Higley Area Drainage Master Plan

Alternatives Analysis Report

FCD #98-13
March, 2000

prepared for:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

prepared by:

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

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HIGLEY AREA DRAINAGE MASTER PLAN
FCD 98-13

ALTERNATIVES ANALYSIS REPORT

Prepared for:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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March 2000

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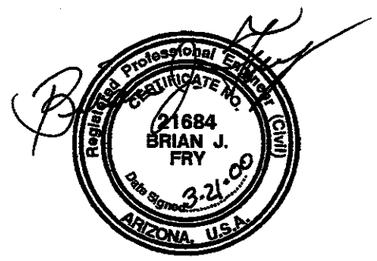

C. Existing Data & Reports

The Higley area has been studied by the FCDMC in three previous hydrology studies as illustrated on **Figure 3**. Additionally, the Arizona Department of Transportation (ADOT) has studied the area as part of the planning for the Santan Freeway.

The *Gilbert-Chandler Flood Insurance Study* (FIS) was completed in 1990 for the area south of the Superstition Freeway. The study area for the FIS is bounded by the Superstition Freeway on the north, Hunt Highway (Maricopa County line) on the south, the RWCD Main Canal and the East Maricopa Floodway on the east, and the SPRR paralleling Arizona Avenue on the west. The study included hydrologic analysis of the entire study area with mapping and delineation of the 100-year floodplain along the Eastern Canal, Consolidated Canal, SPRR (Rittenhouse alignment) and SPRR (Arizona Avenue alignment).

The *Gilbert-Chandler Area Drainage Master Study, Volume I, Current Conditions Hydrology* (ADMS) was completed in July 1993 for a 120 square mile area bounded by Interstate 10 on the west, by the Western Canal and US 60 on the north, by the RWCD Canal on the east, and Queen Creek Road on the south. The study included only existing conditions hydrology for the study area.

The future hydrologic conditions were presented in the *Gilbert-Chandler Area Drainage Master Study, Volume II, Future Conditions Hydrology* completed in January 1994. The planned Santan Freeway location and drainage features were included in the analysis.

The area south of Queen Creek Road to the County boundary at Hunt Highway was studied in the *Gilbert-Chandler ADMS Addendum*, completed in 1998. The study area was bounded by Queen Creek Road on the north, the RWCD Canal/EMF on the east, Hunt Highway on the south, and Arizona Avenue on the west.

The area north of the Superstition Freeway has been more recently studied in the *Eastern Canal North, from Baseline Road north to McDowell Road, Floodplain Delineation Study*, completed in August 1999. The study area is bounded on the north by McDowell Road, on the east by the RWCD Canal/EMF, on the south by Baseline Road and on the west by the Eastern Canal.

All of the previous studies provided hydrologic analysis and/or floodplain delineation. None of the reports presented drainage improvement concepts or plans. The only regional drainage plans presented for the study area are contained in *Concept Drainage Report, Santan Freeway - Price Rd. to Gilbert Rd. and Preliminary Drainage Concepts Santan Freeway - Gilbert Road to Baseline Road*, completed in June 1995 by ADOT.

Existing condition hydrology for this project was prepared by the FCDMC using the hydrology models from the *Eastern Canal FDS*, the *Gilbert-Chandler ADMS*, and the *Gilbert-Chandler ADMS Addendum*. The FCDMC hydrology has been modified for use in this study to simulate the impacts of each plan alternative.

In addition to the existing reports, utility plans, development plans, existing facility as-built plans, and field reconnaissance data have been collected. The data collection process and findings are presented in the *Higley Area Drainage Master Plan, Data Collection Report*, May 1999.

D. Project Coordination

A Review Committee was established by the FCDMC to provide coordination and input throughout the project. The Review Committee includes representatives from local government agencies and primary landholders with an interest in the project. The Review Committee has met to date for the following meetings:

1. Project kick-off meeting.
2. Brainstorming meeting to identify drainage problems and alternative solutions.
3. Potential Alternatives meeting to confirm the drainage alternatives identified by the consultant to be developed in detail for the alternatives evaluation.
4. Alternatives Evaluation meeting to select a preferred drainage alternative based on the alternatives analysis presented in this report.

The Review Committee consists of the following members:

REVIEW COMMITTEE

Agency	Representative
Arizona Department of Transportation	Mr. Javier Guana
Arizona Game & Fish Department	Mr. Timothy Wade
City of Chandler	Mr. Gary LaForge
Flood Control District of Maricopa County	Mr. Tim Phillips
	Ms. Kathryn Gross
Gila River Indian Community	Mr. Fred Ringlero
	Mr. Adrian Hendricks
Town of Gilbert	Mr. Lonnie Frost
Maricopa County Dept. of Transportation	Mr. David DeWeese
City of Mesa	Ms. Anna Leyva
Roosevelt Water Conservation District	Mr. Michael Leonard
Salt River Project	Mr. Paul Cherrington

In addition to the Review Committee, public input was solicited at a public open house held in the project study area. The open house was held early in the project to allow public input to be incorporated into the entire planning process. Other meetings were held to obtain input from the agencies represented on the Review Committee as described in the

Data Collection Report. Prior to final selection of a preferred alternative, a second public open house was held to allow opportunity for comment on the alternatives selected for evaluation.

E. Deliverables

The project consists of five phases resulting in an implementation plan with estimated costs for a recommended plan to address the drainage issues within the study area. The five project phases are summarized as follows:

	Phase	Products
1.	Data Collection	Data Collection Report Survey & Mapping
2.	Level I Analysis	Potential Alternatives Submittal
3.	Level II Analysis	Alternatives Analysis Report
4.	Level III Analysis	Recommended Design Report Preliminary Design Plans
5.	Implementation	Final Submittal Maintenance Plan

This Alternatives Analysis Report is the final deliverable for the Level II analysis documenting the development and analysis of the alternative drainage and outfall solutions and selection of the preferred alternative which will be further developed in the Level III Analysis phase of the project.

F. Acknowledgments

The completion of this report was made possible by many individuals whose assistance and cooperation are gratefully acknowledged. We especially wish to thank Mr. Tim Phillips, P.E., Project Manager, Ms. Kathryn Gross, Hydrologist, Ms. Theresa Hoff, Environmental Services Planner, and Mr. Dennis Holcomb, Landscape Planner of the Flood Control District of Maricopa County, and all members of the Review Committee.

G. Consultant Project Team

Dibble and Associates is the prime consultant on the project. The following individuals from Dibble and Associates are responsible for completion of this project: Mr. Richard Perry, P.E., Principal in Charge, Mr. Brian Fry, P.E., Project Manager, and Mr. Frank Brown, P.E. and Mr. Dan Frank, EIT, Project Engineers.

Dibble and Associates was assisted by Logan Simpson Design (LSD) for environmental studies and landscape design. Individuals from LSD who have contributed to the project include: Ms. Diane Simpson-Colebank, RLA, Principal, Mr. Steve Lohide, RLA, Project Landscape Architect, and Ms. Ashley Kowallis, Planner.

Additional sub-consultant firms and their representatives who have contributed to this project include: Mr. Larry Maldonado, P.E., Project Engineering Consultants, aerial mapping control, and Mr. Robert Parks, Aerial Mapping Company, aerial mapping.

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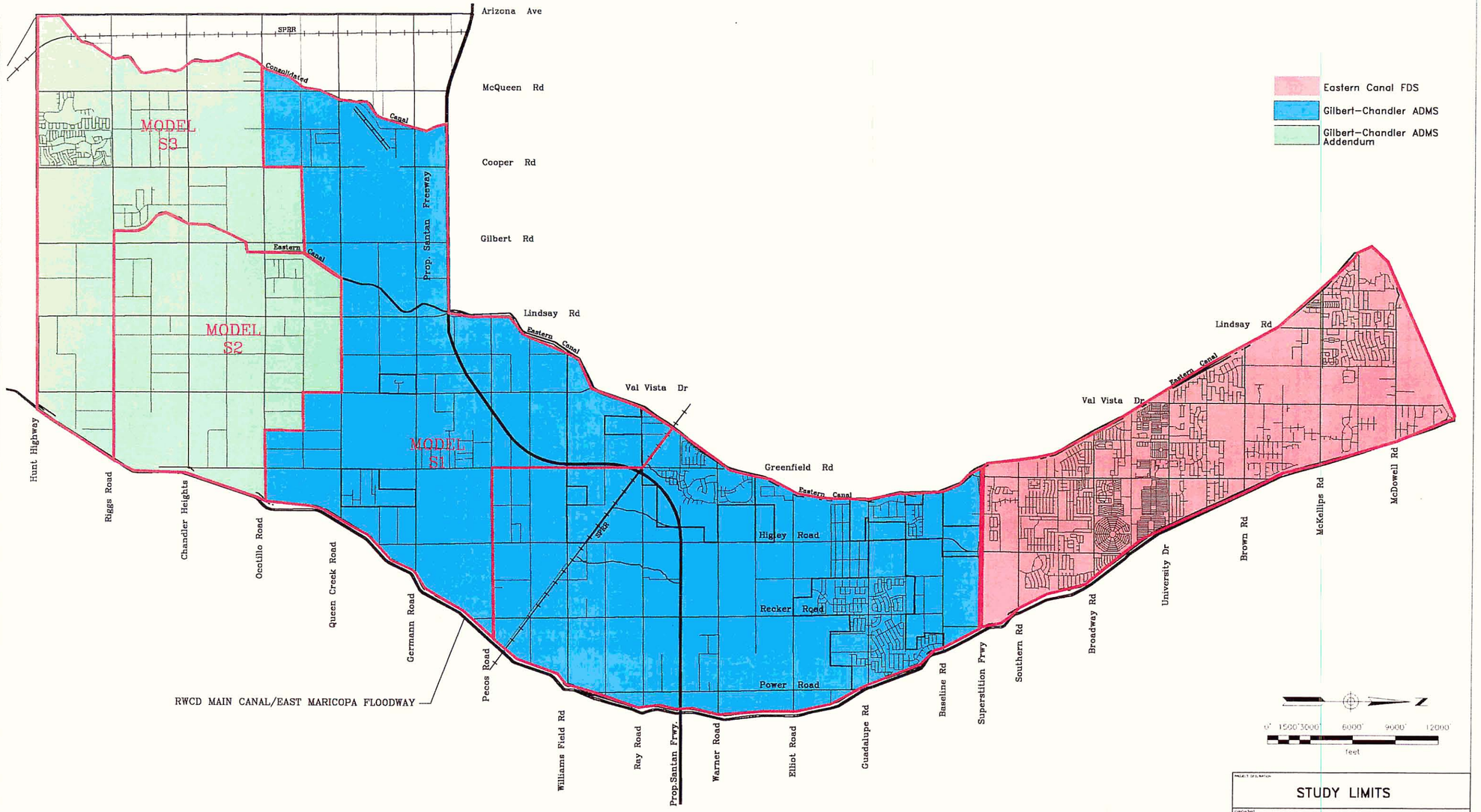

STUDY LIMITS

FIGURE-3

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II. HYDROLOGY

A. Introduction

The existing conditions hydrology was provided by the Flood Control District of Maricopa County from the Eastern Canal FDS, Gilbert Chandler ADMS, and Addendum as described in the previous section. The hydrology is modified in this study to reflect changes in flow routing from the planned channels, storm drains, and detention basins.

B. Methodology

Hydrology for the Higley area was developed using the U.S. Army Corps of Engineers, *HEC-1 Flood Hydrograph Package* (HEC-1) computer program. Guidance is given in the *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology* (DDM1) for application of the HEC-1 program within Maricopa County. Additionally, the computer program *Drainage Design Menu System* (DDMS) has been developed by the FCDMC as an aid in the application of the methods described in DDM1. The application of these tools is more specifically described in the aforementioned reports.

In all models, runoff was evaluated under existing conditions for the 100-year storm event with a 24-hour duration using the SCS Type II time distribution of rainfall. Aerial reduction factors were utilized from the NOAA Atlas II. Rainfall losses were estimated using the Green-Ampt method. The S-graph method was used to represent runoff characteristics for the watershed in the Gilbert-Chandler ADMS and Addendum models. The Clark Unit hydrograph was used in the Eastern Canal FDS. The drainage subarea boundaries are shown on **Figure 4**. The HEC-1 Schematics for each modeled area are contained in the **Appendix**.

C. Drainage Area Characteristics

Rainfall falling within the study area drains naturally from east to west in a shallow, sheet-flow fashion. Natural drainage ways have been obliterated with development of irrigated agricultural fields and residential development. The drainage area contributing runoff to the study area extends from the Eastern and Consolidated Canals east to the RWCD Canal. The East Maricopa Floodway (EMF) was constructed by the FCDMC along the east (upstream) side of the RWCD Canal. The EMF was originally sized for the 100-year storm and intercepts runoff generated east of the RWCD Canal. Although recent studies indicate that the EMF does not have capacity for the existing conditions 100-year flow, for purposes of this study, the EMF/ RWCD Canal is considered the eastern watershed boundary for runoff within the watershed. In addition to the RWCD Canal and the EMF, the Superstition Freeway and the Southern Pacific Railroad at Rittenhouse Road form major man-made drainage boundaries. The Superstition Freeway has a collector channel along its north right-of-way that collects and conveys runoff westerly to the Holmes Park retention basin situated between Greenfield Road and the Eastern Canal. Runoff stored in Holmes Park is pumped into the Eastern Canal following a storm event. The elevated SPRR embankment directs surface runoff north-westerly to the Crossroads Park retention basin west of Greenfield Road. Runoff stored in Crossroads Park is pumped into the RWCD Tailwater ditch following a storm event.

The study area has no natural outfalls. Runoff accumulates along the canals and creates ponding areas. As the water level rises, accumulated runoff flows southerly along the canal bank. In some locations, runoff flows into the irrigation canals and then overtops to the downstream side. Overtopping locations have been identified in the hydrology models.

III. EXISTING CONDITIONS

A. Introduction

This section describes existing flooding problem areas and existing drainage facilities within the study area.

B. Public Open House Meetings

Public Open House meetings were held at Higley Elementary School on February 17, 1999 and at Entz Elementary School on February 18, 1999. The purpose of the meetings was to obtain public input on flooding problems in the area. The meetings were conducted in an open house format with boards displayed showing the study area, drainage sub-basins, current and future land use, and jurisdictional boundaries. FCDMC and consultant representatives were available to answer questions and receive input regarding existing flooding problems and suggestions for solutions. Provision was made for written comments to be received.

A second set of Public Open House meetings was held at Brimhall Junior High and Mesquite Junior High Schools on January 4 and 5, 2000 respectively. Exhibits were displayed showing the three alternatives being considered as well as the Landscape and Visual Assessment results. FCDMC and consultant representatives were available to answer questions and receive comments on the alternatives. Provision was made for written comments to be received.

C. Areas of Flooding

Areas of flooding within the study area have been delineated as FEMA floodplains along the upstream embankments of the Eastern and Consolidated Canals and along the SPRR along Rittenhouse Road and along Arizona Avenue. Existing FEMA floodplains are shown on **Figure 5**. Flooding problems have been reported at major east-west roads crossing the canals, especially at Guadalupe and Pecos Roads.

Areas of potential flooding that have not been delineated exist along the *downstream* side of irrigation canals, particularly the RWCD Eastern Canal Extension. As runoff ponds and overtops the canal embankments it flows into the canals and is diverted downstream within the canals. In the past the RWCD would open the delivery gates and release the runoff onto the fields to prevent canal overtopping at downstream locations. In recent years development has begun converting the agricultural lands that historically received the released runoff to residential planned communities. As a result the gates cannot be opened and the potential exists for downstream flooding at unknown locations.

D. Existing Facilities

Few drainage facilities exist within the study area. The drainage pattern is predominantly overland in an east to west direction accumulating along the Eastern and Consolidated Canals and the Southern Pacific Railroad adjacent to Rittenhouse Road and adjacent to Arizona Avenue.

ADOT Channel - The Superstition Freeway intercepts runoff reaching the freeway from the north and conveys it westerly in a concrete channel along the north right-of-way to Holmes Park.

Holmes Park - Holmes Park is a 17-acre retention basin situated along the east side of the Eastern Canal at Greenfield Road. The basin was constructed by ADOT as part of the Superstition Freeway drainage system and incorporated into the City of Mesa Park system. A storm drain in Greenfield Road discharges into the basin. Holmes Park is drained with a pump system that can discharge into the Eastern Canal or west in the ADOT channel following a storm event.

Crossroads Park - Crossroads Park is a retention basin located along the north side of the SPRR at the Eastern Canal west of Greenfield Road. Crossroads Park was constructed by the Town of Gilbert and FCDMC to reduce flooding of the downtown area. Crossroads Park is approximately 40 acres in size and stores 450 acre-feet of water which is pumped into the RWCD Tailwater ditch after a storm event. The park is an example of a tiered, multi-use facility composed of a lake, baseball and soccer fields and a playground.

East Maricopa Floodway - The East Maricopa Floodway was constructed by the Soil Conservation Service (SCS) along the east side of the RWCD Canal to serve as a regional storm water outfall for eastern Maricopa County. The EMF is now owned and operated by the FCDMC and intercepts storm runoff from east of the RWCD canal south of the Southern Canal near Thomas Road and Val Vista Drive. The EMF starts at Brown and Greenfield Roads, parallels the RWCD canal, and extends over 27 miles crossing the Maricopa County southern boundary into Pinal County, across the Gila River Indian Community (GRIC) to its outfall at the Gila River. The EMF discharges over 15,000 cfs in a 100-year storm event. The EMF and RWCD Canals form the eastern watershed boundary for the Higley ADMP study area.

RWCD Tailwater Ditch & Ponds - The RWCD Tailwater Ditch parallels the SRP Eastern Canal from near the Superstition Freeway to its terminus south of Pecos Road at which point flows in the tailwater ditch drain into the RWCD Eastern Canal Extension. The primary

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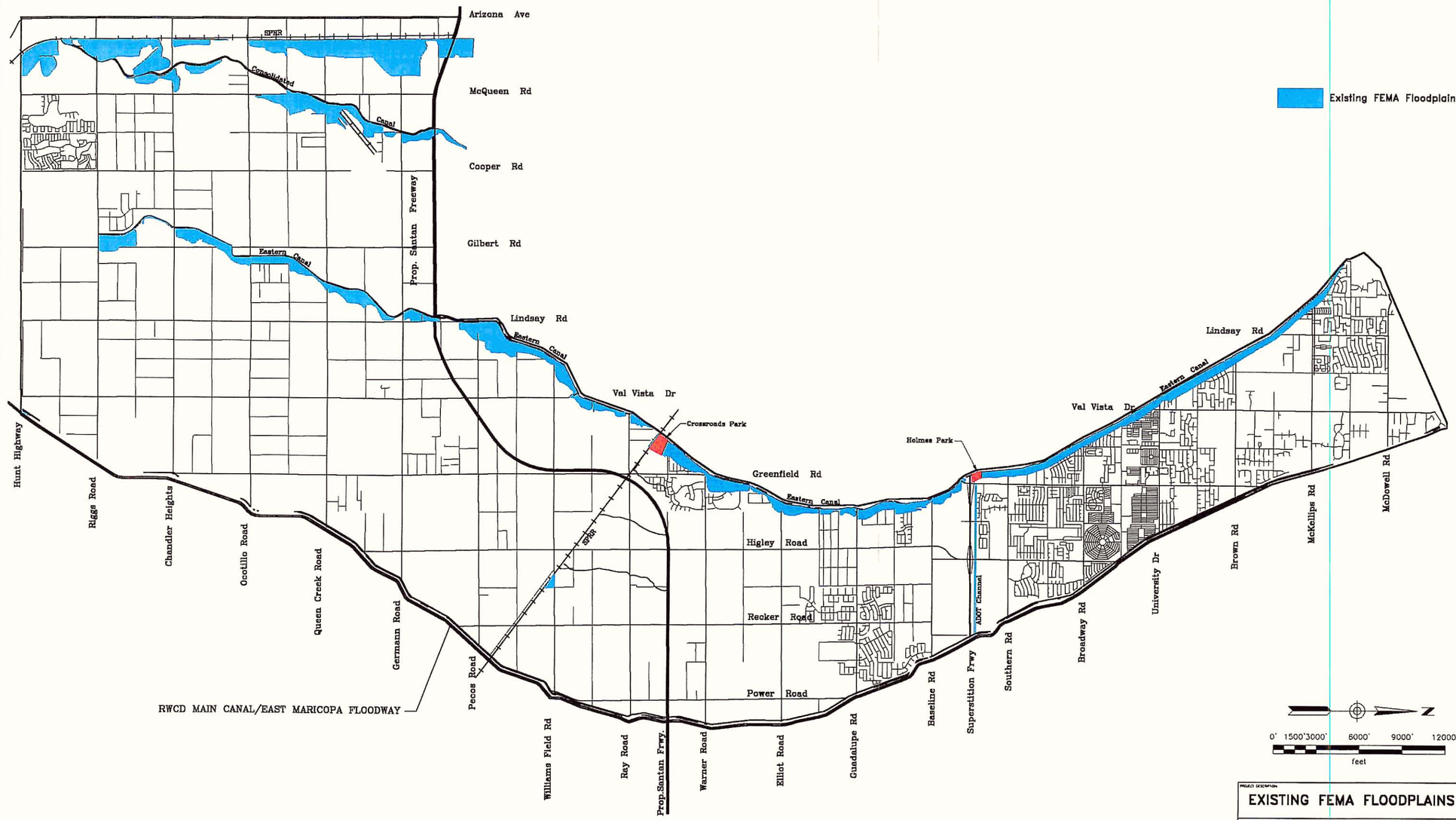

FIGURE-5

PROJECT DESCRIPTION

EXISTING FEMA FLOODPLAINS

CONSULTANT:

DIBBLE & ASSOCIATES
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purpose of the ditch is to collect agricultural return flows at the tail end of the fields for potential reuse. However, during storm events surface runoff also drains into the ditch frequently resulting in flooding. The RWCD tailwater ditch ends at Riggs Road west of Gilbert Road. There is a large tailwater pond near the end of the ditch that collects and retains tailwater flows for future pumped reuse.

Santan Freeway - The proposed Santan Freeway will block westerly drainage within the study area from Lindsay Road to Higley Road. The preliminary design for the freeway includes collector channels and basins to intercept the runoff, retain the flows, and drain westerly along the freeway to the Gila Floodway. Runoff accumulating along the SPRR, Consolidated Canal, and Eastern Canal are not intercepted by the freeway. Large equalizer culverts are proposed under the freeway to pass these flows through from north to south. ADOT has adopted an accelerated construction schedule for the MAG freeway system to include the Santan Freeway. The reach from Arizona Avenue to Gilbert Road has been accelerated from October 2008 to December 2005, the reach from Gilbert Road to Williams Field Road from June 2011 to December 2006, and the reach from Williams Field Road to Power Road from June 2012 to March 2007. The potential may exist to cooperate with ADOT in developing a new drainage outfall for the area. A freeway conveyance system could be incorporated into the final drainage master plan.

E. Runoff Quantities

Runoff quantities from the 100-year, 24-hour storm are summarized in **Table 1** for key concentration points throughout the study area.

Table 1 - 100-Year Runoff Quantities

LOCATION	Existing Q100 (CFS)
Eastern Canal at:	
Hermosa Vista Drive	0
McKellips Road	75
McLellan Road	20
Brown Road	0
Adobe Street	7
University Drive	407
Main Street	623
Broadway Road	407
Southern Avenue	430
Inflow to Holmes Park Basin	779
US60-Superstition Freeway	110
Baseline Road	130
Guadalupe Road	463
Elliot Road	824
Warner Road	1086
Inflow to Crossroads Park Basin	1776
Ray Road	187
Williams Field Road	227
Pecos Road	594
Germann Road	925
Queen Creek Road	623
Ocotillo Road	593
Chandler Heights Road	856
Riggs Road	492
Hunt Highway	568
Consolidated Canal at:	
Germann Road	535
Queen Creek Road	634
Ocotillo Road	581
Chandler Heights Road	1130
Riggs Road	1499
Hunt Highway	333

F. Natural, Physical, and Cultural Environment

For the purposes of this document, the limits of the environmental inventory were extended approximately one mile beyond the Higley ADMP study area boundary, except for the hazardous material investigations and visual analysis. The hazardous material investigation covered an area 500 feet on either side of the Eastern and Consolidated Canals. The visual conditions inventory considered the seen area or viewshed which would, in some areas, extend beyond the ADMP study area boundary.

This section describes the existing natural, physical and cultural environment within the study area in terms of visual, biological, and cultural resources, and hazardous materials. The inventory of the natural, physical, and cultural environment of the study area consisted of gathering existing resource data and information from various local, State, and Federal regulatory agencies having jurisdiction within the project area. These agencies include the Arizona Department of Environmental Quality (ADEQ), Arizona Department of Transportation (ADOT), Arizona Game and Fish Department (AGFD), Arizona State Museum (ASM), State Historic Preservation Office (SHPO), US Fish and Wildlife Service (USFWS), Maricopa County, and the Roosevelt Water Conservation District (RWCD) in addition to the municipalities of Mesa, Gilbert, and Chandler. The characteristics of the physical and natural environment were also identified based on a reconnaissance survey of the study area.

1. Regional and Local Setting

The Higley ADMP study area lies along the interface of Arizona's Basin and Range and Central Highland geologic provinces. The Basin and Range province is characterized by rocky mountain ranges that alternate with desert basins as the primary landform organization. The Central Highlands have tightly-clustered ranges and narrower, shallower, and less numerous basins. These formations are distinct, although some consider them transitional from the Basin and Range to the Colorado Plateau province in northern Arizona. Off-site landforms, such as the

Superstition and Santan Mountains, visible to the north, east and south of the study area are characteristic of the Basin and Range province. Landforms to the northeast and east, such as the Usery Mountains and Four Peaks, are included in the Central Highlands province.

The study area is located in the southeastern portion of the Phoenix Metropolitan Area, within Mesa, Gilbert and Chandler. The entire study area lies within the jurisdiction of Maricopa County, and lands within the study area are generally privately owned. Elevations within the study area range from approximately 1258 feet above mean sea level at McDowell Road to 1224 feet above mean sea level at Hunt Highway. Minor elevational differences within the study area provide panoramic views of distant vistas, adjacent landforms, farmlands, and urban development.

Prior to urbanization, the study area was located within the Sonoran Desertscrub vegetative community. The Sonoran Desertscrub is characterized by Saguaro (*Carnegiea gigantea*), Bursage (*Ambrosia deltoidia*), Creosotebush (*Larrea tridentata*), Ocotillo (*Fouquieria splendens*), Prickly Pear/Cholla (*Opuntia spp.*), Palo Verde (*Cercidium* sp.), and Ironwood (*Olneya tesota*). Native plant communities have been substantially eliminated in the agricultural and urban development areas, where crops and ornamental plants are now prevalent.

2. Visual Resources

The existing visual resources of the study area are described below based on readily accessible viewpoints along existing streets and accessible locations within the study area. Visual resources of the study area were evaluated in terms of the existing visual conditions and landscape character. The visual conditions analysis included an identification of distinct features, areas of high and low scenic quality, relative visual intactness, and location of major viewpoints. Distinct features are those features comprising contrasting landscape elements that make a memorable visual impression as they combine to form a striking visual pattern. Scenic quality or attractiveness is a combination of attributes based on landforms, water characteristics, vegetation patterns, and architectural/cultural elements. Visual intactness relates to the integrity of visual order in the natural and human built landscape, and the extent to which the landscape is free from visual encroachment.

The second component of the visual resource evaluation for the Higley ADMP is the delineation of landscape character units. Landscape character is the physical appearance of the landscape including the natural, physical, and architectural/cultural features that gives it an identity and "sense of place." The existing landscape character is based on defining areas of similar land use, vegetation, spatial enclosure, landform, or architectural/cultural patterns. A relative overall evaluation of visual quality was made in terms of distinctiveness and level of intactness for each unit.

a. Visual Conditions Analysis

Figure 6, *Visual Analysis* graphically represents the existing visual conditions within the Higley ADMP. Within the study area there are distinct built features that modify the natural landscape. Built features include the Eastern, Consolidated, and RWCD canals, surface water bodies associated with irrigation districts and municipal recharge areas, major overhead transmission lines and towers, existing and proposed transportation corridors (Superstition Freeway (US 60), Southern Pacific Railroad, and proposed Santan Freeway), and several cultural or social centers. Falcon Field, Champlin Fighter Museum, Superstition Springs Mall, Chandler Airport, Chandler-Gilbert Community College, and Williams Gateway Airport are cultural centers within the expanded study area.

The outstanding natural features of the seen area from the study area include prominent off-site landforms and vistas across the valley floor. The McDowell and Estrella mountains are visible and contribute to the visual setting of both ends of the study area. The prominence of these features is further articulated by the relatively flat nature of the study area. The Santan Mountains define the background area to the south. To the northeast, the Usery and Superstition Mountains provide distinct rugged landforms and skyline character. Desertscrub vegetation covers a small area of the southeastern portion of the study area, while large tracts of farmland are prominent south of the Superstition Freeway in the study area. Mesquite bosques, mature cottonwoods, remnants of citrus orchards north of Brown Road, the Lehi mesa overlooking the Salt River Valley, and the Salt River channel are considered distinct natural features. Major viewpoints within the Higley ADMP study area to view the noted natural features include the mesa in the northern portion, and at the existing and future overpass locations along the Superstition and Santan freeways, respectively. The arterial crossroads over the canals provide minor viewpoints to the linear water features. They are considered to be minor because of the relatively small window of viewing provided.

Areas of low visual quality are landscapes that have been substantially modified and are also considered to have low levels of intactness. These areas are associated with developed areas where there are large tracts of disturbed land such as the City of Chandler landfill located between Queen Creek Road and Ocotillo Road east of McQueen Road and the parcels near Arizona Avenue and Riggs Road where trash and discarded equipment are stored. The industrial area along the south side of the Lehi mesa contrast in scale and color with the other features in the

landscape and dominate the setting. In general the industrial, and much of the urban developed areas in the northern portion of the study area, are considered to have a low to moderate level of intactness. The exception is the area north of Brown Road that has retained much of the citrus orchards that were established in the mid 1900's. The orchards provide visual interest and coherence and create a higher level of visual integrity in the urban setting, similar to the large tracts of agricultural fields in the middle and southern portion of the study area.

b. Existing Landscape Character

To further describe the visual resources of the Higley ADMP, the study area is broken into broad-based landscape character units. Landscape character units, as previously stated, are based on the presence of vegetation, changes in land use, degree of spatial enclosure, and the presence of notable landform or architectural/cultural patterns in the landscape. The resulting units are areas of similar visual character. Each unit has been named and described in terms of its vegetative cover, landform, land use, and special features in the foreground, middleground, or background. Distance zones refers to the relative position of the observation point as follows: (1) foreground - up to 0.25 mile; (2) middleground - 0.25 mile to three miles; and (3) background - three to five miles. **Figure 7**, *Existing Landscape Character* identifies the location of the eight units delineated within the study area.

Rural/Farmland. Agriculture and low density single-family residences create a rural, pastoral pattern which characterizes the area primarily in the middle and southern portion of the study area. This unit is depicted by flat terrain with expansive views in all directions with agricultural planting patterns and colors dominating the landscape. Agricultural fields include such elements as silos, and irrigation ditches. Several dairy farms are also found within the study area. The color of the structures vary, and the vertical scale and reflective nature of the material associated with silos and farm facilities attract some attention. The various canals and tailwater/irrigation ditches are built features adding to the unit's rural character. Residences are scattered throughout the unit, though some areas are developed more densely than others. The residential structures are conventionally constructed, single-story type residences of varying materials and colors such as wood, brick, and block. The overall visual quality of this unit ranges from moderate to high in the study area because the landscape elements such as landform, color and texture create a notable pattern and there is a high to moderate level of intactness.

