EVALUATION SUMMARY

EVALUATION SUMMARY

Evaluation is an integral part of the design process, and occurs consistently throughout. Ideas are proposed and disposed, proposed and built upon and eventually finalized through continual cycles of evaluation. Many of these evaluations occur internally, as personal processes, or within the discussions of the design team, as design elements are held up to the standards of stated goals and objectives. The ideas put forward in this document have repeatedly undergone both personal and group evaluation, as well as evaluation from the 606 studio principals. This summary is intended to serve as a final check that this project has indeed accomplished the goals it set out to achieve.

CONCEPTUAL PLAN

The planning goals and objectives provide the most useful tool for evaluation; they were built from the more general project goals, community involvement and the San Diego's River context. As presented in Chapter Four, Conceptual Plan, they were:

To preserve and celebrate the river's historic resources

1. Develop partnerships with existing historical resources
2. Enhance preservation of historic and cultural resources
3. Facilitate education about the river's rich history

To support the natural stream processes of the San Diego River

1. Support sediment transport processes and manage erosion
2. Work toward decreasing river water volumes and increasing groundwater volumes
3. Improve water quality
4. Educate the public about how their actions impact the river environment

To preserve and enhance riparian habitat throughout the San Diego River Park

1. Enhance native habitat
2. Maintain and improve habitat connectivity throughout the park and maintain connectivity for bobcats in the upper reaches
3. Integrate recreation in such as way as to minimize impacts on sensitive species
4. Facilitate education about the river environment

To provide access to recreation and activities throughout the San Diego River Park.

1. Connect existing recreational facilities
2. Provide a continuous trail along the length of the San Diego River
3. Provide additional recreational opportunities and improve trail connectivity from the region into the river park
4. Maintain and improve the natural aesthetics of the river corridor
5. Enhance educational opportunities along the river

The following is a break down of how the conceptual plan components of River Park Framework and Design Patterns, and the three site designs, Cottonwood Grove Park, Mission City River Park, and Robb Field Recreation Center and Dusty Rhodes Park met the stated criteria.

The conceptual plan component of Recommendations provides reach specific information and guidelines for design, design patterns and character. The recommendations provide the details by which the components of River Park Framework and Design Patterns are applied within each reach. Because they guide the implementation of components to be evaluated, a break down of evaluation would be redundant and will not be presented here.

River Park Framework

The River Park Framework brings life to the community's vision for a connected and integrated river park. The framework expresses the goals and objectives of the park in a conceptual form in the following ways.

To preserve and celebrate the river's historic resources

1. Develop partnerships with existing historical resources: *Presents opportunities for partnershipe with Julian Historic District, Mission San Diego de Alcala State Historic Landmark, Old Town San Diego State Historic Park and Kuymeyaay Reservations for the preservation of historic village sites.*

2. Enhance preservation of historic and cultural resources: *Preserves and protects historic resources including the old wooden flume from Cuyamaca Reservoir, Mission Dam and Flume National Historic Landmark and Adobe Falls.*

3. Facilitate education about the river's rich history: *Proposes a Historical Interpretive Tour to provide educational opportunities to the public about the river's rich history.*

To support the natural stream processes of the San Diego River

1. Support sediment transport processes and manage erosion: *Provides oppor*

tunities to preserve the natural river character.

2. Work toward decreasing river water volumes and increasing groundwater volumes: *Creates opportunities to maintain impermeable surfaces in the park and to reduce runoff through the use of vegetative swales, protects the floodplain from development through the creation of a park.*

3. Improve water quality: *Provides opportunities to protect native vegetation, implement vegetative swales, and phytoremediation.*

4. Educate the public about how their actions impact the river environment: *Offers opportunities for public education by making natural processes visible within the park.*

To preserve and enhance riparian habitat throughout the San Diego River Park

1. Enhance native habitat: *Calls for coordinated habitat restoration throughout the park.*

2. Maintain and improve habitat connectivity throughout the park and maintain connectivity for bobcats in the upper reaches: *Maintains and improves a continuous habitat corridor and provides a bobcat corridor from headwaters to Mission Trails Regional Park.*

3. Integrate recreation in such as way as to minimize impacts on sensitive species: *Provides for buffers to prevent disturbances to sensitive species*

4. Facilitate education about the river environment: *Creates opportunities for the public to learn about restoration and native habitat and provides schools, colleges and universities opportunities to become involved in research.*

To provide access to recreation and activities throughout the San Diego River Park.

1. Connect existing recreational facilities: *Connects El Capitan Reservoir, El Monte County Park, Cactus Park, Santee Town Center, Mission Creek Park, Mast Park, Santee Lakes Regional Park, Mission Trails Regional Park, FISDRIP, Mission Valley Preserve, Presidio Park, Old Town San Diego State Historic Park, Robb Field Recreation Center, Dusty Rhodes Park and Dog Beach.*

2. Provide a continuous trail along the length of the San Diego River: *Provides the San Diego River Park trail along the entire length of the river park.*

3. Provide additional recreational opportunities and improve trail connectivity from the region into the river park: *Connects isolated trails in Santee, Mission Trails Regional Park, Mission Valley and the estuary and provides additional recreational resources affordably through combining multiple uses of historic preservation, water management and habitat preservation.*

4. Maintain and improve the natural aesthetics of the river corridor: *Protects and enhances the river corridor, thus maintaining the natural aesthetics.*

5. Enhance educational opportunities along the river: *Provides a regional connected system of parks and trails with uncountable educational opportunities.*

Design Patterns

Design Patterns provide the vocabulary to create the physical form of the river park. The goals and objectives of the park will be manifested through their application. Following is a list of design patterns that meet each of the stated criteria.

To preserve and celebrate the river's historic resources

1. Develop partnerships with existing historical resources: *Partnerships are not physical manifestations and are not included as part of design patterns.*

2. Enhance preservation of historic and cultural resources: *View spots (P-8), Interpretive signage (P-11c), Regulatory signage (P-11d).*

3. Facilitate education about the river's rich history: *View Spots (P-8), Interpretive signage (P-11c), Amphitheaters (P-18), Art (P-19).*

To support the natural stream processes of the San Diego River

1. Support sediment transport processes and manage erosion: *Stream meanders (W-1), Bank Restoration (W-2).*

2. Work toward decreasing river water volumes and increasing ground water volumes: *Infiltration Zones (W-3), Vegetative swales (W-4), Detention Basins (W-5), Retention Basins / Wetlands (W-6).*

3. Improve water quality: *Vegetative swales (W-4), Retention Basins/ Wetlands (W-6), Stormwater Treatment Areas (W-7), Phytoremediation (W-8.)*

4. Educate the public about how their actions impact the river environment: *Interpretive signage (P-11c),* Amphitheaters (P-18), Art (P-19).

To preserve and enhance riparian habitat throughout the San Diego River Park

1. Enhance native habitat: Habitat restoration (H-1), Sensitive species areas (H-5), Native landscaping (H-6).

2. Maintain and improve habitat connectivity throughout the park and maintain connectivity for bobcats in the upper reaches: Habitat corridor (H-2), Bobcat corridor (H-3), Wildlife underpass (H-4).

3. Integrate recreation in such as way as to minimize impacts on sensitive species: Habitat corridor (H-2), Bobcat corridor (H-3), Sensitive species areas (H-5).

4. Facilitate education about the river environment: View spots (P-8), Interpretive signage (P-11c), Maintenance centers (P-15), Amphitheaters (P-18), Art (P-19).

To provide access to recreation and activities throughout the San Diego River Park.

1. Connect existing recreational facilities: Bicycle facilities (P-2), Public Transit Access (P-3), Parking (P-4), Horse Facilities (P-5), San Diego River Park Trail (P-6a), Horse trails (P-6c), Road crossings (P-7).
2. Provide a continuous trail along the length of the San Diego River: San Diego River Park Trail (P-6a), Road crossings (P-7)

3. Provide additional recreational opportunities and improve trail connectivity from the region into the river park: Access points (P-1), Bicycle facilities (P-2), Horse facilities (P-5), Spur trails (P6b), Horse trails (P-6c), Road crossings (P-7), View spots (P-8), Water access (P-9), Benches (P-13), Maintenance centers (P-15), Playgrounds (P-16), Picnic areas (P-17), Amphitheaters (P-18), Recreational fields (P-20) .

4. Maintain and improve the natural aesthetics of the river corridor: Habitat restoration (H-1), Native landscaping (H-6), Art (P-19).

5. Enhance educational opportunities along the river: View spots (P-8), Interpretive signage (P-11c), Maintenance centers (P-15), Amphitheaters (P-18), Art (P-19).

SITE DESIGN

Cottonwood Grove Park, Lakeside

This park provides the opportunity to demonstrate and test the practice of phytoremediation using native cottonwoods, while also serving as a gateway to the trails in the Lakeside portion of the river park. This site was identified through a community workshop as an opportunity for the river park.

The native cottonwoods used for phytoremediation may produce a large amount of cottonwood seeds that may be seen as a glorious spring event by some and as a nuisance by others. Opportunities exist to use this natural fiber for crafts, and a cottonwood festival could facilitate this appreciation. If community support of seed bearing species cannot be achieved, cotton-less cottonwoods which produce fewer seeds may be considered for use.

Following is a break down of how this park met the planning goals of the river park conceptual plan.

To preserve and celebrate the river's historic resources

1. Develop partnerships with existing historical resources: No opportunity to develop partnerships was available on this site.

2. Enhance preservation of historic and cultural resources: Echoes the agricultural heritage of the area through the use of a grid pattern for the cottonwoods in the design.

3. Facilitate education about the river's rich history: Engages in a natural water treatment process on land that was formerly used for mechanical water treatment.

To support the natural stream processes of the San Diego River

1. Support sediment transport processes and manage erosion: No opportunities existed at this site, river has been chanelized in this area and mining pits are off site.

2. Work toward decreasing river water volumes and increasing groundwater volumes: Provides approximately thirteen acres of parkland preserving open space from development.

3. Improve water quality: Inexpensively cleans contaminated groundwater through phytoremediation and provides vegetative swales to filter on site runoff.

4. Educate the public about how their

actions impact the river environment: Involves community monitoring in phytoremediation process and provides interpretive signage.

To preserve and enhance riparian habitat throughout the San Diego River Park

1. Enhance native habitat: Preserves existing riparian habitat, restores Diegan coastal sage scrub adjacent to the river.

2. Maintain and improve habitat connectivity throughout the park and maintain connectivity for bobcats in the upper reaches: Maintains a bobcat corridor along the river on site.

3. Integrate recreation in such as way as to minimize impacts on sensitive species: Provides for buffer areas adjacent to bobcat corridor with limited activities, develops horse trails appropriate to the needs of least Bell's vireo.

4. Facilitate education about the river environment: Provides interpretive signage at the view spot.

To provide access to recreation and activities throughout the San Diego River Park.

1. Connect existing recreational facilities: Connects a system of planned parks in Santee to a large proposed park in Lakeside.

2. Provide a continuous trail along the length of the San Diego River: Provides a portion of the San Diego River Park trail through the park.

3. Provide additional recreational opportunities and improve trail connectivity from the region into the river park: Provides a new access point, view spot, picnic area and connects to trails into the eucalyptus hills and down to the river.

4. Maintain and improve the natural aesthetics of the river corridor: Preserves and restores native habitat as well as creating the striking grid of beautiful native cottonwood trees.

5. Enhance educational opportunities along the river: Provides opportunities for education about water quality, phytoremediation and wildlife.

Mission City River Park, Mission Valley

This park provides numerous amenities to the Mission Valley community and is conveniently located adjacent to the public library, a trolley stop and Qualcomm Stadium. A maintenance center and nursery located adjacent to the trolley stop provides restoration facilities and educational opportunities. An enhanced storm drain creates a meandering stream environment. The strolling area provides trails for passive recreation and an amphitheater in an environment reflecting the river's natural channel. Replacing a portion of Qualcomm parking with turf for use as recreational fields and over-flow parking allows for increased groundwater infiltration and reduced heat island effect. All of these things occur in a park that is designed for natural, unavoidable flooding. The site of the strolling area and Qualcomm parking lot were both identified through a community workshop as an opportunity for the development of the river park.

This park facility will become a great asset to the many Mission Valley residents, providing many benefits on publicly owned, but currently inaccessible, land. The replacement of asphalt with turf in the Qualcomm parking lot creates a much more amenable environment by reducing the heat island effect for a variety of activities that occur in the parking area.

The turf playing fields on the Qualcomm lot will require irrigation, fertilizer and maintenance, but the opportunity to have much needed public recreational fields may justify these inputs. A turf area located where the strolling area is proposed will be replaced with native, drought-tolerant ground covers, requiring only drip irrigation during establishment.

Following is a break down of how this park met the planning goals of the river park conceptual plan.

To preserve and celebrate the river's historic resources

1. Develop partnerships with existing historical resources: No opportunity to develop partnerships was available on this site.

2. Enhance preservation of historic and cultural resources: Utilizes a tile mosaic in the entry plaza and amphitheater to invoke past history of the landscape.

3. Facilitate education about the river's rich history: Form of the park invokes images of the former floodplain, amphitheater provides opportunities for many educational activities.

To support the natural stream processes of the San Diego River

1. Support sediment transport processes: Naturalizes a concrete storm drain that flows into the river and allows

it to meander, provides a park that is designed to withstand flooding.

2. Work toward decreasing river water volumes and increasing groundwater volumes: Decreases approximately fourteen acres of impermeable surface of Qualcomm Stadium parking lot and utilizes green roof on maintenance facility, resulting in over twenty two acres suitable for infiltration.

3. Improve water quality: Creates vegetative swales to clean and filter runoff along parking areas, trolley stops and road, naturalizes storm drain allowing it to be filtered naturally by riparian vegetation, utilizes trees with phytoremediation potential on site.

4. Educate the public about how their actions impact the river environment: Provides interpretive signage about the storm drain naturalization and the asphalt removal at Qualcomm

To preserve and enhance riparian habitat throughout the San Diego River Park

1. Enhance native habitat: Preserves existing riparian habitat, restores Diegan coastal sage scrub adjacent to the river.

2. Maintain and improve habitat connectivity throughout the park and maintain connectivity for bobcats in the upper reaches: Maintains a habitat corridor through the river onsite.

3. Integrate recreation in such as way as to minimize impacts on sensitive species: Provides for buffer area adjacent to habitat corridor with limited activities.

4. Facilitate education about the river environment: Creates opportunities for the public to learn about restoration and native habitat through the maintenance center and trolley stop interpretive signage.

To provide access to recreation and activities throughout the San Diego River Park.

1. Connect existing recreational facilities: Connects to a Qualcomm Stadium, a library and a shopping area.

2. Provide a continuous trail along the length of the San Diego River: Provides a portion of the San Diego River Park trail through the park.

