

FEASIBILITY REPORT
FOR
PASEO DE LAS IGLESIAS
TUCSON, ARIZONA

ECONOMIC APPENDIX

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INTRODUCTION

Objective

The following presents an economic evaluation of the benefits and costs associated with flood control, habitat restoration, and recreation opportunities along the Paseo de las Iglesias segment of the Santa Cruz (Los Reales Road to Congress Street) and the New and Old West Branch segments of the Santa Cruz River (Valencia Road to Irvington Road and Irvington Road to 22nd Street) located in eastern Pima County, Arizona.

Methodology

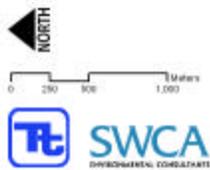
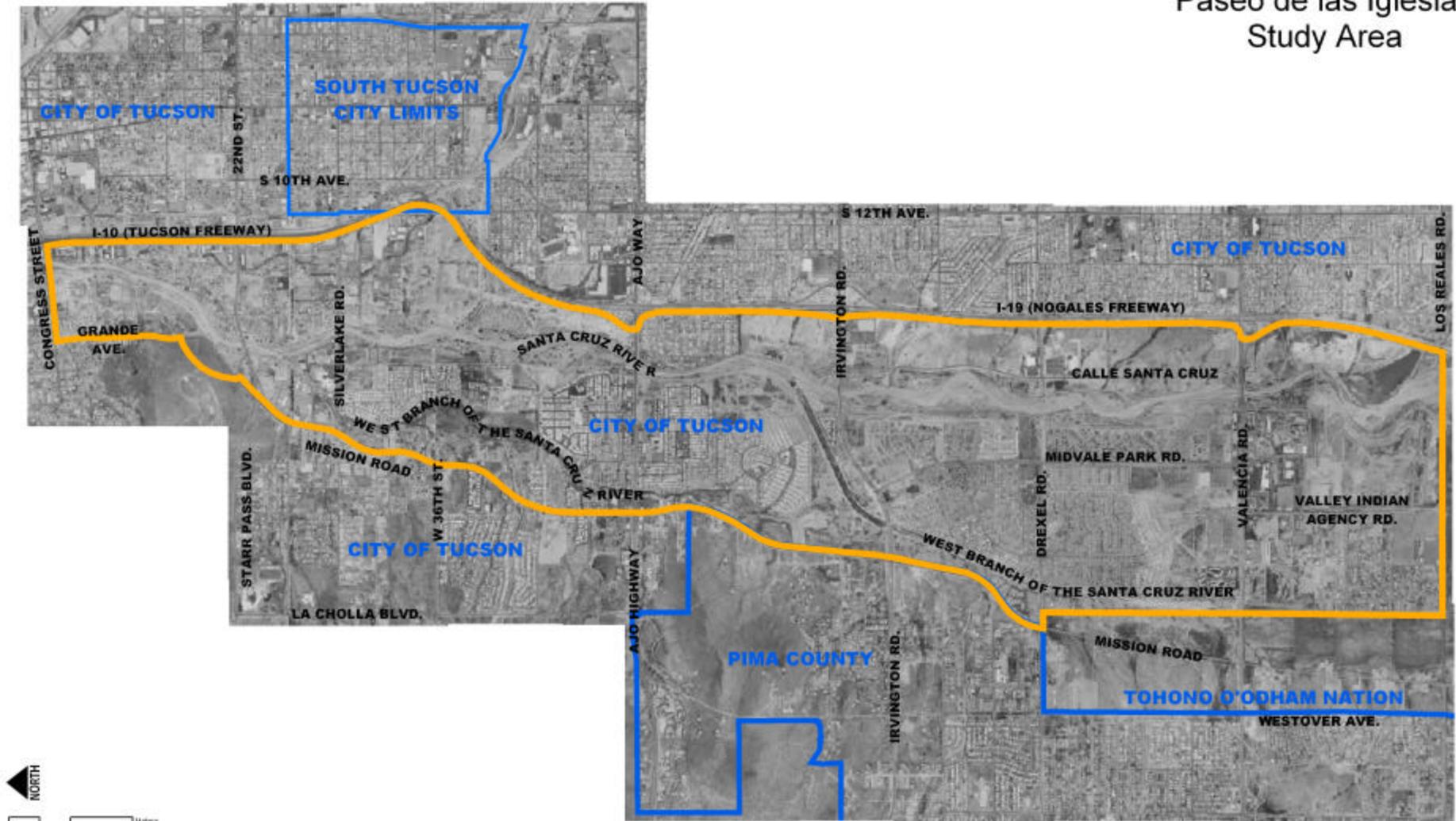
The methodology employed for this economic analysis is in accordance with current Principles and Guidelines and standard economic practices. In agreement with these standards, benefits and costs will be computed at the current 6.125 % interest rate, October 2001 price levels, a base year of 2008, and a 50-year period of analysis. In addition, the environmental restoration analysis will be completed in conformance with IWR Report #95-R-1—Evaluation of Environmental Investments Procedures Manual (May 1995).

Study Area

The Santa Cruz River has its headwaters in the San Rafael Valley in southeastern Arizona. From there, the river flows south into Mexico. After a 35-mile loop through Mexico, it reenters Arizona about six miles east of Nogales. The river continues northward to Tucson then northwest to its confluence with the Gila River 12 miles southwest of Phoenix. The river runs approximately 43 miles north of the US-Mexico border before entering the study area. The Paseo de las Iglesias segment that lies within the study area extends 7 miles along the Santa Cruz River through the urbanized area of metropolitan Tucson. The boundaries are located between Los Reales Road and Congress Street and are considered to be the most suitable for flood control, an environmental restoration project, and possible recreation opportunities. Another suitable area for possible flood control, environmental restoration, and recreation is the New West Branch of the Santa Cruz River that originates at Valencia Road and flows north to the confluence of the Santa Cruz at Irvington Road. Restoration and recreation opportunities will be looked at for the Old West Branch of the Santa Cruz River (Irvington Road to 22nd Street).

Figure 1: The Paseo de las Iglesias and West Branch Study Areas

FIGURE 1:
Paseo de las Iglesias
Study Area



History

The Paseo de las Iglesias and the West Branch portions of the Santa Cruz Rivers were a couple of perennially watered riparian areas of Arizona, with highly productive cottonwoods, willows, and mesquite habitats. These areas were rich in habitat diversity, supporting a wide variety of wildlife species. As the watershed became developed with new homes, industry, and highways (Interstate 19 and Interstate10), riparian and upland habitat degraded significantly displacing the last remnants of riparian and upland vegetation once occupying the region.

