SWCA
ENVIRONMENTAL CONSULTANTS

FINAL MIDDLE RIO GRANDE RIVERINE HABITAT RESTORATION PHASE II BIOLOGICAL ASSESSMENT, NEW MEXICO

Prepared for

U.S. BUREAU OF RECLAMATION

On behalf of

NEW MEXICO INTERSTATE STREAM COMMISSION

Prepared by

SWCA ENVIRONMENTAL CONSULTANTS

July 2006

MIDDLE RIO GRANDE
RIVERINE HABITAT RESTORATION PHASE II
BIOLOGICAL ASSESSMENT

Prepared for

U.S. BUREAU OF RECLAMATION, ALBUQUERQUE AREA OFFICE
555 Broadway NE, Suite 100
Albuquerque, New Mexico 87102

On behalf of

NEW MEXICO INTERSTATE STREAM COMMISSION
121 Tijeras NE, Suite 2000
Albuquerque, New Mexico 87102

Prepared by

SWCA® ENVIRONMENTAL CONSULTANTS
5647 Jefferson Street NE
Albuquerque, New Mexico 87109
Telephone: 505-254-1115; Fax: 505-254-1116
www.swca.com

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BACKGROUND

The New Mexico Interstate Stream Commission (NMISC) seeks to implement portions of the Reasonable and Prudent Alternative (RPA) in the March 2003 *U.S. Fish and Wildlife Service Biological and Conference Opinions on the Effects of Actions Associated with the Programmatic Biological Assessment of Bureau of Reclamation's Water and River Maintenance Operations, the U.S. Army Corps of Engineers' Flood Control Operations, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico* (U.S. Fish and Wildlife Service [USFWS] 2003) and to address priority habitat restoration goals of the Middle Rio Grande Endangered Species Act Collaborative Program (Collaborative Program) (U.S. Bureau of Reclamation 2006). The restoration is being conducted to satisfy federal requirements under the Biological Opinion (BO) RPA Element S that in coordination with the U.S. Fish and Wildlife Service (USFWS) agencies "shall…conduct habitat/ecosystem restoration projects in the Middle Rio Grande to increase backwaters and oxbows, widen the river channel, and/or lower river banks to produce shallow water habitats, overbank flooding, and regeneration of stands of willows and cottonwood to benefit the silvery minnow, the flycatcher, or their habitats" (USFWS 2003:95–96).

The Middle Rio Grande Riverine Habitat Restoration Phase II Project (Project) proposes to apply several habitat restoration techniques in the Albuquerque Reach of the Middle Rio Grande (MRG) (Figure 1) to create or improve habitat for the Rio Grande silvery minnow (*Hybognathus amarus* [silvery minnow]). The Project would construct egg-retention, larval-rearing, and over-wintering habitat for silvery minnow within four subreaches of the Albuquerque Reach. The Project is designed to facilitate evaluation of the selected techniques at the locations described in this document and is primarily funded by the Collaborative Program, with partial funding by the State of New Mexico.

A phased approach would be applied to restoration activities, with a set of techniques applied to selected areas, monitoring and evaluation of the outcomes, and the results incorporated into subsequent planned activities. This Biological Assessment (BA), completed in accordance with provisions of the Endangered Species Act (ESA), evaluates and analyzes potential impacts of the Project on listed threatened, endangered, or other special status species that may occur within the project area during Phase II of the Project, which would take place between November 2006 and December 2007. Further consultation with the USFWS would take place, if required, as specific detailed plans for subsequent phases become available.

PROPOSED ACTION

PROJECT DESCRIPTION

The Project consists of application of several alternative restoration/rehabilitation techniques designed to create aquatic habitat in the four selected subreaches, which include the stretch of through the City of Bernalillo and the City of Albuquerque (Figure 1). The long-term goal of the Project is to promote egg retention, larval rearing, young-of-year, and over-wintering habitat for silvery minnow in support of Element S of the RPA in the March 2003 BO. The objective of the restoration process is to increase measurable habitat complexity in support of various life stages of silvery minnow by facilitating lateral migration of the river across islands, bars, and

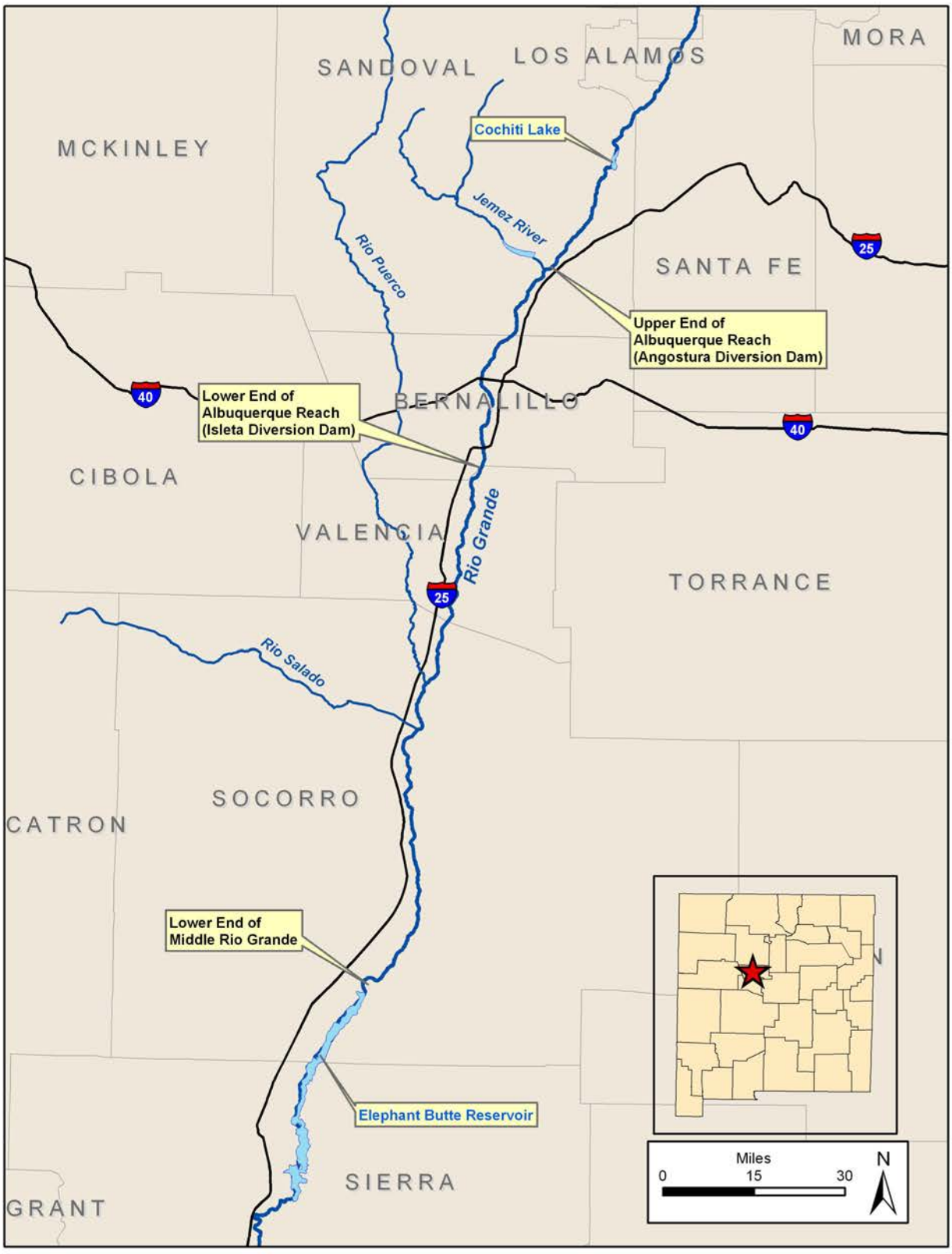

Figure 1. Albuquerque Reach of the Middle Rio Grande.

riverbanks during various mid-level and high flow stages. To this end, the Project would document and evaluate the effectiveness of specific restoration techniques, as discussed in the Habitat Restoration Plan for the MRG (Tetra Tech 2004), in establishing diverse mesohabitats at a range of river flows between 500 and 3,000 cubic feet per second (cfs). The Project is phased, with Phase I construction completed in April 2006, and Phase II to begin in November 2006 and end in December 2007. Subsequent phases would continue through 2009. Specific techniques would be implemented, monitored, and evaluated during each phase, and the restoration plans of subsequent phases would be adjusted to increase treatments that are most effective in meeting the habitat needs of silvery minnow. Seven restoration/rehabilitation techniques (Table 1) were selected for Phase II because of their theoretical ability to improve available habitat for the silvery minnow. In addition, expected benefits to native riverine vegetation would potentially increase habitat for the endangered southwestern willow flycatcher (flycatcher).

Table 1. Restoration Techniques and Potential Benefits of Proposed Techniques

Restoration Technique	Description	Benefits of Technique
Passive restoration	No disturbance of river channel. Allows for higher-magnitude peak flows to accelerate natural channel-forming process and improve floodplain habitat.	Increases sinuosity and allows for development of complex and diverse habitat, including bars, islands, side channels, sloughs, and braided channels.
Evaluation and modification of islands and bars	Physical disturbance (discing, mowing, root-plowing, raking) of islands or bars to remove vegetation, allowing for the mobilization of island features during periods of high flow	Creates more complex habitat for silvery minnow by reducing average channel depth, widening the channel, and increasing backwaters, pools, eddies, and runs of various depths and velocities. Increased inundation would benefit native riverine vegetation, potentially increasing flycatcher habitat.
High-flow ephemeral channels	Construction of ephemeral channels on inlands and islands to carry flow from the main river channel during high-flow events	Creates shallow, ephemeral (normally dry), low-velocity aquatic habitats important for silvery minnow egg and larval development during high flow time periods. Increased inundation would benefit native vegetation, potentially increasing flycatcher habitat.
High-flow bank-line backwater channels and embayments	Cutting areas into banks where water enters, primarily during high-flow events, including spring runoff and floods	Intended to retain drifting silvery minnow eggs and to provide rearing habitat and enhance food supplies for developing silvery minnow larvae. Increased inundation would benefit native vegetation, potentially increasing flycatcher habitat.
Terrace and bank lowering	Removal of vegetation and excavation of soils adjacent to the main channel to create potential for overbank flooding	Could provide for increased retention of silvery minnow eggs and larvae. Increased inundation would benefit native vegetation, potentially increasing flycatcher habitat.
Removal of lateral confinements	Reduction or elimination of structural features and maintenance practices that decrease bank erosion potential.	Creates wider floodplain with more diverse channel and floodplain features, resulting in increased net-zero and low-velocity habitat for silvery minnow.
Woody debris	Placement of trees, root wads, stumps, or branches in the main river channel or along its banks.	Creates slow-water habitats for all life stages of silvery minnow, provides shelter from predators and winter habitat, and provides structure for periphyton growth to improve food availability for silvery minnow.

Information adapted from Tetra Tech 2004.

During the Project, a number of techniques described in the Habitat Restoration Plan for the Middle Rio Grande (Tetra Tech 2004) would be implemented for their utility in addressing channel narrowing and bar formation by islands, and in creating essential silvery minnow habitat (see Table 1). Proposed restoration techniques would include island, bar, and bank line modification. Island modification would increase habitat connectivity to alleviate adverse changes to silvery minnow critical habitat and improve habitat quality and quantity (USFWS 2003). Bank lowering and scouring techniques are intended to provide for overbank flooding and allow the river to create ephemeral nursery habitat for retention of silvery minnow eggs and larvae.

PROJECT LOCATIONS AND PHASE II TREATMENTS

As shown in Figure 2, the four subreaches of the Albuquerque Reach proposed for application of restoration/rehabilitation techniques are: (1) from U.S. Highway 550 approximately 1,200 m downstream (550 Subreach); (2) from Paseo del Norte to Montaño Road (PDN Subreach); (3) from Interstate 40 (I-40) to Central Avenue (I-40 Subreach); and (4) from the South Diversion Channel to I-25 (SDC Subreach).

Specific sites on vegetated islands, bars, and riverbanks are proposed for testing the efficacy of these techniques (Table 2). Approximately 88.3 acres of islands and riverbank would be root-plowed (destabilized) and re-contoured, and an undetermined number of acres of new low-flow habitat would be created adjacent to the treated sites using spoil sediments. Vegetation management on islands would evaluate the river's ability to naturally mobilize sediments and create improved habitat(s). Subsequent phases would maintain restoration sites developed in Phase I and Phase II or add new treatment sites within the same subreaches, as identified in Figure 2.

While many of the proposed techniques are designed primarily to enhance silvery minnow habitat, they also promote riparian functionality and interconnectedness. For example, bank lowering would increase the frequency of inundation during periods of above base flow discharge (not annual events). The overbank areas would not remain flooded for significant periods of time and would not be intended to provide mesohabitat for adult silvery minnow, but to provide the necessary conditions for other processes that would result in residual habitat improvements and nursery habitat.

Topographical contours of the selected sites and surrounding river channel were mapped using survey data collected at selected cross sections, aerial orthorectified photography, and digital elevation models with 0.5-foot contours. These data were collected over at least two flows to develop a stage-to-discharge relationship to help quantify the available low-velocity habitat at different river flows. This relationship would also provide the basis for determining the elevations at which modifications should be excavated for each island.

Conceptual engineering designs have been developed for each site restoration method, showing a topographical representation of the site before restoration and cross sections of the river channel. These engineering designs take into account potential increased sediment retention in the modified sections of the river as well as potential flow-through velocities and depths.

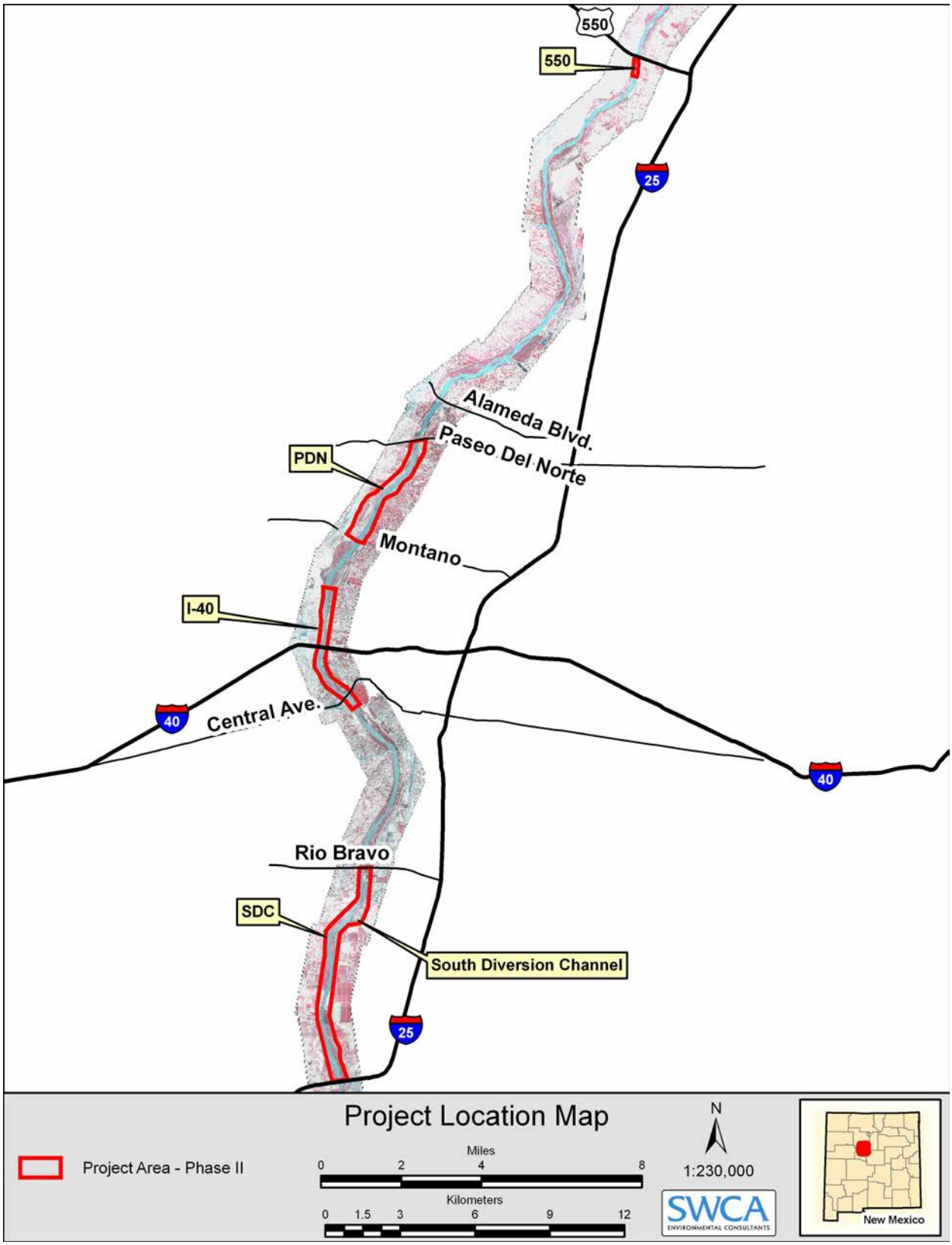

Figure 2. Middle Rio Grande Riverine Habitat Restoration Phase II subreaches.

Table 2. Phase II Restoration Technique Treatment Areas, by Subreach

Restoration Technique	Phase II Action Sites (2006–2007)	Phase II Acres Treated				Total Acres by Restoration Technique
		U.S. 550	*Paseo del Norte*	*I-40/ Central*	*South Diversion Channel*	
Vegetated Island Modification and Evaluation	16 islands	0.0	22.4	1.4	10.5	**34.3**
*Technique #1**	*3 islands*	*0.0*	*1.0*	*0.0*	*0.3*	***1.3***
*Technique #2**	*1 island*	*0.0*	*2.0*	*0.0*	*0.0*	***2.0***
*Technique #3**	*4 islands*	*0.0*	*13.4*	*0.0*	*0.9*	***14.3***
*Technique #4**	*8 islands*	*0.0*	*6.0*	*1.4*	*9.3*	***16.7***
Riverbank Expansion/Terracing	12 sites	0.0	1.9	24.0	5.1	**31.0**
Ephemeral Channels	8 sites	8.7	1.5	0.0	1.1	**11.3**
Drain Enhancement	1 site	0	0.0	6.1	0.0	**6.1**
Backwater Channels	2 sites	0	0.0	4.4	0.0	**4.4**
Embayment Area	1 site	0.0	0.0	0.6	0.0	**0.6**
Jetty Jack Removal	2 sites	0.0	0.3	0.0	0.2	**0.5**
Large Woody Debris	TBD	TBD	TBD	TBD	TBD	**TBD**
Total Acres by Action Site	**TBD**	**8.7**	**26.1**	**36.5**	**16.9**	**88.2**

*Acres of created low-flow habitats to be determined in the field.

General commitments for all locations and treatment areas include:

- Development of as-built plan and profile maps after treatment but before high flows
- Having all applicable permits, certifications, and authorizations in place prior to construction, including Clean Water Act (CWA) Section 404 and 401 permits and certifications
- Implementation of Storm Water Pollution Prevention Plans (CWA Section 402), including appropriate silt fencing and other erosion protection
- Avoiding wetlands and dense native vegetation whenever possible during construction

U.S. HIGHWAY 550 SUBREACH

Within this subreach, one vegetated island channel and one ephemeral braided channel complex are planned in the 550 Subreach, as shown in Figure 3.

PASEO DEL NORTE TO MONTAÑO SUBREACH

Within the PDN Subreach, seven sites for vegetated island evaluation and modification, three locations for bank modification, four ephemeral channel enhancement and/or creation sites, and one in-channel jetty jack removal are planned, as shown in Figure 4.

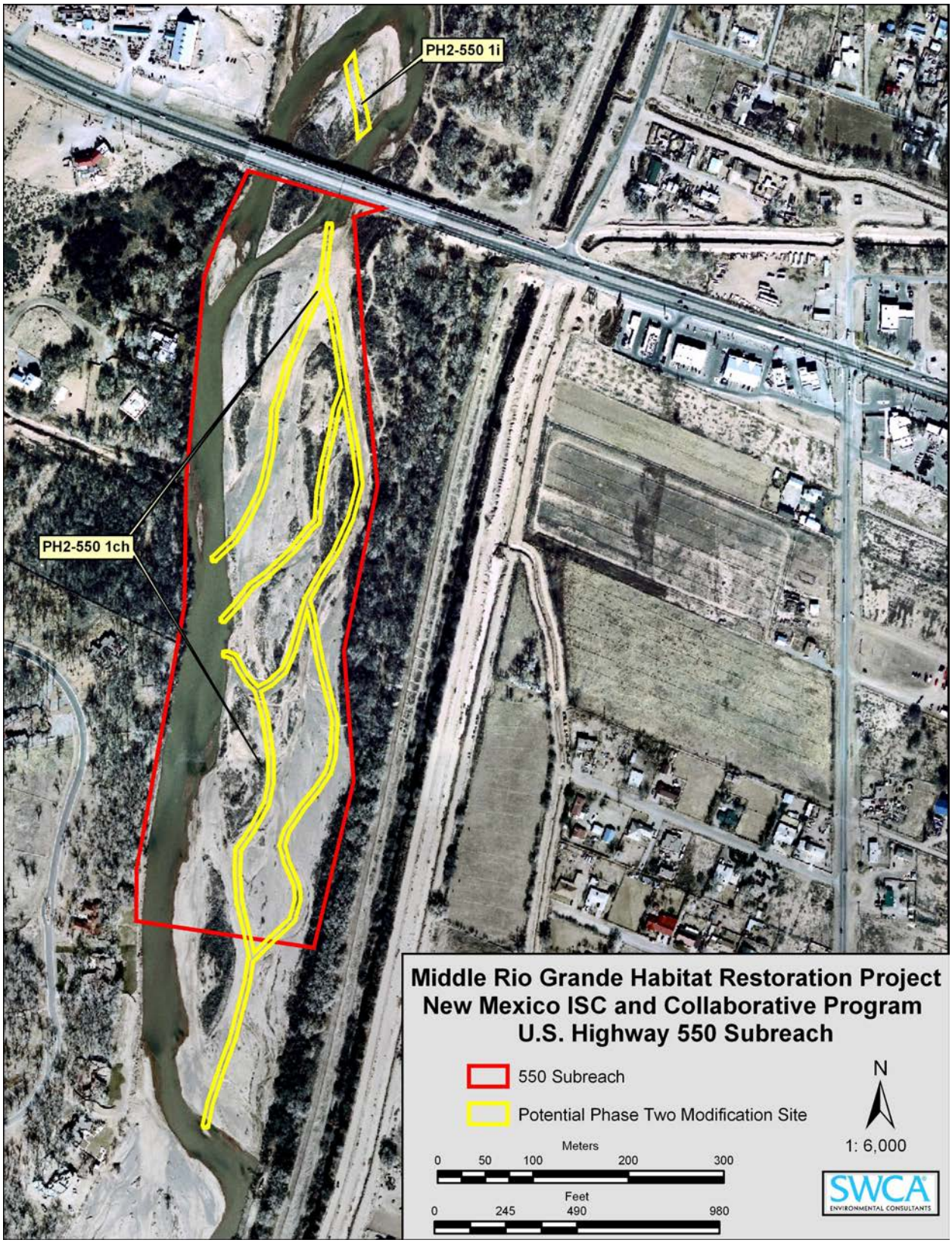

Figure 3. U.S. Highway 550 Subreach treatment locations.

