planned.

### 6.0 CHANGES FROM CONCEPTUAL PLANS

Based on the site-specific data acquired and decisions made by USIBWC, selected changes were made to some of the individual site plans from the Conceptual Site Plan (USACE, 2009).

All sites with bank destabilization have been specified to be graded with a 4:1 slope over 25 ft, or a drop of about 6 ft over 25 ft. Simply removing 0.5 ft as suggested leaves steep banks several feet high next to the water virtually unchanged.

Supplemental irrigation at most sites has been deleted (excluding 19-Clark Lateral). The groundwater survey indicated groundwater is shallow enough to support the desired species in most cases. It is unknown how much this will vary seasonally, and some reduced survival would be expected, particularly if there is an extended drought. However, plantings are fairly dense in most places. Supplemental irrigation requires additional cost to install and maintain. Moreover, some sites were to have extensive excavation/bank lowering in order to facilitate gravity flow of irrigation water. This represents a large amount of soil excavation and expense that would not be necessary if irrigation was not required.

Changes at individual sites are outlined below.

#### Site 1 – Trujillo

- Eliminated irrigation, as groundwater is shallow enough to support vegetation.

- Remove bank destabilization material (approx. 650 cubic yard (CY)) from floodplain to avoid placing in river.
- Noted yellow-billed cuckoo habitat and seasonal restriction on activities.

#### Site 2 – Jaralosa

- Moved bank destabilization downstream of historic bridge to avoid impacts to bridge.
- Remove bank destabilization material (approx. 650 CY) from floodplain to avoid placing in river.
- Eliminated irrigation, as groundwater is shallow enough to support vegetation.
- Substituted Goodding willow for coyote willow, as soil type may not support coyote willow.

#### Site 3 – Yeso Arroyo

- Changed disposal of riprap and bank destabilization material to be along the levee, as opposed to at the toe of the bank. Additional levee protection may be required in the future, and the presence of riprap in particular at this site should provide additional protection.

#### Site 4 – Yeso East

- Eliminated supplemental irrigation, as groundwater is shallow enough to support vegetation
- Eliminated excavation of 1 ft. over 3.3 ac. (approx. 5,300 CY), as it was proposed to facilitate irrigation
- Remove bank destabilization material (approx. 800 CY) from floodplain to avoid placing in river.

#### Site 5 – Yeso West

- Eliminated placement of excavated bank-lowering material at the toe of the bank and specified removal from the floodplain. This is approximately 6,000 CY of material, which would be an excessive amount to place in the river.

#### Site 8 – Placitas Arroyo

- Place bank cut-down material (approx. 1,000 CY) along toe of levee to avoid placing in river. This will also help reinforce the levee from the impact of arroyo floods as the channel meanders in the future.

#### Site 9 – Rincon Siphon

- Potential salt problems in northern corners of both tracts – salt-tolerant shrubs specified in these areas.

- Place bank cut-down material (approx. 40 CY) in former gravel pit adjacent to site to avoid placing in river.
- Noted southwestern willow flycatcher habitat and seasonal restriction on activities.
- Noted yellow-billed cuckoo habitat and seasonal restriction on activities.

Site 10 – Angostura Arroyo

- Place bank destabilization material along toe of levee to avoid placing in river. This will also help reinforce the levee from the impact of arroyo floods as the channel meanders in the future.

Site 11 – Lack Property

- Cut down approximately 4 acres of the site by 1 foot to provide additional borrow for construction of flood protection berm. This will also lower the depth to groundwater for the plantings in this area.

Site 15 – Selden Point Bar

- Goodding willow density reversed to be higher along bankline and lower in interior, in accordance with text (but as contradicted by the table) of conceptual plan and because of removal of higher density of salt cedar along bankline.

Site 16 – Bailey Point Bar

- Noted southwestern willow flycatcher habitat and seasonal restriction on activities.

Site 19 – Clark Lateral

- Establish 0.1% slope in swale carrying irrigation water.

Site 21 – Mesilla East

- Eliminated excavation of entire site (51,000 CY).
- Made vegetation grassland savanna with cottonwoods instead of dense riparian shrubs because of proximity to Mesilla dam.

Site 22 – Berino West

- Eliminated excavation of entire site (25,000 CY).
- Added selective extraction of salt cedars along the bank line.
- Eliminated coyote willows because of deeper groundwater. Added Goodding willow over entire site.
- Increased cottonwood density.
- Added grubbing entire site for salt cedar sprouts and noxious weeds.
- Added grass and forb seeding for entire site.

Site 23 – Berino East

- Eliminated excavation of entire site (20,000 CY).
- Added selective extraction of salt cedars along the bank line.

Site 24 – Vinton A

- Eliminated grass seeding. Site already has 100% coverage.

Site 25 – Vinton B

- Eliminated grass seeding. Site already has 100% coverage.

Site 26 – Valley Creek

- Created patches of coyote willow/longstem riparian shrub plantings at higher density.
- Noted protection of existing trail.

Site 27 – Nemexas Siphon

- Deleted extensive coyote willow planting throughout site, as soil type may not support it.
- Added coyote willows in 100-ft wide strip along bank.
- Increased density of cottonwoods, as soils will support it.
- Noted yellow-billed cuckoo habitat and seasonal restriction on activities.

Site 28 – Country Club East

- Created alternating zones of closed canopy forest and open woodland.
- Remove bank cut-down material (approx. 92 CY) from floodplain to avoid placing in river.

Site 29 – Sunland Park

- Noted southwestern willow flycatcher habitat and seasonal restriction on activities.
- Noted yellow-billed cuckoo habitat and seasonal restriction on activities.

## **7.0 FEDERAL PERMITTING REQUIREMENTS AND EXCAVATION**

Activities in waters of the U.S. below the ordinary high water mark are regulated by the U.S. Army Corps of Engineers (USACE) under Section 10 of the Rivers and Harbors Act for actions in navigable waters and Section 404 of the Clean Water Act for discharge of dredged or fill material. Section 404 activities also require water quality certification from the State under Section 401 of the Clean Water Act. At the restoration sites, the bank destabilization activities in particular would likely fall under USACE jurisdiction.

USACE Nationwide Permit (NWP) 27 – Aquatic Habitat Restoration, Establishment, and Enhancement Activities, authorizes activities in waters of the U.S. associated with the restoration, enhancement, and establishment of wetlands and riparian areas and the restoration and enhancement of non-tidal streams and other non-tidal open waters, provided those activities

result in net increases in aquatic resource functions and services. Some of the types of activities that are authorized under NWP 27 and that are to be performed at the USIBWC restoration sites include:

- Modifications of the stream bed and/or banks to restore or establish stream meanders
- Activities needed to reestablish vegetation
- Mechanized land clearing to remove non-native invasive, exotic, or nuisance vegetation
- Planting native plant species

The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity.

The bank destabilization, cuts, and bank lowering activities at selected sites will result in fill material that must be disposed of. At most of the sites, the estimated quantities are hundreds or thousands of cubic yards of soil.

Disposal of excavated waste material into the river along the foot of the bank was suggested in the Conceptual Restoration Plan as a possible option. However, the environmental impact of disposing of thousands of cubic yards of sediment in this manner would need to be evaluated prior to taking such an action. Informal consultation with the USACE Las Cruces, NM office indicated that NWP 27 probably would not apply for this disposal. In addition, a Section 401 Water Quality Certification from the State of New Mexico (or Texas) would be required.

The recommendation in most of the individual site implementation plans is that any excess excavated material is to be removed from the floodplain and taken to an upland location. At selected sites, specifically at Sites 3, 8, and 10, excess material is to be placed at the toe of the levee to shore up the levee. At those sites, bank destabilization is to be done across from where an arroyo enters the Rio Grande to allow future channel migration and meander formation. Additional levee protection is appropriate at these sites. The estimated amount of soil to be excavated and disposed of at each site is summarized in Table 7-1.

**Table 7-1. Excavation Quantities**

<b>Site Number</b>	<b>Site Name</b>	<b>Estimated Amount of Excavated Soil (bank cu. yd.)</b>
1	Trujillo	650
2	Jaralosa	650
3	Yeso Arroyo	700
4-5	Yeso East-West	6,700
8	Placitas Arroyo	1,000
9	Rincon Siphon A-B	120
10	Angostura Arroyo	1,000
11	Lack Property	6,600

Site Number	Site Name	Estimated Amount of Excavated Soil (bank cu. yd.)
15	Selden Point Bar	256
16	Bailey Point Bar	74
17	Shalem Colony	0
19	Clark Lateral	0
21	Mesilla East	0
22	Berino West	0
23	Berino East	0
24	Vinton A	0
25	Vinton B	0
26	Valley Creek	0
27	Nemexas Siphon	60
28	Country Club East	92
29	Sunland Park	0
30	Anapara Bridge	0
Total Amount of Excavated Soil		17,900

## 8.0 BRUSH REMOVAL AND DISPOSAL

### 8.1 REMOVAL

Most sites require some brush removal, particularly exotic vegetation such as salt cedar. Clearing methods could include:

- Cutting to ground level and treating the stumps with herbicide, such as Garlon® (triclopyr) applied from a backpack sprayer to the exposed cut. These techniques must be performed during late August and September so that herbicide is drawn into the root system of the plants. It is essential to remove or kill the subsurface root crown of salt cedar to prevent resprouting. (Baldwin, 1996)
- Future spot treatments for re-vegetation of non-desirable plants can also be done using the herbicide.
- Selective extraction, such as with a backhoe. Use of a hydraulic thumb attachment to the backhoe arm is efficient in removing selected trees and root crowns with less soil disturbance.
- Stands of large, dense salt cedar can be cleared with a scraper or bulldozer, followed by root plowing to remove the root crown.

## 8.2 DISPOSAL

The recommended method to be used at most sites is to mulch the vegetation with a wood shredder or large whole tree chipper. The resulting mulch can be spread around the bases of the trees and shrubs to be planted. Additional mulch will likely have to be imported to have adequate material for all the plantings. This method will allow recycling of the waste brush and a beneficial use on site.

Alternately, at restoration sites with minor vegetation removal, small piles of woody material can be left onsite to serve as cover for reptiles, birds, and small mammals.

At sites with larger amounts of brush, the material could be burned on site at most locations during times when burn bans are not in place. The cities of El Paso and Las Cruces, and Sierra County, NM, do not allow open burning of brush for this purpose. In other locations (primarily in Doña Ana County, NM), burning may be done when conditions are appropriate. Doña Ana County's rules for open burns are as follows:

1. Prior to commencement of open burning, Mesilla Valley Regional Dispatch Authority (Central Dispatch) shall be notified. (575) 526-0795
2. Open burning of non-piled vegetative material for purposes of disposal of such material, shall not exceed ten acres per day, or burning of piled vegetative material, including material gathered in a pit or open container, does not exceed one thousand cubic feet of pile volume per day.
3. Burning shall be conducted at least three hundred feet from any occupied dwelling, workplace, or place where people congregate, which is on property owned by, or under possessory control of, another person.
4. Burning shall begin no earlier than one hour after sunrise, and shall be extinguished no later than one hour before sunset.
5. Burning shall be attended at all times.

One alternative to open burning is a containerized air-curtain burner. At locations where burning is not allowed, brush must be hauled off to a landfill or recycling/composting facility. The nearest landfill that accepts brush is Camino Real Landfill, 1000 Camino Real Blvd., Sunland Park, NM 88063.

Exact quantities of brush to be cleared and disposed of cannot be determined. Table 8-1 lists relative amounts of brush to be cleared at each site and disposal options (other than the recommended method of chipping on site).

**Table 8-1. Brush Clearing and Disposal**

Site	Level of Cleared Brush	>300' From Dwelling	Burned/ Hauled Off	Comments
1-Trujillo	Med-High	Yes	Hauled	Small group structures about 380' W of site; Sierra Co. does not allow burning
2-Jaralosa	Low	Yes	Burned	Two structures 500' and 600' E of the site
3-Yeso Arroyo	Low	No	Burned	Structures 200' N of site; burning can be done on E side of site
4-Yeso East	Low	Yes	Burned	Structure 530' E of site
5-Yeso West	High	Yes	Burned	
8-Placitas Arroyo	Medium	Yes	Burned	Structures 320' SE and 500' S of site
9-Rincon Siphon A-B	High	Yes	Burned	Structure 600' SW of site A
10-Angostura Arroyo	Low-Med	Yes	Burned	Structures located 760' W and 820' S
11-Lack Property	High	Yes	Burned	
15-Selden Point Bar	High	Yes	Burned	Structure 350' SE of site; burning can be done on W side of site
16-Bailey Point Bar	High	No	Burned	Structures close to site on S; burning can be done in N part of the site
17-Shalem Colony	None		N/A	
19-Clark Lateral	Low	Yes	Burned	Structure 330' NE and structures N of site; burning can be done in SE part of site
21-Mesilla East	Low	Yes	Burned	Structure >1,000' W of site
22-Berino West	Low	Yes	Burned	Structures W of site
23-Berino East	Low	Yes	Burned	
24-Vinton A	Low	Yes	Burned	Structures >1,000' E and W of site
25-Vinton B	Low	Yes	Burned	Structures 530' east of site
26-Valley Creek	Low	No	Hauled	Many houses near site
27-Nemexas Siphon	High	Yes	Burned	Structure 330' W of site; houses N and E of site;
28-Country Club East	Low	No	Hauled	Many houses near site
29-Sunland Park	Low	No	Burned	Structure 230' E of site; burning can be done in NW corner of site

Note: The recommended method of brush disposal is on-site chipping. This table presents other options.

## 9.0 EVAPOTRANSPIRATION AND IRRIGATION ESTIMATES

### 9.1 EVAPOTRANSPIRATION

The proposed site conditions following implementation of the site plans will result in some differences in evapotranspiration (ET) water losses from the sites as compared to existing (pre-treatment) site conditions. Estimates of the post-treatment ET rates have been prepared based on the proposed changes to the restoration sites. For consistency, the ET rates for various vegetation communities used in this analysis are the same as those used in the Conceptual Restoration Plan as follows:

*The following ET rates were used for common habitat types:*

- *Dense shrubs (saltcedar and willow): 4.9 ft/yr*
- *Riparian forest: 4.8 ft/yr*
- *Riparian woodland: 3.4 ft/yr*
- *Grassland: 2.4 ft/yr*

*Interpolated values were sometimes used for plant communities with varying amounts of vegetation than in these typical types. Although the ET rate of a newly planted stand would be low and would increase with maturity, a constant rate was used in this analysis for simplicity. The change in consumptive use resulting from habitat restoration activities was calculated as the difference in rates between the existing and restored habitat types at each site. (USACE, 2009)*

Table 9-1 summarizes the differences in annual ET losses by site. There is an estimated average net increase in losses of 277 acre-feet per year over all the sites.