Rural/Farmland Unit

Industrial/Institutional. Industrial and institutional uses and activities characterize this unit. Large buildings, security fences, and towers are the prominent visual elements within the unit. These structures create strong vertical and horizontal elements and contrast in color and material with their surroundings. The terrain is relatively flat and vegetation is scarce. The colors of some of the features such as the blue tower at Falcon Field and the building colors at Chandler-Gilbert Community create distinct features in the landscape. The visual quality of the unit is low in terms of intactness of the visual resources of the landscape. The landscape elements have been modified in such a way that no particular cohesive patterns or forms blend to create a particularly memorable impression in the setting.

Industrial/Institutional Unit

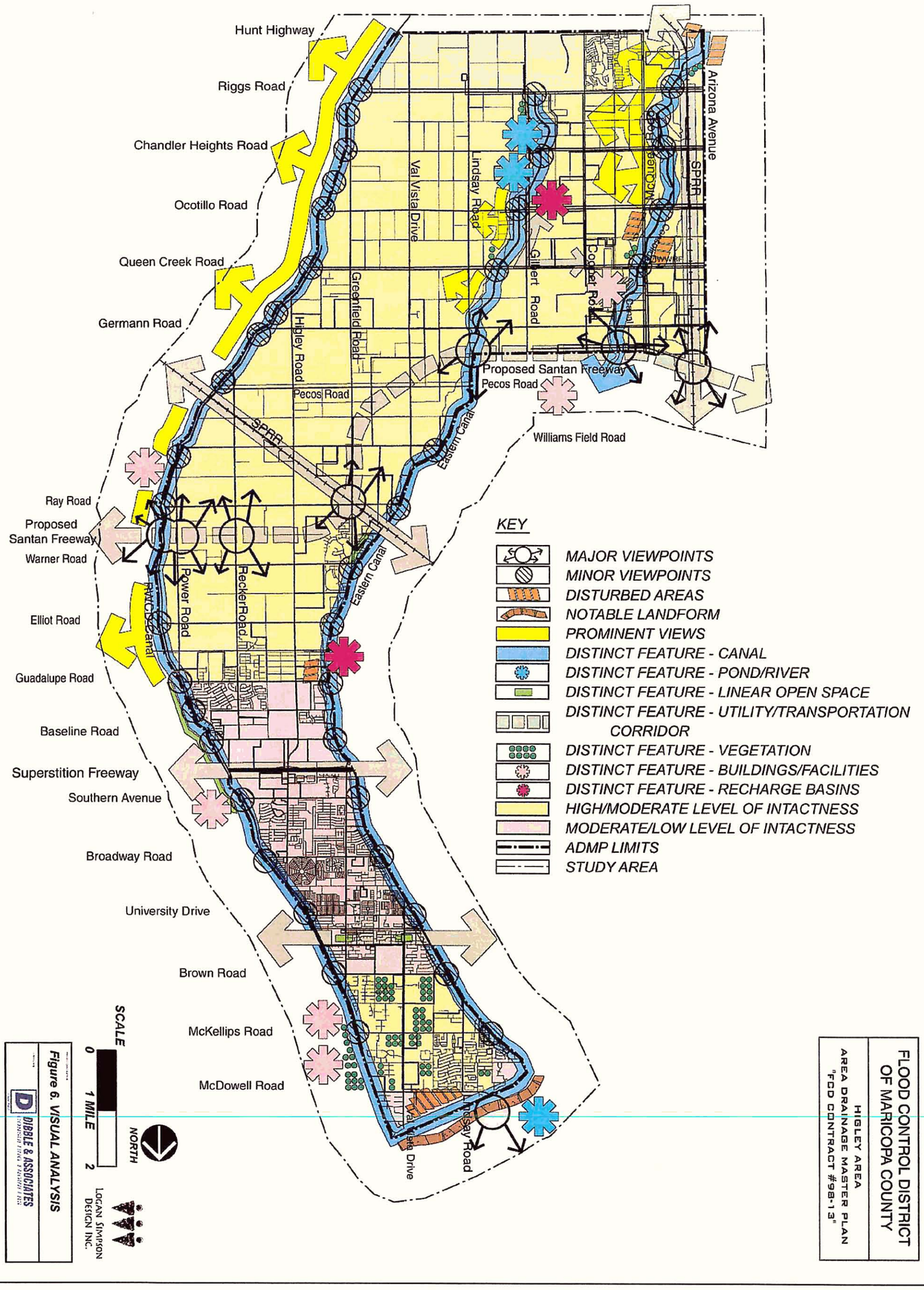

Figure 6. VISUAL ANALYSIS

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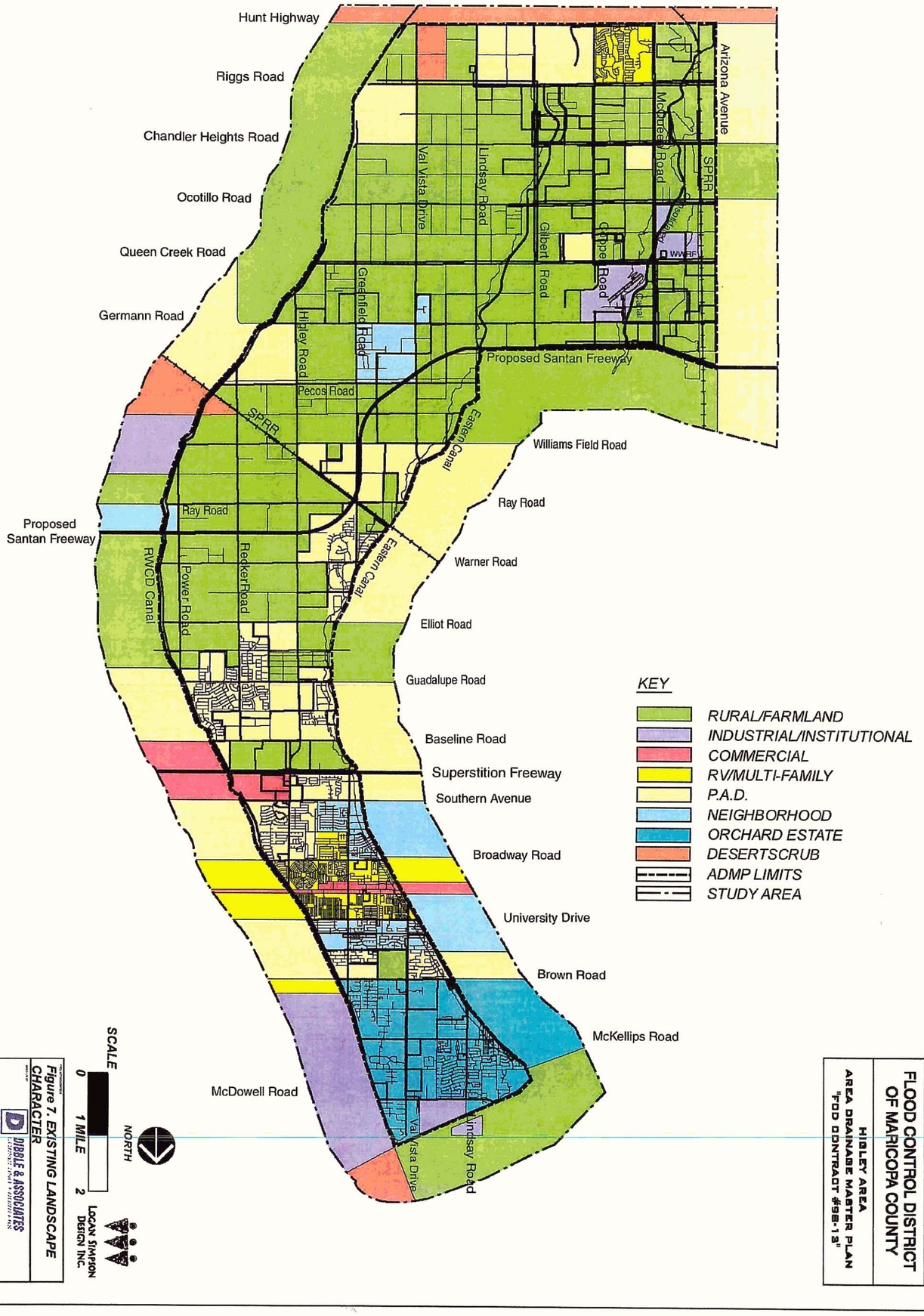

Figure 7. EXISTING LANDSCAPE CHARACTER

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Commercial. The character of this unit is a mixture of development including office, retail, service-oriented, and restaurant uses common to suburban development along major arterial roadways. Billboards, building signs, overhead utilities, and street signage and lighting are built features that dominate and are readily visible in the landscape. University Drive and Southern Avenue are the major local transportation corridors and consequently, act as the cores around which urbanization occurs. The existing structures create high visual enclosure because of the presence of two-story buildings, signs, and other built features. Vegetation is limited and subordinate to the built features. Architectural styles vary and there is a general lack of cohesive materials, textures, or colors. The unit is relatively flat as a landform. In terms of vividness and intactness of the visual resources of the landscape, in general, the visual quality of the unit is low. No particular patterns, spaces, or features combine to make a memorable impression in the landscape. Modifications to the natural landscape have become the dominant features in this unit.

Commercial Unit

RV/Multi-Family. The character of this unit is a mixture of high density residential of typical modern suburban development. Overhead utilities, street signage and lighting are built features that dominate and are readily visible in the landscape. The existing structures create high visual enclosures because of the presence of multi-story buildings. Vegetation is limited and subordinate to the built features. The architectural styles of the multi-family residences vary and there is a general lack of cohesive materials, textures, or colors. In the RV developments, the building scale, form, color, and style are uniform. The unit is relatively flat as a landform. In general, the visual quality of the unit is low in terms of vividness and intactness of the visual resources of the landscape. No particular patterns, spaces, or features combine to make a memorable impression in the landscape. Modifications to the natural landscape have become the dominant features in this unit.

RV/Multi-family Unit

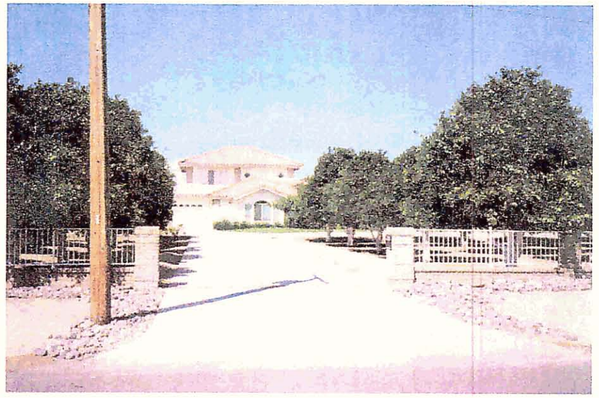
P.A.D. The P.A.D. (planned area development) unit typically has a uniform residential character. Concrete block walls enclose the residential developments. These block walls create a strong linear form within the suburban surroundings. The P.A.D. unit has similar architectural elements, narrow lots, mixed ornamental and desert landscaping, masonry block walls, and street lights typical of a suburban neighborhood setting. These modern, residential developments have similar materials and colors, typical of the stucco, tiled-roof, suburban architectural genre. Residences within the unit include one and two-story homes. The second floor of these homes provides for views to the surroundings. The building and wall structures dominate the setting. Vegetation is predominately ornamental and turf is used frequently to create open space and connect the various built facilities within the subdivision. The vegetation is also consistently manicured and pruned to create a sense of organization and formality. Overall, the visual quality of the unit is moderate to low in terms of vividness and intactness of the visual resources of the landscape. The landscape elements have been modified in such a way that patterns and features do not blend to create a memorable impression, but instead create a visually uniform environment.

P.A.D. Unit

Neighborhoods. Large open lots, scattered single story, ranch-style residences, and mature vegetation typify the character within this unit. There are a few overhead utilities on single wood poles, but in general the appearance and character of this unit is one of a mature, well-established neighborhood. Ornamental tree species bordering yards include eucalyptus, cottonwood, and pine. Seldom are vertical block walls used to delineate property boundaries, instead vegetation, wood, or chain-link fencing are used. The vegetation and building structures are prominent in the setting. The visual quality of the unit is moderate to high in terms of vividness and intactness of the visual resources of the landscape. The landscape elements have been combined in such a way that patterns and features create a notable impression.

Neighborhood Unit

Orchard Estate. Large, custom-styled residences and the mature vegetation of the citrus orchards typify the character within this unit. There are a few overhead utilities on single wood poles, but in general the appearance and character of this unit is one of an exclusive neighborhood. The formal rows of the citrus trees create a distinct, unifying pattern in the landscape. Residences are placed within the orchards of citrus tree species with formal entrances off local streets and spatially enclosed by the mature citrus trees. The vegetation is dominant in the setting with the building structures subordinate. The general visual quality of the unit is moderate to high in terms of the vividness and intactness of the visual resources of the landscape. The landscape elements have been combined in such a way that patterns and features create a notable impression.



Orchard Estate Unit

Desertscrub. The predominant characteristic of lands within this unit is one of relatively undisturbed native desert dotted by scattered single-family residences. The terrain is relatively flat. The irregularity and color of native vegetation makes it readily distinguishable from that of surrounding agricultural fields. Mature mesquite trees, creosotebush, and desert broom are prevalent and dominate the setting. Built elements are isolated visual features which do not affect the overall visual character created by the native desert. Distant views of the Superstition and Santan Mountains form a distinctive background. The overall visual quality of the unit is moderate to low even though the level of intactness would be considered moderate to high. The landscape elements do not combine to make a memorable visual pattern.

Desertscrub Unit

3. Ecological Assessment

An ecological assessment was prepared in coordination with the AGFD, Maricopa County, Cities of Chandler and Mesa, Town of Gilbert, the RWCD, and Salt River Project. The US Fish and Wildlife Service's list of endangered and threatened species for Maricopa County was evaluated. The AGFD's Heritage Data Management System of Wildlife of Special Concern in Arizona (WSCA) for the project area was also reviewed. A reconnaissance field biological survey of the study area was conducted in March and April of 1999 and included site visits with personnel from the FCDMC and AGFD. **Figure 8** illustrates the natural features including areas of high habitat value within the study area.

Within the Higley ADMP study area, there is no prominent natural drainage feature such as a river or stream; however, a diversity of

wildlife inhabits the study area. Along portions of the Consolidated Canal, the canal is earthen and, in some areas, supports small amounts of vegetation at the margins. Natural channels of this type occur parallel to the Eastern Canal north of Pecos Road, and north of Ray Road. These earthen channels offer much higher habitat value for wildlife than the concrete-lined portion of the canals because the soil banks support vegetation, permit burrowing activity, and allow wildlife to move freely in and out of the canals. Adequate breeding conditions for amphibians, i.e., relatively still, shallow, long-standing waters with some vegetative cover and a natural substrate, are scarce within the study area.

Most of the 'laterals' or irrigation side-ditches running east-west are concrete-lined; nevertheless, in some areas silt and vegetation are allowed to accrue, creating ephemeral wildlife habitat. Small fish and tadpoles were observed in some of these laterals. For this reason, the Eastern and Consolidated Canals along their entire length constitute a significant wildlife attractant in the East Valley. Wildlife benefit most from water resources when adjacent natural vegetation is present.

Within the Higley ADMP study area, there are only two substantial areas of natural vegetation. One occurs at the southern end of the Eastern Canal, between Ocotillo Road in the north and Riggs Road in the south, along the west side of Gilbert Road. In this location there are two permanent ponds, referred to as RWCD Ponds #2 and #3. Surrounding these ponds are velvet mesquite bosque, and scrublands dominated by wolfberry, saltbush, and exotic grasses. Many of the wildlife species recorded in the study area during the reconnaissance survey were observed in this area. This woodland has possibly arisen because of the localized surface water drainage impacts of the elevated Eastern Canal, and by subsurface water impacts of the RWCD irrigation overflow ponds.

Another natural area exists on the southeast corner of McQueen Road and Queen Creek Road, just south of the Chandler Municipal Airport. The site is disturbed by grazing, but contains patches of native vegetation in a one-quarter square-mile area. Smaller patches or narrow corridors of mesquite, paloverde, and other native trees and shrubs are present throughout the study area. These areas offer less habitat value than larger, continual blocks of vegetation. The Gilbert and Chandler recharge basins located along the Eastern Canal near Elliot Road and Ocotillo Road respectively, also provide good habitat for waterfowl. Preservation areas for habitat as well as visual and recreation considerations have been identified and include ponds, parks/open spaces, orchards, mesquite bosques and cottonwoods, and the canals.

4. Physical Considerations

The physical considerations for the Higley ADMP consisted of the identification of hazardous material concerns. The inventory of hazardous material concerns constituted of a review of files at ADEQ. Listings within the study area included 18 incidents or areas of hazardous material concerns. These areas are indicated on **Figure 8**. Several sites have more than one incident report. Of the hazardous material sites identified, one location is listed on the State Superfund list. This site near the Consolidated Canal and Riggs Raod may have an actual or potential impact upon the waters of the State caused by hazardous substances.

5. Cultural Resources

Information for the Class I cultural resource study was gathered from archaeological inventory and site records at the ASM, SHPO, the Pueblo Grande Museum, and Arizona State University. The National Register of Historic Places (NRHP) was consulted to determine if properties listed on the Register were located within the study area. Plats from the Government Land Office on file at the Bureau of Land Management (BLM) were consulted to locate historically-recorded properties or features in the study corridors. Information about historic canals was provided by Salt River Project and the Bureau of Reclamation. The areas of high archaeological site density, the potential and listed historical sites, and one potential historic feature are illustrated on **Figure 8**.

The records research shows 17 documented cultural resource surveys have occurred in the study area and archaeological sites have been recorded. Previous cultural resource surveys cover a small portion of the study area; most of the area has not been assessed for cultural resources. The recorded sites contain a range of temporally and functionally diverse artifacts and features associated with the prehistoric Hohokam culture. Sites of similar composition, age and magnitude found elsewhere in the Phoenix Basin are known to have extensive, intact, buried cultural deposits. These sites are considered potentially eligible to be listed on the NRHP.

Although no properties in the study area are listed on the NRHP, the operating SRP canals and the Southern Pacific Railroad are considered potentially eligible to be NRHP listed. These features require additional field-study and research to make a final determination of NRHP eligibility. Cultural resources in the study area also include prehistoric Hohokam sites that are potentially eligible to be NRHP listed. Other current cultural resources within the study area include Rodeo Park as a special use area and the Champlin Fighter Museum.

G. Land Use and Transportation Environment

Information from existing municipalities and planning organizations were utilized in preparing the land use and transportation environment.

1. Existing Land Use

A "windshield survey" of the study area identified the existing land uses in the general categories of residential, commercial, mixed use, agriculture, park/open space, industrial, public/quasi-public, and vacant as shown on **Figure 9**. A greater variety of land uses are found in the northern portion of the study area when compared to the mid and south areas. Agriculture is the predominate land use in the mid and south areas only.

2. General Plan Land Use

Adopted general plans from the respective municipalities of Mesa, Gilbert, and Chandler identify the general planned land uses within the Higley ADMP study area. These land uses are divided into the categories of residential, commercial, mixed use, mixed use employment, transition zone, park/open space, general industrial, and public/quasi-public as shown on **Figure 10**. Much of the agriculture areas are anticipated to change to residential, mixed use employment, and general industrial. The City of Chandler has identified a 'transition zone' that incorporates higher density development to lower density development.

3. Transportation System

Figure 11 depicts the existing and planned intermodal transportation, traffic generators, and gathering spaces within the study area. Existing and planned multi-modal transportation links have been identified and include existing and planned multi-use pathways, existing and planned equestrian trails, existing and planned bike lanes/trails, existing and potential pedestrian bridges, existing transit routes, existing park and ride facilities, proposed Santan Freeway, and Roads of Regional Significance. Existing major trails are generally aligned along the Eastern and RWCD canals conceptually north of the proposed Santan Freeway in a north/south direction. East/west connection of trails are less abundant, but exist along major arterial roadway alignments. A concentration of trails exists in Gilbert around the regional Crossroads Park. Additionally the Maricopa County Sun Circle Trail currently exists along the Southern Canal at the northern reach of the study area and continues down the Consolidated Canal to Elliot Road. The Superstition-Santan Corridor and Marathon Trail is currently being planned by the FCDMC and local jurisdictions as a recreation and multi-use system along the East Maricopa Floodway. The bike facilities include both on-street and remote trails. There are numerous Roads of Regional Significance within the study area (refer to Figure 11, *Transportation Land Use Links & Nodes*). A Road of Regional Significance refers to a designation by the Maricopa Association of Governments of those roadways that are considered major regional transportation corridors. The typical cross section of a Road of Regional Significance includes six travel lanes with bike lanes and a raised median. Existing and planned parks/open spaces, and existing golf courses, flood control basins, utility corridor, schools, and retail/cultural/social centers have also been noted. Significant parks both existing and planned within the study area include: the Gene Autry Park & Ballfield Complex near Falcon Field; the Riparian Preserve at Water Park and proposed adjacent addition as part of Gilbert's water recharge system; the regional parks in Gilbert and Chandler including, Crossroads Park and proposed 40-acres within Chandler; and the adopted plan for 'The Paseo' project–a combination of linked parks and development along the length of the Consolidated Canal from Hunt Highway north to the proposed Santan Freeway.

H. Planning Influences

The inventory and evaluation of the environmental considerations associated with the Higley ADMP study area was synthesized to identify the opportunities and constraints or planning influences on the development of flood control measures. Planning Influences are shown on **Figure 12**. Opportunities included adding trail and pathway segments to complete and connect the existing network, especially utilizing the Eastern, Consolidated, and RWCD canals as major north/south corridors. The Paseo project identifies opportunities to incorporate the canal into the fabric of the community. There are few east-west connections among the canals. Public access points to the canals will become more critical as the trail/pathway system is completed. Locating basins at major crossroads could provide staging areas as well as potential park-and-ride facilities. The City of Chandler has also identified a need for a 40-acre regional park that could also serve as a flood control basin similar to Crossroads and Holmes Parks. The freeway transportation corridors are both a physical constraint and visual barrier. The freeway overpass structures provide an opportunity to connect trails/pathways. There are locations where residences front the canal, more so in the rural areas than in the planned subdivision areas. There is one subdivision located north of the proposed Santan Freeway where the homes front the Eastern Canal. This area could serve as a prototype for future community integration of the flood control facility, especially with the conversion of agricultural land into residential use.

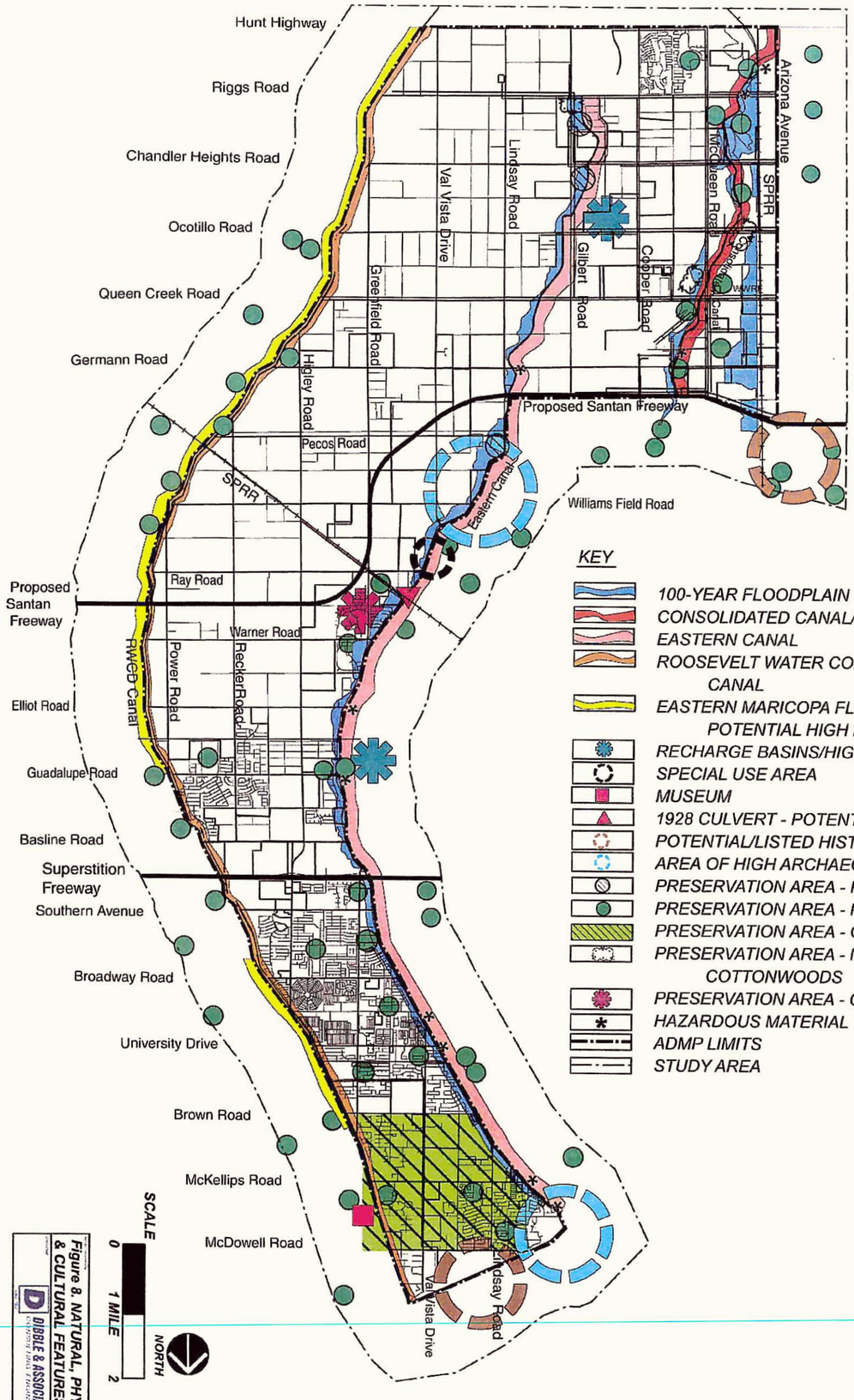


Figure 8. NATURAL, PHYSICAL & CULTURAL FEATURES

DIBBLE & ASSOCIATES CONSULTING ENGINEERS

LOGAN SIMPSON DESIGN INC.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT #98-13"

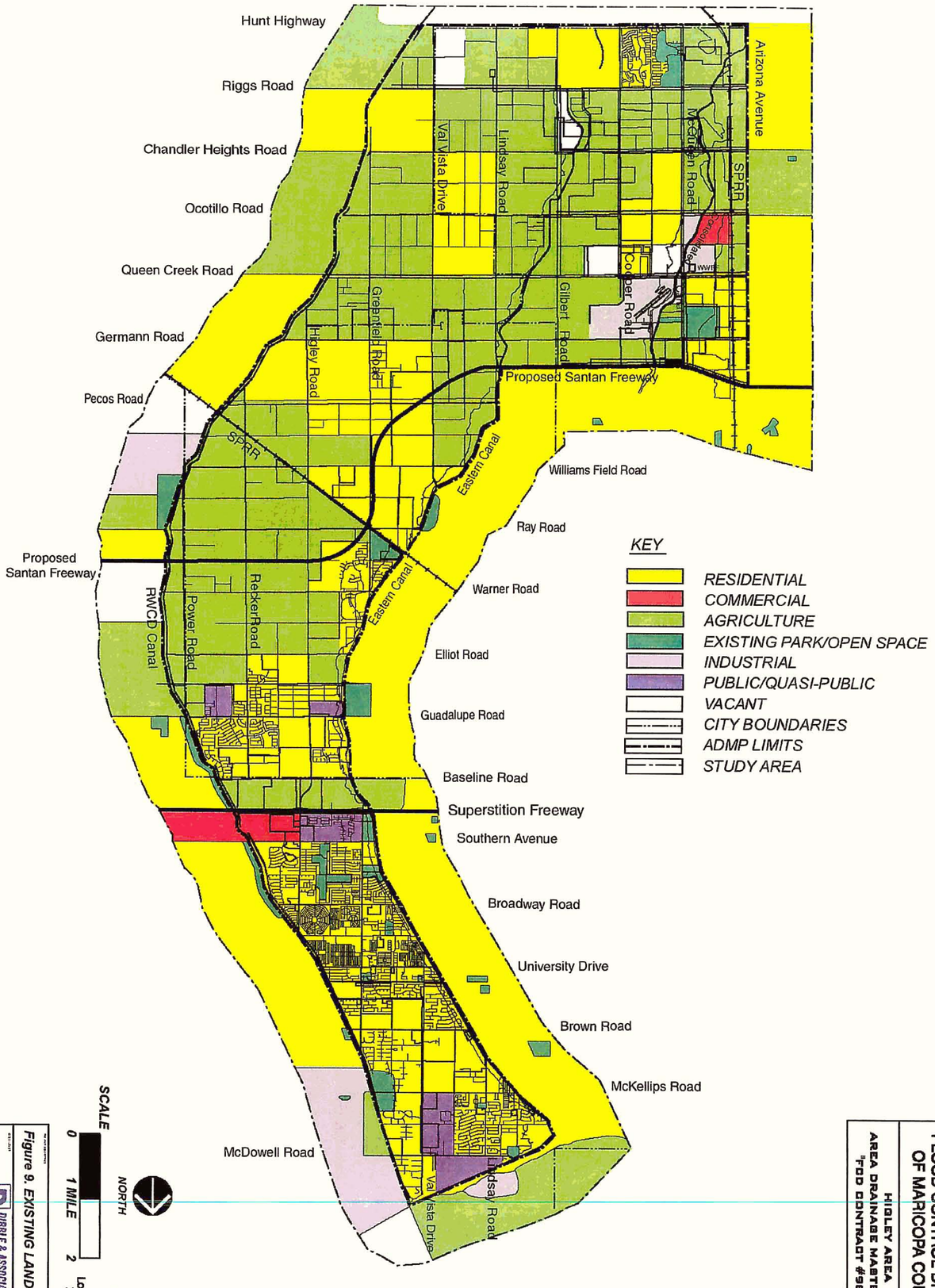


Figure 9. EXISTING LAND USE

DIBBLE & ASSOCIATES CONSULTING ENGINEERS

LOGAN SIMPSON DESIGN INC.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA DRAINAGE MASTER PLAN "FCD CONTRACT #98-12"