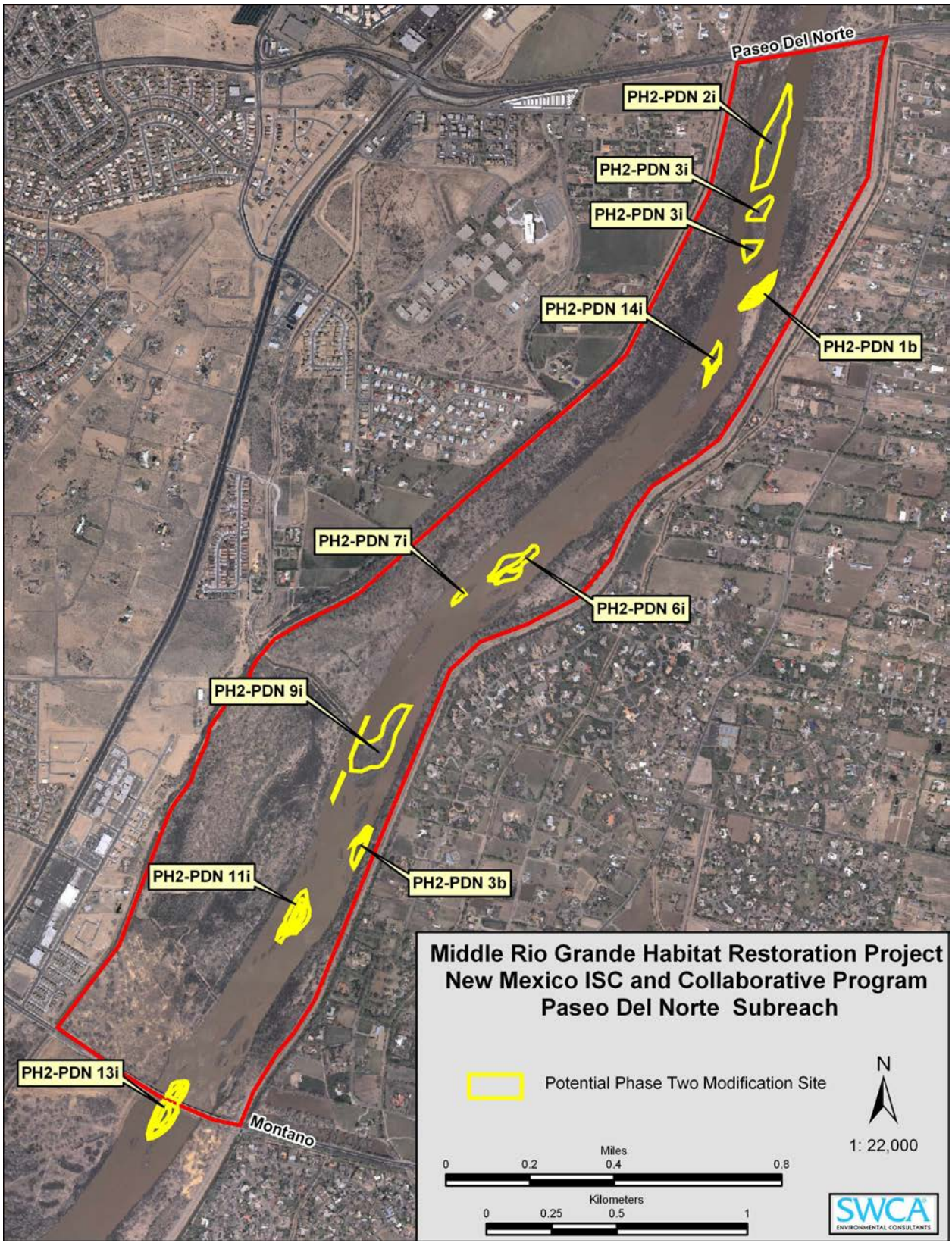

Figure 4. Paseo del Norte Subreach treatment locations.

I-40 TO CENTRAL SUBREACH

Within the I-40 subreach, one site for vegetated island evaluation and modification, five locations for bank modification, and one existing drain enhancement (intake, control structures, outfall) are planned, as shown in Figure 5.

SOUTH DIVERSION CHANNEL SUBREACH

In the area between the Rio Bravo Bridge and the South Diversion Channel (SDC), treatments to six islands are planned, as indicated in Figure 6 and Figure 7. In addition, one ephemeral channel, four bank modification sites, and one in-channel jetty jack removal action would be completed in this subreach.

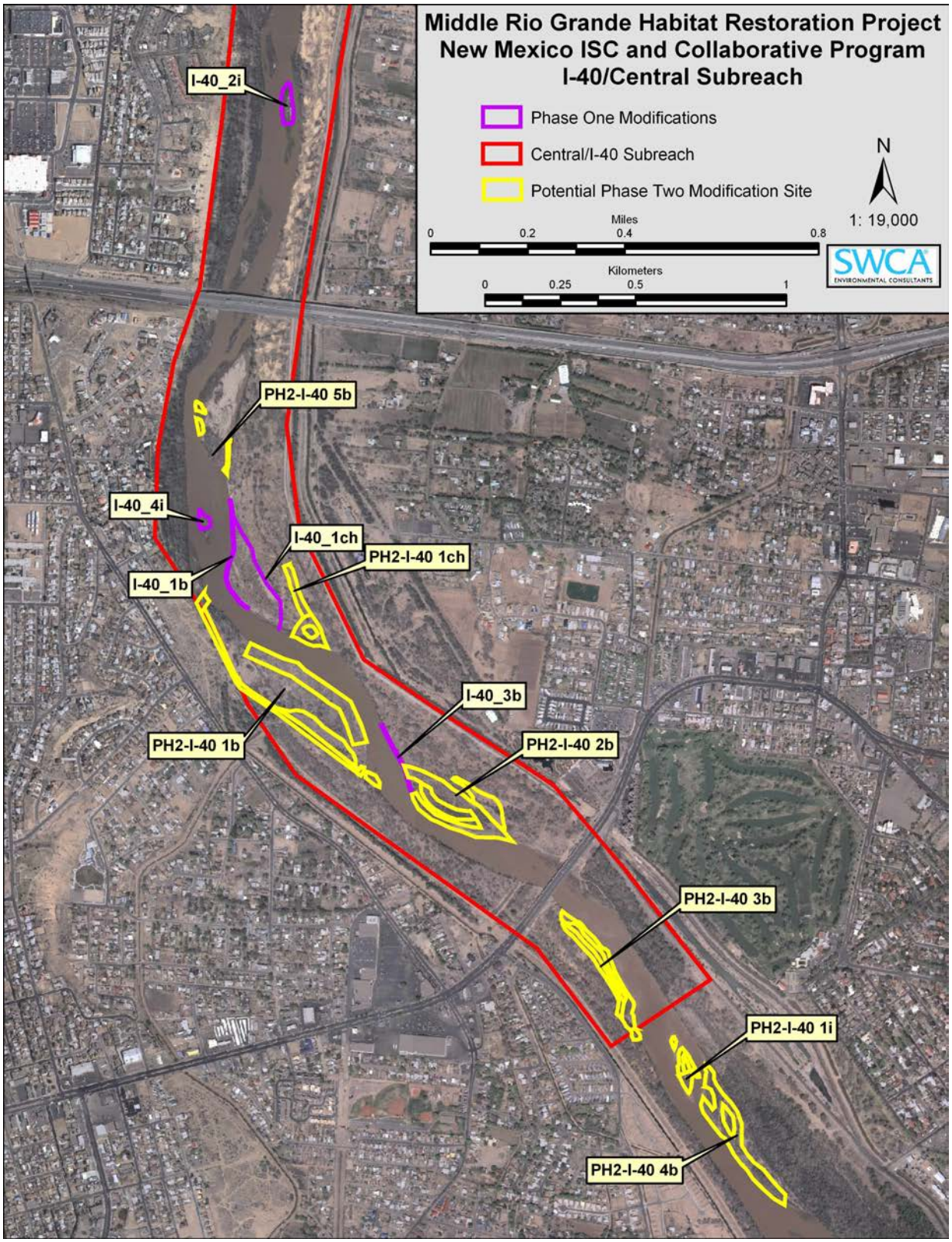

Figure 5. I-40 Subreach treatment locations.

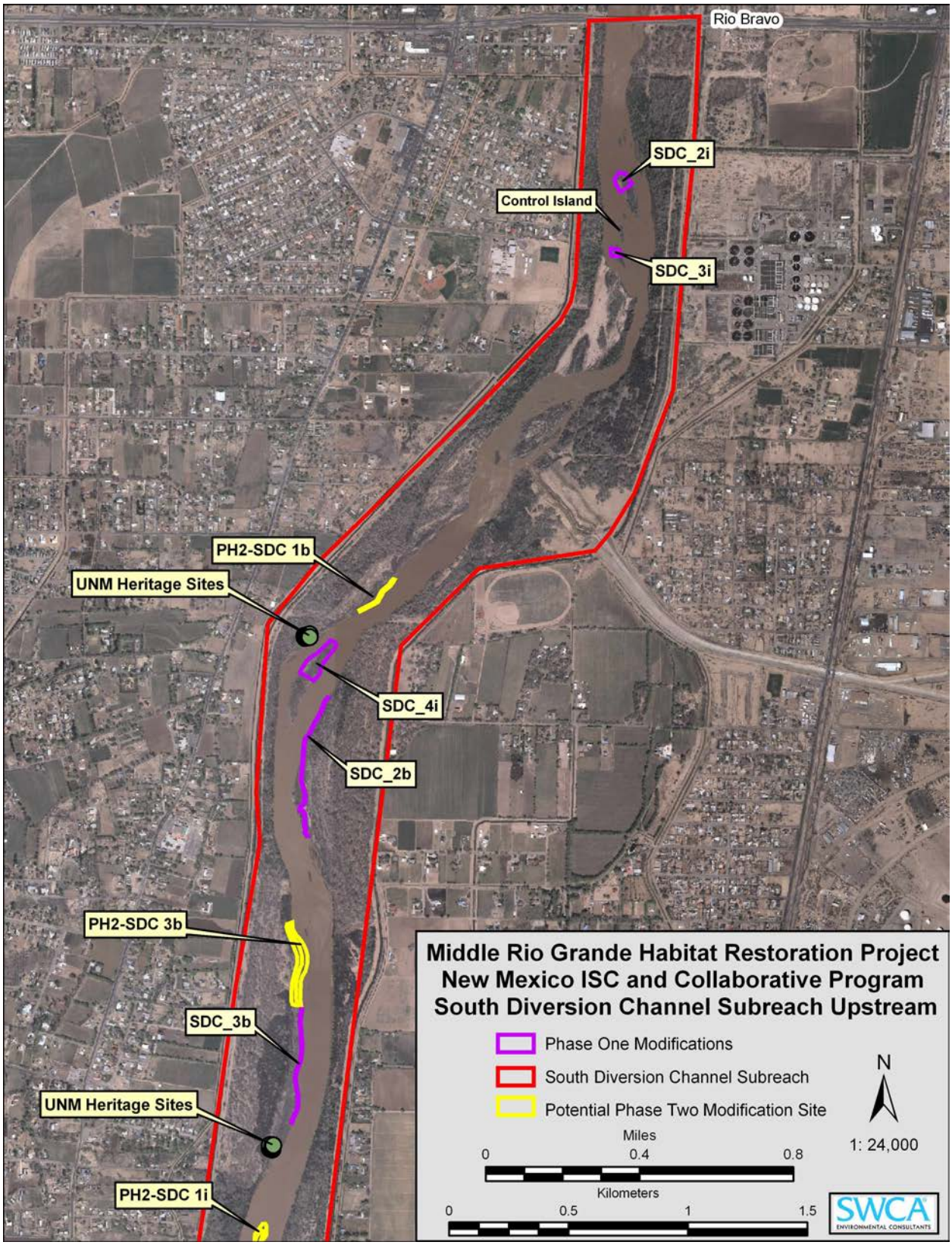

Figure 6. South Diversion Channel Subreach treatment locations, north section.

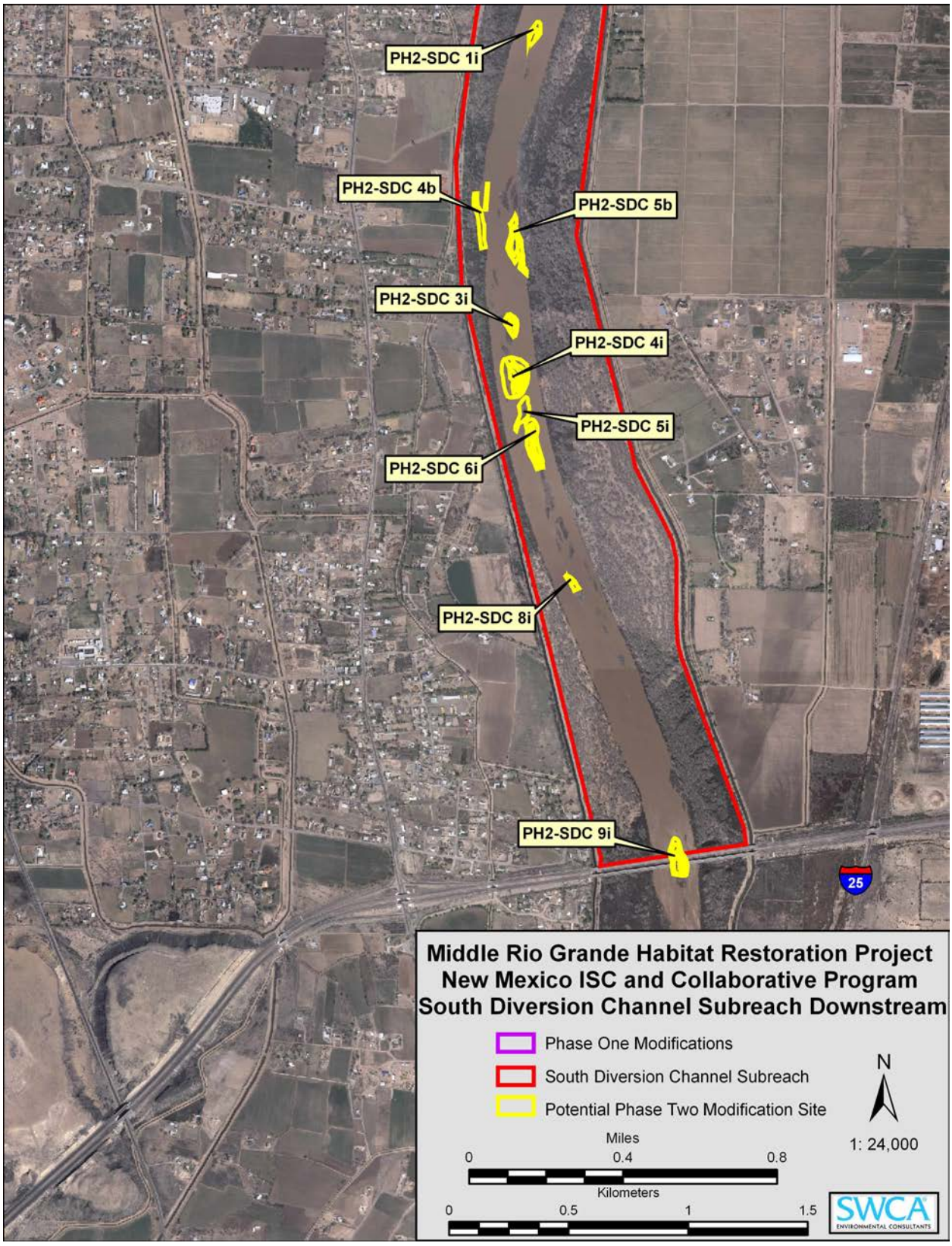

Figure 7. South Diversion Channel Subreach treatment locations, south section.

IN-CHANNEL AND VEGETATED ISLAND MODIFICATION AND EVALUATION

A total of 34.3 acres of island modification is planned for Phase II. Several methods of modification are planned for the 15 islands in the four subreaches. Each method involves recontouring a pre-determined portion of the surface area of the selected island, removing sediments and vegetation with a root-plow attachment on an amphibious caterpillar. These treatments would generate woody debris and sediments that would be used on-site. Deposition of these materials on the island itself would further disturb vegetation on the islands and raise the elevation of the island, reducing opportunities for saturation and inundation. Therefore, new low elevation habitat would be created adjacent to the island using the excess sediment and woody debris generated from island modification techniques.

All treatment and control areas would be monitored for two years to determine the effectiveness of the methods implemented and the potential hydrologic and geomorphic alterations to the project areas. Long term monitoring, up to ten years, and adaptive management would be a coordinated effort with the Collaborative Program and would incorporate interagency objectives to assess the self-sustaining and successfully regenerating ability of restoration treatments. After monitoring and natural reshaping, the remaining island areas void of native vegetation would be replanted with appropriate native species to stabilize the contours to the extent possible. Following restoration, the treated islands are expected to have a surface elevation suitable for inundation at moderate to high river flows. Revegetation, whether natural or planted, would also provide suitable roughness to decrease flow velocities and increase egg and larva retention.

ISLAND TREATMENT #1

Island Treatment #1, to be applied to three islands, consists of removal of woody vegetation and sediments on either the upstream or the downstream half of the island, as shown in Figure 8. One island with modification to the upstream half would have two terraces, with the upstream terrace inundated at flows greater than 1,000 cfs and the downstream terrace inundated at flows greater than 1,500 cfs. A second island with modification to the upstream half would be excavated to a level of 2,000 cfs and would also contain two 1,000-cfs channels, constructed to attempt to create silvery minnow mesohabitat, cause shifts in channel flows, and introduce groundwater to the more interior portions of the island. The third island would be modified on the downstream half, which would be lowered to a single level. On all three islands, vegetation would be cut with a root-plow attachment on the amphibious caterpillar to a depth sufficient to remove the vegetation on the treated portion of the island, with disturbed sediments removed to prescribed depths. Native willow poles would be retained and used along with other native plantings to partially revegetate the treatment areas as needed.

Areas adjacent to the root-plowed treatment zones would be identified for creation of new aquatic habitat at low-flow periods using the disturbed sediments from the island. These areas would be temporarily cut off from the channel by enclosing them along the upstream portion and channel side with a full silt curtain with a chain-weighted bottom. The downstream end of the enclosure would be left open so that enclosed water and aquatic species could escape, as shown in Figure 9. Sediments from the root-plowing treatment area would be pushed into the space

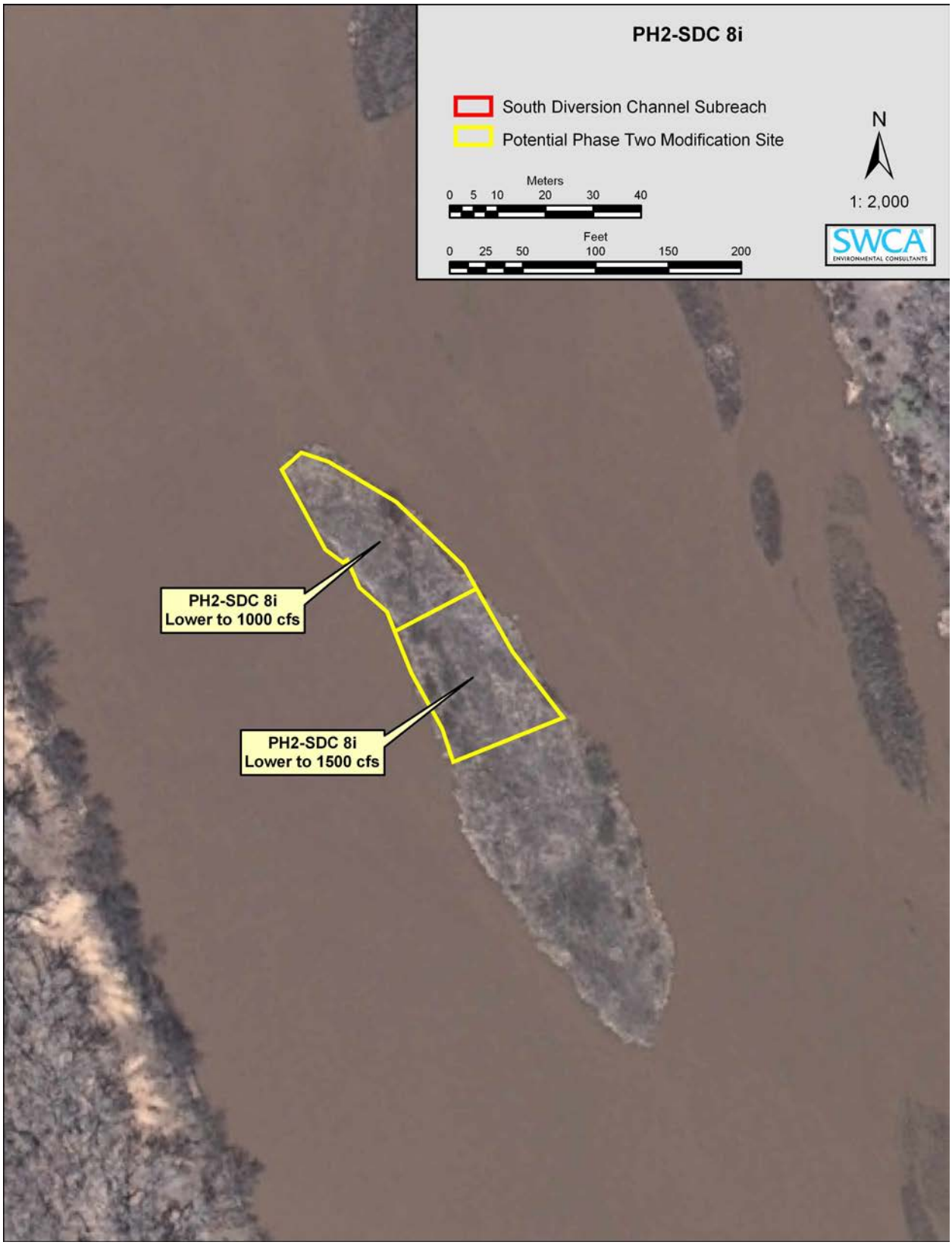

Figure 8. Vegetated island modification, Technique #1 example.

