

POTRERO CREEK WETLANDS
BIOLOGICAL CHARACTERIZATION REPORT

Prepared for:
Arizona Water Protection Fund Commission
Grant Number 95-024WPF

Prepared by:
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September 1996

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SUMMARY

The Arizona Water Protection Fund Commission awarded a grant to EnviroNet Inc. (EnviroNet) to conduct a biological characterization of the Potrero Creek wetlands, approximately five miles north of Nogales, Arizona. The overall goal of the biological characterization is to provide the Arizona Water Protection Fund with baseline biological information for use in developing a management plan for the wetlands. Initial spring, 1996 biological surveys included vegetation transects, an aquatic biota survey, small mammal trapping, a bird survey, and bird banding. Biological monitoring of the project site will continue quarterly until the spring of 1997.

Potrero Creek wetlands today represent a remnant cienega system which provides important riparian and wetland habitat. Three habitat communities within the wetland/riparian area (willow bosque, bulrush marsh, cattail/open water marsh) composed of 71 vascular plants, were identified during the surveys. Three mammals (white-footed mouse, coyote, and collared peccary), one fish species (mosquitofish), two reptiles and amphibians (bullfrogs and whiptails), and three aquatic invertebrate species (crayfish and freshwater clams and snails) were observed within the project site during initial biological surveys. A diverse population of migratory and resident bird species was also observed. Fifty bird species (including 22 migrant, 18 summer resident, and 10 permanent resident species) were observed within the project site during spring biological surveys. Two bird species listed by the State of Arizona as sensitive species were observed during the surveys: gray hawk (*Buteo nitidus*; State Threatened) and belted kingfisher (*Ceryle alcyon*; State Candidate).

Historical research indicates that the wetlands may have been much more extensive prior to habitat alterations including roadway development, construction of a drive-in theater, installation of a gas line, creek channelization and rerouting, construction of a stormwater control berm, groundwater fluctuations, and grazing. According to long-time residents of the area, surface water may have been available historically year-round at the wetlands.

The Potrero Creek wetlands area remains an important riparian/wetland system for wildlife habitat. Native riparian communities throughout the area support a diverse population of migratory and resident bird species. Factors constraining existing and possibly future plant and wildlife diversity include the lack of a permanent water source,

future development plans, and grazing. Management activities may protect this diminishing resource from future development activities, preserve wetland resources, and provide exceptional educational opportunities.

Potrero Creek wetlands support an abundant and diverse assemblage of plant and wildlife species. The wetlands, also known locally as Las Lagunas, Meadow Hills Cienega, and Country Club wetlands, is one of the last remaining cienegas (or desert stream marshlands) along Nogales Wash in the Santa Cruz River valley. The wetlands today encompass approximately 35 acres, and are located about five miles north of Nogales, Arizona, just north of Interstate 19 and Country Club Drive (Figure 1). Historically, the wetlands area may have comprised 65 acres or more.

In 1995, the Arizona Water Protection Fund Commission awarded a grant to EnviroNet Inc. (EnviroNet) to conduct a biological and hydrogeological characterization of the wetlands. The results of the biological characterization portion of the project are presented in this report. The hydrogeological characterization is presented in a separate report. Following characterization, the second phase of the study will focus on community involvement to assist in the development of a management plan for the wetlands. A public hearing is planned for October 10, 1996, to discuss concerns with the wetland and possible management alternatives to enhance, protect, or preserve the wetland area. These management alternatives will be evaluated for feasibility in implementation based on property ownership, funding sources, access, and effectiveness.

The objectives of the biological characterization were to evaluate and document the existing biological resources and habitat communities in the wetlands by 1) conducting an information search and historical review, 2) conducting biological surveys in the spring of 1996, including vegetation, birds, aquatic, and small mammal surveys, and 3) reviewing aerial photographs to evaluate historical trends in wetland biological conditions. Previous biological work conducted within the project site included a jurisdictional delineation and vegetation survey of the site in 1993.

Project site boundaries consist of legally-accessible areas within the wetlands area between Interstate 19 and the Nogales Highway. The project site is intersected by Country Club Road (Figure 2). Access for this project was authorized on public lands and on selected privately-owned lands.

Results of the 1996 biological characterization are organized into the following sections: 1.0 Introduction, 2.0 Information Review, 3.0 Survey Methods, 4.0 Survey Results, 5.0 Historical Review Results, 6.0 Discussion and Conclusions, 7.0 Biological Monitoring, and 8.0 Bibliography. Results of periodic monitoring of the wetlands, conducted from July 1996 to April 1997, will be attached in Appendix 2 as they are completed.

A search was conducted to obtain available information on the Potrero Creek wetlands area through the following methods: 1) a literature search was conducted with agencies, individuals, and at the Arizona State University libraries, 2) an aerial photograph search was conducted to obtain historic aerial photographs of the area, and 3) interviews were conducted with long-time residents of the area to obtain historic information.

2.1 LITERATURE SEARCH

A literature search was conducted to review available documentation of past or present biological resources of the project area. The following agencies and individuals were contacted as part of the literature search:

- U.S. Army Corps of Engineers, Mr. Robert Dummer
- Arizona Department of Transportation, Mr. Dale Choyeski
- Arizona Department of Game and Fish, Mr. Scott Richardson
- U.S. Fish and Wildlife Service, Mr. Frank Baucom
- U.S. Forest Service, Mr. Tom Newman
- Audubon Society, Mr. Bill Branan and Mr. John Bache-wiig
- Friends of the Santa Cruz River, Ms. Sherry Sass
- Arizona State University Noble and Hayden Libraries
- Arizona State Library Archive and Public Documents

2.2 AERIAL PHOTOGRAPH REVIEW

EnviroNet contacted the following agencies and companies requesting historical aerial photographs of the Potrero Creek area:

- U.S. Geological Survey
- Arizona Department of Transportation
- University of California at Santa Barbara
- Whittier College
- Cooper Aerial
- Rupp Aerial

- NRCS
- University of Arizona Historic Aerial Photographs and Mapping Library
- Arizona State Museum
- Salt River Project

Five historic aerial photographs of the Potrero Creek wetlands area (August 1959, July 1968, October 1977, October 1983, and October 1990) were obtained and reviewed. Current aerial photographs were obtained in March of 1996 for comparison to the historic photographic information. These historical aerial photographs are available for review in the Potrero Creek Hydrogeological Characterization Report.

2.3 INTERVIEWS

Interviews were conducted with the following individuals or representatives of the following agencies who contributed information for the historical review:

- Ms. Jan Duke, Director, Pimaria Alta Historical Society
- Ms. Lilian Hoff, Meadow Hills resident
- Mr. Lee Bley, Meadow Hills resident
- Ms. Claudia and Ms. Matilde Proto, long-time residents of the area
- Mrs. Orealiz Mary Bayze Munguia, former resident of the wetland area

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- Mr. Lee Bley, Meadow Hills resident
- Ms. Claudia and Ms. Matilde Proto, long-time residents of the area
- Mrs. Orealiz Mary Bayze Munguia, former resident of the wetland area

Spring biological surveys were conducted on April 3 through 5, 1996, to evaluate and characterize existing biological resources at the Potrero Creek wetlands. Methods are described below for vegetation, bird, aquatic biota, and small mammal surveys.

3.1 VEGETATION

A vegetation survey was conducted in the project site on April 3 and 4, 1996 to evaluate and document vegetation at Potrero Creek wetlands. Vegetation communities within the project site were visually stratified into three vegetation communities based on dominant species. Three non-intercepting 100-foot linear transects were established within each community. If the community size did not allow the establishment of three non-intercepting transects, one transect was conducted within the community. A total of ten transects were established within the project site (Figure 3). Transect location details are provided in Appendix 1.

Transect direction was selected randomly by following the direction of a thrown stick. Repeated throws were conducted if the direction led outside the vegetative community or project site. Point counts were conducted at three-foot intervals along the 100-foot linear transects. Species present at each vertical point were recorded on data sheets in the field.

Upon completion of each transect, species observed in the vicinity of the transects were noted for species listing within the habitat community. Species observed along the roadway margin and in transitional areas were also noted.

3.2 BIRDS

An avifaunal survey was conducted on April 4 and 5, 1996 to document bird species observed or detected within the project site. A combination of point count surveys and bird net lanes were used to conduct the survey as recommended by the U.S. Forest Service Handbook of Field Methods (U.S. Forest Service 1993). Bird banding activities

were conducted to establish a basis for a possible long-term bird banding program as part of future wetland area management and monitoring. Seven five-minute point count surveys were established in willow bosque communities to the north and to the south of Country Club Road. A total of ten net lanes were established within the project site. Point count transect and net lane locations are provided in Figure 4.

Five net lanes were assembled each survey morning between 5:30 and 6:30 A.M. The point count surveys were conducted immediately after net assembly. Five-minute point counts were conducted every 50 meters along linear transects each survey day by one observer. The observer then examined the nets for captured birds. Each netted bird was freed from the net and transported to the bird banding station for banding. Each bird was measured (wing, bill, tarsus, and tail length), weighed, identified for species and sex, banded, and the data recorded. The banded birds were then released at the point of capture. The nets were periodically inspected and the banding process repeated for approximately four hours before disassembling the nets.

3.3 AQUATIC ORGANISMS

An aquatic survey was conducted to observe aquatic organisms, including fish, reptiles, amphibians, and macro-invertebrates that inhabit open water areas of the Potrero Creek wetlands. Aquatic surveys were conducted on April 4 and 5, 1996. A total of ten aquatic sample locations were selected in areas of open water throughout the project site (refer to Figure 4). At each aquatic sampling area, time and water temperature was noted. The area was observed for five minutes, and five dip net samples were conducted. Captured organisms were identified, where possible, and released.

3.4 SMALL MAMMALS

Small mammal traps were set in and around the project site to characterize small mammals inhabiting the area. A total of ten Sherman Folding Live Capture Traps (3" x 3.5" x 9") were set before sunset on April 3 and 4, 1996. A mixture of peanut butter and rolled oats was used as bait for each trap. The traps were inspected the following mornings for capture. Each captured mammal was identified. Casual observations of mammals observed during biological surveys were also noted. Figure 4 illustrates the

small mammal trap locations. Each location was selected to represent habitat types and conditions typical of the wetland and the immediately surrounding area.

Ambient air temperatures on April 3 and 4 were approximately 50^o F and 40^o F, respectively, at dawn. Weather conditions were clear on April third and fourth, shifting to partly cloudy with scattered light rain in the late afternoon on the fourth.