Population

The study area is included in the Tucson-Pima County Metropolitan Statistical Area (MSA). According to the 2000 Census, the Tucson-Pima County MSA population was 843,746 (16.81% of Arizona population). This population figure for 2000 was 26.5 percent larger than the 666,880 residents in 1990 (18.9% of Arizona Population). During the previous decade, the county and MSA increased by 25.5 percent from 531,443 in 1980. In fact, Tucson-Pima County MSA has been growing at an average annual compound rate of about 2.60 compared to the national average of 1.1 percent. A summary of County and Metro Area Data is shown in Table 1 below.

Table 1: Population for Tucson-Pima County MSA

Year	Population
1980	531,443
1990	666,880
2000	843,746

The Pima County population growth illustrated above has been due primarily to net migration into the area. Two main factors contributing to the migration are employment opportunities and the low cost of housing. Because Pima County offers high skilled technical and professional jobs and a diversified occupational base, some people may find the area appealing. Residents also can purchase low cost housing, another lure, that may enhance their quality of living.

Employment

Three primary areas of employment in Pima County are in education, government, and military. First, sources of employment in the educational sector include the University of Arizona, Pima County Community College, and the Tucson Unified School District. Second, government offices offer employment on the state, county, and city level. Third, two military establishments provide further employment opportunities. They are Davis-Monthan Air Force Base and Raytheon Missile Systems Company. All three areas of employment require a higher likelihood of professional and technical skill as well as some collage education that account for some of the 24.70% of professional and technical occupations within Pima County.

This demand for higher paying jobs may account for the reason why Pima County has enjoyed a low employment rate as much as 1.4 and 1.8 percentage point behind the Arizona and the United States. In 1998, unemployment was 2.7 compared with Arizona at 4.1 and the United States at 4.5. Table 2 shows major employers, employment type, and number of employees within Pima County. Table 3 lists the occupation type and the percentage of employees per occupation type.

Table 2: Employers, Employment Type, and Number of Employees

Employer	Employment Type	Number of Employees
University of Arizona	University of Colleges	10,520
State of Arizona	Government	9,694
Davis-Monthan Air Force Base	Military	8,352
Tucson Unified School District	Education	8,187
Raytheon Missiles Systems Co.	Military Manufacturing	7,700
Pima County	Government	7,028
City of Tucson	Government	5,497

Table 3: Percentage of Employees Divided by Occupation Type

Occupation Type	Percentage of Total
Managers and Administrative	6.13
Professional and Technical	24.70
Sales and Related Occupations	11.54
Clerical and Administrative Support	16.75
Service Occupations	20.09
Agriculture, Forestry and Fishing	.55
Production, Maintenance and Material	20.23
Total	100.00

Housing Units and Low Cost Housing

To accommodate the population expansion in the area, about 348,508 housing units were constructed in Pima County in 1999. This figure is up from 298,207 in 1990. According to the 1999 American Community Survey Profile for Pima County, Arizona, about 21 percent of the housing stock has been constructed in the past ten years. Most of the newer homes, in master planned communities, are reasonably priced compared to other metropolitan areas. The average cost of a new single family home is about \$109,102, and this is a primary factor making the overall cost of living in Pima County among the lowest of major US metropolitan areas.

EXISTING CONDITIONS

Flood Control Analysis

Floodplain Description

Four areas for analysis are described in detail as follows:

1. *The Paseo de las Iglesias Segment of the Santa Cruz River*-- Certain areas of Paseo de las Iglesias have been channeled and embanked to combat the destruction resulting from flooding. A soil cement channel has been constructed up and downstream of the Valencia Road Bridge, from Irvington Road to Ajo Way and Silverlake Road up to Grant Road. The stretches of the Paseo de las Iglesia that lack channel stabilization are located from Los Reales Road to Irvington Road and Ajo Way to Silverlake Road.

Currently, the Santa Cruz channel contains the 100-year flood throughout most of the study area. However, some localized areas are still susceptible to the 500-year flood. One area is located on the east bank from Congress to San Juan Road. A second area is located on the west bank of the river near the Old West Branch of the Santa Cruz River and the Paseo de las Iglesias confluence. A third area is located on both banks of the river just south of Ajo Way. A fourth area susceptible to 500-year flooding is located South of Drexel Road.

2. *The New West Branch of the Santa Cruz River*--The New West Branch located to the west of the Santa Cruz from Valencia Road to Irvington Road has been channeled and embanked combating the destruction from flooding. At Irvington Road, the New West Branch channel merges with the Santa Cruz River. The entire stretch contains the 100-year flood except for some small areas. These small areas are a result of other tributaries flowing into the New West Branch.
3. *The Los Reales Area of the New West Branch of the Santa Cruz River*--A small area just south of the New West Branch between Valencia Road to the north and Los Reales Road to the south floods.
4. *The Old West Branch of the Santa Cruz River*--The Old West Branch, also located to the west of the Santa Cruz, is located from Irvington Road to 22nd Street. This river does not have any channel embankment, but 100-year flood flows for the most part stay within the channel and produce an insignificant amount of damages to warrant further analysis. Since discharge frequency values other than the 100-year were unobtainable, the US Army Corps of Engineers and the local sponsor have agreed to limit the analysis to 100-year flow data. Analysis up to the 500-year will not be performed for the Old West Branch.

Reach Delineations

Economics, Hydrology, and Hydraulics study team members participated in the segmenting of the Santa Cruz and West Branch floodplain into distinct reaches of homogeneous characteristics. Critical factors for differentiation included: the discharge-frequency characteristic, the overflow spatial characteristic, and economic activity. Table 4 and 5 provides a summary of reach delineations (each starts at the downstream end of each stream and moves upstream), including stream name, and beginning and ending cross-sections for each reach.

Table 4: Reach Delineation Breakdown for the Santa Cruz River

Reach Name	Cross Streets	Stream	Beginning Cross-Section	Ending Cross-Section
1 SC	Congress St.	Santa Cruz River	32.61	33.38
2 SC	Starpass Blvd. Starpass Blvd. Ajo Way	Santa Cruz River	33.38	35.77
5 SC	Drexel Rd. Valencia Rd.	Santa Cruz River	37.87	38.96

Table 5: Reach Delineation Breakdown for the New West Branch and Los Reales Areas

Reach Name	Cross Streets	Stream	Beginning Cross-Section	Ending Cross-Section
4 NWB	Irvington Rd. Drexel Rd	New West Branch		
5 NWB	Drexel Rd Valencia Rd	New West Branch		
6 LR	Valencia Rd. Los Reales Rd.	Los Reales		

Number of Structures

Because property delineations in the tax assessor's data are by parcel and not by the number of structures, the individual parcel for residential and non-residential categories may include more than one structure. For example, a residential parcel may include more than one apartment building. Likewise, a non-residential parcel may include more than one office building. In these cases, aerial maps and information gathered during the visit to the study area were relied upon to obtain the number of structures by reach and structure type shown in Table 6 and 7.