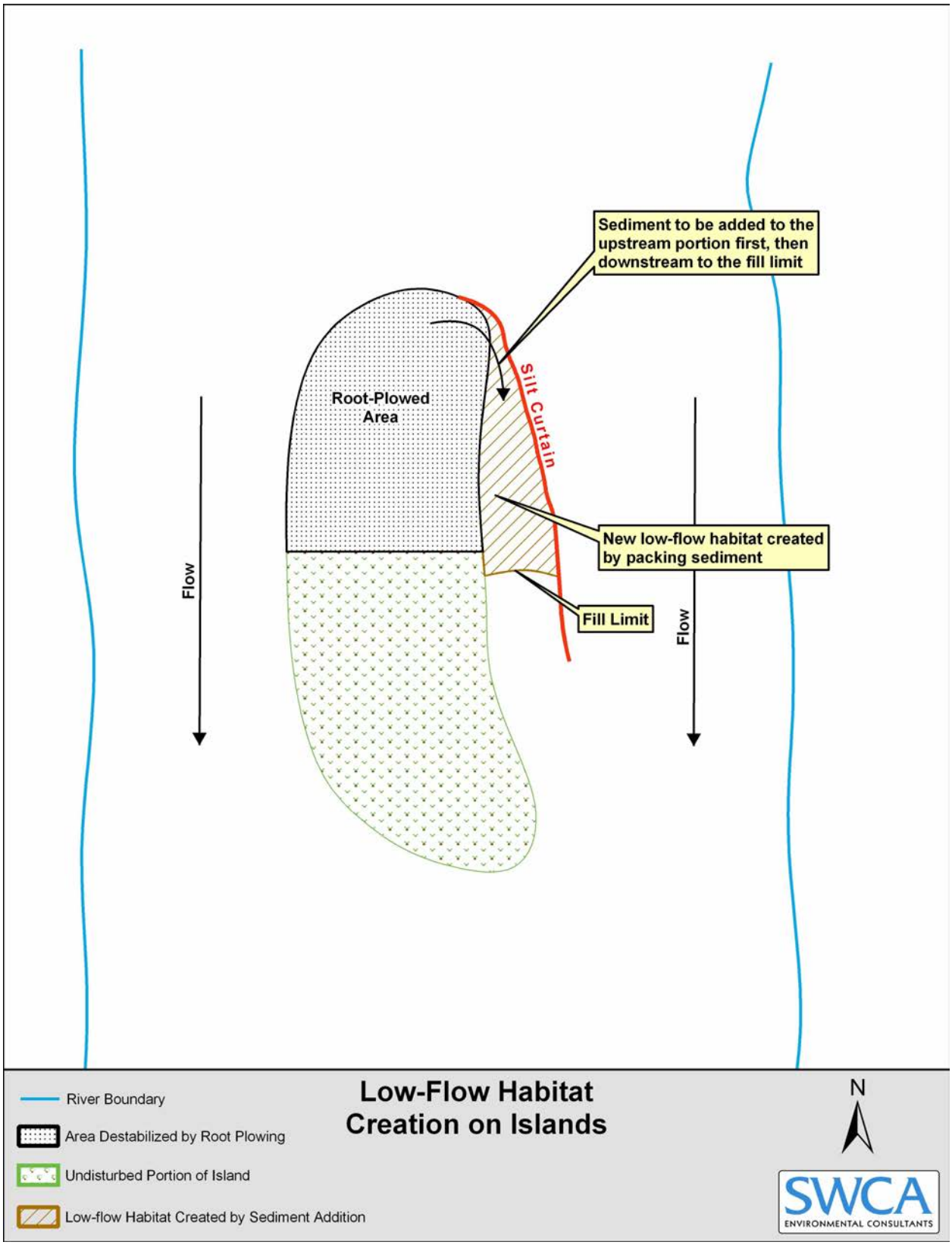

Figure 9. Creation of low-flow habitat on islands.

defined by the silt curtain and used to build up the area to an elevation that would receive inundation at a range of flows from 750 to 1,000 cfs. The excavator would push and pack sediments into the enclosure beginning at the upstream end, using woody debris along the silt curtain. The sediments packed into the upstream end would displace water toward the downstream end. The silt curtain would be removed after the sediments are sufficiently compacted. These newly created habitat areas are expected to be subject to frequent inundation and to have saturated conditions most of the year. They would not be revegetated artificially, but should revegetate naturally with hydrophytic plants from the root material present in the sediments. No additional modifications would be made; the river would be allowed to naturally shape the island, creating contours that would be appropriate for moderate and high flows under current operations. The location of all treatment areas, including newly created low-flow habitats, would be mapped on as-built drawings and monitored for movement and habitat creation relative to the island, as described in the Restoration Monitoring Plan.

ISLAND TREATMENT #2

Island Treatment #2, to be applied to one island, consists of removal of woody vegetation and sediments on the upstream third and downstream third of the island, as shown in Figure 10. The middle third of the island would be left completely undisturbed. Vegetation on the upper and lower portions of the island would be cut with a root-plow attachment on the amphibious caterpillar to a depth sufficient to remove this material, and sediments would be removed to a prescribed depth that would allow for inundation at a range of 1,000 to 2,000 cfs. Native willow poles would be retained and used along with other native plantings to partially revegetate the treatment areas.

Riverbed areas adjacent to the root-plowed treatment areas would be identified for creation of new low-flow- period aquatic habitat using the disturbed sediments from the island. These areas would be temporarily cut off from the channel by enclosing them along the upstream portion and channel side with a full silt curtain with a chain-weighted bottom. The downstream end of the enclosure would be left open so that water and aquatic species could freely escape (see Figure 9). Sediments from the root plowing treatment area would be pushed into the space defined by the silt curtain and used to build up the area to an elevation that would receive inundation at a range of flows from 750 to 1,000 cfs. The excavator would push and pack sediments into the enclosure beginning at the upstream end, using woody debris along the silt curtain. Because the sediments would be packed into place at the upstream end, water would be displaced toward the downstream end. The silt curtain would be removed after the sediments are sufficiently compacted. These newly created habitat areas are expected to be subject to frequent inundation and to have saturated conditions most of the year. They would not be revegetated artificially, but should revegetate naturally with hydrophytic plants from the root material present in the sediments. No additional modifications would be made; the river would be allowed to naturally shape the island, creating contours that would be appropriate for moderate and high flows under current operations. The location of all treatment areas, including newly created low-flow habitats, would be mapped on as-built drawings, and monitored for movement and habitat creation relative to the island, as described in the Restoration Monitoring Plan.

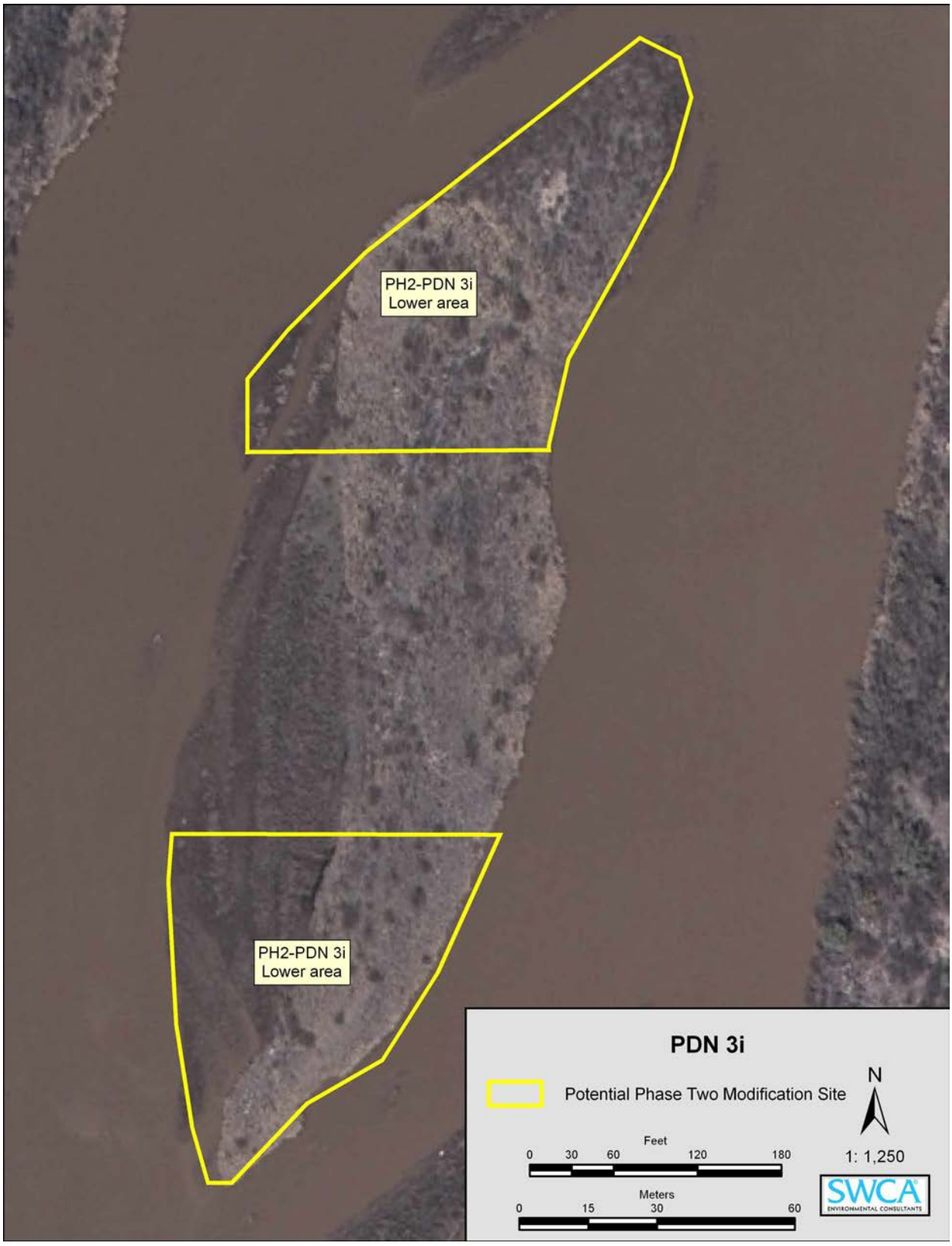

Figure 10. Vegetated island modification, Technique #2 example.

ISLAND TREATMENT #3

Island Treatment #3, to be applied to four islands, consists of lowering the entire island to a depth sufficient for the island to be saturated during low flows (<1,000 cfs) and inundated during moderate and high flows (2,000 and 3,000 cfs, respectively), as shown in Figure 11. Vegetation across the entire island would be cut with a root-plow attachment on the amphibious caterpillar to a depth sufficient to remove all of the vegetation on the island. Sediments would be removed to a prescribed depth. On some islands to be modified by this method, channels are incorporated into the design in an attempt to create silvery minnow mesohabitats, cause shifts in channel flows, and introduce more groundwater into the interior of the islands when they are not inundated. The channels would be constructed to convey water at either 500 or 1,000 cfs, between 500 and 1,000 cfs lower than the proposed leveled island elevation.

Areas adjacent to the root-plowed treatment zone would be identified for creation of new aquatic habitat during low-flow periods using the disturbed sediments from the island. These areas would be temporarily cut off from the channel by enclosing them along the upstream portion and channel side with a full silt curtain with a chain-weighted bottom. The downstream end of the enclosure would be left open so that water and aquatic species could escape (see Figure 9). Sediments from the root-plowing treatment area would be pushed into the space defined by the silt curtain and used to build up the fenced-off area to an elevation that would be inundated at a range of flows from 750 to 1,000 cfs, as described under Island Treatment #1. The location of all treatment areas, including newly created low-flow habitats, would be mapped on as-built drawings and monitored for movement and habitat creation relative to the island, as described in the Restoration Monitoring Plan.

ISLAND TREATMENT #4

Island Treatment #4, to be applied to eight islands, consists of creating a series of terraces across the entire island in an attempt to create silvery minnow mesohabitat during different flow regimes, as shown in Figure 12. Three terrace types would be incorporated into this island modification technique: (1) terracing the island exterior at a lower elevation than the island interior, in a concentrically ringed pattern; (2) terracing the downstream island interior at a lower elevation than the upstream island exterior (creating backwater areas); and (3) terracing the upstream island interior at an elevation lower than the upstream end of the island (creating eddy areas). Island terracing would be accomplished by removing vegetation with a-root plow attachment on the amphibious caterpillar to a depth sufficient to remove vegetation on the entire island. The island would then be re-contoured to meet the prescribed terrace elevations. Any stands of native vegetation would be left in place if possible; if removal is necessary to meet the island modification objectives, removed vegetation would be replanted on the newly formed terraces. Any additional re-vegetation deemed necessary to provide habitat diversity would be with native species.

Areas adjacent to the root-plowed treatment zone would be identified for creation of new aquatic habitat during low-flow periods using the disturbed sediments from the island. These areas would be temporarily cut off from the channel by enclosing them along the upstream portion and channel side with a full silt curtain with a chain-weighted bottom. The downstream end of the enclosure would be left open so that water and aquatic species could escape (see Figure 9).

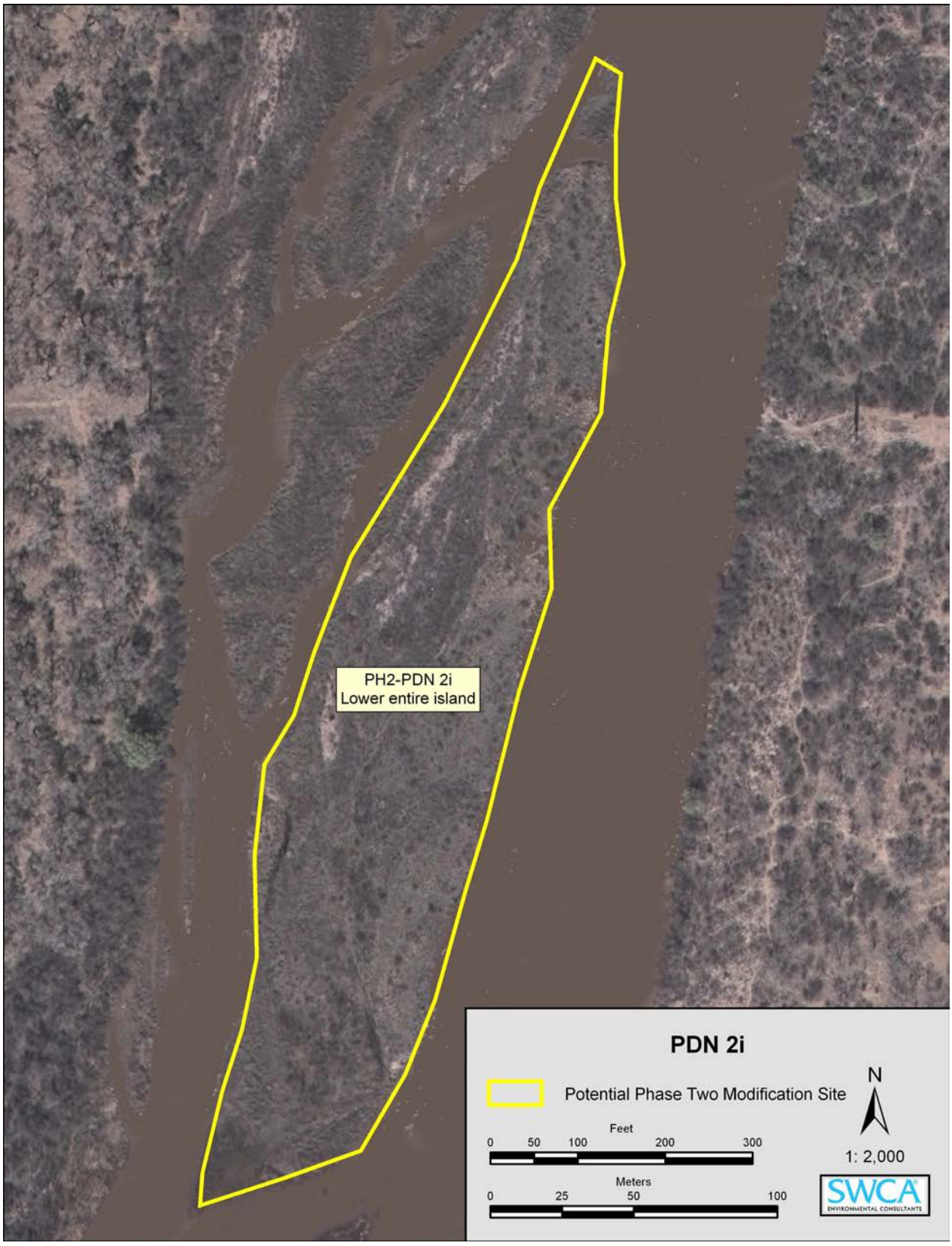

Figure 11. Vegetated island modification, Technique #3 example

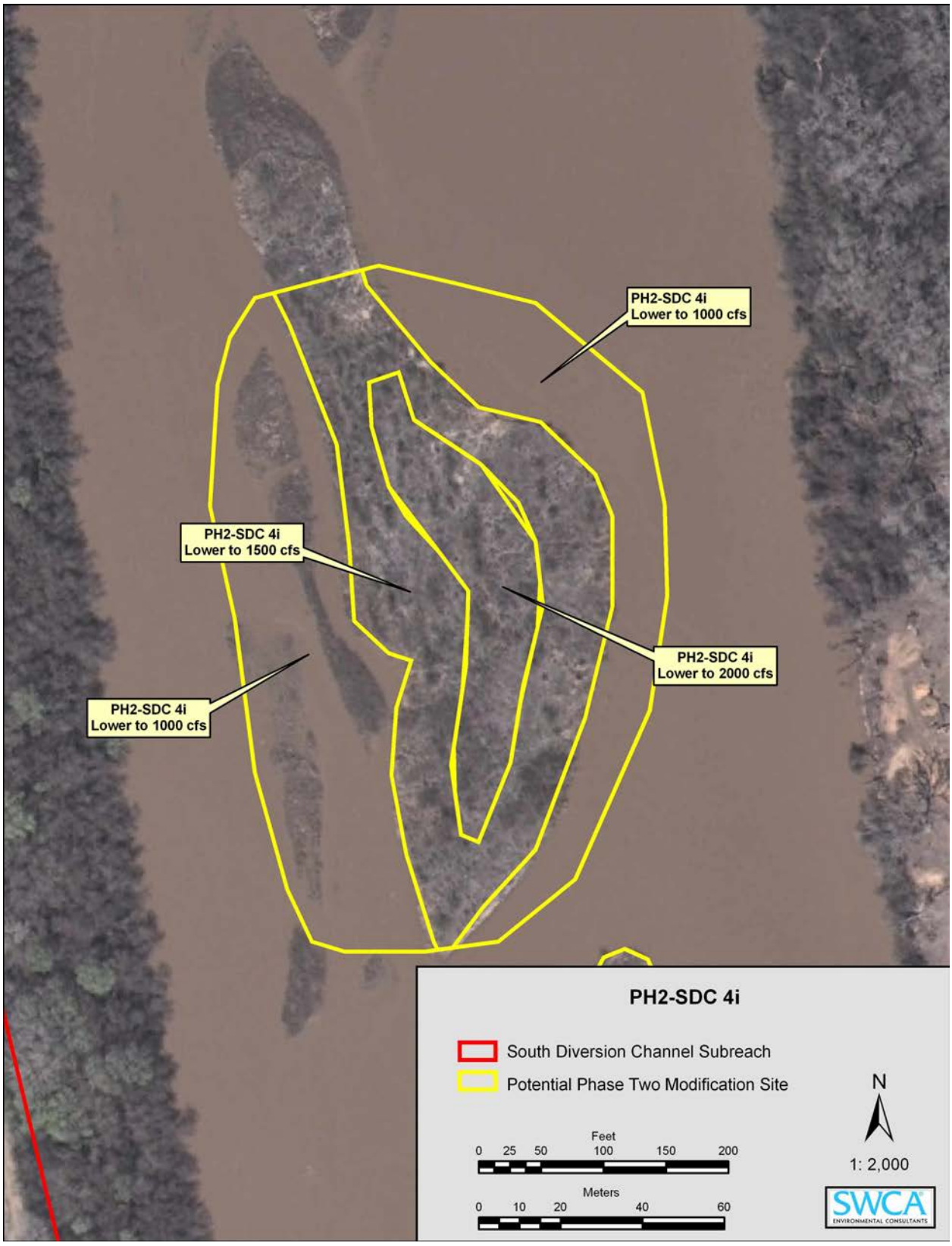

Figure 12. Vegetated island modification, Technique #4 example.

Sediments from the root-plowing treatment area would be pushed into the space defined by the silt curtain and used to build up the fenced-off area to an elevation that would be inundated at target flows of 750 to 1,000 cfs, as described under Island Treatment #1. The location of all treatment areas, including newly created low- flow habitats, would be mapped on as-built drawings and monitored for movement and habitat creation relative to the island, as described in the Restoration Monitoring Plan.

IN-CHANNEL JETTY JACK EXTRACTION

Removal of in-channel jetty jacks over an approximately 0.5-acre area would take place in two specified areas adjacent to island treatment areas, as shown in Figure 13. The purpose of jetty jack extraction would be to reduce the number of structural features that decrease lateral migration potential over in-channel bar and island features, allowing natural river processes to create wider and more diverse channel and floodplain features and thus more low-velocity habitat for silvery minnow.

The jetty jacks would be removed from the channel by an amphibious excavator and placed on the bank, and removed from the bosque shortly thereafter. Collaboration with the Middle Rio Grande Conservancy District (MRGCD), U.S. Army Corps of Engineers, and City of Albuquerque Open Space Division, would be necessary during the extraction process.

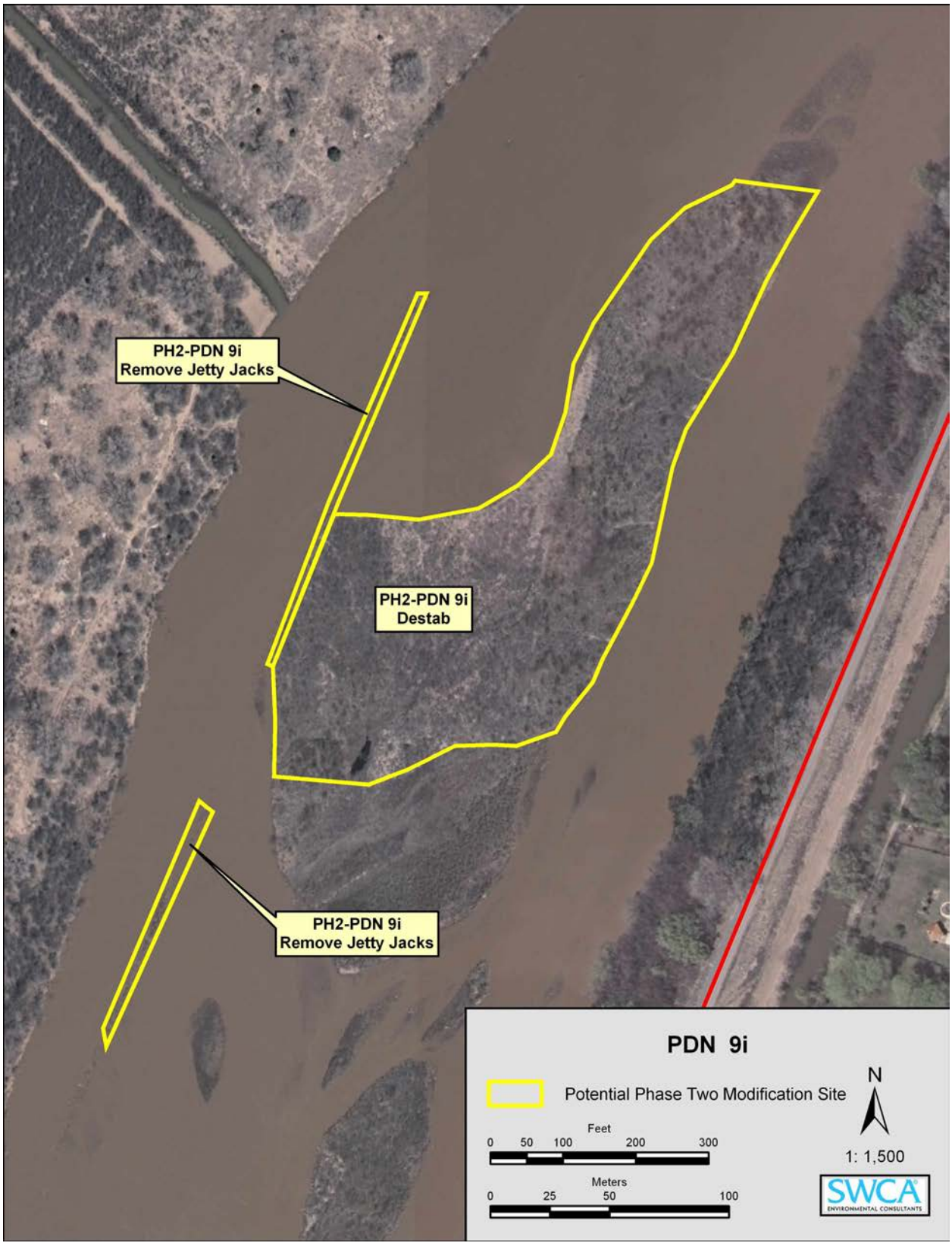

Figure 13. In-channel jetty jack extraction detail.