4.1 VEGETATION

A total of 71 vascular plants was observed within the project site. A list of species observed is provided in Table 1.

Three vegetation communities were identified within the project site, as identified in Figure 3: willow bosque, cattail/open water marsh, and bulrush marsh. Two willow bosque communities separated by Country Club Road varied slightly upon general observation. Transects were conducted in both of these communities to evaluate variations, if any, between the two communities. Percent cover for each community was evaluated based on the presence or absence of vegetation within each vertical point along the transect. Live vegetation only was included in the cover evaluation.

4.1.1 WILLOW BOSQUE COMMUNITY

This riparian deciduous woodland community is the largest vegetation community within the Potrero Creek wetland (Figure 3 and Photograph 1). It occurs along the northern border of the wetland (along the path of Potrero Creek itself) as well as in a somewhat isolated area to the south of Country Club Road. Goodding willow (*Salix gooddingii*) is the dominant species (over 60 percent cover) with a varied understory composition between the two bosque communities. Fremont cottonwoods (*Populus fremontii*), which were present upstream of the project site to the west of Interstate 19 and are frequently co-dominants with willows, were rare. Soils within the willow bosque community were saturated, with some standing water.

Transect results indicate that the understory of the willow bosque to the north of Country Club Road (Willow Bosque Community A) is composed primarily of bermuda grass (*Cynodon dactylon*), curley dock (*Rumex crispus*), watercress (*Rorippa nasturtium-aquaticum*), with occasional whorled pennywort (*Hydrocotyle verticillata*), buttercup (*Ranunculus hydrocharoides*), and water speedwell (*Veronica anagallis-aquatica*) (Figure 5). Although not encountered during point-count transects, vegetation also noted within the community includes brome grass (*Bromus catharticus*), Kentucky bluegrass (*Poa annua*), and meadow fescue (*Festuca arundinaceae*) in the understory and occasional Fremont cottonwoods (*Populus fremontii*) and juniper trees (*Juniperus coahuilensis*) (see Table 1). Percent total cover within Willow Bosque Community B is 94.

Results of the transect point-counts indicate that the understory composition of the more isolated willow bosque to the south of Country Club Road (Willow Bosque Community B) is dominated by buttercup (*Ranunculus hydrocharoides*), two species of spikerush (*Eleocharis macrostachya* and *E. palustris*), meadow fescue (*Festuca arundinacea*), and wire rush (*Juncus balticus*), with occasional curley dock (*Rumex crispus*) (Figure 6). Other species observed within the community included two additional rush species (*Juncus marginatus* and *J. tenuis*). Percent total cover within Willow Bosque Community B is 100.

4.1.2 CATTAIL/OPEN WATER MARSH COMMUNITY

This community, represented by emergent marshland vegetation and open water, occurs in the central portion of the project site (see Figure 3 and Photograph 2). Patches of cattail marsh were also observed in other areas of the wetland where project access was not permitted. The dominant emergent species is southern cattail (*Typha domingensis*), occurring largely in pure stands. Other plants encountered during the transects include knotgrass (*Paspalum distichum*) in open water areas, willow (*Salix gooddingii*) on the community periphery, water smartweed (*Polygonum punctatum*), spikerush (*Eleocharis palustris* and *E. macrostachya*) on the water's edge, with an occasional lady's thumb (*Polygonum persicaria*) and curley dock (*Rumex crispus*). Species composition and percent cover for this community is illustrated in Figure 7. Transect results within the cattail/open water marsh area indicate 84 percent total cover for the community.

4.1.3 BULRUSH MARSH COMMUNITY

The bulrush marsh is an emergent marshland community dominated almost entirely by bulrush (*Scirpus americanus*). The bulrush marsh is located in the southwestern portion of the project site, to the south of Country Club Road (see Figure 3). Due to the small size of the bulrush marsh, only one non-intercepting transect was obtainable. The marsh is comprised of a pure stand of bulrush, with occasional curley dock (*Rumex crispus*) at the fringes of the marsh (Figure 8). At the time of the survey, the majority of the stand consisted of dead vegetation, with live bulrush evident underneath the biomass. Percent total cover in this community is 100.

Another bulrush marsh, outside the project site, but within the wetlands on privately-owned land, was observed in the northeast area of the wetlands. This community also appeared to be a relatively pure stand of bulrush.

4.1.4 RELATIVE DIVERSITY

Relative diversity was evaluated by comparing the number of vegetation species observed on transect point counts within each community. Relative to the other communities, the cattail/open water marsh and Willow Bosque Community B were found to be the most diverse (the greatest number of vegetation species were observed on the transect point counts within these communities), Willow Bosque Community A the next diverse, and the bulrush marsh the least diverse of the vegetation communities on observed at the wetland (Figure 9).

4.2 BIRDS

Twenty-seven bird species were observed in the wetlands area during the spring point-count surveys. An additional 23 species were observed in the wetlands area during bird banding activities and/or casual observations during other portions of the spring biological surveys (Table 2).

Ten permanent resident bird species were observed in the wetland area during the spring surveys. These permanent residents include the song sparrow (*Melospiza melodia*), Gila woodpecker (*Melanerpes uropygialis*), the ladder-backed woodpecker (*Picoides scalaris*), and the common raven (*Corvus corax*). Eighteen summer residents were observed during the spring surveys, the most common including the red-winged blackbird (*Agelaius phoeniceus*), Bewick's wren (*Thryomanes bewickii*), Lucy's warbler (*Vermivora luciae*), yellow warbler (*Dendroica petechia*), common yellowthroat (*Geothlypis trichas*), and lesser goldfinch (*Carduelis psaltria*). Twenty-two migratory bird species were observed during the spring surveys. The most abundant migratory bird species observed within the wetlands include the yellow-rumped warbler (*Dendroica coronata*), the orange-crowned warbler (*Vermivora celata*), and the American coot (*Fulica americana*).

Two sensitive bird species were observed during the surveys: gray hawk (*Buteo nitidus*) and belted kingfisher (*Ceryle alcyon*). The gray hawk, a State Threatened species, was observed and detected immediately following point-count surveys throughout the remainder of each morning. The belted kingfisher, a State Candidate species, was observed within the wetlands area following point-count surveys.

Bird handling during banding allowed an evaluation of the breeding condition of the caught birds. Four female birds caught during bird banding, Black phoebe (*Sayornis nigricans*), two song sparrows (*Melospiza melodia*), and Bewick's wren (*Thryomanes bewickii*) showed signs of brooding (edematous or bare brood patch). Species caught in net lanes and locations are presented in Table 3. Net lane location numbers refer to those indicated in Figure 4.

4.3 AQUATIC ORGANISMS

Pond water temperatures ranged from 55 to 70°F, with a mean value (n = 5) of 61.8 °F (Table 4). The lowest temperature reading corresponded with the creek outflow point (underneath the highway bridge) of the project site, whereas the highest reading appeared to correspond with the most open, ponded area (see Figure 4).

The aquatic habitat survey confirmed physical conditions and biota typical of warm-water seasonal ponds with a perennial refuge component. Aquatic biota in the open water areas consisted largely of non-native species, including crayfish (*Orconectes virilis*), bullfrogs (*Rana catesbiana*), freshwater clams (*Corbicula* sp.) and snails (*Planorbis* sp.), and mosquitofish (*Gambusia affinis affinis*). Species identification of crayfish and freshwater clams and snails are tentative as all specimens were required to be released. Endemic aquatic species with protected status were not observed within the project site. Table 5 illustrates the aquatic organism observations by location. Please refer to Figure 4 for sample locations.

Casual observations of reptiles throughout the biological surveys included whiptails (*Cnemidophorus* sp.) observed along the roadsides.

4.4 SMALL MAMMALS

A total of ten white-footed mice (*Peromyscus leucopus*) were captured during the survey. Soil and habitat conditions for each trap location are provided in Table 6. Table 7 illustrates the results of the small mammal trapping. The captured mice were not tagged or marked; therefore, it is possible that an individual mouse was captured twice (once each night). The trap at location M3 was destroyed on the second survey night, which may have been attributable to dogs or humans observed in the area. The results of the trapping indicate that the mice are fairly widespread in and around the wetlands area.

Other mammals observed in the project area during the surveys included six collared peccaries (*Tayassu tajacu*) observed at 7 A.M. on April 5th in the wetland area to the south of Country Club Drive. Coyote (*Canis latrans*) howls were detected early in the morning of the fifth. Two domestic horses graze on private lands within Willow Bosque A, the area to the north of Country Club Road.

HISTORIC REVIEW RESULTS

Abundant evidence exists around the Potrero Creek wetlands for a long history of human occupation, utilization and ultimately alteration. Archaeological investigations conducted on areas adjacent to the project site reveal prehistoric human occupation for over 1200 years. Although the artifactual remains of the prehistoric people indicate utilization of the resources associated with the wetland, there is no indication of wetland resource development activities. Historical aerial photograph reviews, historical map research, and interviews indicate the pre-1870 wetland area at maximum pool may have comprised approximately 65 acres. Remnants of the original wetland are located along Country Club Road between Interstate 19 and Grand Avenue.

5.1 SURFACE ALTERATIONS

The earliest available documented changes to the surface area of the wetland were drain activities conducted by Pete Kitchen in the 1870's. Mr. Kitchen reportedly drained approximately 20 acres of marsh lands near the confluence of Potrero Creek and Nogales wash to create farmland. It is likely that those reclamation activities involved channeling and realigning Nogales Wash to its current location on the extreme east side of the valley. Information specifying the specific location of the original confluence is inconclusive. The following additional fill activities occurred in and around the Potrero Creek wetlands during the period of 1880 to 1969 (dates approximate):

- 1930 Fill on east side of wetland to allow construction of Route 89.
- 1945 Fill on east side of wetland for construction of a drive-in theater.
- 1960 Fill across south portion of wetland for original construction of Country Club Drive.
- 1968 Channeling Potrero Creek upstream of Interstate 19.
- 1969 Fill across west portion of wetland for construction of Interstate 19.
- 1969 Fill across center for realignment of Country Club Drive.
- 1969 Linear fill (dike) parallel to Potrero Creek for stormwater control.

These isolated fill activities have resulted in an estimated 53 percent reduction in the wetland or floodplain surface area.