**Table 9-1. Evapotranspiration Losses**

Site	Area ac	Est. Post-Treatment ET Rate ft/yr	Pre-Treatment ET* ac-ft/yr	Post-Treatment ET ac-ft/yr	Difference ac-ft/yr
1-Trujillo	14	4.7	79.4	66.4	-13.0
2-Jaralosa	4.7	3.2	10.8	15.0	4.2
3-Yeso Arroyo	22.4	0.9	36.1	20.2	-15.9
4-Yeso East	9.7	3.5	23.3	34.3	11.0
5-Yeso West	1.7	2.4	12.3	4.1	-8.2
8-Placitas Arroyo	48.2	0.6	26	28.9	2.9
9-Rincon Siphon A-B	16.3	4.6	48.9	75.1	26.2
10-Angostura Arroyo	42.3	0.6	26.5	25.4	-1.1
11-Lack Property	51	4.9	163.2	249.9	86.7
15-Selden Point Bar	6.9	4.7	33.8	32.3	-1.5
16-Baily Point Bar	16.6	4.9	81.3	81.3	0.0

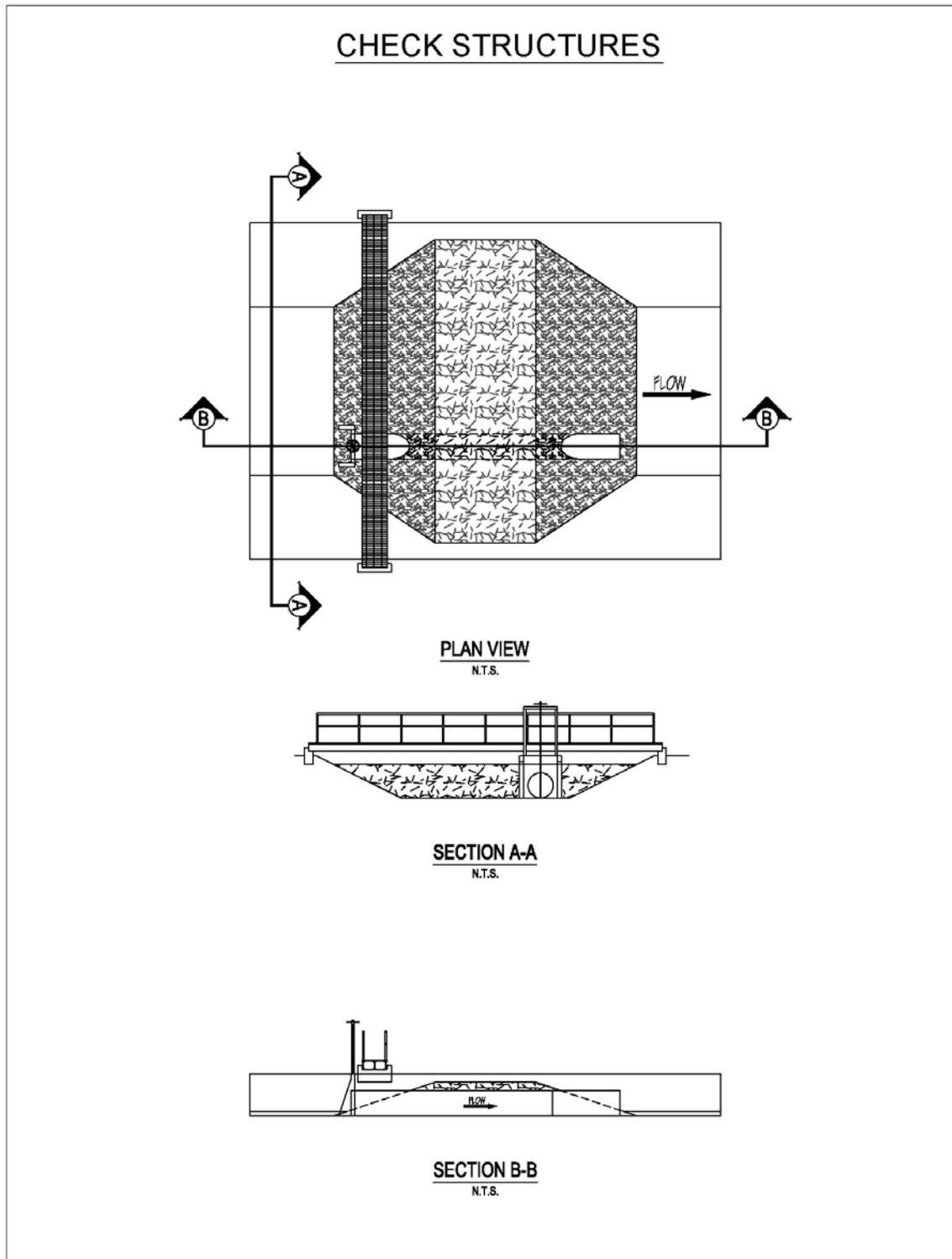
Site	Area ac	Est. Post-Treatment ET Rate ft/yr	Pre-Treatment ET* ac-ft/yr	Post-Treatment ET ac-ft/yr	Difference ac-ft/yr
17-Shalem Colony	14.2	3.4	41.9	48.3	6.4
19-Clark Lateral	6.1	4.5	14.4	27.5	13.1
21-Mesilla East	15.9	2.4	37.9	38.2	0.3
22-Berino West	10.3	2.9	24.7	29.9	5.2
23-Berino East	9.5	4.8	22.8	45.2	22.4
24-Vinton A	14.7	4.2	35.3	61.7	26.4
25-Vinton B	20	3.4	48	68.0	20.0
26-Valley Creek	22	3.5	49.9	77.7	27.8
27-Nemexas Siphon	16.7	4.3	81.8	71.5	-10.3
28-Country Club East	29	4.0	69.6	114.6	45.0
29-Sunland Park	28.8	3.4	69.1	97.9	28.8
TOTAL			1,037	1,314	277

\*Source: USACE, 2009

## 9.2 IRRIGATION

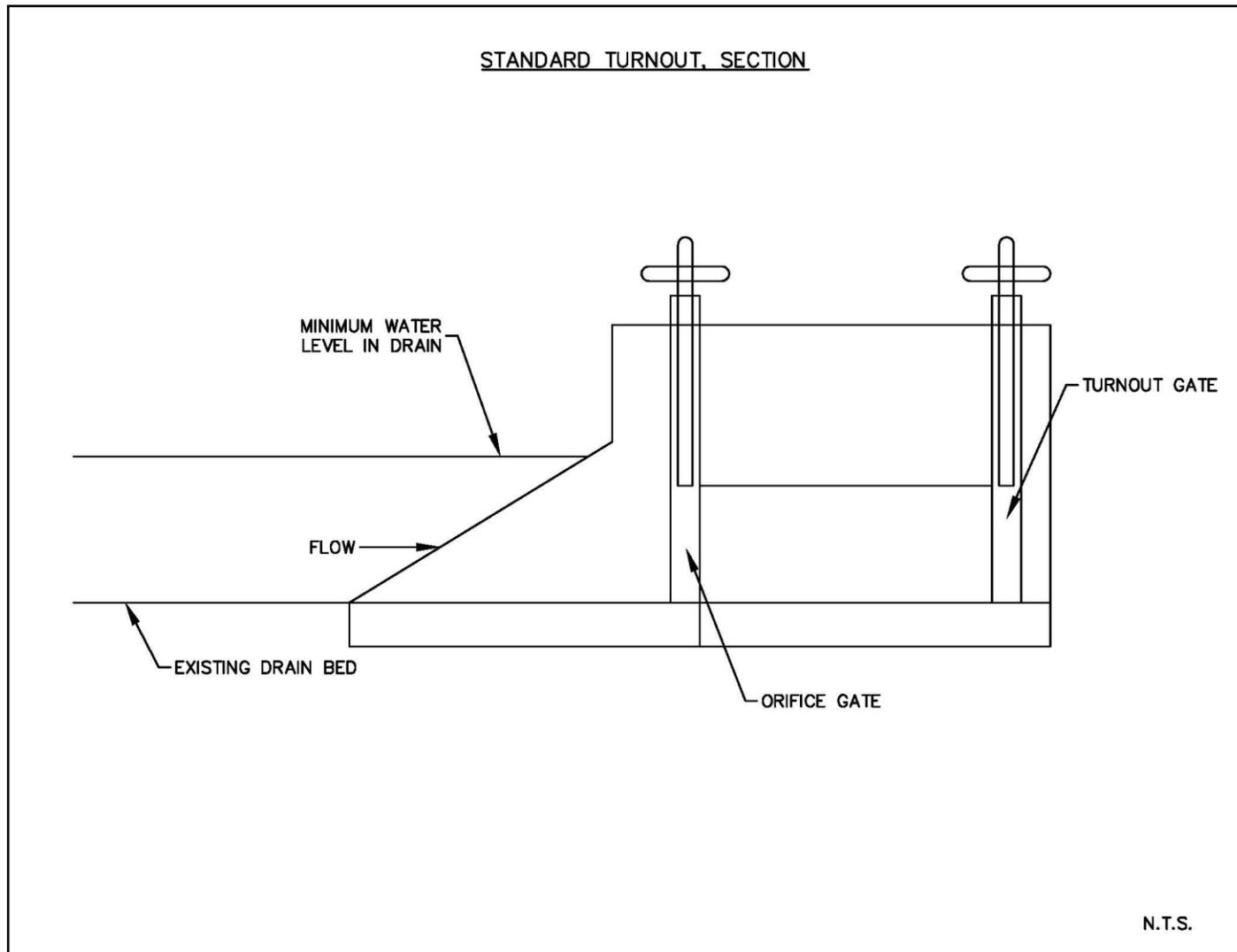
Site 19 – Clark Lateral is to have supplemental irrigation (see site plan, Appendix A). The site area is 6.1 acres. Groundwater depths may be too deep to sustain the target vegetation. Water would be diverted from the wasteway adjacent to the north side of the site with a check structure and standard irrigation turnout. The water would be conveyed via a grassed swale around the site. Excess water would be returned to the wasteway with a gated return. Details of these structures are shown in Figures 9-1, 9-2, and 9-3.

As shown in Table 9-1, the average supplemental water needs at this site are 13.1 acre-feet per year. During the first years and exceptionally dry years, the water needs would likely be higher.



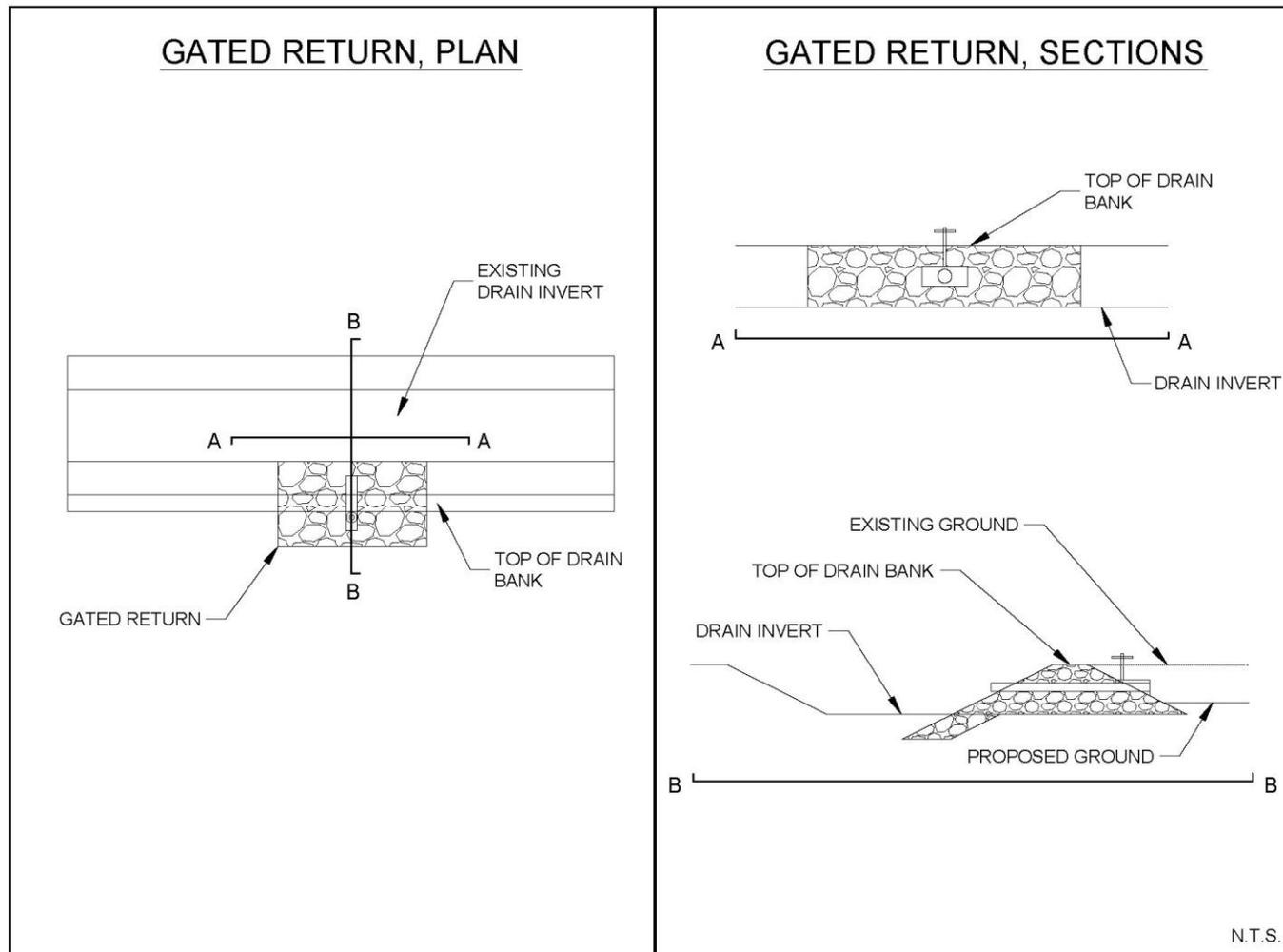
Source: Elephant Butte Irrigation District

**Figure 9-1. Check Structure**



Source: USACE, 2009

**Figure 9-2. Standard Irrigation Turnout**



Source: USACE, 2009

Figure 9-3. Gated Return

## 10.0 INDIVIDUAL SITE IMPLEMENTATION PLANS

Implementation plan sheets have been prepared for each individual site. These plans show the work to be conducted and estimated quantities at each site. The plans are presented in Appendix A.

## 11.0 COST ESTIMATES

Construction cost estimates have been prepared for the work at all restoration sites. In general, costs were estimated using the RS Means 2011 construction cost estimating guide (RS Means, 2011). Costs of plantings were taken from the Conceptual Restoration Plan (USACE, 2009) for consistency.

A summary of the estimated construction costs by site is presented in Table 11-1. The total estimated project construction cost is \$4.2 million. Appendix B presents individual worksheets for each site.

**Table 11-1. Summary of Estimated Construction Costs**

Site Number	Site Name	Total Site Cost
1	Trujillo	\$ 94,100
2	Jaralosa	\$ 56,400
3	Yeso Arroyo	\$ 9,700
4-5	Yeso East-West	\$ 135,000
8	Placitas Arroyo	\$ 14,200
9	Rincon Siphon A-B	\$ 237,000
10	Angostura Arroyo	\$ 13,800
11	Lack Property	\$ 822,000
15	Selden Point Bar	\$ 181,000
16	Bailey Point Bar	\$ 309,000
17	Shalem Colony	\$ -
19	Clark Lateral	\$ 203,000
21	Mesilla East	\$ 135,000
22	Berino West	\$ 130,000
23	Berino East	\$ 119,000
24	Vinton A	\$ 195,000
25	Vinton B	\$ 238,000
26	Valley Creek	\$ 246,000
27	Nemexas Siphon	\$ 261,000
28	Country Club East	\$ 393,000
29	Sunland Park	\$ 321,000
30	Anapara Bridge	\$ 73,000

Site Number	Site Name	Total Site Cost
Total Project Construction Cost		\$ 4,190,000

Maintenance cost will include the annual cost of irrigation water from the Elephant Butte Irrigation District (EBID). However, a water right must be obtained first through EBID’s suspension and transfer mechanism from someone who is no longer using their water right. According to EBID personnel, the estimated market price of a water right for EBID water is \$2,500-\$3,500. The annual operation and maintenance cost payable to EBID is \$80/acre (will be \$75/acre for 2012). This entitles a water right holder to an allotment from EBID. A “normal” year’s allotment is 3 acre-feet per acre, but in 2011, an exceptionally dry year, only 0.33 acre-feet per acre were allotted. Additional water needed would have to be made up from groundwater or other sources. Only Site 19 – Clark Lateral (6.1 acres) is to have supplemental irrigation.