3. Provide additional recreational opportunities and improve trail connectivity from the region into the river park: Provides public access and a large park facility on inaccessible public land.

4. Maintain and improve the natural aesthetics of the river corridor: Preserves and restores native habitat as well as creates the sculpted earth forms reflecting the river's natural flooding tendency.

5. Enhance educational opportunities along the river: Provides educational opportunities at the trolley stop, the maintenance center, the naturalized stream, the amphitheater, and Qualcomm parking lot athletic fields. Location adjacent to library enhances educational opportunities.

Robb Field Recreation Center and Dusty Rhodes Park, Estuary

Redesigning the very popular Robb Field and Dusty Rhodes Park in Ocean Beach is not without risk. Many people know and love these parks as they are, but the opportunities for enhancement are so great it could not be passed by. Redesigning the park to accommodate all existing activities while creating a connection to the San Diego River will improve the park experience for all users. The path along the river's edge was identified in a community workshop as an opportunity for design improvement. Stormwater treatment can be demonstrated, and habitat can be increased. This park, at the mouth of the river can become one of the jewels of the San Diego River Park.

This redesign provides many benefits to the local community. This park could become an even greater asset to Ocean Beach with the changes recommended. The location of the stormwater treatment area within the 100-year flood plain, where dredging of sediment and harvesting of plant material will be necessary is less than ideal. The high profile of this location and great opportunities for community education helps justify the increased maintenance.

Following is a break down of how this park met the planning goals of the river park conceptual plan.

To preserve and celebrate the river's historic resources

1. Develop partnerships with existing historical resources: No opportunity to develop partnerships was available at this existing site.

2. Enhance preservation of historic and cultural resources: No opportuni-

ties to preserve historic or cultural resources were available at this existing site.

3. Facilitate education about the river's rich history: Connects people with the estuary's historic meandering form by using it for inspiration to guide the placement of the riverside path.

To support the natural stream processes of the San Diego River

1. Support sediment transport processes and manage ersoion: The river is channelized through the estuary; no opportunities existed at this site.

2. Work toward decreasing river water volumes and increasing groundwater volumes: Provides infiltration areas by creating unpaved parking lots, a green turf road to the skate park parking and green roofs on new buildings.

3. Improve water quality: Provides a 1.2 acre stormwater treatment demonstration area to clean and filter the water of a storm drain that flows into the river, creates vegetative swales to clean and filter runoff along parking areas, trails, and roads.

4. Educate the public about how their actions impact the river environment: Provides a trail along and interpretive signage about the storm water treatment area.

To preserve and enhance riparian habitat throughout the San Diego River Park

1. Enhance native habitat: Restores native habitat along the channel edge.

2. Maintain and improve habitat connectivity throughout the park and maintain connectivity for bobcats in the upper reaches: Maintains a habitat corridor through the river on site.

3. Integrate recreation in such as way as to minimize impacts on sensitive species: Provides the lowest impact activities adjacent to the most sensitive estuary habitat.

4. Facilitate education about the river environment: Provides increased opportunities to view the natural habitat by creating view spots and benches between the river and bike trail, provides interpretive signage about the wildlife of the estuary.

To provide access to recreation and activities throughout the San Diego River Park.

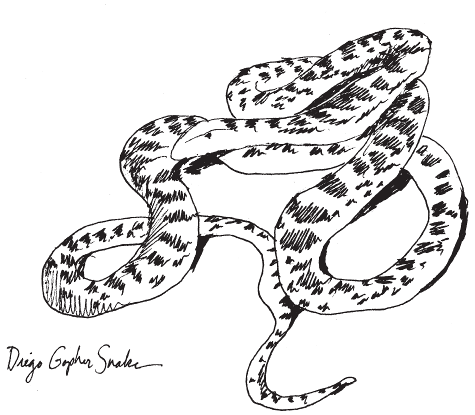
1. Connect existing recreational facilities: Connects the two recreational facilities of Robb Field and Dusty Rhodes to each other with a pedestrian and bicycle bridge and provides stronger connections to the river.

2. Provide a continuous trail along the length of the San Diego River: Enhanses an existing portion of the San Diego River Park trail through the park.

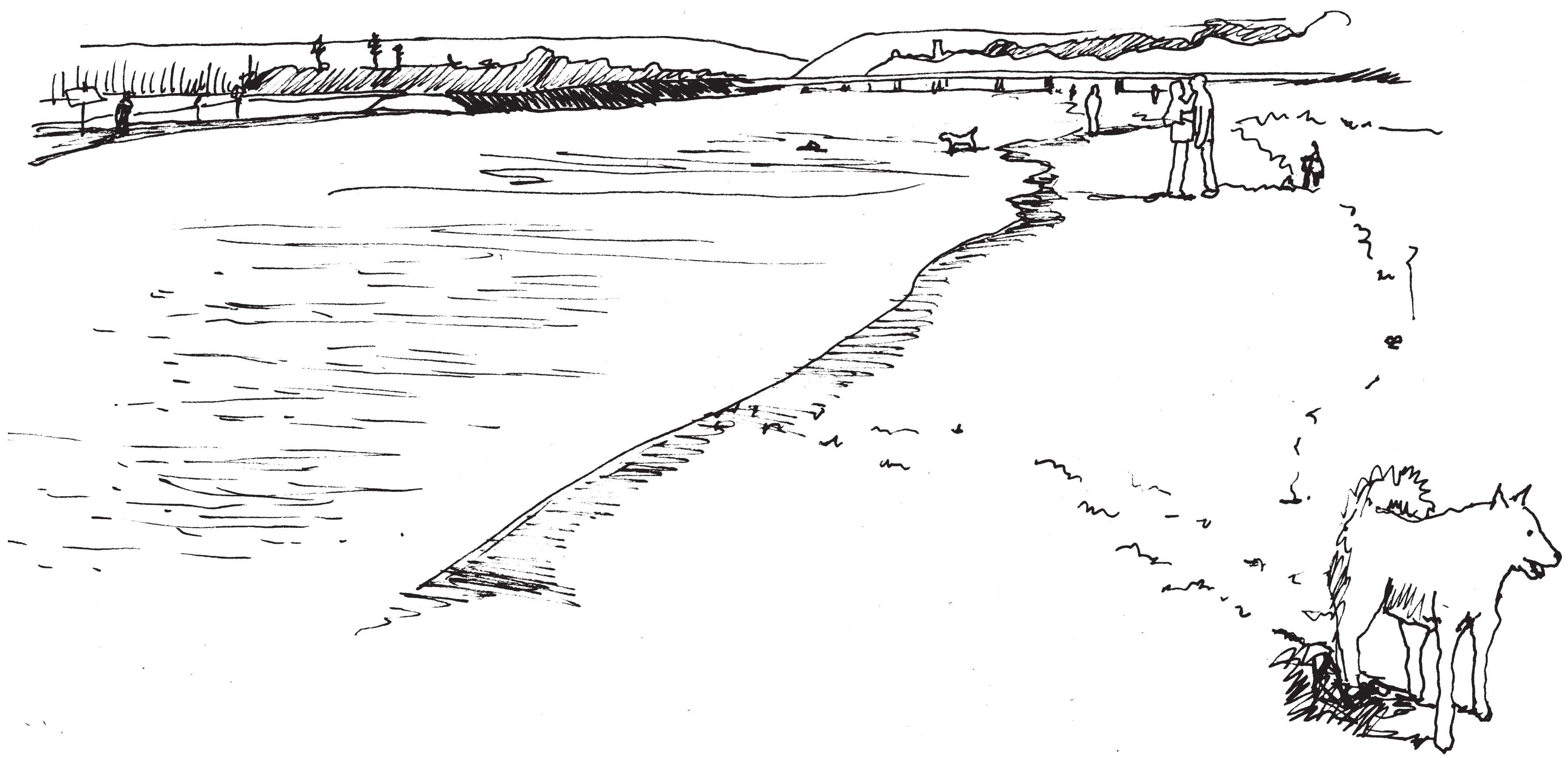
3. Provide additional recreational opportunities and improve trail connectivity from the region into the river park: Connects the two recreational facilities of Robb Field and Dusty Rhodes with a pedestrian and bicycle bridge, providing more convenient pedestrian and bicycle access from adjacent neighborhood.

4. Maintain and improve the natural aesthetics of the river corridor: Recognizes the river's presence at Robb Field by opening up the recreational fields to river views, replacing parking with recreational activities along the river edge, moving dumpsters from river edge to new parking lot, and creating a meandering path reflecting the river's natural state; utilizes native landscaping, preserves and restores native habitat.

5. Enhance educational opportunities along the river: Provides an important opportunity to educate the public about stormwater quality issues and how their actions affect the water quality in the estuary.



San Diego Gopher Snake



Appendices

APPENDIX A

PLANNING DOCUMENTS FOR THE SAN DIEGO RIVER

City of San Diego

Atlas Specific Plan
Prepared for: Atlas Hotels, Inc.
Prepared by: P&D Technologies, Inc. (1998)

City of San Diego Multiple Species Conservation: Subarea Plan
Prepared for: City of San Diego
Prepared by: City of San Diego Community and Economic Development Department (1997)

Famosa Slough Enhancement Plan
Prepared for: City of San Diego and California Coastal Conservancy
Prepared by: Pacific Southwest Biological Services (1993)

First San Diego River Improvement Project: Natural Resource Mangement Plan
Prepared for: City of San Diego
Prepared by: City of San Diego Park and Recreation Department and Ogden Environmental and Energy Services (2000)

First San Diego River Improvement Project Specific Plan
Prepared for: City of San Diego
Prepared by: Multiple Consultants (1994)

Levi-Cushman Specific Plan
Prepared for: Chevron Land and Development Company
Prepared by: Unknown (1987)

Mission City Specific Plan
Prepared for: H.G. Fenton Company
Prepared by: T&B Planning Consultants (1998)

Mission Valley Community Plan
Prepared for: City of San Diego
Prepared by: City of San Diego Planning Department (1998)

Mission Trails Regional Park Master Development Plan
Prepared for: City of San Diego
Prepared by: The Reynolds Environmental Group (1985)

Navajo Community Plan
Prepared for: City of San Diego
Prepared by: Navajo Community Planners and City of San Diego (1982)

Proposed Mission City Parkway Bridge and Associated Facilities Draft Environmental Impact Report
Prepared for: City of San Diego Engineering and Capital Projects Department
Prepared by: City of San Diego Development Services (2002)

Mission Bay Park Natural Resource Management Plan
Prepared for: City of San Diego Park and Receration Department
Prepared by: City of San Diego Development and Environmental Planning Department (1990)

San Diego River Bike Path Feasibility Study: Ocean Beach Bike Path to Hotel Circle North
Prepared for: City of San Diego
Prepared by: Kimley-Horn and Associates (2001)

Temporary Paradise?: A Look at the Special Landscape of the San Diego Region
Prepared for: City of San Diego
Prepared by: Kevin Lynch and Donald Appleyard (1974)

Tierrasanta Community Plan
Prepared for: City of San Diego
Prepared by: City of San Diego Planning Department and Tierra Santa Community Council (1982)

Trails for San Diego
Prepared for: City of San Diego
Prepared by: City of San Diego Planning Department (1966)

City of Santee

City of Santee General Plan
Prepared for: City of Santee
Prepared by: Mooney-Lettieri & Associates (1992)

Santee Town Center Specific Plan
Prepared for: City of Santee
Prepared by: City of Santee Department of Planning and Community Development (1986)

County of San Diego

Construction Stormwater Best Management Practices for Soil Disturbing Activities
Prepared for: County of San Diego
Prepared by: County of San Diego Department of Public Works (2001)

County of San Diego Multiple Species Conservation Program Subarea Plan
Prepared for: County of San Diego
Prepared by: County of San Diego (1997)

El Capitan Golf Course Final Environmental Impact Report
Prepared for: Helix Water District
Prepared by: EnviroMINE (1999)

Examination of the Meteorological Assumptions Underlying the Derivation of the
Standard Project Flood for the San Diego River
Prepared for: San Diego Floodplain Technical Committee
Prepared by: Phil Pryde (1972)

RiverWay: A Specific Plan for the Upper San Diego River Improvement Project
Prepared for: County of San Diego
Prepared by: Brian F. Mooney Associates (2000)

San Diego County General Plan: Lakeside Community Plan
Prepared for: County of San Diego
Prepared by: County of San Diego Department of Planning and Land Use (2000)

San Diego River Habitat Conservation Plan
Prepared for: San Diego Associations of Governments (SANDAG)
Prepared by: San Diego Association of Governments (1990)

San Diego River Project Conceptual Master Plan
Prepared for: County of San Diego
Prepared by: County of San Diego and Wirth Associates (1983)

San Diego River Project Base Data Report Planning Report
Prepared for: County of San Diego
Prepared by: County of San Diego Parks and Recreation Department (1979)

San Diego River Project Draft Environmental Impact Report
Prepared for: County of San Diego
Prepared by: Wirth Associates (1983)

2020 Cities/County Forecast: Land Use Inputs
Prepared for: San Diego Association of Governments
Prepared by: San Diego Association of Governments (1999)

State of California

Water Quality Control Plan for the San Diego Basin (9)
Prepared for: State of California
Prepared by: California Regional Water Quality Control Board San Diego Region (1994)

San Diego County Flood Hazard Investigation
Prepared for: State of California
Prepared by: State of California Resources Agency, Department of Water Resources (1964)

Federal Agencies

An Archaeological Survey of the San Diego River
Prepared for: U.S. Army Corps of Engineers
Prepared by: San Diego State University Foundation (1975)

Evaluation of the Mission, Santee, and Tijuana Hydrologic Subareas for Reclaimed Water Use, San Diego County, California
Prepared for: U.S. Geologic Survey
Prepared by: County of San Diego and California Department of Water Resources (1985)

San Diego River (Mission Valley) Design Memorandum No. 1
Prepared for: U.S. Army Corps of Engineers
Prepared by: U.S. Army Corps of Engineers, Los Angeles District (1975)

APPENDIX B-1

PLANTS AND ANIMALS:

Sensitive Species

COMMON NAME	SCIENTIFIC NAME	HABITAT
MESA CLUBMOSS	*SELAGINELLA CINERASCENS*	CHAPARRAL, RIPARIAN
PROSTRATE SPINE FLOWER	*CHORIZANTHE PROCUMBENS*	COASTAL SAGE SCRUB, CHAMISE CHAPARRAL
SAN DIEGO SAGEWORT	*ARTEMISIA PALMERI*	COASTAL SAGE SCRUB
SAN DIEGO THORNMINT	*ACANTHOMINTHA ILICIFOLIA*	CHAPARRAL, COASTAL SAGE SCRUB
AMERICAN BITTERN	*BOTAURUS LENTIGINOSUS*	FRESHWATER WETLANDS, SHORELINES
AMERICAN PEREGRINE FALCON	*FALIO PEREGRINUS ANATUM*	MARSH, OPEN WATER, RIPARIAN, COASTAL SAGE SCRUB, GRASSLAND
BALD EAGLE	*HALIAEETUS LEUCOCEPHALUS*	CHAPARRAL, GRASSLAND, OTHERS
BURROWING OWL	*ATHENE CUNICULARIA*	GRASSLAND
CALIFORNIA GNATCATCHER	*POLIOPTILA CALIFORNICA*	COASTAL SAGE SCRUB
CALIFORNIA LEAST TURN	*STERNA ANTILLARUM BROWNII*	SALT PAN, BEACH
COOPER'S HAWK	*ACCIPITER COOPERII*	FORESTED RIPARIAN WETLAND, OAK WOODLAND, GRASSLAND
GOLDEN EAGLE	*AQUILA CHRYSEATUS*	COASTAL SAGE SCRUB, CHAPPARAL, GRASSLAND AND OAK WOODLAND
GRASSHOPPER SPARROW	*AMMODRAMUS SAVANNARUM PERPALLIDUS*	GRASSLANDS, RIPARIAN AND WETALND COMMUNTITES
LEAST BELL'S VIREO	*VIREO BELLI PUSILLUS*	RIPARIAN WOODLAND, OAK RIPARIAN FOREST
LEAST BITTERN	*IXOBRYCHUS EXILIS*	FRESH AND BRACKISH WATER MARSHES, DESERT RIPARIAN HABITATS
LIGHT-FOOTED CLAPPER RAIL	*RALLUS LONGIROSTRIS LEVIPES*	SOUTHERN COASTAL SALT MARSH
NORTHERN HARRIER	*CIRCUS CYANEUS*	SALTWATER MARSH, FRESH WATER MARSH, GRASSLAND
SHORT EARED OWL	*ASIO FLAMMEUS*	MARSHES, COASTAL PLAINS, PRAIRIES AND SAGEBRUSH
SOUTHWESTERN WILLOW FLYCATCHER	*EMPIDONAX TRAILLII EXTIMUS*	RIPARIAN HABITATS , OPEN WATER, CIENEGAS, OR SATURATED SOIL
SWAINSON'S THRUSH	*CATHRUS VOLTULATUS*	CONIFEROUS OR MIXED FORESTS, RIPARIAN WOODLAND
TRICOLORED BLACKBIRD	*AGELAIUS TRICOLOR*	GRASSLAND, FRESHWATER MARSH, RIPARIAN SCRUB
YELLOW-BREASTED CHAT	*GEOTHLYPIS TRICHAS*	RIPARIAN SCRUB, MARSHES, SCRUB, GRASSLAND
CALIFORNIA LEGLESS LIZARD	*ANNIELLA PULCHRA*	SAND DUNES, CHAPARRAL, SAGE SCRUB, RIPARIAN SCRUB
ORANGE-THROATED WHIPTAIL	*CNEMIDOHPORUS HYPERTHRUS BELDINGI*	FORESTED RIPARIAN, OAK WOODLAND, GRASSLAND, COASTAL SAGE SCRUB
SAN DIEGO HORNED LIZARD	*PHRYNOSOMA CORONATUM BLAINVILLIEI*	COASTAL SAGE SCRUB, CHAPARRAL, RIPARIAN SCRUB, GRASSLAND
SOUTHWESTERN POND TURTLE	*CLEMMYS MARMOROTA PALLIDA*	OPEN AQUATIC, FRESH WATER MARSH
TWO-STRIPED GARTER SNAKE	*THAMNOPHIS COUCHI HAMMONDII*	RIPARIAN HABITATS, OAK WOODLANDS
BOBCAT	*FELIS RUFUS*	WIDE RANGING
MOUNTAIN LION	*FELIS CONCOLOR*	WIDE RANGING
RINGTAIL	*BASSARISCUS ASTUTUS*	CHAPARRAL, RIPARIAN FOREST
MULTICOLORED DARNER	*AESHNA MULTICOLOR*	AQUATIC LARVAE, CARNIVOROUS ADULTS
VARIEGATED MEADOWHAWK (DRAGONFLY)	*SYMPETRUM CORRUPTUM*	AQUATIC LARVAE, CARNIVOROUS ADULTS
VIOLET DANCER (BLUET)	*CALIFORNIA ARCOLISTES*	AQUATIC LARVAE, CARNIVOROUS ADULTS
HARBISON DUN SKIPPER (BUTTERFLY)	*EUPHYSUS VESTRIS HARBISONI*	FOUND IN MTRP

SPECIAL NEEDS AND COMMENTS	LISTING STATUS
LIES PROSTRATE ON OPEN SLOPES	CALIFORNIA NATIVE PLANT SOCIETY LISTING
OPEN SANDY SOILS	CALIFORNIA NATIVE PLANT SOCIETY LISTING
UNDERSTORY SPEICES, BELOW 600M IN SAN DIEGO COUNTY	CALIFORNIA NATIVE PLANT SOCIETY LISTING
CLAY AND GABBRO SOILS	USFWS: CANDIDATE FOR LISTING, CDFG: ENDANGERED
TALL EMERGENT VEGETATION, VEGETATIVE FRINGES	CDFG: SPECIES OF SPECIAL CONCERN
WILL NEST ON CLIFFS, BUILDINGS AND BRIDGES	USFWS: ENDANGERED, CDFG: ENDANGERED
FORAGES IN WETLANDS AND MARSHES, NEEDS ADJACENT PERCHES	USFWS: THREATENED, CDFG: ENDANGERED
NESTS IN BURROWS IN THE GROUND	CDFG: SPECIES OF SPECIAL CONCERN
6 TO 45 ACRE HOME RANGES	USFWS: THREATENED, CDFG SPECIES OF SPECIAL CONCERN
UNDISTURBED SPARSELY VEGETATED FLAT SANDY AREAS	USFWS: ENDANGERED, CDFG: ENDANGERED
HUNT FROM LOW PERCHES	CDFG: SPECIES OF SPECIAL CONCERN
NESTS IN CLIFFS AND LARGE TREES	BALD EAGLE PROTECTION ACT, CDFG: SPECIES OF SPECIAL
NESTS LOW IN GRASSES, MOWING CAN BE SERIOUS THREAT	CDFG: SPECIES OF SPECIAL CONCERN
NESTS 3' TO 4' FROM GROUND ALONG THICKET EDGES	USFWS: ENDANGERED, CDFG: ENDANGERED
NESTS IN DENSE, EMERGENT VEGETATION	USFWS: CANDIDATE FOR LISTING, CAFG: SPECIES OF
REQUIRES ABUNDANT CORDGRASS HABITAT	USFWS: ENDANGERED, CDFG: ENDANGERED
FORRAGE 4 MILES FROM NESTING SITES	CDFG: SPECIES OF SPECIAL CONCERN
FORRAGE IN RIPARIAN CORRIDORS	CDFG: SPECIES OF SPECIAL CONCERN
WILLOWS AND COTTONWOODS	USFWS: ENDANGERED, CDFG: ENDANGERED
MIGRATES ALONG RIPARIAN HABITAT CORRIDORS	CDFG: SPECIES OF SPECIAL CONCERN
HABITAT EDGES	CDFG: SPECIES OF SPECIAL CONCERN
NEST ON OR NEAR THE GROUND	CDFG: SPECIES OF SPECIAL CONCERN
SAND OR LOOSE LOAMY SOILS,	CDFG: SPECIES OF SPECIAL CONCERN
DENSE VEGETATION FOR COVER, HIDES UNDER SURFACE OBJECTS	CDFG: SPECIES OF SPECIAL CONCERN
ROCKY OR SHALLOW SANDY SOILS	CDFG: SPECIES OF SPECIAL CONCERN
ROCKS ALONG WATER EDGES	CDFG: SPECIES OF SPECIAL CONCERN
ASSOCIATED WITH PERMANENT OR SEMI-PERMANENT BODIES OF WATER	CDFG: SPECIES OF SPECIAL CONCERN
MAY UTILIZE RIPARIAN CORRIDORS	TOP PREDATOR
REQUIRE LARGE RANGES FOR ROAMING	TOP PREDATOR, PROTECTED BY MORATORIUM ON HUNTING
NOCTURNAL, ILLUSIVE	RARE
STILL PONDS, SLOW MOVING WATER, SEMI-AQUATIC	TOP INSECT PREDATOR
STILL PONDS, SLOW MOVING WATER, SEMI-AQUATIC	TOP INSECT PREDATOR, COMMON
STILL PONDS, SLOW MOVING WATER, SEMI-AQUATIC	TOP INSECT PREDATOR
CAREX SPISA IS SPECIFIC HOST FOR LARVAE, LOW TRICKLING WATER	CDFG: SPECIES OF SPECIAL CONCERN

Appendix B-2

PLANTS AND ANIMALS:

Community Descriptions

COMMUNITY	RIPARIAN	AQUATIC
TYPES	SOUTHERN RIPARIAN SCRUB	COASTAL VALLEY FRESHWATER MARSH ESTUARINE
	SOUTHERN RIPARIAN WOODLAND	DISTURBED WETLAND
	SOUTHERN COASTAL LIVE OAK RIPARIAN WOODLAND	SOUTHERN COASTAL SALT MARSH
	SOUTHERN COTTONWOOD-WILLOW RIPARIAN FOREST	INTERTIDAL
DESCRIPTION	WINTER-DECIDUOUS, DENSE, WATER-LOVING SHRUBS	FRESH, BRACKISH AND SALT WATER COMMUNITIES.
	AND TREES. SOUTHERN CALIFORNIA'S FALL COLOR.	IN WATER OR ALONG THE EDGES.
	ALONG WATER COURSES.	
PREDOMINANT PLANTS	COTTONWOODS (POPULUS FREMONTII),	FRESHWATER: CATTAIL (*TYPHA LATIFOLIA*),
	WESTERN SYCAMORES (*PLATANUS RACEMOSA*),	CALIFORNIA BULRUSH (*SCIRPUS CALIFORNICUS*).
	WILLOWS (SALIX SPP.),	BRACKISH OR SALT WATER: EELGRASS (ZOSTERA MARINA),
	WHITE ALDERS (ALNUS RHOMBIFOLIA),	CORDGRASS (SPARTINA FOLIOSA)
	MULEFAT (BACCHARIS SALICIFOLIA)	
ASSOCIATED WILDILFE	MANY INSECTS, AMPHIBIANS AND BIRDS INHABIT	AQUATIC RESOURCES DRAW VERY LARGE DIVERSITY OF
	RIPARIAN COMMUNITIES. RIPARIAN BIRDS SUCH AS	MIGRATORY AND RESIDENT BIRD SPECIES, SOME THAT
	LEAST BELL'S VIREO AND SOUTHWESTERN WILLOW	ARE RARE OR ENDANGERED INCLUDING LIGHT-FOOTED
	FLYCATCHER ARE ENDANGERED DUE TO HABITAT LOSS.	CLAPPER RAIL AND CALIFORNIA LEAST TURN. FISH,
	MANY OTHER BIRDS AND MAMMALS INCLUDING BALD	CRUSTACIANS, INSECTS, AND AMPHIBIANS
	AND GOLDEN EAGLES, COOPER'S HAWKS,	MAY BE ABUNDANT.
	BOBCATS AND COYOTES USE THIS COMMUNITY	
	FOR FORAGING, HUNTING OR MIGRATION	

COMMUNITY	CHAPARRAL	COASTAL SAGE SCRUB	OAK WOODLAND
TYPES	SOUTHERN MARITIME CHAPARRAL NORTHERN MIXED CHAPARRAL CHAMISE CHAPARRAL	DIEGAN COASTAL SAGE SCRUB	DENSE COAST LIVE OAK WOODLAND MIXED OAK WOODLAND
DESCRIPTION	TALL, OFTEN IMPENETRABLE, EVERGREEN SCRUB COMMUNITY ADAPTED TO LONG, DRY SUMMERS. DRY SOUTH FACING HILLSIDES.	FRAGRANT, DROUGHT-DECIDUOUS LOW GROWING SCRUB COMMUNITY. ALLUVIAL SOILS AT LOW ELEVATIONS.	EVERGREEN, BROAD-LEAF TREES WITH SCRUB AND GRASSLAND UNDERSTORY. DEEP SOILS IN CANYONS AND NORTH FACING HILL SIDES.
PREDOMINANT PLANTS	LAUREL SUMAC (*MALOSMA LAURINA*), SUGARBUSH (*RHUS OVATA*), LEMONADEBERRY (*RHUS INTEGRIFOLIA*), CHAMISE (*ADENOSTOMA FASCICULATUM*)	CALIFORNIA SAGEBRUSH (*ARTEMISIA CALIFORNICA*), CALIFORNIA BUCKWHEAT (*ERIOGONUM FASCICULATUM*), SAGES (*SALVIA SPP.*), MONKEYFLOWERS (*MIMULUS SPP.*)	COAST LIVE OAK (*QUERCUS AGRIFOLIA*), POISON OAK (*TOXICODENDRON DIVERSILOBA*), TOYON (*HETEROMELES ARBUTIFOLIA*), FUCHSIA-FLOWERING GOOSEBERRY (*RIBES SPECIOSUM*)
ASSOCIATED WILDILFE	BIRDS ARE PREDOMINANT DIURNAL (DAY TIME) SPECIES. INSECTS, REPTILES AND SMALL NOCTURNAL MAMMALS ARE NUMEROUS. PREDATORS SUCH AS MOUNTAIN LIONS, BOBCATS, GREY FOXES, COYOTES, HAWKS AND EAGLES HUNT IN THESE AREAS.	SIMILAR TO CHAPARRAL SPECIES.	SMALL MAMMALS AND BIRDS THAT EAT ACORNS, SALAMANDERS, REPTILES, SNAKES AND MANY BIRDS ARE ABUNDANT. PREDATORS SUCH AS HUNT IN MOUNTAIN LIONS,BOBCATS, GREY FOXES AND COYOTES THESE AREAS.

APPENDIX B-3

PLANTS AND ANIMALS

Invasive Exotic Plants Species of the San Diego River

Arundo donax	giant reed
Brassica nigra	wild mustard
Chrysanthemum coronarium	giant chrysanthemum
Conzyza canadensis	horseweed
Cortaderia selloana	pampas grass
Cynodon dactylon	Bermuda grass
Eichornia crassipes	water hyacinth
Eucalyptus spps.	eucalyptus species
Fraxinus spps.	ash species
Hydrilla verticillata	hydrilla
Melilotus albus	white bee clover
Melilotus indicus	yellow bee clover
Nicotiana glauca	wild tobacco
Osteospermum fruiticosum	African daisy
Pennisetum clandestinum	kikuyu grass
Pennisetum ruppelii	pink fountain grass
Pennisetum setaceum	fountain grass
Phoenix canariensis	Canary Island date palm
Phragmites communis	common reed
Raphanus sarivus	wild radish
Ricinis communis	castor bean
Salsola iberica	Russian thistle
Schinus molle	California pepper
Schinus terebinthifolia	Brazilian pepper
Sonchus asper	sow thistle
Tamarix spps.	tamarisk species
Washingtonia spps.	Mexican and California palms

Based on FSDRIP Natural Resource Management Plan (2000)

APPENDIX C-1

COMMUNITY WORKSHOPS

Community Visions

At each of the community workshops, participants were asked to describe their personal "visions" for the river park. Participants called out their ideas for inclusion on a large visions list. At the completion of the excercize, participants were given two stickers to vote on their two favoirte visions for the river park. Following is a list of the visions and the vote count for each.