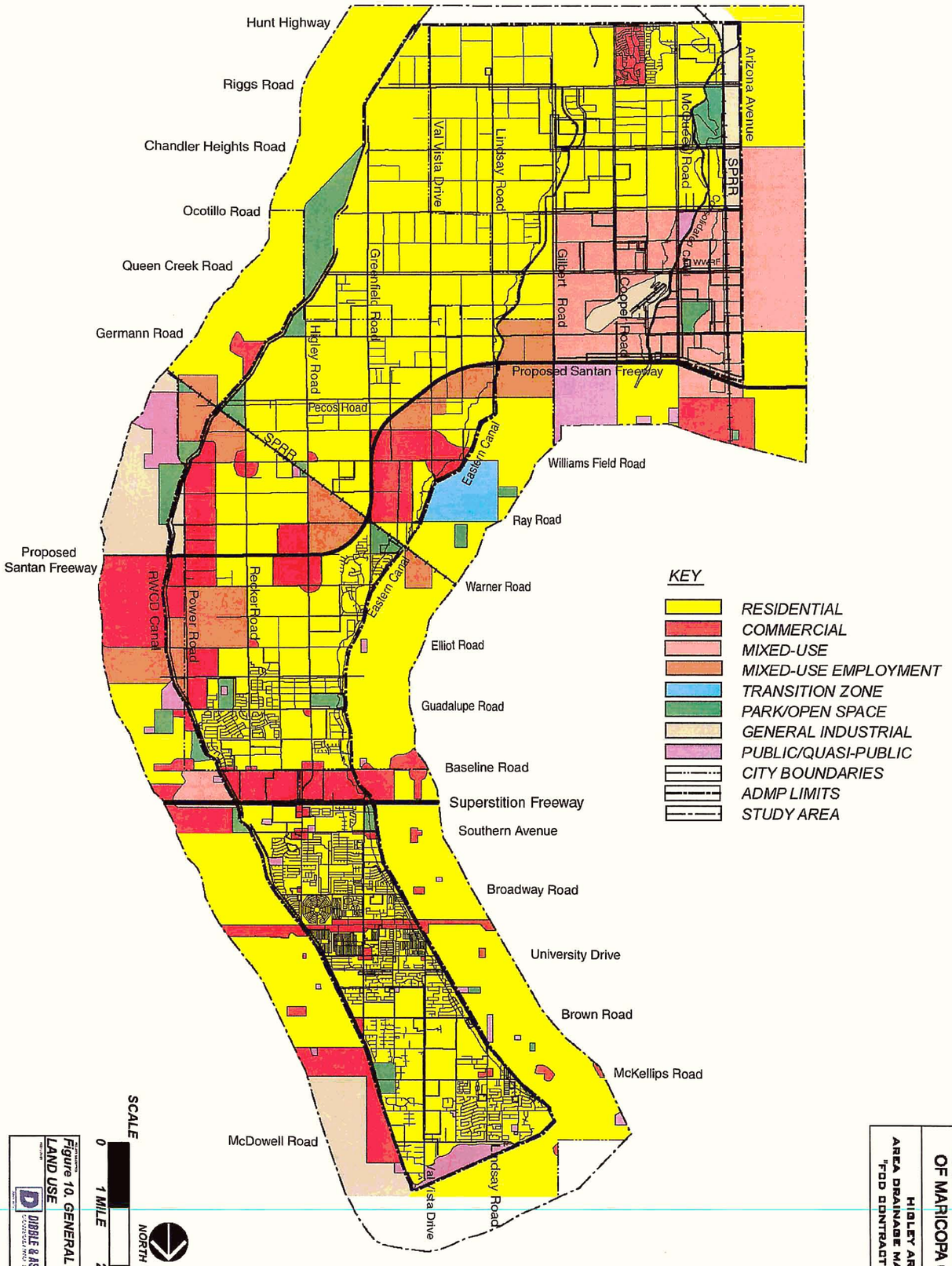


Figure 10. GENERAL PLAN LAND USE

DIBBLE & ASSOCIATES

LOGAN SIMPSON DESIGN INC.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA DRAINAGE MASTER PLAN "FCD CONTRACT #98-13"

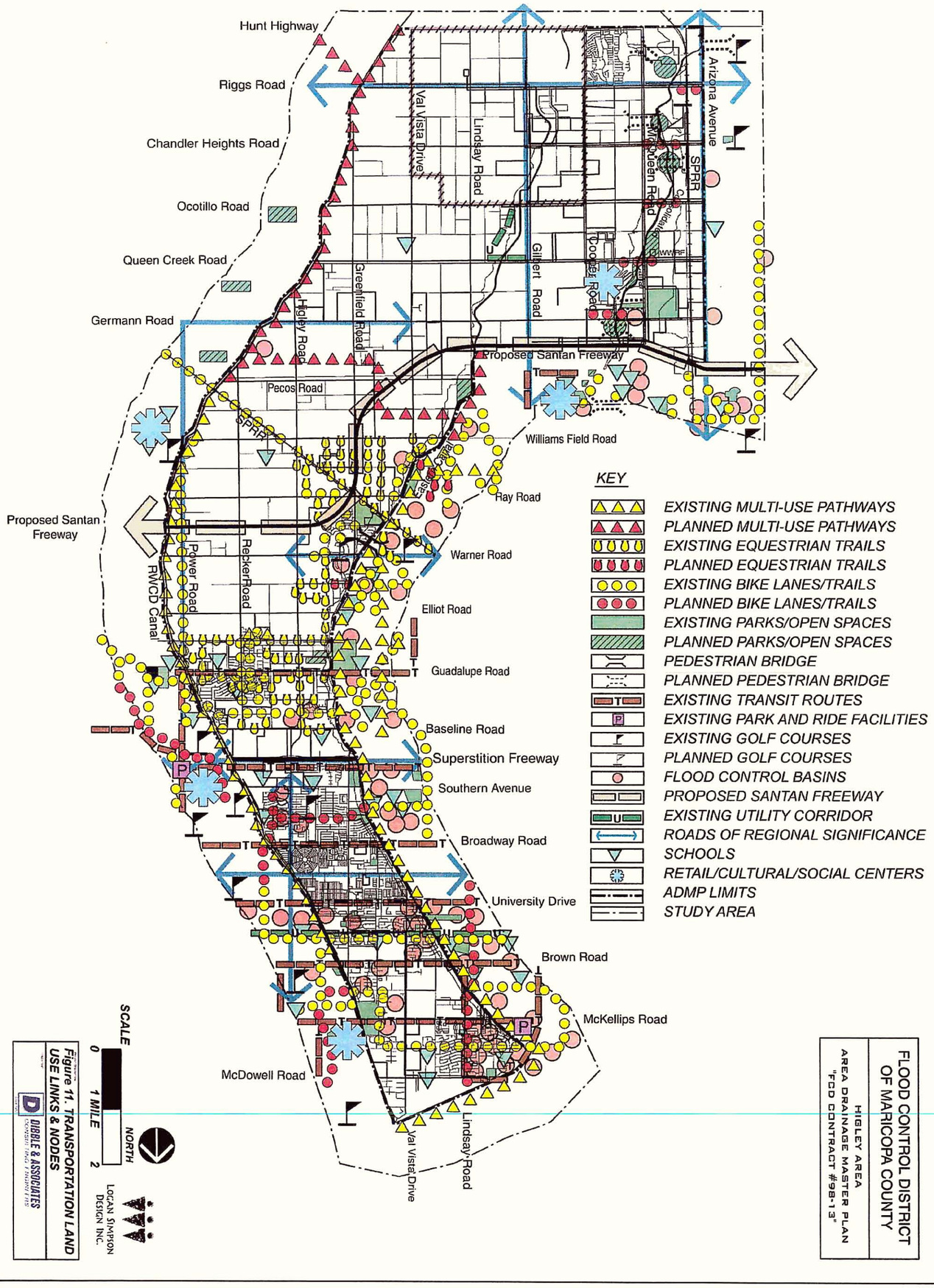


Figure 11. TRANSPORTATION LAND USE LINKS & NODES

DIBBLE & ASSOCIATES
LOGAN SIMPSON DESIGN INC.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT #98-13"

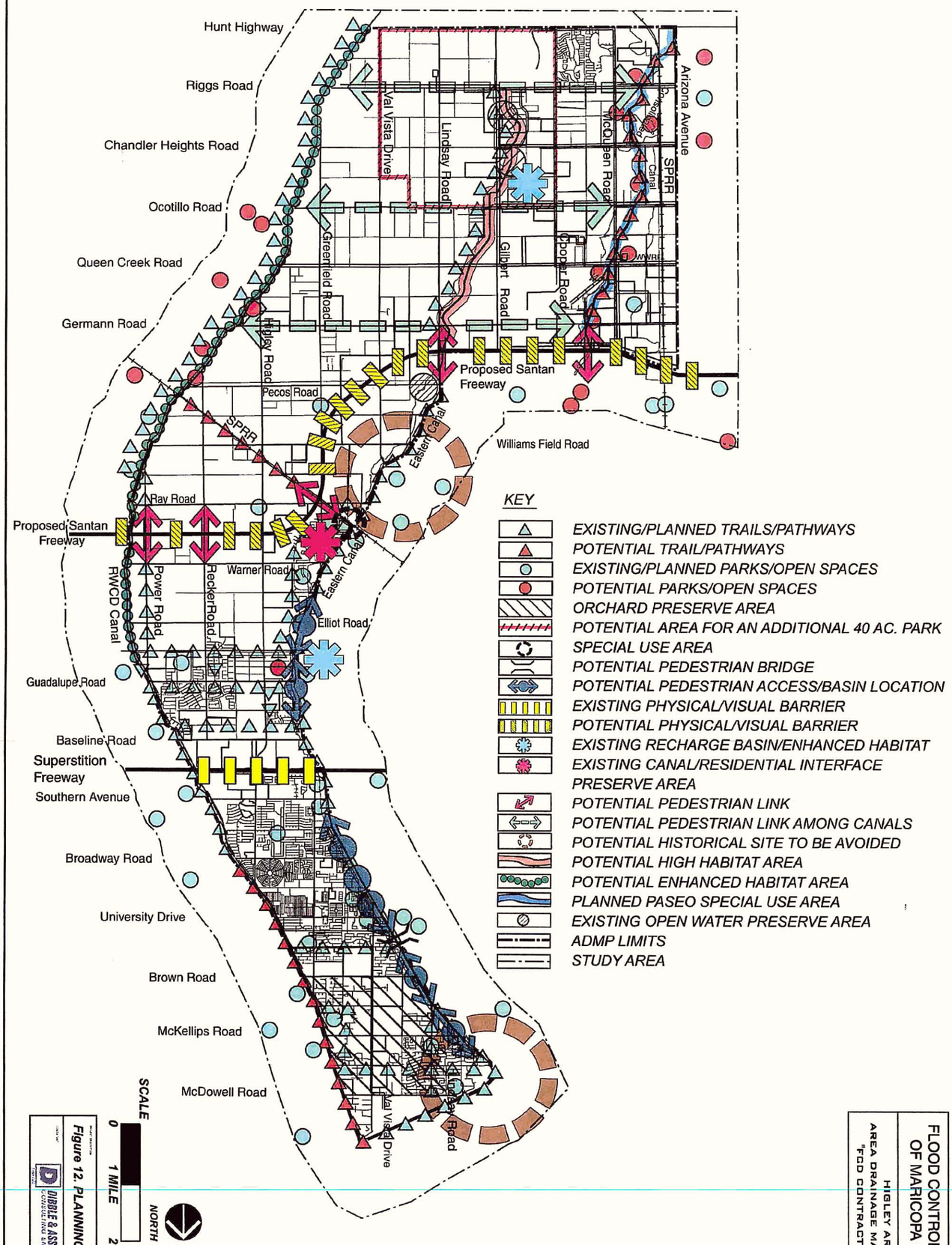


Figure 12. PLANNING INFLUENCES

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT #98-13"

IV. BASIN MANAGEMENT ALTERNATIVES

A. Introduction

Basin storm water management alternatives were identified through a brainstorming session held with the Review Committee on June 2, 1999 at the Maricopa County Parks Department. The purpose of the session was to identify flooding problem areas and alternative concepts for solutions to the drainage problems.

Alternatives for collection and conveyance of runoff were identified separately for each planning area as well as outfall opportunities for each planning area. An Existing Constraints Map, shown on **Figure 13**, was used to show the planning constraints identified in the Data Collection Phase. Blueprints of the map were used to mark alternatives as they were identified. The brainstorming session was intended to be a creative setting to generate possible alternatives. Agency representatives in attendance were given the opportunity to share their issues and objectives for the project as well as opportunities for cooperation and multiple-use benefits that may be achieved with the project.

B. Major Choices in Developing Alternatives

Numerous choices are available in developing drainage alternatives; many more than can be realistically analyzed in detail. The process of developing alternatives involved considering, evaluating, and screening all the alternatives conceived by the review committee. The brainstorming session was used as a forum for generating the initial alternatives. The initial alternatives were screened to a few promising ones by the consultant team after the brainstorming session. The screened alternatives represent different approaches to solving the flooding problem. The major options considered in developing alternatives are summarized below.

Alignment - The location of drainage facilities is often along the historic flow path. This may result in the most economical alignment. When the structure capacity is exceeded, the flow will return to its historic path. There are times when diverting runoff along a new alignment may be more economical. This may occur when additional land can be made available for development or when channels can be aligned adjacent to roadways to share right-of-way. The alignment concepts considered are typically along the Eastern and Consolidated Canal corridors. Otherwise, an alignment that makes use of existing or planned roadway alignments, along a section line or fractional section line is used.

Spacing of Storm Drain Facilities - Storm drain or channel improvements can be planned at many different spacings such as every city block, 1/2-mile, 1-mile, 2-mile or more. Increasing the spacing increases the size of the facilities but may achieve a lower overall cost. In most cases, the existing canals and roadways dictate the spacing of facilities.

Type of Storm Drain Facilities - The type of conveyance facility will generally be dependant on the magnitude of the flows, cost, and environmental considerations. Available choices include, detention or retention basins, channels, and pipes. For each of these conveyance methods there are several materials that are available including earth, concrete, riprap, concrete pipe, and corrugated metal pipe.

Detention vs. Conveyance - Retarding the rate of flow through detention basins allows downstream conveyance facilities to be smaller. The degree to which detention is pursued in a plan is another alternative. Because runoff accumulating along the Eastern and Consolidated Canals flows southerly along the canal for a significant distance, it may be economical to detain the flows to reduce the required outfall capacity.

Nonstructural Plan - In some cases, it may be more economically, politically, or environmentally beneficial to restrict development in flood prone areas. Benefits of restricting development may include creation of open space, maintenance of existing vegetation and wildlife habitat, overbank storage, and avoidance of the cost of drainage improvements.

Acceptance of Risk - The level of risk accepted by the community is another choice that may be considered. Acceptance of additional risk by downsizing improvements results in lower initial costs, but may result in increased long term costs to society in terms of maintenance and repairs of damaged property.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
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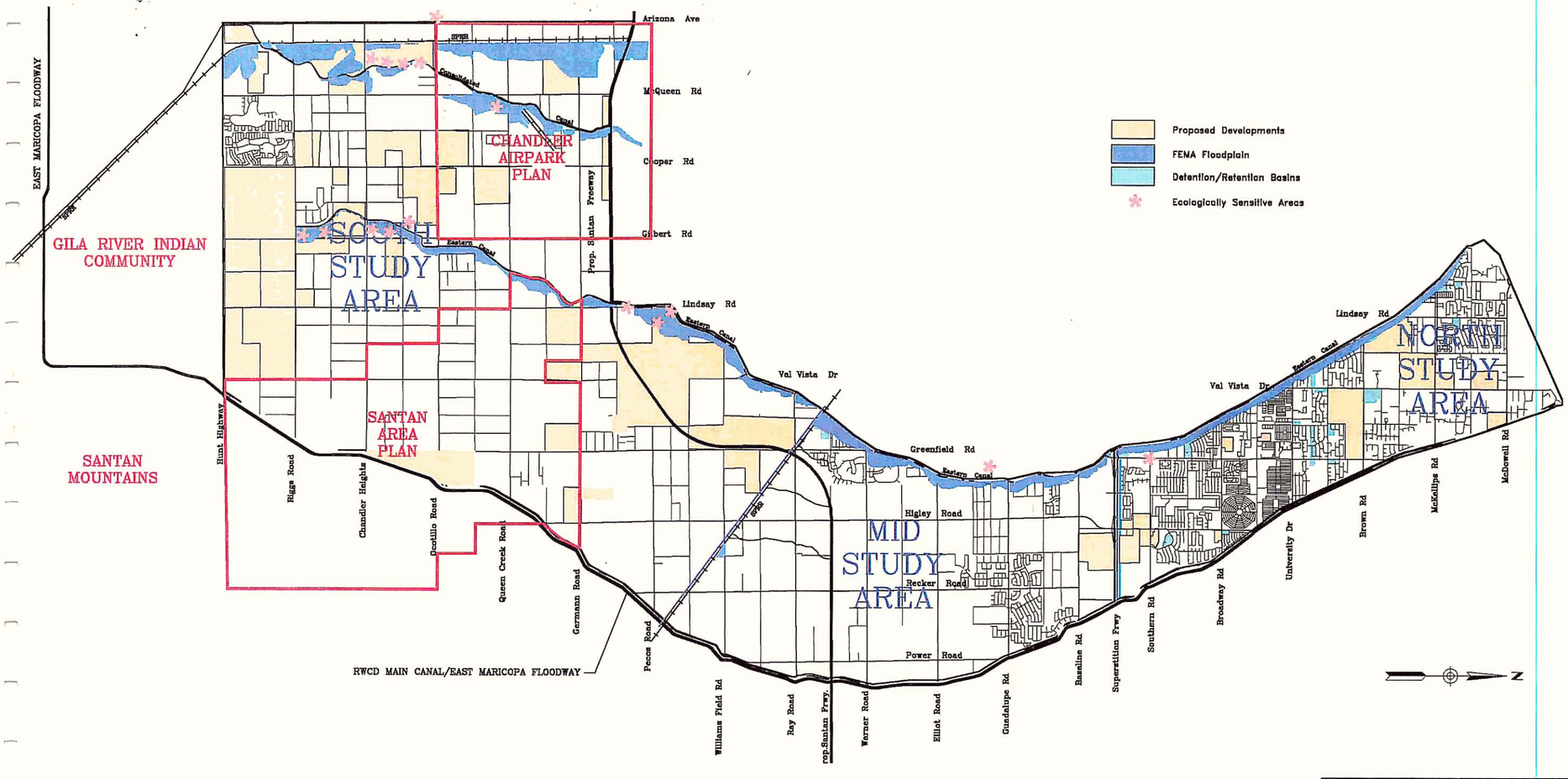

FIGURE 13

STUDY CONSTRAINTS MAP

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

C. Potential Alternatives

The alternatives generated in the brainstorming session are shown schematically on **Exhibits 1 through 6** located at the end of the report and are described below. Detailed exhibits showing the plan elements for alternatives are shown on **Exhibits 7 through 13** for structural alternatives. Summary calculations showing preliminary design flows and sizes for channels, culverts, and detention/retention basins are shown on the pages facing Exhibits 7 through 13.

D. North Study Area, North of the Superstition Freeway

1. Issues in the North Study Area

The ***North Study Area*** is the area north of the Superstition Freeway. This area of approximately 10 square miles in the City of Mesa is urbanized. The objective within the North Study Area is to evaluate opportunities for structural or non-structural solutions, which can mitigate the impacts of the existing FEMA floodplain. Because of limited availability of open land within the area, this area is considered to have limited opportunity for structural improvements. It was noted during the brainstorming session that few drainage problems have been identified in the area. Although a FEMA floodplain has been identified, flooding of structures within the FEMA floodplain has not been widely reported.

Four area alternatives and 3 outfall alternatives were identified for the North Study Area. The North Area alternatives are shown on **Exhibits 1-3 and 7** and are summarized below:

Designator	Description
Area alternatives:	
N-1	Re-delineate floodplain
N-2	Purchase floodprone homes & land
N-3	Conveyance along Eastern Canal
N-4	Do Nothing
Outfall alternatives:	
NO-1	West in ADOT channel
NO-2	South along Eastern Canal alignment
NO-3	Divert flow south in EMF

2. Alternative N-1 - Re-delineate Floodplain
Exhibit 1 ..... $210,000.

Description: Alternative N-1 consists of re-delineating the FEMA floodplain along the Eastern Canal taking into account watershed storage from ponding within backyards and along fences within the watershed. The primary flooding problem within the North Study Area was identified as the FEMA floodplain along the east side of the Eastern Canal which is caused by ponding as runoff flowing westerly overland and within streets encounters the raised canal bank. A re-delineation of the floodplain is currently nearing completion. During review of the re-delineation it was noted that the hydrology procedures used may not adequately account for the large amount of storage within the watershed. Many backyards within the watershed area have relatively flat terrain and are enclosed by block fences. A new study may determine how much runoff from these areas truly contributes to peak discharges and volumes at the Eastern Canal.

Engineering Considerations: Hydrologic methods could be employed to model more watershed losses within the watershed. Modifying the initial abstraction based on field observations of conditions within the watershed would likely be the best approach. The new study that has already been completed has reduced the number of homes in the floodplain from 400 to below 20. Although additional reduction in the number of homes in the floodplain could possibly be achieved, it's doubtful that all of them could be removed.

Environmental Considerations: Re-delineation of the floodplain would not modify the existing environmental conditions associated with the study area. There would be no change to the existing landscape character, and there would be no opportunities for multi-modal or recreation uses in concert with this alternative.

Advantages: The primary advantage of Alternative N-1 is that residents along the Eastern Canal that are currently required to purchase flood insurance may be relieved of that obligation with no structural improvements required.

Disadvantages: Following the identification of this alternative at the brainstorming session, the approach used in the current study was re-evaluated. It is now anticipated that an approach will be incorporated into the current study to account for the watershed losses. This alternative is therefore no longer applicable and will not be considered further.

3. Alternative N-2 - Purchase Floodprone Homes & Land
Exhibit 2 ..... $4,140,000

Description: There are approximately 20 homes along the Eastern Canal that are still in the floodplain following the recent FIS Study. Those homes could be purchased and removed. The vacated lands could be used for storm water ponding and recreation areas.

Engineering Considerations: Purchasing homes would be a very straightforward solution that would have a minimal impact on the area as compared with a structural solution. It would be effective and would eliminate the need for flood insurance in the area.

Environmental Considerations: Depending on the locations of these floodprone homes and land, the acquisition of properties could provide several opportunities for additional park/open space, staging areas for accessing trail/pathway system, park-and-ride facilities, enlarging existing park(s), and enhancing the aesthetics of the landscape. Acquisition of properties can also be a hardship on residents or business owners who do not want to sell their property and relocate. Neighbors may also not want public access or increased use of area if there was no previous public use.

Planned Landscape Character Theme: Within the north study area, the area where parcels may be acquired lies within the P.A.D. (Planned Area Development) and Neighborhood Landscape Character Units. The overall character theme for the P.A.D. Unit would be to integrate the proposed facilities as an extension of the subdivision's streetscape character through: (1) planting specimen exotic and native trees, installation of shrubs, and the introduction of turf at various locations; (2) repeating the adjacent hardscape elements utilizing small walls and concrete pathways; (3) incorporating stucco and tile materials and colors associated with adjacent development; (4) integrating the existing concrete block walls as art elements to add interest and identity to individual subdivisions, and (5) creating a well organized,

repetitive pattern of elements.

The Neighborhood Unit's planned or desired landscape character theme would be for the proposed facilities to be a continuation of the residential "yard" through: (1) planting of large shade tree species with shrubs used as accent plantings; (2) selective use of turf in special use areas; (3) utilizing a variety of materials such as brick, wood, and masonry in hardscape elements; (4) incorporating native materials for pathways and trails such as stabilized decomposed granite, and (5) creating an informal pattern of elements.

Advantages: Floodprone homes would be removed from the floodplain eliminating the need for structural solutions. The acquired parcels could have open space and recreational benefits to the community.

Disadvantages: The cost to purchase and remove the homes as well as potential hardship on owners and neighbors who may not want public open space near their homes.

4. Alternative N-3 - Conveyance along Eastern Canal
Exhibits 3 & 7 ..... $11,615,000.

Description: The conveyance alternative consists of a small earth channel extending from Brown Road south to University Drive, a rectangular concrete channel from University Drive to Broadway Road, and a grass-lined channel from Broadway Road to the Holmes Park Retention Basin. New culverts will be required at Southern Avenue and Brown Road.

Engineering Considerations: The plan will remove 12 homes from the floodplain and will eliminate overtopping of the Eastern Canal. The 12 benefitted homes are situated between University Drive and Brown Road. The remaining 7 homes in the floodplain are north of Brown Road and will not benefit from the project.

Environmental Considerations: Depending on the technical requirement for the width and depth of the flood control channel, opportunities for enlarging existing park(s) and detention basin serving as open space, creating linear parks, linking and expanding pathways and trails, and enhancing the aesthetics of the landscape would be possible. Acquisition of properties is not anticipated with this alternative. Neighbors may not want public access or increased use of area if there was no previous public use.

Planned Landscape Character Theme: Within the north study area, the area where parcels may be acquired lie within the P.A.D. and Neighborhood Landscape Character Units. Refer to Alternative N-2 for a description of the planned landscape character themes for these units.

Advantages: In addition to eliminating the ponding and floodplain, a linear park concept could be a benefit of the project. If a similar concept is adopted farther south along the Eastern Canal, this could be a continuation of the theme extending the length of trails, etc.

Disadvantages: With limited right-of-way along the Eastern Canal, a pipe may be required to allow room for the maintenance road. A channel concept may require acquisition of additional right-of-way which may be objectionable to local residents as well as costly.

5. Alternative N-4 - Do Nothing

Description: The extent of the flooding problem in the north area has been questioned. The new FIS indicates less than 20 homes remaining in the floodplain. In this area a "Do Nothing" alternative may be the best approach.

Engineering Considerations: The older, currently effective FIS indicates that there are approximately 400 homes in the floodplain. Structure damage from flooding has not been reported in the area. The new FIS uses more sophisticated methods to evaluate the flooding potential and indicates less than 20 homes in the floodplain. FEMA approval of the new study would be a substantial benefit to the area by removal of 380 homes from the floodplain. The remaining homes could implement floodproofing measures on their own or continue to pay flood insurance.

Environmental Considerations: Taking no action would have no change to the existing environmental conditions associated with the study area. Problem areas would persist, and only minor projects, emergency repairs, and regular maintenance procedures would continue.

Planned Landscape Character Theme: There would be no change to the existing landscape character.

Advantages: There is no cost. Available CIP funds could be used in other areas.

Disadvantages: No relief is provided for residents paying annual flood insurance premiums, nor for residents that may be subject to flooding.

6. Alternative NO-1 - West in ADOT Channel
Exhibit 1 ..... $41,000.

Description: Outfall alternative NO-1 consists of conveying runoff reaching the outlet of the North Study area westerly in the existing ADOT channel which was constructed with the Superstition Freeway. The Holmes Park retention basin was constructed at the northeast quadrant of the Eastern Canal and the ADOT channel. The basin acts as an off-line basin for the ADOT channel, accepting flows in excess of the channel capacity. Storm drain flows enter the basin from Greenfield Road and surface flows enter the basin from along the Eastern Canal. The basin has no natural outfall and must be pumped. The stored runoff can either be pumped into the Eastern Canal or back into the ADOT channel following the storm. The ADOT Channel continues draining westerly to another off-line retention basin at the Consolidated Canal east of Lindsay Road. The Holmes Park basin layout appears to allow flexibility in designing modifications to implement the NO-1 outfall alternative.

Engineering Considerations: This outfall is only required with Alternative N-3. The other North Area alternatives require no modification to Holmes Park or its outfall. The hydrology results indicate that with Alternative N-3, the basin overtops 21 cfs. The ADOT Channel has excess capacity in the reach downstream from the Eastern Canal and could contain the overtopping flow. A means will need to be developed to capture the 21 cfs and convey it across the Eastern Canal into the ADOT channel.

Environmental Considerations: Incorporating storm water flows into the existing ADOT channel would eliminate any opportunities for aesthetic enhancements, multi-modal or recreation land use opportunities.

Planned Landscape Character Theme: There would be no change to the existing landscape character.

Advantages: The channel already exists. Very little cost would be incurred to implement the plan and no excess runoff needs to be addressed in the Mid Study Area.

Disadvantages: The additional runoff discharged into the ADOT system

would occupy channel and detention basin volume and would need to carried through the system.

7. **Alternative NO-2 - South Along Eastern Canal Alignment**
Exhibit 2 ..... $410,000.

Description: Outfall alternative NO-2 consists of conveying runoff reaching the outlet of the North Study area southerly along the Eastern Canal. The overflow from the Holmes Park Basin would be conveyed south along the Eastern Canal into the M-3 flood control channel. The M-3 channel is required for this outfall alternative to be implemented. Holmes Park could be modified and used to discharge into a new outfall system along the Eastern Canal south of the Superstition Freeway.

Engineering Considerations: The 21 cfs overflow from Holmes Park could easily be conveyed in a pipe under the Superstition Freeway and into an M-3 channel. The flow is small enough that it wouldn't have much impact on the size of an M-3 channel. However, if alternative NO-1 were selected, the M-3 channel could be started farther south, perhaps at Baseline Road.

Environmental Considerations: The potential impacts created by this alternative would occur in the mid study area. Opportunities for enlarging existing park(s) and detention basin serving as open space, creating linear parks, linking and expanding pathways and trails, and enhancing the aesthetics of the landscape would be possible within the mid study area. Acquisition of properties is not anticipated with this alternative. Neighbors may not want public access or increased use of area if there was no previous public use.

Planned Landscape Character Theme: The implementation of Alternative NO-2 would occur along the Eastern Canal in the mid study area and would therefore pass through two landscape character units. The planned landscape character theme associated with the Rural/Farmland Unit would be to reinforce the pastoral landscape through: (1) planting of large shade trees species with few shrubs and no turf; (2) creating a hedgerow or small groves of trees; (3) maintaining open views to the surrounding area; (4) utilizing native material for pathways and trails such as stabilized decomposed granite; (5) incorporating where appropriate, enhanced wildlife habitats and small ponds of water; and (6) creating a regular pattern of elements interwoven with occasional sinuous features such as pathways or stream-like forms.

The second unit present is the P.A.D. Unit. Refer to Alternative N-2 for a description of the planned landscape character theme.

Advantages: There would be a low incremental cost to add outfall capacity to a plan adopted for the Mid Study Area. This would avoid impacts to the existing ADOT channel west of the Eastern Canal.

Disadvantages: Creates interdependence between the North and Mid Study area plans. Totally independent systems would be preferable.

8. **Alternative NO-3 - Divert Flow South in EMF**
Exhibit 3

Description: Outfall alternative NO-3 consists of intercepting runoff flowing westerly within the ADOT channel at the RWCD canal / East Maricopa Floodway (EMF) and diverting the runoff into the EMF. This will free up capacity in the ADOT channel west of the EMF for North Study Area runoff flows.

Advantages: The EMF is already being studied for possible increases in capacity. This additional capacity could be included in the analysis. The extra capacity in the ADOT channel west of the EMF could be used for North Study Area runoff flows.

Disadvantages: It was discovered during a field inspection of this location that the ADOT channel already drains into the EMF at this location. As a result, this alternative has no merit and will not be pursued further.

E. Mid Study Area

1. Issues in the Mid Study Area

The ***Mid Study Area*** is between the Superstition Freeway and the Southern Pacific Railroad (SPRR). This area of approximately 16 square miles is predominately within the Town of Gilbert and is characterized as an area currently experiencing development. The floodplain in this area has been delineated and the Town of Gilbert has been able to limit development along the Eastern Canal. The objective in this area is to evaluate alternative structural and/or non-structural solutions and to provide regional drainage and flooding relief within the area.

Three area alternatives and three outfall alternatives were identified for the Mid Study Area. The Mid Area alternatives are shown on **Exhibits 1-3, 8 and 9** and are summarized below:

Designator	Description
Area alternatives:	
M-1	New ADOT basin, expand Crossroads Park
M-2	On-site retention requirement with drywells
M-3	Flood control channel along Eastern Canal
Outfall alternatives:	
MO-1	Flood control channel along Eastern Canal, combine basin flows.
MO-2	Channel along South side of Santan Freeway, combine basin flows.
MO-3	Two channels, separate basin outflows.

2. **Alternative M-1 - New ADOT Basin, Expand Crossroads Park**
Exhibit 1 & 8 ..... $9,968,000.

Description: Alternative M-1 consists of constructing a detention basin at the planned Santan Freeway north of Ray Road, west of Higley Road. The detention basin is included in the ADOT drainage plan for the freeway. Alternative M-1 also includes enlarging the Town of Gilbert Crossroads Park retention basin. Runoff within the Mid Study Area accumulates along the Eastern Canal and the Southern Pacific Railroad (SPRR) and flows south and northwest, respectively, to an accumulation point at the intersection of the SPRR and Crossroads Park. The planned Santan Freeway will intercept the runoff flowing along the SPRR. The ADOT Basin collects runoff from south of the SPRR to Pecos Road. A collector channel is included along Greenfield Road from Pecos Road to the ADOT basin for this purpose. The Crossroads Park basin could capture the Eastern Canal flows.