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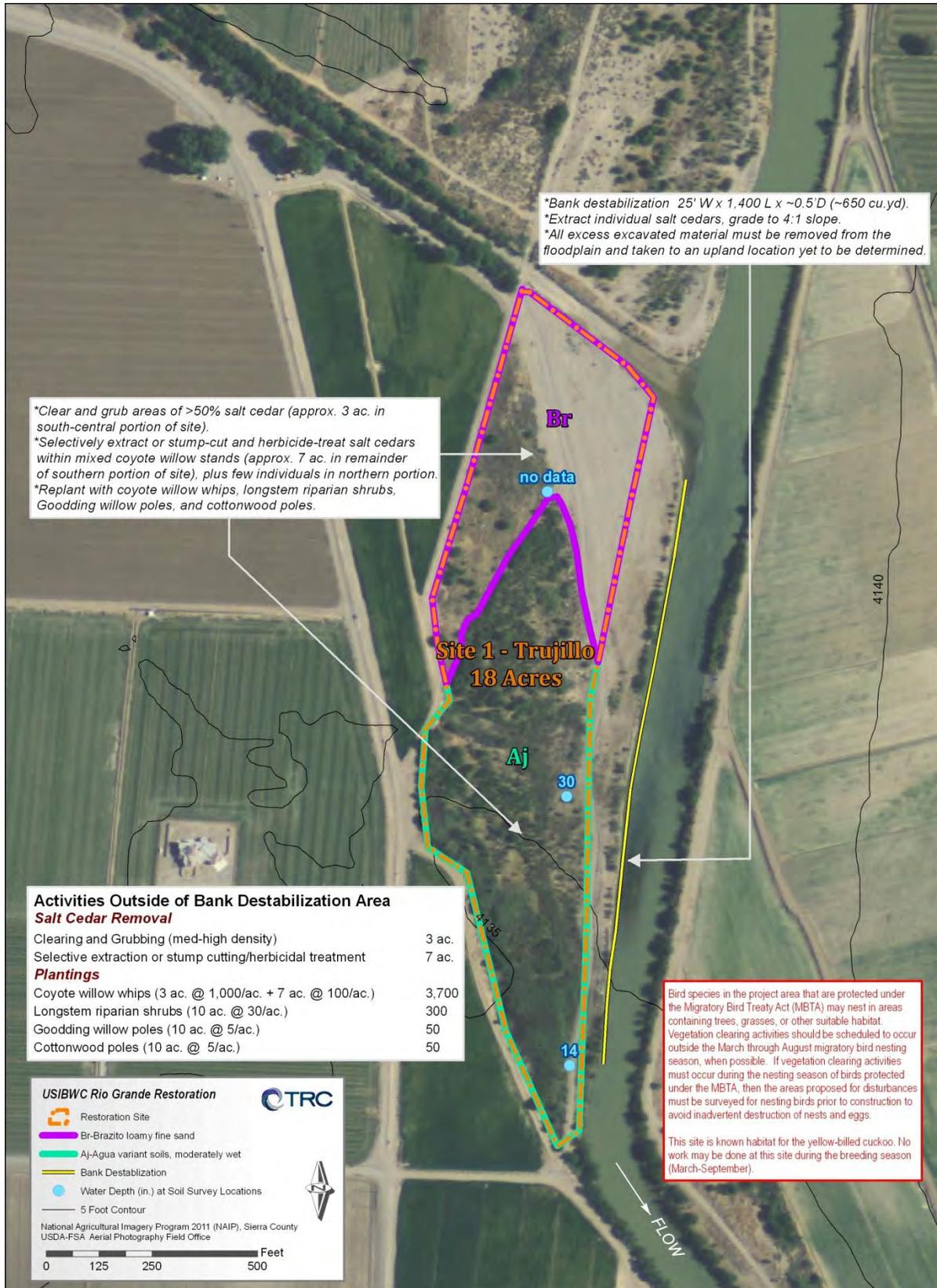
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**APPENDIX A**

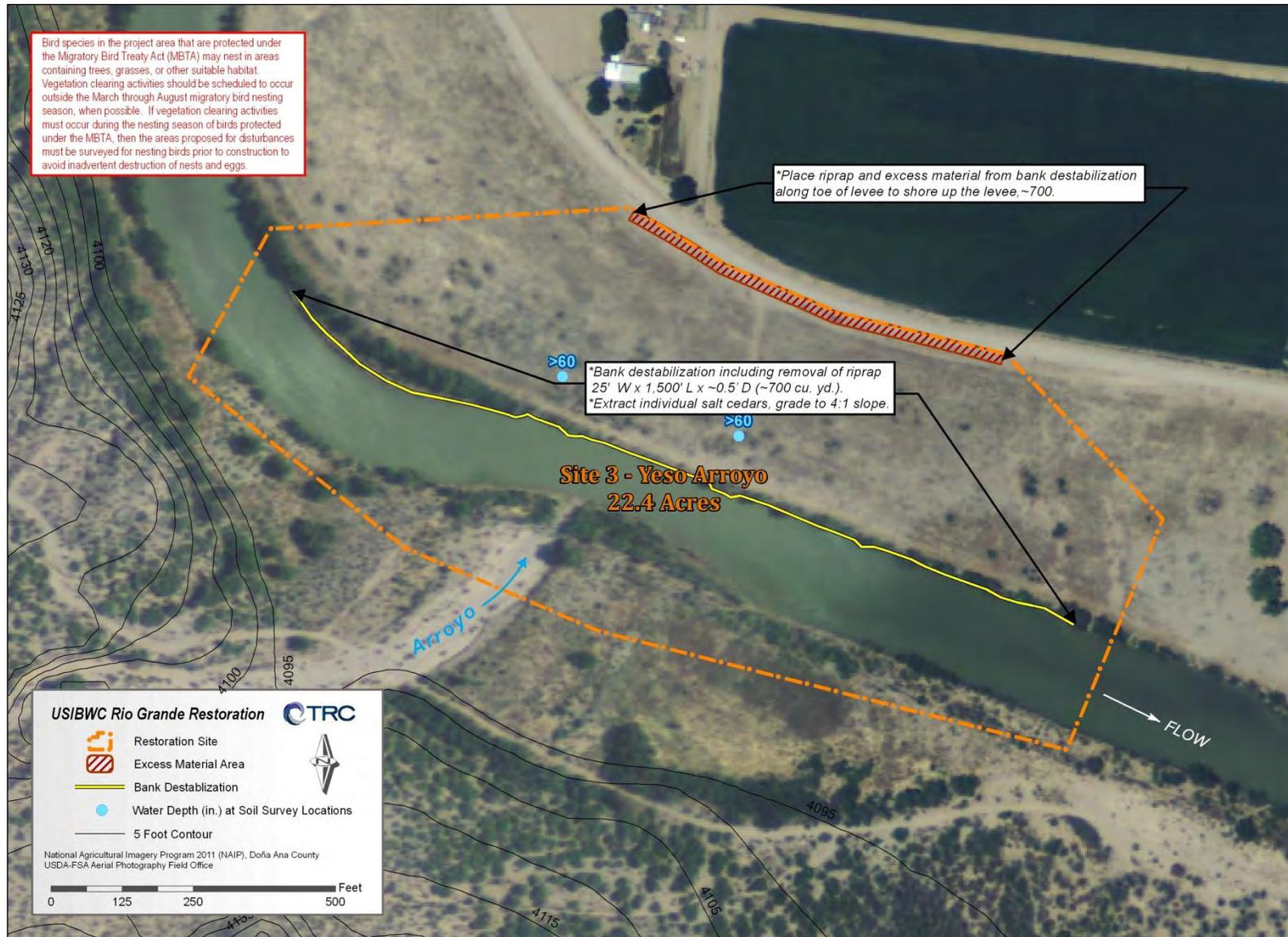
**INDIVIDUAL SITE IMPLEMENTATION PLANS**