**Table 6: Number of Structures by Reach and Structure Type:
The Santa Cruz River**

Reach	Residential			Nonresidential		Total
	SFR	MFR	MH	Commercial	Public	
1 SC	56	13	5	2	0	76
2 SC	103	18	332	15	5	473
3 SC	129	26	594	5	1	755
5 SC	175	1	0	0	0	176
Total	463	58	931	22	6	1,480

**Table 7: Number of Structures by Reach and Structure Type:
The New West Branch River and Los Reales Area**

Reach	Residential			Nonresidential		Total
	SFR	MFR	MH	Commercial	Public	
4 NWB						
5 NWB						
6 LR	44	1	66	6	2	119
Total						

Value of Structures

The total values of structures in the floodplain were estimated using the following methodology.

1. Data from the field survey was imputed into the spreadsheet.
2. Square footage estimates were made based upon TRW Redi Real Estate Data Base.
3. Structure replacement value multipliers were obtained from Marshall & Swift Valuation Service. The multipliers reflected structure type, construction type, and construction quality.
4. Adjustments were made to the multipliers to reflect local and current cost levels for the area.
5. Adjusted square footage multipliers were applied to square footage estimates for each structure.

Value of Contents

Content values were calculated using the Commercial Content Inventory (CCI) Program developed by Marshall & Swift. To use the program as few as three variables for each business can be input to determine comprehensive equipment and inventory cost estimates. Key inputs include: zip code, square footage, type of establishment, estimated revenue, and the number of employees. Once entered, the program uses an algorithm based on a variety of government, commercial, and proprietary databases.

1. Oxford Information Technology Ltd.'s databases include:
 - a. Financial statements and balance sheets from over 12 million companies
 - a. Services and equipment purchases tracked in over 1,100 industries
 - b. Square footage, number of employees, and sales per square foot in six million companies

2. Marshall & Swift / Boeckh's databases include:
 - a. Current building cost information for over 150 types of buildings, localized by zip code
 - b. Over 32,000 construction component costs and labor rates, localized by zip code.

Content ratios were then derived as a percentage of corresponding replacement values of structures. The following ratios were applied in Table 8.

Table 8: Content Ratios

Category	Structure Type	Ratio
SFR	SFR	0.50
MFR	Duplex	0.50
	Apartment	0.50
	Motel	0.50
	Triplex	0.50
	MH	0.50
Commercial	Retail	0.94
	Service Station	1.07
	Office	0.41
	Industry	1.07
	Warehouse	1.72
	Restaurant	0.30
	Dental Office	0.32
	Public	0.24
	Church	0.24

Table 9 and 10 provides a detail of the total structure value and content value by category for each reach.

**Table 9: Structure and Content Values for the Santa Cruz River
(October 2001 Price Levels)**

Reach	Residential			Nonresidential		Total
	SFR	MFR	MH	Commercial	Public	
1 SC Structure	\$3,109,312	\$9,167,975	\$160,906	\$324,718	\$0	\$12,762,912
1 SC Content	\$1,554,656	\$4,583,988	\$80,453	\$119,336	\$0	\$6,338,433
2 SC Structure	\$6,293,536	\$10,676,129	\$12,389,576	\$3,087,051	\$630,018	\$33,076,310
2 SC Content	\$3,146,768	\$5,338,065	\$6,194,788	\$3,364,992	\$151,204	\$18,195,817
3 SC Structure	\$9,516,644	\$11,923,417	\$22,166,892	\$1,761,999	\$2,783,569	\$48,152,521
3 SC Content	\$4,758,322	\$5,961,708	\$11,083,446	\$2,591,465	\$668,057	\$25,062,998
5 SC Structure	\$1,558,322	\$16,501,216	\$0	\$0	\$0	\$18,059,538
5 SC Content	\$779,161	\$8,250,608	\$0	\$0	\$0	\$9,029,769
Total	\$30,716,721	\$72,403,106	\$52,076,061	\$11,249,561	\$4,232,848	\$170,678,297

**Table 10: Structure and Content Values for the New West Branch River and Los Reales Area
(October 2001 Price Levels)**

Reach	Residential			Nonresidential		Total
	SFR	MFR	MH	Commercial	Public	
4 NWB Structure						
4 NWB Content						
5 NWB Structure						
5 NWB Content						
6 LR Structure	\$3,904,143	\$161,454	\$2,490,025	\$3,137,369	\$566,562	\$10,259,553
6 LR Content	\$1,952,072	\$80,727	\$1,245,012	\$4,268,656	\$135,974	\$7,682,441
Total						

Structure and Content Damages

Without project structure and content damages were computed utilizing the HEC-FDA Flood Damage Reduction Model. The model computes equivalent annual damages based upon the following input parameters.

1. Structure data includes: structure name, category (SFR, MFR, MH, Commercial, and Public), stream location, bank, stream name, number of structures, ground elevation, first floor elevation, structure value, and content value.

This data was developed in a Microsoft Excel spreadsheet, converted into a text file, and imported into the HEC-FDA program.

2. Hydrologic and Hydraulic data includes: frequency-discharges and stage-discharge relationships. This data, furnished by Engineering Division, was developed utilizing the HEC-2 Water Surface Profiles program. The output files were imported into the HEC-FDA program. Data was input for the base.
3. Depth-damage relationships for residential structures were obtained from Economic Guidance Memorandum (EGM) 01-03: Generic Depth-Damage Relationships. Commercial depth damage relationships were obtained by FEMA and entered directly into the program.
4. Risk and Uncertainty (R&U) variables. The two variables subject to R&U variations for the economic determination of stage-damage functions are first floor elevation (FFE) and depreciated replacement cost (DRC). For FFE uncertainty, a normal distribution with a mean of 0 and a standard deviation of .6 feet was assumed (based upon guidance contained in EM 1110-2-1619). For DRC uncertainty, a normal distribution with a mean of 0 and a standard deviation

of 10% of structure base value was assumed (based upon variations in Marshall & Swift valuation multiples for various structure types and conditions).

The hydrologic engineering relationships allowed by the HEC-FDA model to fluctuate are frequency-discharge and stage-discharge. For the frequency-discharge relationship, a statistical distribution was computed. This method called the “graphical” approach, based upon data contained in the water surface profiles and equivalent record lengths for each reach, was furnished by Engineering Division. For the stage-discharge relationship, a normal distribution is assumed.

The HEC-FDA model computes equivalent annual damages using a Monte Carlo simulation process. Expected annual damages are calculated for a 2008 base year by damage reach in multiple iterations and converted to equivalent values using standard discounting procedures.