RIVERBANK AND HISTORIC CHANNEL MODIFICATION

RIVERBED EXPANSION AND BANK TERRACING

Artificial riverbed expansion and bank lowering and terracing (Figure 14) would be accomplished with the amphibious caterpillar along approximately 33.5 acres of riverbank at 13 sites (see Figure 3 through Figure 7). Riverbed expansion would be completed by excavating the bank to the depth of the riverbed, sloping the modified area from the toe (nearest the river) toward the top of the treatment area. This modification technique would help to ensure that shallow, low-velocity habitat would be provided from the lowest river flows (200 to 400 cfs) to slightly higher river flows (1,000 cfs) and could increase the potential of lateral migration in the active river channel. Bank terrace features would be created such that river channel flows of 1,000 to 3,000 cfs would have the potential to overtop and inundate the constructed terrace, ultimately producing lower-velocity shallow water habitat areas. Scours and scallops would be constructed periodically along the walls of the terrace to increase the numbers of backwaters, embayments, and eddy areas.

Construction of the expanded riverbed and bank terrace features would consist of removal of vegetation and sediments along the bank to a depth that would allow water to flow at the prescribed elevations. In the event that construction is at or near the current water level in the channel, a silt barrier would be placed 2 feet from the wetted perimeter of the bank to prevent any sediments from falling into the channel. Woody debris generated in the treatment area may be used for the creation of in-channel debris piles adjacent to the treatment area. Sediment generated in the treatment area would be placed above the waterline on undisturbed adjacent upland areas to an uncompacted depth not to exceed 2 feet. No sediments would be placed in the wetted channel.

EPHEMERAL SIDE AND BACKWATER CHANNELS

The restoration and/or creation of 12.8 acres of ephemeral side channels and 5.9 acres of backwater channels would take place on islands, point bars, and inland areas, as shown in Figure 15 and Figure 16. Many of the locations proposed for treatment are historic channels that are no longer functioning or that function only during very high periods of river flow (not yearly events). The side channels would be constructed with the amphibious caterpillar at prescribed elevations to create low-velocity habitats. Side channels would be connected to the river channel when flows are at 500 cfs or higher, but not during lower flows. During these periods of lower flow, side channels would have the potential to become pools and backwater areas with little or no flow. Backwater channels (no upstream inlet) would be constructed on the bottom of large point bars (already low-velocity areas) at a range of elevations that would allow inundation at flows between 500 and 2,000 cfs. Backwater channels would slope slightly, with the downstream end lower than the upstream end, providing habitat opportunities at a range of flows.

Construction of side and backwater channels would consist of removal of vegetation and sediments along the proposed channel at the prescribed depth. Woody debris generated in the treatment area may be used for the creation of in-channel debris piles adjacent to the treatment area.

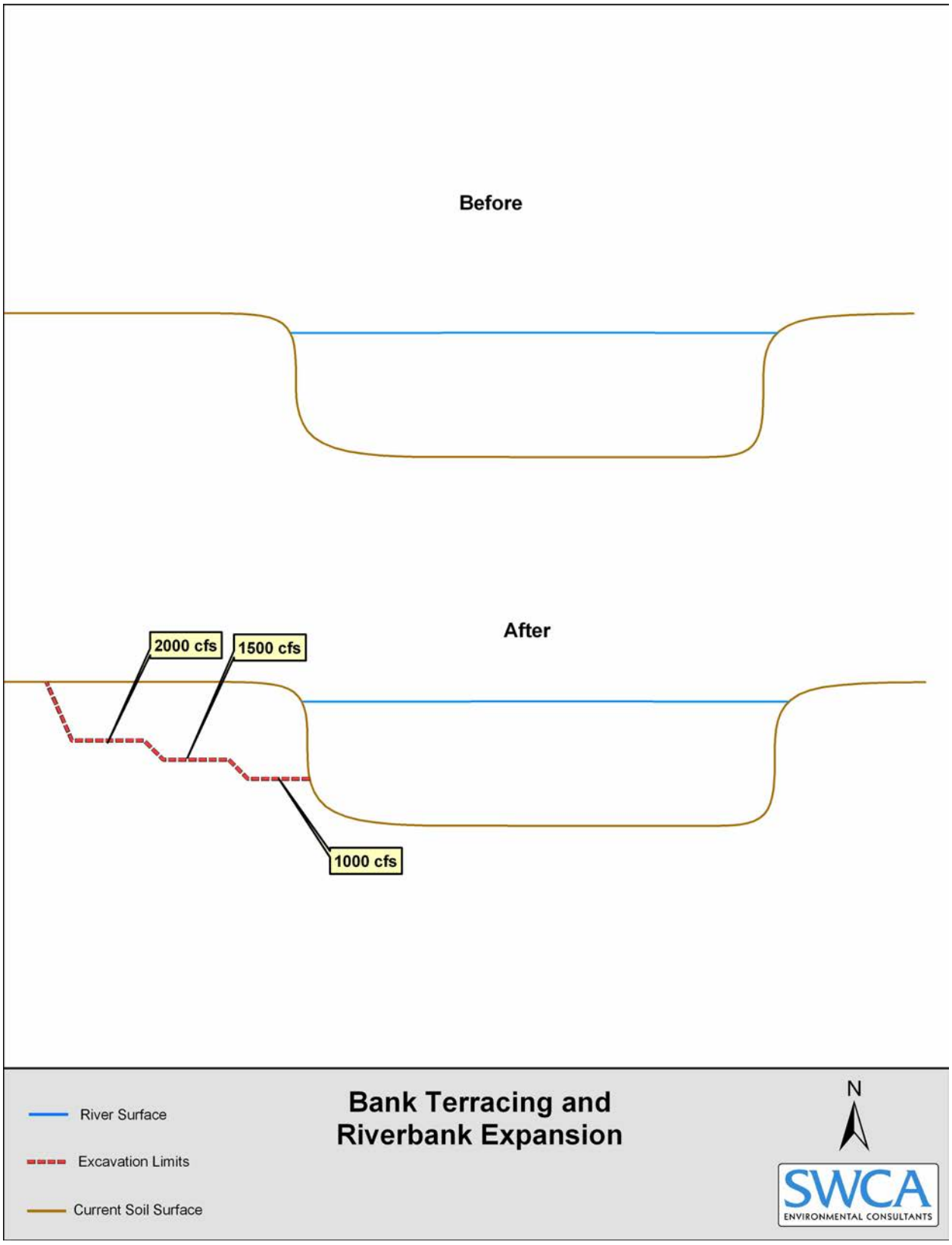

Figure 14. Example of bank terracing and riverbank expansion detail.

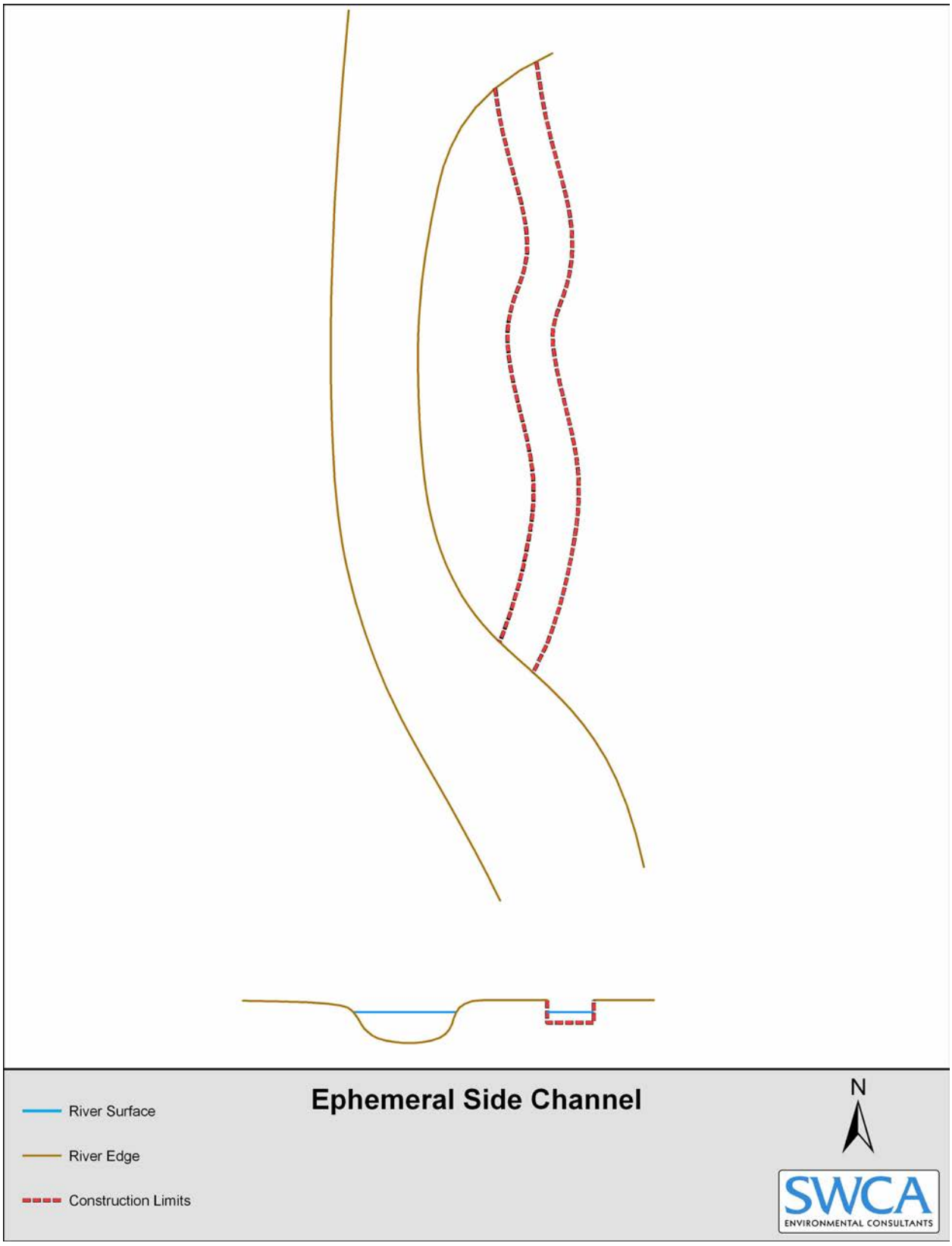

Figure 15. Example of side channel detail.

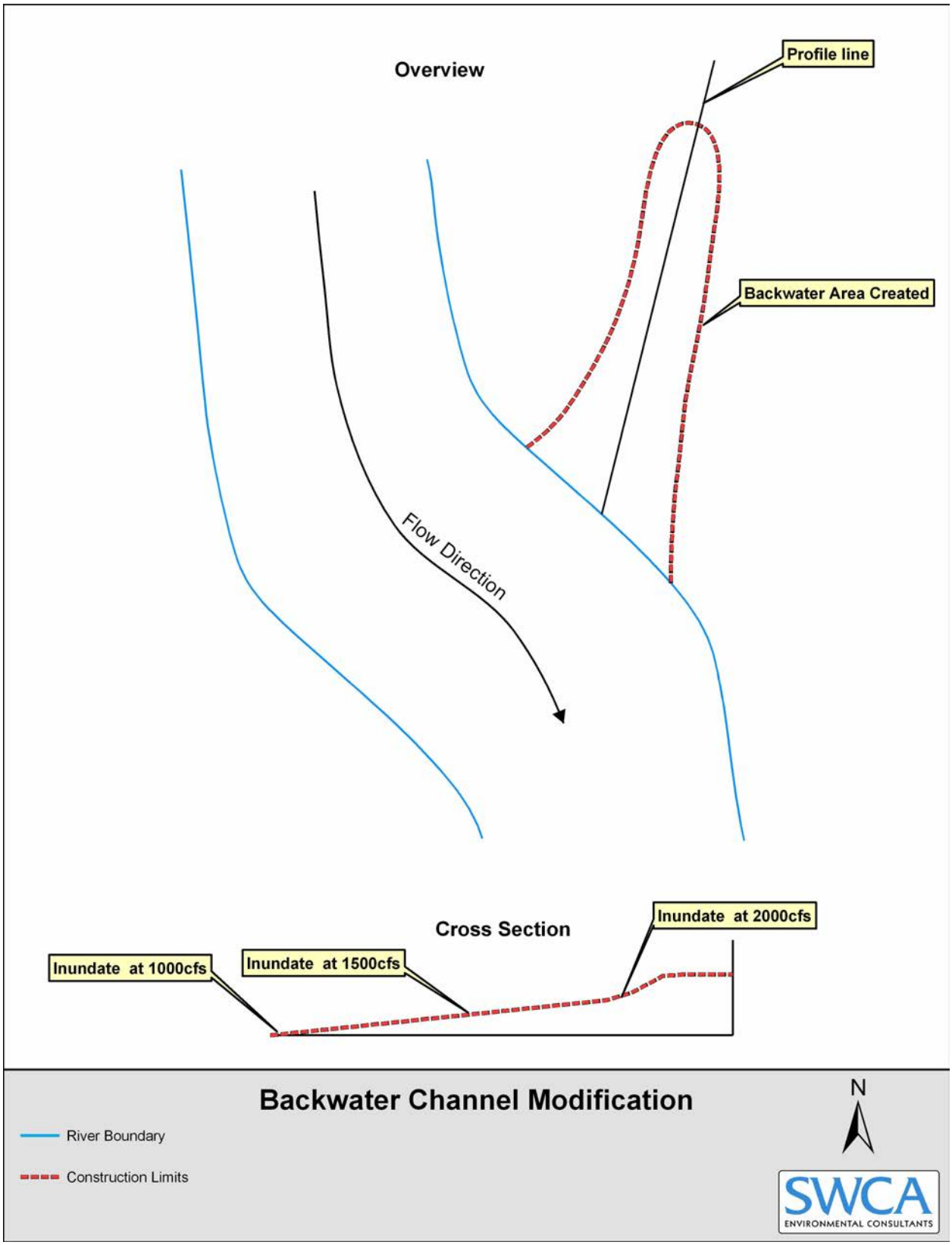

Figure 16. Example of backwater channel detail.

EXISTING ATRISCO DIVERSION RESTORATION

Approximately 6.1 acres of drain restoration, including overbank area, and 5.8 acres of bank lowering would be provided. The wetted channel within the drain-enhanced area would be approximately 3.5 acres in area, and the overbank area would be about 2.6 acres. Planning and design would include a detailed topographic survey for accurate grade control and placement of water control structures. Civil engineering (grading, cuts and fills, excavation disposal areas, etc.), structural engineering (water control structures), and river geomorphology engineering would be performed as part of the project design. The design would take into account and incorporate current and planned uses of the area, historic landmarks and artifacts, and sensitivity to neighboring landowners.

The diversion and wasteway system no longer serves any irrigation function in the MRGCD system. The proposed Project would reconnect the access and bypass channel portions of this system to the Rio Grande to create an ephemeral side channel to the river. The reconnection of the diversion and access channels would be designed to provide backwater areas for egg and larvae retention during spring runoff and refugia for minnow during low-flow periods. A number of the habitat restoration techniques shown in Table **1** would be used and evaluated in this work. The site could be used to provide space for rearing or for acclimation of silvery minnow entering the river during typical spring and fall releases.

Potential improvements would include:

- High flow embankment cuts along the bank line to create embayments during floods and runoff events. These cuts would be sloped to the river to prevent stranding while allowing for retaining silvery minnow eggs/larvae and providing rearing areas.
- Excavation of banks to provide lateral expansion of river channel. This activity would create a wider floodplain, resulting in lower velocity and better access to embayments and overbank areas for silvery minnow egg/larval retention and grow-out. Excavation and lateral cuts into vegetation would allow for natural processes to reduce depositional area and create more habitat diversity.

The reconnection of the drain (Figure 17, Figure 18) would require structural reconstruction and excavation work. The existing entrance channel would function in moderate to high river flows after accumulated sediment is removed to allow reconnection to the river. A second channel would be added by removing sandy sediment between the existing unlined channel and the thalweg of the river to allow connection with the river during low flow-periods.

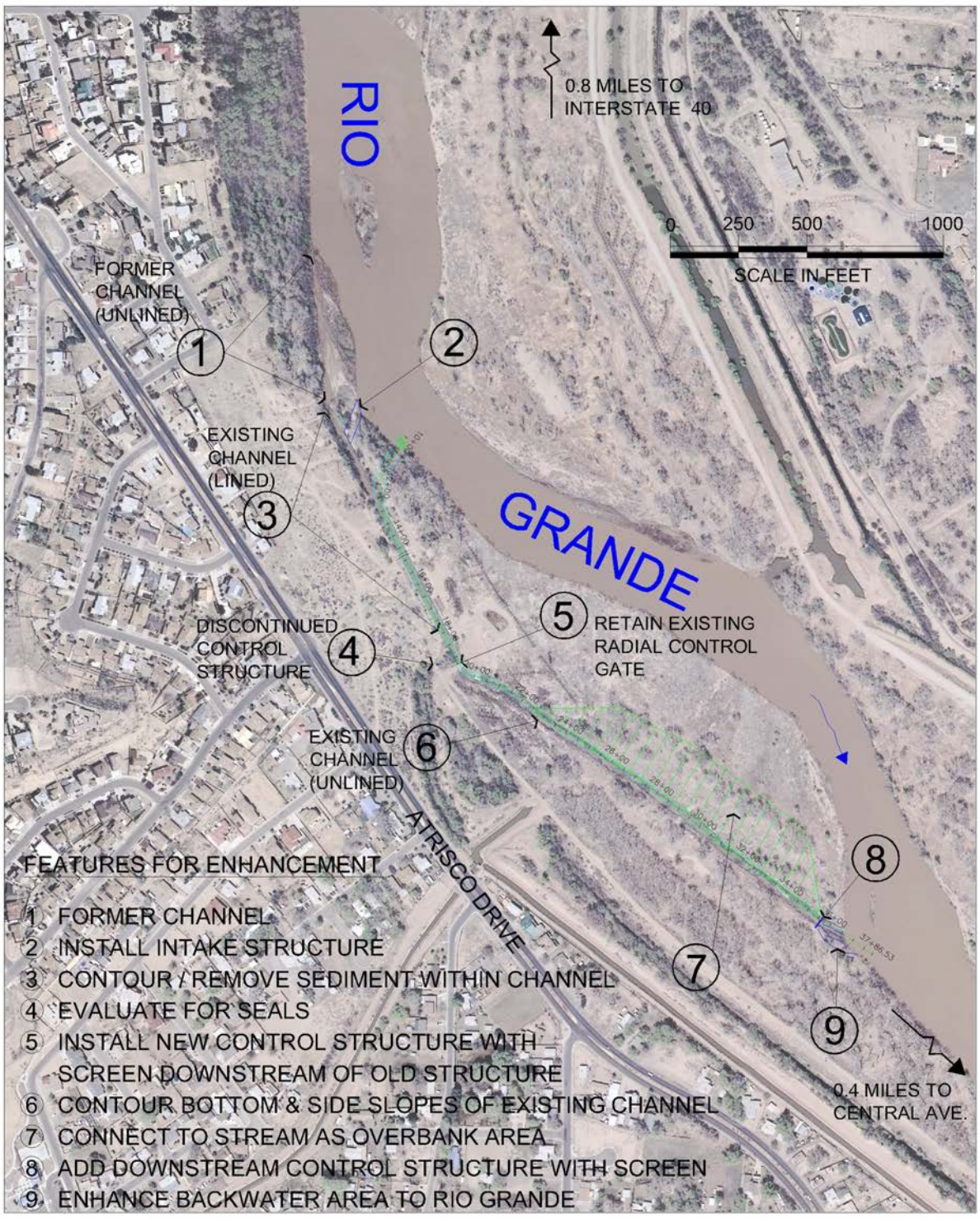

Figure 17. Overview of Atrisco Diversion restoration.

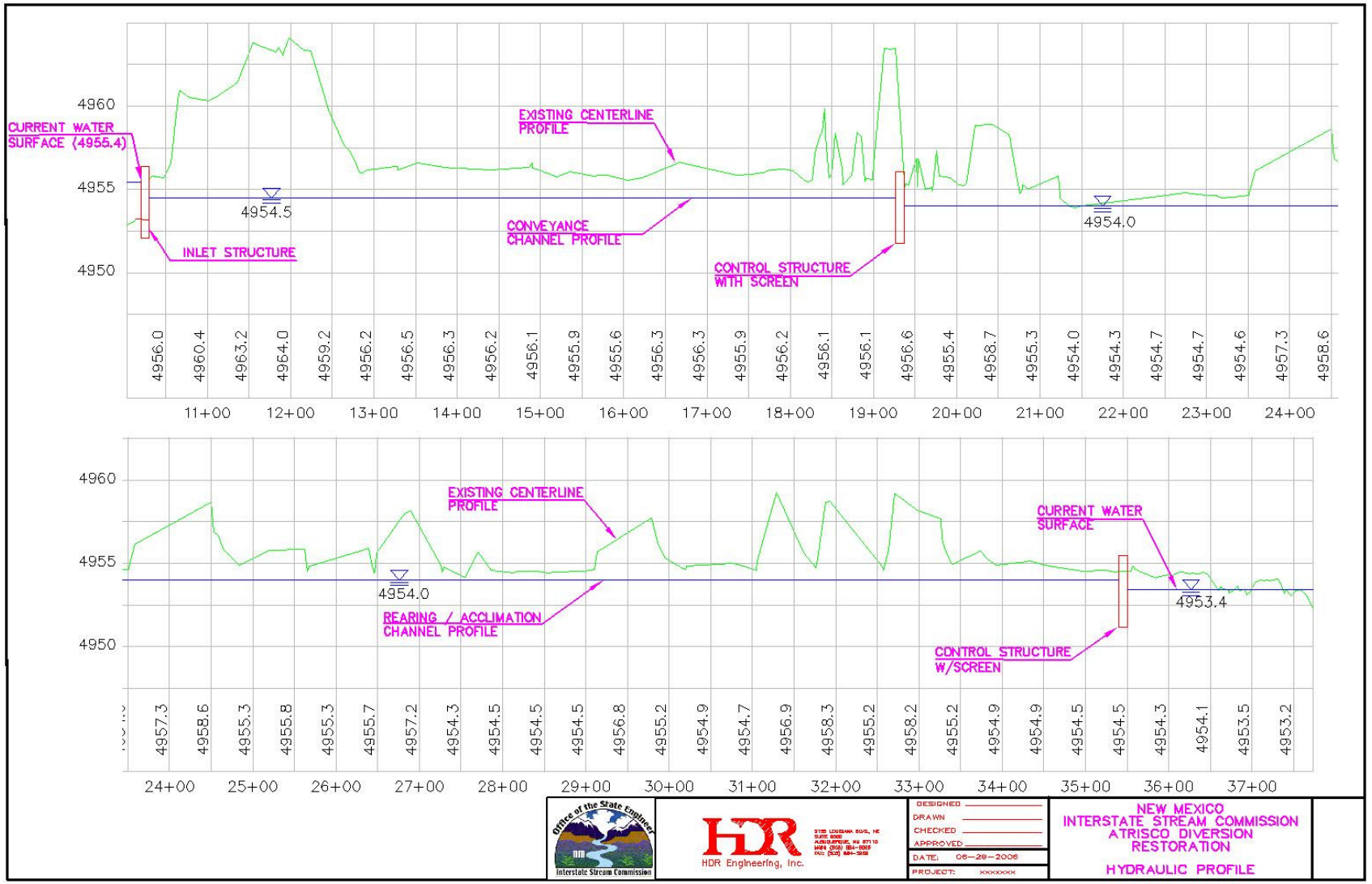

Figure 18. Atrisco Diversion profile.

EQUIPMENT, STAGING, AND ACCESS

EQUIPMENT

Equipment proposed for construction on point bars and banks accessible from the shore, such as the braided channel enhancement at the 550 Subreach, may include a dozer, a belly scraper, an excavator, a backhoe, and a root plow of standard width. For access to islands and less accessible banks and bars, an amphibious Caterpillar 325 excavator would be used (Figure 19). Personnel and other equipment would be transported using an amphibious personnel carrier (Figure 20). Low-impact amphibious equipment is used for work in wetlands and other sensitive aquatic sites where ecological disturbance must be kept to a minimum.