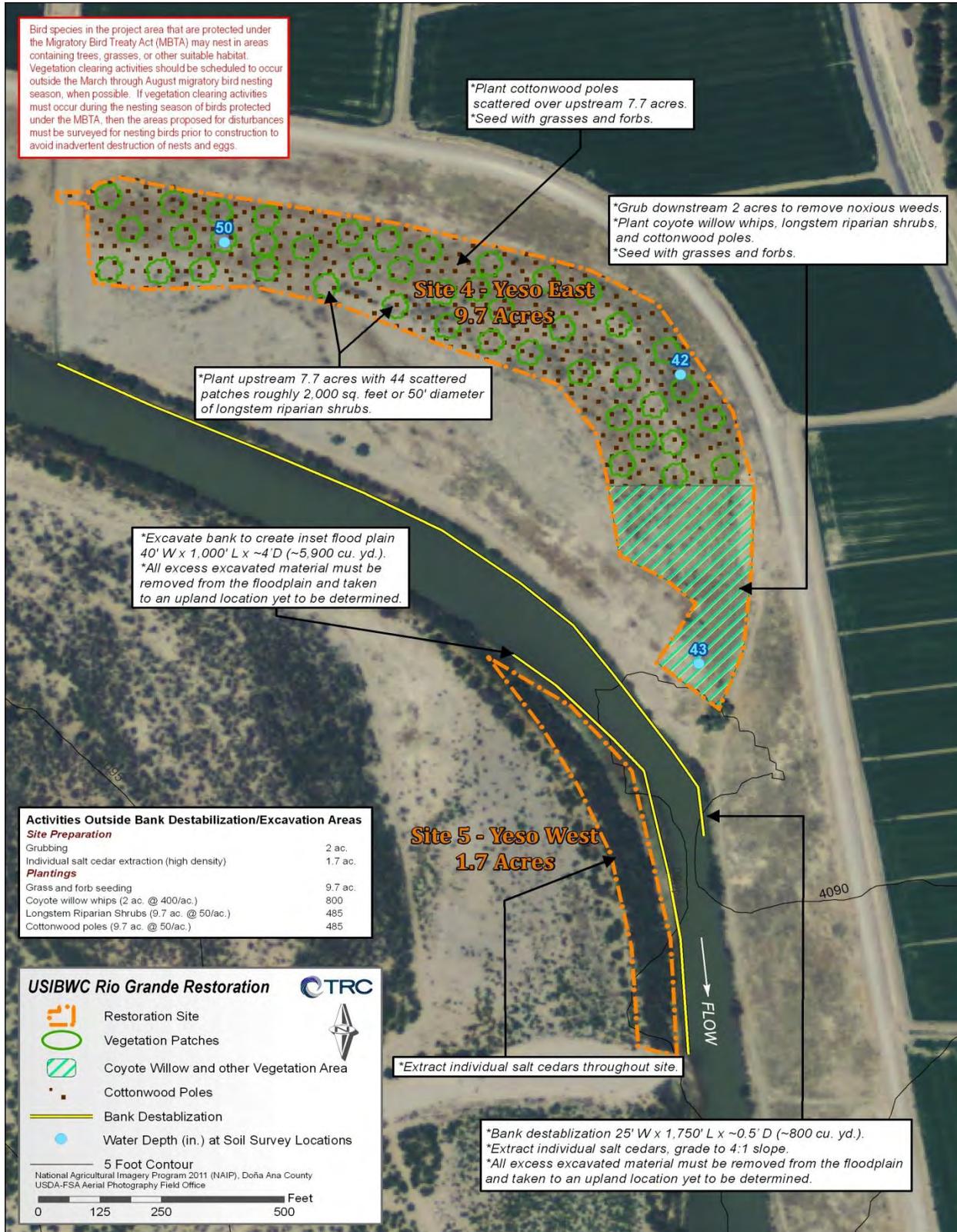
Site 1 – Trujillo



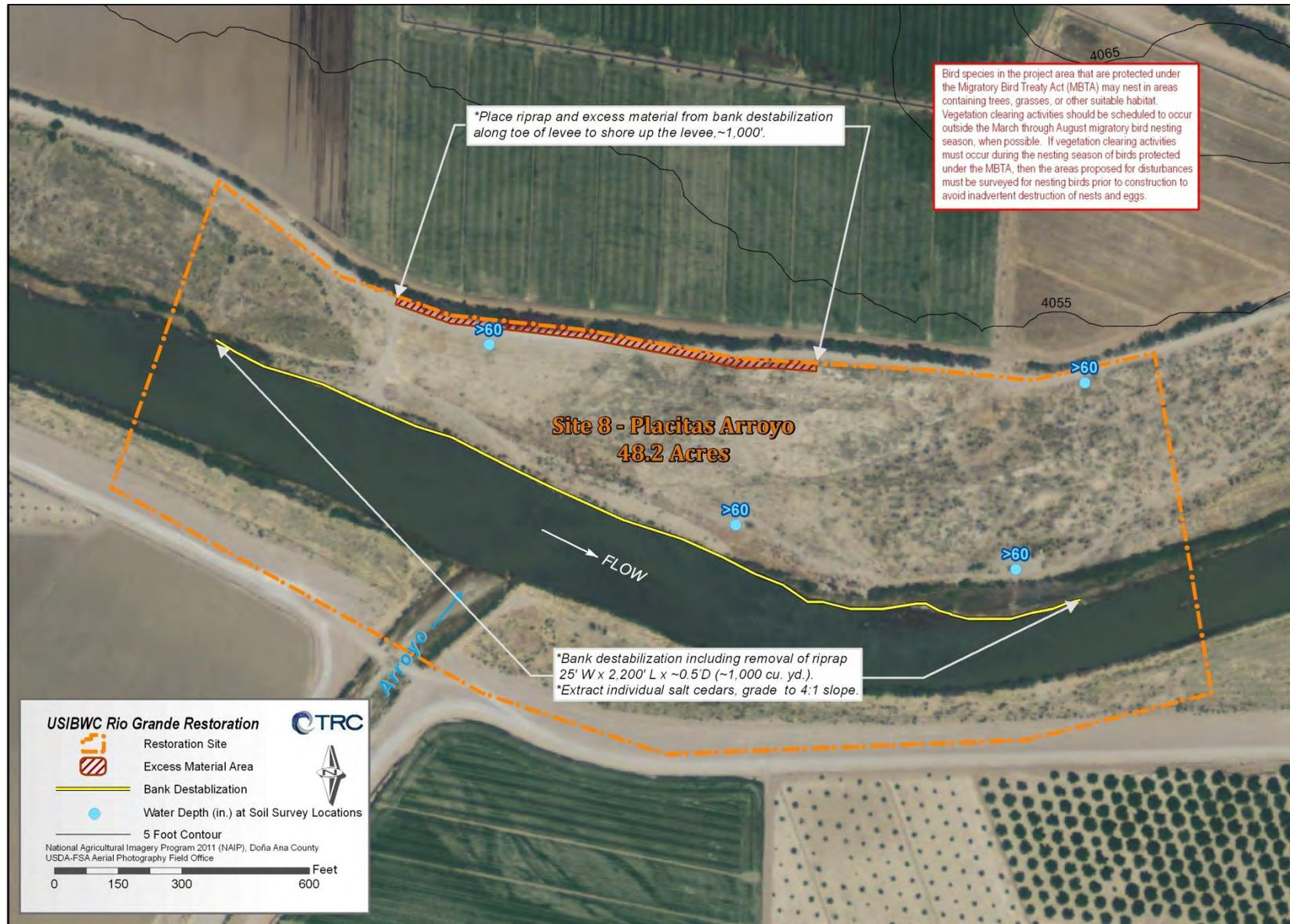
Site 2 – Jaralosa



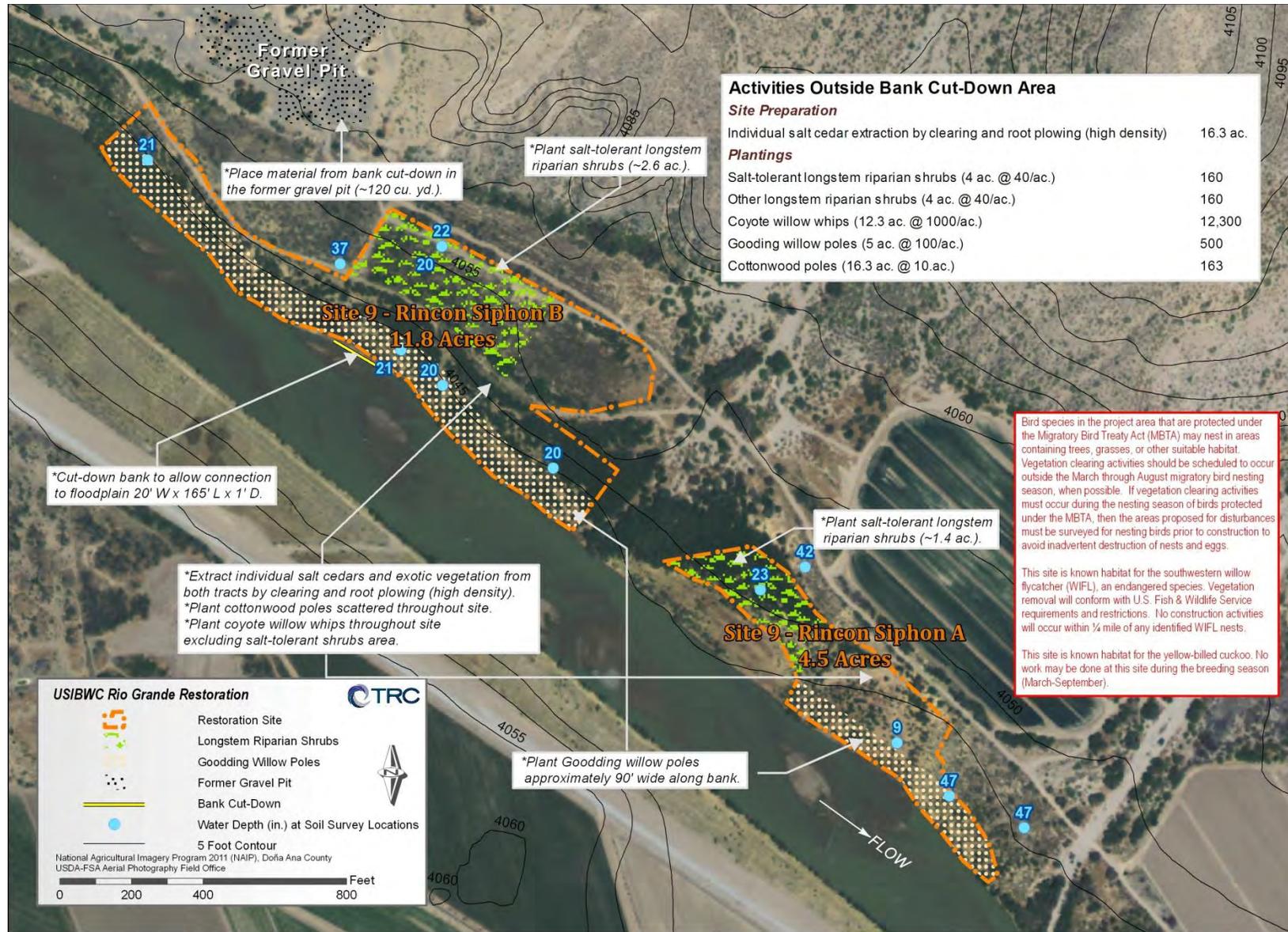
Site 3 – Yeso Arroyo



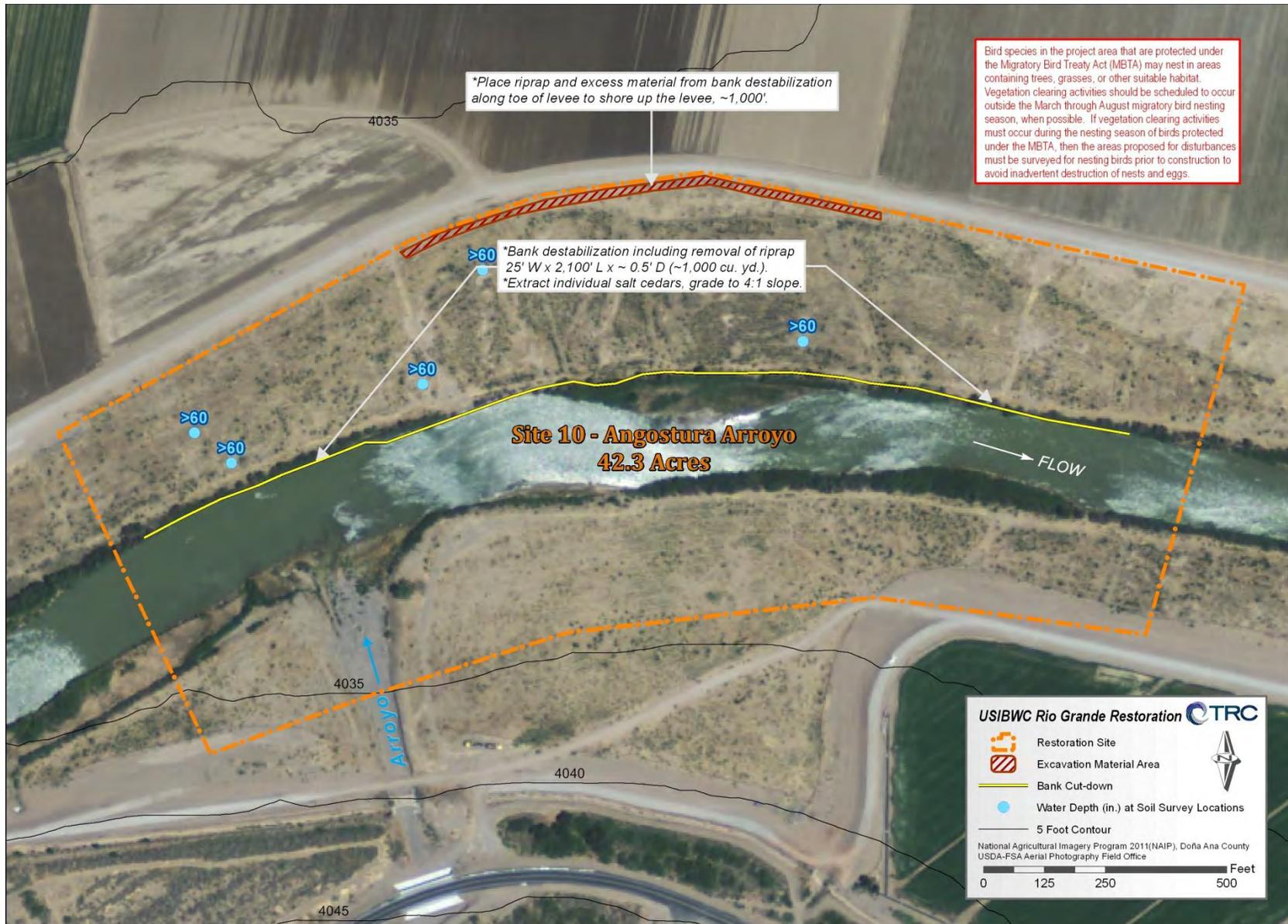
Sites 4 and 5 – Yeso East and Yeso West



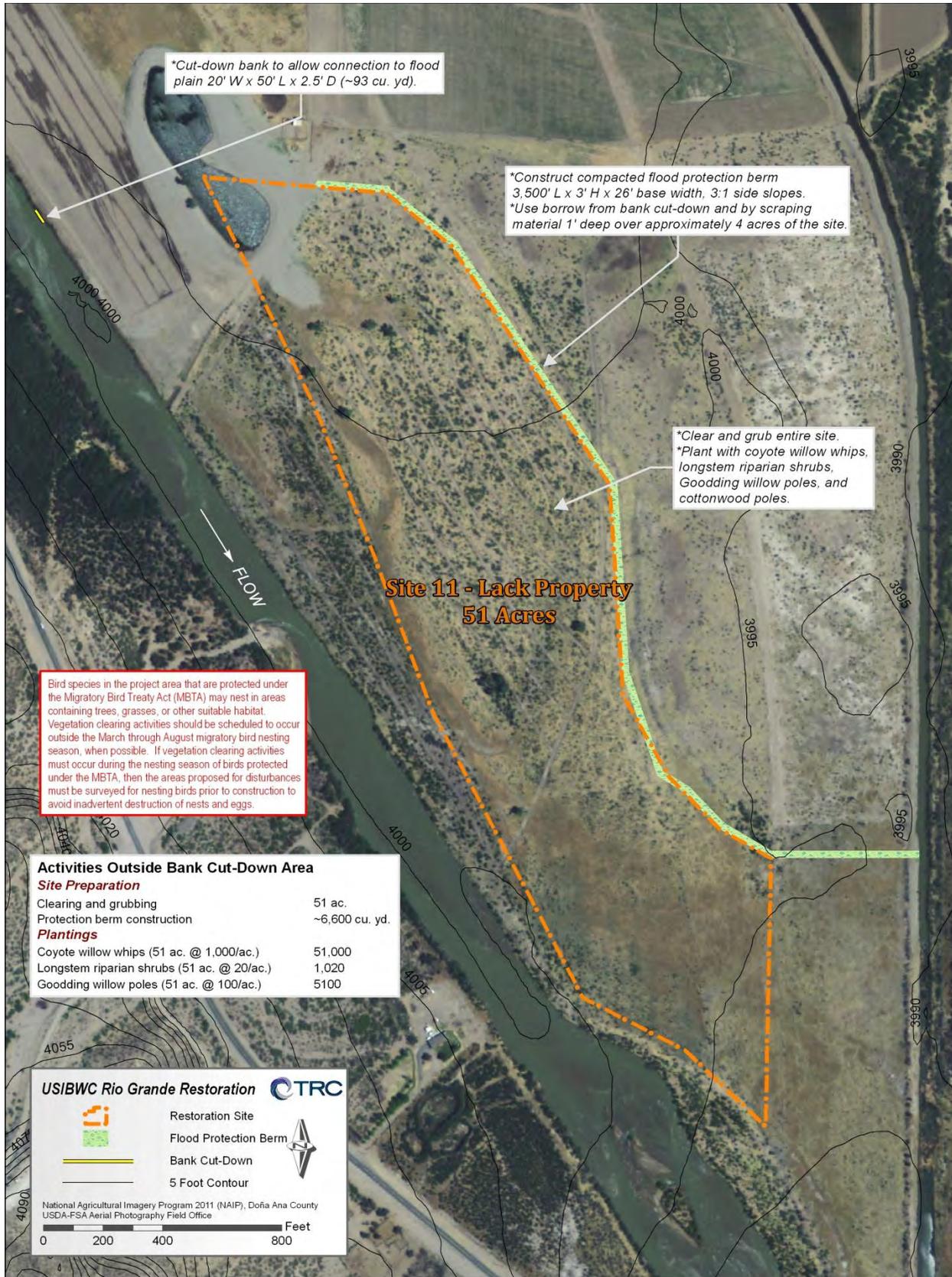
Site 8 – Placitas Arroyo



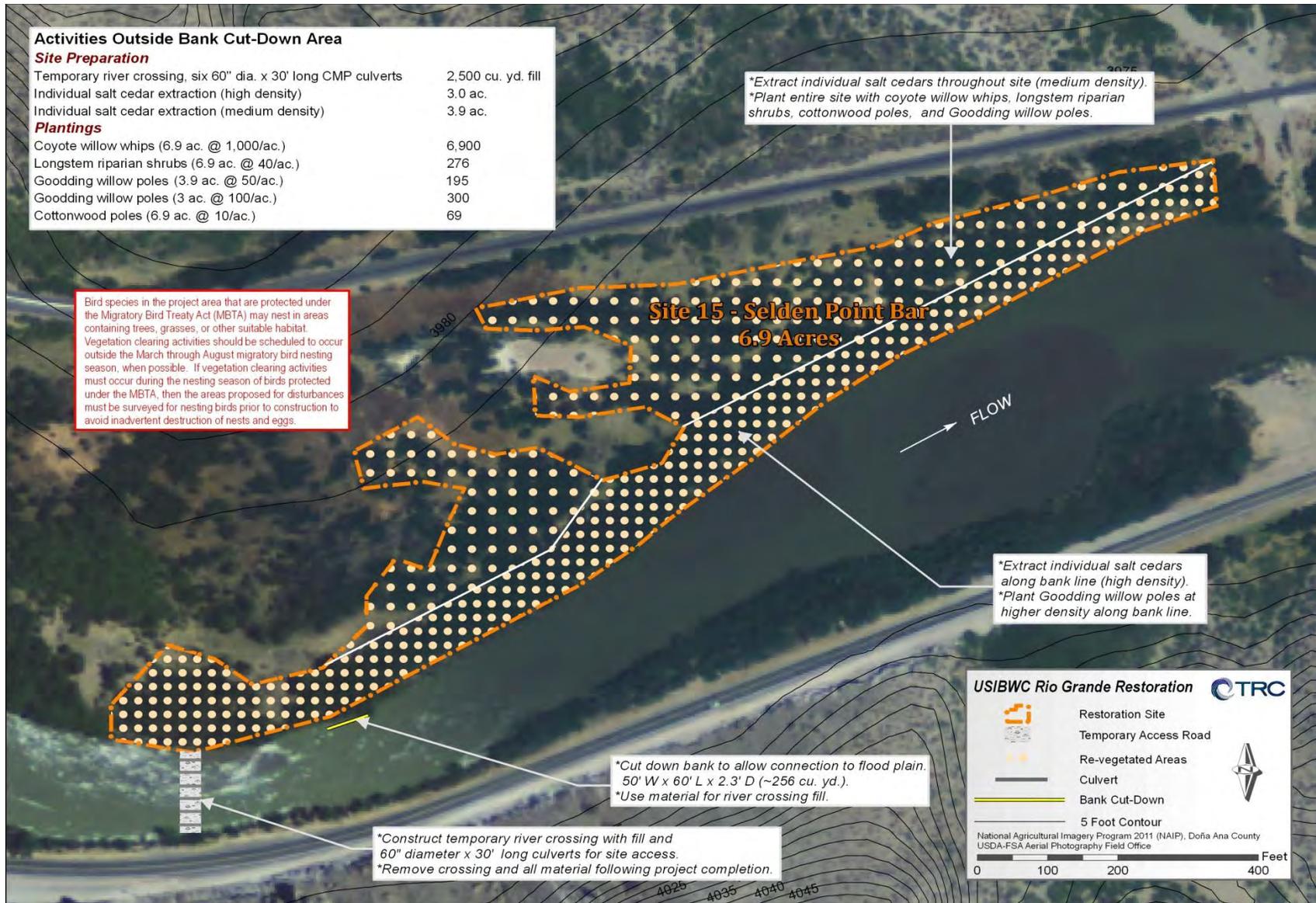
Site 9 – Rincon Siphon A and B



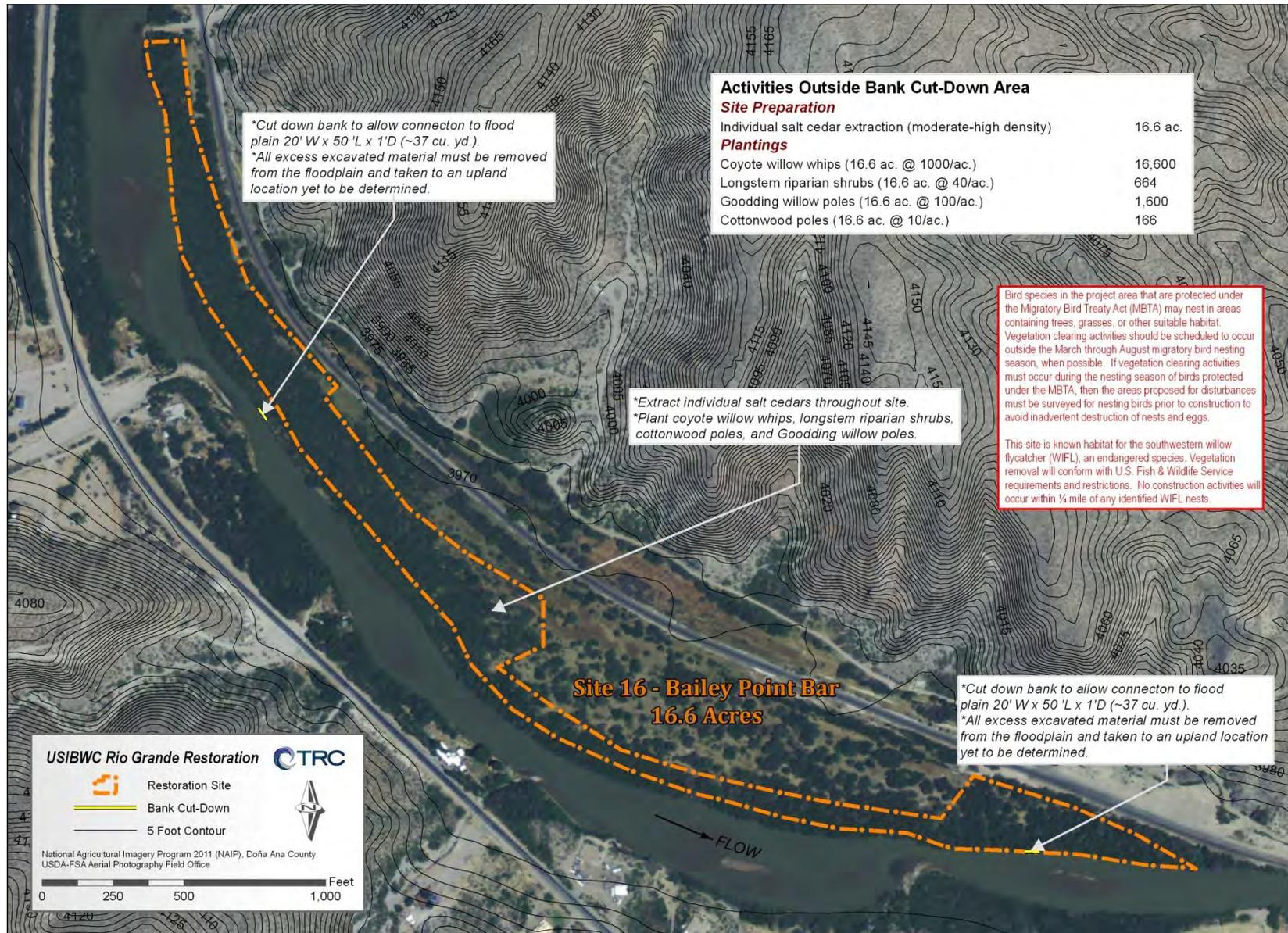
Site 10 – Angostura Arroyo