Engineering Considerations: This alternative needs to be combined with the M-3 alternative to provide a collection and conveyance system to deliver runoff to the Crossroads Park Basin. The expanded Crossroads Park Basin discharges 250 cfs with Alternative M-3 in place. The ADOT Basin would be enlarged from the current ADOT plan to incorporate the regional drainage requirements.

Environmental Considerations: Alternative M-1 would complement the existing recreation facility by expanding Crossroads Park. The proposed Santan Freeway crosses the railroad with an elevated structure. The presence of the railroad provides the opportunity to connect the new ADOT basin with Crossroads Park along the north side of the tracks with pathways and multi-use trails. The new basin could also serve to expand the recreation facilities of the regional park.

Planned Landscape Character Theme: This area of the mid study area lies within the P.A.D. Landscape Character Unit. A description of the design theme is provided in Alternative N-2.

Advantages: The substantial detention storage volume that could be developed would provide significant attenuation of peak flows. The close proximity of the basins would allow flexibility in planning for operations and could facilitate development of a shared outfall. ADOT would benefit and could be a project partner. Recreation benefits could be realized within the expanded Crossroads Park and the new Santan basin.

Disadvantages: The disadvantage is related to the high cost of right of way that will be required to implement the plan.

3. Alternative M-2 - On-site Retention Requirement with Drywells

Exhibit 2 ..... $0

Description: This is a non-structural alternative. At build-out, this retention requirement will reduce the quantity of runoff reaching the Eastern Canal. This alternative consists of building nothing now and waiting for development build-out to occur before the benefits of on-site retention can be realized.

Engineering Considerations: The Town of Gilbert requires on-site retention for the 50-year, 24-hour storm which includes capturing and retaining the adjacent half street flows. The on-site basins would be drained with dry-wells, eliminating the need for outfalls.

Environmental Considerations: Incorporating on-site retention requirements with drywells would eliminate any opportunities for aesthetic enhancements, multi-modal or recreation land use opportunities.

Planned Landscape Character Theme: There would be no change to the existing landscape character.

Advantages: No initial capital costs for public agencies. The cost would be born by the developers and subsequent homeowners. If conservative estimates are made for the actual retention provided within the watershed, runoff would occur during a 100-year, 24-hour storm. The resulting peak discharges and structure sizes could be reduced in size as compared with "existing" runoff conditions.

Disadvantages: It is uncertain when full build-out will actually occur. As a result, there will still be potential for flood damage in the intervening years. The existing FEMA floodplains would remain in place for some time. Additionally, runoff would still occur during the 100-year, 24-hour storm event, which is the design storm for this project. There would be no "fall back" position in case dry-wells do not continue to perform adequately or if water quality issues limit their use in the future.

4. Alternative M-3 - Flood Control Channel along Eastern Canal

Exhibit 3 & 8 ..... $22,640,000

Description: Alternative M-3 consists of a flood control channel along the Eastern Canal from Baseline Road south to the Crossroads Park Retention Basin. This alternative could be implemented in conjunction with alternatives N-3 and/or NO-2 from the North Study Area. The channel could also be developed in conjunction with the detention basins in alternative M-1.

Engineering Considerations: Runoff accumulates along the Eastern Canal and tailwater ditch in a sheetflow fashion along most of its length. A flood control channel will collect sheet flow and prevent ponding along the canal which will eliminate the FEMA floodplain. This alternative would be most effective if implemented in conjunction with Alternative M-1, *New ADOT Basin, Expand Crossroads Park.* This combination would reduce the combined discharge leaving the basins to approximately 400 cfs.

Environmental Considerations: Opportunities for enlarging existing park(s) and detention basin serving as open space, creating linear parks, linking and expanding pathways and trails, and enhancing the aesthetics of the landscape would be possible within the mid study area. There is also the potential to expand the habitat enhancement established by the Gilbert recharge basins. Hazardous material concerns have been identified within the mid study area, adjacent to the Eastern Canal. Acquisition of properties is not anticipated with this alternative. Neighbors may not want public access or increased use of area if there was no previous public use.

Planned Landscape Character Theme: The implementation of Alternative M-3 would pass through two landscape character units, P.A.D. and Rural/Farmland. The description of these alternatives is provided in Alternatives N-2 and NO-2, respectively.

Advantages: A linear park concept could be pursued that would meet recreational objectives with bicycle and/or pedestrian paths and other related public amenities. Pocket retention basins could be included to attenuate peak discharge rates. The plan could be implemented by developers as they develop adjacent to the Eastern Canal. Other agencies could participate in implementing various park and recreational amenities. Good examples of how this could be implemented were found within the area.

Disadvantages: The linear park concept would have limited application in areas along the Eastern Canal where development has already taken place. Substantial coordination would be required among the project participants to implement the varied project features. More right of way would likely be required than for a conventional "flood control only" channel.

5. Alternative MO-1 - Flood Control Channel along Eastern Canal, combine basin flows

Exhibit 1 & 8 ..... $11,800,000

Description: Outfall Alternative MO-1 consists of combining the outflows from the ADOT and Crossroads Park basins identified in Alternative M-1 and conveying them adjacent to the Eastern Canal to the point where the Santan Freeway crosses the Eastern Canal south of Pecos Road at Lindsay Road (see Exhibit 5).

Engineering Considerations: This approach would provide a gravity outlet for the ADOT Basin. There is about 15 feet of fall from the ADOT Basin to the Crossroads Park Basin. This will allow the ADOT Basin to be deeper and still have a gravity outfall. Additionally, it requires only one outfall channel for the combined flows.

Environmental Considerations: The potential impacts created by this

alternative would occur in the south study area. Opportunities for enlarging existing park(s) and detention basin serving as open space, creating linear parks, linking and expanding pathways and trails, and enhancing the aesthetics of the landscape would be possible within the mid study area. Hazardous material concerns have been identified within the south study area, adjacent to the Eastern Canal. Acquisition of properties is not anticipated with this alternative. Neighbors may not want public access or increased use of area if there was no previous public use.

Planned Landscape Character Theme: The implementation of Alternative MO-1 would pass through two landscape character units, Rural/Farmland and Industrial/Institutional within the south study area. The description of the Rural/Farmland Unit is provided in Alternative NO-2. Within the Industrial/Institutional Unit, the planned landscape character theme would be to visually mitigate the horizontal and vertical scale of the adjacent industrial or institutional land uses through: (1) planting of specimen and exotic/native trees, and shrubs, but no turf; (2) utilizing large, bold masses of plant material; (3) mimicking distinct features on a smaller scale and incorporating them into hardscape elements; (4) interpreting industrial/institutional land uses in materials and colors; and (5) creating simple, yet bold pattern of elements.

Advantages: Alternative MO-1 could be implemented in conjunction with South Study Area alternatives utilizing the Eastern Canal alignment. By combining the basin flows, only one outfall is required.

Disadvantages: The combined peak discharges may be too high for the available right of way area.

6. Alternative MO-2 - Channel along south side of Santan Freeway, combine basin flows
Exhibit 2

Description: Discharge from the Crossroads Park Basin would be pumped uphill to join the outfall from the ADOT Basin. A combined outlet channel would extend along the new Santan Freeway alignment to the point where the Santan Freeway crosses the Eastern Canal south of Pecos Road at Lindsay Road. To allow the ADOT Basin to be deeper, a low flow pipe is included under the ~~channel to drain~~ the basin.

Engineering Considerations: This alternative is similar to MO-1 except that the outfall is along the Santan Freeway instead of the Eastern Canal. For this alternative to work, the runoff stored in Crossroads Park would need to be pumped up to the ADOT Basin.

Environmental Considerations: A channel along the south side of the Santan Freeway adjacent to, but outside of ADOT's right-of-way, would provide the opportunity to provide a link between the regional Crossroads Park facility and the proposed Superstition-Santan Corridor and Marathon Trail.

Planned Landscape Character Theme: The channel would pass through three landscape character units, P.A.D., Rural/Farmland, and Neighborhood. The description of the planned landscape character themes is provided in Alternatives N-2 and NO-2.

Advantages: Alternative MO-2 could be implemented in conjunction with the Santan Freeway project. ADOT could participate in right of way and construction costs. As with Alternative MO-1, by combining the basin flows, only one outfall is required.

Disadvantages: ADOT construction is planned to be completed as late as March 2007 in this reach of the Santan Freeway. Developing a new alignment may have more complications than utilizing the existing Eastern Canal alignment in MO-1. Given the choice between MO-1 and this alternative there appears to be no advantage to selecting an alternative that requires pumping. This alternative is therefore eliminated from further consideration.

7. Alternative MO-3 - Two Channels, separate basin flows
Exhibit 3 & 9 ..... $41,732,000.

Description: The ADOT Basin would drain through a channel along the Santan Freeway, similar to the current ADOT plan. The Crossroads Park Basin would discharge south along the Eastern Canal. The two channels come together where the Santan Freeway crosses the Eastern Canal. At that point the combined flows could follow the Eastern Canal in Alternative S-1 or continue west along the Santan Freeway in Alternative S-2.

Engineering Considerations: This alternative would result in smaller channels along the Santan Freeway and the Eastern Canal than if the flows were combined. It would also provide advantages in phasing implementation. ADOT could construct a portion of the project with construction of the Santan Freeway.

Environmental Considerations: Refer to MO-1 and MO-2 descriptions of the environmental considerations.

Planned Landscape Character Theme: Refer to MO-1 and MO-2 descriptions of the appropriate planned landscape character themes.

Advantages: By dividing flows between two outfalls, the design discharges for each outfall channel will be smaller resulting in smaller structures that each require less right of way.

Disadvantages: Economies of scale may be lost by having two structures. The total project will likely be more expensive unless sufficient participation can be obtained from other agencies.

F. South Study Area, South of SPRR

1. Issues in the South Study Area

The ***South Study Area*** is south of the Southern Pacific Railroad to Hunt Highway. This area of approximately 47 square miles is generally rural in nature and provides the greatest opportunity to provide a proactive approach to providing drainage and flooding solutions, prior to the onset of development. The area is within the Town of Gilbert, the City of Chandler and unincorporated Maricopa County. Flooding problems exist at major east-west crossroads, particularly in the vicinity of Pecos Road. The objective in this area is to evaluate alternative structural and/or non-structural solutions and to provide planning for development.

Two area alternatives and five outfall alternatives were identified for the South Study Area. The South Area alternatives are shown on **Exhibits 4-6 and 10-13** and are summarized below:

Designator	Description
Area alternatives:	
S-1	Linear park w/basins along Eastern & Consolidated Canals
S-2	Conveyance westerly along Santan Freeway
Outfall alternatives:	
SO-1	Total retention at Consolidated Canal and

Eastern Canal

SO-2	Drain North to Santan Freeway along Consolidated Canal alignment
SO-3	Drain South to EMF through Gila River Indian Community with two channels
SO-4	Drain East to EMF along Riggs Road
SO-5	Drain West to Sun Lakes

2. Alternative S-1 - Linear Park with Basins along Eastern & Consolidated Canals

Exhibit 4 & 10 ..... $67,467,000

Description: Alternative S-1 consists of linear park, flood control channels with "pocket park" retention basins along the Eastern and Consolidated Canals. The flood control channels collect surface flows and convey them south to Riggs Road and Hunt Highway, respectively.

Engineering Considerations: Earth channels would be constructed adjacent to the Eastern and Consolidated Canals. Due to operational requirements for irrigation water delivery with the Eastern and Consolidated Canals, they cannot be incorporated into the new flood control channel cross-section. Tailwater ditches and the Eastern Canal Extension will be incorporated into the flood control channel cross-section as low flow features.

Environmental Considerations: Opportunities for creating linear parks and implementing portions of The Paseo project and linking and expanding pathways and trails. Large basins located adjacent to the Eastern Canal south of Ocotillo Road could be used as part of the potential 40-acre park identified by Chandler. Several disturbed areas are noted along the Consolidated Canal. This alternative would provide the opportunity to enhance the aesthetics of the landscape adjacent to these areas. There is also the potential to expand the habitat enhancement established by the Chandler recharge basins and the existing riparian and mesquite bosques. Hazardous material concerns have been identified within the south study area, adjacent to the Eastern and Consolidated canals. Acquisition of properties for construction of basins may be a hardship on residents or business owners who do not want to sell their property and relocate. Neighbors may not want public access or increased use of area if there was no previous public use. Historic properties may be impacted in the vicinity of the Eastern Canal. Any facilities that are planned in this area would need to avoid these cultural sites or mitigate any disturbance.

Planned Landscape Character Theme: The channels and basins along the Eastern and Consolidated canals would pass through three landscape character units, P.A.D., Rural/Farmland, and Industrial/Institutional. The description of the planned landscape character themes is provided in Alternatives N-2, NO-2, and MO-1, respectively.

Advantages: Multiple use benefits were identified during the data collection phase that could be implemented with this plan. A primary advantage of all alternatives along the Eastern and Consolidated Canals is the use of an existing corridor with right of way that is already defined. There is also an existing gradient from north to south that is compatible with gradients required for channel design. Drop structures will likely not be required.

Disadvantages: There is a growing demand for use of the existing Eastern and Consolidated Canal corridors for many uses. Some of those uses will likely be incompatible with each other. This could be an advantage or disadvantage; A disadvantage due to the extent of coordination required to implement and gain approval for the plan, an advantage when considering the opportunity for community benefit.

3. Alternative S-2 - Conveyance westerly along Santan Freeway

Exhibit 5 & 11 31,171,000

Description: Alternative S-2 consists of a flood control channel adjacent to the Santan Freeway to convey runoff westerly along the Santan Freeway to the Gila Drain which is more than 8 miles west of the study area. Alternative S-2 could operate in conjunction with outfall alternatives MO-1, MO-2, and/or MO-3 from the Mid Study area. Alternative S-2 could also operate in conjunction with outfall alternative SO-2 for the South Study Area.

Engineering Considerations: The primary advantage of this alternative is to "piggy-back" with the current ADOT plan to utilize an existing outfall across the GRIC if a new outfall as identified in Alternatives SO-3 or SO-3a is not selected. This alternative utilizes the retention basin sites identified in the ADOT plan. However, the basins are enlarged to accommodate the regional flood control needs and maintain the peak discharges conveyed westerly in the ADOT system.

Environmental Considerations: A channel along the south side of the Santan Freeway would provide a potential multi-modal and recreation east-west link between the Consolidated and Eastern canals.

Planned Landscape Character Theme: The channel would pass through two landscape character units, P.A.D., and Rural/Farmland. Refer to Alternatives N-2 and NO-2, respectively for a description of the themes.

Advantages: Alternative S-2 can be combined with the ADOT plan for the Santan Freeway which provides funding and implementation participation from ADOT. This also facilitates implementation of outfall alternative SO-2 which is an alternative that utilizes an existing outfall across the GRIC.

Disadvantages: The ultimate outfall for this alignment is the Gila Drain which is more than 8 miles west of the study area. Additionally, the impact on the current GRIC discharge agreement of adding additional flow is uncertain.

4. Outfall Alternatives

The natural direction for runoff within the entire Higley ADMP study area is generally from east to west. The Eastern and Consolidated Canals and SPRR embankments are elevated features that intercept runoff and create diversions. Runoff reaching the Eastern and Consolidated canals accumulates along the upstream (east) face of the embankments and is diverted southerly. Key concentration points are located at the interface between the North, Mid, and South study areas. Outfall alternatives are provided for the North and Mid study areas that convey runoff southerly to the next downstream area. It is conceivable that if those outfall alternatives are adopted for the North and Mid areas, then runoff could reach the GRIC boundary at Hunt Highway from the entire study area. The South Study area is the "end of the line" for passing runoff south without crossing the GRIC. Runoff flows across the GRIC under current conditions.

Recognizing that there may be obstacles to implementing an outfall

alternative across the GRIC, alternatives have been identified that could be adopted in lieu of the GRIC outfall. The primary concentration points within the South Study area are at the Eastern Canal at Riggs Road and at the Consolidated Canal/SPRR at Hunt Highway. Alternative outfall concepts are identified for each concentration point. It should be noted that the outfall alternatives presented could be implemented in various combinations to achieve a comprehensive drainage plan. Outfall Alternatives SO-2, SO-3, and SO-5 apply to the Consolidated Canal concentration point. Outfall alternatives SO-1, SO-3, SO-3a, and SO-4 apply to the Eastern Canal concentration point.

5. **Alternative SO-1 - Total Retention at Riggs Road at Eastern Canal**
Exhibit 4, 12, & 13 ..... $21,981,000

Description: As part of an outfall alternative that does not require right of way across the GRIC, this alternative would retain the entire 100-year, 24-hour volume of runoff reaching Riggs Road in the S-1 channels along the Eastern and Consolidated Canals.

Engineering Considerations: This alternative was evaluated with and without the S-2 alternative that would divert runoff from the Mid Study area west along the Santan Freeway. The retention basin volume required at the Eastern Canal and Riggs Road basin is less with the S-2 alternative than with alternatives that deliver Mid Study area runoff to the basin. An additional 24 acres of land for retention would be needed at Gilbert Road adjacent to the Eastern Canal. It is anticipated that the existing RWCD basin would be expanded to provide an additional 550 acre-feet of storage without the S-2 alternative and 480 acre-feet with the S-2 alternative. A 38 acre basin storing 460 acre-feet of runoff would be required at the Consolidated Canal situated adjacent to the SPRR at the Consolidated Canal crossing. Both basins would be approximately 15 feet deep and would therefore not drain by gravity. This alternative with the pumped outfall alignments from Alternatives SO-2 and SO-4 would be a comprehensive outfall alternative if an outfall across the GRIC is not selected.

Environmental Considerations: A large basin located adjacent to the Eastern Canal would have the potential to expand the habitat enhancement established by the existing riparian and mesquite bosques near Riggs Road. Acquisition of properties for construction of basins may be a hardship on residents or business owners who do not want to sell their property and relocate.

Planned Landscape Character Theme: This alternative lies within the Rural/Farmland Landscape Character Unit; refer to Alternative NO-2 for a description of the theme.

Advantages: Eliminates the need to develop an outfall across the GRIC. Additionally, the basin could include habitat enhancement, mitigation, or recreational uses.

Disadvantages: The primary disadvantage is the cost of right of way for retention basins and the cost to pump the basins to drain them. The drain time will be from 3 to 5 days.

6. **Alternative SO-2 - Drain North to Santan Freeway along Consolidated Canal alignment**
Exhibit 5 ..... $3,368,000

Description: Alternative S-2 would be required to implement this alternative which collects runoff along the Consolidated Canal using Alternative S-1. The runoff collected at Hunt Highway or Riggs Road would then be pumped back north to the Santan Freeway alignment and the S-2 outfall.

Engineering Considerations: This alternative was initially developed based on pumping the peak discharge reaching the SPRR north to the Santan Freeway alignment. Pumping and pipe capacity for 400 cfs would have been required to implement this plan. Two 60 inch pipes would have been required to convey the discharge. This approach is shown on Exhibit 12. A more feasible approach to this alternative is to combine it with Alternative SO-1, which provides total retention. A pump system and this alignment would be used to drain the basin within three to five days following an event. This approach is shown on Exhibit 13 and is reflected in the cost estimate reported above.

Environmental Considerations: Because of the difference in grade, the channel or pipe would have to be substantially depressed near the freeway. This would limit the recreation, multi-modal, and habitat enhancement opportunities.

Planned Landscape Character Theme: The channel along the Consolidated Canal would pass through two landscape character units, Rural/Farmland, and Industrial/Institutional. The description of the planned landscape character themes is provided in Alternatives NO-2, and MO-1, respectively.

Advantages: This alternative eliminates the need to develop an outfall across the GRIC. Additionally, the alternative would be implemented in conjunction with the Santan freeway, taking advantage of a partnership with ADOT and sharing the Santan freeway alignment and Gila Drain outfall.

Disadvantages: There is more than ten feet of fall from the location where the Santan freeway crosses the Consolidated Canal to where the Consolidated Canal crosses the SPRR east of Arizona Avenue, north of Hunt Highway. The need and cost of pumping for this alternative is a disadvantage.

7. **Alternative SO-3 - Drain South through GRIC**
Exhibit 6 & 12 ..... $35,126,000.

Description: Outfall alternative SO-3 utilizes the Arizona Avenue and/or Gilbert Road alignments to develop an outfall across the GRIC to the EMF. Two outfalls could be developed; one for the Consolidated Canal along Arizona Avenue, the other for the Eastern Canal Extension along Gilbert Road. Alternatively, the Eastern Canal flow could be diverted west along Hunt Highway or Riggs Road to Arizona Avenue (Alternative SO-3a) and combined with the Consolidated Canal alignment flows for a single, combined outfall.

Engineering Considerations: This is a straight-forward solution that eliminates the need for a lot of retention and pumping as is required in some other alternatives. The alignments across the GRIC are clear of obstructions and could be easily implemented. The water quality requirements of the GRIC will need to be satisfied to reach an agreement to allow development of this alternative. The GRIC has expressed a preference for two outfalls as shown in SO-3. The cost reported above therefore reflects alternative SO-3

Environmental Considerations: Environmental clearance through the GRIC including biological and cultural resource clearance would have to be completed during the planning stages of the project. The project schedule would have to accommodate the time required for the appropriate surveys and consultation for the clearance.

Planned Landscape Character Theme: An identification of the appropriate landscape character units were not completed for the GRIC lands.

Advantages: The natural drainage path flows south across the GRIC. It is always desirable, due to cost and liability considerations, to utilize the existing flow path for drainage improvements. Additionally, opportunities currently exist to partner with other agencies to combine a water delivery element with the flood control element. There is a potential need to provide irrigation water delivery to the GRIC as part of a settlement of the water rights adjudication that is currently under way.

Disadvantages: There may be delays in reaching an agreement with the GRIC for the outfall requirements, if an agreement can be reached at all. Outfall alternatives that do not rely on an agreement with the GRIC are included in the study for this reason.

8. Alternative SO-4 - Drain East to EMF
Exhibit 6, 12, & 13 ..... $2,116,000.

Description: Outfall Alternative SO-4 consists of pumping runoff from the Eastern Canal system collected at Riggs Road east to the EMF within Maricopa County. Runoff would be pumped from the existing tailwater pond along Riggs Road.

Engineering Considerations: This alternative was initially developed based on using the existing RWCD pond as a fore-bay for pumping. the pipe size and pumping capacity were developed to not exceed the existing pond capacity. The resulting peak discharge would be 600 cfs. Three 60 inch pipes would be required to convey the flow to the EMF. This alternative is shown on Exhibit 12. A more feasible approach to this alternative is to combine it with Alternative SO-1, which provides total retention. A pump system and this alignment could be used to drain the basin within three to five days following an event. This approach is shown on Exhibit 13 and is reflected in the cost estimate reported above.

Environmental Considerations: Construction of a drain along Hunt Highway or Riggs Road would provide a potential multi-modal and recreation east-west link between the Eastern Canal and the RWCD/Eastern Maricopa Floodway.

Planned Landscape Character Theme: The drain would pass through three landscape character units, P.A.D., Rural/Farmland, and Desertscrub. Refer to Alternatives N-2 and NO-2, respectively for a description of the themes for the P.A.D. and Rural/Farmland units. The planned landscape character theme associated with the Desertscrub Unit would be to reinforce the native Sonoran Desertscrub Biotic Community through: (1) planting of native trees, shrubs, and grasses, but no turf; (2) incorporating historic and prehistoric elements such as imprinted Hohokam symbols and historic stagecoach route information in any hardscape elements; (3) maintaining open views to the surrounding area; (4) utilizing native material for pathways and trails such as stabilized decomposed granite; and (5) creating an irregular more organic pattern of elements.

Advantages: This alternative eliminates the need to develop an outfall across the GRIC and utilizes the existing EMF as an outfall.

Disadvantages: There is approximately fifty feet of fall from the EMF to the Eastern Canal alignment at Gilbert Road. Pumping would be required to lift the water from the Eastern Canal to the EMF. The long term operation and maintenance costs of a pumping system would be high.

9. Alternative SO-5 - Drain West to Sun Lakes
Exhibit 6

Description: Outfall alternative SO-5 consists of conveying runoff from the Consolidated Canal alignment west to Sun Lakes. Sun Lakes has a system of lakes that are used for retention of stormwater runoff.

Advantages: Sun Lakes is immediately west of Arizona Avenue which would provide a nearby outfall without the need to cross the GRIC.

Disadvantages: Sun Lakes has indicated that they have no excess capacity in their lake system to accept additional runoff. It is likely that if the lake system were used as a means to convey runoff, a new outfall would still need to be identified in some other location. This alternative is considered not feasible and is not considered further.

V. CONCEPT EVALUATION

A. Introduction

This section describes the process used to screen the alternatives, evaluate the alternatives, and identify the preferred concept that will be developed to the preliminary design stage during the Level III Analysis.

B. Screening of Alternatives

The alternatives identified in the brainstorming session were reviewed in the field and with available mapping and aerial photos. Preliminary calculations were performed to determine the approximate size and cost of the alternative plan elements as described in the previous section. The purpose of the screening effort was to select the *best* combination of alternative features to form three comprehensive plans for the entire study area. The three comprehensive plans are referred to as *Concepts* to distinguish them from the alternative elements discussed previously. The Concepts are described in the following sections.

Concept 1	Irrigation Canals with GRIC Outfall
Concept 2	Retention with ADOT/EMF Outfall
Concept 3	Non-Structural

C. Alternatives Development

Alternatives N-1, NO-3, MO-2, and SO-5 were determined to be not feasible and were eliminated from consideration without further development. The remaining alternative elements identified in the previous section were further developed to determine the engineering feasibility and approximate costs. During alternative development, refinements were made to the location and alignment of facilities resulting from the more detailed analysis. The existing condition HEC-1 model was revised to reflect the routing required for each alternative. The channel routing parameters and the sequence of hydrograph routing and combinations were modified to model the effects of each alternative.

The detention basins, channels, pipes, and culverts were then sized based on the revised 100-year peak discharges. Detention basins were sized to maximize flow attenuation with the land area available using both off-line and flow-through concepts. The off-line concept uses a perimeter channel to allow low flows to bypass the detention basin. The flow-through concept allows the entire flow to be intercepted by the detention basin. Channels and storm drains were sized using Manning's equation with a hydraulic slope equal to the average ground slope in the reach. Culverts were placed at existing road crossings and at all existing and future one-half mile and mile street crossings.

D. Concept Descriptions

The Concepts chosen for further evaluation are described below. The cost for each Concept is summarized at the end of the section in **Table 2** broken down by planning area. Detailed descriptions of the elements referenced with each Concept are contained in Section IV. **Exhibits 7 - 13** at the end of the report show the plan elements, descriptors, and the detailed cost estimate breakdowns for each planning area and alternative.

1. Concept 1 - Irrigation Canals with GRIC Outfall

Concept 1 emphasizes use of the existing north-south corridors formed by the Eastern Canal and Extension and the Consolidated Canal to create multiple-use flood control channels with detention/retention basins at selected locations. Outfalls are included through the Gila River Indian Community to the East Maricopa Floodway. Concept 1 is shown on **Figure 14**.

Concept 1 combines conveyance Alternative N-3 with the ADOT outfall Alternative NO-1 for the north area. It appears that there is adequate capacity in the ADOT channel adjacent to the Superstition Freeway to accommodate the 21 cfs overtopping discharge from Holmes Park resulting from the plan.

Conveyance Alternative M-3 is combined with Detention Alternative M-1 in the Mid Study area utilizing the Eastern Canal outfall Alternative MO-1 to convey the combined basin outflows to the South area. Draining the ADOT basin into the MO-1 channel will be a benefit to ADOT for the Santan Freeway drainage.

Conveyance Alternative S-1 along the Eastern Canal Extension and the Consolidated Canal will drain across the GRIC using outfall alternative SO-3. The GRIC expressed a preference for two outfalls as opposed to one as long as their water quality requirements are met.

2. Concept 2 - Retention with ADOT/EMF Outfall

The second concept is based on a GRIC outfall not being utilized and emphasizes retention of storm water runoff with outfalls combined with the ADOT freeway drainage systems and the EMF north of the GRIC boundary. Concept 2 is shown on **Figure 15**.

Concept 2 utilizes the purchase floodprone homes and land Alternative N-2 in the north area, which does not require an outfall. Open space would be created while maintaining the natural watershed storage characteristics and eliminating the flood hazard for homes.

As with Concept 1, conveyance and detention alternatives M-3 and M-1

are included in the Mid-Study area with separate basin flows Alternative MO-3 outfall. The expanded Crossroads park basin would drain into a channel along the Eastern Canal and the ADOT Basin would drain along the Santan Freeway to the point where they combine at Lindsay Road. The combined flows would then be conveyed westerly along the Santan Freeway S-2 alignment. Detention basins are included from the ADOT drainage plan at the Eastern and Consolidated Canals. The ADOT basins are all enlarged to accommodate the additional off-site runoff from the regional plan.

The conveyance alternative S-1 in the south area will be used to collect runoff generated south of the Santan Freeway and convey it south to the outfall alternative SO-1 retention basins. The basins will be drained with pumps following the storm event using the SO-2 and SO-4 outfall alternatives. The basins can be drained within 3 to 5 days, depending on the selected design criteria.

3. Concept 3 - Non-Structural

The third approach is based on management measures to limit development in flood prone areas and reducing runoff by enforcing on-site retention requirements as the area develops.

The Do-Nothing Alternative N-4 is included for the north area. No outfall is required for the N-4 alternative.

The on-site retention Alternative M-2 is included for the Mid Study area and is added for the South Study area. As part of this alternative, development should be limited to prevent any new structures from being built in flood prone areas.

Table 2 - Summary of Costs

	Concept 1	Concept 2	Concept 3
North Area	$11,656,000.	$4,140,000.	$0
Mid Area	$64,265,000.	$74,339,000.	$0
South Area	$127,651,000.	$126,103,000.	$0
Total	$203,572,000.	$204,582,000.	$0

E. Evaluation of Concepts

Method of Evaluation - The evaluation of concepts is accomplished by subjecting the numerous criteria to professional experience and judgment. To achieve a ranking of concepts, the "Multi-Attribute Utility Analysis" technique has been used. Briefly, the Multi-Attribute Utility Analysis technique involves first establishing evaluation criteria and their relative weights. Then a score is assigned for each criterion for each concept. Concepts are then ranked based on scores assigned by the evaluators for each evaluation criterion.

Representatives from the Flood Control District and members of the Review Committee make up the evaluation committee. The weighting of each criterion is established by assigning each a factor of one, two, or three. The factors from all the evaluators are then averaged to establish a composite weighting factor to be applied to each criterion.

The concepts are scored by ranking the concepts for each criterion according to how well the concept meets the criterion. This scoring is done for each of the evaluation criteria described below. The scores given by all the evaluators are added together and multiplied by the weighting factor for that criterion. This establishes the score for each concept and criterion. The concept receiving the highest total score is the preferred concept.

Evaluation Criteria - The following criteria is used to evaluate the concepts.

1. **Capital Cost** - Capital cost is the initial cost of the project which includes construction, right-of-way acquisition, utility relocation, and design engineering and contingencies including utility relocation, design engineering, survey, and other miscellaneous costs. Operation and Maintenance costs are addressed under the Maintenance criteria. A score of three is assigned to the project with the least first cost. A score of one is assigned to the concept with the highest first cost.

2. **Effectiveness** - Effectiveness is the ability of a concept to control a flooding problem by collecting storm water runoff and conveying it in a controlled manner. Consideration should be given to the impact of a storm that exceeds the design event. A score of three is assigned to the concept that best controls the flooding problem by collecting runoff and conveying it in a controlled manner. A score of one is assigned to the concept which least controls the flooding problem or would result in the most damage if the design storm is exceeded.