Visions gathered from the San Diego River Coalition on February 15, 2002

Cultural and historic features (3)
Recreation (6)
Natural park (5)
Clean water (4)
Habitat (4)
Historical (4)
Native vegetation (4)
Biking (3)
Educational facility (3)
Natural floodplain (3)
Wildlife (3)
Ecotourism (2)
Park versus preserve (2)
Remove concrete channels (2)
Volunteerism (2)
Wild and Scenic River (2)
Community asset (1)
Community bonding and focal points (1)
Compatible economic uses (1)
Contiguous (1)
Families (1)
Fishing (1)
Flood control (1)
Ground-water recharge (1)
Improve the watershed (1)
Kayaking (1)
Minimize edge effects (1)
Ownership (1)
Pedestrian walkways (1)
Picnics (1)
Preserve versus park (1)
Pride (1)
Relatively isolated (1)
Remove nonnatives (1)
Restore (1)
River sounds (1)
Stewardship (1)
Succession (1)
Tourist attraction/destination (1)
Tranquil (1)
Unconfined (1)

Visions gathered from the community meeting held in Mission Valley on February 21, 2002

User-friendly walking / jogging / bike / equestrian paths (10)
Abundant wildlife habitat (6)
Interpretive displays / historic (5)
Loop trail (4)
Preserve in tributaries (4)
Natural ecological / hydrological functions (4)
Preservation of Dog Beach (4)
Natural Park (4)
Remove exotics (plants) (4)
Cafes and shops (3)
Camping (3)
Canoe / kayak (3)
Ecotourism (3)
Flood control – no channel (3)
Reintroduce steelhead trout and other species (3)
Showcase alternative energy (3)
Tie rails / bike racks (3)
Balance of natural flow with safety (2)
Child-friendly education (2)
Open space (2)
Outdoor amphitheater (2)
Picnic areas (2)
Public transportation access (2)
Resort facility, hotel, B&B (2)
Restorations of mining (2)
River through time (2)
Run-off control/ capture (2)
Water quality clean enough to swim in (2)
Call boxes (1)
Commercial sponsorship (1)
Connected (1)
Contemplative places (1)
Continuous and frequent accessibility (1)
Design for flood (1)
Different moods (1)
Disability access (1)
Dry season concerns (1)
Entry statement (1)
Fishing (1)
Geology / morphology made visible (1)
Groundwater (1)
Keep park feeling (1)
Leash free dog areas (1)
Lighting (1)
Maintenance of waterway (1)
Multi-cultural aspect (1)
Native American representation (1)
Unobtrusive W.C. (1)
Patrols (1)
Plant I.D. (1)
Pollution control (1)
Public art (1)
Safety (1)
Swallows (1)
User-friendly (1)
Viewpoints (1)
Visible waterway (all the way) (1)

Visions gathered from the community meeting held in Lakeside on February 28, 2002

Trail from El Capitan to ocean (12)
Senior / 13-15 league baseball (12)
Riparian habitat (10)
Equestrian trails (9)
Interpretive trails (7)
Water clean enough to canoe (6)
Wetland restoration (6)
Roller hockey (5)
Environmental education (4)
Bike trails (4)
Abundant wildlife habitat (3)

Dedicated trails (3)
Historic markers / interpretive sites (3)
Historical building park (3)
Invasive/exotic free (3)
Open space between projects (3)
Water quality monitoring (3)
Continuous trees (2)
Natural and cultural center (2)
Natural area / narrow trails (2)
School programs (2)
Walkable community connectors (2)
Benches (1)
Clean / crime free (1)
Community garden (1)
Continuous riparian with core areas, no non=natives (1)
Design standards (1)
Drinking fountains (1)
Fishing (1)
Fitness trail (1)
Lighting / passive (1)
Limit urban development (1)
Lookout spots (1)
Natural flood-plain (1)
Natural shade (1)
No asphalt trails/earth-based (1)
Offsite parking (1)
Picnic areas (1)
Quiet places (1)
School projects / community groups (1)
Small amphitheater (1)
Staging areas (unpaved) (1)
Strategic sanitary service (1)
Volunteer cleanup (1)
Volunteer patrols (1)

APPENDIX C-2

COMMUNITY WORKSHOPS:

Opportunities and Constraints

Summaries of input from the community meeting mapping exercises per reach. Many great opportunities and constraints were gathered for each reach of the river park. They have been consolidated to best communicate the input.

Headwaters

The opportunities that were expressed for the Headwaters include:

- Connect with the Trans County Trail at northern tip of El Capitan Reservoir
- Promote Wild and Scenic River designation, including Cedar and Boulder Creek
- Promote Wilderness proposal for Eagle Peak
- Become a field study area for community research
- Preserve the historic olive orchard along the river
- Connect to hiking destination areas such as Casa Grande Indian Mission and an oak woodland

The constraints that were expressed for the Headwaters include:

- Access is difficult because of extremely rugged terrain
- Negative impacts that occur by human access to remote areas such as Cedar Creek Falls

Reservoir to 67

The opportunities that were expressed for the reservoir to 67 Freeway include:

- Include the proposed trail connection from El Monte Park to Blossom Valley

Provide a future trail from Lake Jennings to El Monte Park

- Run the river trail on the south side of the river with access points
- Collaborate with the new golf course

Provide El Cajon Mountain connection

Access the Flume Trail from river

The constraints that were expressed for the reservoir to 67 Freeway include:

- Access the El Capitan Dam
- Obstacles of accessing through the future golf course

Lakeside

The opportunities that were expressed for Lakeside include:

- Provide access to many possible connecting trails
- Provide trail access from Eucalyptus Hills to the river as well as fishing and equestrian access
- Protect the water supply of the Lakeside / El Monte Water District
- Obtain grants for restoration projects
- Reclaim and incorporating the sand mining ponds
- Run the river trail on the north side of the river

The constraints that were expressed for Lakeside include:

- MTBE contamination site south of river

industrial pollution

- Homeless that inhabit river corridor areas
- Inadequate bridge across Wildcat Canyon
- Bridge will be necessary to cross at Channel Road
- Access through the 67 overpass
- Planned road encroachment on river
- Trails versus sand mining conflict
- No access from Riverford Road

Santee

The opportunities that were expressed for Santee include:

- Utilize the Town Center Park as an educational opportunity
- Acquire the vernal pools in Santee and linking them to the river park
- Purchase land for restoration in mining areas
- Provide trail access through quarries
- Provide trail connections to Santee Lakes
- Provide access through the golf course
- Provide trail connections to San Vicente Reservoir

The constraints that were expressed for Santee include:

- Homeless that reside near bridges
- Asphalt processing plant along San Vicente Creek
- Water quality issues from the water treatment plant
- Forrester Creek is 90% channelized

The opportunities that were expressed for Mission Trails Regional Park include:

- Connecting the trail runs through the park on the south side of the river to its adjacent areas
- The great inspiration that MTRP offers for the river park
- Provide trail access to Little Sycamore Creek
- Enlarge the equestrian trailhead at the parks eastern access point.

The were no constraints mentioned for Mission Trails Regional Park.

Mission Valley

The opportunities that exist for Mission Valley include:

- Develop park between new mission valley library and the river at existing practice field

- Redevelop portion of Qualcomm Stadium for active recreation and future park use
- Connecting the river park to the Presidio Park and Old Town, Mission de Alcala and the Native American historic settlement to its east
- Transient problems near and underneath bridge structures
- Moving sewer line out of the river that exists from edge of MTRP to Admiral Baker Golf Course
- Incorporating the proposed trail from Admiral Baker Golf Course to 15 Freeway
- Restore the natural lowlands that exist just south of the Admiral Baker Golf Course
- Locate constructed wetlands or offline retention ponds for water quality improvements
- Remove concrete channel north of Alvarado Creek
- Use impervious surfaces or other necessary paving projects
- Coordinate with Army Corps of Engineers to allow mitigation to be directed upstream for weed removal
- Provide a patrol
- Provide pedestrian access in Mission Valley Preserve
- Potential for a "natural park" in what is now the Mission Valley Preserve
- Provide trail access through the golf courses
- Add trees to Qualcomm parking lot
- Acquire the undeveloped land east of Town and Country with high restoration potential
- Acquire the land just east of the 805 freeway for the river park

cluster of riverside shops, cafes to evoke a sense of casual usage

- Promote shops to design towards the river, Friars Village on the south side of the river is a good place to start
- Install a hard surface trail from MTRP to Mission Bay for bicycle commuting
- Link to public transportation access
- Include child friendly education
- Showcase alternative energy uses near Qualcomm Stadium
- Act as a pedestrian friendly link for hotel guests
- Provide access to backside of Qualcomm Stadium
- Provide access to Adobe Falls' future park
- Install signage to river about the river at trolley stations
- Refurbish railroad bridge for pedestrian and bike crossing
- Bring active life to the river by allowing shops adjacent to trolley stops
- Expand trail through Levi-Cushman Specifc Plan
- Clean-up water quality at Qualcomm Stadium
- Daylight the channelized Alvarado Creek

The constraints that were expressed for Mission Valley include:

- Active quarry south of MTRP
- Endangered species exist along corridor
- Federal golf course difficult to acquire land
- Golf courses not compatible with a river park
- Buildings are too close to the flood plain
- Traffic noise in general
- Need better access to cross major roadways in USDRIP
- 163 freeway is difficult to cross
- Safety concerns near Mission Valley Preserve
- Homeless people

Estuary

The opportunities that were expressed for estuary include:

- Make the area visually look like river
- Mimic the trail layout to the river's flow
- Encourage bicycling
- Access works well for bicyclists
- Add additional restrooms, benches and water fountains
- Install riverway signage (throughout river park)
- Improve parking at access to Ocean Beach
- Provide ocean education
- Allow horseback riding access on beach
- Fill and revegetate riprap
- Remove fill material from under the 5 Freeway bridge which is currently a truck parking lot
- Remove concrete channel
- Remove freeway and allow Famosa Slough to connect directly to the river
- Reconnect river to Mission Bay
- Extend trolley line
- Incorporate a boardwalk
- Install bilingual signage
- Interpretive signage regarding specific facts and tools for action
- Design a labyrinth for meditative walking
- Visually connect to Famosa Slough

The constraints expressed for the estuary included:

- Sea World expansion encroachment

APPENDIX C-3

COMMUNITY WORKSHOPS

Participants

February 15, 2002
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Gail Sabbadinni, Lakeside Frontier Riders
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We would like to thank everyone for atternding and participating in these workshops.

APPENDIX D

OPPORTUNITY ANALYSIS BY REACH

The matrix looks at the opportunities presented for historical recognition, water management, plants and anim-las and recreationa and education in each of the river's seven reaches. This suitability analysis helped to build the Design Recommendations portion of the Conceptual Plan.

		Headwaters	Reservoir to 67 Fwy	Lakeside	Santee	Mission Trails Regional Park	Mission Valley	Estuary
Historical Recognition	Kumeyaay Reservations	●						
	Large Parks	●				●		
	Developed Historic Sites	●				●	●	
	Kumeyaay Village Sites	●				●	●	●
	Agricultural History	●	●	●				
	Management	●	●	●	●	●	●	●
	Catalyst for Interest	●	●	●	●	●	●	●
	Transportation Route	●	●	●	●	●	●	●
	San Diego Infrastructure	●	●	●	●	●	●	●
	Hydrological Engineering	●	●	●	●	●	●	●
Water Resources	Free Flowing Portions	●	●	●	●	●	●	
	Mining Restoration		●	●	●		●	
	Permeable Surfaces	●	●	●	●	●	●	●
	Prevent Development	●	●	●	●	●	●	●
	Remove Non- Natives		●	●	●	●	●	●
	Facilitate Education	●	●	●	●	●	●	●
	Maintain Habitat	●	●	●	●	●	●	●
	Promote Management	●	●	●	●	●	●	●
	Vegetation Filters	●	●	●	●	●	●	●
	Promote Education	●	●	●	●	●	●	●
Plants and Animals	Habitat Protection	●	●	●	●	●	●	●
	Habitat Restoration	●	●	●	●	●	●	●
	Mining Restoration		●	●	●	●	●	
	Management	●	●	●	●	●	●	●
	Water Quality		●	●	●	●	●	●
	Habitat	●	●	●	●	●	●	●
	Bobcats	●	●	●	●			
	Horseback Riding	●	●	●	●	●		
	Decreased Disturbances	●	●	●	●	●	●	●
	Plants and Animals	●	●	●	●	●	●	●
	Disturbances	●	●	●	●	●	●	●
	Outdoor Laboratory	●	●	●	●	●	●	●
Recreation and Education	Existing Rec. Facilities	●	●	●	●	●	●	●
	Existing Trails	●	●	●	●	●	●	●
	Additional Rec. Facilities	●	●	●		●	●	●
	Additional Trails	●	●	●	●	●	●	●
	Schools, Colleges and Universities	●	●	●	●	●	●	●
	Interpretive Resources	●	●	●	●	●	●	●

APPENDIX E

PRESERVING FLOODPLAINS AS OPEN SPACE AMENITIES

By Leslie Redick

The Balance Between Nature and Floodplain

Rivers play a critical role in the development of our society. Our relationship with water through time has been one of dependence, abundance, and catastrophe. Dependence led to the early development of river flood plains as bases for agriculture and transportation. The abundance afforded by these river resources attracted more settlement and more structures were built in the flood plain. This settlement in the floodplain has reached the point in many parts of the world where a flood equals a catastrophe in loss of property and lives. How can we find the balance between floodplain settlement and natural river ecology? How do we manage suburban river corridors and strike a balance between ecological, recreational, and built systems? How can we sever the connection between the words flood and catastrophe?

These questions are particularly difficult when flood planning is attempted in an already developed flood plain. Furthermore, as landscape architects, what is our specific contributing role to the issue of flood management? Perhaps it is in looking at what has been done before in both structural and non-structural flood control, then subsequently looking forward with creative design solutions which take into consideration natural stream processes, water quality, recreation, safety, and protecting a sense of place.