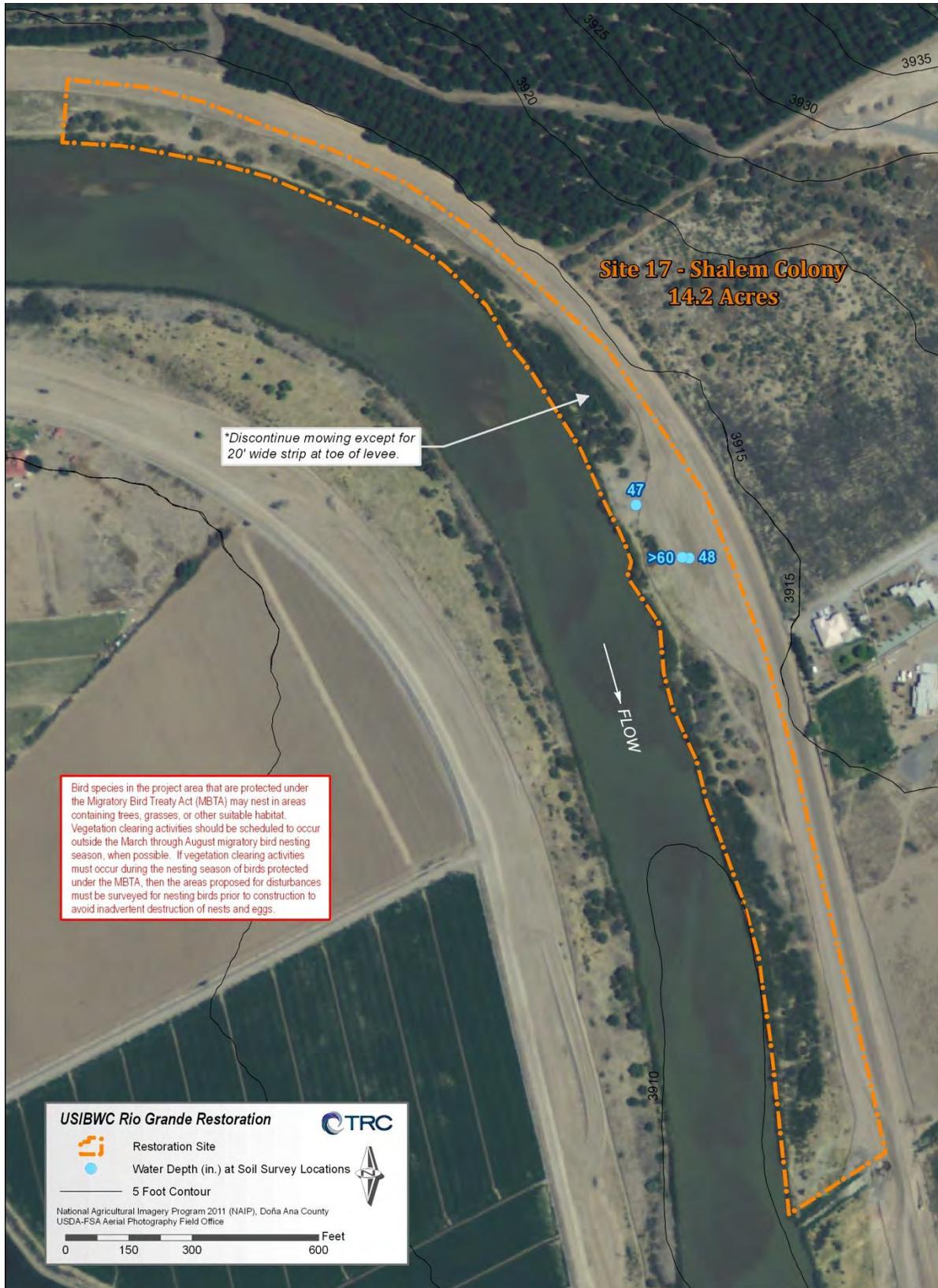
Site 11 – Lack Property



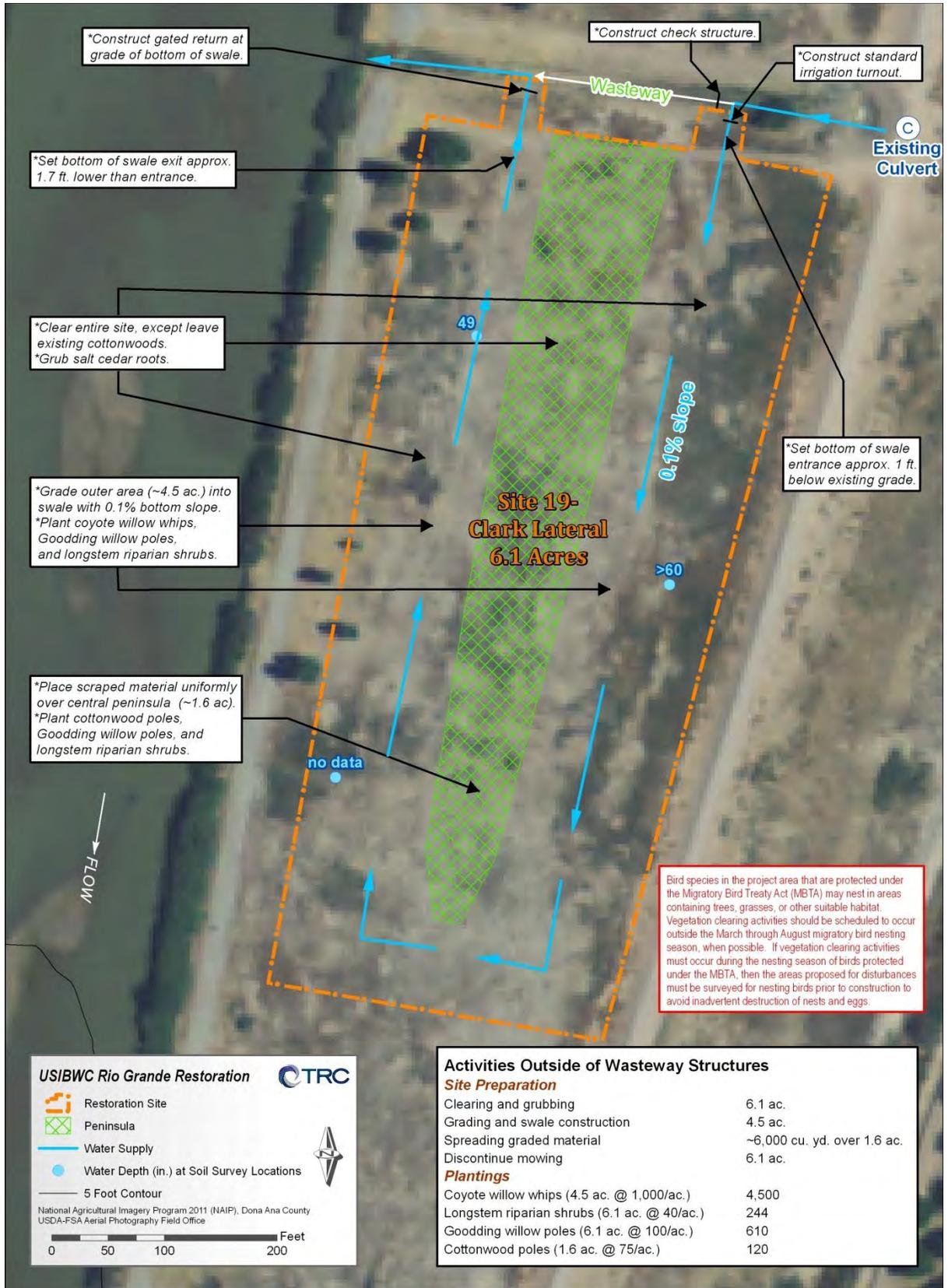
Site 15 – Selden Point Bar



Site 16 – Bailey Point Bar



Site 17 – Shalem Colony



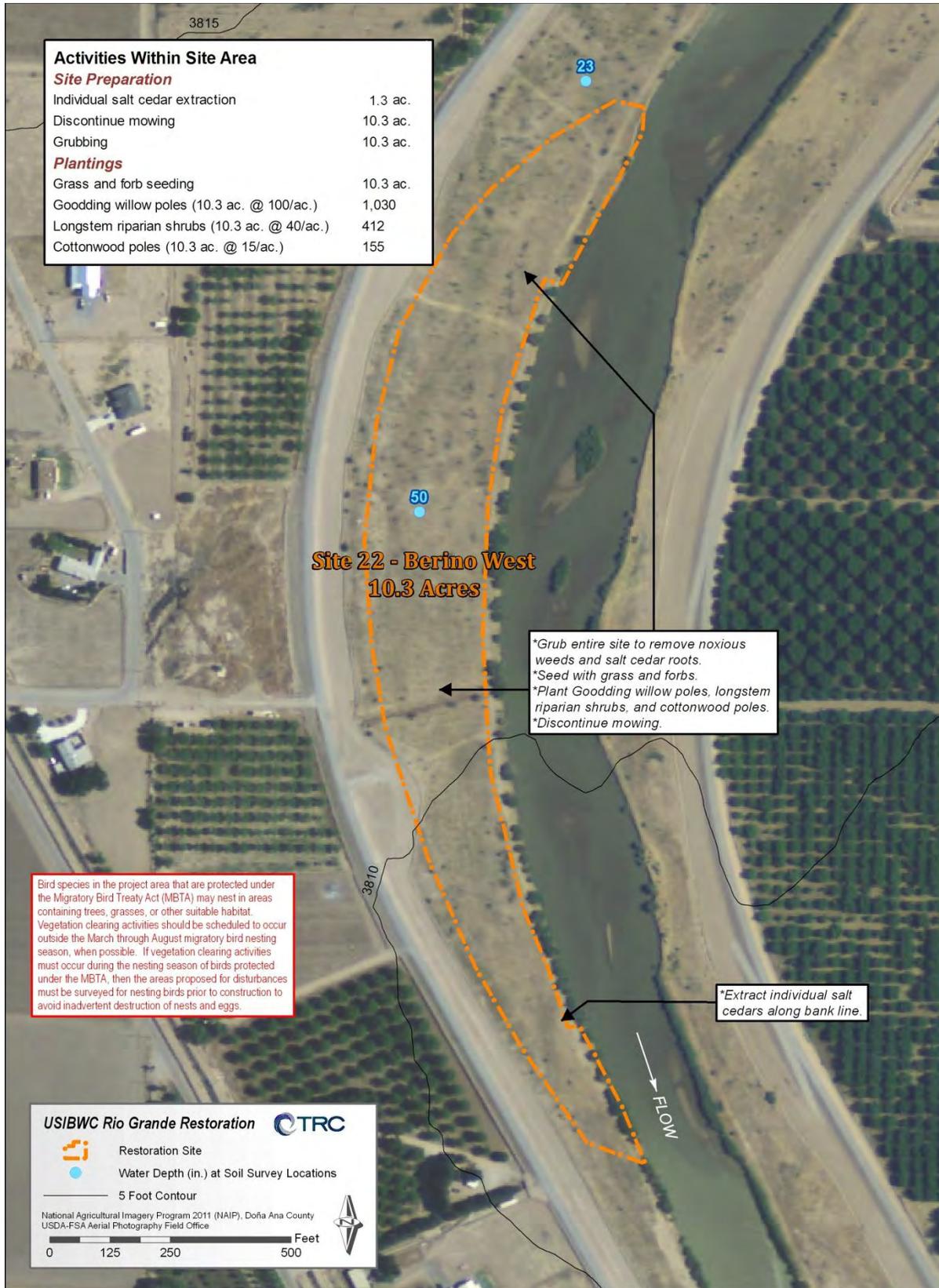
Site 19 – Clark Lateral



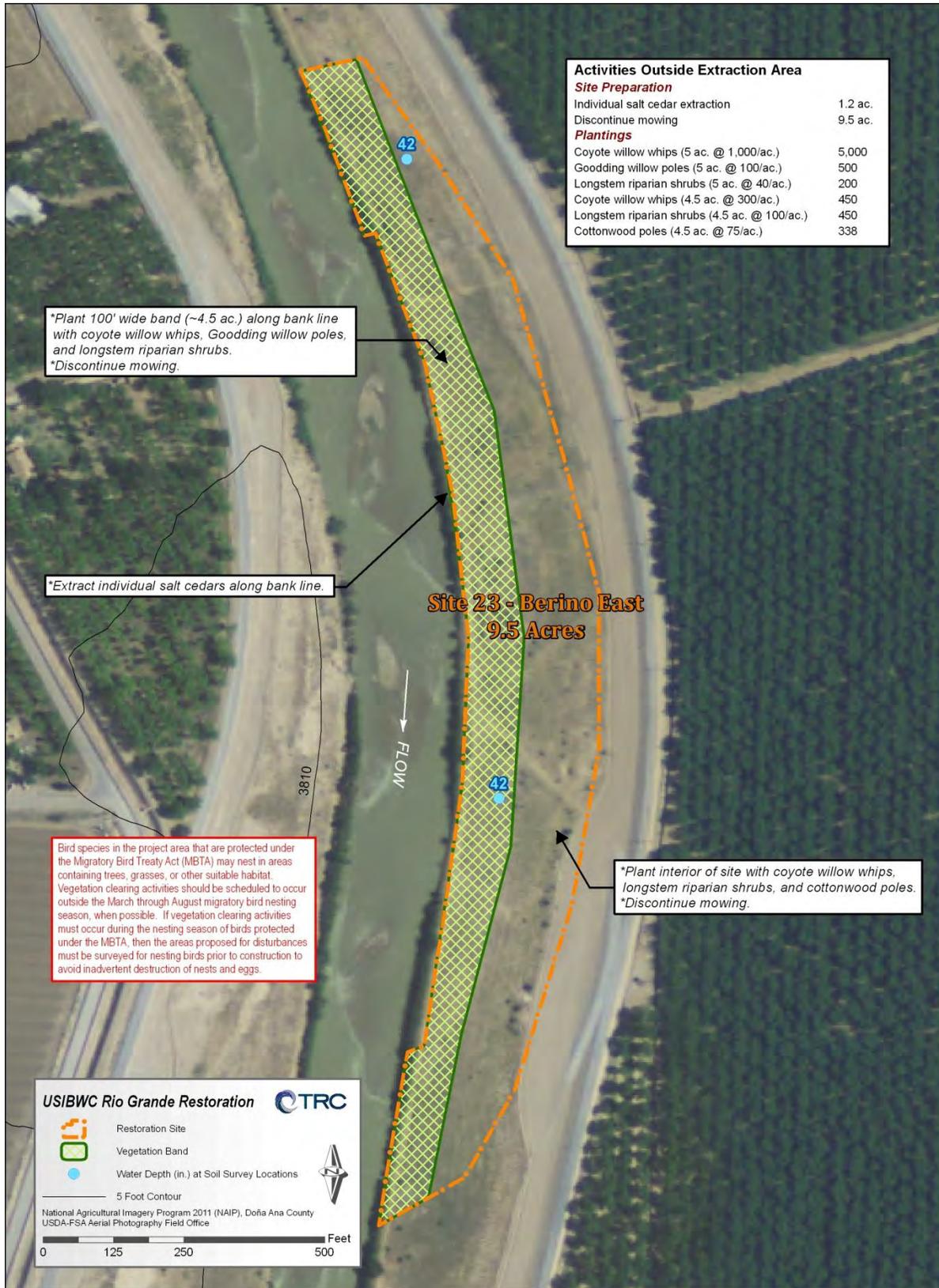
\*Extract individual salt cedars throughout site (low density).  
 \*Grub entire site to remove noxious weeds.  
 \*Plant scattered cottonwood poles.  
 \*Seed with grasses and forbs.  
 \*Discontinue mowing.