Table 11: Total Without Project Condition Damages

Santa Cruz River		West Brach River	
Reach	Base Year	Reach	Base Year
1 SC	\$33,870	4 NWB	
2 SC	\$89,670	5 NWB	
3 SC	\$104,710	6 LR	
5 SC	\$18,350		
Total	\$246,600	Total	

Table 12 and 13 that follow summarize without project expected annual damages by reach for base year conditions for the Santa Cruz River and the New West Branch and Los Reales Area, respectively.

**Table 12: Without Project Conditions
Santa Cruz River Expected Annual Damages**

Reach	Residential			Nonresidential		Total
	SFR	MFR	MH	Commercial	Public	
1 SC	\$6,650	\$24,800	\$630	\$1,790	\$0	\$33,870
2 SC	\$12,890	\$20,340	\$41,150	\$14,030	\$1,260	\$89,670
3 SC	\$6,050	\$53,140	\$31,640	\$9,450	\$4,420	\$104,710
5 SC	\$17,900	\$450	\$0	\$0	\$0	\$18,350
Total	\$43,490	\$98,740	\$73,420	\$25,270	\$5,680	\$246,600

**Table 13: Without Project Conditions
New West Branch River and Los Reales Area Expected Annual Damages**

Reach	Residential			Nonresidential		Total
	SFR	MFR	MH	Commercial	Public	
4 NWB						
5 NWB						
6 LR						
Total						

Emergency Response Damages

Due to the limited amount of information available concerning emergency response costs along the Santa Cruz and West Branch Rivers, emergency response cost estimates will be based on estimate derived in the January 1993 Flood Damage Summary Report written by the Pima County Department of Transportation and Flood Control District. In the report, Pima County has provided limited information on the emergency response cost to residents as they evacuate, relocate and, reoccupy their residence during a flood event. Based on the experience of residents who were flooded in the 1993 flood, the temporary relocation cost was approximately \$1,400 per resident. This number was applied to the number of residences in the 500-year floodplain and was used along with a non-damaging frequency of a 100-year event to perform equivalent annual damages. The equivalent annual damages (EAD) to residents due to flooding along the Paseo de las Iglesias portion of the Santa Cruz River is \$8,288 and the New West Branch of the Santa Cruz River is \$XXXXX.

Traffic Damages

Typically, expected annual traffic damages are estimated based upon delineations of floodplain areas with inundation levels exceeding one foot and durations of flooding. However, Hydrology and Hydraulics used the steady state or peak flow method in computing overflows. This method does not allow for a means to estimate durations of flooding by flooding event; therefore, traditional methods of computing traffic damages will not be used. Instead, traffic damages are estimated as a single event assuming traffic flow will be disrupted for a day no matter what the duration.

According to this analysis, the Santa Cruz River could cause temporary closures of Silverlake Road, 22nd Street, and Congress Street. These roads carry 12,000, 21,700, and 17,200 vehicles per day while vehicle detour miles traveled from closures along these roads are: 2.9, 3.9, and 6.1, respectively. Total vehicle detour miles traveled per day are: Silverlake Road: 34,800, 22nd Street: 84,630, and Congress Road: 104,920. At a detour speed limit of 55 miles per hour, the time involved is 632 hours along Silverlake Road, 1,538 hours along 22nd Street, and 1,907 hours along Congress Road. Using a traffic delay cost of \$1.40 and \$7.06 per hour depending on the length of the delay, potential damages resulting from delays are \$884, \$2,153, and \$13,463 for the three roads. At an operation cost of 14.4 cents per mile, the potential annual damage is \$32,306. Total

vehicle delay and operation damages equal 48,806 while average annual vehicle delay and operation damages equal \$2,968.

Table 16: Vehicle Delay and Operation Damages

Street	Vehicle Delay Damages	Vehicle Operation Damages	Total
Silverlake Road	\$884	\$5,011	\$5,895
22 nd Street	\$2,153	\$12,186	\$14,339
Congress Street	\$13,463	\$15,109	\$28,572
Total	\$16,500	\$32,306	\$48,806
Expected Annual Damages	\$1,003	\$1,965	\$2,968

Modified Habitat Evaluation Procedure (HEP) Analysis

Description of Environment

The natural environment in the study area includes riparian and upland vegetation. Currently the riparian habitat contains sparse vegetation mostly of tamarisk (*Tamarix* spp.), African sumac (*Rhus lancia*) and non-native grasses. Tamarisk is found in the channel bottom throughout the study area and provides relatively poor habitat compared to native riparian vegetation that has disappeared from most of the study area except for occasional cottonwoods and mesquite found along the deeply incised banks. The tops of both banks have both native and restored Sonoran upland vegetation that is characterized by native mesquite (*Prosopis velutina*), palo verde (*Cercidium* spp.), and creosote (*Larrea tridentate*). These vegetated areas have been heavily disturbed and invaded by exotic species of grass. They provide a minimal biological corridor and habitat linkage to and from the Tucson Mountains to the west.

In the expected future, riparian vegetation will decline and invasive exotic species of plants will expand to fill the void. These species will monopolize available water leaving less for competing plants. Diversity of upland habitat at the top of the bank will decline and will be dominated by species tolerant of extremely disturbed conditions. The increased stress on riparian and upland habitats will allow exotic species to invade more readily resulting in a loss of animal diversity.

Description of HEP Analysis

The methodology used to assess the environment described above is the Habitat Evaluation Procedure (HEP) analysis. The HEP methodology, in widespread use since first developed by the US Fish and Wildlife Service in the early 1980s, compares the suitability of habitat conditions in the study area for a particular species to ideal conditions. HEP takes into account both the quality and quantity of habitat by multiplying a species-specific numerical habitat suitability index (HSI) by the area of the habitat under consideration. The HSI value, which varies from 0 to 1 (0 represents no value as habitat, while 1 represents ideal habitat.), is multiplied by acreage to yield habitat units (HUs). (Habitat units are not measured in dollars but serve as a quantitative

expression for environmental output. Because environmental output is not in monetary terms, it is not possible to develop a benefit cost ratio. Instead, combinations of environmental outputs are compared with associated costs to determine cost effective solutions.)

To perform a standard HEP analysis for this study, a detailed understanding of each evaluation species is needed. The Fish and Wildlife Service has developed HSI for many species, but they have not been developed for the evaluation species under consideration (includes up to 56 species, including Federally listed threatened and endangered species, and proposed species currently being considered in the Pima County Municipal Species Conservation Plan). Because knowledge of the needs of these species is not sufficient to support calculation of HSI, the HEP will be modified to accommodate this lack of knowledge. The procedure will evaluate only the amount of cover type conditions that resemble ideal areas for species that are known to live within Pima County. For each species of potentially suitable habitat, current species needs are considered and incorporated. Table 17 shows the cover type classification, HSI and HUs for the entire study area.