5.2 INTERVIEWS

Relevant information from interviews are summarized in the following table:

INDIVIDUAL	POTRERO CREEK AREA INFORMATION
Mrs. Lilian Hoff	Mrs. Lilian Hoff stated that plants have recently encroached in the wetlands and that the area used to be open water with no cattails. Mrs. Hoff remarked that City utility work, tree removal, and road widening on Country Club Drive was leaving large amounts of construction debris in the area around the wetland and needed to be cleaned up. She has also noticed a drop in bird populations in the wetland and the general area as well. She believes the City of Nogales may be overpumping from its wells and is intercepting water that once flowed into the wetland.
Ms. Claudia and Matilde Proto	Mme. Protos' uncles used to play polo and graze their horses at the confluence of Potrero Creek with Nogales Wash. The area where the existing drive-in is located was their uncle's pasture and where the City golf course is located were cows with water up to their knees. Ms. Proto spoke of the increase in cattails in the wetland compared to earlier years.
Mrs. Orealiz Mary Bayze Munguia	The Bayze family homesteaded area in the late 1800's around Meadow Hills. The family was from Alsaisse Lorraine, and planted willows and cottonwoods in rows, and built a lake to make the area look like European landscapes. The homestead supplied water to the town of Nogalitos. Her grandfather's cattle grazed in the area of the golf course until the depression (1930's) when there was a drought. Cattle were dying. Prior to the drought, the area was full of springs. Water was much less abundant after the drought in 1930's.
	Mrs. Munguia's father's house was located where St. James church is now on Country Club Drive. Old Tucson road was nearer the center of the valley, moved to the east side of the railroad. Her father sold part of ranch in 1937. The State took property from land owners to build the freeway. The drive-in theater was built in the late 1940s.
	Mrs. Munguia and her siblings used to gather watercress from Nogales Wash when they were children, prior to all of the pollution. She remembers planting strawberries in the golf course area and hearing owls in the cottonwood trees. The project site had perennial water except during the drought, although there was some seasonal fluctuation. Cattails were much less abundant.

INDIVIDUAL**POTRERO CREEK AREA INFORMATION**

Mr. Lee Bley

The Meadow Hills area began development around 1970. He believes that since the cessation of pumping potable water into three upgradient, unlined irrigation ponds for the golf course in the fall of 1994, the amount of water in the wetland has declined. Mr. Bley remarked that when the City ponds were drained, the wetlands dried up and that the City ponds were possibly leaking and subsequently feeding the wetlands. The northeast-southwest running berm on the edge of the ADOT easement along the northern edge of the wetland has been there since at least 1968.

DISCUSSION AND CONCLUSIONS

Potrero Creek wetlands is characterized by open water areas, with dense patches of southern cattail, surrounded by riparian willow communities. These riparian/wetland habitats are dominated by few plant species and provide wildlife habitat for aquatic biota (including invertebrates, reptiles, and amphibians), small mammals, and a diverse assemblage of migratory and resident bird species. Due to alterations over the past 100 years, the Potrero Creek wetlands area represents a remnant cienega in an area now dominated by agricultural fields, a golf course, and residential areas.

6.1 BIOLOGICAL RESOURCES

Vegetation. Three habitat communities (willow bosque, cattail/open water marsh, and bulrush marsh), and 71 vascular plant species were observed within the Potrero Creek wetland area. Two willow bosque communities, separated by Country Club Road, were surveyed. The dominant vegetation in these communities is Goodding's willow (*Salix gooddingii*), which is ideally adapted to a floodplain environment and has a high tolerance for flooding (Reichenbacker 1984, Walters et al. 1980). The notable sparsity of cottonwoods throughout the project site may be due to flooding as cottonwood seedlings have a lower tolerance for prolonged saturation than do willows (Stromberg 1993). Both willow bosque communities are bounded to the south by berms which has increased flooding or ponding in these areas.

Transect results from the cattail/open water marsh indicate a relatively high plant diversity within this community. This may be attributed in part to the diversity of plants which occurred along the fringes of the marsh, or community boundary. According to long-time residents of the area, cattails may be a fairly recent addition to the wetlands. Cattails may have encroached into the wetlands in recent years during periods of lowered water levels.

Although reduced from its historic wetland size, habitat value within the wetlands remains high as exotic dominants such as salt cedar (*Tamarix* sp.) have not invaded into

the communities as in other disturbed riparian areas. Exotic grasses, likely introduced for grazing at one time, observed within the wetlands include bermuda grass (*Cynodon dactylon*), Kentucky bluegrass (*Poa annua*), and meadow fescue (*Festuca arundinacea*).

Aquatic Biota. Aquatic biota observed within the open water areas of the project site consist largely of non-native species, including crayfish, freshwater clams and snails, bullfrogs, and mosquitofish. No endemic fish such as Gila topmillow were observed. The existing aquatic biota help support a diverse bird population, as well as to provide a degree of recreation within the wetlands (fishing for crayfish).

Mammals. The white-footed mouse (*Peromyscus leucopus*) was captured in 50 percent of the traps set within the project area. A mouse was captured at seven of the ten trap locations at least one night, and within each habitat community. These results indicate a relatively well-distributed small mammal population throughout the project area. The white-footed mouse provides a food source for raptors that may visit or nest within the wetlands, including gray hawk (*Buteo nitidus*), red-tailed hawk (*Buteo jamaicensis*), and possibly the turkey vulture (*Cathartes aura*).

Birds. Numerous bird species were observed within the project site, likely due to the presence of open water areas, the abundance of cover, and the available structure within the willow communities for use by different bird species. Fifty species were observed within the wetlands area despite urban disturbances including traffic, a moderate amount of recreation (bird-watchers, joggers, and other visitors), and grazing. The combination of privately-owned lands and noise from the adjacent interstate highway may reduce the number of visitors that may otherwise be attracted to the area.

No other documentation of the birds found within the project site was identified. Tucson Audubon Society Christmas bird counts in the area surveyed a 7.5-mile radius which included the Potrero Creek wetlands area, however, no specific notes on the site are maintained.

6.2 HABITAT ALTERATIONS

Studies and historical research indicate that desert stream marshlands (cienegas) may have been historically much more extensive in the desert grasslands of southeastern Arizona (Minckley and Hendrickson 1985). The historic Potrero Creek wetland system has been altered and fragmented by multiple activities dating back to as early as the 1800's when cattle grazed the area. More recent activities which may have contributed to alteration of the system include surface disturbances (construction of roadways, drive-in theater, berms), stream channeling and rerouting, grazing, and changes in groundwater levels.

Surface Disturbances. Surface disturbances in and around the Potrero Creek area have led to fragmentation and reduction of potential wetlands area. Based on historic aerial photographs, surface disturbances including the construction of Nogales Highway, Country Club Road, Interstate 19, the drive-in theater, a gas line, a stormwater control berm, and agricultural activities may have reduced the wetlands and/or floodplain area by 53 percent.

Stream Channeling. Numerous studies on impacts on riparian communities from stream channeling or rerouting, also known as "arroyo cutting", have shown the alteration of successional trends within the habitat. In the Potrero Creek area, these actions reduced the floodplain area and increased flood velocity within the creek. Nogales Wash was similarly realigned and channeled. The lack of cottonwoods in the willow bosque areas may be due to increased flooding from stream channeling, as noted above.

Grazing. Cattle grazing has historically occurred within the Potrero Creek floodplain and riparian area. Although cattle no longer graze the project site, horses graze the willow bosque area in the northern area of the project site (Willow Bosque Community A). Differences between the willow bosque community in this area and the one to the south of Country Club Road, which is not grazed, are apparent. While roughly the same percentage of trees are present, a more diverse understory composed of buttercup and a variety of rushes (*Eleocharis macrostachya*, *E. palustris*, *Juncus balticus*) in the ungrazed habitat (see Photograph 3) can be compared to a less diverse understory dominated by bermuda grass, curley dock and watercress in the grazed habitat. Overall

percent cover was six percent less in the grazed habitat. Similar studies between grazed and ungrazed sites have indicated lower species diversity in grazed riparian areas (Reichenbacker 1984; Shannon and Weaver 1964). Exotic grasses likely introduced for grazing observed within the project site include bermuda grass (*Cynodon dactylon*), Kentucky bluegrass (*Poa annua*), and meadow fescue (*Festuca arundinacea*).

Changes in Groundwater Levels. Watershed and groundwater alterations have also affected the Potrero Creek wetlands. Open water is now observed only seasonally; historically it may have been a more permanent condition. The perched aquifer, which supports the wetlands, collects streamflow and, until the past few years, probably collected seepage losses from unlined ponds at the golf course upstream of the wetlands. These ponds were drained in approximately 1994 and are planned for lining. The loss of this seepage into the perched aquifer may have recently decreased available groundwater for the wetlands. More information on historic and current groundwater conditions are presented in the Potrero Creek Wetlands Hydrogeological Characterization Report.

7.3 CONCLUSIONS

Potrero Creek wetlands area, though reduced from its historic size, remains an important riparian/wetland system for wildlife habitat. Exotic dominants such as salt cedar (*Tamarix* sp.) have not invaded into this community as in other disturbed riparian areas. A diverse population of migratory and resident bird species were observed throughout the wetland area. Factors constraining existing and possibly future plant and wildlife diversity include the lack of a permanent water source, future development plans, and grazing. Management activities may protect this diminishing resource from future development activities, preserve wetland resources, and enhance educational opportunities.

BIOLOGICAL MONITORING

Monitoring of the biological resources of Potrero Creek is scheduled for the summer, fall, and winter of 1996 to observe seasonal changes at the project site as compared to the spring 1996 surveys described in this report. Objectives of the biological monitoring include: 1) observe habitat communities for signs of new growth, senescence, or readily observable changes; 2) conduct casual observations for small mammals, reptiles, and aquatic inhabitants; and 3) conduct a bird survey along the transects established during the spring survey. Monitoring results will be attached in Appendix 2 as they are completed.