3. **Recreation and Social Considerations** - The concept that would create multi-use opportunities, provide recreation amenities, develop links between public transportation facilities and routes, minimizes relocation of residences, and benefits adjacent property owners would be assigned a score of three. A score of one would be given to a concept with few multi-use opportunities, limited recreation amenities, lacks the potential to link public transportation facilities and routes, requires substantial relocation of residences, and negatively affects

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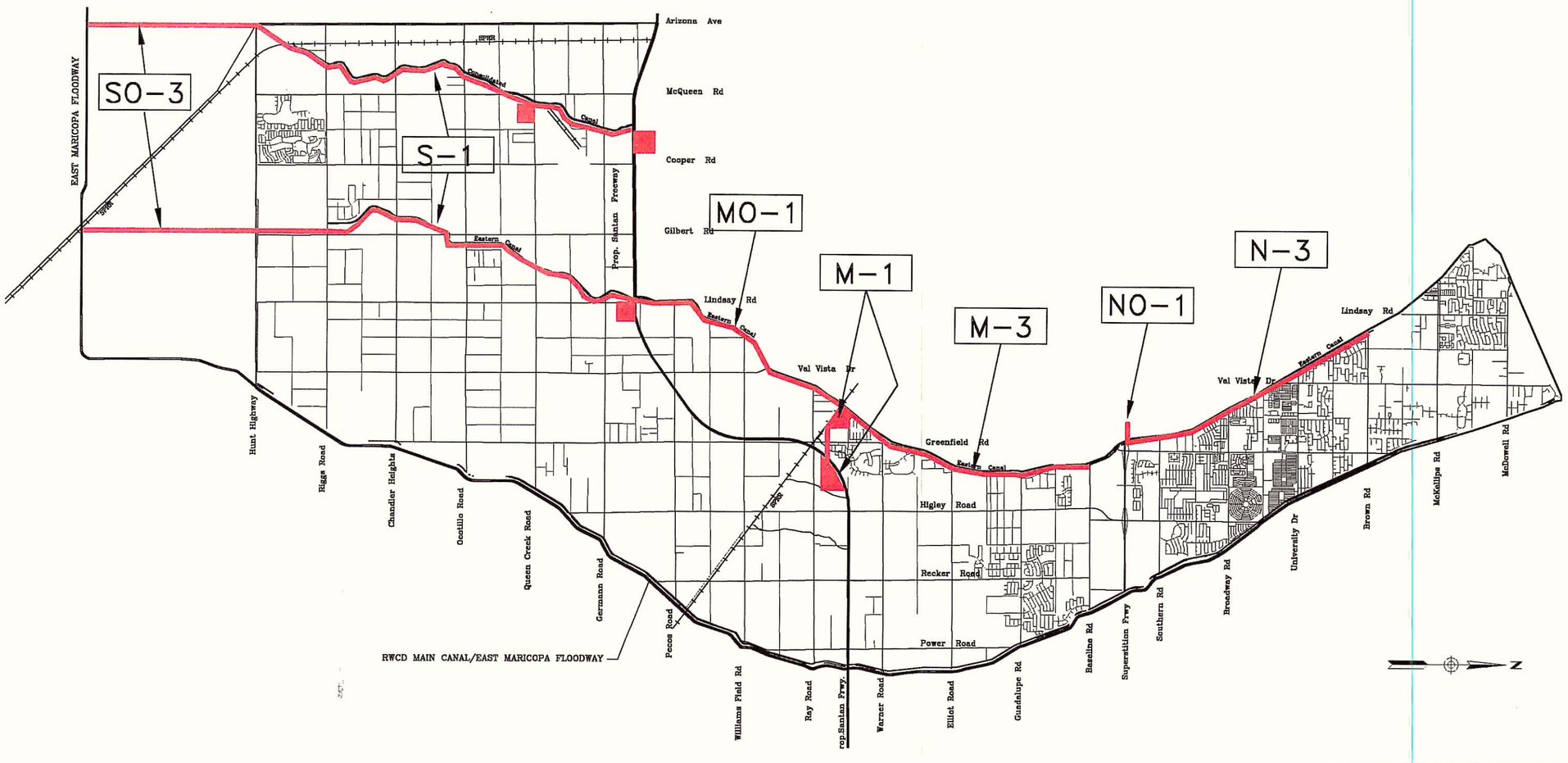

FIGURE 14

CONCEPT 1
IRRIGATION CANALS W/GRIC OUTFALL

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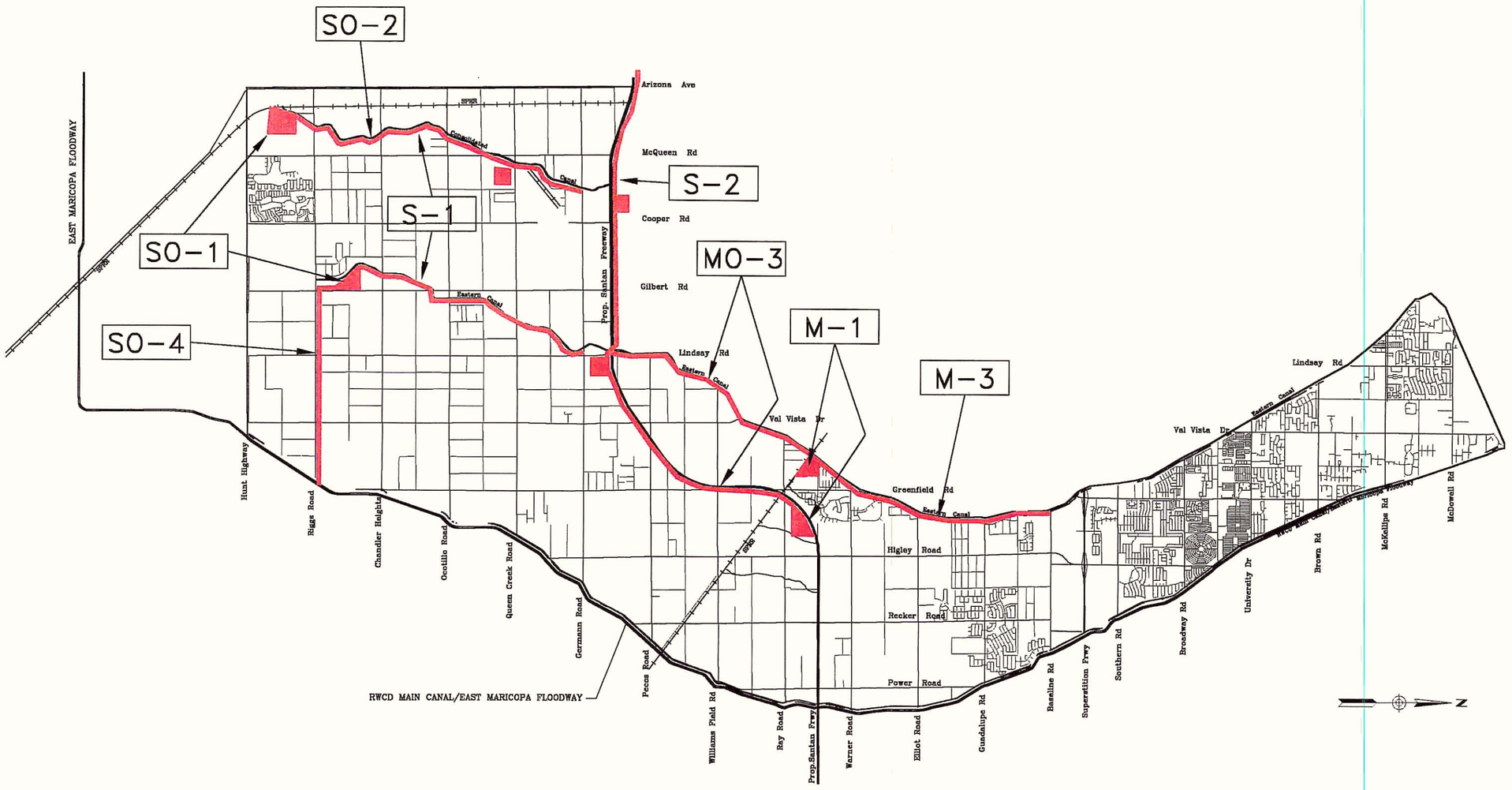

FIGURE 15

PROJECT DESCRIPTION
CONCEPT 2
RETENTION WITH ADOT/EMF OUTFALL

PREPARED BY
DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

adjacent property owners.

4. **Wildlife and Aesthetic Considerations** - These environmental considerations refer to the potential impact to areas of high habitat value, wildlife enhancement opportunities, and opportunities to improve the aesthetics and visual character of the study area. A score of three is assigned to the concept that will protect areas of high habitat value and provides for the opportunity to enhance habitat and/or aesthetics. A score of one would have the most negative impacts on the physical, natural, and cultural considerations, and provide the fewest opportunities to enhance wildlife and aesthetics.

5. **Potential for Staged Construction** - Evaluates the flexibility of a plan to allow phased construction. A score of three is assigned to the concept that can best be built in phases with little or no transition or "throw-away" construction between phases and which does not create drainage problems for existing residential or commercial developments located downstream from the improvement during the interim period between phases. A score of one is assigned to the concept least able to be staged or requires a significant transition or "throw-away" construction between phases or which causes drainage problems for existing residential or commercial downstream developments in the interim period.

6. **Maintenance** - Maintenance is the annual cost for maintenance of the drainage facility. A score of three is assigned to projects with the lowest annual maintenance cost. A score of one is assigned to projects with the highest annual maintenance cost. Frequency of maintenance and difficulty of access affect annual maintenance costs.

7. **Compatibility with other Projects** - Compatibility is reflected in how well the concept utilizes existing improvements and is consistent with planned development or drainage projects by others. A score of three is assigned to the concept that best utilizes existing and planned drainage features and can potentially be funded and/or constructed as part of other projects. A score of one is assigned to the concept that abandons existing drainage features or renders them obsolete or underutilized or that requires total funding by the lead agency with little opportunity for cost sharing or combined benefits from other projects.

8. **Potential for removal of FEMA flood zones** - A primary objective of the project is to remove homes from the FEMA floodplain identified along the Eastern and Consolidated Canals. A score of three is assigned to the concept that removes the greatest number of homes from the floodplain and restores the most land area for future development. A score of one is assigned to the concept that removes the fewest homes from the floodplain and restores the least amount of land area for future development.

Evaluation Matrix - The evaluation matrix in **Figure 16** was used to rank the three concepts. Blank copies of Figure 16 were distributed to the Review Committee. Each agency represented on the committee was an evaluator and completed the form according to these instructions. The composite final scores for each concept are shown. Figure 16 contains a separate matrix for each of the three planning areas. For each planning area, space is provided for the evaluator to specify a weighting factor and a score for each of the evaluation criteria just described. The weighting factor allows some criteria to be given a greater influence on the outcome than others. Factors can be assigned a value of one, two, or three for each of the eight criteria. All criteria are assigned a default value of two. Criteria that the evaluator feels should be weighted more heavily than the others are assigned a weighting factor of three. Criteria the evaluator feels should be weighted less than the others are assigned a factor of one. The factors assigned by all evaluators are averaged for each evaluation criterion to determine the weighting factors used in the evaluation.

Each concept is assigned a score. Scores are established by ranking the concepts in order of how well they meet the evaluation criteria. The concept that best meets the criteria is assigned a score of 3, the concept that most poorly meets the criteria is assigned a score of one, and the remaining concept is assigned an intermediate score of two. The total of scores assigned for each criteria should equal six (1+2+3). If the evaluator feels there is a tie, the score should be split between the tied concepts so that the total for all three concepts is still six. The scores from all evaluators are totaled for each criteria and concept, multiplied by the weighting factor, and then summed to determine the total score for the concept. The concept receiving the highest weighted composite score is the preferred concept. A different concept may be selected for each planning area.

Review Committee Meeting No. 2 - The evaluation was performed at Review Committee meeting number 2 on February 1, 2000. At the meeting, the Visual Analysis results were presented leading into a presentation of the landscape opportunities that influenced the planning effort. An overview of the three concepts and the evaluation process was presented. Opportunity was provided for questions and discussion. Following discussion, the evaluation forms were completed. The scores

was presented. Opportunity was provided for questions and discussion. Following discussion, the evaluation forms were completed. The scores were tabulated with the aid of a laptop computer and the results presented to the Review Committee. The resulting composite scores are shown on **Figure 16**.

NORTH AREA - NORTH OF SUPERSTITION FREEWAY

EVALUATION CRITERIA	FACTOR	CONCEPT - 1 GRIC OUTFALL	CONCEPT - 2 ADOT/EMF OUT	CONCEPT - 3 DO NOTHING
Capital Cost	2.50	8	15	13
Effectiveness	2.17	15	12.5	8.5
Recreation & Social	1.83	13	14	9
Wildlife & Aesthetics	1.83	10	17	9
Potential for Staged Constr.	1.33	11.5	14.5	10
Maintenance	2.00	7	13	16
Compatibility with other proj.	2.00	12.5	14.5	9
Removal from FEMA Zones	2.17	14.5	15.5	6
Score		180.4	229.3	160.3
Rank		2	1	3

MID AREA - BETWEEN SPRR & SUPERSTITION FREEWAY

EVALUATION CRITERIA	FACTOR	CONCEPT - 1 GRIC OUTFALL	CONCEPT - 2 ADOT/EMF OUT	CONCEPT - 3 DRY WELLS
Capital Cost	2.2	10	9	12.5
Effectiveness	2.8	12.5	12.5	6.5
Recreation & Social	2.2	11	14	7
Wildlife & Aesthetics	1.8	12.5	12.5	7
Potential for Staged Constr.	1.6	11.5	12.5	8
Maintenance	1.8	8	9	12
Compatibility with other proj.	2	12	13	6.5
Removal from FEMA Zones	2.2	12.5	12.5	6.5
Score		188	197.8	135.4
Rank		2	1	3

SOUTH AREA - SOUTH OF SPRR TO GRIC

EVALUATION CRITERIA	FACTOR	CONCEPT - 1 GRIC OUTFALL	CONCEPT - 2 ADOT/EMF OUT	CONCEPT - 3 DRY WELLS
Capital Cost	2.17	9	10	11
Effectiveness	2.83	14.5	10.5	5
Recreation & Social	2.33	12	13	5
Wildlife & Aesthetics	2.17	12.5	12.5	5
Potential for Staged Constr.	1.67	11	11	8
Maintenance	2.00	12	7	11
Compatibility with other proj.	2.17	10.5	13.5	6
Removal from FEMA Zones	2.33	13	12	5
Score		211.1	198.4	120.5
Rank		1	2	3

Figure 16 - Evaluation Matrix

VI. RECOMMENDED CONCEPT

A. Introduction

The recommended concept was selected at Review Committee Meeting No. 2. The resulting recommended plan and estimated costs is presented in the following sections.

B. Ranking of Alternatives

The results of the concept evaluation are shown on **Figure 16**. Different weighting factors were used for the evaluation criteria within each planning area. *Effectiveness* and *removal from FEMA zones* were weighted in the top 3 in all areas reflecting the importance of the Flood Control District's primary objective for the project. *Capital cost* was weighted in the top 3 in the North and Mid Areas but not the South Area. *Recreation and Social* was weighted in the top 3 in the Mid and South Areas but not the North Area. *Potential for Staged Construction* was weighted the lowest in all 3 areas. *Maintenance* was weighted in the bottom 3 in the Mid and South Areas but not the North Area, whereas *wildlife and aesthetics* was weighted in the bottom 3 in the North and Mid Areas but not the South Area. If a trend can be discerned at all, it would appear to be toward minimizing cost with a low value on the "softer" elements of recreation, wildlife, and aesthetics in the North Area with a reversal toward less emphasis on cost while placing a higher value on recreation, and social benefits toward the southerly areas south of the Superstition Freeway and a desire to maintain the wildlife habitat values that have been identified in the South Area. This may reflect the difficulty in retro-fitting the "softer" elements of recreation, wildlife, and aesthetics into the North area that is already developed. The retro-fitting would be at the cost of existing development. On the contrary, in the Mid and South areas, more value appears to be placed on the opportunity to create a pleasing environment that is a benefit to the community as the area is developing.

The *Purchase floodprone homes and land* concept was selected for the North area. The *Retention with ADOT Outfall* concept was selected for the Mid area which utilizes the planned Santan freeway as a regional outfall along with flood control channel alignments along the Santan freeway and the Eastern Canal. The *GRIC Outfall* concept was selected for the South Area. The *Do Nothing* and *Enforce On-site retention* concepts finished last in all three areas.

C. Recommended Plan

The *GRIC outfall* concept presented in Concept 1 included runoff from the Mid study area. Based on the selected concepts, the *GRIC outfall* concept was revised to accept only runoff generated south of the SPRR and Santan Freeway. The revised recommended plan is shown on **Figure 17**. The Recommended Plan is also shown on **Exhibits 14, 15, and 16** at the end of the report showing the plan elements, descriptors, and estimated costs. The estimated costs are summarized in **Table 3**.

A 15 percent construction contingency is added to the estimated construction costs. Landscape costs are based on the "ultimate" landscape character themes presented in this report. Estimated landscape costs are therefore higher than the minimum landscape normally used on FCDMC projects. Design and construction management costs are estimated as 15 percent of the construction cost.

Table 3 - Recommended Alternative - Estimated Costs

Project	Land Acquisition Cost	Construction Cost	Construction Contingency (15%)	Landscape Cost	Design & CM (15%)	Total
Channels						
Consolidated Canal Diversion Channel	$2,427,109	$18,162,600	$2,724,390	$7,021,008	$2,724,390	$33,059,498
Consolidated Canal Diversion Channel Outfall	$1,489,610	$9,839,361	$1,475,904	$4,298,932	$1,475,904	$18,579,711
Eastern Canal Diversion Channel - Middle	$1,605,063	$10,691,814	$1,603,772	$4,586,984	$1,603,772	$20,091,405
Eastern Canal Diversion Channel - North	$2,048,357	$8,210,956	$1,231,643	$5,930,857	$1,231,643	$18,653,456
Eastern Canal Diversion Channel - South	$2,437,726	$16,938,980	$2,540,847	$7,221,483	$2,540,847	$31,679,882
Eastern Canal Diversion Channel Outfall	$1,973,604	$13,621,733	$2,043,260	$5,872,388	$2,043,260	$25,554,245
Santan Channel East	$1,509,823	$14,652,757	$2,197,913	$4,177,108	$2,197,913	$24,735,514
Santan Channel West	$1,228,273	$10,195,871	$1,529,381	$3,294,635	$1,529,381	$17,777,541
Detention Basins						
ADOT Basin "L"	$896,988	$2,505,549	$375,832	$1,993,318	$375,832	$6,147,518
ADOT Basin "Q"	$1,194,546	$2,036,227	$305,434	$2,654,563	$305,434	$6,496,204
ADOT Basin "O"	$2,354,592	$6,292,664	$943,900	$5,232,459	$943,900	$15,767,514
Crossroads Park Basin Expansion	$258,746	$884,421	$132,663	$638,880	$132,663	$2,047,374
Queen Creek Road Basin	$1,121,234	$1,903,615	$285,542	$2,491,647	$285,542	$6,087,582
Water Quality Basins						
Riggs Road Basin	$1,595,603	$1,494,838	$224,226	$3,545,806	$224,226	$7,084,698
SPRR Basin	$1,293,732	$195,592	$29,339	$2,874,978	$29,339	$4,422,979
						$238,185,122

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA AREA DRAINAGE MASTER PLAN

"FCD CONTRACT # 98-13"

FIGURE 17

PROJECT DESCRIPTION:

RECOMMENDED PLAN

CONSULTANT:

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

VII. REFERENCES

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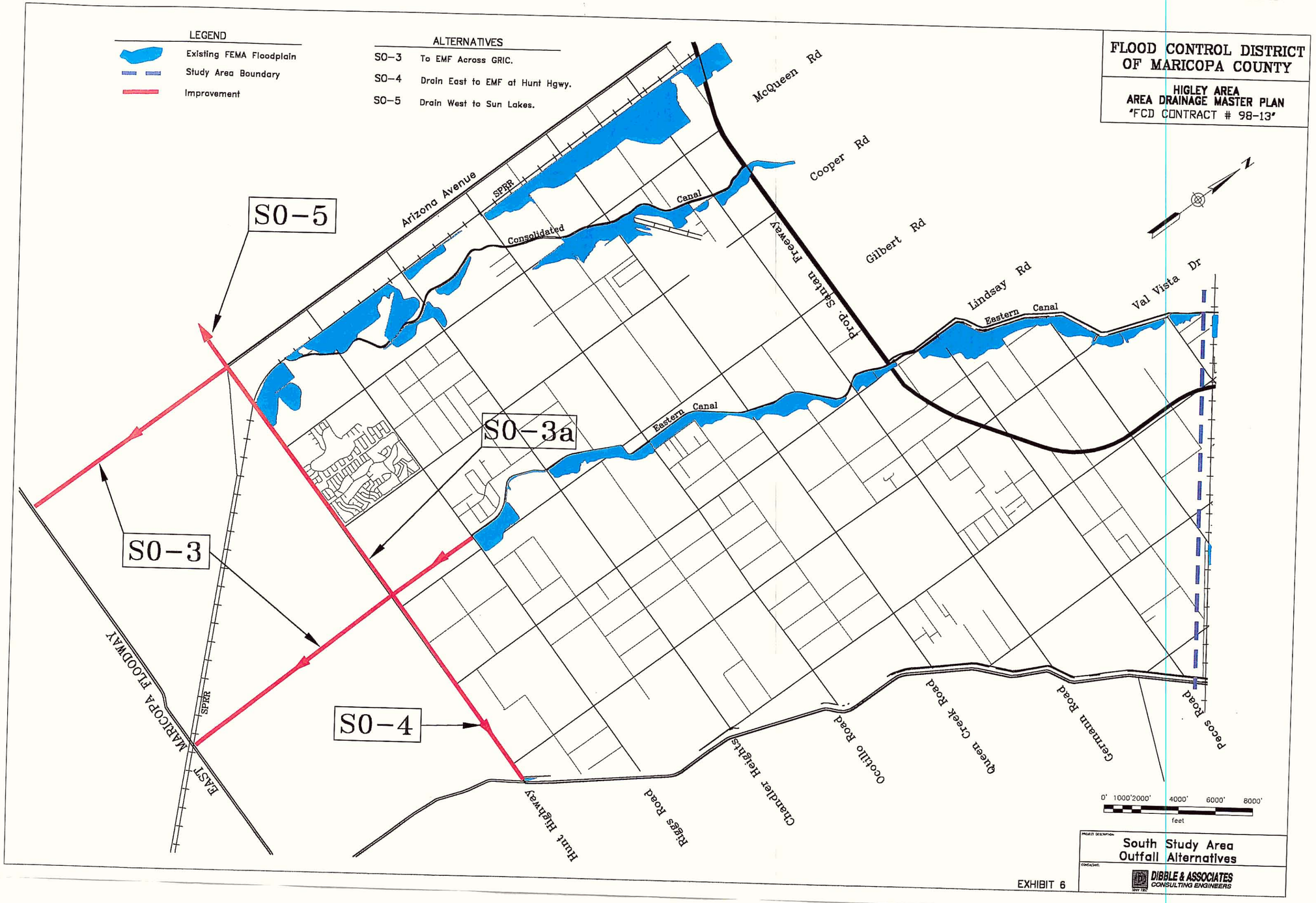
LEGEND
Existing FEMA Floodplain
Study Area Boundary
Improvement
ALTERNATIVES
SO-3 To EMF Across GRIC.
SO-4 Drain East to EMF at Hunt Hgwy.
SO-5 Drain West to Sun Lakes.
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT # 98-13"
S0-5
S0-3
S0-3a
S0-4
Arizona Avenue
SPRR
Consolidated Canal
McQueen Rd
Cooper Rd
Gilbert Rd
Lindsay Rd
Val Vista Dr
Eastern Canal
Eastern Canal
Roosevelt Irrig. Canal
EAST MARICOPA FLOODWAY
SPRR
Hunt Highway
Riggs Road
Chandler Heights
Ocotillo Road
Queen Creek Road
Germann Road
Pecos Road
0' 1000' 2000' 4000' 6000' 8000'
feet
South Study Area
Outfall Alternatives
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CONSULTING ENGINEERS
EXHIBIT 6

North Area, Alternative N-3

CHANNEL CAPACITIES AND COSTS

I.D.	Q100 (cfs)	Q (cfs)	Downstream Elevation	Upstream Elevation	Length (ft.)	Slope (ft./ft.) *	Material Type	Manning's "n" Value	Bottom Width (ft.)	Depth (ft.)	Sideslope (H:1)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (lf.)	Unit Cost ($/lf)	Fence Cost	Riprap Volume (cy)	Unit Cost ($/cy)	Riprap Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land & Landscape Costs
NEC-1	886	886	1284.0	1284.0	1000	0.00050	E	0.040	60	5.0	6	445.7	120.4	0.16	Sub	2.0	1.3	6.2	26176	$11.00	$309,930.60	0	$310	$0	2,000	$12.00	$24,000				117,322	$2.20	$258,108	3.5	Res.	$0.99	$150,052	$592,039	$258,108	$1,000,199
NEC-2	317	317	1284.0	1284.0	2300	0.00050	E	0.040	10	4.9	6	193.3	69.6	0.13	Sub	1.6	1.2	6.1	33377	$11.00	$367,145.81	0	$310	$0	4,600	$12.00	$55,200				153,717	$2.20	$338,178	5.3	Res.	$0.99	$229,598	$760,524	$338,178	$1,328,301
NEC-3	65	65	1284.0	1284.0	1400	0.00050	E	0.040	4	2.8	6	58.8	38.2	0.12	Sub	1.1	1.0	3.8	8846	$11.00	$97,302.81	0	$310	$0	2,800	$12.00	$33,600				65,635	$2.20	$144,396	2.2	Res.	$0.99	$96,693	$275,299	$144,396	$516,388
NEC-4	935	921	1284.0	1286.0	3000	0.00067	E	0.040	40	4.9	6	344.8	74.2	0.28	Sub	2.7	1.0	5.9	38210	$11.00	$420,306.79	0	$310	$0	6,000	$12.00	$72,000				287,057	$2.20	$631,526	7.3	Res.	$0.99	$314,119	$1,123,833	$631,526	$2,069,478
NEC-5	901	901	1286.0	1288.0	1600	0.00050	C	0.013	20	6.6	0	131.4	29.9	0.54	Sub	6.9	1.4	8.0	9612	$11.00	$105,736.39	1659	$310	$514,349	3,200	$12.00	$38,400				64,000	$2.20	$140,800	1.5	Res.	$0.99	$63,360	$799,285	$140,800	$1,003,445
NEC-6	692	692	1286.0	1288.0	1400	0.00143	C	0.013	20	4.3	0	85.3	33.1	0.56	Sub	8.1	1.9	6.2	10697	$11.00	$117,671.55	1325	$310	$410,891	2,800	$12.00	$33,600				56,000	$2.20	$123,200	1.3	Res.	$0.99	$55,440	$685,363	$123,200	$864,003
NEC-7	555	555	1288.0	1288.0	1300	0.00050	C	0.013	20	4.8	0	96.4	28.5	0.49	Sub	5.8	1.2	6.0	6892	$11.00	$75,810.99	1221	$310	$378,622	2,600	$12.00	$31,200				52,000	$2.20	$114,400	1.2	Res.	$0.99	$51,480	$800,033	$114,400	$765,913
NEC-8	457	457	1288.0	1288.0	1800	0.00050	C	0.013	20	4.4	0	87.1	29.6	0.42	Sub	5.2	1.3	5.7	10486	$11.00	$115,345.60	1660	$310	$514,680	3,600	$12.00	$43,200				72,000	$2.20	$158,400	1.7	Res.	$0.99	$71,280	$831,626	$158,400	$1,061,306
NEC-9	30	30	1288.0	1292.0	6800	0.00061	E	0.040	4	2.3	6	40.9	57.0	0.08	Sub	0.7	1.1	3.4	70689	$11.00	$777,582.24	0	$310	$0	13,200	$12.00	$158,400				292,682	$2.20	$643,857	13.4	Res.	$0.99	$576,814	$1,579,840	$643,857	$2,800,511

CULVERT CAPACITIES AND COSTS

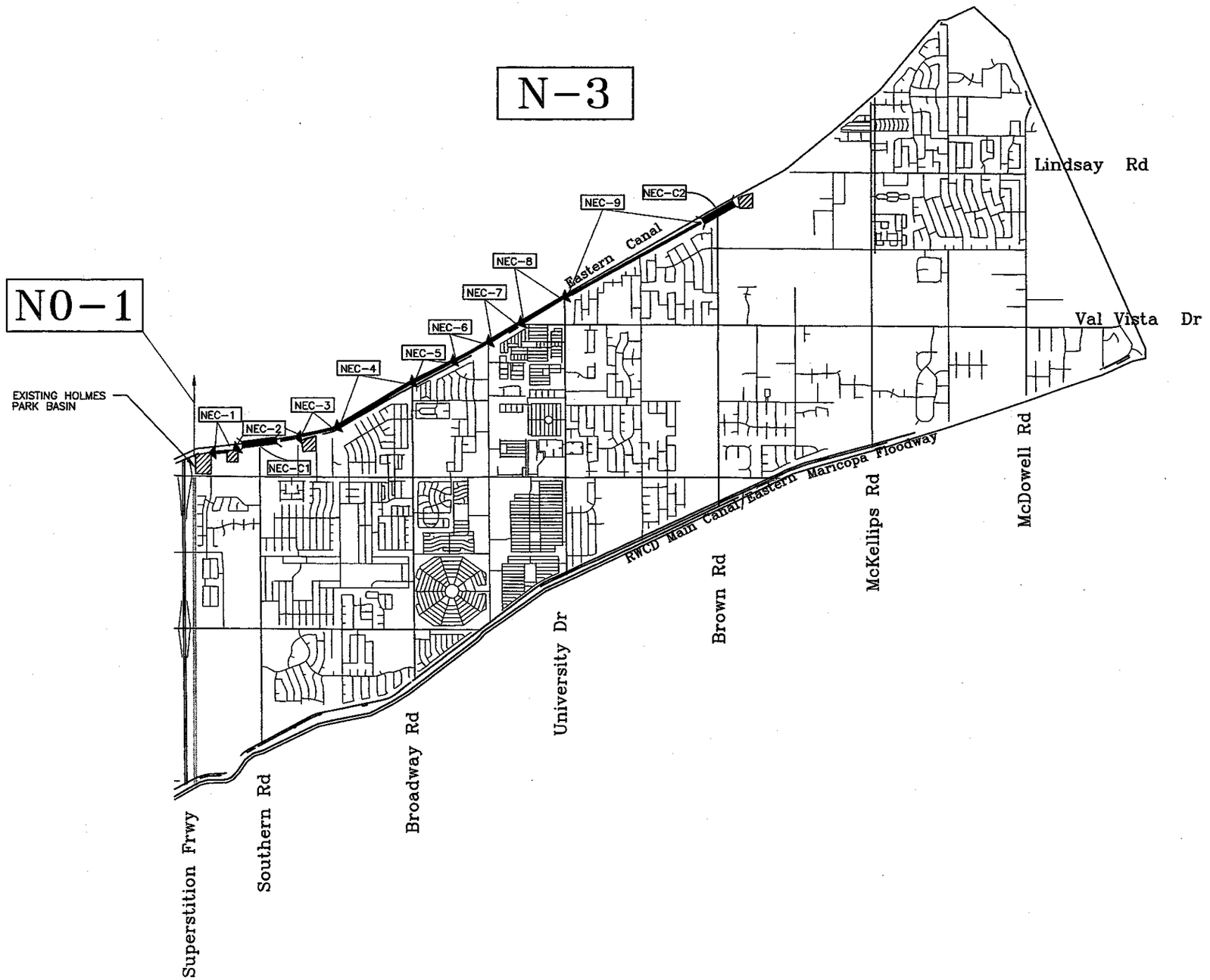
I.D.	Q100 (cfs)	Q (cfs)	R/W width (ft.)	Skew Angle (degrees)	Length (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Diameter/ Height	Width	Barrel Material	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Inlet Headwall	Unit Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (Ea.)	Outlet Headwall Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land & Landscape Costs
NEC-C1	317	317	110	90	110	0.00500	C	0.012	1	4	6	RCBC	4.5	9.94	2.48	IC	110	$300	$33,000	1	$3,200	$3,200	1	$5,700	$5,700	0.0	N/A	$0	$0	$41,900	$0	$41,900
NEC-C2	19	19	110	60	450	0.01000	C	0.012	1	2	0	RCP	1.7	2.51	1.26	IC	450	$60	$27,000	1	$3,200	$3,200	1	$5,700	$5,700	0.0	N/A	$0	$0	$35,900	$0	$35,900