Table 17: Cover Type Classification, HSI, and HUs for the Study Area

BLP Code	Cover Type Classification	Hectares (Acres) in Study Area	% of Study Area	Habitat Suitability Index (Average)	Habitat Units Hectares (Acres)
154.1	Sonoran Desertscrub Biome	134.6 (332.5)	6.6	0.65	87.5 (216.1)
154.12	Paloverde-Mixed Cacti Series	95.8 (236.6)	4.7	0.73	69.9 (172.7)
154.17	Saltbush Series	38.8 (95.9)	1.9	0.57	22.1 (54.7)
224.5	Sonoran Riparian Deciduous Forest and Woodlands Biome	68.7 (169.7)	3.4	0.60	41.22 (101.8)
224.52	Mesquite Series (includes 234.71 Mixed Scrub Series of Sonoran Deciduous Riparian Scrub Biome)	68.7 (169.7)	3.4	0.60	41.22 (101.8)
234.7	Sonoran Deciduous Riparian Scrub Biome	35.3 (87.3)	1.7	0.40	14.1 (67.9)
234.72	Saltcedar Disclimax Series	35.3 (87.3)	1.7	0.40	14.1 (67.9)
254.7	Sonoran Interior Strand Biome	105.5 (260.7)	5.2	0.50	52.8 (130.4)
254.71	Mixed Shrub Series	105.5 (260.7)	5.2	0.50	52.8 (130.4)
300	Cultivated and Cultured Uplands	1624.4 (4013.9)	80.2	0.20	324.9 (802.8)
314.1	Urban: Residential, commercial, and industrial	1231.8 (3043.9)	60.8	0.20	246.36 (608.6)
314.15	Recreational (=maintained park)	36.6 (90.5)	1.8	0.30	10.98 (27.15)
364.1	Sonoran Vacant or Fallow lands	355.8 (879.2)	17.6	0.10	35.6 (87.9)

BLP Code	Cover Type Classification	Hectares (Acres) in Study Area	% of Study Area	Habitat Suitability Index (Average)	Habitat Units Hectares (Acres)
400	Cultivated and Cultured (or Anthropogenic water dependent wetlands)	56.7 (140)	2.8	0.40	22.68 (56)
414.12	Urban Drainage	40.8 (100.7)	2.0	0.20	8.16 (20.14)
424.53	Cottonwood-Willow Series	3.6 (8.8)	0.2	0.50	1.8 (4.4)
444.71	Cattail Series	12.3 (30.5)	0.6	0.50	6.2 (15.3)
Total Study Area		2025.1 (5004.1)	100	0.50	1012.5 (2502.1)

Recreation Analysis

For the purpose of this analysis, local parks will be surveyed to show existing recreation in the area. One more park, the Santa Cruz River Park will be added to the list and discussed in detail because a portion of it exists within the Paseo de las Iglesias study area. The Santa Cruz River Park may represent a model for possible future extensions to the existing park within the Paseo de las Iglesias study area and for possible development of a river park along the New West Branch of the Santa Cruz. Other future plans include the City of Tucson's plan to restore a segment of Paseo de las Iglesias which lies within the Rio Nuevo District and create areas and parks ideal for recreation. There are currently no plans for significant development of other future parks along the New West Branch. The future recreational needs of the Paseo de las Iglesias and New West Branch of the Santa Cruz River can be supported through a discussion of recreational demand and the unit day value method. (See addendum for a list of County and City Parks in the Pima County/Tucson metropolitan area.)

Parks Within Study Area

The following shows the names of parks in close vicinity to the Paseo de las Iglesias and New West Branch portions of the Santa Cruz River.

Sentinel Peak Park--Sentinel Peak Park is located at 1000 S. Sentinel Peak Road and is a regional park approximately 272.93 acres.

El Presidio Plaza Park--El Presidio Plaza Park is located at 160 W. Alameda Street and is classified as a neighborhood park. It has drinking fountains, dusk to dawn lights, and public art. The area of the park is 2.75 acres.

Oaktree Park--Oaktree Park is located at 5433 S. Oaktree Drive. It has a basketball court, a multiple use field, two picnic sites, a playground, a ramada, a drinking fountain, and a BBQ grill. This neighborhood park is about 7.29 acres.

Ormsby Park--Ormsby Park, a neighborhood park, is located at 24th street and Verdugo Avenue. The facilities include: bathrooms, a recreation center, a basketball court, a picnic site, a playground, a softball field, a volleyball court, two drinking fountains, and a BBQ grill. These facilities are on a 4.77 acres parcel.

Richey Elementary School--Richey elementary school is located at 2209 N. 15th Avenue. Even though, the park is part of the school grounds it is still considered a neighborhood park. The park offers two basketball courts, a multi-use path, a playground, a ramada. Total acres equal 3.67.

Veinte De Agosto Park--Veinte De Agosto Park is located at the intersection of Broadway Boulevard and Church Avenue. This neighborhood park offers public art on 1.02 acres.

Garden of Gethsemane--The Garden of Gethsemane, a mini park on .27 acres, is located at 602 W. Congress Avenue. It has life-size concrete religious statues on display. .

Verdugo Park--Verdugo Park is located at the intersection of 19th street and Verdugo Avenue. It is a mini park, approximately .47 acres, with a picnic site, a playground, a drinking fountain, and a BBQ grill.

John F. Kennedy Park--John F. Kennedy Park is located at Ajo Way and Mission Road and is considered a metro park. The park has two basketball courts, five restrooms, soccer fields, private boating, fishing lake, a basketball court, two multi-use fields, an amphitheatre, six picnic sites, three playgrounds, thirty nine ramadas, a swimming pool, two tennis courts, seventeen drinking fountains, and forty five BBQ grills. The park encompasses 167.59 acres.

Paseo De Los Arboles Commemorative Park--The Park is located on the west side of the Santa Cruz River Park and Irvington. The Park offers a multi-use trail and water fountains.

Paseo De Lupe Eckstrom (Tucson Diversion Channel)--Paseo De Lupe Eckstrom Park is located at 10th avenue near 39th street. The park is ADA accessible. It also has a multi-use path, restrooms, drinking fountains, picnic areas, ramadas, and public art.

Cardinal Neighborhood Park--Cardinal Neighborhood Park is located at 6925 S. Cardinal Avenue. The park has baseball and softball fields, a walking path, a playground, a picnic area, an exercise station, a horseshoe pit, a lighted basketball court, a ramada, restrooms, and drinking water fountains.

Mission Ridge Neighborhood Park--At 3300 W. Tucker Street, Mission Ridge Neighborhood Park has a lighted basketball court, a basketball court, a baseball field, a picnic area, a ramada, a playground, restrooms, and drinking water fountains.