The amphibious equipment is designed to disperse weight and minimize impact of the treads when operating in water. The excavator is about 18 feet wide and 34 feet long, and is equipped with a 60-foot boom, allowing the machine to perform extensive work with a minimal footprint. The gross pressure of the excavator is 1.7 psi and the maximum speed of the machine is 1.2 mph on level ground and 1 mph in water. The amphibious personnel carrier is approximately 16 feet wide, 27 feet long, and 13 feet high. The gross pressure of the amphibious personnel carrier is 1.4 psi, and the maximum speed of the unit is 3 mph. To successfully and safely implement all habitat restoration activities, the construction contractor would be held to the following safety precautions and construction specifications:

- Prior to leaving contractor facilities, all equipment would be thoroughly inspected, and any leaky or damaged hydraulic hoses would be replaced.
- To avoid any potential impacts to silvery minnow critical habitat or southwestern willow flycatcher proposed critical habitat, all fuels, hydraulic fluids, and other hazardous materials would be stored outside the normal floodplain and refueling would take place on dry ground with a spill kit ready. Extra precautions would be taken when refueling because of the environmentally sensitive location.
- An environmental specialist trained in spill prevention and spill clean-up would be onsite during all construction activities.
- All equipment would be steam-cleaned before arriving and departing the job site.
- A spill kit would be maintained on every rig in the river, with spill pans, containment diapers, oil booms, absorbent pads, oil mats, plastic bags, gloves, and goggles.
- Steel-mesh guards would cover all external hydraulic lines.
- Each individual operator would be briefed on and would sign off on local environmental considerations specific to the project tasks, including specific Storm Water Pollution Prevention Plans (SWPPPs).
- Water-quality testing would be conducted prior to entering the water and periodically during the operating day to ensure that standards are being maintained.
- Water-quality parameters to be tested include pH, temperature, dissolved oxygen, and turbidity, both upstream and downstream of the work area.
- Responses to changes in water-quality measures exceeding the applicable standards would include reporting the measurements to the New Mexico Environment Department (NMED) Surface Water Quality Bureau and returning equipment to shore.
- Equipment operation would minimize sediment displacement by river flow.

Figure 19. Amphibious Caterpillar 325.

Figure 20. Amphibious personnel carrier.

STAGING AND ACCESS

Equipment and personnel staging and access locations for the four subreaches are shown in Figure 21 through Figure 24. Permission from the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), the Middle Rio Grande Flood Control Authority, the Pueblo of Sandia, Reclamation, MRGCD, and other interested entities would be obtained prior to implementation. No mature native vegetation would be removed and construction would occur outside the southwestern willow flycatcher-breeding season.

To prevent the mixing of sediments with surface pools and runoff in each of the subreaches, access paths that minimize travel distances in wetted pools or flowing water would be predetermined. Prior to crossing the wetted portion of the diversion channels, water-quality parameters would be measured and temporary silt fencing would be placed downstream of the crossing to minimize sediment disturbance. The fencing would be removed after suspended sediments have settled out and water-quality parameters, including dissolved oxygen, have returned to within 10 percent of the ambient condition or parameters outlined by NMED.

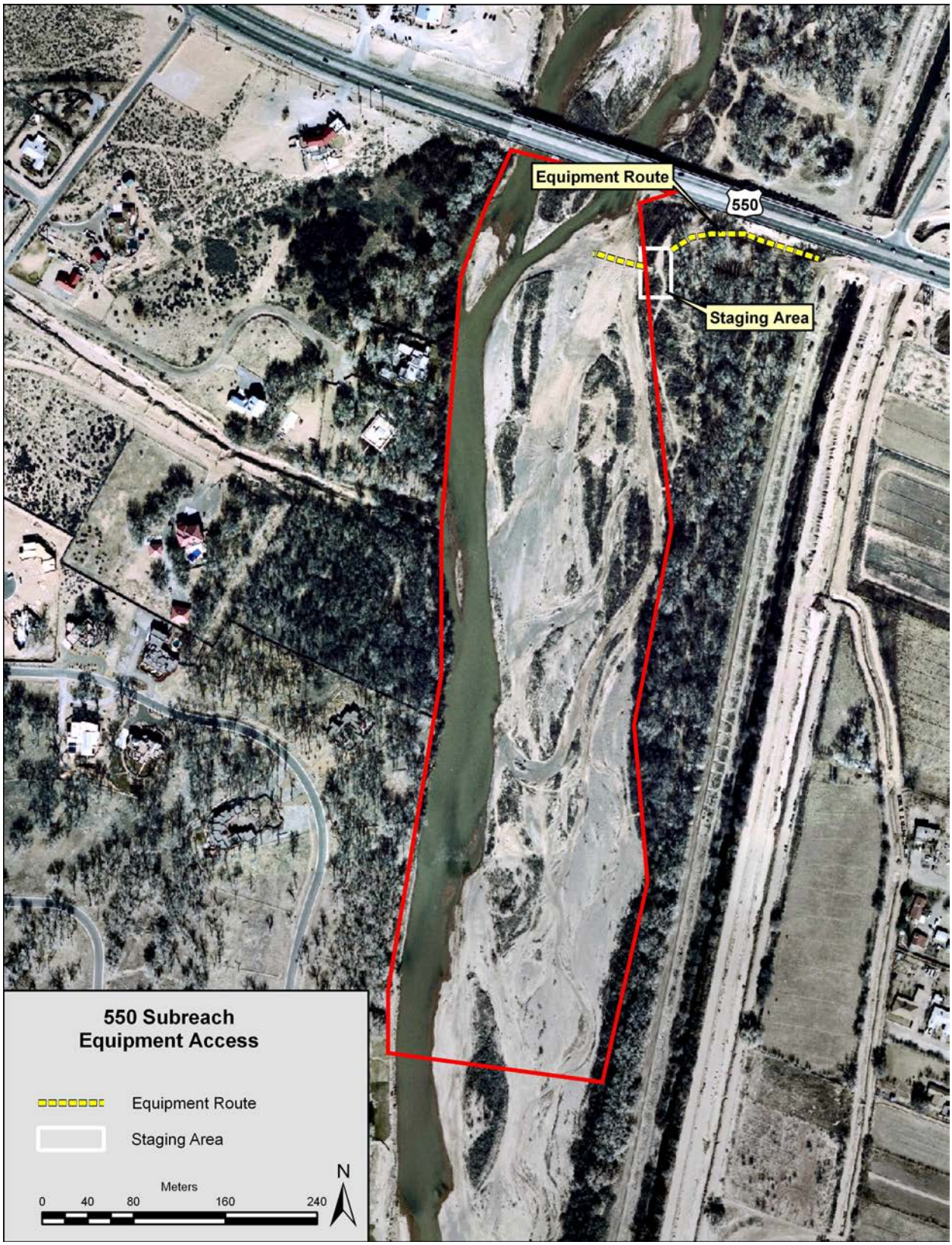

Figure 21. U.S. Highway 550 Subreach staging and access areas.

Figure 22. Paseo del Norte Subreach staging and access areas.

Figure 23. I-40/Central Subreach staging and access areas.

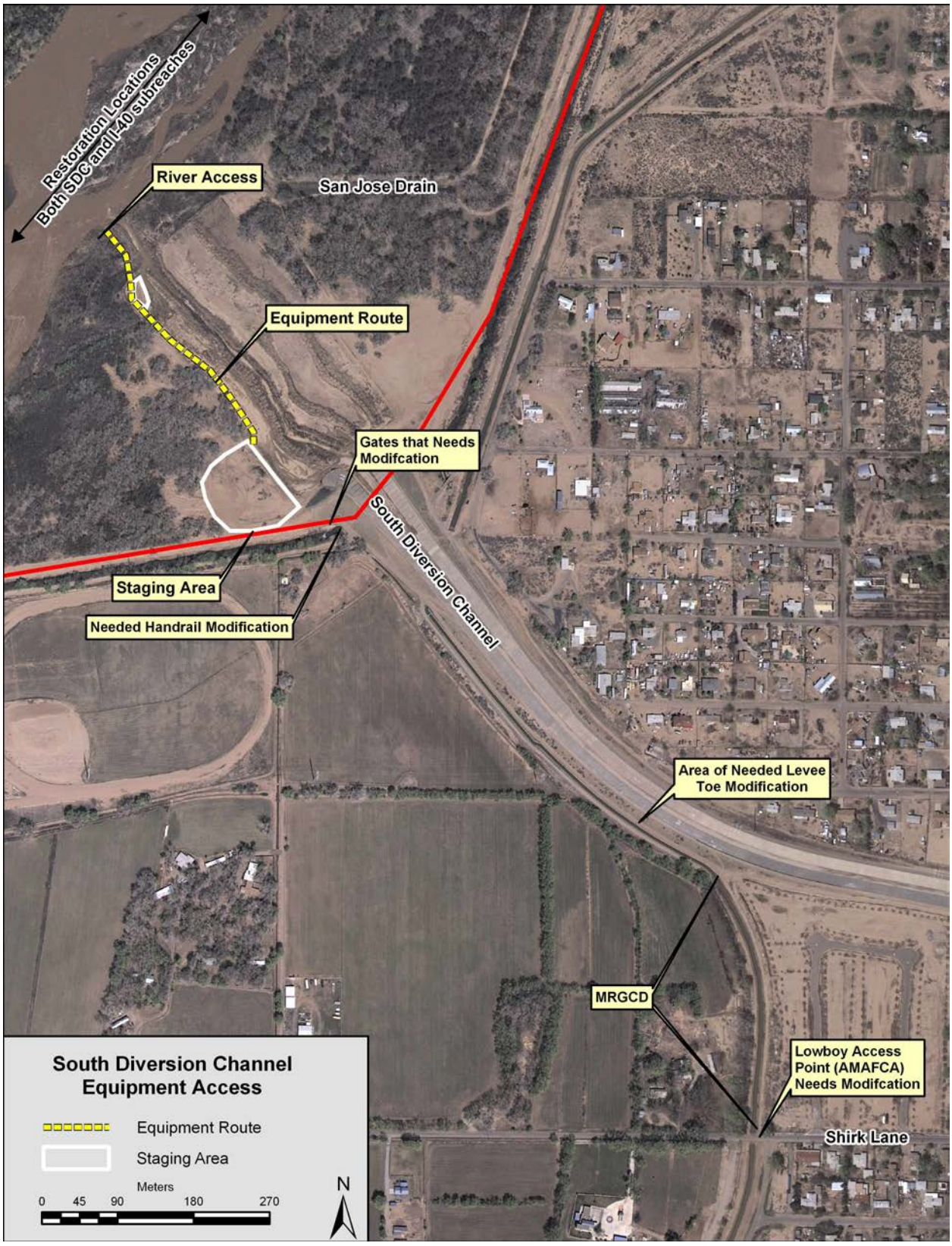

Figure 24. South Diversion Channel Subreach staging and access areas.

ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. The environmental baseline includes the anticipated impacts of all proposed Federal projects that have undergone Section 7 consultation, and the impacts of State and private actions that are contemporaneous with the consultation in progress.

CITY OF ALBUQUERQUE DRINKING WATER PROJECT

In April 2006 the City of Albuquerque Drinking Water Project completed construction of their surface water diversion on the Rio Grande. The project will allow diversion of the City's San Juan-Chama Project water to provide a sustainable drinking water supply for its citizens. The project includes a fish passage channel to allow silvery minnows to move upstream around the inflatable dam during diversions.

NEW MEXICO INTERSTATE STREAM COMMISSION HABITAT RESTORATION PHASE I

The New Mexico Interstate Stream Commission completed construction for the Middle Rio Grande Riverine Habitat Restoration project in April 2006. The NMISC implemented various habitat restoration techniques, which have been identified by the Collaborative Program to benefit the endangered silvery minnow within the Albuquerque Reach of the Middle Rio Grande. The objective of the project is to continue and expand the habitat restoration currently being undertaken by the NMISC in the Albuquerque Reach and to increase measurable habitat complexity that supports various life stages of the silvery minnow, including: egg retention; larval development and recruitment of young-of-year, and over-winter habitats to retain adult minnows. Monitoring and evaluation of the project are ongoing.

I-40 HABITAT RESTORATION DEMONSTRATION PROJECT

The Bureau of Reclamation completed construction of the Rio Grande silvery minnow habitat demonstration project immediately downstream of Interstate 40 in August 2005. The project is designed to evaluate habitat features for silvery minnow spawning and rearing habitat at flows between 500 and 6000 cfs. The site was inundated at flows between 700 and 4000 cfs during summer rainstorm events.

BERNALILLO AND SANDIA PRIORITY SITE PROJECTS

The Levee Priority Site Projects at Bernalillo and Sandia Pueblo have completed environmental compliance and began construction in summer 2005. The project designs incorporate hydraulic features that protect the levee by redirecting flow away from the levees. These features also increase habitat complexity that should benefit the silvery minnow and other fish species.

AFFECTED SPECIES INFORMATION

RIO GRANDE SILVERY MINNOW (*HYBOGNATHUS AMARUS*)

The Rio Grande silvery minnow was federally listed as endangered under the ESA on July 20, 1994 (Federal Register [FR] 1994), and is listed as endangered by the State of New Mexico as well. The final recovery plan for the silvery minnow was released in July 1999 (USFWS 1999). The primary objectives of the decision are to increase numbers of the silvery minnow, enhance its habitat in the Middle Rio Grande valley, and expand its current range by re-establishing the species in at least three other areas in its historic range (USFWS 2003).

The silvery minnow is a moderate-sized, stout minnow that reaches 3.5 inches (9 cm) in total length and spawns in the late spring and early summer, coinciding with high spring snowmelt flows (Sublette et al. 1990). The silvery minnow is herbivorous, feeding primarily on diatoms (Shirey 2004). These fish travel in schools and tolerate a wide range of habitats (Sublette et al. 1990), but generally prefer low-velocity areas (<0.33 feet per second, 10 cm/second [cm/sec]) over silt or sand substrate that are associated with shallow (<15.8 inches [40 cm]) braided runs, backwaters, or pools (Dudley and Platania 1997). Adults are most commonly found in backwaters, pools, and habitats associated with debris piles, whereas young-of-year occupy shallow, low-velocity backwaters with silt substrates (Dudley and Platania 1997). Habitat includes stream margins, side channels, and off-channel pools where water velocities are low or reduced from main-channel velocities. Stream reaches dominated by straight, narrow, incised channels with rapid flows are not typically occupied by silvery minnow (Bestgen and Platania 1991).

The species is a pelagic spawner that produces 3,000 to 6,000 semi-buoyant, non-adhesive eggs during a spawning event (Platania 1995; Platania and Altenbach 1998). Adults may spawn multiple times during spring runoff and increased summer monsoon flows (USFWS 2003). Eggs and larvae may drift for 3–5 days and be transported from 134 to 223 miles (216–359 km) downstream. Recent data from augmentation and relocation projects suggest that dispersal of eggs, larvae, and older age classes is less than 10 miles (15 km) (Dudley et al 2005; Porter et al. 2004; Remshardt and Davenport 2003). Silvery minnow larvae can be found in low-velocity habitats where food (mainly phytoplankton and zooplankton) is abundant and predators are scarce.

Platania (1995) suggested that historically the downstream transport of eggs and larvae of the silvery minnow over long distances was likely beneficial to the survival of their populations. The spawning strategy of releasing floating eggs allows recolonization of reaches impacted during periods of natural drought (Platania 1995). Swimming studies demonstrate that silvery minnow can traverse distances equivalent to 30 miles (50 km) in 72 hours (Bestgen et al. 2003). Bestgen et al. (2003) also recorded silvery minnow speed bursts up to 118 cm/sec (70.8 m/min) for short periods of time.

The 2003 Biological Opinion (USFWS 2003) lists the following primary constituent elements of silvery minnow critical habitat:

1. Throughout silvery minnow life-history, a hydrologic regime that provides sufficient flowing water with low to moderate currents capable of forming and maintaining a diversity of aquatic habitats, such as, but not limited to, backwaters, shallow side channels, pools, eddies, and runs of varying depth and velocity. These characteristics are necessary for silvery minnow life-history stages in given seasons (e.g., habitat with sufficient flows from early spring [March] to early summer [June] to trigger spawning; flows in the summer [June] and fall [October] that do not increase prolonged periods of low or no flow; relatively constant winter flow [November through February]).

2. The presence of eddies created by debris piles, pools, or backwaters, or other refuge habitat within unimpounded stretches of flowing water of sufficient length (river miles) to provide a variety of habitats with a wide range of depths and velocities.

3. Substrates predominantly of sand or silt.

4. Water of sufficient quality to maintain natural, daily, and seasonally variable water temperatures in the approximate range of more than 1ºC (35ºF) and less than 30ºC (85ºF) and mitigate degraded conditions (e.g., decreased dissolved oxygen, increased pH).

SOUTHWESTERN WILLOW FLYCATCHER (*EMPIDONAX TRAILLII EXTIMUS*)

The southwestern willow flycatcher (flycatcher) was listed as endangered without critical habitat designation on February 27, 1995 (FR 1995). Critical habitat was designated on July 22, 1997 (FR 1997) but was later withdrawn. In October 2004, the USFWS proposed a new extent of critical habitat, which were finalized in October 2005 (FR 2004). The historic range of the flycatcher includes riparian areas throughout Arizona, California, Colorado, New Mexico, Texas, Utah, and Mexico (FR 1993). The flycatcher is an insectivore, foraging in dense shrub and tree vegetation along rivers, streams, and other wetlands (USFWS 2003), and prefers dense riparian thickets, typically willows with a scattered cottonwood overstory. Dense riparian woodlands are particularly important as breeding habitat.

The proposed extent of critical habitat within the project area begins just south of the Alameda Bridge and extends southward to Elephant Butte Reservoir. The Paseo del Norte, I-40, and SDC subreaches were within the original proposed critical habitat area but not designated; the entire 550 Subreach is outside of the designated portion of the Rio Grande floodplain (FR 2005). As described in the 2003 BO, declining flycatcher numbers have been attributed to loss, modification, and fragmentation of riparian breeding habitat, loss of wintering habitat, and brood parasitism by the brown-headed cowbird. Habitat loss and degradation are caused by a variety of factors, including urban, recreational, and agricultural development; water diversion and groundwater pumping; and channelization, dams, and livestock grazing.

BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS*)

This species is listed as threatened by both the USFWS and the State of New Mexico. Bald eagles are associated with habitats near open water. In New Mexico, bald eagles commonly winter adjacent to rivers and lakes or where carrion is available. The major food items for bald eagles in New Mexico are waterfowl, fish, and carrion (New Mexico Department of Game and Fish [NMDGF] 2004). Bald eagles are uncommon during the summer and have limited breeding sites in New Mexico, with documented nests in the extreme northern and western portions of the state. The number of bald eagles wintering in the state has been steadily increasing. They commonly winter along the Rio Grande, and overwintering bald eagles have been recorded within the project area, where a few individuals may roost in tall cottonwood trees near the river.

ANALYSIS OF THE EFFECTS OF THE ACTION

CUMULATIVE EFFECTS

The cumulative effects of recent federal and non-federal (state, local governments, or private) activities on endangered and threatened species or critical habitat within the action area are considered with this consultation. The construction projects discussed under the environmental baseline have incorporated elements to create habitat for silvery minnows and foster development of riparian habitat for flycatchers. The cumulative impacts of these projects are to improve habitat for the species of concern. The actions proposed for this project will complement previous habitat construction in the reach and expand the area of quality habitat.

RIO GRANDE SILVERY MINNOW (*HYBOGNATHUS AMARUS*)

Silvery minnow critical habitat encompasses the entire project area (FR 2003). The species has declined as a result of impacts from dewatering, channelization, and flow regulation for irrigation, diminished water quality, and competition/predation by non-native species (FR 1994). The primary objective of the Proposed Action would be to create mesohabitat for the silvery minnow based on the best available information. The Project would provide long-term direct and indirect beneficial effects on silvery minnow and their critical habitat in the Albuquerque Reach. Beneficial effects of the Proposed Action include improved egg and larval retention, increased recruitment rates, and increased survival of both young-of-year and adults. The described techniques would be implemented in phases and monitored for achievement of restoration goals. This BA covers the effects of Phase II implementation only.

DIRECT EFFECTS

Direct effects to threatened or endangered species or their critical habitats may occur during the construction phase from disturbance and removal of vegetation or the possibility of harm from the associated equipment operation. While accessing the islands, the amphibious personnel carriers and the excavator would be in partial contact with the river bottom. In water more than 3 feet deep, the Caterpillar 325 would be in full flotation, and fish movement would not be impeded. In shallower water, the equipment would move along the riverbed surface. The average speed of the Caterpillar 325 is approximately 1 mile per hour, or 26 m per minute. In comparison, silvery minnow are capable of swimming up to 70.8 m per minute (118 cm/sec) (Bestgen et al. 2003) and can readily avoid the equipment as it moves through the river channel. The slow speed and the noise of the amphibious equipment, combined with the sensitivity of silvery minnow to sound, their high swimming speed, and access to the water column around the equipment make it possible, but unlikely that any silvery minnow would be physically harmed by the equipment. Once at the construction site, wherever possible equipment would operate on the riverbanks, bars, and islands to avoid contact with aquatic habitats of the silvery minnow.

The creation of new low-flow habitats on an island would be accomplished by placing sediments and debris from root plowing in a pre-defined area adjacent to the disturbed area on the island. The contractor would employ a silt curtain to contain the sediments while they are being put in place and compacted, and work would proceed by filling and compacting the upstream portion of the contained area first and allowing displaced water and fish to move out of a downstream

opening, as shown in Figure 9. Large woody debris would be placed directly in the channel adjacent to the island where the flow and depth of the channel are adequate to disperse the material into locations during high flows, benefiting silvery minnow by allowing habitats to form around the wood.

Although the risk of direct effects on minnows in the vicinity of the restoration sites is very low, as described above, such risk cannot be ruled out entirely. A conservative interpretation indicates the possibility for incidental take to occur as a result of implementation of island modification or other specific techniques.

WATER QUALITY EFFECTS

Indirect harm or mortality from reduced water quality in the critical habitat of silvery minnow may occur from accidental introduction of hydrocarbon contaminants from fuel and fluids used by the proposed equipment. Protection of hydraulic lines would prevent punctures during operation. All fueling activities would take place outside of the active floodplain, and all equipment would undergo thorough cleaning and inspection prior to daily operation. Excavator personnel are trained and equipped for emergency spill prevention and clean-up, with detailed specifications to prevent any accidental introduction of hazardous materials into the river channel. Equipment would be parked at predetermined locations on high ground overnight. Upstream gages would be monitored during the days prior to and during operation in the channel, and equipment would be removed from the channel in the event of high storm surges detected at the upstream gages. No effects on silvery minnow are expected to result from contamination related to equipment fueling and leakage or accidental spills.

Disturbance of contaminated sediments may occur when equipment is crossing wetted portions of the river channel to access in-channel treatment areas. The general commitment to take the shortest path in crossing the wetted portion of the channels, to avoid crossing during high flows, and to install silt fences to prevent the downstream dispersal of disturbed sediments and allow sediments to resettle before the curtains are removed would avoid any unintended water quality effects. Water quality parameters, including dissolved oxygen, would be monitored before the silt fences are installed and equipment crosses the diversion channel. The silt fencing would be removed only after the water quality returns to within 10 percent of original levels. Since direct access into the channel would be off of dry banks, transfer of any contaminated sediments on the equipment tracks would be minimized.