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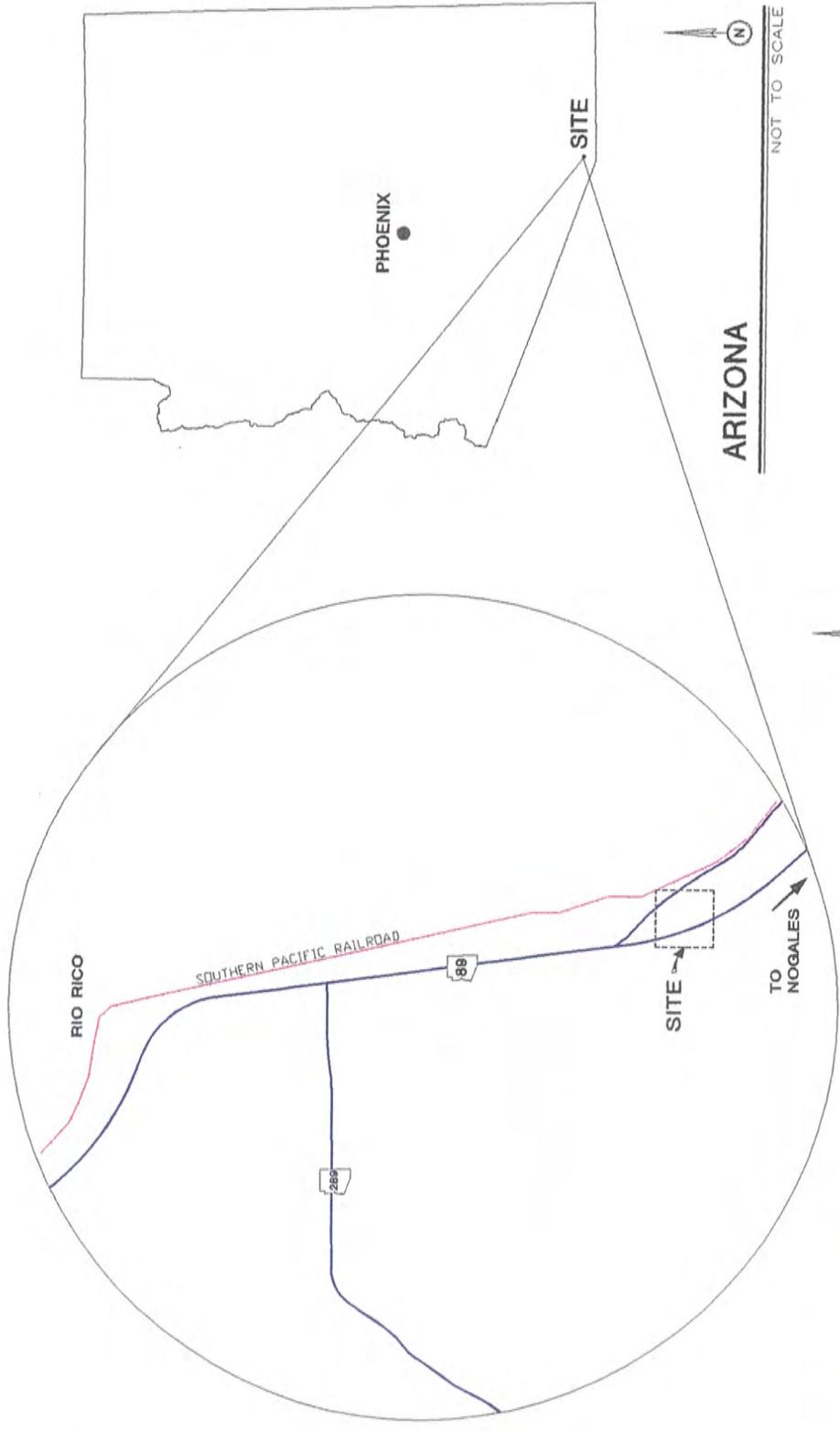
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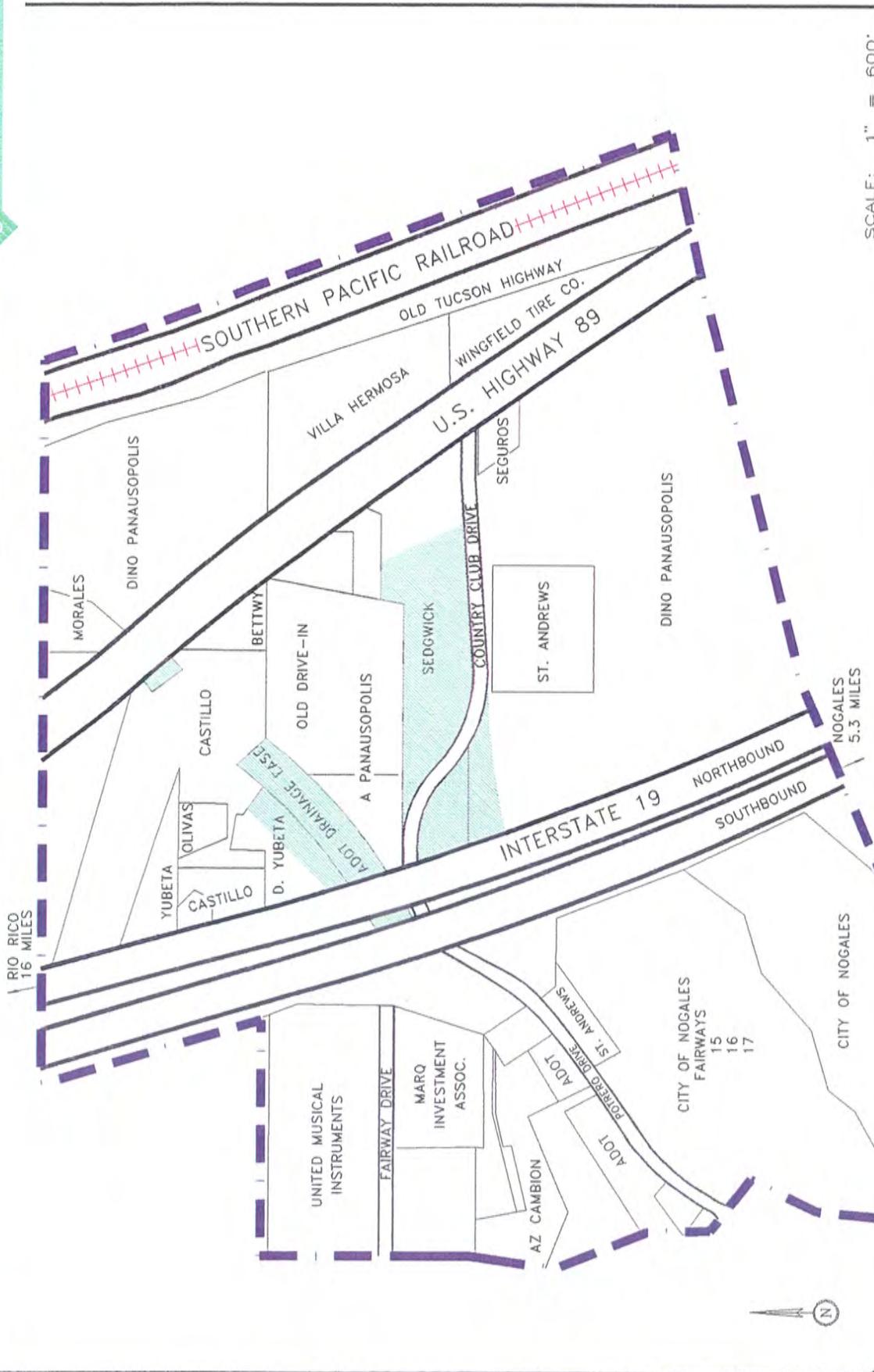
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FIGURES



POTRERO CREEK WETLANDS CHARACTERIZATION AND MANAGEMENT PLAN	
Vicinity Map	
Project No. : 95X029A	4/30/96
	FIGURE 1



KEY

- PROJECT SITE (WETLAND ACCESS AREAS)
- PROJECT VICINITY

POTRERO CREEK WETLANDS CHARACTERIZATION AND MANAGEMENT PLAN

Detailed Site Map

Project No. : 95X029A

4/17/96

FIGURE 2



WILLOW BOSQUE A

WILLOW BOSQUE A
OPEN

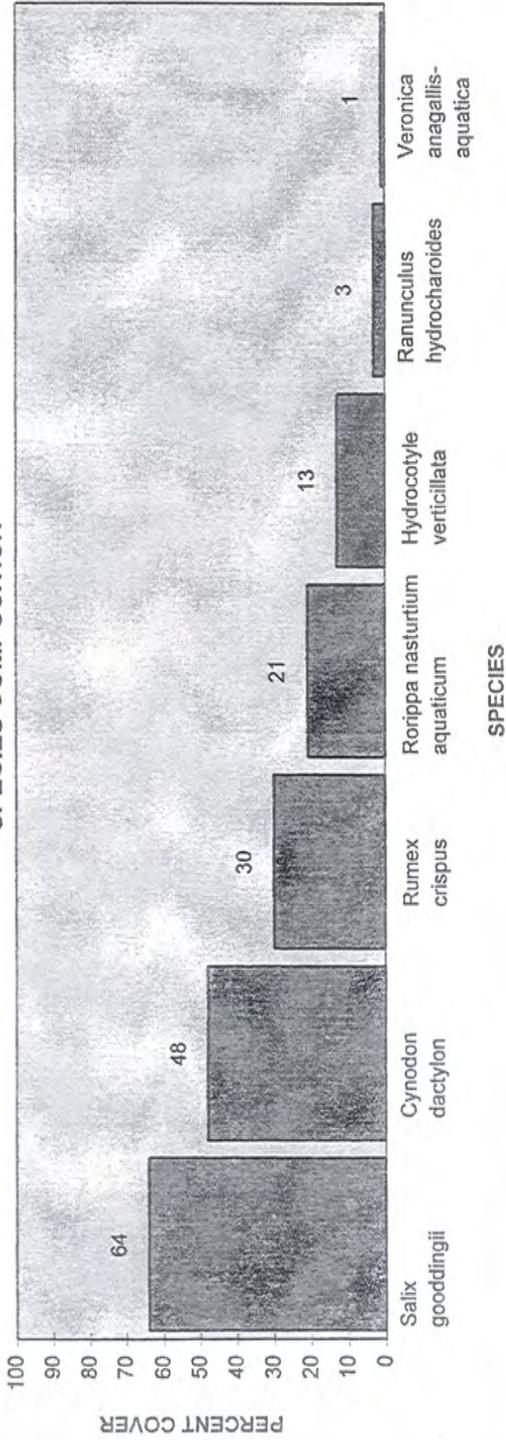
APPROXIMATE
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3. TREATMENT