Winston Reynolds-Manzanita District Park--Located at 5200 S. Westover Avenue, the park has tennis courts, a volleyball court lighted baseball, football, and soccer fields, a lighted basketball court, a playground, a swimming pool, ramadas, a BMX track, a concession building, horseshoe pits and restrooms.

Santa Cruz River Park

In addition to the parks listed above, there is one more park: the Santa Cruz River Park. The Santa Cruz River Park is located west of Interstate 10 and 19. It was constructed in stages. The most recent section, Silverlake Road to Grant Road (Congress to Silverlake is within the study area), was completed in 1993. This river park includes pedestrian and bicycle trails, a frisbee golf course, exercise courses, restrooms, drinking fountains, ramadas, picnic sites, BBQ grills, playgrounds, parking, and art projects. The section between Irvington Road and Ajo Way (all within the study area) was completed in 1992 and includes pedestrian and bicycle trails, a picnic area, and exercise course.

The overall goal of the Santa Cruz River Park and any future extensions is to establish a continuous river trail which will link up to a system of trails (some not yet developed) along the Santa Cruz River, Rillito River, Tanque Verde Creek, Pantano Wash and Canada del Oro Wash.

The benefits of the Santa Cruz River Park and any future extensions or development of other river parks within the study areas include:

1. the development of a continuous interconnected corridor networking the metropolitan area
2. the creation of a portion of a region-wide trail system that will integrate with other established and integrated trails
3. the opportunity to maintain and enhance wildlife corridors
4. the implementation of multi-objective management for floodplain, visual, recreational, natural, and cultural resources
5. the establishment of a cohesive sense of regional distinction
6. the creation of educational and interpretive opportunities
7. the enhancement of property values, economic development, and tourism
8. the encouragement of alternative modes of transportation that can reduce vehicular use and air pollution in the community

Table 18 lists visitation figures for the Santa Cruz River Park River Park by month for two years, 1999 and 2000. The Pima County Parks and Recreation Department provided

this data. It was collected through the use of a laser counting device located at one point along the Santa Cruz River Park.

The data shows attendance figure declined substantially along the Santa Cruz River Park. One possible explanation for the decline in attendance for the Santa Cruz River Park might be due to recreation transfers due to the recent enhancement of another park called the Rillito River Park. Possibly, individuals have chosen to recreate along the larger improved Rillito River Park over the smaller Santa Cruz River Park.

Table 18: Attendance Figures for the Santa Cruz River Parks

Month	Santa Cruz River Park	
	1999	2000
January	21,682	3,667
February	16,530	5,272
March	18,721	6,437
April	13,288	5,017
May	Broken	3,507
June	9,633	3,961
July	10,113	2,058
August	7,471	4,936
September	9,256	2,364
October	8,502	4,302
November	2,794	2,798
December	4,670	4,286
Totals	122,660	48,605
Average		85,632

Future river parks are planned for Tanque Verde Creek and Pantano Wash. Design work has been completed for sections of River Park along Canada del Oro from Thornydale Rd. to Magee Rd., along Tanque Verde Creek from Sabino Canyon to Tanque Verde Rd. and along Pantano Wash from Tanque Verde Rd to Golf Links Rd. Together the Santa Cruz, Rillito, Tanque Verde Creek, and Pantano Wash river parks will function as one large unified trail system.

Future Recreation Facilities

The City of Tucson has produced the Rio Nuevo Master Plan, which will create “a network of unique experience areas, linked by shaded plazas which connect new cultural, civic, entertainment, and business uses interwoven in a historically accurate and aesthetically pleasing manner throughout the Rio Nuevo District.” The boundaries of this revitalization effort are Congress Street to the North, 22nd Street to the South, I-10 to the East, and Mission Road to the West.

Central to this project is the Santa Cruz River that may be converted into a linear greenbelt. Included in this effort are restored river terraces, islands and sandbars, and new weirs and ponds to slow and collect reclaimed water to ensure a healthy ecosystem and wildlife corridor through the core of downtown Tucson. Cottonwoods, Willows,

Arizona Ash and other riparian trees and shrubs are planned for planting along the River to provide habitat for wildlife and contribute to pollination and seed dispersal.

Sentinel Peak Mountain over looks the City of Tucson and is included in the Rio Nuevo Plan. The proposal is to restore the mesquite shrub land that existed when Indian burials occurred there. Additionally, the plan proposes that the mountain be connected to the river through the creation of restored mesquite/paloverde upland habitat. This upland habitat will function as a wilderness park with nature paths that cross a series of carefully recreated habitats that interpret the pertinent Sonoran Habitats.

At the base of Shook-Shon Mountain, a natural Cienega of Sonoran Desert Marsh will be created to provide a watering hole for reintroduced wildlife. This Cienega will function as a sanctuary for flora and fauna and provide opportunities for interactive recreation such as bird watching and learning.

As part of the environmental restoration effort the following three parks have been introduced as part of the Rio Nuevo Project. They are located in close proximity to and immediately west of the Santa Cruz River.

1. Tucson Origins Cultural Park (2002-2005)
Requiring: approx. 10 acres
Attendance: 200,00 visitors per year
2. Sentinel Peak Nature Park (2006)
Requiring: approx. 20-30 acres
Attendance: 100,000 visitors per year
3. Rancho Chuk-Shon (2003-2006)
Requiring: approx. 2-3 acres
Attendance: 50,000-100,000 visitors per year

Recreation Demand

Many factors contribute to make the proposed riparian habitat area along the Paseo de las Iglesias and New West Branch study areas attractive in terms of recreation potential unmet demand. They include:

1. *Recreation Experience*--Proposed general recreation activities for the study area include trails for hiking, biking, and jogging. These activities are the fastest growing activities throughout Arizona according to the Arizona Trails 2000 document. Throughout Arizona walking and hiking ranks at 78% annually followed by bicycling at 36% and jogging at 28%. All activities rank higher than the national average except for jogging. Nationally, walking ranks at 67%, hiking at 33%, bicycling at 31%, and jogging at 70%. Among the activities identified, most have significant unmet demand.