Some disturbance of the subsurface sediments in the river channel would occur as the equipment travels to the in-channel treatment areas. The temporary suspension of sediments by amphibious caterpillars at operational flows (<1,000 cfs) is less than normal suspended sediment levels at higher flows (>3,000 cfs). When moving in shallow water, the low-psi tracks of the equipment may disturb the water-sediment interface slightly. When traveling in deep water (>3 feet), the equipment would float and use its boom with an attached bucket to propel itself forward. Sediment has the potential to be transported when the excavator's bucket secures itself to the riverbed to pull itself forward. The bucket is about 4 feet wide, and disturbances may increase local turbidity within the water column in deep water. The suspended sediments should settle quickly at projected flows. Water quality would be monitored before, during, and after equipment operation in the channel. The dispersed effects of and limited increase in turbidity

would be negligible and unlikely to affect silvery minnow, since they can move to avoid short-term water quality effects. Effects to turbidity and dissolved oxygen would be monitored at both locations. No effects to silvery minnow are anticipated.

SOUTHWESTERN WILLOW FLYCATCHER (*EMPIDONAX TRAILLII EXTIMUS*)

DIRECT EFFECTS

Short-term potential effects on flycatcher during construction would be related to temporary noise and the nesting season. Project construction is proposed to take place outside of the breeding season for flycatcher and would not directly affect the species. To minimize impacts to this and other riparian species, clearing and grubbing of woody vegetation would take place between August 15 and April 15. The nearest designated flycatcher critical habitat is from the south boundary of Isleta Pueblo to Sevilleta National Wildlife Refuge. Therefore, the entire proposed project is outside of the designated critical habitat for flycatcher (FR 2005). No flycatcher critical habitat will be affected by this project.

INDIRECT EFFECTS

Indirect effects to flycatcher may occur from removal of suitable migratory-stopover and nesting habitats. In the Middle Rio Grande, flycatchers are known to form territories and nest in very dense riparian vegetation ranging in height from about 12 feet to 29 feet (Moore and Ahlers 2004). These habitats are most frequently dominated by willow but may also contain cottonwood, Russian olive, and/or saltcedar. The primary habitat requirement is for very dense twig structure at the 12–29 foot height, plus proximity to water.

To determine if vegetation proposed for disturbance constitutes suitable habitat for the flycatcher, a vegetation survey of all treatment locations was conducted during June 2006. Vegetation composition and structure were surveyed at each proposed restoration site and quantified using a modified Hink and Ohmart classification system that has been used in earlier vegetation classification studies of the MRG (Hink and Ohmart 1984). Data summarizing the proposed vegetation disturbance associated with the Project are provided in Appendix A. Vegetation modification on the restoration sites would total approximately 22.4 acres, most of it consisting of mixed native and exotic riparian species less than 15 feet tall, with intermittent native vegetation.

A careful review of vegetation composition and structure at each of the restoration sites indicates that some areas are classified as Hink and Ohmart Structural Type 3, which may have the height and structure used by the flycatcher (Appendix A). However, the survey found that these areas of potential disturbance have a lower twig density than is generally characteristic of flycatcher habitat. Furthermore, removal of these habitats would be temporary. Revegetation with native willow is planned for some island areas to supplement the natural regeneration process. Vegetation would be monitored as it re-establishes in the disturbed island and bar restoration areas. Dynamic succession characterizes riparian bar and island habitats, and since the restoration would bring the island and bar ground levels closer to groundwater, the future potential for dense stands of native trees to develop would be improved in these areas, providing better support for flycatcher in the future. However, loss of suitable flycatcher habitat may result from the Project in the short term.

BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS*)

The Proposed Action would have only short-term and indirect potential effects on bald eagles during construction, related to temporary noise and other disruptions. As discussed in the Environmental Commitments section below, guidelines would be employed to minimize the potential for disturbing bald eagles. The Proposed Action would not include removal of any large trees or snags that could provide suitable bald eagle roost habitat. No long-term effects on bald eagle populations or habitat are expected to result from the Proposed Action.

EFFECT DETERMINATIONS: AFFECTED SPECIES

RIO GRANDE SILVERY MINNOW (*HYBOGNATHUS AMARUS*)

The direct effects of the modification of islands, banks, and ephemeral channels are limited to small, isolated areas and a brief disturbance time period. The use of a silt curtain when constructing shallow water habitats along the perimeter of islands would minimize any possibility of trapping, injuring, or causing mortality to silvery minnow. An opening in the silt curtain on the downstream end of the shallow habitat creation areas and placement and packing of fill (sediment and debris) from the upstream end (against the silt curtain) to the downstream end would allow silvery minnow to escape the treatment area. As a result, there are no direct or indirect adverse effects to designated critical habitat of the silvery minnow. The long-term benefits to silvery minnow critical habitat in the MRG would be evaluated as part of this study.

However, there is risk of harm or harassment to silvery minnows in the immediate area during construction due to the potential for heavy equipment to be moving and operating in the river channel near minnows. Silvery minnows have been identified in the project area in fairly high numbers. Although minnows present near the work area would be able to move freely in the water column to avoid direct contact, there is uncertainty regarding minnow behavior in the presence of heavy equipment operating in the channel. Guidelines discussed in the Environmental Commitments section would be employed to minimize the potential for any short-term effects during the implementation of this Project.

The Proposed Action is not likely to adversely affect or result in the destruction or adverse modification of any critical habitat for the minnow. A risk of harming minnows cannot be ruled out during construction. The Project may affect, and is likely to adversely affect, the endangered silvery minnow, and Incidental Take is requested for the action as a conservative measure.

SOUTHWESTERN WILLOW FLYCATCHER (*EMPIDONAX TRAILLII EXTIMUS*)

The Proposed Action may affect but is not likely to adversely affect the endangered southwestern willow flycatcher. Potential effects may result from vegetation removal within the project area. Best management practices discussed in the Environmental Commitments would be implemented to avoid or minimize any potential effects to flycatcher or flycatcher habitat. Flooding on bars and islands frequently disturbs this vegetation type, and since the project proposes to replant native willow in disturbed areas as necessary, no long-term adverse effects should be experienced by wildlife using these habitats.

BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS*)

The Proposed Action may affect but is not likely to adversely affect the bald eagle. No critical habitat is designated for bald eagle in the proposed project area. Guidelines discussed in the Environmental Commitments section would be employed to minimize the potential for disturbing bald eagles if they are encountered in the project area.

ENVIRONMENTAL COMMITMENTS

1) Impacts to terrestrial habitats would be minimized by using existing roads and cleared staging areas. In general, equipment operation would take place in the most open area available, and all efforts would be made to minimize damage to native vegetation.

2) Silvery minnow critical habitat encompasses the entire project area (FR 2003) in the river channel. Best management practices would be enforced to minimize potential impacts to silvery minnow from direct construction impacts and erosional inputs into the river during construction periods.

3) To avoid direct impacts to migratory birds protected by the Migratory Bird Treaty Act (16 U.S.C. 703, et seq.), construction and clearing of vegetated islands would be scheduled between August 15 and April 15, outside of the normal breeding season for most avian species. Should vegetation removal be required during the breeding season, pre-construction breeding bird surveys would be conducted to assure that no breeding birds would be affected. Any positive pre-construction survey results or observation of affected species during construction would be discussed with the USFWS to coordinate nesting area avoidance.

4) To mitigate potential short-term construction impacts to the flycatcher, clearing of dense woody vegetation would be avoided and conducted only between August 15 and April 15. Should vegetation removal be required during the breeding season, pre-construction breeding bird surveys would be conducted to assure that no breeding birds would be affected. Any positive pre-construction survey results or observation of affected species during construction would be discussed with the USFWS to coordinate nesting area avoidance.

5) Construction would cease in the location if a flycatcher is observed between April 15th and August 15th , and the USFWS would be notified.

6) The shortest path would be used to cross the South Diversion Channel, or any other arroyos or drains, and silt fencing would be installed downstream of the crossing. Water quality would be monitored before silt fencing is installed, and the fencing would not be removed until water quality has returned to within 10 percent of the original measures.

7) If a bald eagle is observed within 0.25 mile of the proposed project area in the morning when activity starts, or arrives during breaks in activity, the contractor would be required to suspend all construction activity until the bird leaves on its own volition, or until the project biologist, in consultation with the USFWS, determines that the potential for harassment is minimal. If a bald eagle arrives during construction activities, or is observed more than 0.25 mile from the construction site, activity would not be interrupted.

8) Clean Water Act (CWA) compliance is required of all aspects of the Project, and since most work associated with the Proposed Action would be completed within aquatic areas regulated by this law, a 404 permit is required. A state water quality certification permit

under Section 401 of the CWA may also be required, including consultation with the Pueblo of Sandia and the Pueblo of Isleta. The 404 and 401 permitting processes would be completed prior to commencement of the Proposed Action.

9) Storm water discharges under the Proposed Action would be limited to ground-disturbing activities outside the mean high water mark. All such activities would be evaluated for compliance with National Pollutant Discharge Elimination System (NPDES) guidance, an NPDES permit, or a SWPPP.

10) Additional evaluation of the net depletion effects of each proposed technique would be included in the monitoring of project elements. Restoration techniques that are determined to add significant levels of depletion to the surface waters of the Rio Grande would be curtailed.

11) All necessary permits for access points, staging areas, and study sites would be acquired prior to construction activity. Access coordination has begun with the City of Albuquerque Open Space Division, the MRGCD, AMAFCA, and the Pueblo of Sandia.

APPENDIX A

VEGETATION SURVEY AND IMPACTS EVALUATION FOR THE U.S. HIGHWAY 550, PASEO DEL NORTE TO MONTAÑO, I-40 TO CENTRAL, AND SOUTH DIVERSION CHANNEL SUBREACHES

APPENDIX A

MIDDLE RIO GRANDE RIVERINE RESTORATION PHASE II PROJECT: VEGETATION SURVEY AND IMPACTS EVALUATION

METHODS OF VEGETATION SURVEY AND CLASSIFICATION

The baseline vegetation survey and impacts to vegetation were assessed during field visits to proposed sites in June 2006. The biological team responsible for the survey and its interpretation included Claudia Oakes, Ph.D., Matthew McMillan, M.S., and Jeff Ham. Dr. Oakes and Mr. McMillan are listed on SWCA's U.S. Forest Service (USFWS) permit for southwestern willow flycatcher survey and are experienced in habitat assessment. Using 2004 aerial photographs of the area and GPS coordinates, biologists navigated to the proposed treatment locations and surveyed each site. Data collection included vegetation density at different heights, vegetation composition, and other factors, such as evidence of previous disturbance, fire, recent flood, or erosion. A modified Hink and Ohmart classification system (Hink and Ohmart 1984) was used to code the vegetation based on height, structural class, and the dominant overstory and understory species. Vegetation accounting for less than 25% density in any layer was not included. The field crew used handheld GPS units to record the boundaries of different habitat types.

Estimates of the acreage of disturbance for each treatment site are based on the observed boundaries of different habitats and the anticipated buffer around each proposed treatment. For example, ephemeral channels were mapped and surveyed at a width of 15 feet, although the constructed width may be 10 feet or less. Data were entered into ArcGIS, including the polygon perimeters and acres of each vegetation type. The size of each treatment has been rounded to the nearest 0.05 acre to account for the margins of error for the vegetation survey and GIS analysis, and any polygons of vegetation smaller in extent than 0.05 acre were eliminated as outside the resolution of the study.

Hink and Ohmart (1984) recognized six structural classes of riparian wetland vegetation in the Middle Rio Grande, which are reported for each treatment area surveyed.

Structural Type 1: Mature and mid-aged trees with shrubby vegetation at all heights

Structural Type 2: Mature and mid-aged trees with little or no shrubby vegetation

Structural Type 3: Intermediate-aged trees with dense shrubby vegetation

Structural Type 4: Intermediate-aged trees with little or no shrubby vegetation

Structural Type 5: Young stands with dense shrubby vegetation

Structural Type 6: Very young, low, and/or sparse vegetation

The Hink and Ohmart vegetation types were further correlated to USFWS Resource Categories defined in the USFWS Mitigation Policy (Federal Register [FR] 1981). The Mitigation Policy

was designed to assist USFWS personnel in the development of consistent and effective recommendations for the protection and conservation of valuable fish and wildlife resources. Of particular interest to this BA are those portions of the Mitigation Policy that address habitat issues and the criteria that define specific habitat types and potential mitigation measures. Each of the habitat types defined by the Mitigation Policy's Resource Categories supports diverse species but of descending biological value.

Resource Category 1: Habitat is of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section. The mitigation goal for habitat in Resource Category 1 is "no loss of existing habitat value."

Resource Category 2: Habitat is of high quality for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section. The mitigation goal for habitat in Resource Category 2 is "no net loss of in-kind habitat value."

Resource Category 3: Habitat is of high to medium value for evaluation species. The mitigation goal for habitat in Resource Category 3 is "no net loss of habitat value while minimizing loss of in-kind habitat value."

Resource Category 4: Habitat is of medium to low value for evaluation species. The mitigation goal for habitat in Resource Category 4 is "minimize loss of habitat value."

The data obtained during vegetation surveys are reported by both Hink and Ohmart Structural Types and by USFWS Resource Categories.

U.S. HIGHWAY 550 SUBREACH

The proposed treatment sites and associated Hink and Ohmart vegetation classes for the 550 Subreach are listed described in Table A.1, along with the corresponding USFWS Resource Categories. The locations of the Hink and Ohmart classes are shown on a 2004 aerial image in Figure A.1.

Table A.1. Summary of U.S. 550 Subreach Vegetation Survey and Acreage

Treatment Site	Hink & Ohmart Classification	Hink & Ohmart Structural Type	Vegetation Composition	USFWS Resource Category	Acres
550_1i	RO-CW-SC5	5	5–15 ft young Russian olive, coyote willow, and saltcedar	3	0.24
550 USFWS RESOURCE CATEGORY 3 HABITAT					**0.24**
550_1ch	SC5S	5	5–15 ft saltcedar	4	3.10
550 USFWS RESOURCE CATEGORY 4 HABITAT					**3.10**
TOTAL 550 SUBREACH VEGETATION MODIFICATION					**3.34 Acres**

ISLAND 1 *(550_1i)*

Vegetation on the island consists of a coyote willow (*Salix exigua*) stand (5–15 ft) with an occasional Russian olive (*Elaeagnus angustifolia*) (Figure A.2 and Figure A.3). The proposed treatment would enhance the northeastern tip of the island by creating a channel and would modify about 2.46 acres.

EPHEMERAL CHANNEL 1 *(550_1ch)*

Much of the proposed treatment area consists of open areas with existing natural channels. Vegetation is interspersed within the channels and on several small islands (Figure A.4 and Figure A.5). Saltcedar (*Tamarix ramosissima*) is found throughout the area, along with a few immature cottonwoods (*Populus deltoides*) and coyote willows (*Salix exigua*), which are mainly restricted to the islands. Almost all of the vegetation within the area is of the same age and height, 5–15 feet (Type 5). Along the river there is no canopy and only a few small herbaceous areas. The proposed modifications would enhance the existing channels to flow at 500 cfs. Any cottonwoods would be flagged and avoided during implementation. The proposed treatment would modify approximately 10.19 acres.

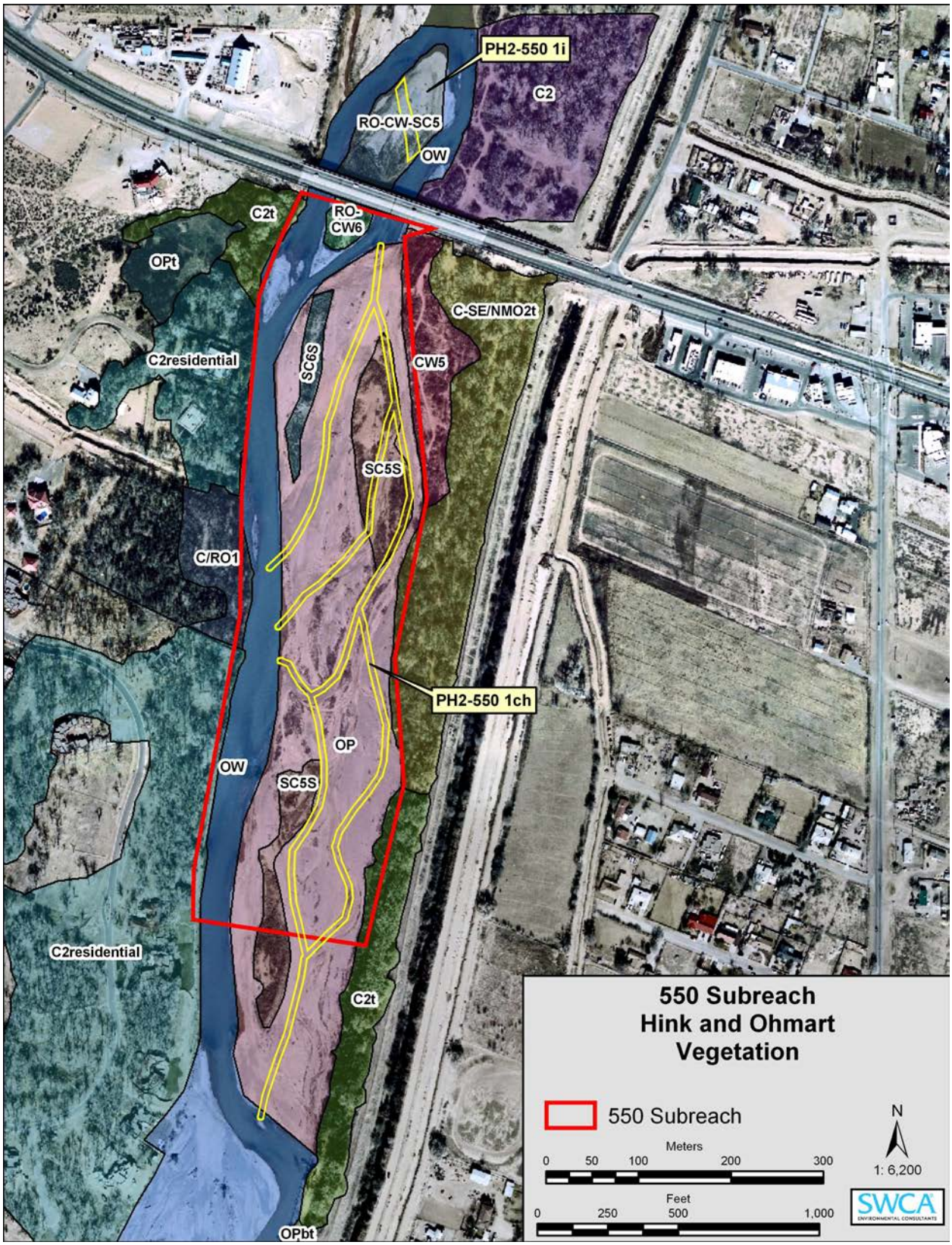

Figure A.1. U.S. Highway 550 Subreach.

Figure A.2. Island 1 (550_1i) — Hink and Ohmart Type 5 vegetation.

Figure A.3. Island 1 (550_1i) — Hink and Ohmart Type 5 vegetation.

Figure A.4. Ephemeral Channel 1 (550_1ch) — Hink and Ohmart Type 5 vegetation.

Figure A.5. Ephemeral Channel 1 (550_1ch) — Hink and Ohmart Type 5 vegetation.

PASEO DEL NORTE TO MONTAÑO SUBREACH

The proposed treatment sites and associated Hink and Ohmart vegetation classes for the Paseo del Norte Subreach are listed and described in Table A.2, along with the corresponding USFWS Resource Categories. The locations of the Hink and Ohmart classes are shown on 2004 aerial images in Figure A.6 and Figure A.7.

Table A.2. Summary of Paseo del Norte to Montaño Subreach Vegetation Survey and Acreage

Treatment Site	Hink & Ohmart Classification	Hink & Ohmart Structural Type	Vegetation Composition	USFWS Resource Category	Acres
PDN_2i	CW5	5	5–15 ft coyote willow	2	2.56
PDN_3i	RO/CW-SC3	3	20–40 Russian olive canopy with coyote willow and saltcedar understory	2	1.03
PDN_3i	RO/CW3	3	20–40 Russian olive canopy with coyote willow understory	2	0.94
PDN_6i	CW5	5	5–15 ft coyote willow	2	1.72
PDN_6i	RO/CW3	3	20–40 ft Russian olive and coyote willow	2	0.92
PDN_9i	RO/CW3	3	20–40 ft Russian olive and coyote willow	2	5.72
PDN_11i	RO/CW3	3	15–25 ft Russian olive and coyote willow	2	2.73
PDN_13i	RO/CW3	3	10–20 ft Russian olive and coyote willow	2	3.30
PDN_14i	CW5	5	5–15 ft coyote willow	2	0.77
PDN_14i	RO/CW5	5	15–25 ft Russian olive and coyote willow	2	0.29
PDN USFWS RESOURCE CATEGORY 2 HABITAT					**19.98**
PDN_1b	CW-RO5	5	5–15 ft coyote willow and Russian olive	3	1.60
PDN_3b	CW-SC5	5	5–15 ft coyote willow and Russian olive	3	1.25
PDN_2i	RO/CW5	5	15–20 ft Russian olive and coyote willow	3	2.94
PDN_7i	RO-CW6	6	<5 ft Russian olive and coyote willow	3	0.26
PDN USFWS RESOURCE CATEGORY 3 HABITAT					**6.05**
TOTAL PDN SUBREACH VEGETATION MODIFICATION					**26.03 Acres**

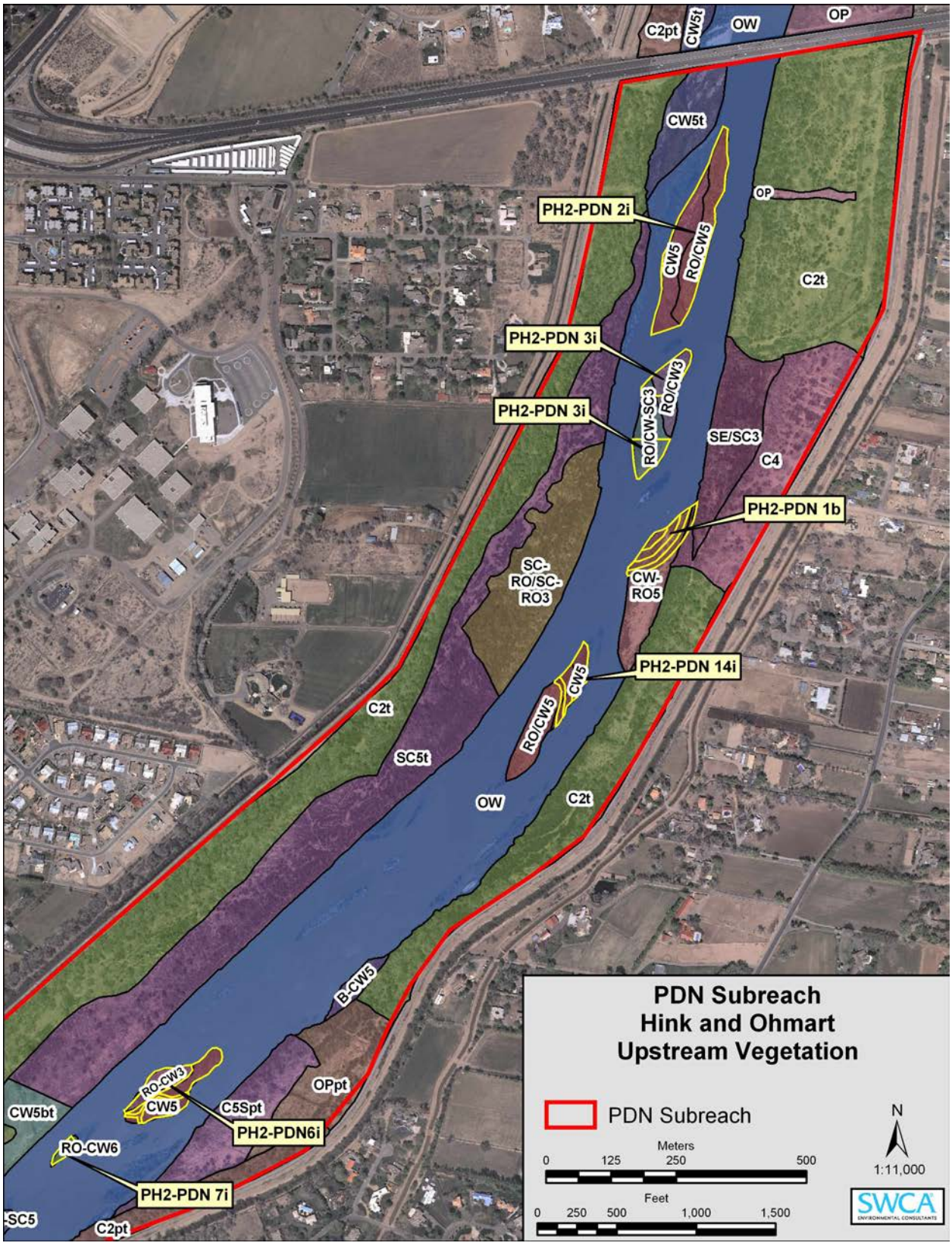

Figure A.6. Paseo del Norte to Montaño Subreach, upstream section.