Bird species in the project area that are protected under the Migratory Bird Treaty Act (MBTA) may nest in areas containing trees, grasses, or other suitable habitat. Vegetation clearing activities should be scheduled to occur outside the March through August migratory bird nesting season, when possible. If vegetation clearing activities must occur during the nesting season of birds protected under the MBTA, then the areas proposed for disturbances must be surveyed for nesting birds prior to construction to avoid inadvertent destruction of nests and eggs.

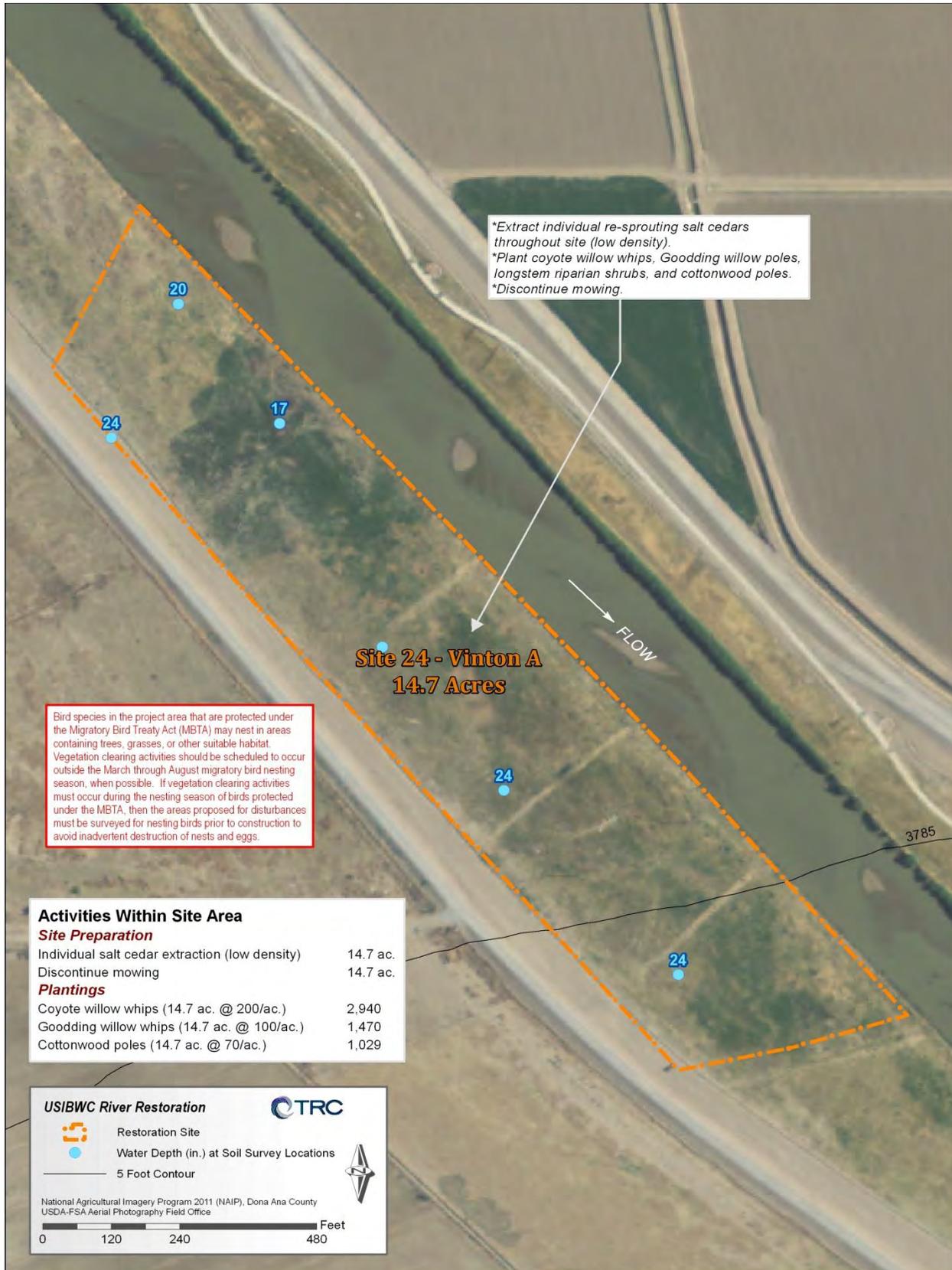
Site 21 – Mesilla East



Site 22 – Berino West



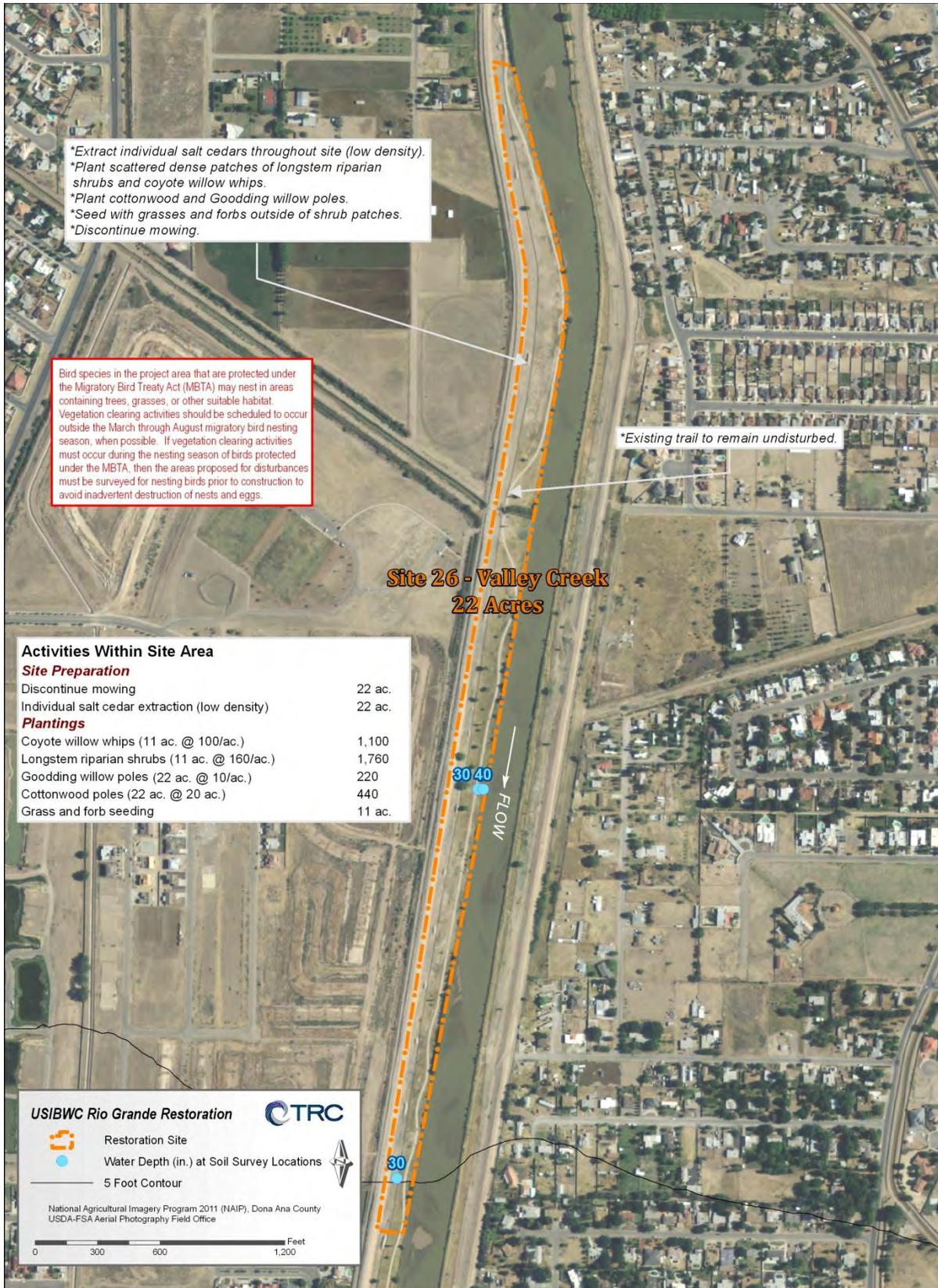
Site 23 – Berino East



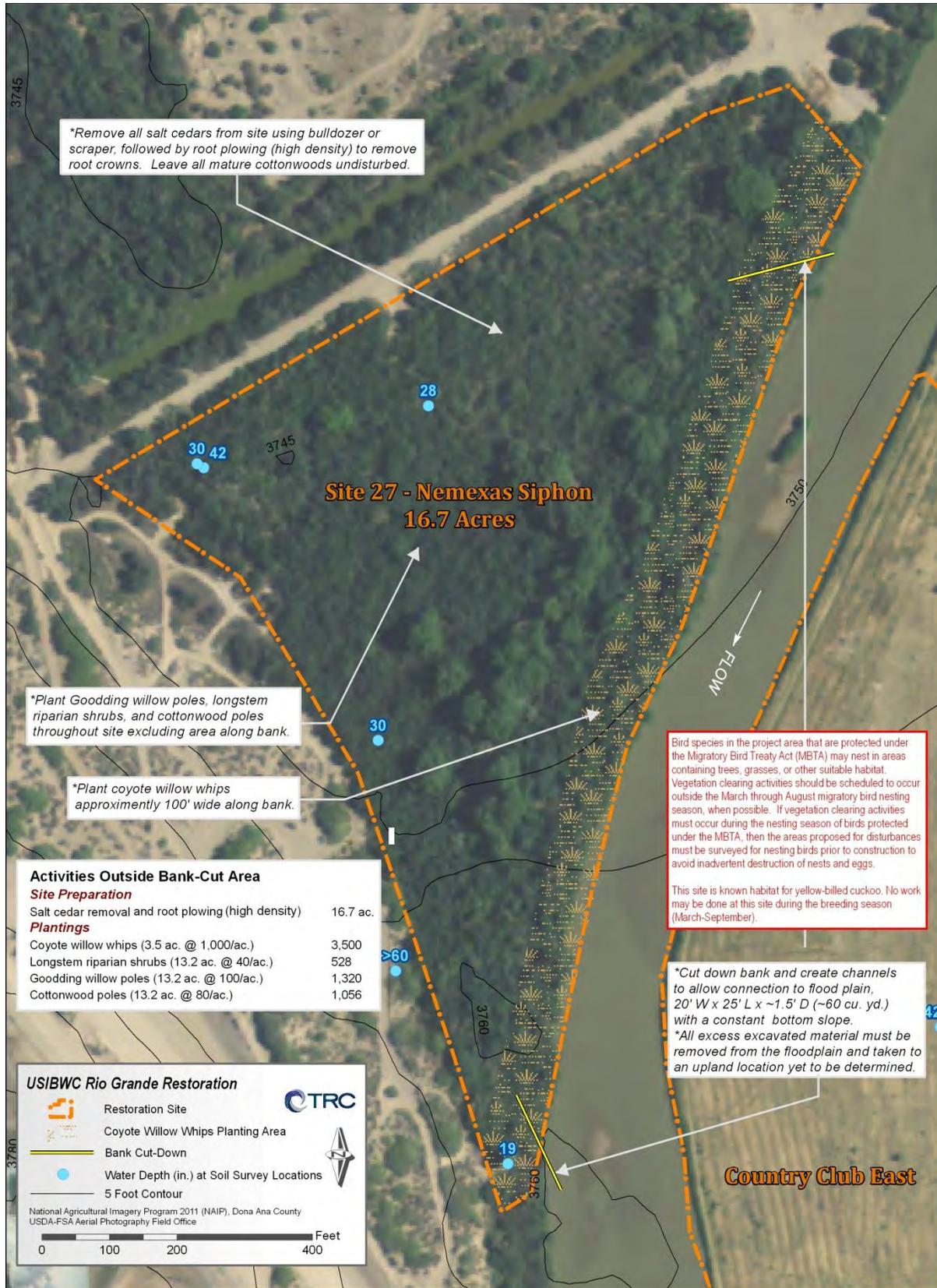
Site 24 – Vinton A



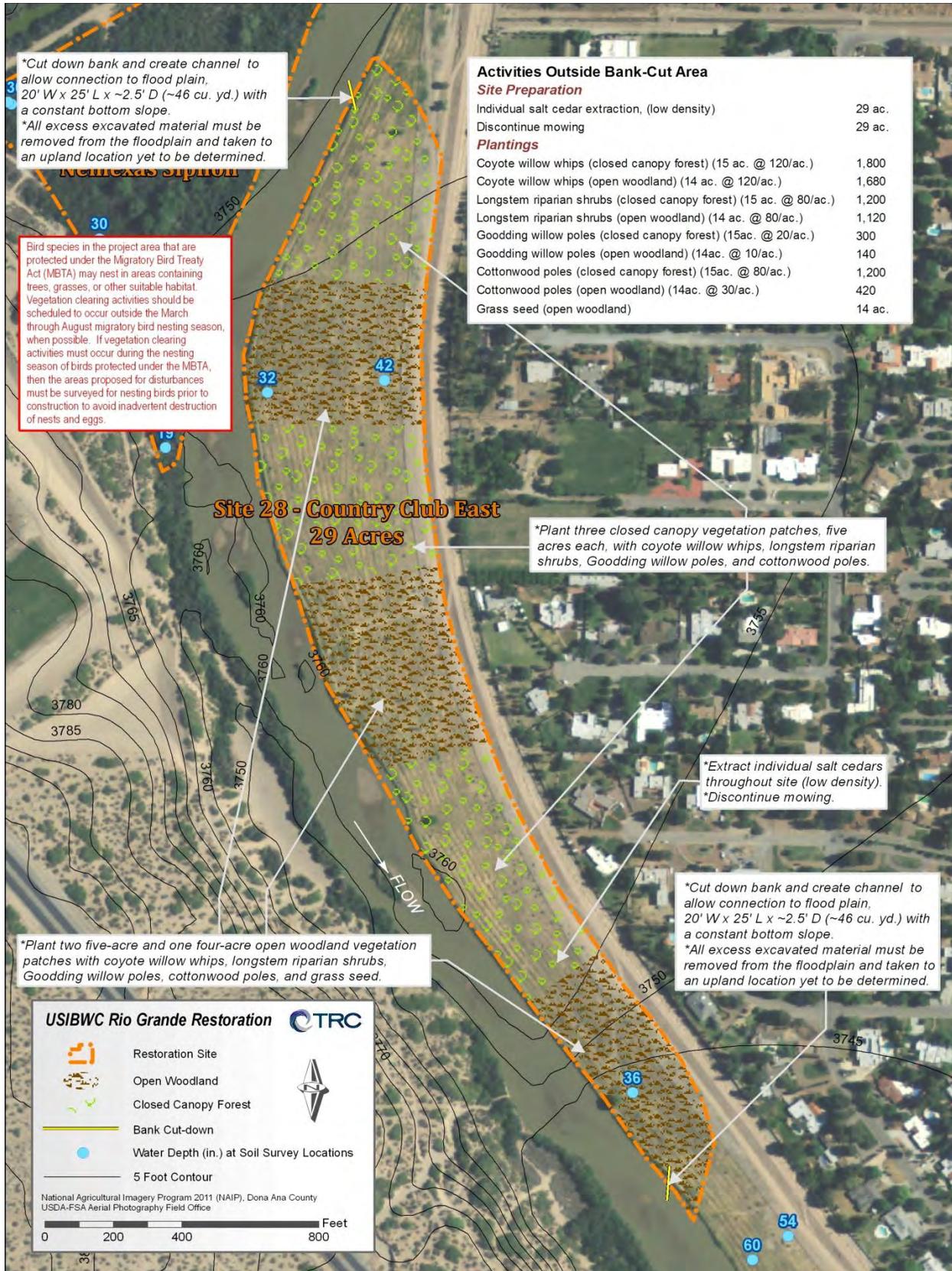
Site 25 – Vinton B



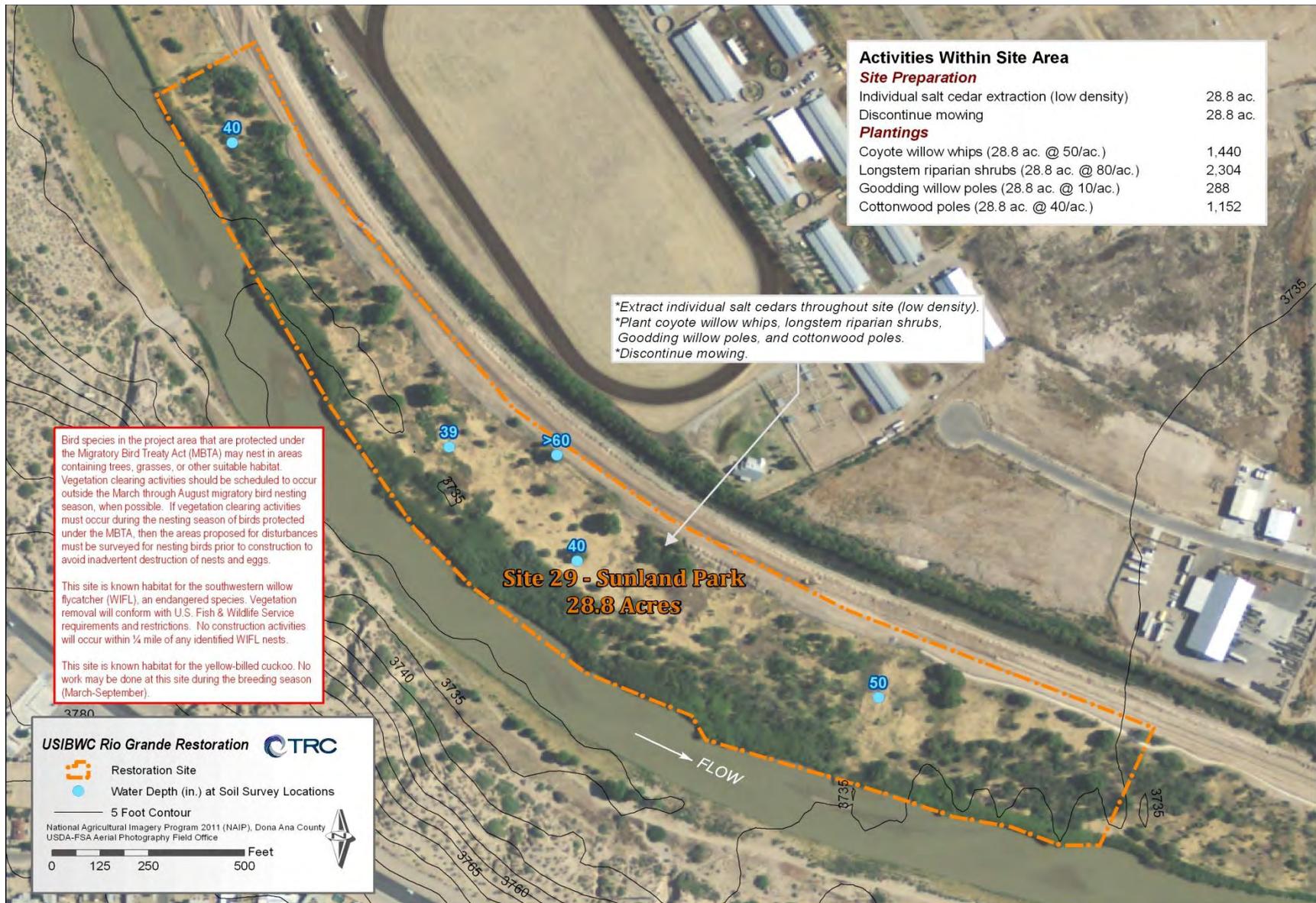
Site 26 – Valley Creek



Site 27 – Nemexas Siphon



Site 28 – Country Club East



Site 29 – Sunland Park



Site 30 – Anapra Bridge

**APPENDIX B**  
**COST WORKSHEETS**

<b>Abbreviations</b>	
<b>Abbreviation</b>	<b>Meaning</b>
ac.	acre
ave.	average
B.C.Y.	bank cubic yard
CMP	corrugated metal pipe
C.Y.	cubic yard
diam.	diameter
hr.	hour
L.C.Y	loose cubic yard (25% swell factor applied)
L.F.	linear foot
Ld.	load
MPH	miles per hour
mtd.	mounted
S.F.	square foot
S.Y.	square yard
Uld.	unload

<b>Site 1: Trujillo</b>				
<i>Bank Destabilization</i>				
Activity	Amount	Activity description	Cost/ unit	Total Cost
Bank destabilization	650 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y./hr.	\$ 2.11	\$ 1,372
Excess bank material haul	813 L.C.Y.	8 C.Y. truck, 15 MPH ave, cycle 0.5 miles, 10 min. wait/Ld./Uld.	\$ 2.39	\$ 1,943
Grade (4:1 slope)	3900 S.Y.	Finish grading slopes, steep slopes	\$ 0.22	\$ 858
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/ unit	Total Cost
Clearing	3 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 12,375
Grubbing	3 ac.	Grub stumps and remove	\$ 1,775.00	\$ 5,325
Selective extraction or stump cutting/ herbicidal treatment	7 ac.	With tractor, large tract, firm level terrain, no boulders, less than 12" diam. Trees: 300 HP dozer, up to 400 trees/ ac., 0 to 25% hardwoods	\$ 3,350.00	\$ 23,450
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/ unit	Total Cost
*Coyote willow whips (3ac. @ 1000/ac)				
*Coyote willow whips (7ac. @ 100/ac.)	3700	Cost of planting including installation	\$ 7.50	\$ 27,750
*Longstem riparian shrubs (10 ac. @ 30/ac.)	300	Cost of planting including installation	\$ 55.00	\$ 16,500
*Goodding willow poles (10 ac. @ 5/ac.)	50	Cost of planting including installation	\$ 45.00	\$ 2,250
*Cottonwood poles (10ac. @ 5/ac.)	50	Cost of planting including installation	\$ 45.00	\$ 2,250
RS Means was used for cost except where noted.		Total cost for Trujillo		\$ 94,100
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande- Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

<b>Site 2: Jaralosa</b>				
<i>Bank Destabilization</i>				
Activity	Amount	Activity Description	Cost/ unit	Total Cost
Bank destabilization	650 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y/hr.	\$ 2.11	\$ 1,372
Excess bank material haul	813 L.C.Y.	8 C.Y. truck, 15 MPH ave, cycle 0.5 miles, 10 min. wait/Ld./Uld.	\$ 2.39	\$ 1,943
Excess bank material placement	813 C.Y.	Spread dumped material, by dozer, no compaction	\$ 1.91	\$ 1,553
Grade (4:1 slope)	3900 S.Y.	Finish grading slopes, steep slopes	\$ 0.22	\$ 858
<i>Site Preparation</i>				
Activity	Amount	Activity Description	Cost/ unit	Total Cost
Individual salt cedar extraction	4.7 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 19,388
Grubbing	4.7 ac.	Grub stumps and remove	\$ 1,775.00	\$ 8,343
Grading	22750 S.Y.	Finish grading slopes, gentle	\$ 0.18	\$ 4,095
Discontinue mowing	4.7 ac.		\$ -	\$ -
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Grass/forb seeding	4.7 ac.	Cost of planting including installation	\$ 1,900.00	\$ 8,930
*Goodding willow poles (1 ac. @ 100/ac.)	100	Cost of planting including installation	\$ 45.00	\$ 4,500
*Longstem riparian shrubs (1ac. @ 50/ac.)	50	Cost of planting including installation	\$ 55.00	\$ 2,750
*Cottonwood poles	60	Cost of planting including installation	\$ 45.00	\$ 2,700
RS Means was used for cost except where noted.		Total cost for Jaralosa		\$ 56,400
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande- Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

<b>Site 3: Yeso Arroyo</b>				
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Bank destabilization and riprap removal	700 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y/hr.	\$ 2.11	\$ 1,477