Flood Management

Urbanization of the floodplain will continue and flood control will always be an issue. Consequently, the question becomes what form this flood control takes. There are two basic classifications of flood management, structural and non-structural. Structural modifications pertain to the protection of settled areas and quick removal of water, whereas non-structural modifications involve changes in human activity to accommodate the flood. Often times the two methods coexist. Many people forget that they live in a flood plain until it is too late and a flood has destroyed their home. Often the first reaction is to look for structural answers to abate the floodwaters.

Both structural and non-structural flood control practices are based on controlling the 100-year floodplain. This planning assumes that the numbers derived to estimate the 100-year flood are accurate and consistent. Unfortunately, in the arid southwest of the U.S., high precipitation does not necessarily equal a flood and most damage from floods occurs in cycles much shorter than 100 years.

Federal Guidelines for Insurance Zoning

The U.S. National Flood Insurance Program is based on the 100-year floodplain. The designated area is divided into the floodway, where most frequent flood flows occur, and the floodway fringe, an area which would receive light flooding in a 100-year flood. Buildings in the floodway are not eligible for insurance, but the fringe is allowable if the structures are flood-proofed. Yet, damage still occurs. The flood insurance program was designed as a way of curbing development in the flood plain, yet in a way it has opened the door for more by offering a false sense of security. Another choice in preventing development would be to rezone land. Often times it is too late to have property owners relocate and so engineering changes seem to be the next choice. Unfortunately these methods are expensive, ecologically damaging, and can exacerbate the problem.

Structural management

An engineered solution to flood control can take many shapes. Most often it is in the form of a concrete lined channel that straightens the meander of a river and is meant to increase the channel capacity and remove water from the site as quickly as possible. These channels have many unforeseen consequences. The channels alter flow velocities, in turn altering sediment distribution which affects invertebrates and fish. The removal of riparian habitat reduces organic matter and nutrient input as well as habitat diversity and cover. There is also a chance of an increase in water temperature that directly affects habitat on site and all the way down to the ocean.
Channel stabilization is another method of artificially strengthening stream banks against erosion. It can be done in many ways, including riprap with vegetation to reduce soil erosion, especially during floods. Although these structures may work well on site, they can trigger upstream and downstream channel adjustments that can increase flood hazards and sediment transport. (Wohl,'00)

These engineered solutions offer a quick fix, but unfortunately, floods, especially in arid climates, are unpredictable as to their timing and magnitude. Even an engineered flood control channel can overrun its banks. The channels provide a misleading sense of security that encourages human occupation of the floodplain. The Flood Control Acts of 1928 and 1936 were the first steps the government took to involve themselves in flood control. The U.S. Army Corps of Engineers was responsible for building reservoirs and channels along tributaries and primary river systems (Littleworth, '95). Despite these efforts, flooding continues to be a problem. In the last century, the rise in human population-density and rising land costs, as well as the sense of security from flooding as the result of new reservoirs and channels, have encouraged increased development in the flood zone. These developments expose more people and structures to flood damage. The encroachment of more structures into the floodplain leads to a loss in flood storage capacity, increasing velocity and flood elevation, and increasing peak flows downstream (Wohl, '00).

Solving the flooding problem with structural methods creates many more problems in its wake. The riparian community of plants is greatly reduced, thereby reducing vital habitat for native animal species. Sediment is prevented from the flow that eventually leads to the development of beaches. So the money spent to channelize a river is spent again, further down the line, by having to dredge sand from the ocean floor to replenish the beaches. Groundwater recharge is also severely affected. Water is rushed out as quickly as possible, never given a chance to infiltrate, thus leading to groundwater depletion.

Non-Structural Management

Non-Structural flood control measures are also subject to unpredictability in their containment of floodwater. But philosophically, these non-structural methods are set up as prevention rather than cure. This approach comes with the attitude that we must adapt our lives to water fluctuations. No matter what we do, floods will be a part of life in the flood plain. Non-structural measures include flood proofing, land-use planning, soil bioengineering, warning systems, pre-flood mitigation efforts, and insurance. Until the 1970s, most flood loss reduction efforts were based on structural solutions. The shift presently has been to a mix of structural/non-structural methods.

One the best strategies for reducing property losses is through public acquisition of land. More than 30 years ago the U.S. established a cost sharing program for relocation. The properties are purchased with FEMA funding, and the Army Corps of Engineers has also purchased property that was left as open space. Land use control is one the most effective ways to prevent flood damage. A floodway left undeveloped through an urban area can be beautiful park asset.

Creative Design Solutions

In the past, improving rivers meant increasing their flow capacity. In the future, it should refer to the capacity of the floodplain to function as a visual amenity, a recreation area, a nature preserve, a storm detention area, and a movement corridor for humans and animals. Multi-purpose planning can help change the definition of the river into more than a channel for water. Flood risk can be managed by detaining storm water and letting it infiltrate, and vegetated roofs could decrease flooding, along with porous paving. Wetlands can also serve many ecological functions. Plants and aquatic life clean surface and groundwater, and reduce flooding by acting like natural sponges, storing storm water and slowly releasing it back to natural waterways. Wetlands also provide habitat and decrease the velocity of storm water that allows the sediments to settle out. Plants can synthesize organic pollutants such as oils and greases and use minerals from runoff for nutrients.

Innovative examples

Citizens of Denver have transformed a ten-mile derelict stretch of the South Platte River that runs through downtown Denver, into a park full of recreational opportunities, active and passive. As a result of a disastrous flood in 1973, more attention was brought to the flooding issue and a nine-member task force was set up to raise money for park projects. The Platte River Greenway, linking eighteen parks with fifteen miles of interconnected trails, is the result. When complete, the greenway will extend twenty-five miles north to the Rocky Mountains and twenty miles south to a state recreation area. Local communities were encouraged to develop trails along the greenway making the park a huge recreational resource while also providing habitat and flood control. All of the parks along the floodway are designed to resist flood damage, but also to provide flood storage. The efforts of both public and private organizations, and individual citizens, helped create this greenway. The Platte River Greenway Foundation funded and implemented the projects and then handed over management to the city's park department.

The Guadalupe River Park, another example of an innovative solution to flood control, is a three-mile ribbon of parkland currently being developed along the banks of the Guadalupe River in downtown San Jose. Efforts by the Friends of Guadalupe Park have contributed to the collaboration among government agencies and community interest groups to solve problems related to the Guadalupe River Flood Control project. The park provides an integrated approach to providing flood protection, habitat creation, and recreational opportunities. The landscape architecture firm of Hargreaves and Associates is currently designing the park. It is meant to be an example of a modern flood control project integrated with a major recreation park and wildlife habitat. The river park plan consists of a grading plan for the flood control channel which includes undulating terraced banks and landforms, obviously manmade, as a backbone to the natural riverbank landscape. The lower section of the park is meant to serve as a flood retention basin.

The Indian Bend Wash Flood Control Project located in Phoenix, Arizona took on a major enhancement project with the Salt River. This project aimed to limit development in the floodplain. The concept for the plan was to confine the flood to its natural path with structural elements and then enrich the natural path with golf courses, trails, picnic areas, ball fields, and other recreational features. The wash was designed to safely handle the 100-year flood. At the core of the project is a greenbelt which runs through Scottsdale. The channel conveys flood flows through Scottsdale to the Salt River. The project was designed and constructed by the U.S. Army Corps of Engineers.

Institutional Involvement in Flood Control Restructuring.

In 1998 the U.S. Army Corps of Engineers began to focus on more sustainable approaches to flood control. The Corp's claims are: "Through its focus on nonstructural alternatives to flood protection, it will move families and businesses out of harm's way and strive to return the floodplains of rivers and creeks to a condition where they can naturally moderate floods as well as provide other benefits to communities and the environment"(Wohl, 2000).

"The United States is coming to appreciate the full significance of the fragile ecosystems that border rivers. When development takes place in flood plains, when river channels are straightened, and when locks and dams are built, wetlands and aquatic habitats are eliminated and species are lost" (Littleworth). Flood plains make an important contribution to regional open space networks. Zoning of these areas should be as agriculture and open space to best preserve the natural river ecology and the safety for the communities on the fringe.

"The maintenance of the regional setting, the green matrix, is essential for the culture of cities…" (Spirin) Riverbeds in their natural state represent the resolution of many forces. The changing edges of the channel and the flow patterns hold great significance. The visible effects include runoff control, sediment deposition and flood control. The less visible affects of infiltration and transpiration hold just as much importance. When disturbed in any way, the balance is thrown off and usually has negative affects on communities downstream. Improvements to river systems may be necessary in urban settings. These changes should only be made with a thorough understanding of the future effects upon the ecosystem.

The Wisdom of Non-structural Solutions

Reservation of floodplain lands as open space corridors and wildlife habitat, bank stabilization by replanting with native riparian species, and bed stabilization by restoration of a pool-riffle sequence are all examples of nonstructural approaches to flood hazards that benefit river ecosystems and, in the long run, are economically more viable than traditional river engineering. All of these nonstructural elements could be incorporated into a river park that could serve as a source for rejuvenation of the local community and for the river itself.

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APPENDIX F

DESIGNING RIPARIAN CORRIDORS FOR BIODIVERSITY

By Sarah Easley

Introduction

Biodiversity can be described as the diversity of living things and their life patterns and processes. More specifically, it is defined as the diversity of species, ecosystem structures and ecosystem functions; it includes the diversity of life at all scales, including genetic, species, population, ecosystem, landscape and region. Biodiversity on earth has fluctuated through time, and periods of extinction have been followed by periods of expansion. Today, however, the rate of extinction is approaching an all time high, and it is human activity that accounts for most modern species loss (Grumbine, 1992).

The magnitude of the global loss of biodiversity is one of the most significant environmental issues of our time. Our planet's biodiversity is an irreplaceable resource, providing adaptability for an uncertain future. Loss of biodiversity is occurring in areas all over the world, and America is no exception. Our sprawling, land-intensive patterns of urban and suburban growth have lead to inevitable conflicts between development and habitat. The potential for loss of our biodiversity increases as habitat become increasingly isolated and fragmented (Beatley, 1994).

This loss and isolation of habitat is the most serious threat to global biodiversity today, and in our modern world, it seems to be an unstoppable phenomenon (Collinge, 1996). But if the reduction of biodiversity is to be slowed or stopped, this issue must be addressed. Fragmentation, dissection, perforation, shrinkage and attrition are all ways in which habitat areas can be lost or isolated over time. In the face of these pressures, it becomes increasingly important to provide landscape connectivity (Hansen and di Castri, 1992). Habitat corridors provide one means of maintaining these connections (Collinge, 1996), and a growing empirical body of knowledge is showing the many benefits of high quality linkages, such as biological corridors, between habitat patches (Dramstad et al., 1996).

A biological corridor can be defined as a strip, swath or other functional habitat that allows species to move between otherwise isolated patches (Grumbine, 1992). Riparian corridors are among the most basic of corridor types. Even in the undeveloped landscape, riparian corridors facilitate the movement of many species, while in the developed landscape, this function becomes even more critical. With increasing numbers of tributaries in the system, the size of the riparian network increases, as does the ecological integrity. An ideal riparian network contains the habitat corridors of a river or stream and all of its tributaries linked together through a self-sustaining water system (Marsh, 1998).

Stream corridors offer exceptionally diverse environments, and often support the highest species richness in a given landscape. Especially in dry areas, the riparian corridors can be seen as a linear oasis, containing high numbers of rare species. Besides providing habitat to riparian species, these areas also provide water, food or shade to many species in the surrounding habitat matrixes (Forman, 1999). Beyond biodiversity, these corridors play major roles in protecting the integrity of riparian processes by controlling water and minimizing nutrient flows (Forman and Godron, 1986).

The planning and design of riparian corridors is complex and challenging with many factors that must be considered for successful establishment. Through careful design, however, riparian habitat corridors can help maintain regional biodiversity and sustain natural riparian processes in a future increasing land development.

Riparian Habitat Corridors in the Urban and Suburban Setting

Corridors are most likely to be established in rural settings, which is especially important when those areas are anticipated to be developed. However, their identification and preservation in urban and suburban areas can provide important linkages to habitat areas in more rural settings. These corridors in developed areas should be designed and managed with special attention to discouraging human harassment of wildlife and to providing adequate width for wide ranging species (Smith and Hellmund, 1993).

In many urban and suburban landscapes, riparian corridors have been left undeveloped by default, because of their natural tendency for flooding. Remnant natural systems, unbuildable stream corridors, empty lots and unmanicured properties, provide refuge for many native species in the built environment. It is these remnant pieces that may form the basis to bring natural processes back into urban and suburban environments (Hough, 1995). These accidental remnants though often significantly altered by human activities, can be highly valuable habitat if managed and preserved properly (Gilbert, 1989). Riparian areas have rich alluvial soils and associated high biological diversity. They often provide moderated microclimates due to the presence of shade and water. Abundant insects and plants are available to feed wildlife, and tree cavities and dense growth can provide shelter for birds and mammals.

The density of vertebrate species is especially high in riparian landscapes in comparison to surrounding habitats. This is particularly true in the arid southwest where riparian areas are often the sole low lying landscapes with native trees and tall shrubs. Many plant and animal species are riparian obligates, that is they are found only in riparian areas. In Southern California, many of these species are rare or endangered due to increasing human development, and so conservation of riparian land becomes increasingly important (Smith and Hellmund, 1993).

Function of Riparian Habitat Corridors

Habitat corridors and riparian habitat corridors have been used as tools for biodiversity conservation since the 1970s. Corridors provide two key biological functions that enhance biodiversity: conduits for movement, and dwelling habitat for plants and animals (Smith and Hellmund, 1993).

Riparian corridors as conduits for daily and seasonal movements are important to a wide range of species, allowing animals to move through the landscape in relative safety to find food, water, cover, and potential mates. These corridors may be used regularly by species, or in times of need, such as in times of drought when upland species move into lower wetter areas. Many species, including birds, tend to move along vegetated corridors that provide shelter and refuge from stalking predators.

Riparian corridors provide for dispersal when animals or plant seeds travel between populations and when genetic material flows between populations through breeding. Population isolation and inbreeding causes a loss of genetic diversity and a decline in population health over time. Dispersal is essential to the maintenance of healthy populations, particularly in fragmented landscapes.

At larger scales, habitat connectivity through corridors can help protect species from the effects of landscape and climate changes by allowing for migration to more suitable locations. Without such connections, isolated species have the potential of being trapped in unfavorable environments where their survival is uncertain. Generally, the diversity of wildlife in an area can be described as proportional to the available length of routes (Lyle, 1999).

An obvious advantage of corridors is the simple fact that they protect natural areas and provide dwelling habitat for plants and animals, as do other types of preserves. Riparian corridors are especially important because, within a small area, they can protect a variety of habitats including aquatic, riparian and upland communities. These areas also tend to contain high biological diversity for their relative size (Smith and Hellmund. 1993).