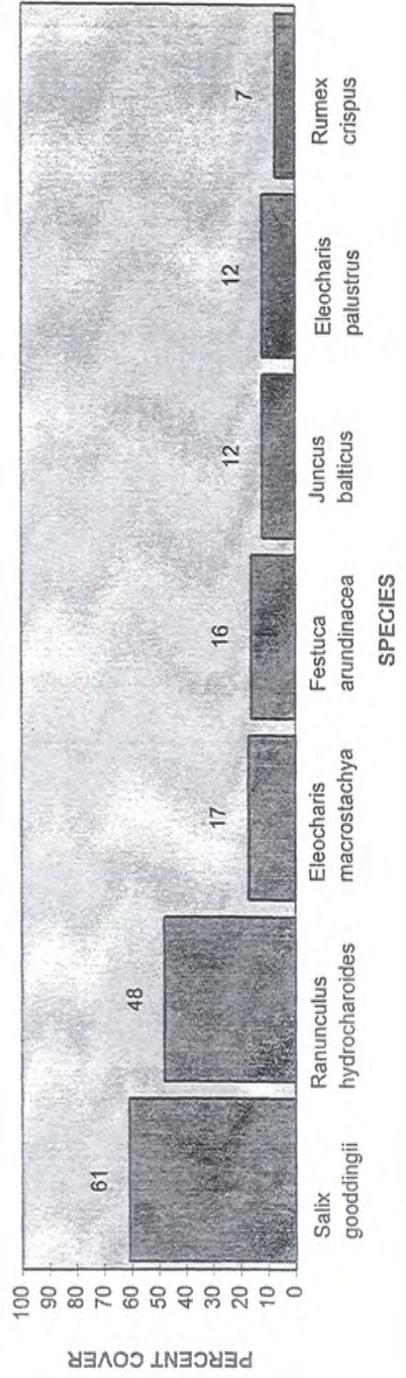
JOINT COUNTY BIRD CLUB
LOCATION
PHOTIC SAMPLING LOCATION
BIRN LANE LO
MAMMAL TR
PI OUL SITE
VEY AND SAMEN

FIGURE 1

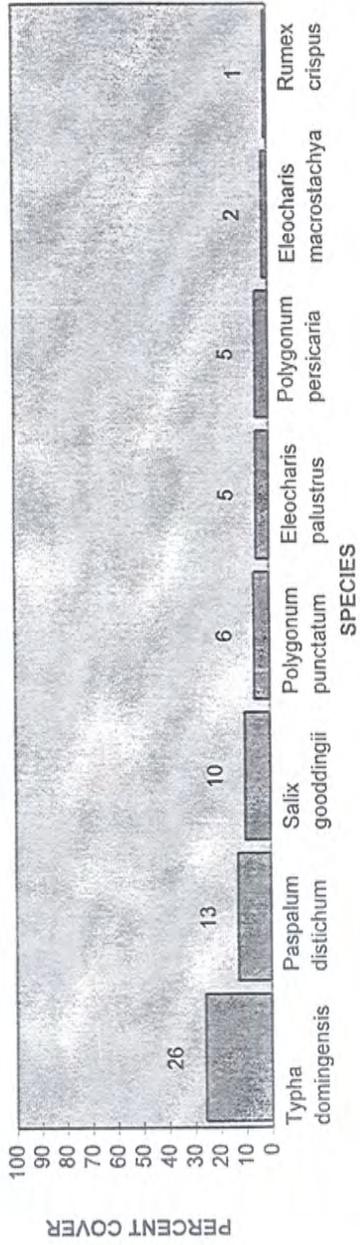
**FIGURE 5
WILLOW BOSQUE A
SPECIES COMPOSITION**



**FIGURE 6
WILLOW BOSQUE B
SPECIES COMPOSITION**



**FIGURE 7
CATTAIL/OPEN WATER MARSH
SPECIES COMPOSITION**



**FIGURE 8
BULRUSH MARSH
SPECIES COMPOSITION**

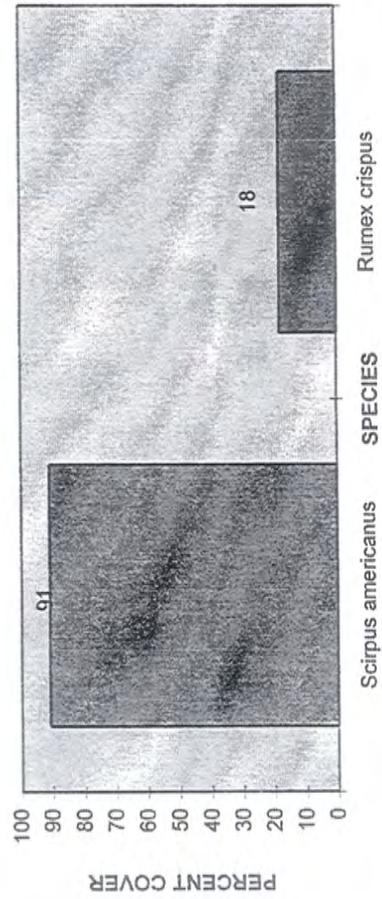
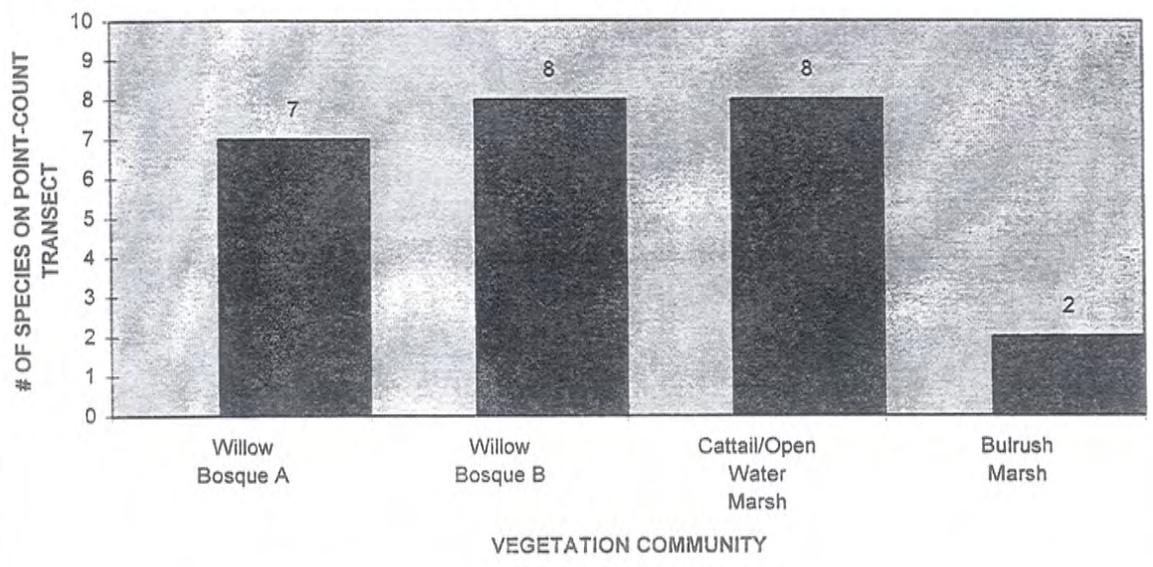


FIGURE 9
RELATIVE DIVERSITY



TABLES

TABLE 1
VASCULAR PLANT SPECIES OBSERVED WITHIN THE POTRERO CREEK WETLANDS

Species	Family	Common name	WBA	WBB	C/O	B	RD
<i>Acacia greggii</i>	(FABACEAE)	catclaw					■
<i>Amsinckia intermedia</i>	(BORAGINACEAE)	fiddleneck					■
<i>Aristida ternipes</i> (tentative ID)	(POACEAE)	spider grass			■		■
<i>Arundo donax</i>	(POACEAE)	giant reed					■
<i>Avena fatua</i>	(POACEAE)	wild oats					■
<i>Baccharis sarothroides</i>	(ASTERACEAE)	desert-broom					■
<i>Bidens leptocephala</i>	(ASTERACEAE)	few-flower beggar-ticks					■
<i>Bothriochloa laguroides</i> ssp. <i>torreyana</i>	(POACEAE)	beardgrass					■
<i>Bouteloua curtipendula</i>	(POACEAE)	sideoats grama					■
<i>Bouvardia ternifolia</i>	(RUBIACEAE)	smooth bouvardia					■
<i>Brassica tournefortii</i>	(BRASSICACEAE)	mustard					■
<i>Bromus catharticus</i>	(POACEAE)	brome grass					■
<i>Bromus hordeaceus</i>	(POACEAE)	soft-chess	■				■
<i>Bromus marginatus</i>	(POACEAE)	brome grass					■
<i>Bromus rubens</i>	(POACEAE)	red brome					■
<i>Carex praegracilis</i>	(CYPERACEAE)	clustered fieldseed			■		■
<i>Cirsium neomexicanum</i>	(ASTERACEAE)	New Mexican thistle					■
<i>Clematis drummondii</i>	(RANUNCULACEAE)	Texas virgin bower		■			■
<i>Corydalis aurea</i>	(FUMARIACEAE)	golden corydalis					■
<i>Cryptantha barbiger</i>	(BORAGINACEAE)	bearded cryptantha					■
<i>Cynodon dactylon</i>	(POACEAE)	bermuda grass	■		■		■
<i>Datura wrightii</i>	(SOLANACEAE)	Jimson-weed					■
<i>Descurainia sophia</i>	(BRASSICACEAE)	tansy-mustard					■
<i>Eleocharis palustris</i>	(CYPERACEAE)	spikerush		■	■		■
<i>Eleocharis macrostachya</i>	(CYPERACEAE)	spikerush		■	■		■
<i>Elymus elymoides</i>	(POACEAE)	squirrel-tail					■
<i>Eragrostis lehmanniana</i>	(POACEAE)	Lehmann's lovegrass					■
<i>Festuca arundinacea</i>	(POACEAE)	meadow fescue	■	■			■
<i>Heterotheca psammophila</i>	(ASTERACEAE)	camphorweed					■
<i>Hordeum pusillum</i>	(POACEAE)	little barley					■
<i>Hydrocotyle verticillata</i>	(APIACEAE)	whorled pennywort	■				■
<i>Juncus balticus</i>	(JUNCACEAE)	wire rush					■
<i>Juncus marginatus</i>	(JUNCACEAE)	wire rush					■
<i>Juncus tenuis</i>	(JUNCACEAE)	slender rush					■
<i>Juniperus coahuilensis</i>	(CUPRESSACEAE)	Coahuila juniper	■				■
<i>Lamium amplexicaule</i>	(LAMIACEAE)	henbit deadnettle	■				■
<i>Lappula occidentalis</i>	(BORAGINACEAE)	stickseed	■				■
<i>Ligustrum lucidum</i>	(OLEACEAE)	glossy privet					■