Riprap and bank material haul	875 L.C.Y	8 C.Y. truck, 15 MPH ave, cycle 0.5 miles, 10 min. wait/Ld./Uld.	\$ 2.39	\$ 2,091
Riprap and excess bank material placement	875 C.Y.	Spread dumped material, by dozer, no compaction	\$ 1.91	\$ 1,671
Grade (4:1 slope)	4170 S.Y.	Finish grading slopes, steep slopes	\$ 0.22	\$ 917
Individual salt cedar extraction	0.86 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 3,548
RS Means was used for cost except where noted.		Total cost for Yeso Arroyo		\$ 9,700

<b>Site 4-5: Yeso East - West</b>				
<i>Bank Destabilization/Excavation</i>				
Activity	Amount	Activity Description	Cost/unit	Total Cost
Bank excavation	5900 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y/hr.	\$ 2.11	\$ 12,449
Excess bank material haul	7375 L.C.Y.	8 C.Y. truck, 15 MPH ave, cycle 0.5 miles, 10 min. wait/Ld./Uld.	\$ 2.39	\$ 17,626
Excess bank material placement	7375 C.Y.	Spread dumped material, by dozer, no compaction	\$ 1.91	\$ 14,086
Bank excavation	800 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y/hr.	\$ 2.11	\$ 1,688
Excess bank material haul	1000 L.C.Y.	8 C.Y. truck, 15 MPH ave, cycle 0.5 miles, 10 min. wait/LD./Uld.	\$ 2.39	\$ 2,390
Excess bank material placement	1000 C.Y.	Spread dumped material, by dozer, no compaction	\$ 1.91	\$ 1,910
Grade (4:1 slope)	4860 S.Y.	Finish grading slopes, steep slopes	\$ 0.22	\$ 1,069
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Individual salt cedar extraction	1.7 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 7,013
Grubbing	2 ac.	Grub stumps and remove	\$ 1,775.00	\$ 3,550
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Grass/forb seeding	9.7 ac.	Cost of planting including installation	\$ 1,900.00	\$ 18,430
*Coyote willow whips (2ac. @ 400/ac.)	800	Cost of planting including installation	\$ 7.50	\$ 6,000
*Longstem riparian shrubs (9.7 ac. @ 50/ac)	485	Cost of planting including installation	\$ 55.00	\$ 26,675
*Cottonwood poles (9.7 ac. @ 50/ac.)	485	Cost of planting including installation	\$ 45.00	\$ 21,825
RS Means was used for cost except where noted.		Total cost for Yeso East West		\$ 135,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande- Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

<b>Site 8: Placitas Arroyo</b>				
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Bank destabilization and riprap removal	1000 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y/hr.	\$ 2.11	\$ 2,110
Bank material and riprap haul	1250 L.C.Y.	8 C.Y. truck, 15 MPH ave, cycle 0.5 miles, 10 min. wait/Ld./Uld.	\$ 2.39	\$ 2,988
Excess bank material and riprap placement	1250 C.Y.	Spread dumped material, by dozer, no compaction	\$ 1.91	\$ 2,388
Grade (4:1 slope)	6111 S.Y.	Finish grading slopes, steep slopes	\$ 0.22	\$ 1,344
Extract individual salt cedars	1.3 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 5,363
RS Means was used except where noted.		Total cost for Placitas Arroyo		\$ 14,200

**Site 9: Rincon Siphon A-B**

*Bank Cut-Down*

Activity	Amount	Activity description	Cost/unit	Total Cost
Bank cut down	120 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y/hr.	\$ 2.11	\$ 253
Excess bank material haul	150 L.C.Y.	8 C.Y. truck, 15 MPH ave, cycle 0.5 miles, 10 min. wait/Ld./Uld.	\$ 2.39	\$ 359
Excess bank material placement	150 C.Y.	Spread dumped material, by dozer, no compaction	\$ 1.91	\$ 287

*Site Preparation*

Activity	Amount	Activity description	Cost/unit	Total Cost
Individual salt cedar extraction by clearing	16.3 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 67,238
Root plowing	16.3 ac.	Grub stumps and remove	\$ 1,775.00	\$ 28,933

*Plantings*

Activity	Amount	Activity description	Cost/unit	Total Cost
*Salt-tolerant longstem riparian shrubs (4ac. @ 40/ac.)	160	Cost of planting including installation	\$ 55.00	\$ 8,800
*Other longstem riparian shrubs (4ac. @ 40/ac.)	160	Cost of planting including installation	\$ 55.00	\$ 8,800
*Coyote willow whips (12.3ac. @ 1000/ac.)	12000	Cost of planting including installation	\$ 7.50	\$ 90,000
*Goodding willow poles (5ac. @ 100/ac.)	500	Cost of planting including installation	\$ 45.00	\$ 22,500
*Cottonwood poles (16.2ac. @ 10/ac.)	163	Cost of planting including installation	\$ 45.00	\$ 7,335

RS Means was used for cost except where noted.	Total cost for Rincon Siphon A-B			\$ 235,000
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\*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande- Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.