In addition to benefits to biodiversity, riparian corridors offer a wide range of benefits to stream health and water quality. The quantity and timing of stream flows, know as hydrologic regulation, is significantly influenced by the presence of riparian corridors. Vegetation, wetlands and flood plains all contribute to the slowing and dissipation of flood waters. Erosion and sediment control is better balanced in vegetated corridors due to the stabilizing effects of plant roots, and excess nutrients can be filtered out by the presence of riparian vegetation. Water temperatures are also moderated when shade is provided, resulting in benefits to the aquatic habitat. These improvements in stream health, flooding potential and water quality can have a positive effect on the landscape as a whole beyond the boundaries of the corridor itself.

Design Strategies for Urban and Suburban Riparian corridors

It cannot be assumed that a given riparian corridor will be beneficial to native biodiversity. Preserved habitats will meet the living and dispersal requirements of some species but not of others. In some cases, weedy and invasive non-native species may benefit from the presence of a corridor. Corridors must be designed with careful consideration to the goals and biodiversity issues of the given design. Is the design to benefit one or more particular species that may be threatened or rare, is the design to benefit particular habitat types? Is the design to benefit the dispersal of species through the landscape or is the design to serve a combination of purposes? These questions must be addressed specifically and carefully in each design project, and detailed knowledge of the ecosystems involved is necessary.

Corridor design should not be allowed to substitute for the preservation of whole, intact nature preserves. Corridors serve a particular function, but cannot replace the value of continuous habitat (Collinge, 1996). Likewise, corridor establishment should not divert attention from the view and management of the landscape as a whole. Corridors can be essential pieces of regional management strategies, providing much needed connectivity, but they cannot, by themselves, be an entire conservation strategy (Smith and Hellmund, 1993).

Design Strategies: Alignment

When designing riparian corridor alignment, the placement of the corridor through the landscape, many concerns should be kept in mind. Whenever possible, the waterways and the adjacent waterway-influenced lands on each side should be preserved within the corridor. All tributaries within the watershed ideally will be included, and if they cannot, the tributaries should be ranked and chosen for inclusion according to the impact or potential impact of adjacent land uses. This will ensure higher water quality within the waterway and provide additional connectivity. Connectivity of corridors to surrounding habitat patches is a critical issue. High priority needs to be given to the protection of nodes, such as where tributaries meet the waterway, as these are critical links in the stream network for animal movement. High priority should also be given to areas where habitat patches connect, as well as areas with high levels of biodiversity or sensitive species.

Also of primary importance to the design and management of riparian corridors is native biological diversity. The needs of species sensitive to fragmentation and human disturbance will need to be examined relative to the needs of invasive exotic species that tolerate or thrive in human landscapes. When management of a particular species is the goal, the minimum planning unit should be the minimum area required to ensure genetic survival of the species. This area can be determined by population studies, and planning at smaller scales will have little or no impact on the species viability.

When alternatives are available, the alignment of a corridor should be carefully considered, as the alignment selection is critical to the future functioning of the corridor. Habitat patches that were linked in the past should be connected with corridors of similar habitat. Habitats whose species are sensitive to fragmentation should be linked, while connections to habitats that have been artificially disturbed or are dominated by weedy species should be avoided. A range of habitats should be included in a corridor while maintaining continuity of habitat for any species of concern to the project. Continuity of habitats with native vegetation should be included to encourage the movement of native species within the corridor. Naturally existing movement corridors, including riparian areas, should be located and maintained whenever possible. A network of redundant corridors providing multiple linkages between habitat patches is ideal, while long stretches of corridor without significant nodes of high quality habitat should be avoided, unless the corridor is very wide. Finally, roads and other potential barriers to movement should be avoided within the corridor, and if present, strategies must be developed to compensate for the loss of connectivity (Smith and Hellmund, 1993).

Design Strategies: Width

Many considerations should come into play when designing corridor widths. Habitat corridors should be wide enough to minimize edge effects and to encompass as much interior habitat as possible. The necessary width should be determined for the most sensitive species, considering its tolerance to edge effects and disturbance. The maximum amount of high quality habitat for the most sensitive species should be included within the width. Where possible, the interior habitat areas should be wide enough to accommodate for natural succession after disturbances.

In the creation of riparian corridors, it is important to understand the impact of surrounding land uses on the stream and riparian community integrity, and to use this knowledge as a basis for corridor design. The target stream's geomorphic floodplain, the riparian forest, wetlands, and the stream's shallow groundwater system should also be included. Other critical areas to include, if possible, are intermittent tributaries, gullies and swales, aquifer recharge and discharge areas, adjacent slopes, and erosion areas. Widths should be adjusted to account for the impacts of adjacent land uses. Wider corridors should be used in areas with high-impact adjacent uses, such as for intensive agriculture or dense housing developments (Smith and Hellmund, 1993).

Corridor widths need to be determined on a site by site basis with the consultation of a qualified wildlife biologist, but an examination of a local case study can give estimates of appropriate distances. Currently in the process of being implemented, a wildlife corridor for bobcats, mountain lions, gray fox, coyotes and badgers in the rapidly urbanizing lands between the Santa Monica Mountains and Santa Susana Mountains on the western edge of the city of Los Angeles, California recommends minimum corridor widths of 15,000 feet for short spans. Across spans of one-quarter mile or more, widths are recommended to be even greater. Wildlife underpasses as narrow as sixteen feet wide and 170 feet long are, however, included in the corridor and regular bobcat use has been documented in these (Smith and Hellmund, 1993).

Design Strategies: Site Scale Biological Issues

In smaller scale design within the corridor, it is necessary to plan and manage for native vegetation preservation and/or restoration within the corridor, with emphasis on habitats used by the most sensitive species. Invasive exotics and weedy species should be carefully controlled and eliminated if possible. Ongoing management strategies for this may be necessary. Care should be taken to maintain a diversity of vegetation heights to provide a variety of habitat types, if ongoing vegetative management, such as trimming, is necessary. Practices such as mowing should be strictly avoided. Narrow corridors, with limited interior habitat areas, should be managed to encourage as much vegetative diversity as possible.

In situations where roads or other transportation right-of-ways bisect the corridor, careful attention should be given to wildlife crossing alternatives. Tunnels, underpasses or other wildlife crossings should be developed with the behavior of the most sensitive animal species using the corridor. The width of such structures depends on the size and behavior of the sensitive species. For example, a three-foot tunnel may be sufficient for amphibian crossings, where as a quarter-mile wide underpass would be best for large animals. Fences or other barriers can help to tunnel animals into the desired crossing areas and to prevent them from crossing at undesirable locations. Careful research into the behavior of targeted species is necessary for adequate design standards of any wildlife crossing structure.

Consideration should be given to the question of livestock access within riparian corridors. Livestock should be excluded from riparian areas when possible. When this is not possible, they should be limited to short segments and contained to one side of the stream to reduce impacts. Riparian areas are often seen as recreational opportunities for local communities, and equestrian access is often an issue. Consideration should be given to the tolerance of the most sensitive species to the presence of horses, and if their presence is deemed appropriate, trail design should avert equestrians from sensitive areas. Additional maintenance and management may be necessary to control invasive species due to increased disturbances.

Riparian corridors, because of their linear nature, are open to invasion by many nonnative or aggressive species. In urban and suburban areas, domestic dogs and cats can prove devastating to some native species, especially low nesting birds. Fencing and neighborhood education are two ways to alleviate this situation. Certain opportunistic mesopredators such as jays, crows, cowbirds, raccoons and skunks can thrive in corridors due to their preferences for edge habitats. When this is a foreseeable problem to sensitive corridor species, corridor width should be adjusted to increase interior habitat areas. When this is not possible, species-specific conservation practices, such as providing predator protected habitat areas, may be necessary to alleviate predation pressures (Smith and Hellmund, 1993).

Design Strategies: Site Scale Human Issues

Human access becomes an important consideration in urban and suburban riparian corridors. Habitat areas in developed settings can provide much needed space for exercise, refuge and recreation. In dense urban areas with inadequate open space, it can be impossible to prevent people from utilizing these areas. It becomes important, therefore, to carefully plan for human presence to provide a safe environment for people and to reduce the impacts to sensitive corridor species.

When recreation is planned for within the corridor, all necessary requirements for public safety and access must be met, and a sound human safety program should be developed. Liability issues should be carefully considered and legal consultation is advised. For protection against litigation, an organization should have a well thought out maintenance and risk management program, adequate liability insurance, and a good knowledge of local recreation laws and recent case histories. Nonprofit organizations interested in developing or managing habitat corridors with recreational components should consider partnering with a government owner, such as a parks department to assist with legal responsibilities (Flink and Searns, 1993).

Designing appropriate areas for recreational access plays a key role in reducing potential negative impacts to habitat. Facilities such as trails, access points and picnic areas should be located and designed with regard to both ecosystem sensitivity and anticipated recreational uses and types. Centers of activity such as parking lots, large picnic areas and visitor centers should be located on the edges of protected areas and in locations that are both durable and central. A system of zones should be established based on the sensitivity of the landscape, with highest impact activities allowed in the least sensitive zones.

Trail routes should be planned to avoid habitats preferred by sensitive species. Spur trails off main routes can provide access to sensitive areas when deemed appropriate. Off trail use should be discouraged by designing trails that access the locations people desire, building trails that are well-defined and of adequate width and surfaces for intended uses, and educating visitors about trail routes and the impacts of off trail use. Dense vegetation, logs and routing trails through rough terrain are preferable to fencing and signs to keep people on trail.

These trail needs must be balanced with minimizing trail widths and forest clearings to reduce the attractiveness to edge-oriented species that could displace or prey on sensitive corridor species. For example, wider trails are beneficial to the brown headed cowbirds who parasitize the nests of an endangered Southern California songbird, the least Bell's vireo; in least Bell's vireo habitat, it may be more appropriate to have multiple narrower trails instead of a single wider multiuse trail.

When possible, subtle means of behavior discouragement are preferable to restricting or eliminating access, but in highly sensitive areas restrictions, closures or fencing may become necessary to protect sensitive species and habitat. Interpretation and education of corridor visitors can play an essential role in maintaining the ecological integrity of the area. Visitors should be made aware of the value of the riparian corridor's sensitive natural resources, problems associated with certain discouraged behaviors, and how they can behave to minimize their impacts while in the corridor environment. Education can help the public to truly appreciate the unique environment they have access to, and may provide long-term support in the form of volunteerism and support for similar projects in the future (Smith and Hellmund, 1993).

Conclusions

The design and development of riparian habitat corridors is a complex and challenging undertaking. Many factors and issues must be taken into account, and consultants or experts on specific topics such as hydrology and wildlife biology may be necessary. But, despite the complexities of the planning process, the ideas behind corridor development are simple. Isolation of habitat is harmful to biodiversity, and riparian habitat corridors offer a means of connecting otherwise isolated habitat patches. As urbanization and suburbanization continue to spread through the landscape, a network of functioning habitat corridors between isolated habitat patches may very well prove to be the key to sustaining regional biodiversity over time.

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APPENDIX G

DESIGN CONSIDERATIONS FOR THE COEXISTENCE OF RECREATIONAL TRAILS AND WILDLIFE

By Katie Turnbull

As outdoor recreational activities continue to grow in frequency and spatial scale, so will pressures they place on access to open spaces historically populated by wildlife (Knight, 1995). Recreational activities and wildlife are typically not compatible without some form of overall management (Knight, 1995). The goal of management is to find balance between the benefits of creating access in open spaces and being stewards of nature, especially of wildlife (Hellmund, 1998). There is debate whether people should or should not have any form of recreational access near wildlife because of the direct and indirect impacts. It is important to recognize that strong political support for open space provisions stems from the public's desire and perceived right to experience wildlife (Knight, 1995). Trails offer opportunities to reduce the negative impacts that have degraded many of the open spaces where wildlife reside or historically populated. For example, a combination of recreation and wildlife management strategies provides management of access, environmental outreach to the community and initiates habitat restoration programs. By understanding the direct and indirect impacts that negatively affect wildlife and the motivations of trail users, appropriate planning, design and management decisions can then be implemented and evaluated for the coexistence of recreational trails and wildlife.

Negative Wildlife Impacts from Recreational Use

To assess the potential for interaction between recreationists and wildlife, recreational activities are classified as either wildlife dependant or nondependent. Dependant activities are contingent on the expected occurrence of wildlife in the area. Dependant activities are further classified as consumptive or nonconsumptive. Activities such as fishing and hunting are consumptive, while bird watching is nonconsumptive. Activities such as jogging and horseback riding are nondependent activities and are often enhanced by, but are not dependant on, the presence of wildlife (Knight, 1995).

When an area has little or no management for recreation, the wildlife will undergo either direct or indirect impacts. Direct impacts involve exploitation and disturbance. Exploitation involves immediate death from consumptive activities such as hunting, fishing or collection. Disturbance is either intentional, such as harassment, or unintentional from nonconsumptive activities such as bird watching or unintentionally hiking through an animal's territory. Indirect impacts involve habitat modification and pollution. (Knight, 1995) Habitat modifications contribute to alteration of food supply and living spaces. Pollution results from a wide range of sources such as runoff and litter. Destructive consequences of all impacts include fragmentation of habitat, an increase of habitat edges, an influx of generalists and soil erosion. Indirect impacts differ from direct impacts because they are inevitable and they generally occur over a long period of time. Scheduling of recreational activities has less of an influence on indirect than on direct impacts. Management and design strategies that limit the amount, type and spatial distribution of use, as well as those that enhance site durability are strategic for managing indirect impacts. Management strategies that emphasize visitor education and temporal restrictions are more effective on direct impacts (Knight, 1995).

Recreational Planning

When working with complex issues such as recreation and wildlife, it is essential to plan at the regional scale and to study the wildlife habitat spatially and temporally. The goal with planning for recreation in open spaces is to avoid, minimize, and mitigate impacts. A planning framework developed by Noss and Cooperrider provides a framework for accommodating recreationists and wildlife while minimizing indirect impacts. The framework sets aside core biological reserves where human activities are limited and the maintenance of wildlife habitat and biodiversity are the primary goals. Surrounding the core are buffer zones, where increasing human impact- is allowed, while also supporting many species of wildlife. Outside of the buffer zones, land use is primarily human-oriented and only very human-tolerant wildlife species are present. Wherever possible, core reserves are connected by corridors that are also surrounded by buffer zones (Noss, 1994). Trails are kept to the outer successive buffers and occasionally go into core areas when appropriate (Hellmund, 1998). Managers and designers should consult with specialists such as the US Fish and Wildlife Service and the California Department of Fish and Game, who are able to provide information on areas of ecological sensitivity, critical foraging and breeding grounds, sensitive species, zones and standards.