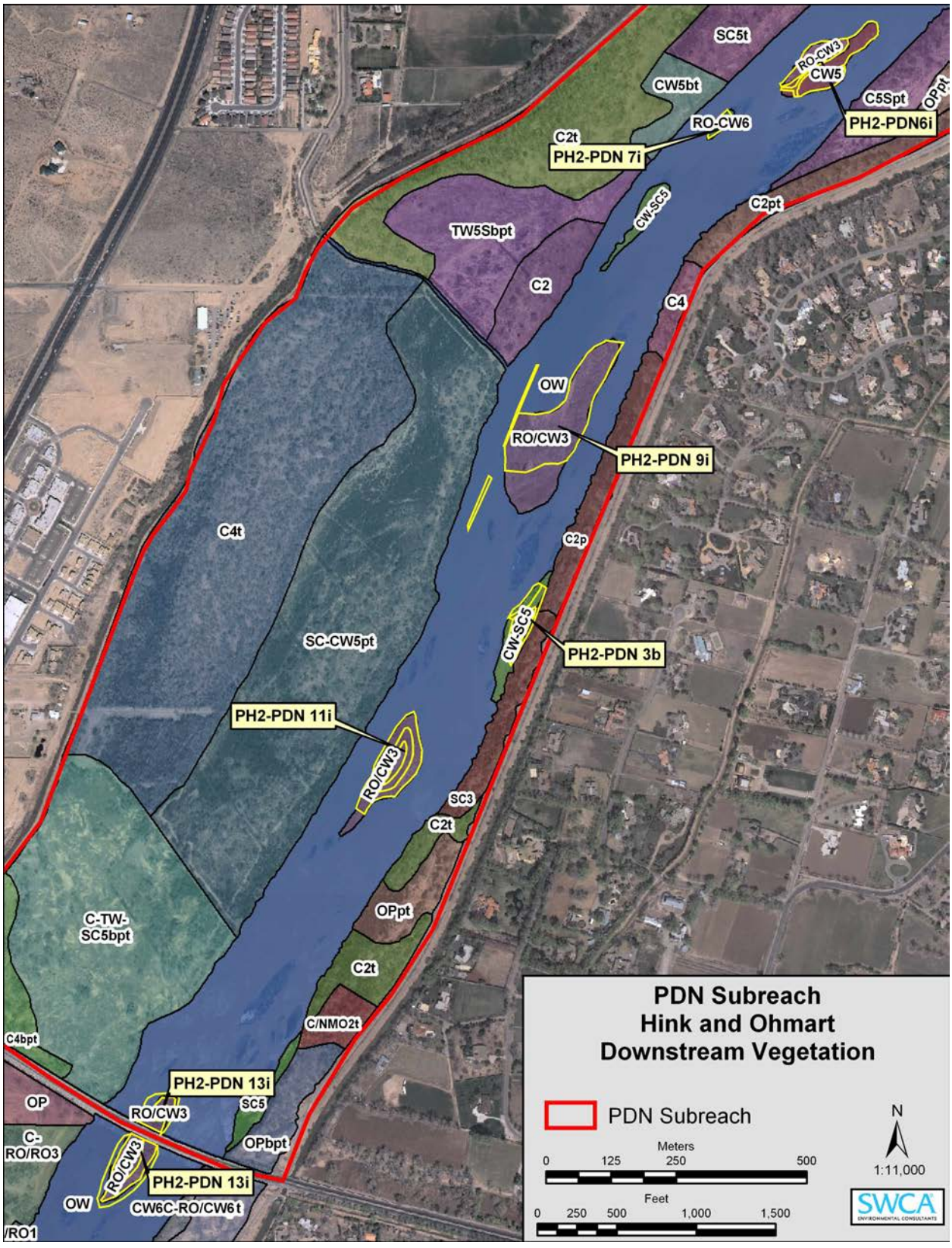

Figure A.7. Paseo del Norte to Montaño Subreach, downstream section.

ISLAND 1 *(PDN_2i)*

Vegetation on the island consists of short Type 5 coyote willow and intermediate Russian olive (Figure A.8). The island has wetland areas on the western and southern sides, as well as an attached sand bar on the southern tip. The proposed treatment would lower the entire island and would modify about 5.51 acres.

ISLAND 2 *(PDN_3i)*

Vegetation on the island consists of a Russian olive canopy and a coyote willow/saltcedar understory. The saltcedar is primarily restricted to the northern portion of the island (Figure A.9). The island has a wetland along the west side The proposed treatment would lower the northern and southern portions of the island and would modify approximately 1.98 acres.

ISLAND 3 *(PDN_6i)*

Vegetation on the western third of this island, which is separated from the eastern portion of the island by a small channel, consists of Russian olive and coyote willow. The northern and eastern sections support primarily coyote willow (Figure A.10). The proposed treatment would lower each of the sections of the island as well as the channel and would modify approximately 1.68 acres.

ISLAND 4 *(PDN_7i)*

This island has a mixture of young Russian olive and a coyote willow understory (Figure A.11). A natural terrace exists on the northern half of the island. The proposed treatment would destabilize the southern half and would modify approximately 0.26 acre.

ISLAND 5 *(PDN_9i)*

The vegetation on this island consists of a Type 3 open canopy of intermediate Russian olive with an understory of coyote willow. A mixture of cottonwood, Russian olive, and saltcedar saplings accounts for about 15–20% of the vegetation cover. This island is stabilized on the western side by jetty jacks that extend downstream approximately 500 feet (Figure A.12). The proposed treatment would destabilize the upper three-fourths of the island and remove the jetty jacks, modifying approximately 5.72 acres.

ISLAND 6 *(PDN_11i)*

Vegetation on this island consists of intermediate Russian olive and coyote willow with less than 25% young cottonwood saplings. The island is attached to the west bank by a sand bar. Within the center of the island is a natural depression that runs north to south and probably is frequently inundated (Figure A.13). The proposed treatment would create terraces on the island and would modify approximately 2.74 acres.

Figure A.8. Island 1 (PDN_2i) — Hink and Ohmart Type 5 vegetation.

Figure A.9. Island 2 (PDN_3i) — Hink and Ohmart Type 3 vegetation.

Figure A.10. Island 3 (PDN_6i) — Hink and Ohmart Type 3 vegetation.

Figure A.11. Island 4 (PDN_7i) — Hink and Ohmart Type 6 vegetation.

Figure A.12. Island 5 (PDN_9i) — Hink and Ohmart Type 3 vegetation.

Figure A.13. Island 6 (PDN_11i) — Hink and Ohmart Type 3 vegetation.

ISLAND 7 *(PDN_13i)*

This island lies directly under the Montaño Bridge, and the proposed treatment would create terraces on both sides of the bridge. The north and south sections of the island have a Russian olive canopy and coyote willow understory (Figure A.14). The southern portion of the island has a small depression that most likely is frequent inundated at higher flows. The formation of the terraces would modify approximately 3.30 acres.

ISLAND 8 *(PDN_14i)*

Vegetation on this island consists of a Russian olive canopy and a coyote willow understory, with the Russian olive mainly on the west half of the island (Figure A.15). The proposed treatment would lower the northern and southern portions of the island and would modify approximately 1.06 acres.

BANK MODIFICATION 1 *(PDN_1b)*

The proposed bank modification treatment at this location is to enhance a natural channel and create two terraces next to the channel. The bankline vegetation is dominated by coyote willow (5–15 ft) and Russian olive (Figure A.16). A few young cottonwoods are present. There are also wetland patches of Type 6 non-native herbaceous vegetation such as bulrush (*Scirpus* sp.), Canada goldenrod (*Solidago canadensis*), and rough cockle-bur (*Xanthium strumarium*). However, the herbaceous areas constitute less than 0.05 acre and are not included in the data table. The total modification area for the proposed treatment would be approximately 1.60 acres.

BANK MODIFICATION 2 *(PDN_3b)*

The proposed treatment is to enhance a natural channel and destabilize two areas next to the channel. The vegetation consists of coyote willow and saltcedar, with no more than 25% Russian olive (10 – 20 ft) (Figure A.17). A few young cottonwoods are present. The total modification area for the proposed treatment would be approximately 1.25 acres.

Figure A.14. Island 7 (PDN_13i) — Hink and Ohmart Type 3 vegetation.

Figure A.15. Island 8 (PDN_14i) — Hink and Ohmart Type 5 vegetation.

Figure A.16. Bank Modification 1 (PDN_1b) — Hink and Ohmart Type 5 vegetation.

Figure A.17. Bank Modification 2 (PDN_3b) — Hink and Ohmart Type 5 vegetation.

I-40 TO CENTRAL SUBREACH

The proposed treatment sites and associated Hink and Ohmart vegetation classes for the I-40 to Central Subreach are listed and described in Table A.3, along with the corresponding USFWS Resource Categories. The locations of the Hink and Ohmart classes are shown on 2004 aerial images in Figure A.18 and Figure A.19.

Table A.3. Summary of I-40 to Central Subreach Vegetation Survey and Acreage

Treatment Site	Hink & Ohmart Classification	Hink & Ohmart Structural Type	Vegetation Composition	USFWS Resource Category	Acres
I-40_1i	RO/CW1	1	Russian olive canopy and 5–15 ft Coyote willow understory	2	1.45
I-40_1b #3	C/RO1 S	1	Mature cottonwood and 10–20 ft Russian olive	2	1.11
I-40_1b #5	C/MB1	1	Mature cottonwood with 5–15 ft mulberry	2	1.01
I-40_1b #7	C/MB5	1	Mature cottonwood with 5–15 ft mulberry	2	0.01
I-40_2b #1	C/C-CW5	1	Intermediate cottonwood canopy with cottonwood and coyote willow understory	2	7.58
I-40_2b #2	C2	1	Mature cottonwood canopy with no understory	2	1.67
I-40_3b	C/SE-RO1	1	Mature cottonwood canopy with intermediate Siberian elm and Russian olive understory	2	5.00
I-40_4b	RO/CW5	1	Mature Russian olive canopy with 5–10 ft coyote willow understory	2	5.82
I-40_1ch #1	C/CW1	1	Mature cottonwood canopy with 5–15 ft coyote willow understory	2	1.11
I-40 USFWS RESOURCE CATEGORY 2 HABITAT					**24.76**
I-40_1b #2	C-RO1	2	5–15 ft cottonwood and Russian olive canopy with no understory	3	1.06
I-40_1b #6	RO-CW5	5	10–20 ft Russian olive and 5–15 ft coyote willow	3	1.10
I-40_5b	CW-SC-RO5	5	5–15 ft young Russian olive, saltcedar, and coyote willow	3	0.58
I-40_1ch #2	CW-RO6	5	Young cottonwood with 5–15 ft Russian olive understory	3	0.25
I-40_1ch #3	CW-RO6	5	Young cottonwood with 5–15 ft Russian olive understory	3	0.58
I-40 USFWS RESOURCE CATEGORY 3 HABITAT					**3.57 Acres**
I-40_1b #1	SC5	5	5–15 ft saltcedar	4	0.95
I-40 USFWS RESOURCE CATEGORY 4 HABITAT					**0.95**
TOTAL I-40 SUBREACH VEGETATION MODIFICATION					**29.28 Acres**

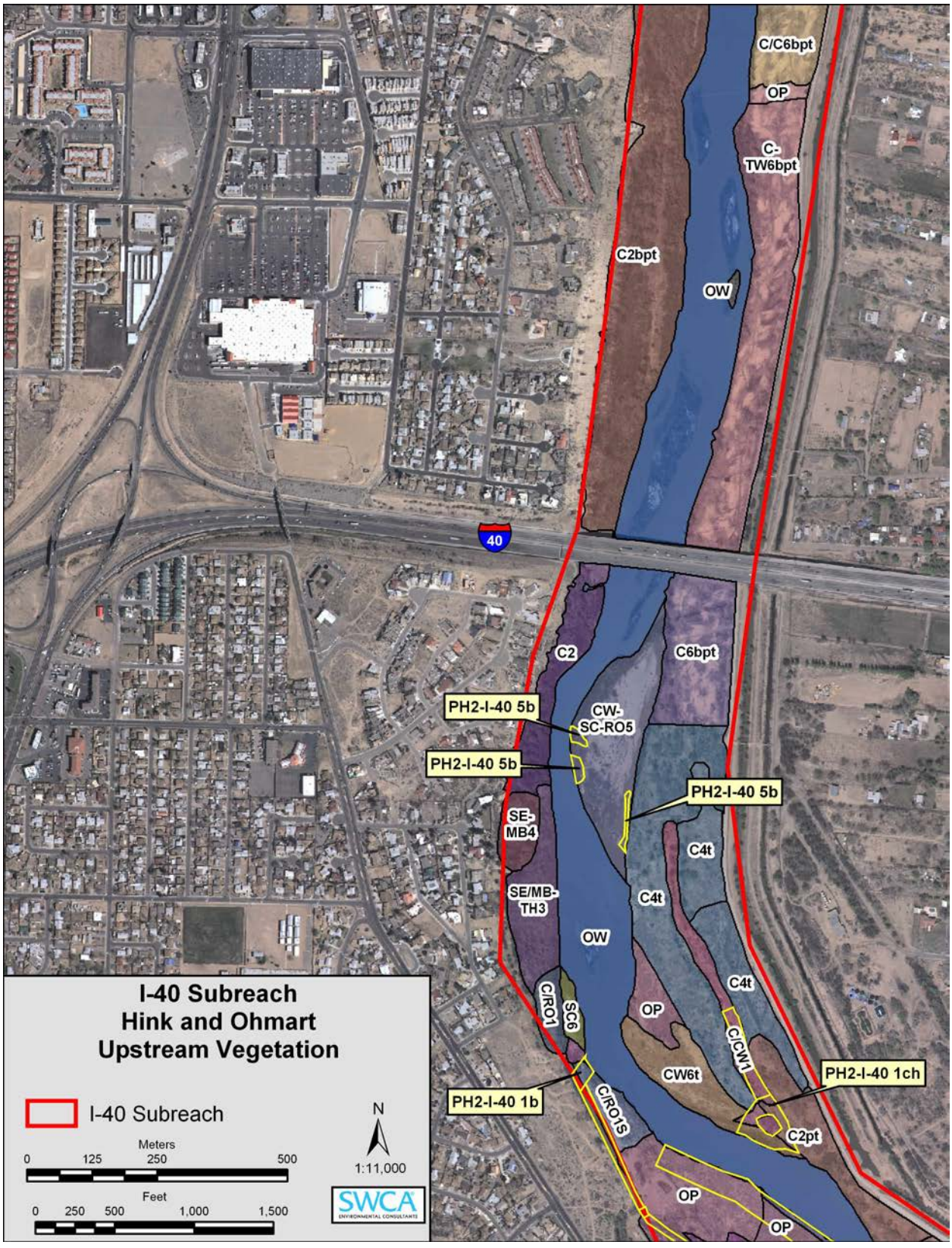

Figure A. 18. I-40 to Central Subreach, upstream section.

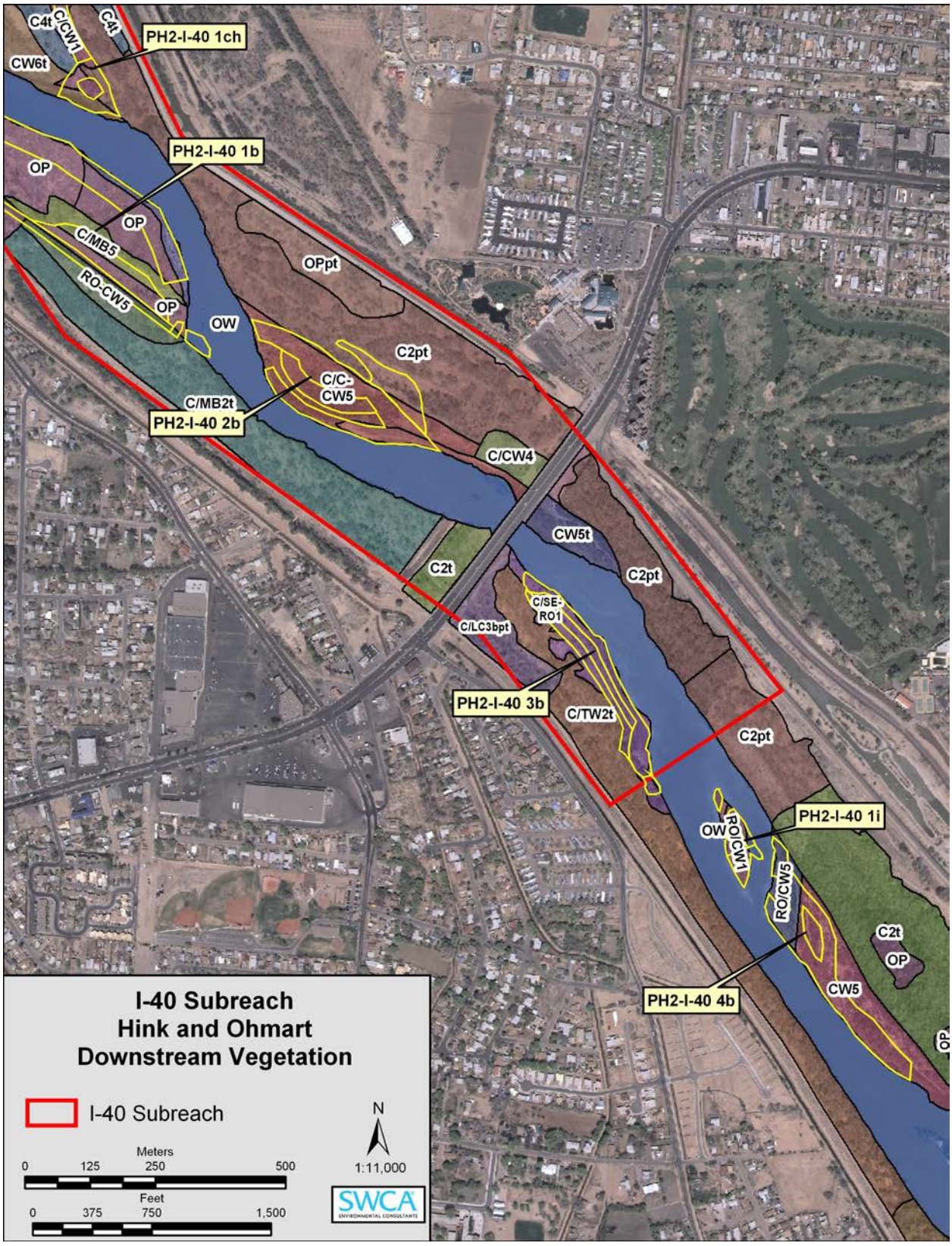

Figure A. 19. I-40 to Central Subreach, downstream section.

ISLAND 1 *(I-40_1I)*

Vegetation on this island, which is connected to the east bank by a sand bar, consists of a Russian olive canopy and a coyote willow understory (Figure A.20). A smaller island is approximately 25 feet to the north. As of the June 2006 survey, a small channel ran down the eastern bank of the sand bar where it meets the east bank and the north end of I-40–4b. The proposed treatment would lower the entire island and modify approximately 1.45 acres.

EPHEMERAL CHANNEL 1 *(I-40_1ch)*

The proposed treatment site encompasses two different Hink and Ohmart classifications. The first, at the north end, mature cottonwoods line the sides of an old natural channel and coyote willows are growing within the channel (Figure A.21). In the southern area, a very small backwater with mixed young successional stands of coyote willow and Russian olive is most likely inundated during high-flow events (Figure A.22). This area also has many wetland species, primarily sedges (*Carex* sp.) and rushes. The proposed treatment would create a backwater channel by lowering the pre-existing channel and forming an outflow drain area. This treatment would modify approximately 2.51 acres.

BANK MODIFICATION 1 *(I-40_1b)*

The proposed treatment site occurs in an area that has been partially thinned and exhibits evidence of wildfire. The Atrisco diversion runs along the western edge of the treatment area. An area at the north end of the site contains a dominant saltcedar monoculture along the riverbank (Figure A.23), and just to the west is a cottonwood/Russian olive canopy where some of the understory has been thinned (Figure A.24). In the middle of the treatment site is an area with a mature cottonwood canopy and Russian olive understory (Figure A.25). The middle section is dominated by an open area (Figure A.26), with young cottonwoods (pole plantings, 10–15 ft) on about 10–15% of the area. In the southern portion of the treatment area, there is a cottonwood canopy with a mulberry understory (Figure A.27), as well as an area with no cottonwood canopy but a Russian olive and coyote willow understory. These two areas are separated by a thin open area, which has recently been thinned. Within these three vegetative areas runs the Atrisco diversion. The proposed treatment would enhance the current diversion and would include development of an intake structure at the northern end and reshaping of the southern end. A section east of the diversion would be lowered along the riverbank. This treatment would modify approximately 11.84 acres.

BANK MODIFICATION 2 *(I-40_2b)*

The proposed treatment site occurs in an area that has been thinned in some places. The area closer to the river has a canopy of mature cottonwoods with a coyote willow and immature cottonwood understory (Figure A.28); the coyote willows are close to the river. The area to the east has only a mature cottonwood canopy (Figure A.29), as nearly the entire understory has been recently thinned. The proposed treatment would create a channel through the middle of the bar, lower the area to the east of the channel, and lower and create a backwater in the area west of the channel. Along the river, the bank line would be lowered from just below the northern

Figure A.20. Island 1 (I-40_1i) — Hink and Ohmart Type 1 vegetation.

Figure A.21. Ephemeral Channel 1 (I-40_1ch) — Hink and Ohmart Type 1 vegetation.

Figure A.22. Ephemeral Channel 1 (I-40_1ch) — Hink and Ohmart Type 1 vegetation.

Figure A.23. Bank Modification 1 (I-40_1b #1) — Hink and Ohmart Type 5 vegetation.

Figure A.24. Bank Modification 1 (I-40_1b #2) — Hink and Ohmart Type 2 vegetation.

Figure A.25. Bank Modification 1 (I-40_1b #3) — Hink and Ohmart Type 1 vegetation.

Figure A.26. Bank Modification 1 (I-40_1b #4) — Hink and Ohmart open habitat.

Figure A.27. Bank Modification 1 (I-40_1b #5) — Hink and Ohmart Type 1 vegetation.

Figure A.28. Bank Modification 1 (I-40_2b #1) — Hink and Ohmart Type 1 vegetation.

Figure A.29. Bank Modification 1 (I-40_2b #2) — Hink and Ohmart Type 1 vegetation.

part of the channel to the southern part of the channel, where it re-enters the river. This treatment would modify approximately 9.34 acres.

BANK MODIFICATION 3 *(I-40_3b)*

The vegetation at this site consists of a cottonwood canopy with a Siberian elm (*Ulmus pumila*) and Russian olive understory. The cottonwoods generally run north to south along a line of jetty jacks, while the understory is closer to the river (Figure A.30). The proposed treatment would lower the bank line area at three different levels to provide a sloped contour and would modify approximately 5.00 acres.