TOTALS	**37.3**	**Ac.**		**$1,608,835**	**$7,325,641**	**$2,552,867**	**$11,487,343**
CONTINGENCIES AT 30%							**$2,197,692**
GRAND TOTAL							**$13,685,036**

* NOTE: Slopes Obtained Directly From HEC-1 Output
30% Contingency is applied to the Total Construction Cost Only

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT # 98-13"



0' 1000' 2000' 4000' 6000' 8000'
feet

N

LEGEND

- NEC-1 NEW CHANNEL REACH
- NEW CULVERT
- EXIST DETENTION BASIN

EXHIBIT 7

PROJECT DESCRIPTION: NORTH AREA
ALTERNATIVE N-3, NO-1

CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS

Middle Area, Alternative MO-1

CHANNEL CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	Downstream Elevation	Upstream Elevation	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's 'n' Value	Bottom Width (ft.)	Depth of Flow (ft.)	Sideslope (H:1)	Area of Flow (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost	Riprap Volume (cy)	Unit Cost ($/cy)	Riprap Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost
MEC-1	2242	2242	*	*	4160	0.00057	E	0.040	100	5.6	6	753.7	168.5	0.22	Sub	3.0	1.4	7.1	184426	$11	$2,028,691	0	$310	$0	8200	$12	$98,400	0	$35	$0	666,071	$2.20	$1,465,356
MEC-2	1133	1133	*	*	5884	0.00057	E	0.040	75	4.4	6	449.5	128.8	0.21	Sub	2.5	1.1	5.5	160895	$11	$1,769,856	0	$310	$0	11368	$12	$136,416	0	$35	$0	729,506	$2.20	$1,604,918
MEC-3	892	892	*	*	5400	0.00057	E	0.040	50	4.5	6	527.4	144.8	0.14	Sub	1.7	1.1	5.6	175379	$11	$1,929,171	0	$310	$0	10800	$12	$129,600	0	$35	$0	770,853	$2.20	$1,769,077
MEC-4	484	484	*	*	5412	0.00043	E	0.040	45	4.2	6	296.8	98.3	0.14	Sub	1.6	1.1	5.3	105974	$11	$1,176,711	0	$310	$0	10824	$12	$129,888	0	$35	$0	523,412	$2.20	$1,151,506
MGF-1	1677	1677	*	*	3000	0.00060	E	0.040	100	5.6	6	746.8	168.0	0.17	Sub	2.2	1.4	7.0	133484	$11	$1,468,327	0	$310	$0	6000	$12	$72,000	0	$35	$0	468,170	$2.20	$1,029,974
MGF-2	584	584	*	*	5280	0.00050	E	0.040	50	4.3	6	325.1	102.2	0.15	Sub	1.8	1.1	5.4	112776	$11	$1,240,541	0	$310	$0	10560	$12	$126,720	0	$35	$0	539,937	$2.20	$1,187,861
MGF-3	584	584	*	*	5280	0.00050	E	0.040	50	4.3	6	325.1	102.2	0.15	Sub	1.8	1.1	5.4	112776	$11	$1,240,541	0	$310	$0	10560	$12	$126,720	0	$35	$0	539,937	$2.20	$1,187,861

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Landscape Cost	Total Const. Land, & Landscape Costs
MEC-1	19.3	Res.	$0.60	$504,085	$3,592,446	$1,465,356	$1,969,440
MEC-2	21.1	Res.	$0.60	$551,422	$3,510,189	$1,604,918	$2,159,339
MEC-3	22.0	Res.	$0.99	$959,110	$3,767,846	$1,769,077	$2,659,187
MEC-4	16.0	Res.	$0.99	$688,694	$2,458,105	$1,151,506	$1,839,600
MGF-1	14.1	Res.	$0.99	$606,216	$2,609,901	$1,029,974	$1,676,760
MGF-2	16.3	Res.	$0.99	$703,171	$2,595,122	$1,187,861	$1,891,032
MGF-3	16.3	Res.	$0.99	$703,171	$2,595,122	$1,187,861	$1,891,032

CULVERT CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	R/W width (ft.)	Skew Angle (degrees)	Length (ft.)	Slope (ft./ft.)	Material Barrel Type	Manning's 'n' Value	Number of Barrels	Culvert Diameter/ Height	Width	Barrel Material	Tailwater Depth (ft.)	Composite Headwater	Composite HW/D	Control	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Inlet Headwall	Inlet Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (Ea.)	Outlet Headwall Cost
MEC-C1	388	388	110	90	110	0.00500	C	0.012	1	6	10	RCBC	4.4	5.80	0.97	IC	110	$800	$88,000	1	$5,700	$5,700	1	$9,500	$9,500
MEC-C2	1133	1133	110	90	220	0.01000	C	0.012	5	4	10	RCBC	5.5	4.42	1.10	TW	220	$1,400	$308,000	1	$6,900	$6,900	1	$9,900	$9,900
MEC-C3	892	892	110	60	127	0.01000	C	0.012	3	4	10	RCBC	4.4	4.89	1.22	IC	127	$1,400	$177,824	1	$4,800	$4,800	1	$8,800	$8,800
MEC-C4	484	484	110	90	110	0.00750	C	0.012	2	4	8	RCBC	4.5	5.41	1.35	IC	110	$800	$88,000	1	$3,900	$3,900	1	$7,000	$7,000
MEC-C5	130	130	110	90	110	0.00750	C	0.012	1	4	4	RCBC	4.4	5.76	1.44	IC	110	$800	$88,000	1	$3,200	$3,200	1	$5,700	$5,700
MGF-C1	584	584	110	90	710	0.01000	C	0.012	3	4	8	RCBC	5.8	4.26	1.06	IC	710	$1,000	$710,000	1	$4,300	$4,300	1	$7,700	$7,700
MGF-C2	584	584	110	90	633	0.01000	C	0.012	3	4	8	RCBC	5.8	4.26	1.06	IC	633	$1,000	$633,465	1	$4,300	$4,300	1	$7,700	$7,700
MGF-C3	584	584	110	90	110	0.01000	C	0.012	3	4	8	RCBC	7.1	6.98	1.75	TW	110	$1,000	$110,000	1	$4,300	$4,300	1	$7,700	$7,700

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Landscape Cost	Total Const. Land, & Landscape Costs
MEC-C1	0.0	N/A	$0.60	$0	$91,200	$0	$91,200
MEC-C2	0.0	N/A	$0.00	$0	$323,700	$0	$323,700
MEC-C3	0.0	N/A	$0.00	$0	$191,624	$0	$191,624
MEC-C4	0.0	N/A	$0.00	$0	$98,900	$0	$98,900
MEC-C5	0.0	N/A	$0.00	$0	$98,900	$0	$98,900
MGF-C1	0.0	N/A	$0.60	$0	$722,000	$0	$722,000
MGF-C2	0.0	N/A	$0.00	$0	$645,465	$0	$645,465
MGF-C3	0.0	N/A	$0.00	$0	$122,000	$0	$122,000

DETENTION BASIN QUANTITIES AND COSTS

I.D.	Q In (cfs)	Q Out (cfs)	Length (ft.)	Material Type	Manning's 'n' Value	Outlet Pipe Diameter (ft.)	Volume (Ac-ft)	Detention Basin Excavation (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Emergency Spillway Length (ft.)	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Dumped Riprap (cy)	Unit Cost ($/cy)	Riprap Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost
BSNQ	1677	0	-	-	-	-	458	738,910	$6	$4,433,460	1909805	$2.20	$2,674,676	2	$1,100	$2,200	240	71	$310.00	$22,042	222	$35.00	$7,770.00	6,000	$12.00	$72,000
CRPB	2260	255	0	-	-	-	546	92,000	$6	$552,000	280400	$2.20	$638,880	0	$1,100	$0	350	311	$310.00	$96,410	389	$35.00	$13,615.00	0	$12.00	$0

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Landscape Cost	Total Const. Land, & Landscape Costs
BSNQ	30	Res.	$0.99	$1,299,732	$7,412,460	$2,674,676	$11,581,160
CRPB	0	Res.	$0.99	$0	$1,300,905	$638,880	$1,939,785

STORM DRAIN QUANTITIES AND COSTS

I.D.	Q100 (cfs)	Q full (cfs)	Downstream Elevation	Upstream Elevation	Conveyance, K	V full	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's 'n' Value	Number of Pipes/Boxes	Pipe or Box	Pipe Diameter (in.)	Box Height (ft)	Box Width (ft)	Length of Pipe (ft.)	Unit Cost ($/ft.)	Pipe/Box Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Manhole	Unit Cost (Ea.)	Manhole Cost
MST-P1	-	-				0.00	13800		C	0.0120	1	Pipe	36			13800	$90	$1,242,000	2	$1,100	$2,200	28	$3,000	$84,000

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Landscape Cost	Total Const. Land, & Landscape Costs
MST-P1				$0	$1,328,200	$0	$1,328,200

TOTALS	155.0	Ac.	$6,000,000	$33,370,976	$12,890,011	$31,212,254
CONTINGENCIES AT 30%						$10,011,293
GRAND TOTAL						$41,223,547

* NOTE: Slopes Obtained Directly From HEC-1 Output
30% Contingency is applied to the Total Construction Cost Only

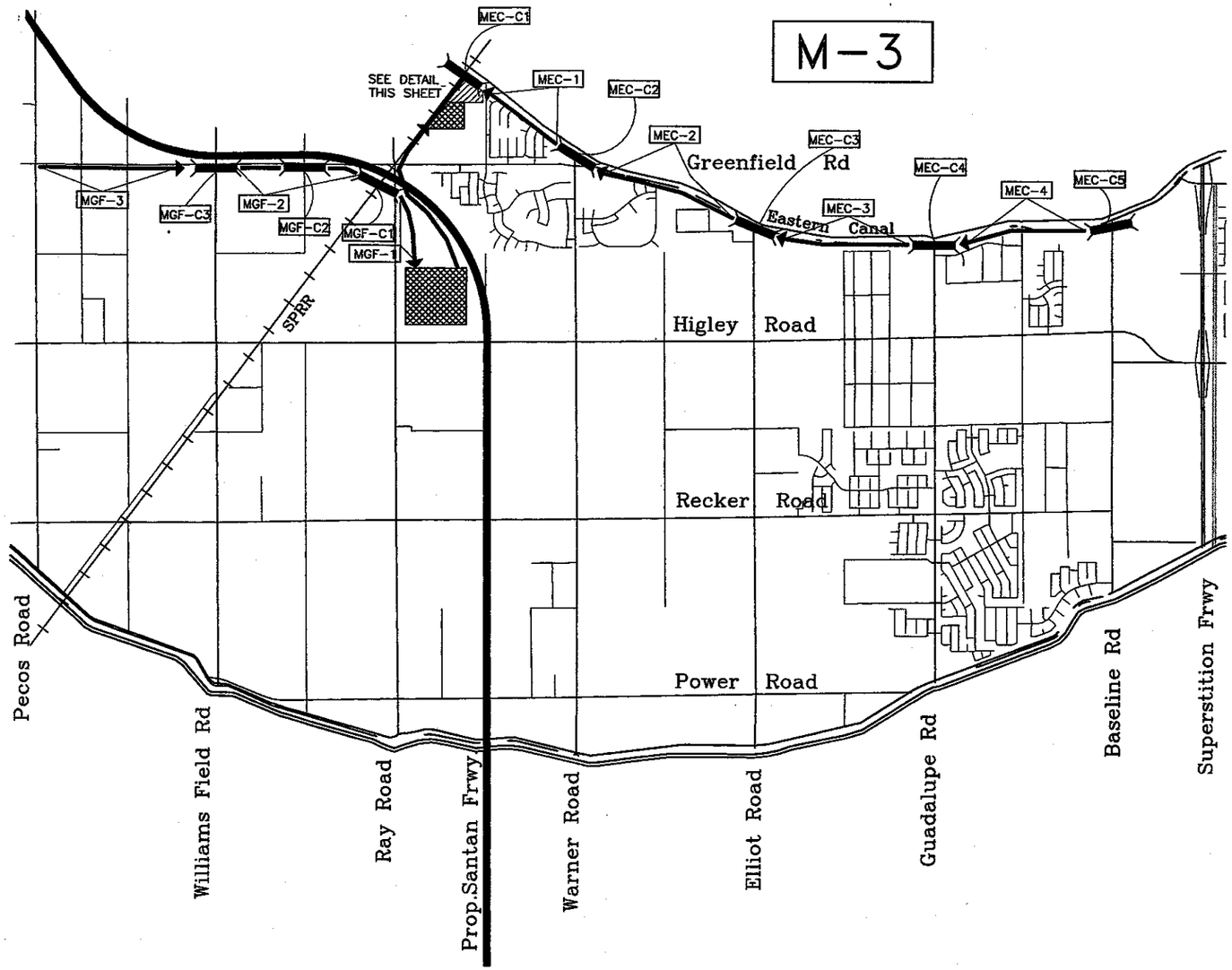
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT # 98-13"

0' 1000'2000' 4000' 6000' 8000'
feet

N

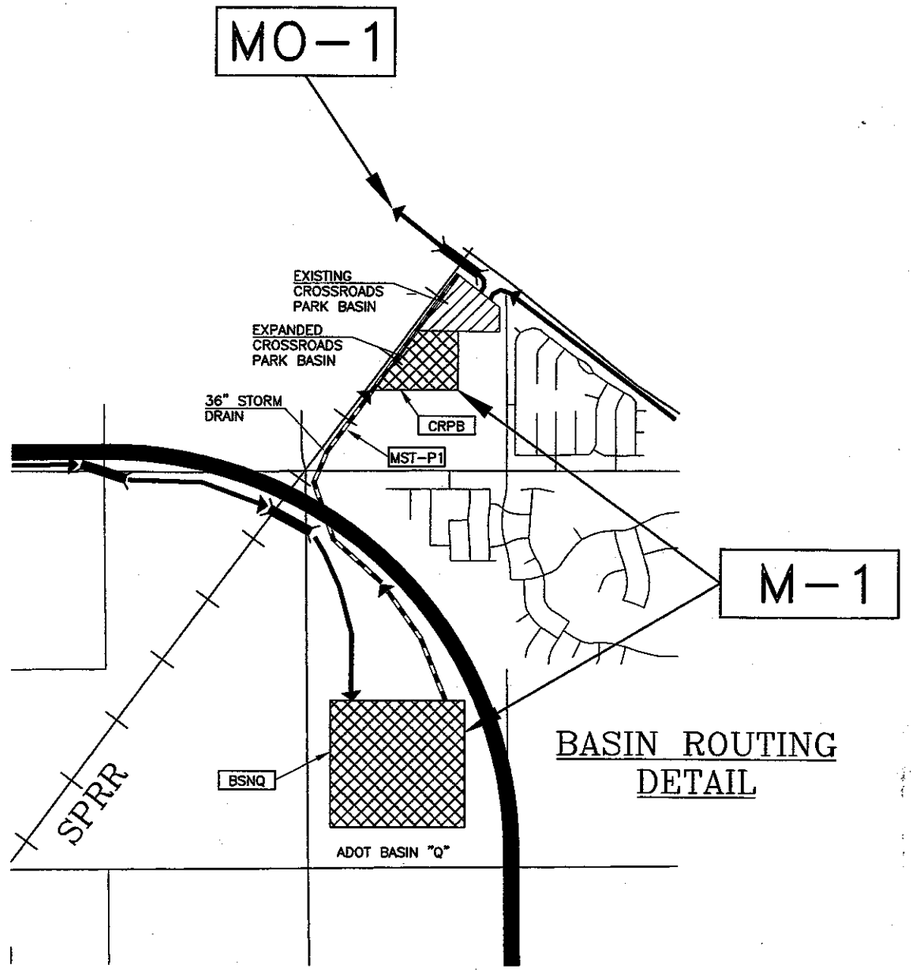
M-3



LEGEND

- MEC-1 NEW CHANNEL REACH
- NEW CULVERT
- EXIST DETENTION BASIN
- NEW DETENTION BASIN

MO-1



BASIN ROUTING DETAIL

PROJECT DESCRIPTION: MIDDLE AREA
ALTERNATIVE M-1, M-3, MO-1

CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS

EXHIBIT 8

Middle Area, Alternative MO-3

CHANNEL CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	Downstream Elevation	Upstream Elevation	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's "n" Value	Bottom Width (ft.)	Depth of Flow (ft.)	Sideslope (H:1)	Area of Flow (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)
MEC-1	2242	2242	*	*	4100	0.00067	E	0.0400	100	5.6	6	753.7	168.5	0.22	Sub	3.0	1.4	7.1
MEC-2	1133	1133	*	*	5884	0.00067	E	0.0400	75	4.4	6	449.5	129.8	0.21	Sub	2.5	1.1	5.6
MEC-3	892	892	*	*	5400	0.00037	E	0.0400	90	4.5	6	527.4	144.8	0.14	Sub	1.7	1.1	5.6
MEC-4	484	484	*	*	5412	0.00043	E	0.0400	45	4.2	6	296.8	96.3	0.14	Sub	1.6	1.1	5.3
MST-1	499	499	*	*	2460	0.00050	E	0.0400	35	4.5	6	281.2	90.0	0.15	Sub	1.8	1.1	5.7
MST-2	499	499	*	*	8800	0.00050	E	0.0400	35	4.5	6	281.2	90.0	0.15	Sub	1.8	1.1	5.7

I.D.	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost	Riprap Volume (cy)	Unit Cost ($/cy)	Riprap Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost
MEC-1	184425	$11	$2,028,691	0	$310	$0	8200	$12	$98,400	0	$35	$0	699,071	$2.20	$1,465,356
MEC-2	160805	$11	$1,768,855	0	$310	$0	11368	$12	$136,416	0	$35	$0	729,508	$2.20	$1,604,918
MEC-3	175379	$11	$1,929,171	0	$310	$0	10800	$12	$129,600	0	$35	$0	778,863	$2.20	$1,709,077
MEC-4	106974	$11	$1,176,711	0	$310	$0	10824	$12	$129,888	0	$35	$0	523,412	$2.20	$1,151,506
MST-1	45714	$11	$502,854	0	$310	$0	4600	$12	$57,600	0	$35	$0	213,614	$2.20	$469,952
MST-2	167618	$11	$1,843,799	0	$310	$0	17600	$12	$211,200	0	$35	$0	783,253	$2.20	$1,723,155

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const. Land & Landscape Costs
MEC-1	19.3	Res.	$0.60	$504,065	$3,592,446	$1,465,356	$5,561,867
MEC-2	21.1	Res.	$0.60	$551,422	$3,510,189	$1,604,918	$5,666,528
MEC-3	22.0	Res.	$0.60	$575,824	$3,767,848	$1,709,077	$6,052,750
MEC-4	16.0	Res.	$0.60	$417,025	$2,458,106	$1,151,506	$4,026,638
MST-1	6.8	Res.	$0.60	$177,137	$1,030,406	$469,952	$1,677,495
MST-2	24.9	Res.	$0.60	$649,503	$3,778,155	$1,723,155	$6,150,815

CULVERT CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	RW width (ft.)	Skew Angle (degrees)	Length (ft.)	Slope (ft./ft.)	Material Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Diameter/ Height	Width	Barrel Material	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
MEC-C1	255	255	110	90	110	0.01000	C	0.012	1	6	6	RCBC	5.5	6.16	1.03	IC
MEC-C2	1133	1133	110	30	220	0.01000	C	0.012	4	6	8	RCBC	5.5	5.45	0.90	IC
MEC-C3	892	892	110	60	127	0.01000	C	0.012	3	4	10	RCBC	4.4	4.89	1.22	IC
MEC-C4	484	484	110	90	110	0.01000	C	0.012	2	4	8	RCBC	4.5	5.40	1.35	IC
MEC-C5	130	130	110	90	110	0.01000	C	0.012	1	4	6	RCBC	4.2	3.93	0.98	IC
MST-C1	499	499	110	90	110	0.01000	C	0.012	2	4	8	RCBC	4.5	5.54	1.39	IC
MST-C2	499	499	110	70	117	0.01000	C	0.012	2	4	8	RCBC	4.5	5.54	1.39	IC

I.D.	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Inlet Headwall	Unit Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (Ea.)	Outlet Headwall Cost
MEC-C1	110	$800	$88,000	1	$5,700	$5,700	1	$9,500	$9,500
MEC-C2	220	$1,500	$330,000	1	$5,900	$5,900	1	$8,800	$8,800
MEC-C3	127	$1,400	$177,824	1	$4,500	$4,500	1	$8,800	$8,800
MEC-C4	110	$800	$88,000	1	$3,900	$3,900	1	$7,000	$7,000
MEC-C5	110	$800	$88,000	1	$3,200	$3,200	1	$5,700	$5,700
MST-C1	110	$800	$88,000	1	$3,900	$3,900	1	$7,000	$7,000
MST-C2	117	$800	$93,648	1	$3,900	$3,900	1	$7,000	$7,000

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const. Land & Landscape Costs
MEC-C1	0.0	N/A	$0.00	$0	$91,200	$0	$91,200
MEC-C2	0.0	N/A	$0.00	$0	$344,700	$0	$344,700
MEC-C3	0.0	N/A	$0.00	$0	$191,524	$0	$191,524
MEC-C4	0.0	N/A	$0.00	$0	$98,900	$0	$98,900
MEC-C5	0.0	N/A	$0.00	$0	$96,900	$0	$96,900
MST-C1	0.0	N/A	$0.00	$0	$98,900	$0	$98,900
MST-C2	0.0	N/A	$0.00	$0	$104,548	$0	$104,548

DETENTION BASIN QUANTITIES AND COSTS

I.D.	Q in (cfs)	Q Out (cfs)	Length (ft.)	Material Type	Manning's "n" Value	Outlet Pipe Diameter (ft.)	Volume (Ac-ft)
CRPB	2350	255	0	-	-	-	548
BSNQ	1195	195	0	-	-	4	142.2

I.D.	Detention Basin Excavation (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Emergency Spillway Length (ft.)	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Dumped Riprap (cy)	Unit Cost ($/cy)	Riprap Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost
CRPB	129,889	$6	$774,396	280400	$2.20	$616,880	0	$1,100	$0	350	311	$310.00	$96,410	359	$35.00	$13,615.00	0	$12.00	$0
BSNQ	319,947	$6	$1,914,282	1206619	$2.20	$2,654,563	0	$1,100	$0	170	151	$310.00	$46,810	189	$35.00	$6,615.00	5,710	$12.00	$68,520

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const. Land & Landscape Costs
CRPB	0	Res.	$0.99	$258,746	$1,525,301	$636,880	$2,420,927
BSNQ	27.7	Res.	$0.99	$1,194,545	$4,660,790	$2,654,563	$8,539,898

STORM DRAIN QUANTITIES AND COSTS

I.D.	Q100 (cfs)	Q Mf (cfs)	Downstream Elevation	Upstream Elevation	Conveyance, K	V Mf	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's "n" Value	Number of Pipes/Boxes	Pipe or Box	Pipe Diameter (in.)	Box Height (ft)	Box Width (ft)
MST-P1							22500		C	0.0120	1 Pipe		48		

I.D.	Length of Pipe (ft.)	Unit Cost ($/ft.)	Pipe/Box Cost	Headwall	Unit Cost (Ea.)	Headwall Unit Cost	Headwall Cost	Manhole	Unit Cost (Ea.)	Manhole Cost
MST-P1	30000	$120	$3,600,000	2	$1,100	$2,200	$2,420,000	45	$3,000	$135,000

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const. Land & Landscape Costs
MST-P1					$6,155,000	$0	$6,155,000

TOTALS	143.7	Ac.	$4,328,290	$31,522,912	$11,417,408	$47,268,610
CONTINGENCIES AT 30%						$9,456,874
GRAND TOTAL						$56,725,483

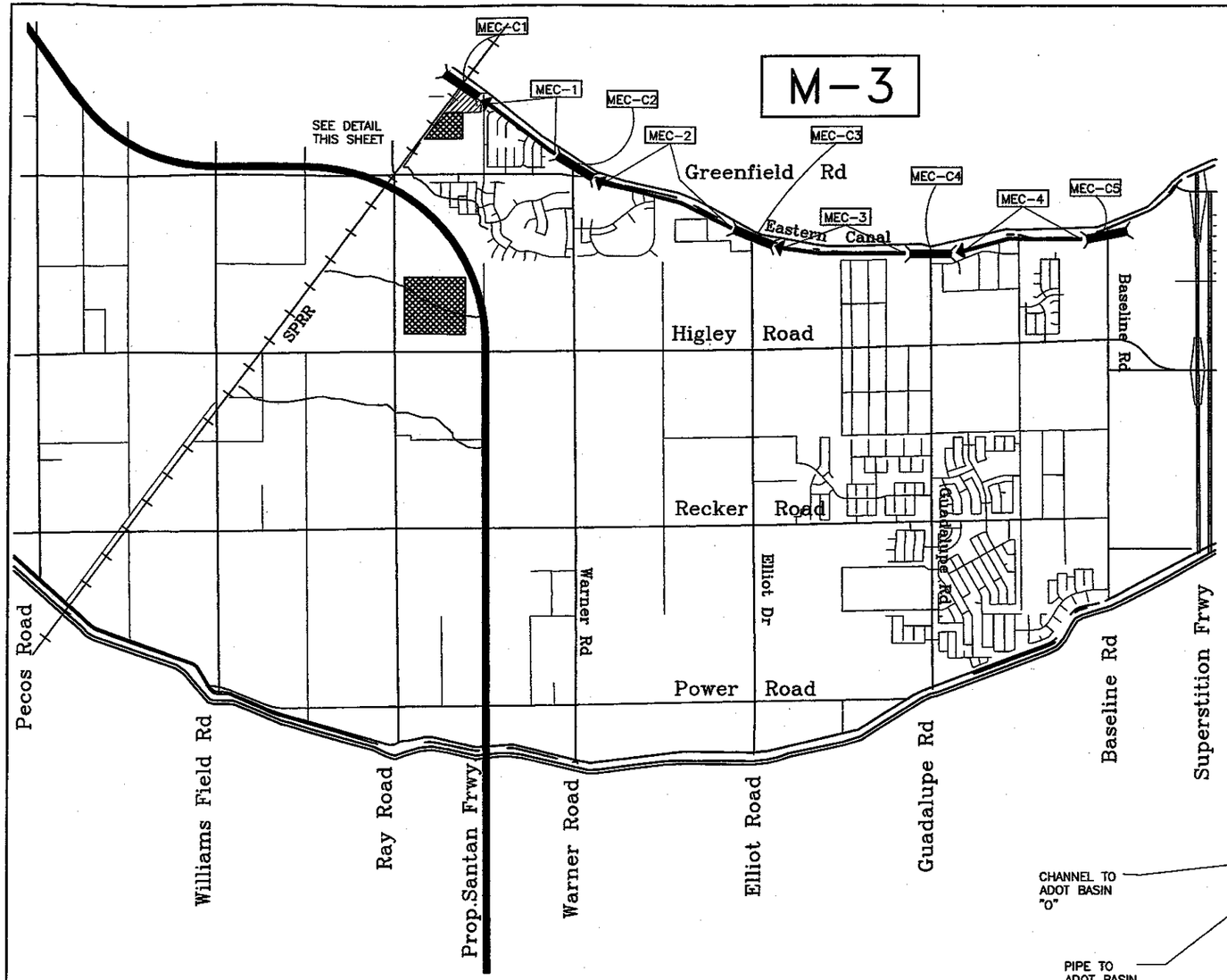
* NOTE: Slopes Obtained Directly From HEC-1 Output
30% Contingency is applied to the Total Construction Cost Only

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT # 98-13"