Including the public in the planning

process is also essential. The large framework of laws and community desires determine what should be valued and protected (Hellmund, 1998). The various jurisdictions included in a recreation area need to be coordinated as well. For example, federal lands have their own environmental review process. An important process often overlooked is a monitoring program both before and after the trail construction. Programs monitor the wildlife population, evaluate and adjust for the negative impacts caused by recreational activities.

Trail Design for Reduction of Negative Wildlife Impacts

The immediate challenge is to design core reserves for wildlife as human populations continue to increase outside these core areas. When designing for the coexistence of recreational trails and wildlife, there are only rules of thumb based on experience, common sense and scientific literature (Hellmund, 1998). The most desirable trails ~~are~~ designed for coexistence include a unique combination of management strategies. Trails have a zone of influence and the impacts vary due to species and season (Flink, 2001). A trail carrying capacity is not a direct relationship between amount of use and amount of impact. The amount and type of impact is influenced by the interrelationships of timing, type, distribution of use, setting and mitigation measures applied (Hammitt, 1998). There are different design strategies that should be used depending on the situation. Sometimes it is necessary to limit certain activities proven to cause negative impacts to wildlife, whether they are dependant or independent activities. Independent activities such as bicycling, horseback riding and dog walking can have negative impacts in particular instances. Zoning strategies allow these activities to take place in selected areas while restricting access near sensitive habitat (Smith and Hellmund, 1993). It is important for designers to consider the amount of area that will be cleared for a trail. The trail plus its thinned vegetation edges will result in approximately an acre of habitat loss per mile. A standard guideline is that multi-use trails impact their environment at least 100 feet on either side (Flink, 2001). Areas that are already degraded might be preferable for placing the trail rather than disturbing additional areas. Minimizing trail width and clearing size in the interiors of habitat areas reduces the attractiveness of trails to edge oriented species. Placing barriers such as brush or boulders is more attractive than fencing to keep people on the trail. Using signs also discourages diversions into habitat areas by trail users. If sufficient resources are not available to enforce trail closure during critical times, rerouting the trail is necessary (Smith and Hellmund, 1998). Native plants that provide food and shelter should be chosen for trail restoration projects. In order to prevent trail erosion on steep slopes, design switchbacks to run perpendicular to the direction of water flow (Smith and Hellmund, 1993). Water is a main contributor to the eroding of trails whereas trampling is a main contributor to the widening of them (Hammitt, 1998). Designers should use water-permeable trail surfaces as much as possible, and use concrete or asphalt in areas of intensive use.

Riparian areas are extremely sensitive because of their high biologic diversity. They are also attractive to people which contributes to their degradation. Plants in riparian soils are extremely vulnerable to compaction and soil erosion. To avoid volunteer trails in riparian areas, run the trail on topographic bench and lead in at key areas rather than continuously along riparian areas (Hellmund, 1998). Because they tend to be nodes for wildlife, trails should have a minimal amount of stream crossings and avoid stream confluences. While trails that encircle ponds or lakes are attractive to people, they should be avoided so that shoreline birds have to access water. Providing boardwalks in wetlands is a sensible way to allow access for people while decreasing the damaging effects. When designing boardwalks, minimize the footprint, use untreated wood and provide spaces between the wood planks for water and light to pass through (Thompson, 2000).

Trail Design for the Human Experience

While design for the wildlife is crucial, careful attention must also be given to the complexities of the human experience. Carefully orchestrated design enriches the user's enjoyment, reinforces their respect and modifies their behavior. Trails provide public recreational access to open space. The location of the trail gives direction and purpose to the movement of its users (Ashbaugh, 1965). When appropriate, spur trails divert users from the main trail. While most people will stay on the main trail, spur trails provide access to unique areas of interest such as wildlife viewing (Smith and Helmund, 1993). These areas are often ecologically sensitive and spur trails allow limited access rather than routing a primary trail through or along a sensitive area.

Before planning a trail, the designer needs to observe how people informally use the area. This will provide insight into their motivations and behaviors (Smith and Hellmund, 1993). People tend to prefer coherent areas with a bit of mystery through a sense of depth and opening. For trail users this opens views and increases the perception of safety, whereas dense vegetation along trails tends to block the views (Kaplan, 1998). On the other hand, clearing the vegetation reduces the natural visual screening that makes most wildlife more tolerant of user disturbances (Hellmund, 1998). Fences, low walls and partitions provide orientation and cause the decision process of whether to pass beyond a particular location. These transition points are also effective when they are simply materials from the surrounding environment such as boulders or a contrast in the vegetation types and scale. When a trail is human scale rather than scaled for a vehicle, the width of the trail has an influence on the users sense of intimacy with nature (Kaplan, 1998). The impact of lighting areas for nighttime use must also be weighed. There are many studies stating that nighttime illumination affects habitat rhythms that are set by natural light and darkness cycles. If an area must be illuminated for safety purposes, there are devices and methods that reduce light from spilling into adjacent habitat (Thompson, 2000).

Interpretive design provides orientation, education and provocation. Information is usually communicated by signs, but other methods exist, such as visitor guides and leaflets. Orientating information provides a sense of comfort. People like to be convinced that the trail will lead them to where they want to go in order for continued exploration. It is helpful to use signs in places where people need to be kept out of sensitive habitat. Educational methods that aim to modify human behavior and diminish direct impacts on wildlife should be encouraged (Knight, 1995). Provocation encourages the visitor to think about the broader implications of the message. Themes are successful to communicate larger patterns in the landscape because people tend to remember themes but forget facts (Beck, 1998).

Sustainable Construction

Trail construction is often harmful to its surrounding environment. The building or restoration of trails needs to be carefully planned by managers and designers to minimize unnecessary damage to the environment. By analyzing the energy life cycle costs of materials and maintenance, a more sustainable trail is achievable. The practice of sustainable construction offers many tips for lessening the damaging impacts of trail construction. When surveying the site before design, use global positioning to minimize vegetation clearing. Designate areas to be protected by clearly citing them on all plans and in the field. Restricting the onsite stockpiling equipment prevents the compaction of soil and leaching of pollutants into the water supply. Temporary fencing on slopes and sediment curtains in wetlands prevents disturbance from construction. To reduce runoff and leaching of pollutants, trail surfaces should be made of porous and nontoxic paving materials. By specifying local materials, the overall transportation inputs to the site are minimized (Thompson, 2000).

Case Study

Chatfield State Park in Jefferson County, planners of Colorado developed a design and management program to minimize disturbances to the park's sensitive bird habitat, which are attracted to the park's water and native vegetation. The program focuses on spatial and temporal zoning, wildlife viewing access and environmental education. The main method for protecting birds at sensitive times is their zoning strategy. Users are only allowed to access the outer zone of the park during the bird's breeding season. During this season, parking is provided offsite and bicycles and horseback riders are only allowed access into the park to a limited depth. During the regular season, the spatial design is well programmed with physical design and supporting signage that keep people a safe distance from sensitive bird habitat. A variety of design elements were incorporated in the site to minimize human caused disturbances. There are select viewing areas along the water's edge where users are allowed access. Tangential trails were created rather than direct approaches to reduce the perceived threats by birds. Timbers of varying heights along the trail to the viewing areas were designed to disrupt human profiles. The existing vegetation was kept to block the views of the people. Positioning of the viewing deck is such so that its view is obscured by an embankment. The park does ongoing monitoring projects to assess the short-term and long-term impacts of the users (Knight, 1995).

Conclusion

While outdoor recreation activities are increasing at unprecedented levels, misuse may deplete the very natural resources on which they are based. Designing for the trail users experience and enjoyment, while at the same time protecting the wildlife habitat, is important to reducing and preventing the direct and indirect impacts caused by users. Through planning, design and management, managers and designers of outdoor recreation areas can minimize the negative impacts on wildlife while providing people access to today's limited open spaces.

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APPENDIX H

ALIGNING LANDSCAPE AESTHETICS AND LANDSCAPE ECOLOGY

by Wei Zhang

Designing landscapes for aesthetic purposes and for ecologically sound objectives involves some fundamental dilemmas. The artists and ecologists have separately created landscapes, which often become stages for the play of two ironic characters, aesthetics and ecology. We may differ in our feelings towards these two characters, but we are all experiencing the increasing conflicts between their oftentimes disparate goals. Today, the dramatic tension between these two opposing faces has never asked more loudly for resolution. Ecological issues can no longer be ignored, but rather, are being recognized worldwide as serious problems that must be addressed. This resolution will offer the possibilities for both hope and action:

- Hope that we can develop a new vocabulary of landscape design
- Action taken to maintain and sustain our essential bonds with the earth

The historic role of each character in the design of landscapes will be explored first. A new "combined" language addressing the needs of both factions will then be presented and discussed.

Aesthetic Character

We live mostly in response to surface appearance, both of the landscape and of life's events (Tuan, 1971). In the case of appreciation or response to the land and the landscape, surface values have always had great significance. Our bond with the earth has always been dependent upon them. Landscape painters and, more recently, photographers of scenic postcards and travel posters have played a significant role in shaping our aesthetic experience of the land's surface (Stilgoe, 1984). The National Park Service locates signs with camera icons near commonly photographed scenic spots in national parks. Many visitors to national parks never leave their automobiles, but seemingly enjoy an aesthetic experience entirely through their car windows. This superficial level of aesthetic bonds with the landscape seems satisfying and sufficient for many people.

Likewise, many of the aesthetic pleasures of life involve anticipating the possibility that an aesthetic experience might occur, and enjoying the surprises that this newfound knowledge might bring. In 1989, two researchers, Richard Chenoweth and Paul Gobster, had their students record all of their aesthetic experiences during a spring semester in their diaries (Chenoweth and Gobster, 1990). The researchers found that the students' aesthetic experiences were less frequent, more sudden, and more surprising than expected, and that their occurrences were unevenly distributed in space and time. The experiences were characterized as involving feelings of the triviality of the individual in an immense landscape, intensive assimilation in the event, newly discovered awareness and appreciation of environments, rebirth, and changing seasons. In summary, the authors wrote:

> Our results showed that aesthetic experiences tended to occur unexpectedly rather than being sought out by a person, occurred most often as a result of interactions with natural objects, and tended to occur in familiar places. Together, these findings suggest that opportunities should be provided for people to experience nature in their home environments as part of their everyday activities (p.8).

Aesthetic experiences are a type of fantasy in one's life. However, enjoying them may cause one to ignore the reality of the landscape, a reality that involves numerous variables and complex webs of interactions.

The picturesque, therefore, was and is, very dominant in popular culture. However, landscape aesthetics does not necessarily protect nature. The scenic landscape is often assumed to be ecologically healthy and cared for, an assumption that in many cases is not correct. For example, if we want to prevent a hill from eroding, the conventional aesthetic design would call for a retaining wall many inches thick to hold the earth in place. The extent of the design process would involve only choosing the materials and laying out the pattern of the retaining wall. Such a wall makes ostentatious use of materials, and may look aesthetically pleasing. However, this design solution does little to heal the land but rather, from an ecological point of view, only places a Band-Aid upon an open wound.

Ecological Character

The conventions and rules of aesthetics will have added power when placed in context with the underlying biophysical determinants (Hough, 1984). Hough advocates "a vernacular landscape whose aesthetic rests on its ecological and functional basis for form, and second, on the integration of design objectives" (Hough, 1984, 94). What is ecological design? Just as we feel more alive in a room open to sunlight and fresh air than one closed to the elements, E.O. Wilson speculates that we have an innate need for contact with a wide variety of species. Ecological design responds to this need by bringing a fundamental awareness of natural processes and interactions into the urban context. Ecology is the science of inclusion and connection rather than of isolation and individual analysis. Ecological design provides a coherent framework for adapting to and integrating with natural processes. This design approach addresses the issues of energy, water, food, manufacturing, and waste systems in the construction of new landscapes, buildings, and cities. This approach makes natural processes active at diverse levels of scale from the household to the neighborhood to the entire city. It compels designers to ask new questions during each design decision: Does it enhance and heal the living world, or does it diminish it? Does it preserve relevant ecological structures and processes, or does it degrade them?

With the arrival of growing ecological awareness in the past 40 years, we are just beginning to make the transition from surface-focused landscape consideration towards functional connections between organisms (both human and others) and contexts. There are now sewage treatment plants that use constructed wetlands to simultaneously purify water, reclaim nutrients, and provide habitat for wildlife. There are agricultural systems that imitate natural ecosystems and also merge with their surrounding landscapes. There are new kinds of industrial systems in which the waste streams from one process are designed to be useful inputs to the next, thus minimizing pollution. Such examples are becoming more numerous.

These examples show that we need to think differently about design. Ecological processes should be utilized to guide and inspire design solutions. For instance, certain plants have been found to be particularly effective at removing pollutants from the air. They can be utilized for providing both an aesthetic solution and also an effective air purification filter within office buildings. Let us look at the example of the retaining wall again. The conventional way of building a retaining wall to support a badly eroding hill is not adapted or integrated with the natural process of the earthwork. In looking for an ecological design solution, we can perform the same function by seeding the hill with hundreds of willow branches. Within months, the branches sprout providing effective soil stabilization. The willow's articulated roots are far more adapted to keeping the soil in place than a concrete, stone, or wood retaining wall. Ecological design is a design with a deep care; care of soil, vegetation, animals, climate, topography, water flows, and people.

To the general public, ecologically sound landscape often means less fun, fantasy, and imagination. Fantasy and imagination are necessary for human survival, and there is much room in the ecological world for both. In recent years of landscape practice, the artist and ecologist have begun working together to integrate landscape aesthetics and landscape ecology. By making nature visible, fantasy is being embodied in reality. Ecology, which underlines any landscape, must be kept in mind. Nevertheless, ecological landscapes need not be a purely and rigorously scientific. Such spaces, especially those close to urbanized areas where most people live, should be aesthetically appealing. If we expect the public to enthusiastically reorganize its environmental and landscape design preferences, the ecological landscapes themselves should engage public interest and motivate support for their expansion and replication. This is vital to the promo tion and acceptance of ecological design (Nassauer 1997).

Combined, New Language

Ecological processes, however, are often invisible and may take place within a time frame or under circumstances not conducive to human comprehension. We need a new design to help us literally "make sense" out of the unseen. Bringing core ecologies to the surface will be the challenge for landscape artists and designers. The ability to see into and understand the inner ecological processes of a landscape is essential, especially in a world where more and more of the technology controlling our lives is invisible and incomprehensible to the average person. As humans, we would like to know and have a right to know where we are, how we are connected, and how we are doing. Without being able to see into the workings of our own landscapes, we may be unable to make the necessary adjustments to changing environmental conditions.