<b>Site 10: Angostura Arroyo</b>				
<i>Bank Destabilization</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Bank destabilization and riprap removal	1000 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y/hr.	\$ 2.11	\$ 2,110
Excess bank material and riprap haul	1250 L.C.Y.	8 C.Y. truck, 15 MPH ave, cycle 0.5 miles, 10 min. wait/Ld./Uld.	\$ 2.39	\$ 2,988
Riprap and excess material placement	1250 C.Y.	Spread dumped material, by dozer, no compaction	\$ 1.91	\$ 2,388
Grade (4:1 slope)	5833 S.Y.	Finish grading slopes, steep slopes	\$ 0.22	\$ 1,283
Extract individual salt cedars	1.21 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 4,991
RS Means was used for cost except where noted.		Total cost for Angostura Arroyo		\$ 13,800

<b>Site 11: Lack Property</b>				
<i>Bank Cut-Down</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Bank cut down	93 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y/hr.	\$ 2.11	\$ 196
Excess bank material haul	117 L.C.Y.	8 C.Y. truck, 15 MPH ave, cycle 0.5 miles, 10 min. wait/LD./Uld.	\$ 2.39	\$ 280
Material scrape up	6500 C.Y.	21 C.Y., 1/4 push dozer, common earth, 3000' haul	\$ 3.73	\$ 24,245
Excess material to berm haul	8125 L.C.Y.	8 C.Y. truck, 15 MPH ave, cycle 0.5 miles, 10 min. wait/LD./Uld.	\$ 2.39	\$ 19,419
Protection berm construction	6600 C.Y.	Spread dumped material, by dozer, no compaction; Riding, vibrating roller, 6" lifts, 2 passes	\$ 2.34	\$ 15,444
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Clearing	51 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 210,375
Grubbing	51 ac.	Grub stumps and remove	\$ 1,775.00	\$ 90,525
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Coyote willow whips (51ac. @ 1000/ac.)	51000	Cost of planting including installation	\$ 7.50	\$ 382,500
*Longstem riparian shrubs (51ac. @ 20/ac.)	1020	Cost of planting including installation	\$ 55.00	\$ 56,100
*Goodding willow poles (51 ac. @ 100/ac.)	510	Cost of planting including installation	\$ 45.00	\$ 22,950
RS Means was used for cost except where noted.		Total cost for Lack Property		\$ 822,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande- Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

<b>Site 15: Selden Point Bar</b>				
<i>Bank Cut-Down</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Bank cut down	256 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y/hr.	\$ 2.11	\$ 540
<i>Site Preparation</i>				
Temporary river crossing, six 60" diam. X 30' long CMP culverts	180 L.F.	Corrugated metal pipe, galvanized, 60" diam.	\$ 147.00	\$ 26,460
Fill for temporary river crossing	2500 C.Y.	Spread dumped material, by dozer, no compaction	\$ 1.91	\$ 4,775
Temporary river crossing demolition	180 L.F.	Selective demolition, CMP pipe, aluminum, 60" diam.	\$ 19.95	\$ 3,591
Fill removal	2500 C.Y.	21 C.Y., 1/4 push dozer, common earth, 1500' haul	\$ 3.29	\$ 8,225
Haul fill from site	3125 L.C.Y.	8 C.Y. truck, 15 MPH, ave, cycle 4 miles, 10 min. wait/Ld./Uld.	\$ 5.30	\$ 16,563
Individual salt cedar extraction (high density)	3.0 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 12,375
Individual salt cedar extraction (medium density)	3.9 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 16,088
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Coyote willow whips (6.9ac. @ 1000/ac.)	6,900	Cost of planting including installation	\$ 7.50	\$ 51,750
*Longstem riparian shrubs (6.9ac.@40/ac.)	276	Cost of planting including installation	\$ 55.00	\$ 15,180
*Goodding willow poles (3.9ac. @ 50/ac.)	195	Cost of planting including installation	\$ 45.00	\$ 8,775
*Goodding willow poles (3ac. @ 100/ac.)	300	Cost of planting including installation	\$ 45.00	\$ 13,500
*Cottonwood poles (6.9ac. @ 10/ac.)	69	Cost of planting including installation	\$ 45.00	\$ 3,105
RS Means was used for cost except where noted.		Total Cost for Selden Point Bar		\$ 181,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande- Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

**Site 16: Bailey Point Bar**

*Bank Cut-Down*

Activity	Amount	Activity description	Cost/unit	Total Cost
Bank cut down	74 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y/hr.	\$ 2.11	\$ 156
Excess bank material placement	93 C.Y.	Spread dumped material, by dozer, no compaction	\$ 1.91	\$ 178

*Site Preparation*

Activity	Amount	Activity description	Cost/unit	Total Cost
Individual salt cedar extraction (moderate-high density)	16.6 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 68,475

*Plantings*

Activity	Amount	Activity description	Cost/unit	Total Cost
*Coyote willow whips (16.6ac. @ 1000/ac.)	16,600	Cost of planting including installation	\$ 7.50	\$ 124,500
*Longstem riparian shrubs (16.6ac. @ 40/ac.)	664	Cost of planting including installation	\$ 55.00	\$ 36,520
*Goodding willow poles (16.6ac. @ 100/ac.)	1600	Cost of planting including installation	\$ 45.00	\$ 72,000
*Cottonwood poles (16.6ac. @ 10/ac.)	166	Cost of planting including installation	\$ 45.00	\$ 7,470
RS Means was used for cost except where noted.	Total cost for Bailey Point Bar			\$ 309,000

\*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande- Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.

<b>Site 17: Shalem Colony</b>				
<i>Site Activities</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Discontinue mowing			\$ -	\$ -
Total cost for Shalem Colony				\$ -

<b>Site 19: Clark Lateral</b>				
<i>Irrigation Structures</i>				
	Amount	Activity description	Cost/unit	Total Cost
*Check dam and standard turnout construction	1		\$ -	\$ 50,000
Armored return spillway construction	1	Gabions, 8" diameter corrugated metal piping, and 8" diameter gate valve	\$ -	\$ 22,012
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Clearing	6.1 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 25,163
Grubbing	6.1 ac.	Grub stumps and remove	\$ 1,775.00	\$ 10,828
Spread graded material	6000 C.Y.	Spread dumped material, by dozer, no compaction	\$ 1.91	\$ 11,460
Grading	21780 S.Y.	Finish grading slopes, gentle	\$ 0.18	\$ 3,920
Discontinue mowing	6.1 ac.		\$ -	\$ -
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Coyote willow whips (4.5ac. @ 1000/ac.)	4500	Cost of planting including installation	\$ 7.50	\$ 33,750
*Longstem riparian shrubs (6.1ac. @ 40/ac.)	244	Cost of planting including installation	\$ 55.00	\$ 13,420
*Goodding willow poles (6.1ac. @ 100/ac.)	610	Cost of planting including installation	\$ 45.00	\$ 27,450
*Cottonwood poles (1.6ac. @ 75/ac.)	120	Cost of planting including installation	\$ 45.00	\$ 5,400
RS Means was used for cost except where noted.		Total cost for Clark Lateral		\$ 203,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande- Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

<b>Site 21: Mesilla East</b>				
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Individual salt cedar extraction	15.9 ac.	Cut and chip, medium, tress to 6" diam.	\$ 4,125.00	\$ 65,588
Grubbing	15.9 ac.	Grub stumps and remove	\$ 1,775.00	\$ 28,223
Discontinue mowing	15.9 ac.		\$ -	\$ -
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Grass/forb seeding	15.9 ac.	Cost of planting including installation	\$ 1,900.00	\$ 30,210
*Cottonwood poles (15.9ac @ 15/ac.)	239	Cost of planting including installation	\$ 45.00	\$ 10,755
RS means was used for cost except where noted.		Total cost for Mesilla East		\$ 135,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande-Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

<b>Site 22: Berino West</b>				
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Individual salt cedar extraction	1.3 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 5,363
Grubbing	10.3 ac.	Grub stumps and remove	\$ 1,775.00	\$ 18,283
Discontinue mowing	10.3 ac.		\$ -	\$ -
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Grass/forb seeding	15.9 ac.	Cost of planting including installation	\$ 1,900.00	\$ 30,210
*Goodding willow poles (10.3ac. @ 100/ac.)	1030	Cost of planting including installation	\$ 45.00	\$ 46,350
*Longstem riparian shrubs (10.3ac. @ 40/ac.)	412	Cost of planting including installation	\$ 55.00	\$ 22,660
*Cottonwood poles (10.3ac. @ 15/ac.)	155	Cost of planting including installation	\$ 45.00	\$ 6,975
RS means was used except where noted.		Total cost for Berino West		\$ 130,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande-Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

<b>Site 23: Berino East</b>				
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Individual salt cedar extraction	1.2 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 4,950
Discontinue mowing	9.5 ac.		\$ -	\$ -
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Coyote willow whips (5ac. @ 1000/ac.)	5000	Cost of planting including installation	\$ 7.50	\$ 37,500
*Goodding willow poles (5ac. @ 100/ac.)	500	Cost of planting including installation	\$ 45.00	\$ 22,500
*Longstem riparian shrubs (5ac. @ 40/ac.)	200	Cost of planting including installation	\$ 55.00	\$ 11,000
*Coyote willow whips (4.5ac. @ 300/ac.)	450	Cost of planting including installation	\$ 7.50	\$ 3,375
*Longstem riparian shrubs (4.5ac. @ 100/ac.)	450	Cost of planting including installation	\$ 55.00	\$ 24,750
*Cottonwood poles (4.5ac. @ 75/ac.)	338	Cost of planting including installation	\$ 45.00	\$ 15,210
RS Means was used for cost except where noted.		Total Cost for Berino East		\$ 119,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande-Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

<b>Site 24: Vinton A</b>				
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Individual salt cedar extraction (low density)	14.7 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 60,638
Discontinue mowing	14.7 ac.		\$ -	\$ -
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Coyote willow whips (14.7ac. @ 200/ac.)	2940	Cost of planting including installation	\$ 7.50	\$ 22,050
*Goodding willow whips (14.7 ac. @ 100/ac.)	1470	Cost of planting including installation	\$ 45.00	\$ 66,150
*Cottonwood poles (14.7ac. @ 70/ac.)	1029	Cost of planting including installation	\$ 45.00	\$ 46,305
RS Means was used for cost except where noted.		Total Cost for Vinton A		\$ 195,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande-Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

<b>Site 25: Vinton B</b>				
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Individual salt cedar extraction (low density)	20 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 82,500
Discontinue mowing	20 ac.		\$ -	\$ -
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Coyote willow whips (20ac. @ 150/ac.)	3000	Cost of planting including installation	\$ 7.50	\$ 22,500
*Goodding willow poles (20ac. @ 10/ac.)	200	Cost of planting including installation	\$ 45.00	\$ 9,000
*Longstem riparian shrubs (20ac. @ 80/ac.)	1600	Cost of planting including installation	\$ 55.00	\$ 88,000
*Cottonwood poles (20ac. @ 40/ac.)	800	Cost of planting including installation	\$ 45.00	\$ 36,000
RS Means was used for cost except where noted.		Total cost Vinton B		\$ 238,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande-Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

<b>Site 26: Valley Creek</b>				
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Individual salt cedar extraction, very low density	22 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 90,750
Discontinue mowing	22 ac.		\$ -	\$ -
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Coyote willow whips (11ac. @ 100/ac.)	1100	Cost of planting including installation	\$ 7.50	\$ 8,250
*Longstem riparian shrubs (11ac. @ 160/ac.)	1760	Cost of planting including installation	\$ 55.00	\$ 96,800
*Goodding willow poles (22ac. @ 10/ac.)	220	Cost of planting including installation	\$ 45.00	\$ 9,900
*Cottonwood poles (22ac. @ 20/ac.)	440	Cost of planting including installation	\$ 45.00	\$ 19,800
*Grass and forbs seeding	11 ac.	Cost of planting including installation	\$ 1,900.00	\$ 20,900
RS Means was used for cost except where noted.	Total cost for Valley Creek			\$ 246,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande-Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

<b>Site 27: Nemexas siphon</b>				
<i>Bank Cut down</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Bank cut down	60 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y/hr.	\$ 2.11	\$ 127
Excess bank material haul	75 L.C.Y.	8 C.Y. truck, 15 MPH ave, cycle 0.5 miles, 10 min. wait/Ld./Uld.	\$ 2.82	\$ 212
Excess bank material placement	75 C.Y.	Spread dumped material, by dozer, no compaction	\$ 1.91	\$ 143
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Salt cedar removal	16.7 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 68,887.5
Root plowing	16.7 ac.	Grub stumps and remove	\$ 1,775.00	\$ 29,643
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Coyote willow whips (3.5ac. @ 1000/ac.)	3500	Cost of planting including installation	\$ 7.50	\$ 26,250
*Longstem riparian shrubs (13.2 ac. @ 40/ac.)	528	Cost of planting including installation	\$ 55.00	\$ 29,040
*Goodding willow poles (13.2ac. @ 100/ac.)	1320	Cost of planting including installation	\$ 45.00	\$ 59,400
*Cottonwood poles (13.2ac. @ 80/ac.)	1056	Cost of planting including installation	\$ 45.00	\$ 47,520
RS Means was used for cost except where noted.		Total cost for Nemexas siphon		\$ 261,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande- Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

**Site 28: Country Club East**

*Bank Cut down*

Activity	Amount	Activity description	Cost/unit	Total Cost
Bank cut down	92 B.C.Y.	Front end loader, track mtd, 2-1/2 C.Y. cap= 95 C.Y/hr.	\$ 2.11	\$ 194
Excess bank material haul	115 L.C.Y.	8 C.Y. truck, 15 MPH ave, cycle 0.5 miles, 10 min. wait/Ld./Uld.	\$ 2.82	\$ 324
Excess bank material placement	115 C.Y.	Spread dumped material, by dozer, no compaction	\$ 1.91	\$ 220

*Site Preparation*

Activity	Amount	Activity description	Cost/unit	Total Cost
Individual salt cedar extraction, (low density)	29 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 119,625
Discontinue mowing	29 ac.		\$ -	\$ -

*Plantings*

Activity	Amount	Activity description	Cost/unit	Total Cost
*Coyote willow whips (29ac. @ 120/ac.)	3480	Cost of planting including installation	\$ 7.50	\$ 26,100
*Longstem riparian shrubs (29ac. @ 80/ac.)	2320	Cost of planting including installation	\$ 55.00	\$ 127,600
*Goodding willow poles (closed canopy forest (15ac. @ 20/ac.)	300	Cost of planting including installation	\$ 45.00	\$ 13,500
*Goodding willow poles (open woodland) (14ac. @ 10/ac.)	140	Cost of planting including installation	\$ 45.00	\$ 6,300
*Cottonwood poles (closed canopy forest) (15ac. @ 80/ac.)	1200	Cost of planting including installation	\$ 45.00	\$ 54,000
*Cottonwood poles (open woodland) (14ac. @ 30/ac.)	420	Cost of planting including installation	\$ 45.00	\$ 18,900
*Grass seed	14 ac.	Cost of planting including installation	1900	\$ 26,600
RS Means was used for cost except where noted.		Total Cost for Country Club East		\$ 393,000

\*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande- Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.

<b>Site 29: Sunland Park</b>				
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Individual salt cedar extraction, (low density)	28.8 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 118,800
Discontinue mowing	28.8 ac.		\$ -	\$ -
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Coyote willow whips (28.8ac @ 50/ac.)	1440	Cost of planting including installation	\$ 7.50	\$ 10,800
*Longstem riparian shrubs (28.8ac. @ 80/ac.)	2304	Cost of planting including installation	\$ 55.00	\$ 126,720
*Goodding willow poles (28.8ac. @ 10/ac.)	288	Cost of planting including installation	\$ 45.00	\$ 12,960.0
*Cottonwood poles (28.8ac. @ 40/ac.)	1152	Cost of planting including installation	\$ 45.00	\$ 51,840
RS Means was used for cost except where noted.		Total Cost for Sunland Park		\$ 321,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande- Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				

<b>Site 30: Anapara Bridge</b>				
<i>Site Preparation</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
Individual salt cedar extraction, (low density)	11 ac.	Cut and chip, medium, trees to 6" diam.	\$ 4,125.00	\$ 45,375
Discontinue mowing	11 ac.		\$ -	\$ -
<i>Plantings</i>				
Activity	Amount	Activity description	Cost/unit	Total Cost
*Coyote willow whips (11ac. @ 30/ac.)	330	Cost of planting including installation	\$ 7.50	\$ 2,475
*Longstem riparian shrubs (11ac. @ 30/ac.)	330	Cost of planting including installation	\$ 55.00	\$ 18,150
*Goodding willow poles (11ac. @ 5/ac.)	55	Cost of planting including installation	\$ 45.00	\$ 2,475
*Cottonwood poles (11ac. @ 10/ac.)	110	Cost of planting including installation	\$ 45.00	\$ 4,950
RS Means was used for cost except where indicated.		Total Cost for Anapara Bridge		\$ 73,000
*U.S. Army Corps of Engineers Albuquerque District (2009). Conceptual Restoration Plan and Cumulative Effects Analysis, Rio Grande-Caballo Dam to American Dam, New Mexico and Texas. Albuquerque.				