2. *Availability of Opportunity*--In the past, demand for trail opportunities was fulfilled by the County's many back trails. But, as the County continues to grow, the demand has increased for urban trails and other recreation opportunities close to home. The proposed facilities along the Paseo de las Iglesias and New West Branch will provide opportunity for many urban individuals to recreate close to their homes, work, and downtown. Currently, several parks exist within an hour of travel time and a few exist within 30 minutes travel time for most urban individuals living in Tucson, but only one river park trail system exists which will provide a unique availability. According to Arizona Trails 2000 published under the authority of the Arizona State Parks Board, the number one reason given by trail users for preferring a particular area is its proximity to home (56%).
3. *Carrying Capacity*--As previously discussed, Pima County has experienced rapid population growth. Pima County's MSA population is 843,746 at year 2000 and is expected to reach 1,518,000 by year 2025—a difference of 674,254 over 25 years. With this increase in population comes and increased demand for recreational facilities proposed for this study. At present, facilities at the park are adequate to conduct activities and promote public health and safety at the park, but as population grows, the need for more facilities may grow.
4. *Accessibility*--According to 43% of the Arizona Trails 2000 survey respondents, loss of access to trails is the top three most important issues facing trails today. This is not the case for the facilities that are easily and quickly accessible to the public. There are also two interstates (10 and 19) and several crossroads that intersect the study areas. This provides a park area in high demand with considerable access not only by automobile but also by pedestrians.
5. *Environmental*--As demonstrated earlier, there are several recreation areas located in the study area. Of these parks, there are no significant thriving riparian areas. The Paseo de las Iglesias and New West Branch of the Santa Cruz have pockets of riparian vegetation but remain significantly degraded and are not considered to be a thriving habitat for plants and animals. Other parks in the area have desert terrain and are not in riparian areas. This lack of riparian habitat is expected to result in significant unmet recreational demand.

According to County and City officials with the Park and Recreation Department the use of population based standards represents one of the most widely used methods for assessing community demand and the need for open space and recreation. This is attributed to the fact that they are easily understood and convenient. Such standards are considered most useful as a means for determining whether the supply of recreational resources is lacking behind demand that is supported by population growth. These standards also aid in supporting visitation data. The City of Tucson Parks and Recreation Department describes national standards for park type (ie. mini park, neighborhood park, community park, metro park, and regional park) that have been established. The National Recreation and Parks Association (NRPA) set these standards. They are compared to

current service levels and set by the City of Tucson for the Core/Mid City region and the Edge/Future City region. The following tables summarize this data.

Table 19: Park Type, Standard Park Size, and Service Radius

Park Type	Park Size	Service Radius
Mini Park	0-1 acre	¼ mile
Neighborhood Park	1-15 acres	½ mile
Community Park	15-40 acres	1 mile
Metro Park	40-200 acres	2 ½ miles
Regional Park	>200 acres	7 miles

Table 20: Recreation Demand

Facility Type	Current Ratio	National Guidelines	COT	
			Core/Mid-City	Edge/Future City
Mini Park ¹	.01 ac/1,000	N/A	N/A	N/A
Neighborhood Park	1.1 ac/1,000	2.5 ac/1,000	2.5 ac/1,000	2.5 ac/1,000
Community Park	1.0 ac/1,000	3.0 ac/1,000	3.0 ac/1,000	3.0 ac/1,000
Metro Park	3.0 ac/1,000	N/A ²	3.0 ac/1,000	3.5 ac/1,000
Regional Park	1.3 ac/1,000	2.0 ac/1,000	1.0 ac/1,000	2.0 ac/1,000
Total	5.9 ac/1,000	10.0 ac/1,000	9.5 ac/1,000	11.0 ac/1,000

¹N/A was placed in the row of cells for mini park because the City of Tucson Park and Recreation Department no longer plans to construct this type of park therefore any acre per population guideline is no longer applicable.

²There are no national guidelines for metro park, so this guideline is not applicable.

As the above data indicates, the current ratio of acres per 1,000 population is lower in most cases than the National and City Guidelines. A lack of sufficient recreation resources exists for all the types of parks except for metro and regional parks. Currently, existing metro parks have met population needs in the core/mid-city area but not the edge/future city region. Regional parks have also met demand for the core/mid city area but not the edge/future city. Unless a significant number of recreation facilities are built, the projected population growth (2010) will make the existing deficit and surplus become worse.

Table 21: Additional Park Facilities Needed to Achieve Guidelines

Facility Type	COT	COT	Total 2010	Existing 2001	Needed to Fill Demand 2010
	Core/Mid-City 2010	Edge/Future City 2010			
Mini Park	N/A	N/A	N/A	5 acres	N/A
Neighborhood Park	1,041 acres	366 acres	1,408 acres	515 acres	893 acres
Community Park	1,250 acres	439 acres	1,689 acres	504 acres	1,185 acres
Metro Park	1,250 acres	513 acres	1,762 acres	1,450 acres	312 acres
Regional Park	417 acres	293 acres	709 acres	619 acres	90 acres
Total	3,957 acres	1,611 acres	5,568 acres	3,093 acres	2,480 acres

Multi-Use Path	27.77 miles	9.76 miles	37.53 miles	10.00 miles	27.53 miles
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Table 21 shows an estimate of the number of acres needed by 2010 to meet anticipated population needs. The estimated number of park acres needed to fill demand by 2010 is 2,480. Also, an estimate of 27.53 miles of multi-use path is needed by 2010 to meet anticipated population needs.

Unit Day Value Method

For this analysis the unit day value (UDV) method is used for the economic evaluation of the proposed recreational features along the Paseo de Las Iglesias and the New West Branch study areas. The method uses administratively set dollar values to determine the worth of recreational experiences and calculates the value of recreation. This value is an approximation of the area under the site demand curve or otherwise known as willingness to pay. To obtain this value you must first select specific points from a range of values provided in Planning Principles, and Guidelines (ER-1105-2-100). A table of criteria and point values is shown below:

Table 22: Criteria and Point Values

Criteria	Key Variable	Range of Point Values
Recreation Experience	Number of key activities	0-30
Availability of Opportunity	# of similar opportunities nearby	0-18
Carrying Capacity	Adequacy of facilities for activities	0-14
Accessibility	Ease of access to and within site	0-18
Environmental	Esthetic quality of site	0-20
Total		0-100

Second, point values for without project conditions are calculated and converted into equivalent dollar amount. Based upon the total number of points assigned, the equivalent dollar amount is obtained. UDVs for 2002 can range from \$2.90 to \$8.69 per recreation day. This dollar amount is the value per visit of unit day value. Third, the value is multiplied by the annual number of visitors to get an estimate of annual recreation value.

Evaluation of the Paseo de las Iglesias Study Area

Point values for the existing Santa Cruz River Park of which a portion is located within the Paseo de las Iglesias study area are estimated. These numbers do not consider any possible future expansion of the park and are assigned using information described earlier in this report under the recreation demand section of the report.

**Table 23: Point Values for Without Project Conditions
Paseo de las Iglesias**

Recreation Criteria	Value Range	Point Values
Recreation Experience	0-30	8
Availability of Opportunity	0-18	3
Carrying Capacity	0-14	6
Accessibility	0-18	8
Environmental	0-21	2
Total		27

The point values described above are totaled and converted into equivalent a UDV amount. The total point value from Table 23 is 27 for the five recreational criteria. The equivalent UDV amount for 27 points is \$4.18. This UDV amount represents how much a visit to the park is worth in dollar amount for the without project condition.