How can we align aesthetics and ecology in design of the landscape? Making nature visible is a way of reacquainting ourselves with the wider communities of life, but it also informs us about the ecological consequences of our activities. In Cities and Natural Process (1995), Hough emphasizes "the notion of visibility," uncovering the myriad of hidden processes that make cities work (Hough 1995, 30-31, 83). With conventional storm water drain systems, for instance, water quickly disappears into subterranean arteries picking up various toxins along the way. The water is hidden, and so are the impacts of the system itself – contamination of downstream rivers or wetlands, altered hydrology, and decreased groundwater recharge. We can make the drainage system both visible and ecologically functional by letting water flow on the surface into drainage ponds. We can preserve wetland and stream corridors to store storm water. People love to watch this process in action. All of this suggests a new kind of aesthetic for the built environment, a “knowledge based aesthetic” (Nassauer, 1997). Such an aesthetic will teach people about the potentially symbiotic relationship between culture, nature, and design. Making nature visible is a powerful approach, since new ideas are learned most rapidly when they are expressed visually and experienced directly. The landscape architect Robert L. Thayer, Jr. has called this aesthetic “visual ecology functional deliberation”.

One way to communicate the ecological function of the landscape is to embrace the social nature of our landscape perception. If we probe the social language of landscape form and learn the conventions of landscape appearance, we can use these conventions to label ecological function. This general design principle marks ecological function with socially recognized signs of human intentions for the landscape. This is accomplished by providing expected characteristics of landscape beauty side by side with characteristics of ecological health (Nassauer, 1997). For instance, water more than any other element of the landscape, has deeply rooted spiritual and symbolic meanings. As an element of great experiential power, water has historically been manipulated and shaped to create places of delight and beauty. Water has reflected cultural attitudes towards nature. The Romans celebrated extravagance through the use of the water in their engineering and architecture. The great Italian water gardens celebrate water in its volume, light and the sound of its flow. The Japanese celebrate tranquility by using water elements in their traditional garden designs. The task today is to create a new design symbolism for water that reflects the hydrological processes of the city; an urban design language that re-establishes its identity with life processes.

An opportunity exists within sewage treatment plants to establish a vernacular landscape whose aesthetics rest on the ecological and functional basis of nature. In Toronto, Canada, an artistic expression of the storm water runoff catch basin and drainage swales has been created in a city park. This design educates people about a part of the water cycle and reminds them where the water goes. At the Rudolf Steiner Seminariat, Jarne, Sweden, the designer of the Sculpture Garden of the Sewage Treatment Plant created flowform sculptures for detoxifying the sewage water. Sewage water cascades down various sculptured basins and is aerated as it drops. The design is not only aesthetically pleasing, but also hydrologically functional.

Integrating aesthetics and ecology by making nature visible has been practiced successfully from humanized form to natural-looking wetlands in other parts of the world. An awarding winning project, the Living Water Park in Chendu, China, is a pilot project of aesthetic visual ecological landscape design within China. In the project, the designers incorporated the regional landscape with the local environment to demonstrate natural processes for cleansing water. The city has also been provided with a new access to its river (Lyndon,2000). Living Water Park is part of the endeavor by Chengdu, a city of nine million, to reclaim its river, a river which life and prosperity have historically depended on. In 1992, Chengdu constructed flood control and treatment facilities, relocated 100,000 residents to new and modern housing, and created approximately fifty miles of new public waterfront with gardens and parks. This project was instigated following the recent passage of China’s largest comprehensive water quality initiative in modern history. The project was a joint effort of designers, scientists, and engineers.

Living Water Park is located within this open space system, and serves as an educational and inspirational model. This park demonstrates how water can be cleansed through biological processes. The Park also reveals the spiritual connection of the Chinese people to water within an urban location. The design includes reclaiming polluted river water through a series of aeration surfaces; constructed wetlands and water features that enable people to view how these natural processes can remove pollutants from the river. Visitors can walk down to the river along terraces, wander along the riverbank, or sit in an amphitheater on the river’s edge.

The main element is a system that filters river water through natural means and runs within the length of the park (about 1,500 feet). Water is pumped in, emerges through a fountain into a settling pond, and then gushes along a series of flow sculptures. During this process, the water is exposed to the atmosphere and partially detoxified. The water next drains into constructed wetlands and fishponds, and finally returns to the river. In the design, people can view the water as it is purified in ponds and filtering channels, and watch it return to the river. Therefore, the system reveals the natural functions of the river cycle and hints at the original landscape character of the river.

The Real Goods Trading Company's Solar Living Center in Hopland, California is another example where ecological design is linked to visual aesthetics. This site consists of twelve acres on an agricultural floodplain and serves as a demonstration landscape and garden to inform people about the company's products and its ecological vision. The design offers strong possibilities for making natural processes visible. The silted, damaged stream on one end of the site is being restored to reflect its original riparian qualities. Constructed wetlands, ponds, and gardens fill the floodplain. The landscape design imitates the original variety of plant communities found in the area. The planting plan is spatially related to the seasons, and provides clues of the design's orientation to the sun's daily and seasonal paths. Water recycled from an on-site aquifer is a major element in the design. This water provides summer cooling for outdoor spaces, soothing background sounds, and an animated path for visitors to follow. The design is a complex interweaving of communities; it is not only favorable for humans, but also favorable for plants and animals (Bennett, 2000).

The whole site is full of visually pleasing living sculptures that reflects ecological functions, the company's vision, and the designer's ethical positions. "The memorial car grove is a testament to the gas-guzzler of yesteryear" (Bennett, 2000). It is the most controversial of the works, angering local officials who complained that it was junk and not art. It consists of five old cars, cut through the bottom and planted with poplars. The grove sits on Highway 101 and serves as an advertisement for the center. As the designers describe, "It is a fitting monument for a business whose mission is the elimination of fossil fuels." The drip ring, supporting a canopy of cottonwoods, is another living sculpture. Integrating wire and metal sculptural frames with fast-growing plants, this sculpture is a "riff" on traditional garden follies. Like traditional follies, the drip ring's purpose is to direct our view to the landscape. In this particular case, visitors are asked not only to enjoy the structures but also to understand the natural processes that created them (Bennett, 2000).

In some sense, visual ecology projects have certain commonalities. They have the same vision of form follows function (Lyle, 1994). "Function" is an ecologically based order. "Form" follows function, a changing notion of the underlying interrelationships of nature, and will be expressed on the surface in a unique way by different cultures. New forms of landscape seek to reveal ecological order through the interplay of both surface aesthetics and ecology to both culture and place. As our understanding of the natural world continues to grow, the representation of newly discovered natural functions will result in the continued evolution of new innovative design solutions.

Conclusion

Visual ecology will help us to reduce the tension that exists between the visual qualities of landscape designs and the underlying natural functions. Visual ecology allows us to see, understand, and appreciate nature. At the same time, this design philosophy will allow the representation of a landscape that relies on local resources, celebrates local cultures, and preserves local ecosystems. Visual ecology provides an alternative landscape design where the natural process is dominant, and presents an entertaining, simulating landscape where essential life functions are undertaken, revealed, and celebrated. In addition, visual ecology represents a landscape that relies on local resources, celebrates local cultures, and preserves local ecosystems.

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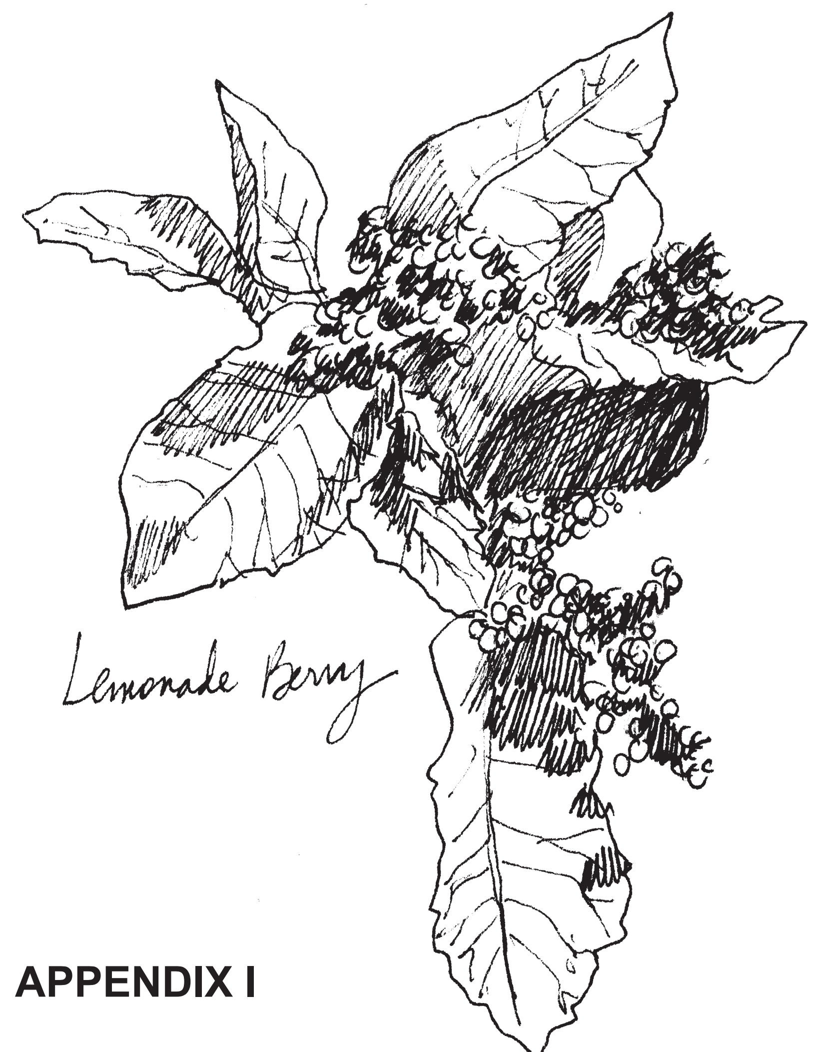
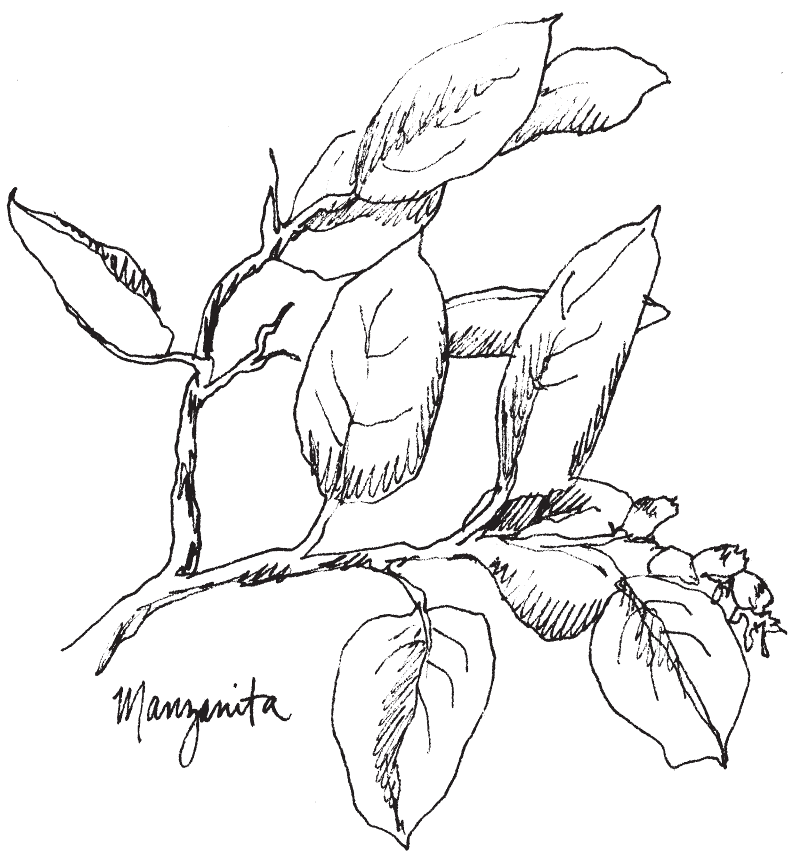


APPENDIX I

606 STUDIO DESIGN PROCESS

The 606 Studio is a group of third-year landscape architecture graduate students and faculty at California State Polytechnic University in Pomona. The studio focuses on the application of advanced methods of analysis and design with particular emphasis on preservation and restoration of sensitive natural systems. Projects address serious, important ecological, social and aesthetic issues related to urban, suburban, rural and natural landscapes. They generally result in conceptual or specific plans, schematic site designs, land use plans or land management strategies.

Teams of third-year graduate students and members of the graduate faculty carry out the projects. Working with the direction and continuous participation of the faculty, graduate students perform the tasks of research, analysis, planning and presentation. The academic studio environment offers a unique opportunity for graduate students to explore issues and possibilities at a variety of levels. Because of its function within an academic institution, the 606 Studio must maintain academic integrity, advance the state of the art and demand that projects have a strong, practical base, as well as display technical and professional expertise. Projects undertaken by the 606 Studio are expected to satisfy the following criteria: they must address significant issues concerning resources and the physical environment with broad implications beyond the boundaries of the project site and they must promise to result in significant benefits to the general public. Projects should be complex; requiring application of advanced methods beyond those routinely used in the field. Sufficient time and support must be available to explore all promising approaches, to do a thorough job and to communicate the results clearly and completely. The



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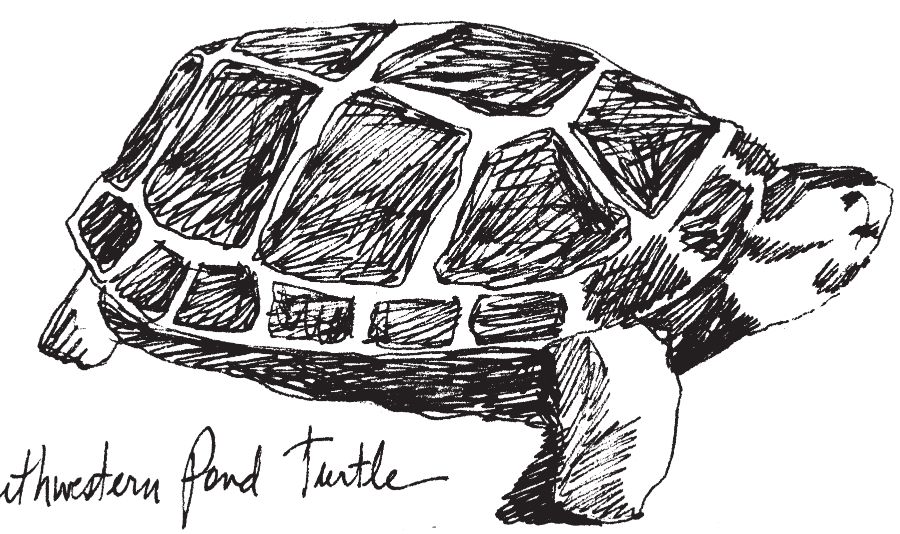

Southwestern Pond Turtle