0' 1000'2000' 4000' 6000' 8000'
feet

N



LEGEND

- MEC-1 NEW CHANNEL REACH
- NEW CULVERT
- EXIST DETENTION BASIN
- NEW DETENTION BASIN
- NEW UNDERGROUND PIPE

BASIN ROUTING DETAIL

PROJECT DESCRIPTION:
MIDDLE AREA
ALTERNATIVE M-1, M-3, MO-3

CONSULTANT:
DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

EXHIBIT 9

South Area, Alternative S-1

CHANNEL CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	Downstream Elevation	Upstream Elevation	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's "n" Value	Bottom Width (ft.)	Depth of Flow (ft.)	Sideslope (ft:1)	Area of Flow (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost	Riprap Volume (cy)	Unit Cost ($/cy)	Riprap Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const. Land & Landscape Costs
SEC-2	1296	1296	*	*	5760	0.00050	m	0.0400	100	4.8	6	625.8	159.0	0.17	Sub	2.1	1.2	6.1	218171	$11	$2,399,879	0	$310	$0	11520	$12	$138,240				991,202	$2.20	$1,982,644	25.1	Res.	$0.60	$657,261	$4,520,763	$1,982,644	$7,160,648
SEC-3	1170	1170	*	*	6200	0.00050	m	0.0400	88	4.3	6	459.0	132.7	0.22	Sub	2.5	1.1	5.4	178564	$11	$1,964,524	0	$310	$0	12400	$12	$148,800				822,313	$2.20	$1,809,089	23.3	Res.	$0.60	$808,968	$3,922,422	$1,809,089	$6,341,471
SEC-4	1007	1007	*	*	6100	0.00050	m	0.0400	90	4.4	6	516.9	143.9	0.16	Sub	1.9	1.1	5.5	194754	$11	$2,142,293	0	$310	$0	12200	$12	$146,400				874,359	$2.20	$1,923,589	24.5	Res.	$0.60	$941,227	$4,212,283	$1,923,589	$6,777,099
SEC-5	815	815	*	*	2715	0.00070	m	0.0400	80	4.3	6	398.6	94.6	0.20	Sub	2.2	1.1	5.4	65315	$11	$718,467	0	$310	$0	5430	$12	$65,160				305,860	$2.20	$672,892	9.0	Res.	$0.60	$234,692	$1,456,519	$672,892	$2,364,104
SEC-6	724	724	*	*	3375	0.00060	m	0.0400	40	4.5	6	308.6	94.6	0.20	Sub	2.4	1.1	5.6	67970	$11	$747,669	0	$310	$0	6750	$12	$81,000				316,623	$2.20	$696,571	8.6	Res.	$0.60	$254,020	$1,525,239	$696,571	$2,476,730
SEC-7	735	735	*	*	3640	0.00050	m	0.0400	60	4.5	6	390.7	114.7	0.16	Sub	1.9	1.1	5.6	66069	$11	$726,763	0	$310	$0	5280	$12	$63,360				300,383	$2.20	$660,844	8.8	Res.	$0.60	$231,135	$1,450,967	$660,844	$2,342,946
SEC-8	738	738	*	*	3000	0.00050	m	0.0400	60	4.5	6	391.8	114.8	0.16	Sub	1.9	1.1	5.6	75271	$11	$827,983	0	$310	$0	6000	$12	$72,000				341,566	$2.20	$751,446	10.1	Res.	$0.60	$262,866	$1,651,429	$751,446	$2,665,741
SEC-9	725	725	*	*	6225	0.00050	m	0.0400	60	4.5	6	387.0	114.3	0.16	Sub	1.9	1.1	5.6	154455	$11	$1,698,006	0	$310	$0	12450	$12	$149,400				706,751	$2.20	$1,554,852	20.8	Res.	$0.60	$543,532	$3,403,258	$1,554,852	$5,501,643
SEC-10	624	624	*	*	2900	0.00090	m	0.0400	35	4.4	6	267.2	88.1	0.20	Sub	2.3	1.1	5.5	52915	$11	$582,070	0	$310	$0	5800	$12	$69,600				265,416	$2.20	$584,054	7.9	Res.	$0.60	$207,755	$1,212,324	$584,054	$1,980,733
SEC-11	624	624	*	*	4060	0.00080	m	0.0400	35	4.5	6	278.9	89.7	0.19	Sub	2.2	1.1	5.6	75756	$11	$833,311	0	$310	$0	8000	$12	$96,000				195,970	$2.20	$431,134	11.1	Res.	$0.60	$290,352	$1,711,227	$781,916	$2,783,495
SEC-12	388	388	*	*	2500	0.00050	m	0.0400	25	4.4	6	229.5	79.0	0.14	Sub	1.7	1.1	5.6	40440	$11	$444,839	0	$310	$0	5000	$12	$60,000							6.5	Res.	$0.60	$165,471	$935,973	$431,134	$1,532,578
SCC-1	1062	1062	*	*	3000	0.00080	m	0.0400	70	4.5	6	437.9	124.9	0.20	Sub	2.4	1.2	5.7	82976	$11	$912,733	0	$310	$0	6000	$12	$72,000				371,914	$2.20	$818,212	10.8	Res.	$0.60	$281,043	$1,802,945	$818,212	$2,902,200
SCC-2	1175	1175	1218.0	1222.0	5980	0.00067	m	0.0400	85	4.6	6	515.2	140.7	0.19	Sub	2.3	1.2	5.7	190945	$11	$2,100,394	0	$310	$0	11960	$12	$143,760				835,457	$2.20	$1,838,005	23.6	Res.	$0.60	$618,048	$4,082,159	$1,838,005	$6,538,212
SCC-3	732	732	*	*	5793	0.00050	m	0.0400	60	4.5	6	389.6	114.5	0.18	Sub	1.9	1.1	5.6	144605	$11	$1,590,659	0	$310	$0	11586	$12	$139,032				658,708	$2.20	$1,449,158	19.4	Res.	$0.60	$506,774	$3,178,849	$1,449,158	$5,134,781
SCC-4	248	248	1226.0	1228.0	5847	0.00050	m	0.0400	10	4.4	6	160.9	83.7	0.13	Sub	1.5	1.1	5.5	72471	$11	$797,186	0	$310	$0	11694	$12	$140,328				369,209	$2.20	$812,260	12.7	Res.	$0.60	$333,081	$1,749,774	$812,260	$2,895,116
SCC-5	1154	1154	1228.0	1228.0	6965	0.00050	m	0.0400	100	4.5	6	578.2	155.3	0.16	Sub	2.0	1.2	5.7	213968	$11	$2,353,573	0	$310	$0	12130	$12	$145,560				935,640	$2.20	$2,057,888	26.0	Res.	$0.60	$678,758	$4,564,520	$2,057,088	$7,282,367
SCC-6	537	537	1228.0	1228.0	2000	0.00050	m	0.0400	40	4.5	6	298.6	94.5	0.15	Sub	1.8	1.1	5.6	40063	$11	$440,696	0	$310	$0	4000	$12	$48,000				187,339	$2.20	$412,146	5.8	Res.	$0.60	$150,902	$998,842	$412,146	$1,463,889

CULVERT CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	F/W width (ft.)	Skew Angle (degrees)	Length (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Diameter/ Height	Width	Barrel/Material	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/lf.)	Pipe/Box Culvert Cost	Inlet Headwall	Unit Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (EA.)	Outlet Headwall Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const. Land & Landscape Costs
SEC-C3	1170	1170	110	90	110	0.01000	C	0.012	4	4	10	RCBC	4.9	5.15	1.29	TW	110	$1,800	$198,000	1	$5,600	$5,600	1	$11,100	$11,100	0.0	N/A	$0.00	$0	$214,700	$0	$214,700
SEC-C4	1170	1170	110	50	144	0.01000	C	0.012	4	4	10	RCBC	4.3	4.84	1.21	IC	144	$1,800	$258,471	1	$5,600	$5,600	1	$11,100	$11,100	0.0	N/A	$0.00	$0	$275,171	$0	$275,171
SEC-C5	1007	1007	110	90	110	0.00500	C	0.012	3	4	10	RCBC	4.3	5.93	1.48	IC	110	$1,400	$154,000	1	$4,900	$4,900	1	$8,800	$8,800	0.0	N/A	$0.00	$0	$167,700	$0	$167,700
SEC-C6	815	815	110	90	127	0.01000	C	0.012	3	4	10	RCBC	4.4	4.59	1.15	IC	127	$1,400	$177,824	1	$4,900	$4,900	1	$8,800	$8,800	0.0	N/A	$0.00	$0	$191,524	$0	$191,524
SEC-C7	724	724	110	60	127	0.01000	C	0.012	3	4	10	RCBC	4.5	4.25	1.06	IC	127	$1,400	$177,824	1	$4,900	$4,900	1	$8,800	$8,800	0.0	N/A	$0.00	$0	$191,524	$0	$191,524
SEC-C8	738	738	110	90	110	0.01000	C	0.012	3	4	8	RCBC	4.5	5.48	1.37	IC	110	$1,400	$154,000	1	$4,900	$4,900	1	$8,800	$8,800	0.0	N/A	$0.00	$0	$167,700	$0	$167,700
SEC-C9	725	725	110	90	110	0.01000	C	0.012	3	4	8	RCBC	4.5	5.40	1.35	IC	110	$1,400	$154,000	1	$4,900	$4,900	1	$8,800	$8,800	0.0	N/A	$0.00	$0	$167,700	$0	$167,700
SEC-C10	624	624	110	90	127	0.00500	C	0.012	2	4	10	RCBC	4.5	5.56	1.39	IC	127	$1,000	$127,017	1	$4,300	$4,300	1	$7,700	$7,700	0.0	N/A	$0.00	$0	$139,017	$0	$139,017
SEC-C11	624	624	110	45	156	0.00500	C	0.012	2	4	10	RCBC	4.4	5.58	1.39	IC	158	$1,000	$155,563	1	$4,300	$4,300	1	$7,700	$7,700	0.0	N/A	$0.00	$0	$167,563	$0	$167,563
SEC-C12	388	388	110	60	127	0.00500	C	0.012	2	4	6	RCBC	4.5	5.74	1.43	IC	127	$600	$76,210	1	$3,500	$3,500	1	$6,400	$6,400	0.0	N/A	$0.00	$0	$86,110	$0	$86,110
SCC-C3	1175	1175	110	60	127	0.01000	C	0.012	4	4	10	RCBC	4.5	4.85	1.21	IC	127	$1,800	$228,631	1	$5,600	$5,600	1	$11,100	$11,100	0.0	N/A	$0.00	$0	$245,331	$0	$245,331
SCC-C4	732	732	110	50	144	0.01000	C	0.012	3	4	10	RCBC	4.6	4.26	1.07	IC	144	$1,400	$201,033	1	$4,900	$4,900	1	$8,800	$8,800	0.0	N/A	$0.00	$0	$214,733	$0	$214,733
SCC-C5	248	248	110	50	144	0.01000	C	0.012	2	4	6	RCBC	4.5	3.82	0.95	TW	144	$600	$86,157	1	$3,500	$3,500	1	$6,400	$6,400	0.0	N/A	$0.00	$0	$98,057	$0	$98,057
SCC-C6	248	248	110	10	633	0.00500	C	0.012	2	4	4	RCBC	4.4	5.53	1.38	IC	633	$2,900	$1,837,048	1	$3,500	$3,500	1	$5,400	$5,400	0.0	N/A	$0.00	$0	$1,846,948	$0	$1,846,948
SCC-C7	1154	1154	110	80	112	0.01000	C	0.012	4	4	10	RCBC	4.4	4.79	1.20	IC	112	$1,800	$201,654	1	$6,600	$6,600	1	$11,100	$11,100	0.0	N/A	$0.00	$0	$217,754	$0	$217,754
SCC-C8	537	537	110	80	112	0.00500	C	0.012	2	4	8	RCBC	4.5	5.98	1.48	IC	112	$800	$89,358	1	$3,900	$3,900	1	$7,000	$7,000	0.0	N/A	$0.00	$0	$100,258	$0	$100,258

DETENTION BASIN QUANTITIES AND COSTS

I.D.	Q in (cfs)	Q Out (cfs)	Length (ft.)	Material Type	Manning's "n" Value	Outlet Pipe Diameter (ft.)	Volume (Ac-ft)	Detention Basin Excavation (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Headwall	Unit Cost (EA.)	Headwall Cost	Emergency Spillway Length (ft.)	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Dumped Riprap (cy)	Unit Cost ($/cy)	Riprap Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const. Land & Landscape Costs
QDRB	1713	48	-	-	-	-	188	303,307	$6	$1,819,842	1132567	$2.20	$2,491,647	1	$1,100	$1,100	250	74	$310.00	22,961	93	$35.00	$3,240.71	4,706	$12.00	56,472	26	Res.	$0.99	$1,121,234	$4,396,283	$2,491,647	$8,008,144
BSNO	1946	86	0	-	-	-	838	1,029,307	$6	$6,175,842	2376391	$2.20	$5,232,459	2	$1,100	$2,200	275	61	$310.00	25,257	102	$35.00	$3,564.79	7,150	$12.00	85,800	54.6	Res.	$0.99	$2,354,592	$11,525,123	$5,232,459	$19,112,174
BSNL	667	57	0	-	-	-	252	406,560	$6	$2,439,360	906854	$2.20	$1,993,918	2	$1,100	$2,200	100	30	$310.00	9,184	37	$35.00	$1,296.26	4,459	$12.00	53,508	20.8	Res.	$0.99	$896,988	$4,498,896	$1,993,318	$7,389,172

TOTALS	356.5	Ac.	$11,040,573	$67,182,535	$28,929,924	$107,153,033
CONTINGENCIES AT 30%						$20,154,761
GRAND TOTAL						$127,307,793

* NOTE: Slopes Obtained Directly From HEC-1 Output
30% Contingency is applied to the Total Construction Cost Only

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT # 98-13"

S-1

LEGEND

- SEC-1 NEW CHANNEL REACH
- NEW CULVERT
- EXIST DETENTION BASIN
- NEW DETENTION BASIN

0' 1000'2000' 4000' 6000' 8000'
feet

McQueen Rd
Cooper Rd
Gilbert Rd
Lindsay Rd
Val Vista Dr
Arizona Ave.
SPRR
Consolidated Canal
Eastern Canal
Prop. Santan Freeway
ADOT BASIN "L" BSNL
ADOT BASIN "O" BSNO
PROPOSED QUEEN CREEK ROAD BASIN QCRB
SCC-1
SCC-2
SCC-3
SCC-4
SCC-5
SCC-6
SCC-C3
SCC-C4
SCC-C5
SCC-C6
SCC-C7
SCC-C8
SEC-2
SEC-3
SEC-4
SEC-5
SEC-6
SEC-7
SEC-8
SEC-9
SEC-10
SEC-11
SEC-12
SEC-C3
SEC-C4
SEC-C5
SEC-C6
SEC-C7
SEC-C8
SEC-C9
SEC-C10
SEC-C11
SEC-C12
$1,700,000
$2,500,000
1200
2500
1000
4700
EAST MARICOPA FLOODWAY
SPRR
Hunt Highway
Riggs Road
Chandler Heights
Ocotillo Road
Queen Creek Road
Germann Road
Pecos Rd

EXHIBIT 10

PROJECT DESCRIPTION: SOUTH AREA ALTERNATIVE S-1

CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS

South Area, Alternative S-2

CHANNEL CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	Downstream Elevation	Upstream Elevation	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's 'n' Value	Bottom Width (ft.)	Depth of Flow (ft.)	Sideslope (H:1)	Area of Flow (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (ft.)	Unit Cost ($/ft)	Fence Cost	Riprap Volume (cy)	Unit Cost ($/cy)	Riprap Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const. Land & Landscape Costs
SST-1	57	57	*	*	8000	0.00050	E	0.0400	4	2.7	6	53.3	36.4	0.12	Sub	1.1	1.0	3.7	47613	$11	$525,946	0	$310	$0	16000	$12	$192,000	0	$35	$0	367,898	$2.20	$809,375	12.5	Res.	$0.60	$326,277	$1,527,321	$809,375	$2,662,972
SST-2	667	667	*	*	16800	0.00050	E	0.0400	50	4.6	6	357.2	106.0	0.15	Sub	1.9	1.2	5.8	259917	$11	$2,760,690	0	$310	$0	21600	$12	$259,200	0	$35	$0	1,129,664	$2.20	$2,485,260	34.5	Res.	$0.60	$901,566	$5,504,550	$2,485,260	$8,891,807
SST-3	885	885	*	*	7000	0.00050	E	0.0400	75	4.5	6	489.9	129.7	0.16	Sub	1.9	1.1	5.6	201301	$11	$2,214,316	0	$310	$0	14000	$12	$168,000	0	$35	$0	901,818	$2.20	$1,984,000	28.1	Res.	$0.60	$683,182	$4,366,316	$1,984,000	$7,033,498
SEC-1	972	972	*	*	3000	0.00050	E	0.0400	50	4.6	6	494.6	135.9	0.16	Sub	2.0	1.2	5.8	92169	$11	$1,013,862	0	$310	$0	6000	$12	$72,000	0	$35	$0	403,711	$2.20	$888,164	11.5	Res.	$0.60	$306,903	$1,974,026	$888,164	$3,169,093
SEC-2	972	972	*	*	6400	0.00050	E	0.0400	80	4.6	6	494.6	135.9	0.16	Sub	2.0	1.2	5.8	196628	$11	$2,162,906	0	$310	$0	12800	$12	$153,600	0	$35	$0	861,250	$2.20	$1,894,750	24.9	Res.	$0.60	$649,600	$4,211,256	$1,894,750	$6,755,606
SEC-3	576	576	*	*	3000	0.00050	E	0.0400	30	4.4	6	349.6	83.7	0.19	Sub	2.3	1.1	5.5	51895	$11	$570,845	0	$310	$0	6000	$12	$72,000	0	$35	$0	249,750	$2.20	$549,451	8.0	Res.	$0.60	$209,701	$1,192,296	$549,451	$1,951,448
SEC-4	621	621	*	*	4500	0.00050	E	0.0400	35	4.5	6	277.9	89.8	0.19	Sub	2.2	1.1	5.6	84961	$11	$934,574	0	$310	$0	9000	$12	$108,000	0	$35	$0	369,474	$2.20	$678,843	12.7	Res.	$0.60	$330,869	$1,921,417	$678,843	$3,131,129
SEC-5	256	256	*	*	2500	0.00050	E	0.0400	6	4.8	6	164.2	63.8	0.13	Sub	1.8	1.2	6.0	32059	$11	$352,654	0	$310	$0	5000	$12	$60,000	0	$35	$0	154,298	$2.20	$339,451	5.8	Res.	$0.60	$148,155	$752,105	$339,451	$1,237,712
SCC-1	1052	1052	*	*	3000	0.00080	E	0.0400	70	4.5	6	497.9	124.9	0.20	Sub	2.4	1.2	5.7	82976	$11	$912,733	0	$310	$0	6000	$12	$72,000				371,914	$2.20	$818,212	10.8	Res.	$0.60	$281,049	$1,802,945	$818,212	$2,902,200
SCC-2	1175	1175	1218.0	1222.0	5990	0.00067	E	0.0400	85	4.6	6	516.2	140.7	0.19	Sub	2.3	1.2	5.7	180945	$11	$2,100,284	0	$310	$0	11980	$12	$143,760				825,457	$2.20	$1,838,005	23.6	Res.	$0.60	$618,048	$4,082,159	$1,838,005	$6,538,212
SCC-3	732	732	*	*	5793	0.00050	E	0.0400	80	4.5	6	389.6	114.5	0.16	Sub	1.9	1.1	5.5	144605	$11	$1,690,659	0	$310	$0	11586	$12	$139,032				658,708	$2.20	$1,448,188	19.4	Res.	$0.60	$506,774	$3,178,849	$1,448,159	$5,134,781
SCC-4	248	248	1220.0	1228.0	5847	0.00080	E	0.0400	10	4.4	6	169.9	68.7	0.13	Sub	1.5	1.1	5.5	72471	$11	$797,186	0	$310	$0	11694	$12	$140,328				360,200	$2.20	$812,280	12.7	Res.	$0.60	$323,091	$1,749,774	$812,280	$2,885,146
SCC-5	1154	1154	1228.0	1238.0	6985	0.00050	E	0.0400	100	4.5	6	578.2	156.3	0.16	Sub	2.0	1.2	5.7	213986	$11	$2,353,673	0	$310	$0	12130	$12	$145,560				935,040	$2.20	$2,057,088	28.0	Res.	$0.60	$678,758	$4,555,529	$2,057,088	$7,292,367

CULVERT CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	h/W width (ft.)	Skew Angle (degrees)	Length (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's 'n' Value	Number of Barrels	Culvert Diameter/ Height	Width	Barrel Material	Depth of Flow (ft.)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Inlet Headwall	Unit Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (Ea.)	Outlet Headwall Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const. Land & Landscape Costs
SST-C1	57	57	110	90	110	0.01000	C	0.012	1	4	6	RCBC	2.7	2.22	0.55	IC		110	$300	$33,000	1	$3,200	$3,200	1	$5,700	$5,700	0.0	N/A	$0.00	$0	$41,900	$0	$41,900
SST-C2	57	57	110	90	110	0.01000	C	0.012	1	4	6	RCBC	2.7	2.22	0.55	IC		110	$300	$33,000	1	$3,200	$3,200	1	$5,700	$5,700	0.0	N/A	$0.00	$0	$41,900	$0	$41,900
SST-C3	867	867	110	90	110	0.01000	C	0.012	3	6	6	RCBC	4.6	4.59	0.77	IC		110	$1,200	$132,000	1	$8,200	$8,200	1	$13,900	$13,900	0.0	N/A	$0.00	$0	$154,100	$0	$154,100
SST-C4	867	867	110	90	110	0.01000	C	0.012	3	6	6	RCBC	4.6	4.59	0.77	IC		110	$1,200	$132,000	1	$8,200	$8,200	1	$13,900	$13,900	0.0	N/A	$0.00	$0	$154,100	$0	$154,100
SST-C5	885	885	110	45	155	0.01000	C	0.012	4	4	6	RCBC	4.5	4.65	1.16	IC		155	$1,400	$217,789	1	$4,000	$4,000	1	$8,800	$8,800	0.0	N/A	$0.00	$0	$231,489	$0	$231,489
SST-C6	499	499	110	45	155	0.01000	C	0.012	2	4	5	RCBC	4.5	5.54	1.39	IC		155	$800	$124,451	1	$3,900	$3,900	1	$7,700	$7,700	0.0	N/A	$0.00	$0	$136,051	$0	$136,051
SEC-C1	972	972	110	20	322	0.01000	C	0.012	3	6	5	RCBC	4.6	5.56	0.59	IC		322	$1,200	$385,942	1	$8,400	$8,400	1	$10,800	$10,800	0.0	N/A	$0.00	$0	$408,142	$0	$408,142
SEC-C2	972	972	110	90	110	0.01000	C	0.012	3	6	5	RCBC	4.6	5.56	0.59	IC		110	$1,200	$132,000	1	$8,400	$8,400	1	$10,800	$10,800	0.0	N/A	$0.00	$0	$140,200	$0	$140,200
SEC-C3	576	576	110	60	127	0.01000	C	0.012	2	4	10	RCBC	4.6	4.78	1.20	IC		127	$1,800	$227,017	1	$4,300	$4,300	1	$7,700	$7,700	0.0	N/A	$0.00	$0	$139,017	$0	$139,017
SEC-C4	621	621	110	90	110	0.01000	C	0.012	2	4	10	RCBC	4.4	5.52	1.38	IC		110	$1,000	$110,000	1	$4,300	$4,300	1	$7,700	$7,700	0.0	N/A	$0.00	$0	$122,000	$0	$122,000
SEC-C5	256	256	110	70	117	0.01000	C	0.012	1	4	3	RCBC	4.5	5.66	1.42	IC		117	$700	$81,942	1	$3,700	$3,700	1	$6,600	$6,600	0.0	N/A	$0.00	$0	$92,242	$0	$92,242
SCC-C3	1175	1175	110	60	127	0.01000	C	0.012	4	4	10	RCBC	4.5	4.85	1.21	IC		127	$1,800	$228,631	1	$5,600	$5,600	1	$11,100	$11,100	0.0	N/A	$0.00	$0	$245,331	$0	$245,331
SCC-C4	732	732	110	50	144	0.01000	C	0.012	3	4	10	RCBC	4.6	4.26	1.07	IC		144	$1,400	$201,033	1	$4,800	$4,800	1	$8,800	$8,800	0.0	N/A	$0.00	$0	$214,733	$0	$214,733
SCC-C5	248	248	110	50	144	0.01000	C	0.012	2	4	8	RCBC	4.5	3.82	0.85	TW		144	$600	$86,157	1	$3,600	$3,600	1	$8,400	$8,400	0.0	N/A	$0.00	$0	$98,057	$0	$98,057
SCC-C6	248	248	110	10	639	0.00500	C	0.012	2	4	4	RCBC	4.4	5.53	1.38	IC		639	$2,800	$1,837,048	1	$5,500	$5,500	1	$8,400	$8,400	0.0	N/A	$0.00	$0	$1,845,948	$0	$1,845,948
SCC-C7	1154	1154	110	80	112	0.01000	C	0.012	4	4	10	RCBC	4.4	4.79	1.20	IC		112	$1,800	$201,654	1	$5,600	$5,600	1	$11,100	$11,100	0.0	N/A	$0.00	$0	$217,754	$0	$217,754
SCC-C8	537	537	110	80	112	0.00500	C	0.012	2	4	8	RCBC	4.5	5.53	1.48	IC		112	$800	$89,858	1	$3,900	$3,900	1	$7,000	$7,000	0.0	N/A	$0.00	$0	$100,258	$0	$100,258

DETENTION BASIN QUANTITIES AND COSTS

I.D.	Q In (cfs)	Q Out (cfs)	Length (ft.)	Material Type	Manning's 'n' Value	Outlet Pipe Diameter (ft.)	Volume (Ac-ft)	Detention Basin Excavation (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Emergency Spillway Length (ft.)	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Dumped Riprap (cy)	Unit Cost ($/cy)	Riprap Cost	Fence Length (ft.)	Unit Cost ($/ft)	Fence Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const. Land & Landscape Costs
BSMO	1945	88	0	-	-	-	638	1,029,907	$6	$6,175,842	2978991	$2.20	$6,555,381	2	$1,900	$3,800	275	61	$310.00	25,257	102	$36.00	$3,684.78	7,150	$12.00	$85,800	54.6	Res.	$0.99	$2,354,392	$11,525,123	$5,232,459	$19,112,174
BSNL	657	57	0	-	-	-	232	466,599	$6	$2,499,900	908654	$2.20	$1,998,318	2	$1,100	$2,200	100	39	$310.00	9,184	37	$35.00	$1,296.28	4,469	$12.00	$53,808	20.8	Res.	$0.99	$896,388	$4,468,868	$1,993,316	$7,359,172

STORM DRAIN QUANTITIES AND COSTS

I.D.	Q100 (cfs)	Q full (cfs)	Downstream Elevation	Upstream Elevation	Conveyance, K	V full	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's 'n' Value	Number of Pipes/Boxes	Pipe or Box	Pipe Diameter (in.)	Box Height (ft)	Box Width (ft)	Length of Pipe (ft.)	Unit Cost ($/ft.)	Pipe/Box Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Manhole	Unit Cost (Ea.)	Manhole Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const. Land & Landscape Costs
SST-P1	-	-				-	9,000	-	C	0.0120	1	Pipe	48			9000	$120	$1,080,000		$1,100	$0	18	$3,000	$54,000					$1,134,000	$0	$1,134,000
SST-P2	-	-				-	13,000	-	C	0.0120	1	Pipe	48			13000	$120	$1,560,000		$1,100	$0	26	$3,000	$78,000					$1,638,000	$0	$1,638,000
SST-P3	-	-				-	7,500	-	C	0.0120	1	Pipe	48			7500	$120	$900,000		$1,100	$0	15	$3,000	$45,000					$945,000	$0	$945,000

TOTALS	303.7	Ac.	$9,217,967	$80,946,745	$24,029,793	$94,194,406
CONTINGENCIES AT 30%						$18,284,024
GRAND TOTAL						$112,478,430

* NOTE: Slopes Obtained Directly From HEC-1 Output
30% Contingency is applied to the Total Construction Cost Only

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT # 98-13"

0' 1000'2000' 4000' 6000' 8000'
feet

LEGEND

- SEC-1 NEW CHANNEL REACH
- NEW CULVERT
- EXIST DETENTION BASIN
- NEW DETENTION BASIN

S-2

TO ADOT BASIN "K"
SST-C1
SST-P1
SST-C2
SST-1
McQueen Rd
ADOT BASIN "L" BSNL
Cooper Rd
SST-C3
SST-2
SST-C4
Gilbert Rd
SST-P2
Arizona Ave.
SPRR
Consolidated Canal
Santan Freeway
SEC-2
Lindsay Rd
Eastern Canal
SEC-3
SEC-4
Val Vista Dr
SEC-5
SEC-1
SEC-C2
SEC-C3
SEC-C1
SEC-C4
SEC-C5
SST-3
ADOT BASIN "Q" BSNO
SST-C5
SST-C6
SST-P3
FROM ADOT BASIN "Q"
EASTERN MARICOPA FLOODWAY
SPRR
Hunt Hwy.
Riggs Road
Chandler Heights Road.
Ocotillo Road
Queen Creek Road
Germann Rd.
Pecos Rd.

EXHIBIT 11

PROJECT DESCRIPTION:
SOUTH AREA
ALTERNATIVE S-2

CONSULTANT:
DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

South Area, Outfall Alternatives

CHANNEL CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	Downstream Elevation	Upstream Elevation	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's 'n' Value	Bottom Width (ft.)	Depth of Flow (ft.)	Sideslope (H:1)	Area of Flow (sf)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)
OUTFALL ALTERNATIVE SO-3A																		
SHH-1	1448	1448	-	-	2400	0.00240	E	0.0400	50	4.6	6	354.9	105.7	0.34	Sub	4.1	1.2	5.8
SHH-2	1448	1448	-	-	8000	0.00240	E	0.0400	50	4.6	6	354.9	105.7	0.34	Sub	4.1	1.2	5.8
SHH-3	1448	1448	-	-	5200	0.00240	E	0.0400	50	4.6	6	354.9	105.7	0.34	Sub	4.1	1.2	5.8
SAA-1	2170	2170	-	-	13728	0.00050	E	0.0400	100	6.4	6	892.7	178.3	0.17	Sub	2.4	1.6	8.1

I.D.	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost	Riprap Volume (cy)	Unit Cost ($/cy)	Riprap Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost
SHH-1	59038	$11	$618,398	0	$310	$0	4800	$12	$57,600				251,375	$2.20	$553,025
SHH-2	186787	$11	$2,054,659	0	$310	$0	16000	$12	$192,000				837,917	$2.20	$1,843,418
SHH-3	121412	$11	$1,335,528	0	$310	$0	10400	$12	$124,800				544,646	$2.20	$1,198,221
SAA-1	720764	$11	$7,928,290	0	$310	$0	27456	$12	$329,472				2,312,229	$2.20	$5,086,905

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land & Landscape Costs
SHH-1	7.7	Res.	$0.60	$200,850	$1,227,029	$553,025	$1,980,898
SHH-2	25.6	Res.	$0.60	$669,501	$4,090,076	$1,843,418	$6,602,995
SHH-3	16.7	Res.	$0.60	$436,175	$2,668,550	$1,198,221	$4,291,947
SAA-1	68.3	Res.	$0.60	$1,786,259	$12,344,688	$5,086,905	$20,217,850
TOTALS	118.3	Ac.		$3,091,785	$21,320,315	$8,681,569	$33,093,670
CONTINGENCIES AT 30%							$9,928,101
GRAND TOTAL							$43,021,771

CHANNEL CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	Downstream Elevation	Upstream Elevation	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's 'n' Value	Bottom Width (ft.)	Depth of Flow (ft.)	Sideslope (H:1)	Area of Flow (sf)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)
OUTFALL ALTERNATIVE SO-3																		
SAA-1	1175	1175	1232.0	1252.0	13728	0.00146	E	0.0400	60	4.4	6	378.4	113.3	0.3	Sub	3.1	1.1	5.5
SAA-2	1062	1062	-	-	3000	0.00080	E	0.0400	70	4.5	6	437.9	134.9	0.29	Sub	2.4	1.2	5.7
SGR-1	1354	1354	1210.0	1215.0	13728	0.00088	E	0.0250	70	4.5	6	440.3	135.1	0.3	Sub	3.1	1.2	5.7
SGR-2	1448	1448	1252.0	1252.0	5290	0.00060	E	0.0400	100	5.2	6	675.1	162.7	0.17	Sub	2.1	1.3	6.5

I.D.	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost	Riprap Volume (cy)	Unit Cost ($/cy)	Riprap Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost
SAA-1	395576	$11	$3,891,334	0	$310	$0	27456	$12	$329,472				1,562,747	$2.20	$3,416,044
SAA-2	82976	$11	$912,733	0	$310	$0	6000	$12	$72,000				371,914	$2.20	$818,212
SGR-1	382632	$11	$4,208,947	0	$310	$0	27456	$12	$329,472				1,705,025	$2.20	$3,751,055
SGR-2	214217	$11	$2,356,386	0	$310	$0	10560	$12	$126,720				838,346	$2.20	$1,844,360

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land & Landscape Costs
SAA-1	45.8	Res.	$0.60	$1,191,193	$7,436,850	$3,416,044	$12,044,840
SAA-2	10.8	Res.	$0.60	$281,049	$1,802,946	$818,212	$2,902,200
SGR-1	49.3	Res.	$0.60	$1,287,976	$8,289,474	$3,751,055	$13,328,594
SGR-2	23.5	Res.	$0.60	$614,169	$4,327,466	$1,844,360	$6,786,015

CULVERT CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	R/W width (ft.)	Skew Angle (degrees)	Length (ft.)	Slope (ft./ft.)	Material/Barrel Type	Manning's 'n' Value	Number of Barrels	Culvert Diameter/ Height	Width	Barrel/Material	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
OUTFALL ALTERNATIVE SO-3																
SGR-C1	1448	1448	110	90	110	0.00050	C	0.012	3	8	10	RCBC	4.4	8.78	1.10	IC
SGR-C2	1296	1296	110	90	110	0.00050	C	0.012	3	8	10	RCBC	5.0	8.28	1.04	IC
SAA-C1	1062	1062	110	90	110	0.01000	C	0.012	4	4	10	RCBC	4.4	4.52	1.13	IC
SAA-C2	1175	1175	110	60	127	0.01000	C	0.012	4	4	10	RCBC	4.5	4.85	1.21	IC

I.D.	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Inlet Headwall	Unit Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (Ea.)	Outlet Headwall Cost
SGR-C1	110	$1,500	$165,000	1	$8,900	$8,900	1	$11,700	$11,700
SGR-C2	110	$1,500	$165,000	1	$8,900	$8,900	1	$11,700	$11,700
SAA-C1	110	$1,800	$198,000	1	$5,600	$5,600	1	$11,100	$11,100
SAA-C2	127	$1,800	$228,631	1	$5,600	$5,600	1	$11,100	$11,100