To calculate the recreational value for without project conditions, the UDV is multiplied by annual visitation. Average annual visitation to the park (see Table 18) is 85,632. The product of the UDV and average annual visitations equals \$357,941.

Evaluation of the New West Branch Study Area

There are currently no recreational features along the New West Branch of the Santa Cruz. Even though some isolated instances of recreation may exist in the form of walking or maybe bird watching, the recreation point value will probably remain quit low. For this reason, recreation value will be based entirely upon the proposed recreational features and estimated future visitation.

ADDENDUM

Existing Recreational Resources

The following presents the primary recreation facilities within Pima County/Tucson metropolitan area.

National Parks (Tucson Metropolitan Area):

- Coronado National Forest
- Saguro National Park
 - Rincon Mountain District
 - Tucson Mountain District
- Santa Catalina Ranger District
 - Pusch Ridge Wilderness
 - Ricon Mountain Wilderness

State Parks (Tucson Metropolitan Area):

- Catalina State Park

BLM Lands (Tucson Metropolitan Area):

- Empire-Cienega Conservation Area

County Parks

- Augie Acuna Los Ninos Neighborhood Park
- Cienega Creek Natural Preserve
- John A Valenzuela Community Center
- Southeast Regional Park
- Coronado Middle School Park
- Emily Gray Jr. High School
- George Mehl Foothills District Park
- McDonald District Park
- Lew Sorensen Tanque Verde Center
- Kino Veterans Memorial Community Center and Sports Complex
- Kino Teen Center
- Old Spanish Trail Bicycle and Hiking Trail
- Thomas Jay Regional Park
- Murphey Multi-Use Field
- Rillito River Park
- Roy P. Drachman- Agua Caliente Regional Park
- Arthur Pack Regional Park
- Casas Adobes Neighborhood Park
- Catalina Neighborhood Park and Recreation Center
- Children's Memorial Neighborhood Park
- Denny Dunn Neighborhood Park
- Feliz Paseos
- Flowing Wells Jr. High School
- Linda Vista Neighborhood Park
- Meadowbrook Neighborhood Park
- Overton Arts Center
- Pegler Recreation Area
- Picture Rocks Community Center and District Park
- Richardson Neighborhood Park
- Rillito Vista Neighborhood Park and Recreation Center
- Sunset Point Neighborhood Park
- Ted Walker District Park
- Wildwood Neighborhood Park
- Branding Iron Neighborhood Park
- Cardinal Neighborhood Park
- Centro Del Sur Community Center
- Lawrence District Park
- Mission Ridge Neighborhood Park
- Paseo De Los Arboles Commemorative Park
- Paseo De Lupe Eckstrom (Tucson Diversion Channel)
- Santa Cruz River Park
- Southwest Community Center
- Three Points Veterans Memorial Neighborhood Park
- Vesey Neighborhood Park
- Winston Reynolds-Manzanita District Park
- Ajo Regional Park
- E.S. "Bud" Walker Neighborhood Park
- Gibson Neighborhood Park
- Palo Verde Neighborhood Park
- Anamax Neighborhood Park and Recreation Center
- Continental Community Center
- Kay Stupy-Sopori Neighborhood Park
- Tucson Mountain Park
- Sahuarita District Park and
- Cienega Creek Natural Preserve
- Tortolita Mountain Park
- Colossal Cave Mountain Park
- Joan M. Swetland Community Center

City Parks

- Christopher Columbus Park
- Sentinel Peak Park
- Case Park
- Fort Lowell Park
- Golf Links Sports Complex
- Greasewood Park
- Houghton Park
- Jacobs Park
- John F. Kennedy Park
- Kino and 36th St. Park
- Lakeside (Charles Ford) Park
- Lincoln Park
- Gene C. Reid Park
- Rodeo Park
- Santa Cruz River Park
- Morris K Udall Park
- Valle Alegre Park
- Freedom Park
- Himmel Park
- Juhan Park
- Mansfield Park
- McCormick Park
- Mission Manor Park
- Joaquin Murrieta Park
- North Central Park
- Jesse Owens Park
- Palo Verde Park
- Michael Perry Park
- Purple Heart Park
- Rodeo Grounds
- San Juan Park
- Santa Rita Park
- Sunnyside Park
- 20/30 Park
- Alvernon Park
- Balboa Heights Park
- Bravo Park
- Catalina Park
- Cherry Avenue Park
- Connor Park
- Country Club Annex Park
- De Anza Park
- Desert Aire Park
- Desert Shadows Park
- Eastmoor Park
- El Presidio Plaza Park
- El Pueblo Park
- Escalante Park
- Francisco E. Esquer Park
- Estevan Park
- Fiesta Park
- Stefan Gollob Park
- Groves Park
- Hoffman Park
- Don Hummel Park
- Iron Horse Park
- Jacinto Park
- Harriet Johnson Park
- La Madera Park
- La Mar Park
- Linden Park
- Menlo Park
- Mesa Village Park
- Military Plaza Park
- Miracle Mile Manor Park
- Mirasol Park
- Mitchell Park
- Oaktree Park
- Ormsby Park
- Oury Park
- Parkview Park
- Pinecrest Park
- Pueblo Gardens Park
- Rodeo Wash Park
- Rolling Hills Park
- Santa Rosa Park
- Sears Park
- Swan Park
- Swanway Park
- Tahoe Park
- Terra Del Sol Park
- James Thomas Park
- Toumey Park
- Veinte De Agosto Park
- Villa Serena Park
- Vista Del Prado Park
- Vista Del Pueblo Park
- Vista Del Rio Park
- Wilshire Heights Park
- Harold Bell Wright Park
- Amphitheater High School
- Amphitheater Middle School
- E.C. Nash Elementary School
- Flowing Wells High School
- Pima Community College
- Sunnyside High School
- Booth-Fickett Middle School
- Catalina High School
- Cholla High School
- Doolen Middle School
- Jefferson Park Elementary School
- John B. Wright Elementary School
- Magee Middle School
- Manzo Elementary School
- Palo Verde High School
- Richey Elementary School
- Rincon High School
- Rollin Gridley Middle School
- Sahuaro High School
- Santa Rita High School
- Townsend Middle School
- Tucson Magnet High School
- Utterback Middle School
- Vail Middle School
- Manuel Valenzuela Alvarez Park
- Cherokee Avenue Park
- El Tiradito Wishing Shrine
- Garden of Gethsemane
- Jardin Cesar Chavez Park
- Mariposa Park
- Riverview Park
- San Augustine Park
- Seminole Park
- Street Scene Park
- Sunset Park
- Verdugo Park