TABLE 1 (CONCLUDED)
 VASCULAR PLANT SPECIES OBSERVED WITHIN THE POTRERO CREEK WETLANDS

Species	Family	Common name	WBA	WBB	C/O	B	RD
<i>Lycium fremontii</i>	(SOLANACEAE)	Fremont thornbush					■
<i>Malva parviflora</i>	(MALVACEAE)	little mallow	■				■
<i>Marrubium vulgare</i>	(LAMIACEAE)	horehound	■				■
<i>Melilotus officinalis</i>	(FABACEAE)	yellow sweet-clover	■				■
<i>Mimulus guttatus</i>	(SCROPHULARIACEAE)	seep monkey-flower	■				■
<i>Morus microphylla</i>	(MORACEAE)	Texas mulberry	■				■
<i>Muhlenbergia arenacea</i>	(POACEAE)	ear muhly		■			
<i>Oxalis albicans</i>	(OXALIDACEAE)	canyon sorrel	■				■
<i>Passiflora caerulea</i>	(PASSIFLORACEAE)	bluecrown passionflower	■				■
<i>Paspalum distichum</i>	(POACEAE)	knotgrass		■			
<i>Phalaris caroliniana</i>	(POACEAE)	Carolina canary grass					■
<i>Plantago major</i>	(PLANTAGINACEAE)	common plantain	■				■
<i>Plantago patagonica</i>	(PLANTAGINACEAE)	silky plantain	■				■
<i>Poa annua</i>	(POACEAE)	Kentucky bluegrass					■
<i>Polygonum persicaria</i>	(POLYGONACEAE)	lady's thumb		■			
<i>Polygonum punctatum</i>	(POLYGONACEAE)	water smartweed	■		■		
<i>Populus fremontii</i>	(SALICACEAE)	fremont cottonwood	■				■
<i>Prosopis velutina</i>	(FABACEAE)	velvet mesquite					■
<i>Pyracantha koidzumii</i>	(ROSACEAE)	formosa firethorn	■				■
<i>Rafinesquia neomexicana</i>	(ASTERACEAE)	desert dandelion	■				■
<i>Ranunculus hydrocharoides</i>	(RANUNCULACEAE)	butter-cup	■				■
<i>Rorippa nasturtium-aquaticum</i>	(BRASSICACEAE)	water cress	■				■
<i>Rumex crispus</i>	(POLYGONACEAE)	curley dock	■				■
<i>Salix gooddingii</i>	(SALICACEAE)	Goodding willow	■				■
<i>Salsola kali</i>	(CHENOPODIACEAE)	Russian thistle	■				■
<i>Sambucus mexicana</i>	(CAPRIFOLIACEAE)	Mexican elderberry	■				■
<i>Scirpus americanus</i>	(CYPERACEAE)	bulrush				■	
<i>Silybum marianum</i>	(ASTERACEAE)	milk-thistle					■
<i>Sonchus oleraceus</i>	(ASTERACEAE)	sow-thistle	■				■
<i>Sorghum halepense</i>	(POACEAE)	Johnson grass					■
<i>Typha domingensis</i>	(TYPHACEAE)	southern cattail					■
<i>Uropappus lindleyi</i>	(ASTERACEAE)	silver-puffs				■	
<i>Veronica anagallis-aquatica</i>	(SCROPHULARIACEAE)	water speedwell	■				■

B = Bulrush Marsh
 RD = Roadside

WBA = Willow Bosque A
 WBB = Willow Bosque B
 C/O = Cattail/Open Water Marsh

TABLE 2
BIRD SPECIES OBSERVED

BIRD SPECIES	STATUS	SURVEY	SURVEY	CASUAL OBSERVATIONS
		1	2	
Great Blue Heron <i>Ardea herodias</i>	M	1		
Green-backed Heron <i>Butorides striatus</i>	S		1	
Cinnamon Teal <i>Anas cyanoptera</i>	M		3	
Turkey Vulture <i>Cathartes aura</i>	M			flyover
Cooper's Hawk <i>Accipiter cooperii</i>	S	1	1	
Gray Hawk <i>Buteo nitidus</i>	S			X
Red-tailed Hawk <i>Buteo jamaicensis</i>	M			X
Sora <i>Porzana carolina</i>	M			X
American Coot <i>Fulica americana</i>	M	4	2	
Common Snipe <i>Gallinago gallinago</i>	M			X
Gull sp. <i>Larus</i> sp.	M			flyover
White-winged Dove <i>Zenaida asiatica</i>	S			flyover
Mourning Dove <i>Zenaida macroura</i>	S	1	2	
Greater Roadrunner <i>Geococcyx californianus</i>	P			X
Black-chinned Hummingbird <i>Archilochus alexandri</i>	S			X
Belted Kingfisher <i>Ceryle alcyon</i>	M			X
Gila Woodpecker <i>Melanerpes uropygialis</i>	P	3	2	
Ladder-backed Woodpecker <i>Picoides scalaris</i>	P	2	1	
Hammond's/Dusky Flycatcher <i>Empidonax</i> sp.	M			X
Cordilleran Flycatcher <i>Empidonax occidentalis</i>	M			X
Black Phoebe <i>Sayornis nigricans</i>	S	2		
Vermilion Flycatcher <i>Pyrocephalus rubinus</i>	S	1		
Western Kingbird <i>Tyrannus verticalis</i>	S			X
Northern Rough-winged Swallow <i>Stelgidopteryx serripennis</i>	S	1		
Barn Swallow <i>Riparia riparia</i>	S		2	
Common Raven <i>Corvus corax</i>	P	3		
Bridled Titmouse <i>Parus wollweberi</i>	P			X
Bewick's Wren <i>Thryomanes bewickii</i>	S	10	11	
House Wren <i>Troglodytes troglodytes</i>	M	1	1	
Ruby-crowned Kinglet <i>Regulus calendula</i>	M		1	
Curve-billed Thrasher <i>Toxostoma curvirostre</i>	P			X
Phainopepla <i>Phainopepla nitens</i>	D			X
European Starling <i>Sturnus vulgaris</i>	P			X
Solitary Vireo <i>Vireo solitarius</i>	M			X
Hutton's Vireo <i>Vireo huttoni</i>	M			X
Orange-crowned Warbler <i>Vermivora celata</i>	M	5	3	
Nashville Warbler <i>Vermivora ruficapilla</i>	M			X
Virginia's Warbler <i>Vermivora virginiae</i>	M			X
Lucy's Warbler <i>Vermivora luciae</i>	S	9	11	
Yellow Warbler <i>Dendroica petechia</i>	S	8	11	
Yellow-rumped Warbler <i>Dendroica coronata</i>	M	15	14	
Common Yellowthroat <i>Geothlypis trichas</i>	S	6	9	
Wilson's Warbler <i>Wilsonia pusilla</i>	M	1		
Song Sparrow <i>Melospiza melodia</i>	P	11	11	
Lincoln's Sparrow <i>Melospiza lincolnii</i>	M		1	
Red-winged Blackbird <i>Agelaius phoeniceus</i>	S	51	49	
Great-tailed Grackle <i>Quiscalus mexicanus</i>	P			X
House Finch <i>Carpodacus mexicanus</i>	P	2		
Lesser Goldfinch <i>Carduelis psaltria</i>	S	6	7	
Pine Siskin <i>Carduelis pinus</i>	M			X

M=Migrant
S= Summer Resident
P= Permanent Resident

Survey 1 = Point count series in Willow
Bosque B
Survey 2 = Point count series in Willow
Bosque A

TABLE 3
NET RESULTS

NET LOCATION	NET HOURS	SPECIES CAUGHT	NOTES
1	3	Yellow-rumped (Myrtle) Warbler	male
		Lincoln's Sparrow	female
2	3	Song Sparrow	male
		Song Sparrow	male
3	3	Yellow-rumped (Myrtle) Warbler	female
		Black Phoebe	female; brood patch edematous
4	2.5	Song Sparrow	male
5	2	Song Sparrow	male
		Song Sparrow	male
6	3.5	Common Yellowthroat	female
		Common Yellowthroat	female
		Song Sparrow	female; brood patch bare
		Song Sparrow	male
		Song Sparrow	male
7	3.5	Black-chinned Hummingbird	male; not banded
		Nashville Warbler	male
		Song Sparrow	female; brood patch bare
8	3	nothing in net	
9	3	Yellow-rumped (Audubon's) Warbler	female
		Yellow-rumped (Audubon's) Warbler	female
10	3.5	Bewick's Wren	female; brood patch edematous; not banded
		Song Sparrow	male; not banded
		Yellow-rumped (Audubon's) Warbler	male
		Yellow-rumped (Audubon's) Warbler	female

TABLE 4
WATER TEMPERATURES

SAMPLE LOCATION	WATER TEMPERATURE (°F)	DATE/TIME
A1	66.0	4/4 - 1253
A2	70.0	4/4 - 1422
A3	55.0	4/4 - 1401
A4	60.0	4/4 - 1306
A5	58.0	4/4 - 1327

TABLE 5
AQUATIC ORGANISMS OBSERVED

SPECIES	COMMON NAME	A1	A2	A3	A4	A5
<i>Orconectes virilis</i>	crayfish		x		x	x
<i>Rana catesbiana</i>	bullfrog					x
<i>Gambusia affinis affinis</i>	mosquitofish				x	x
<i>Planorbis</i> sp.	freshwater snail		x	x	x	
<i>Corbicula</i> sp.	freshwater clam			x		

TABLE 6
SMALL MAMMAL TRAP LOCATION CONDITIONS

TRAP LOCATION	CONDITIONS
M1	marsh perimeter, saturated soils
M2	upland slope, dry soils
M3	adjacent to Potrero Creek outflow and highway bridge, upland slope
M4	marsh perimeter, roadway margin, partially saturated soils
M5	underneath I-19 highway overpass, wetland area, saturated soils
M6	southern slope of ADOT berm, dry soils adjacent to ponded water
M7	willow bosque, wetland conditions, saturated soils
M8	beginning of upland slope north of wetland area, dry soils
M9	south of Country Club Road, saturated soils
M10	gas line berm area, dry soils surrounded by wetland area

TABLE 7
SMALL MAMMAL TRAP RESULTS

LOCATION	CAPTURED APRIL 4	CAPTURED APRIL 5
M1	<i>Peromyscus leucopus</i>	<i>P. leucopus</i>
M2	<i>P. leucopus</i>	<i>P. leucopus</i>
M3	<i>P. leucopus</i>	trap destroyed
M4	<i>P. leucopus</i>	<i>P. leucopus</i>
M5	<i>P. leucopus</i>	none
M6	none	<i>P. leucopus</i>
M7	none	none
M8	none	none
M9	none	<i>P. leucopus</i>
M10	none	none

PHOTOGRAPHS



Photograph 1 Potrero Creek within Willow Bosque Community A (north of Country Club Road); April 1996.