BANK MODIFICATION 4 *(I-40_4b)*

The proposed treatment site is just south of I-40-1i. As of the June 2006 survey, a small channel ran down the western bank of the site to a sand bar that connects to I-40–1i. The northern half of this site has a Russian olive canopy and a coyote willow understory (5–10 ft). The southern portion of the site has no canopy, only coyote willow about 5 feet tall (Figure A.31). This area has been thinned of Russian olives and saltcedar. The proposed treatment would lower the bank line area and create a channel starting at the northeast tip of the bar, modifying approximately 5.82 acres.

BANK MODIFICATION 5 *(I-40_5b)*

The vegetation at this site consists of young stands of coyote willow, saltcedar, and Russian olive (Figure A.32). Type 6 herbaceous vegetation exists in a wetland area along the southwest bank, where bulrush, horsetail (*Equisetum arvense*), Canada goldenrod, and rabbit-foot grass (*Polypogon monspeliensis*) occur. The proposed treatment would lower two areas along the west bank to create embayments and would enhance a small portion of an old channel to create a backwater environment. This treatment would modify approximately 0.56 acre.

Figure A.30. Bank Modification 1 (I-40_3b) — Hink and Ohmart Type 1 vegetation.

Figure A.31. Bank Modification 1 (I-40_4b) — Hink and Ohmart Type 5 vegetation.

Figure A.32. Bank Modification 1 (I-40_5b) — Hink and Ohmart Type 5 vegetation.

SOUTH DIVERSION CHANNEL SUBREACH

The proposed treatment sites and associated Hink and Ohmart vegetation classes for the South Diversion Channel Subreach are listed and described in Table A.4, along with the corresponding USFWS Resource Categories. The locations of the Hink and Ohmart classes are shown on 2004 aerial images in Figure A.33, Figure A.34, and Figure A. 35.

Table A.4. Summary of South Diversion Channel Vegetation Survey and Acreage

Treatment Site	Hink & Ohmart Classification	Hink & Ohmart Structural Type	Vegetation Composition	USFWS Resource Category	Acres
SDC_1b	SE/CW5	3	Intermediate Siberian elm canopy with coyote willow understory	2	0.39
SDC_4b	C2	2	Mature cottonwood canopy	2	0.25
SDC_5b	RO/CW5	3	Intermediate Russian olive with 5–15 ft coyote willow	2	1.56
SDC_3i	RO/CW3	3	Intermediate Russian olive canopy with 5–15 ft coyote willow understory	2	0.78
SDC_4i	RO/CW3	3	Intermediate Russian olive canopy with 5–15 ft coyote willow understory	2	1.72
SDC_5i	RO/CW3	3	Intermediate Russian olive canopy with 5–15 ft coyote willow understory	2	0.77
SDC_6i	RO/CW3	3	Intermediate Russian olive canopy with 5–15 ft coyote willow understory	2	2.07
SDC_8i	RO/CW3	3	Intermediate Russian olive canopy with 5–10 ft coyote willow understory	2	0.31
SDC_9i	C-CW5	5	Young 5–15 ft cottonwood and coyote willow	2	1.18
SDC USFWS RESOURCE CATEGORY 2 HABITAT					**9.03**
SDC_3b	CW-RO5	5	Mixed young Russian olive with coyote willow	3	2.63
SDC USFWS RESOURCE CATEGORY 3 HABITAT					**2.63**
SDC_4b	RO-SC5	5	Young Russian olive and saltcedar	4	0.15
SDC_1i	RO4	4	Intermediate Russian olive canopy	4	0.58
SDC USFWS RESOURCE CATEGORY 4 HABITAT					**0.73**
TOTAL SDC SUBREACH VEGETATION MODIFICATION					**12.39 Acres**

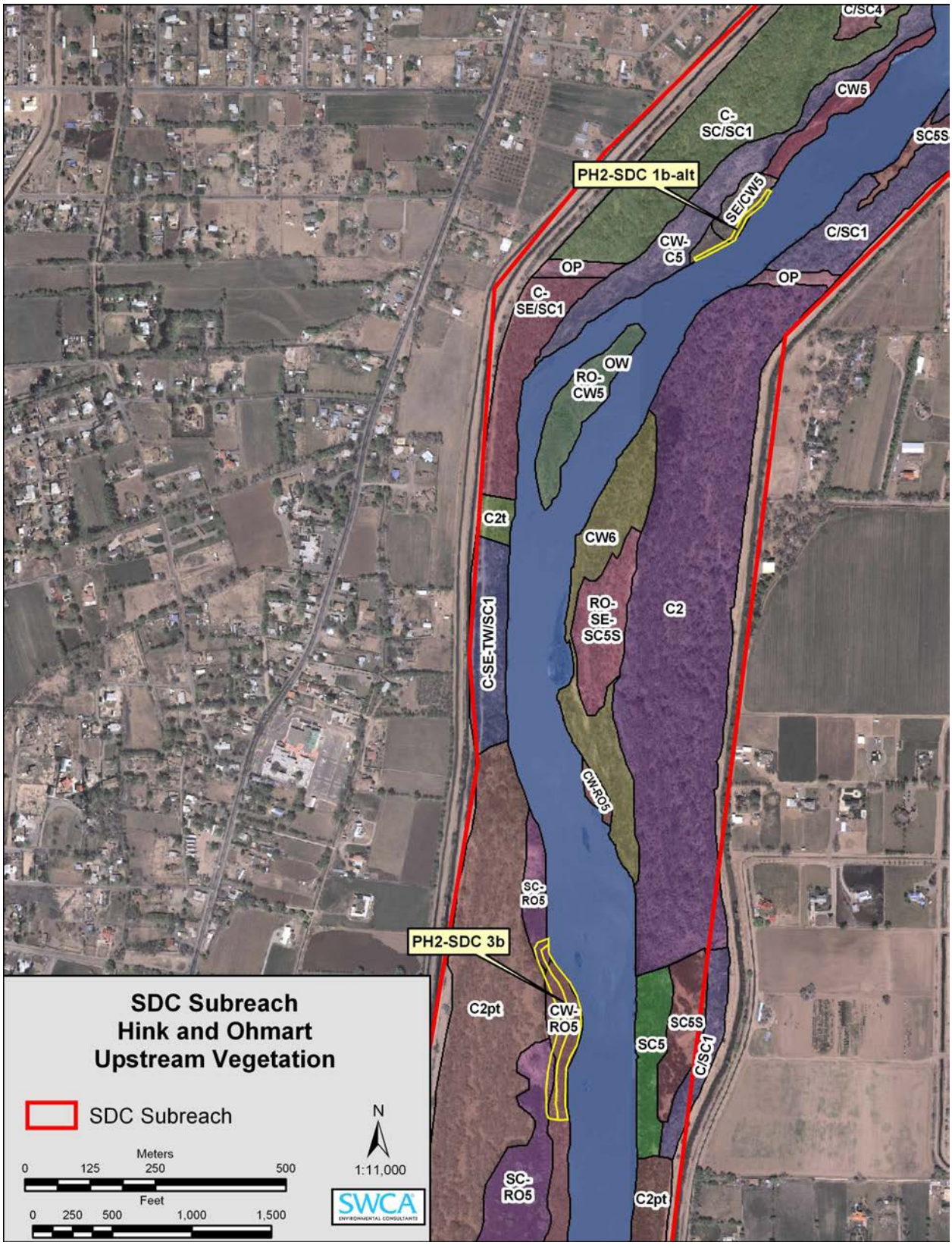

Figure A. 33. South Diversion Channel Subreach, upstream section.

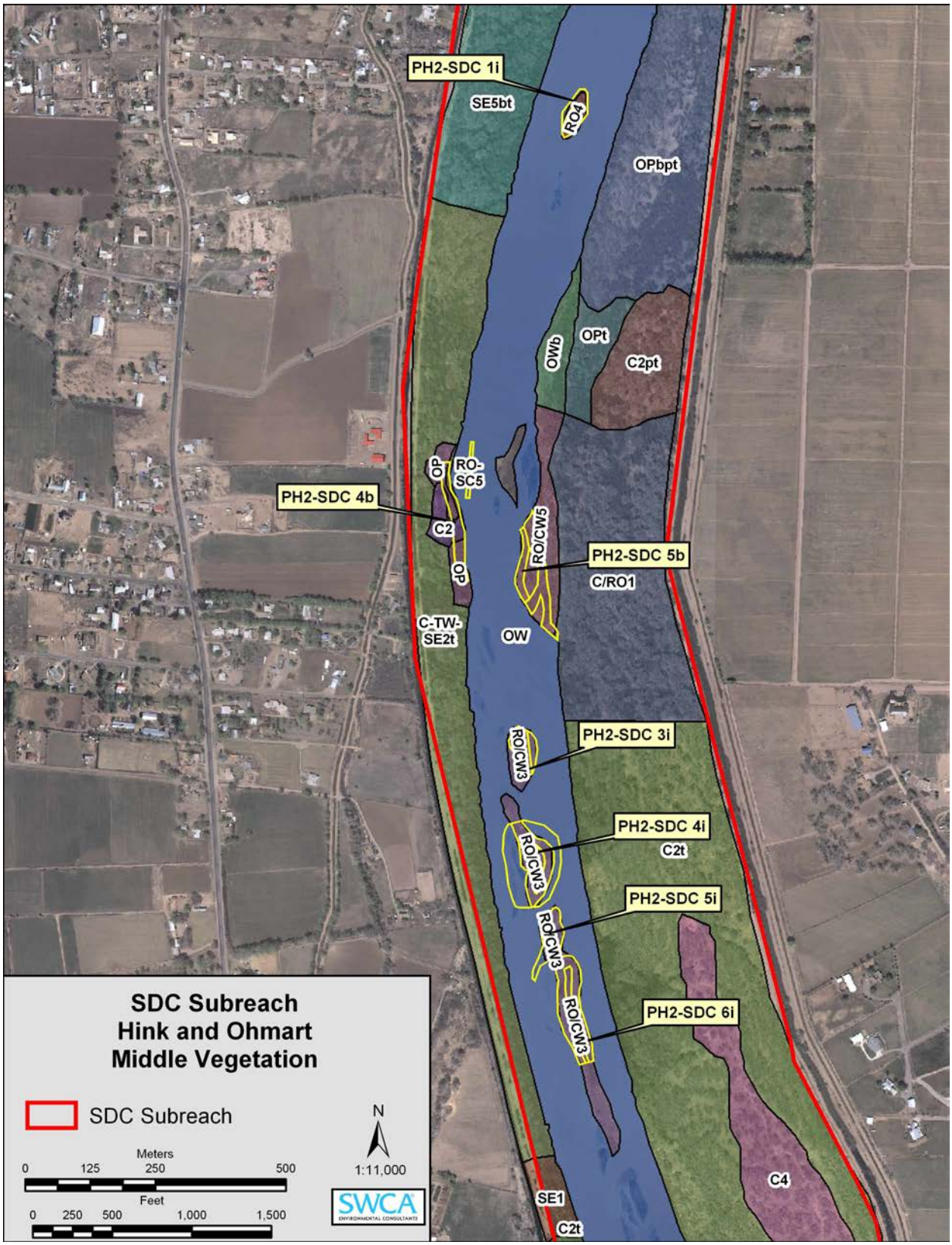

Figure A. 34. South Diversion Channel Subreach, middle section.

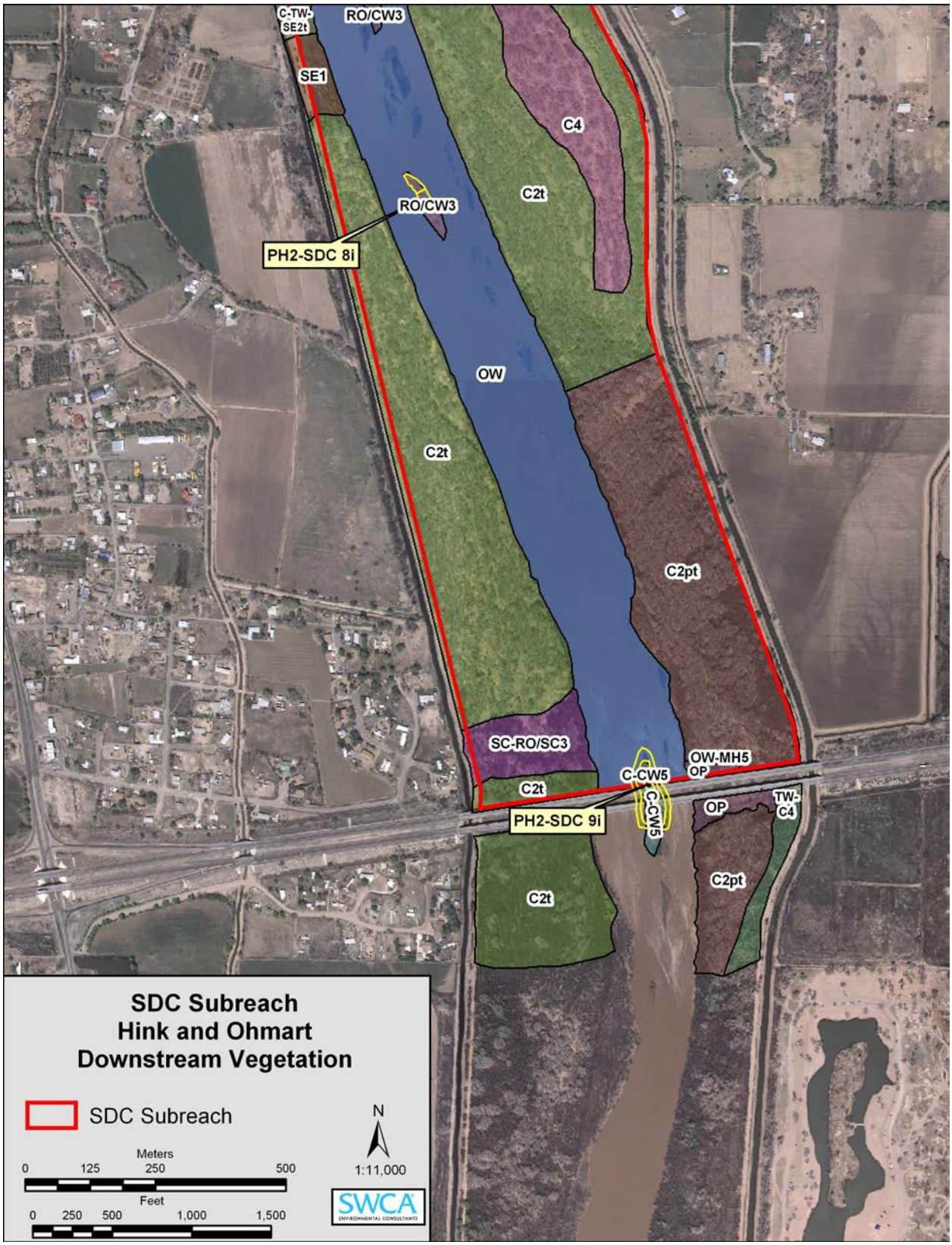

Figure A. 35. South Diversion Channel Subreach, downstream section.

ISLAND 1 *(SDC_1i)*

Vegetation on this island consists of only a Russian olive canopy with no understory. Siberian elms account for no more than 25% of the arboreal species. The bank line of nearly the entire island contains Type 6 wetland vegetation in which species such as water sedge (*Carex aquatilis*), horsetail, Canada goldenrod, and fox-tail barley (*Hordeum jubatum*) occur (Figure A.36). The proposed treatment would lower the entire island, creating two terraces and modifying approximately 0.72 acre.

ISLAND 2 *(SDC_3i)*

Vegetation on the island consists of a Russian olive canopy with a coyote willow understory (5–15 ft). Some tall saltcedar makes up no more than 25% of the cover (Figure A.37). The proposed treatment would create a channel in the middle of the island with two higher terraces on the east and west sides and would modify approximately 0.80 acre.

ISLAND 3 *(SDC_4i)*

Vegetation on this island consists of an intermediate Russian olive canopy with a coyote willow understory (5–15 ft) (Figure A.38). Several small, disjunct islands occur to the west side of the main island, each with Type 6 wetland vegetation in which species such as soft-stem bulrush, narrow-leaf cattail (*Typha angustifolia*), common reed (*Phragmites* sp.), and Canada goldenrod occur. The proposed treatment would create three terraces on the largest part of the island, leaving the northernmost tip unmodified. This treatment would modify approximately 3.71 acres.

ISLAND 4 *(SDC_5i)*

Vegetation on this island also consists of an intermediate Russian olive canopy with a coyote willow understory (5–15 ft) (Figure A.39). A large sand bar connects SDC-5i with SDC-4i. The northern and southern tips of the island support wetland Type 6 vegetation, with water sedge, bulrush, horsetail, rabbit-foot grass, and fox-tail barley. The proposed treatment would lower the entire island and would modify approximately 0.93 acre.

ISLAND 5 *(SDC_6i)*

This island also supports an intermediate Russian olive canopy with a coyote willow understory (5–15 ft) (Figure A.40). A wetland area that includes a small channel with Type 6 vegetation occurs on the western side of the island, with species such as water sedge, horsetail, Torrey's rush (*Junchus torreyi*), rabbit-foot grass, and common reed. The proposed treatment would create two terraces on the northern two-thirds of the island and would modify approximately 2.13 acres.

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Figure A.36. Island 1 (SDC_1i) — Hink and Ohmart Type 4 vegetation.

Figure A.37. Island 2 (SDC_3i) — Hink and Ohmart Type 3 vegetation.

Figure A.38. Island 3 (SDC_4i) — Hink and Ohmart Type 3 vegetation.

Figure A.39. Island 4 (SDC_5i) — Hink and Ohmart Type 3 vegetation.

Figure A.40. Island 5 (SDC_6i) — Hink and Ohmart Type 3 vegetation.

Figure A.41. Island 6 (SDC_8i) — Hink and Ohmart Type 3 vegetation.

ISLAND 6 *(SDC_8i)*

As on Islands 2–5, vegetation on SDC-8i consists of an intermediate Russian olive canopy with a coyote willow understory (5–15 ft) (Figure A.41). Saltcedar is present on no more than 25% of the island. The proposed treatment would create two terraces on the northern half of the island and would modify approximately 0.33 acre.

ISLAND 7 *(SDC_9i)*

The island lies berneath the I-25 Bridge and supports young stands of cottonwood (5–15 ft) and coyote willow (Figure A.42). The treatment area on the northern side of the bridge contains a wetland, which comprises nearly all of the vegetated area. On the southern side of the bridge, the Russian olives have been thinned. The saltcedar on the island has been thinned and is present on no more than 25% of the surface area. The proposed treatment would create three terraces on the island and would modify approximately 1.98 acres.

BANK MODIFICATION 1 *(SDC_1b)*

The vegetation at this site consists of an intermediate Siberian elm canopy with a coyote willow understory (5–15 ft) (Figure A.43). The proposed treatment would lower the bank line area to the river bottom and modify approximately 0.39 acre.

BANK MODIFICATION 2 *(SDC_3b)*

The southern end of the proposed treatment site would connect to a Phase I bank modification. The vegetation at this site consists of young stands of coyote willow and Russian olive with no canopy (Figure A.44). The northern portion of the bank line is a bar attached to a small island. A wetland area extends almost the entire length of the bank. The proposed treatment would lower the bank line at two levels, creating a sloped contour and modifying approximately 3.22 acres.

BANK MODIFICATION 3 *(SDC_4b)*

The vegetation at this site consists of a small strip of mature cottonwoods just west of the bank line and young stands (5–15 ft) of exotic Russian olive and saltcedar along the bank line (Figure A.45). The proposed treatment would remove the jetty jacks from within the main channel and lower the bank line to the river bottom, modifying approximately 1.23 acres.

BANK MODIFICATION 4 *(SDC_5b)*

The vegetation at this site consists of an intermediate Russian olive canopy and a coyote willow understory (5–15 ft) (Figure A.46). A wetland area on the southern half of the bank line supports Type 6 vegetation with water sedge, horsetail, rabbit-foot grass, and Canada goldenrod. The proposed treatment would create a scallop at the north end of the site and also modify the area just east of the bank to create a channel that runs to the south end of the bar. The bank line between the scallop and the south end of the channel would be lowered to the river bottom. This treatment would modify approximately 1.58 acres.

Figure A.42. Island 7 (SDC_9i) — Hink and Ohmart Type 5 vegetation.

Figure A.43. Bank Modification 1 (SDC_1b) — Hink and Ohmart Type 3 vegetation.

Figure A.44. Bank Modification 2 (SDC_3b) — Hink and Ohmart Type 5 vegetation.

Figure A.45. Bank Modification 3 (SDC_4b) — Hink and Ohmart Type 5 vegetation.

Figure A.46. Bank Modification 4 (SDC_5b) — Hink and Ohmart Type 3 vegetation.

PROJECT IMPACTS TO RIPARIAN HABITATS

A few cattail (*Typha* sp.) stands were observed in some of the treatment areas; they would be left undisturbed if possible. Also, any cottonwood trees with diameters of 4 inches or more would be left standing if possible.

Over 70% of the woody vegetation that the project will disturb is predominantly young or immature native vegetation less than 15 feet tall, most of it fast-growing native coyote willow or herbaceous plants. This vegetation type is frequently disturbed by flooding on bars and islands, and since the project proposes to replant native willow in disturbed areas, no long-term adverse effects should be experienced by wildlife using these habitats.

Habitats of predominantly native vegetation of intermediate height and complex structure fit USFWS Resource Category 2. These habitats make up 18.4 acres, or 22.2%, of the combined vegetation on all restoration sites in all subreaches, as shown in Table A.5. This habitat is of high quality and is relatively scarce or becoming scarce, primarily due to fragmentation and loss of native riparian vegetation. The mitigation goal for habitat in Resource Category 2 is "no net loss of in-kind habitat value." On-site replanting of native willows to replace lost habitat values is therefore recommended as part of the overall site restoration plan.

Table A. 5. Summary of Impacts to USFWS Resource Categories

Hink & Ohmart Structural Type	Vegetation Composition	USFWS Resource Category	Combined Acres (all treatment sites)	Relative %
1	Mature native canopy with native understory	2	9.76	11.77
2	Mature native canopy	2	1.92	2.31
3	Intermediate native or mixed canopy with understory	3	8.96	10.80
3	Non-native canopy with native, mixed or non-native understory	3	32.93	39.70
5	Native young successional stands	2	6.73	8.11
5	Exotic or mixed young successional stands	3	10.95	13.20
OTH	Open	4	10.40	12.54
OTH	Open Water	N/A	1.30	1.57
TOTAL			**82.95**	**100.00%**

Habitats of primarily non-native vegetation of intermediate height or of native vegetation that is less than 15 feet in height fit USFWS Resource Category 3. These habitats make up 52.84 acres (63.7%) of the vegetation in the restoration sites. These habitats are of moderate value for some species. The recommended mitigation for this vegetation is to monitor natural regeneration of vegetative cover to assure that native vegetation is established so that no net loss of habitat value

occurs. If native species do not regenerate naturally, replanting with native seed mix or saplings is recommended.

The USFWS categorizes habitats of medium to low value for evaluation species as Resource Category 4. These habitats make up 10.40 acres (12.5%) of the total area in the restoration sites. The recommended mitigation goal for these areas is to minimize loss of habitat value. If native vegetation exists, it will be flagged and avoided as necessary so that no net loss of habitat value occurs.

No recommendation is made for loss of herbaceous vegetation.

APPENDIX B

LIST OF CONTRIBUTORS

Joseph Fluder, M.S. – Project Manager
Claudia Oakes, Ph.D. – Senior Biologist
Matt McMillan, M.S. – Lead Biologist
Jeff Ham – Ecologist/Wetlands Specialist
Burt McAlpine – GIT Coordinator, Surveyor
Jean Ballagh – Senior Editor

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