Photograph 2 Cattail/Open Water Marsh; April 1996.



Photograph 3 Buttercup (*Ranunculus hydrocharoides*) flowering within Willow Bosque Community B; April 1996.

APPENDICES

APPENDIX 1

VEGETATION TRANSECT LOCATION DETAILS

APPENDIX 1
VEGETATION TRANSECTION LOCATION DETAILS

V1: North of Country Club road, walk along ADOT berm and continue to eastern fence line, adjacent to structure on drive-in property. Begin transect 50 yards west of fence line in an east/northeasterly direction.

V2: North of Country Club Road, from the willow tree at the western end of the ADOT berm, begin transect 45 feet perpendicular from the berm walking in a southwesterly direction (parallel to the berm).

V3: North of Country Club Road, at the fence entrance to the ADOT berm just east of the I-19 underpass, walk 10 North for 45 feet. Begin transect in an easterly direction.

V4: At the parking area along the south side of Country Club Road, walk west along the gas line berm to the large willow tree blocking the berm path. Begin transect 45 feet 60 degrees East of North, in a westerly direction.

V5: Walk west of V3 reference point to the next mature willow tree on the gas line berm. Begin transect 15 feet 45 degrees North (west) walking towards Country Club Road (north).

V6: South of Country Club Road, at the corner of the dirt road and the fence at the end of the gas line berm, begin transect 60 feet out 70 degrees of North. Conduct transect facing Country Club Road at 60 degrees of North.

V7: At the large dead willow adjacent to I-19 and County Club Road, head East 45 feet and begin transect in an southerly direction.

V8: On the northeastern side of Country Club Road, begin at the right-of-way marker at the fence. Head 45 feet at 20 degrees off North and conduct transect heading in an easterly direction (300 degrees off North).

V9: At the northeast side of the open water marsh, walk west to the first mature willow tree along the fence. Head 15 feet perpendicular to the fence (south) and begin transect walking west.

V10: On the north side of Country Club Road at the willow tree across from the parking area, walk 25 feet north. Conduct transect in a northwesterly direction (320 degrees off North).

APPENDIX 2
MONITORING RESULTS

SUMMER 1996 MONITORING

Summer biological monitoring of the project site was conducted on July 31, 1996. Conditions were sunny and clear, although it had rained the night before. Evidence of the recent storm event was observed along Potrero Creek channel, including recently crushed vegetation, debris, and flattened grasses from recent flows. Cut channel edges and sand deposits were evident. Ponded water was present under and immediately east of the Interstate 19 overpass.

Vegetation. Visual observations within Willow Bosque Community A (north of Country Club Drive) revealed that vegetation species density and diversity remained relatively unchanged. Willow (*Salix gooddingii*), curley dock (*Rumex crispus*), and bermuda grass (*Cynodon dactylon*) were the most prominent species within the community. Soils in or adjacent to the creek were slightly saturated with ponded water in the creek near the Interstate 19 overpass. Soils within Willow Bosque Community B were slightly saturated with no standing water. Willow, curley dock, and meadow fescue (*Festuca arundinacea*) were abundant in this community. Spikerush (*Eleocharis macrostachya*) was in bloom and common, while other species observed include another spikerush species (*Eleocharis palustris*), wire rush (*Juncus balticus* and *J. tenuis*) and whorled pennywort (*Hydrocotyle verticillata*).

A live stand of bulrush (*Scirpus americanus*) was observed in the bulrush marsh during monitoring as compared to the dead vegetation earlier in the spring (see attached photographs). The majority of the open water within the cattail/open water marsh had evaporated. Nearly 100 percent of the previously observed open water area was covered with knotgrass (*Paspalum distichum*).

Birds. A bird survey was conducted along the transects established for the spring survey from 5:37 A.M. to 6:31 A.M. A total of 24 species were observed during the survey and 6 observed at the project site not during the survey (see Table 1 attached). These bird species are summer resident or permanent residents of the wetland area, with the exception of the yellow-rumped warbler, a migrant species. Most birds observed during the summer monitoring period are suspected of nesting within or near the project site,

with a possible exception of the two fulvous whistling ducks (*Dendrocygna bicolor*) which were observed flying over the area twice.

The most abundant species observed during the summer monitoring surveys include the red-winged blackbird (*Agelaius phoeniceus*), the northern rough-winged swallow (*Stelgidopteryx serripennis*), the lesser goldfinch (*Carduelis psaltria*), and the common yellowthroat (*Geothlypis trichas*). Two adult and two immature gray hawks (*Buteo nitidus*) were also observed. The gray hawk nest was identified in a willow tree within the Willow Bosque Community B (south of Country Club Road).

Obligate riparian/wetland nesting birds observed include the summer tanager (*Piranga rubra*), common yellowthroat, yellow-breasted chat (*Icteria virens*), lesser goldfinch, and the red-winged blackbird.

Reptiles, Amphibians, and Small Mammals. Reptile species observed included numerous juvenile bullfrogs (*Rana catesbeiana*) along Potrero Creek and in open water areas. A female collared lizard (*Crotaphytus* sp.) was observed on a willow tree limb within the eastern portion of Willow Bosque Community A. Whiptails (*Cnemidophorus* sp.) were observed along the roadsides and along the berm within Willow Bosque Community A. No small mammal species were observed.

TABLE 1
SUMMER 1996 MONITORING
BIRD SURVEY RESULTS

BIRD SPECIES	STATUS	NUMBER OBSERVED	SPECIES OBSERVED, NOT DURING SURVEY
Green-backed Heron <i>Butorides striatus</i>	S		X
Fulvous Whistling Duck <i>Dendrocygna bicolor</i>	M		X
Gray Hawk <i>Buteo nitidus</i>	S	2 ad; 2 imm.	
White-winged Dove <i>Zenaida asiatica</i>	S		X
Mourning Dove <i>Zenaida macroura</i>	S	6	
Black-chinned Hummingbird <i>Archilochus alexandri</i>	S	1 female	
Gila Woodpecker <i>Melanerpes uropygialis</i>	P	1 pair	
Gilded Flicker <i>Colaptes chrysoides</i>	P	1	
Vermilion Flycatcher <i>Pyrocephalus rubinus</i>	S	1	
Brown-crested Flycatcher <i>Myiarchus tyrannulus</i>	S	1 pair	
Cassin's Kingbird <i>Tyrannus vociferans</i>	S	1 pair	
Northern Rough-winged Swallow <i>Stelgidopteryx serripennis</i>	S	16	
Cliff Swallow <i>Hirundo pyrrhonota</i>	S	3	
Bridled Titmouse <i>Parus wollweberi</i>	P	1	
Verdin <i>Auriparus flaviceps</i>	P		X
Bewick's Wren <i>Thryomanes bewickii</i>	S	8	
Curve-billed Thrasher <i>Toxostoma curvirostre</i>	P	1	
European Starling <i>Sturnus vulgaris</i>	P	1	
Lucy's Warbler <i>Vermivora luciae</i>	S		X
Yellow Warbler <i>Dendroica petechia</i>	S	2	
Yellow-rumped Warbler <i>Dendroica coronata</i>	M	2	
Common Yellowthroat <i>Geothlypis trichas</i>	S	7	
Yellow-breasted Chat <i>Icteria virens</i>	S	2	
Summer Tanager <i>Piranga rubra</i>	S	2 pair	
Blue Grosbeak <i>Guiraca caerulea</i>	S	1 male	
Song Sparrow <i>Melospiza melodia</i>	P	6	
Red-winged Blackbird <i>Agelaius phoeniceus</i>	S	93	
Brown-headed Cowbird <i>Molothrus ater</i>	S	2	
House Finch <i>Carpodacus mexicanus</i>	P		X
Lesser Goldfinch <i>Carduelis psaltria</i>	S	9	

M = Migrant

S = Summer Resident

P = Permanent Resident

BIOLOGICAL MONITORING
JULY 31, 1996
PHOTOGRAPHS



Recent creek deposits within Willow Bosque Community A



Remaining open water area



Previous open water area now covered with knotgrass (*Paspalum distichum*)



Live bulrush (*Scirpus americanus*)
stand south of Country Club Road

FALL 1996 MONITORING

Fall biological monitoring of the project site was conducted on October 31, 1996. Weather conditions were partly cloudy.

Vegetation. Visual observations within Willow Bosque Community A (north of Country Club Drive) revealed that vegetation species density and diversity remained relatively unchanged. However, signs of new growth were observed. Willow (*Salix gooddingii*), curley dock (*Rumex crispus*), and bermuda grass (*Cynodon ^{da c74104}dactylon*) were the most predominant species within the community. Groundcover within the eastern area of the community was predominately curley dock (see photographs) while groundcover to the northwest of the community was largely bermuda grass. Whorled pennywort (*Hydrocotyle verticillata*), buttercup (*Ranunculus hydrocharoides*), and watercress (*Rorippa nasturtium-aquaticum*) were observed in damp areas along the creek itself. Rushes were not observed. Open water was not observed in the creek within Willow Bosque Community A, with the exception of one small area under the Interstate 19 overpass which had ponded water. Soils within the community were dry to slightly saturated.

Tamarisk (*Tamarix* sp.) was observed on the berm within Willow Bosque Community B. Groundcover on the eastern side of the community was meadow fescue (*Festuca arundinacea*), and seep-willow (*Baccharis salicifolia*) in the western portion of the community (see photographs). Some live rushes and sedges were observed (though rarely), including spikerush (*Eleocharis palustris*) and clustered fieldsedge (*Carex praegracilis*). Buttercup (*Ranunculus hydrocharoides*) and curley dock (*Rumex crispus*) were also observed within Willow Bosque Community B. Soils were dry to slightly saturated with no standing water.

The majority of the bulrush (*Scirpus americanus*) stand within the bulrush marsh adjacent to Willow Bosque Community B was dead. However, some plants were live, and live plants were evident underneath the biomass as well (see photograph). Wire rush (*Juncus balticus*), spikerush (*Eleocharis macrostachya*), and curley dock were interspersed with the bulrush at the fringes of the marsh.

All of the open water within the cattail/open water marsh present during the spring (March/April) surveys had evaporated or recharged into the perched aquifer. Vegetation in the area of the cattail/open water marsh, predominantly cattail (*Typha domingensis*) and knotgrass (*Paspalum distichum*), was largely dead (see photograph). Some live cattail roots were observed growing between the cracks of the dry soil, apparently able to reach the water table. Spikerush (*Eleocharis palustris* and *E. macrostachya*) and wire rush (*Juncus balticus*) were observed along the eastern fringes of the marsh. Giant reed (*Arundo donax*) was observed on the northern fringe of the marsh (visible in background of photograph of cattail/open water marsh community). Soils within this community were dry to slightly saturated at the fringes of the community.

Birds. A bird survey was conducted along the transects established for the spring survey from approximately 5:30 A.M. to 6:30 A.M. A total of 25 species were observed during the survey (Table 1). These bird species consist of both fall migrants and permanent residents of the wetland area.

The most abundant species observed during the fall monitoring surveys include the raven (*Corvus* sp.), the red-winged blackbird (*Agelaius phoeniceus*), the yellow-rumped warbler (*Dendroica coronata*), and the song sparrow (*Melospiza melodia*). Six bird species which were observed during the fall monitoring and not observed during any other monitoring period consist of the great egret (*Casmerodius albus*), cattle egret (*Bubulcus ibis*), black vulture (*Coragyps atratus*), Anna's hummingbird (*Archilochus alexandri*), marsh wren (*Cistothorus palustris*), and white-crowned sparrow (*Zonotrichia leucophrys*).

Casual Observations. Whiptails (*Cnemidophorus* sp.) were observed along the roadsides. No small mammal or amphibian species were observed. Numerous grasshoppers and crickets occurred within Willow Bosque A and B and along the roadsides.

TABLE 1
FALL 1996 MONITORING
BIRD SURVEY RESULTS

BIRD SPECIES	STATUS	NUMBER OBSERVED
Great Egret <i>Casmerodius albus</i>	M	1
Cattle Egret <i>Bubulcus ibis</i>	M	1 flyover
Black Vulture <i>Coragyps atratus</i>	R	8 flyover
Red-tailed Hawk <i>Buteo jamaicensis</i>	R	1
Anna's Hummingbird <i>Archilochus alexandri</i>	R	1 male
Gila Woodpecker <i>Melanerpes uropygialis</i>	R	1 pair
Ladder-backed Woodpecker <i>Picoides scalaris</i>	R	1
Gilded Flicker <i>Colaptes chrysoides</i>	R	1
Black Phoebe <i>Sayornis nigricans</i>	R	2
Raven sp. <i>Corvus sp.</i>	R	27 flyover
Bridled Titmouse <i>Parus wollweberi</i>	R	3
Verdin <i>Auriparus flaviceps</i>	R	1
Bewick's Wren <i>Thryomanes bewickii</i>	R	9
House Wren <i>Troglodytes aedon</i>	M	1
Marsh Wren <i>Cistothorus palustris</i>	M	1
Ruby-crowned Kinglet <i>Regulus calendula</i>	M	7
European Starling <i>Sturnus vulgaris</i>	R	1
Orange-crowned Warbler <i>Vermivora celata</i>	M	1
Yellow-rumped Warbler <i>Dendroica coronata</i>	M	10
Common Yellowthroat <i>Geothlypis trichas</i>	R	1
Song Sparrow <i>Melospiza melodia</i>	R	10
White-crowned Sparrow <i>Zonotrichia leucophrys</i>	M	5
Red-winged Blackbird <i>Agelaius phoeniceus</i>	R	11
House Finch <i>Carpodacus mexicanus</i>	R	7
Lesser Goldfinch <i>Carduelis psaltria</i>	R	7

M = Migrant

R = Resident

BIOLOGICAL MONITORING
OCTOBER 31, 1996
PHOTOGRAPHS



East side of Willow Bosque Community A showing 75 to 90 percent curley dock (*Rumex crispus*) groundcover.



Remaining open water area north of Country Club Road.



Previous open water/cattail area, now covered with dead vegetation, cattail (*Typha domingensis*) and knotgrass (*Paspalum distichum*). Note giant reed (*Arundo donax*) in background.



Bulrush (*Scirpus americanus*) marsh, looking towards Country Club Road.



Meadow fescue (*Festuca arundinacea*) groundcover in Willow Bosque Community B.

WINTER 1997 MONITORING

Winter biological monitoring of the project site was conducted on January 14, 1997. Conditions were cloudy, with steady rain the previous night and light showers late morning, immediately following monitoring activities.

Vegetation. Standing water was present in Potrero Creek throughout Willow Bosque Community A. Visual observations revealed that species density and diversity was relatively unchanged. However, signs of senescence and new growth were visible within the community. Deciduous willows (*Salix gooddingii*) provided a blanket of leaves over the ground surface. Bermuda grass (*Cynodon dactylon*) and curley dock (*Rumex crispus*) remain the dominant understory species, although curley dock showed visible signs of senescence. Potrero Creek, dividing into two smaller branches to the north and south of willow bosque and converging at the eastern end of Willow Bosque Community A, provided standing water for aquatic vegetation growth, including buttercup (*Ranunculus hydrocharoides*), whorled pennywort (*Hydrocotyle verticillata*), and watercress (*Rorippa nasturtium-aquaticum*) (see photographs). Rushes were not observed. Tamarisk (*Tamarix* sp.) was observed on the drainage control berm which forms the southern border of the community.

Meadow fescue (*Festuca arundinacea*) remained the dominant understory species in the eastern half of Willow Bosque Community B. Standing water up to two feet and saturated soils were observed in some areas within the community. Evidence of new aquatic vegetative growth was common in these wet areas, including two spikerush species (*Eleocharis macrostachya* and *E. palustris*) and buttercup (see photographs). Curley dock showed visible signs of senescence, having turned a reddish-brown color.

The majority of the vegetation within the bulrush (*Scirpus americanus*) marsh was dead (see photographs), although live wire rush (*Juncus balticus*) and/or spikerush was observed along the fringes of the marsh. Few live bulrush species were detected underneath the biomass of dead vegetation. No standing water was detected within the marsh, although soils were saturated underneath the biomass.

Vegetation within the cattail/open water marsh also showed signs of senescence and new growth. Standing water was present within the cattail/open water marsh. Vegetation in the area of the cattail/open water marsh, predominantly cattail (*Typha domingensis*) and knotgrass (*Paspalum distichum*) was largely dead (see photographs). Curley dock showed signs of senescence, as well as the knotgrass (*Paspalum distichum*) covering the ground surface in areas of open water and at the water's edge. Live rushes were observed from the water's edge to 20 to 30 feet upland, including spikerush, and possibly clustered fieldsedge (*Carex praegracilis*). Giant reed (*Arundo donax*) was observed on the northern fringe of the marsh.

Birds. A bird survey was conducted along the transects established for the spring (1996) survey from approximately 7:22 A.M. to 8:30 A.M. on January 24, 1997. Conditions were cold, clear skies, and no wind. Sunrise was at 7:40 A.M. A total of 26 species were observed during the survey (Table 1). Bird species observed consisted of wintering birds and permanent residents of the wetland area.

The most abundant species observed during the winter monitoring surveys include the red-winged blackbird (*Agelaius phoeniceus*) and Bewick's wren (*Thryomanes bewickii*). Four bird species observed during the winter monitoring which were not observed during previous surveys at the wetlands consist of the northern shoveler (*Anas clypeata*), ash-throated flycatcher (*Myiarchus cinerascens*), the American robin (*Turdus migratorius*), and the chipping sparrow (*Spizella passerina*).

Casual Observations. Reptiles, amphibians, and aquatic organisms were not observed within the project site, likely due to the low temperatures and rain showers. One small mammal species, possibly the white-footed mouse (*Peromyscus leucopus*), was observed being captured as prey by an immature red-tailed hawk during the bird survey.

TABLE 1
WINTER 1996 MONITORING
BIRD SURVEY RESULTS

BIRD SPECIES	STATUS	NUMBER OBSERVED
Great Blue Heron <i>Ardea herodias</i>	W	1
Northern Shoveler <i>Anas clypeata</i>	W	1 pair
Red-tailed Hawk <i>Buteo jamaicensis</i>	W	1
American Coot <i>Fulica americana</i>	R	2
Mourning Dove <i>Zenaida macroura</i>	R	4
Gila Woodpecker <i>Melanerpes uropygialis</i>	R	1 pair
Ladder-backed Woodpecker <i>Picoides scalaris</i>	R	1 pair
Gilded Flicker <i>Colaptes chrysoides</i>	R	1 pair
Black Phoebe <i>Sayornis nigricans</i>	R	2
Ash-throated Flycatcher <i>Myiarchus cinerascens</i>	W	1
Raven sp. <i>Corvus sp.</i>	R	2
Bridled Titmouse <i>Parus wollweberi</i>	R	3
Verdin <i>Auriparus flaviceps</i>	R	1
Bewick's Wren <i>Thryomanes bewickii</i>	R	10
Ruby-crowned Kinglet <i>Regulus calendula</i>	W	6
American Robin <i>Turdus migratorius</i>	W	1 flyover
Orange-crowned Warbler <i>Vermivora celata</i>	W	1
Yellow-rumped Warbler <i>Dendroica coronata</i>	W	3
Common Yellowthroat <i>Geothlypis trichas</i>	R	5
Chipping Sparrow <i>Spizella passerina</i>	W	2
Song Sparrow <i>Melospiza melodia</i>	R	6
White-crowned Sparrow <i>Zonotrichia leucophrys</i>	W	6
Red-winged Blackbird <i>Agelaius phoeniceus</i>	R	85
Great-tailed Grackle <i>Quiscalus mexicanus</i>	R	1
House Finch <i>Carpodacus mexicanus</i>	R	1
Lesser Goldfinch <i>Carduelis psaltria</i>	R	3

W= Winter resident/transient

R = Permanent resident

BIOLOGICAL MONITORING
JANUARY 14, 1997
PHOTOGRAPHS



Potrero Creek at the west end of Willow Bosque Community A. Note aquatic vegetation, including whorled pennywort (*Hydrocotyle verticillata*), watercress (*Rorippa nasturtium-aquaticum*) and buttercup (*Ranunculus hydrocharoides*) on the surface of the water.



Potrero Creek on the northeast side of Willow Bosque Community A.



Spikerush (*Eleocharis macrostachya* and *E. palustris*) in areas of standing water within Willow Bosque Community B.



Bulrush (*Scirpus americanus*) marsh, looking towards Country Club Road.



One of the few areas with open water throughout 1996, north of Country Club and south of Willow Bosque Community A.



Open water/cattail marsh with standing water. Curley dock (*Rumex crispus*) fringes the marsh (note the reddish-brown color vegetation).