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land & Landscape Costs
SGR-C1	0.0	N/A	$0.00	$0	$185,600	$0	$185,600
SGR-C2	0.0	N/A	$0.00	$0	$185,600	$0	$185,600
SAA-C1	0.0	N/A	$0.00	$0	$214,700	$0	$214,700
SAA-C2	0.0	N/A	$0.00	$0	$245,331	$0	$245,331
TOTALS	129.1	Ac.		$3,374,388	$22,683,965	$9,829,670	$35,887,998
CONTINGENCIES AT 30%							$10,766,389
GRAND TOTAL							$46,654,385

DETENTION BASIN QUANTITIES AND COSTS

I.D.	Q In (cfs)	Q Out (cfs)	Length (ft.)	Material Type	Manning's 'n' Value	Outlet Pipe Diameter (ft.)	Volume (Ac-ft)
OUTFALL ALTERNATIVE SO-1							
GRB	1424	0	-	-	-	-	546
CCB	1070	0	-	-	-	-	460

I.D.	Detention Basin Excavation (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Emergency Spillway Length (ft.)	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Dumped Riprap (cy)	Unit Cost ($/cy)	Riprap Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost
GRB	464,640	$6	$2,787,840	1359080	$2.20	$2,989,977	0	$1,100	$0	201	60	$310.00	$18,460	74	$35.00	$2,605.53	7,800	$12.00	$93,600
CCB	742,133	$6	$4,452,798	2151877	$2.20	$4,734,130	0	$1,100	$0	150	44	$310.00	$13,776	56	$35.00	$1,944.43	6,721	$12.00	$80,652

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land & Landscape Costs
GRB	31.2	Res.	$0.99	$1,345,461	$5,892,463	$2,989,977	$10,227,941
CCB	49.4	Res.	$0.99	$2,130,346	$9,283,301	$4,734,130	$16,147,776
TOTALS	80.6	Ac.		$3,475,827	$15,175,783	$7,724,107	$26,375,717
CONTINGENCIES AT 30%							$7,912,715
GRAND TOTAL							$34,288,432

UNDERGROUND PIPE QUANTITIES AND COSTS

I.D.	Q In (cfs)	Velocity (ft/s)	System Length (ft.)	Number of Pipes	Pipe Size (in)	Length of Pipe (ft.)	Unit Cost ($/ft.)	Pipe Cost	Pump Cost
OUTFALL ALTERNATIVE SO-2									
SCC-P1	402	10	26400	2	60	52800	$150	$7,920,000	$1,000,000
OUTFALL ALTERNATIVE SO-4									
SRR-P1	595	10	15840	3	60	47520	$150	$7,128,000	$1,500,000

I.D.	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land & Landscape Costs
SCC-P1	0	Res.	$0.99	$0	$8,920,000	$0	$8,920,000
SRR-P1	0	Res.	$0.99	$0	$8,628,000	$0	$8,628,000

DETENTION BASIN QUANTITIES AND COSTS

I.D.	Q In (cfs)	Q Out (cfs)	Length (ft.)	Material Type	Manning's 'n' Value	Outlet Pipe Diameter (ft.)	Volume (Ac-ft)
OUTFALL ALTERNATIVE SO-2							
CCB	1070	402	-	-	-	-	98

I.D.	Detention Basin Excavation (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Emergency Spillway Length (ft)	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Dumped Riprap (cy)	Unit Cost ($/cy)	Riprap Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost
CCB	141,973	$6	$851,838	461739	$2.20	$1,015,825	0	$1,100	$0	150	44	$310.00	13,776	56	$35.00	$1,944.43	$2,628	$12.00	$31,540

I.D.	Required Land Acquisition (Ac)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land & Landscape Costs
CCB	10.6	Res.	$0.99	$457,119	$1,914,932	$1,015,825	$3,387,876
TOTALS	10.6	Ac.		$457,119	$19,462,932	$1,015,825	$20,935,876
CONTINGENCIES AT 30%							$5,838,880
GRAND TOTAL							$26,774,756

* NOTE: Slopes Obtained Directly From HEC-1 Output
30% Contingency is applied to the Total Construction Cost Only

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT # 98-13"

0' 1000' 2000' 4000' 6000' 8000'
feet

LEGEND

- SEC-1 NEW CHANNEL REACH
- NEW CULVERT
- EXIST DETENTION BASIN
- NEW DETENTION BASIN
- NEW UNDERGROUND PIPE

SAA-C1
SAA-2
SAA-C2
SAA-1
CCB
SHH-1
SHH-2
SHH-3
SGR-2
SGR-C2
SGR-C1
SGR-1
GRB
SCC-P1
SRR-P1

SO-1
SO-2
SO-3
SO-3A
SO-4

SPRR
Consolidated Canal
McQueen
Cooper Rd
Gilbert Rd
Santan Freeway
Prop.
Lindsay Rd
Eastern Canal
Val Vista Dr
Eastern Canal
MARICOPA FLOODWAY
EAST
SPRR
Hunt Highway
Riggs Road
Chandler Heights
Ocotillo Road
Queen Creek Road
Germann Rd.
Pecos Rd.

N

EXHIBIT 12

PROJECT DESCRIPTION:
SOUTH AREA
OUTFALL ALTERNATIVES

CONSULTANT:
DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

Middle Area, Recommended Plan

CHANNEL CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	Downstream Elevation	Upstream Elevation	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's "n" Value	Bottom Width (ft.)	Depth of Flow (ft.)	Sideslope (h:1)	Area of Flow (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (ft.)	Unit Cost ($/ft)	Fence Cost	Riprap Volume (cy)	Unit Cost ($/cy)	Riprap Cost	Landscape Restration (sf)	Unit Cost ($/sf)	Landscape Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land and Landscape Costs
MEC-1	2242	2242	*	*	4100	0.00057	m	0.0400	100	5.8	6	753.7	168.5	0.22	Sub	3.0	1.4	7.1	184426	$11	$2,028,691	0	$310	$0	8200	$12	$98,400	0	$35	$0	668,071	$2.20	$1,465,356	19.3	Res.	$0.60	$504,085	$2,127,091	$1,465,356	$4,094,531
MEC-2	1133	1133	*	*	5684	0.00057	m	0.0400	75	4.4	6	449.5	128.8	0.21	Sub	2.5	1.1	5.6	160805	$11	$1,768,855	0	$310	$0	11368	$12	$136,416	0	$35	$0	729,508	$2.20	$1,604,918	21.1	Res.	$0.60	$551,422	$1,905,271	$1,604,918	$4,061,611
MEC-3	892	892	*	*	5400	0.00037	m	0.0400	90	4.5	6	527.4	144.8	0.14	Sub	1.7	1.1	5.6	109974	$11	$1,209,171	0	$310	$0	10800	$12	$129,600	0	$35	$0	776,853	$2.20	$1,709,077	22.0	Res.	$0.60	$575,624	$2,098,771	$1,709,077	$4,383,472
MEC-4	484	484	*	*	5412	0.00043	m	0.0400	45	4.2	6	296.9	96.3	0.14	Sub	1.6	1.1	5.3	105974	$11	$1,176,711	0	$310	$0	10824	$12	$129,888	0	$35	$0	529,412	$2.20	$1,151,506	16.0	Res.	$0.60	$417,626	$1,306,599	$1,151,506	$2,875,132
MST-1	499	499	*	*	2400	0.00050	m	0.0400	35	4.5	6	287.2	90.0	0.15	Sub	1.5	1.1	5.7	45714	$11	$502,854	0	$310	$0	4800	$12	$57,600	0	$35	$0	213,614	$2.20	$469,952	6.8	Res.	$0.60	$177,137	$560,454	$469,952	$1,207,543
MST-2	499	499	*	*	8600	0.00050	m	0.0400	35	4.5	6	281.2	90.0	0.15	Sub	1.8	1.1	5.7	167615	$11	$1,843,799	0	$310	$0	17200	$12	$211,200	0	$35	$0	783,253	$2.20	$1,722,156	24.9	Res.	$0.60	$649,593	$2,054,999	$1,722,156	$4,427,659

CULVERT CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	RW width (ft.)	Skew Angle (degrees)	Length (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Diameter / Height	Width	Barrel Material	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Inlet Headwall	Unit Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (Ea.)	Outlet Headwall Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land and Landscape Costs
MEC-C1	255	255	110	90	110	0.01000	C	0.012	1	6	6	RCBC	5.8	6.16	1.03	IC	110	$900	$99,000	1	$5,700	$5,700	1	$9,800	$9,800	0.0	N/A	$0.00	$0	$81,200	$0	$81,200
MEC-C2	1133	1133	110	30	220	0.01600	C	0.012	4	6	6	RCBC	5.8	5.43	0.90	IC	220	$1,500	$330,000	1	$5,600	$5,600	1	$8,800	$8,800	0.0	N/A	$0.00	$0	$344,700	$0	$344,700
MEC-C3	892	892	110	60	127	0.01000	C	0.012	3	4	10	RCBC	4.4	4.88	1.22	IC	127	$1,400	$177,824	1	$4,600	$4,600	1	$8,800	$8,800	0.0	N/A	$0.00	$0	$191,224	$0	$191,224
MEC-C4	484	484	110	60	110	0.01000	C	0.012	2	4	6	RCBC	4.5	5.40	1.35	IC	110	$800	$88,000	1	$3,000	$3,000	1	$7,000	$7,000	0.0	N/A	$0.00	$0	$98,000	$0	$98,000
MEC-C5	130	130	110	90	110	0.01000	C	0.012	1	4	6	RCBC	4.2	3.93	0.98	IC	110	$800	$88,000	1	$3,200	$3,200	1	$5,700	$5,700	0.0	N/A	$0.00	$0	$96,900	$0	$96,900
MST-C1	499	499	110	90	110	0.01000	C	0.012	2	4	8	RCBC	4.5	5.54	1.39	IC	110	$800	$88,000	1	$3,900	$3,900	1	$7,000	$7,000	0.0	N/A	$0.00	$0	$98,900		$98,900
MST-C2	499	499	110	70	117	0.01000	C	0.012	2	4	8	RCBC	4.5	5.54	1.39	IC	117	$800	$93,648	1	$3,900	$3,900	1	$7,000	$7,000	0.0	N/A	$0.00	$0	$104,548		$104,548

DETENTION BASIN QUANTITIES AND COSTS

I.D.	Qin (cfs)	Q Out (cfs)	Length (ft.)	Material Type	Manning's "n" Value	Outlet Pipe Diameter (ft.)	Volume (Ac-ft)	Detention Basin Excavation (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Emergency Spillway Length (ft.)	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Dumped Riprap (cy)	Unit Cost ($/cy)	Riprap Cost	Fence Length (ft.)	Unit Cost ($/ft)	Fence Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land and Landscape Costs
CRPB	2369	255	0	-	-	4	548	129,005	$6	$774,395	290400	$2.20	$638,880	0	$1,100	$0	350	311	$310.00	$96,410	389	$35.00	$13,615.00	0	$12.00	$0	6	Res.	$0.59	$258,746	$894,421	$638,880	$1,792,047
BSNG	1198	165	0	-	-	4	142.2	319,047	$6	$1,914,282	1298619	$2.20	$2,854,593	0	$1,100	$0	170	151	$310.00	$46,870	189	$35.00	$6,615.00	5,710	$12.00	$68,520	27.7	Res.	$0.59	$1,194,546	$2,938,227	$2,854,593	$5,985,336

STORM DRAIN QUANTITIES AND COSTS

I.D.	Q100 (cfs)	Q full (cfs)	Downstream Elevation	Upstream Elevation	Conveyance, K	V full	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's "n" Value	Number of Pipes/Boxes	Pipe or Box	Pipe Diameter (in.)	Box Height (ft)	Box Width (ft)	Length of Pipe (ft.)	Unit Cost ($/ft.)	Pipe/Box Cost	Headwall	Unit Cost (Ea.)	Headwall Unit Cost	Headwall Cost	Manhole	Unit Cost (Ea.)	Manhole Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land and Landscape Costs
MST-P1							22500		C	0.0120	1	Pipe	48			30000	$120	$3,600,000	2	$1,100	$2,200	$2,420,000	45	$3,000	$135,000					$6,155,000	$0	$6,155,000

TOTALS	**147.0**	**Ac.**	**$4,328,290**	**$20,105,505**	**$11,417,408**	**$35,851,202**
CONTINGENCIES AT 30%						**$5,031,651**
GRAND TOTAL						**$41,882,854**

* NOTE: Slopes Obtained Directly From HEC-1 Output
30% Contingency is applied to the Total Construction Cost Only

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

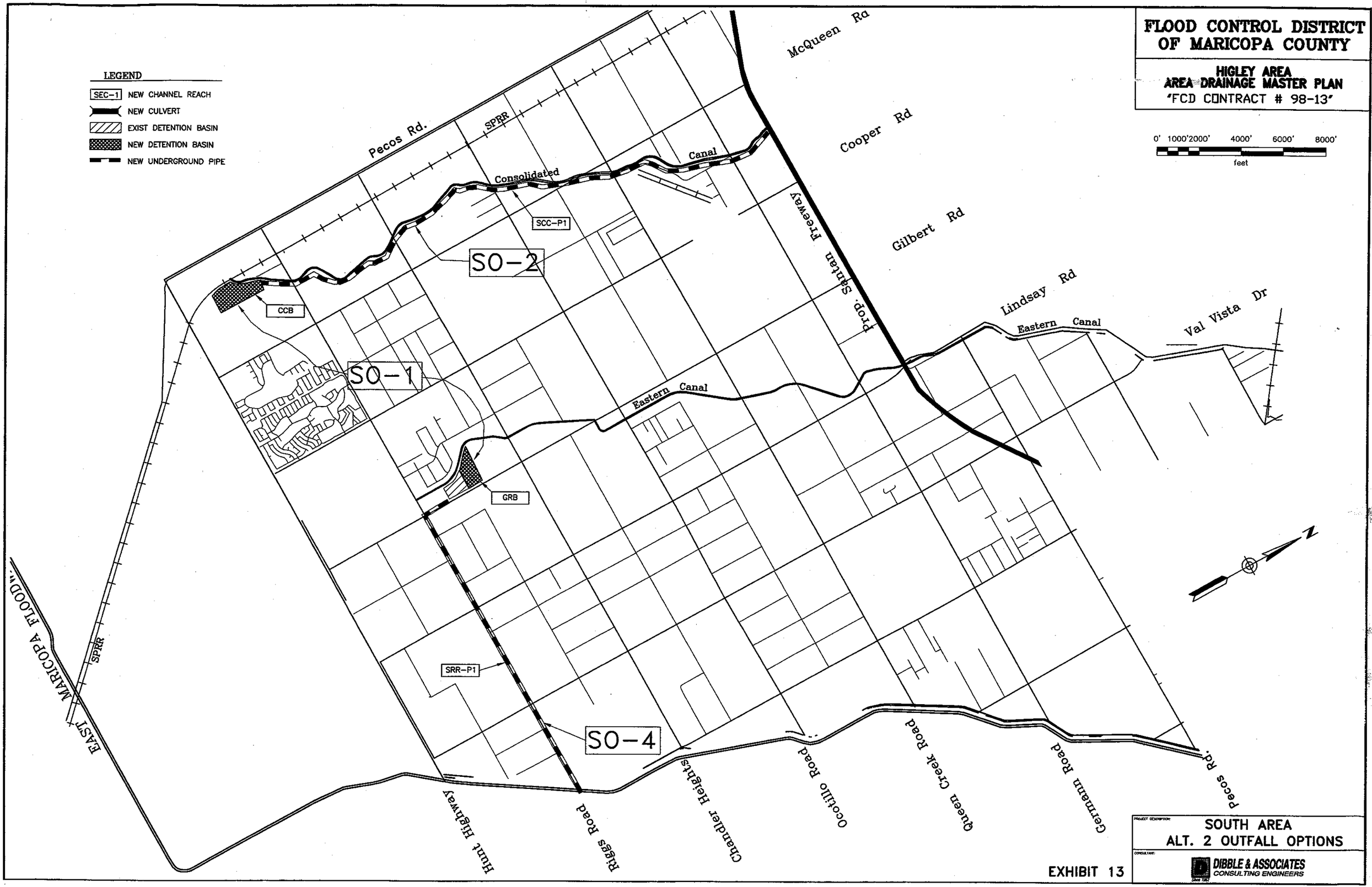
HIGLEY AREA AREA DRAINAGE MASTER PLAN

"FCD CONTRACT # 98-13"

LEGEND

- SEC-1 NEW CHANNEL REACH
- NEW CULVERT
- EXIST DETENTION BASIN
- NEW DETENTION BASIN
- NEW UNDERGROUND PIPE

0' 1000'2000' 4000' 6000' 8000'
feet



PROJECT DESCRIPTION:

SOUTH AREA ALT. 2 OUTFALL OPTIONS

CONSULTANT:

DIBBLE & ASSOCIATES CONSULTING ENGINEERS

EXHIBIT 13

North Area, Recommended Plan

			PROPERTY COSTS																				
HOUSES IN FLOODPLAIN	AVERAGE COST PER HOUSE ($)	PROPERETY COST ($)	DEMOLITION UNIT COST ($/house)	DEMOLITION COST ($)	AVERAGE LOT SIZE (sf)	LANDSCAPE UNIT COST ($/sf)	LANDSCAPE COST														Total Landscape Cost	Total Costs
7	$120,000	$840,000	$50,000	$350,000	6000	$1.50	$63,000														$63,000	$1,253,000
12	$140,000	$1,680,000	$50,000	$600,000	8000	$1.50	$144,000														$144,000	$2,424,000
19																						

TOTALS	**$207,000**	**$3,677,000**
CONTINGENCIES AT 30%		**$1,103,100**
GRAND TOTAL		**$4,780,100**

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT # 98-13"

LEGEND

- Building
- Building in Floodplain
- Floodplain Boundry

7 Homes in Floodplain

12 Homes in Floodplain

0' 600' 1200' 2400' 3600' 4800'

FEET

NORTH AREA
RECOMMENDED PLAN

EXHIBIT 14

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

Middle Area, Recommended Plan

CHANNEL CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	Downstream Elevation	Upstream Elevation	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's "n" Value	Bottom Width (ft.)	Depth of Flow (ft.)	Sideslope (z:1)	Area of Flow (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (ft.)	Unit Cost ($/ft)	Fence Cost	Riprap Volume (cy)	Unit Cost ($/cy)	Riprap Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Revised Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land and Landscape Costs
MEC-1	2242	2242	*	*	4100	0.00087	m	0.0400	100	5.6	6	753.7	168.5	0.22	Sub	3.0	1.4	7.1	164429	$11	$2,028,691	0	$310	$0	8200	$12	$98,400	0	$35	$0	668,671	$2.20	$1,465,358	19.3	Res.	$0.89	$694,085	$2,127,091	$1,465,358	$4,886,531
MEC-2	1133	1133	*	*	5084	0.00087	m	0.0400	75	4.4	6	449.5	128.8	0.21	Sub	2.5	1.1	5.5	168805	$11	$1,768,855	0	$310	$0	11366	$12	$136,416	0	$35	$0	729,068	$2.20	$1,604,898	21.1	Res.	$0.89	$551,422	$1,905,271	$1,604,918	$4,061,611
MEC-3	882	882	*	*	5460	0.00092	m	0.0400	50	4.5	6	327.4	144.6	0.14	Sub	1.7	1.1	5.6	175279	$11	$1,829,171	0	$310	$0	10800	$12	$129,600	0	$35	$0	776,853	$2.20	$1,709,077	22.8	Res.	$0.89	$575,624	$2,058,771	$1,709,077	$4,343,572
MEC-4	484	484	*	*	5412	0.00043	m	0.0400	45	4.2	6	296.8	98.3	0.14	Sub	1.6	1.1	5.3	108974	$11	$1,176,711	0	$310	$0	10824	$12	$129,888	0	$35	$0	523,412	$2.20	$1,151,506	16.0	Res.	$0.89	$417,885	$1,306,599	$1,151,506	$2,875,122
MST-1	499	499	*	*	3400	0.00058	m	0.0400	35	4.5	6	281.2	90.0	0.15	Sub	1.8	1.1	5.7	45714	$11	$502,854	0	$310	$0	4600	$12	$57,500	0	$35	$0	213,014	$2.20	$468,952	6.8	Res.	$0.89	$177,137	$560,454	$468,952	$1,207,543
MST-2	499	499	*	*	8800	0.00050	m	0.0400	35	4.5	6	281.2	90.0	0.15	Sub	1.8	1.1	5.7	167648	$11	$1,843,799	0	$310	$0	17600	$12	$211,200	0	$35	$0	783,253	$2.20	$1,723,156	24.9	Res.	$0.89	$648,509	$2,054,899	$1,723,156	$4,427,659

CULVERT CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	R/W width (ft.)	Skew Angle (degrees)	Length (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Diameter/ Height	Width	Barrel Material	Tailwater Depth (ft.)	Computed Headwater	Computed HWD	Control	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Inlet Headwall	Unit Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (Ea.)	Outlet Headwall Cost	Revised Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land and Landscape Costs
MEC-C1	255	255	110	60	110	0.01000	C	0.012	1	6	6	RCBC	5.8	6.16	1.69	IC	110	$880	$96,800	1	$5,700	$5,700	1	$9,500	$9,500	0.0	N/A	$0.00	$0	$81,200	$0	$81,200
MEC-C2	1133	1133	110	30	220	0.01000	C	0.012	4	6	6	RCBC	5.8	5.43	0.90	IC	220	$1,500	$330,000	1	$5,808	$5,808	1	$8,809	$8,809	0.0	N/A	$0.00	$0	$344,760	$0	$344,760
MEC-C3	882	882	110	60	127	0.01000	C	0.012	3	4	10	RCBC	4.4	4.89	1.22	IC	127	$1,400	$177,824	1	$4,600	$4,600	1	$8,800	$8,800	0.0	N/A	$0.00	$0	$191,524	$0	$191,524
MEC-C4	484	484	110	90	110	0.01000	C	0.012	2	4	8	RCBC	4.6	5.49	1.35	IC	110	$800	$88,000	1	$3,600	$3,600	1	$7,000	$7,000	0.0	N/A	$0.00	$0	$98,600	$0	$98,600
MEC-C5	130	130	110	90	110	0.01000	C	0.012	1	4	6	RCBC	4.2	3.83	0.86	IC	110	$800	$88,000	1	$3,200	$3,200	1	$5,700	$5,700	0.0	N/A	$0.00	$0	$96,900	$0	$96,900
MST-C1	499	499	110	90	110	0.01000	C	0.012	2	4	8	RCBC	4.5	5.54	1.39	IC	110	$800	$88,000	1	$3,600	$3,600	1	$7,000	$7,000	0.0	N/A	$0.00	$0	$98,600	$0	$98,600
MST-C2	499	499	110	70	117	0.01000	C	0.012	2	4	8	RCBC	4.5	5.54	1.39	IC	117	$800	$93,648	1	$3,600	$3,600	1	$7,000	$7,000	0.0	N/A	$0.00	$0	$104,548	$0	$104,548

DETENTION BASIN QUANTITIES AND COSTS

I.D.	Q hh (cfs)	Q Out (cfs)	Length (ft.)	Material Type	Manning's "n" Value	Outlet Pipe Diameter (ft.)	Volume (Ac-ft)	Detention Basin Excavation (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Emergency Spillway Length (ft.)	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Dumped Riprap (cy)	Unit Cost ($/cy)	Riprap Cost	Fence Length (ft.)	Unit Cost ($/ft)	Fence Cost	Revised Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land and Landscape Costs
CRPB	2260	255	0	-	-	-	548	$29,055	$5	$274,366	230400	$2.20	$638,880	0	$1,100	$0	350	311	$310.00	$96,410	289	$35.00	$13,615.00	0	$12.00	$0	6	Res.	$0.89	$258,746	$994,421	$638,880	$1,782,047
BSNO	1196	195	0	-	-	4	142.2	318,047	$6	$1,914,282	1298819	$2.20	$2,854,583	0	$1,100	$0	170	151	$310.00	$46,810	169	$35.00	$6,615.00	5,710	$12.00	$68,520	27.7	Res.	$0.89	$1,194,546	$2,838,227	$2,854,583	$6,885,336

STORM DRAIN QUANTITIES AND COSTS

I.D.	Q100 (cfs)	Q full (cfs)	Downstream Elevation	Upstream Elevation	Conveyance, K	V full	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's "n" Value	Number of Pipes/Boxes	Pipe or Box	Pipe Diameter (in.)	Box Height (ft)	Box Width (ft)	Length of Pipe (ft.)	Unit Cost ($/ft.)	Pipe/Box Cost	Headwall	Unit Cost (Ea.)	Headwall Unit Cost	Headwall Cost	Manhole	Unit Cost (Ea.)	Manhole Cost	Revised Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land and Landscape Costs
MST-P1							22500		C	0.0120	1	Pipe	48			20000	$120	$3,000,000	2	$1,100	$2,200	$2,420,000	45	$3,000	$135,000					$6,155,000	$0	$6,155,000

TOTALS	**147.0**	**Ac.**	**$4,328,290**	**$20,105,505**	**$11,617,408**	**$35,851,202**
CONTINGENCIES AT 30%					**$5,031,651**
GRAND TOTAL					**$41,882,854**

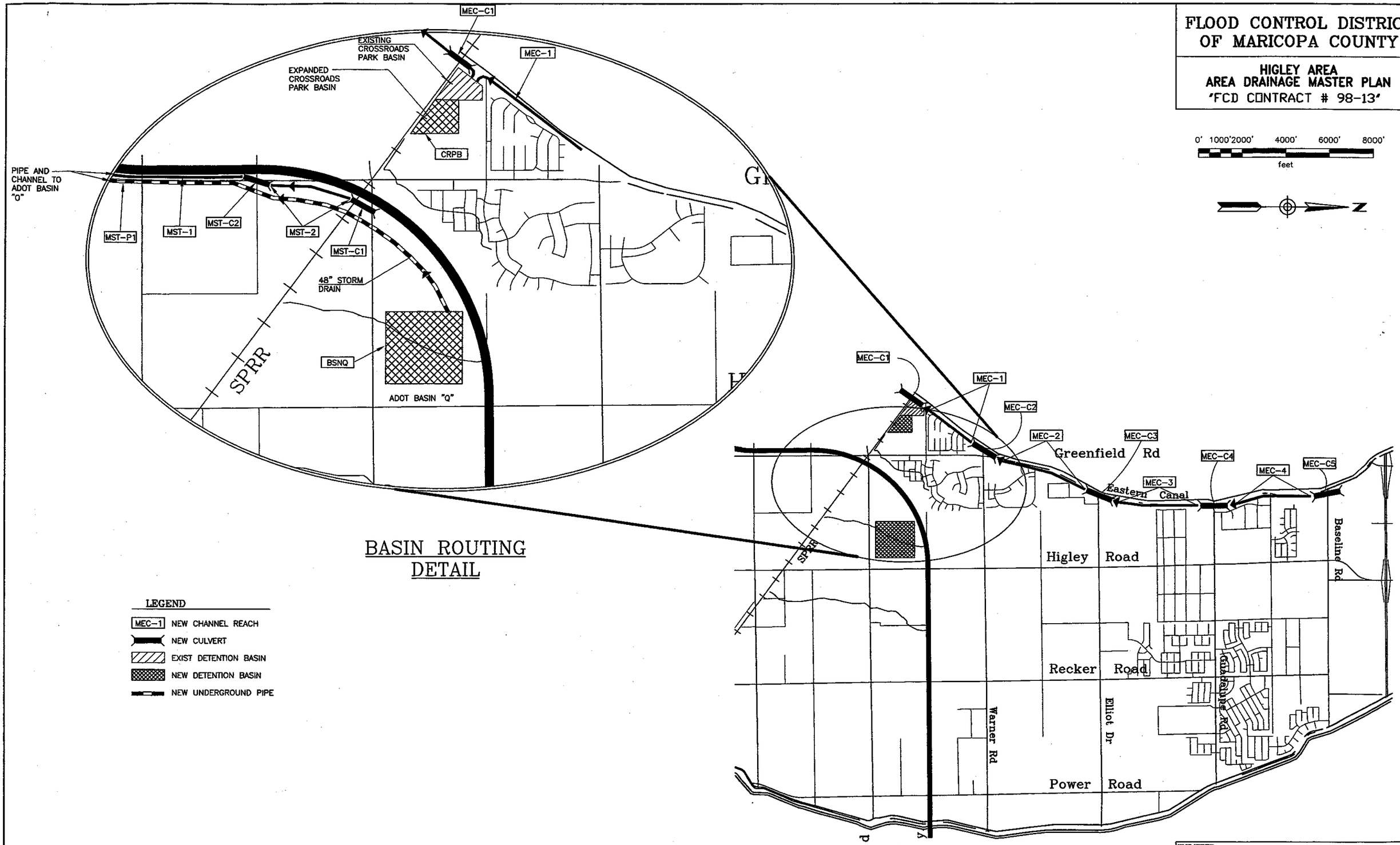
* NOTE: Slopes Obtained Directly From HEC-1 Output
30% Contingency is applied to the Total Construction Cost Only

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT # 98-13"

0' 1000'2000' 4000' 6000' 8000'
feet

N



BASIN ROUTING DETAIL

LEGEND

- MEC-1 NEW CHANNEL REACH
- NEW CULVERT
- EXIST DETENTION BASIN
- NEW DETENTION BASIN
- NEW UNDERGROUND PIPE

PROJECT DESCRIPTION: **MIDDLE AREA RECOMMENDED PLAN**

CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS

EXHIBIT 15

South Area, Recommended Plan

CHANNEL CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	Downstream Elevation	Upstream Elevation	Length (ft)	Slope (ft./ft.)	Material Type	Manning's 'n' Value	Bottom Width (ft.)	Depth of Flow (ft.)	Freeboard (ft.)	Area of Flow (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (ft.)	Unit Cost ($/ft)	Fence Cost	Riprap Volume (cy)	Unit Cost ($/cy)	Riprap Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land & Landscape Costs
SST-1	57	57	*	*	8000	0.00050	E	0.0400	4	2.2	6	53.5	36.4	0.12	Sub	1.1	1.0	3.7	47813	$11	$525,945	0	$310	$0	16000	$12	$192,000	0	$25	$0	357,899	$2.20	$808,375	12.5	Res.	$0.60	$326,577	$1,527,321	$808,375	$2,662,272
SST-2	667	667	*	*	10800	0.00050	E	0.0400	20	4.6	6	357.2	106.6	0.15	Sub	1.9	1.2	5.8	239317	$11	$2,760,690	0	$310	$0	21600	$12	$259,200	0	$25	$0	1,129,664	$2.20	$2,485,260	34.5	Res.	$0.60	$901,886	$5,564,558	$2,485,260	$8,951,887
SST-3	885	885	*	*	7000	0.00050	E	0.0400	75	4.5	6	458.9	139.7	0.16	Sub	1.9	1.1	5.6	201381	$11	$2,214,316	0	$310	$0	14000	$12	$168,000	0	$25	$0	901,915	$2.20	$1,984,000	26.1	Res.	$0.60	$683,182	$4,398,316	$1,984,000	$7,033,498
SEC-2	1404	1404	*	*	5700	0.00050	E	0.0400	100	5.1	6	667.4	162.1	0.17	Sub	2.1	1.3	6.4	271279	$11	$2,543,974	0	$310	$0	11520	$12	$138,240	0	$25	$0	912,457	$2.20	$2,007,403	23.6	Res.	$0.60	$668,051	$4,689,707	$2,007,403	$7,365,161
SEC-3	1301	1301	*	*	6200	0.00050	E	0.0400	80	4.2	6	503.8	142.8	0.22	Sub	2.5	1.1	5.5	193866	$11	$2,132,969	0	$310	$0	12400	$12	$148,800	0	$25	$0	884,821	$2.20	$1,946,606	24.5	Res.	$0.60	$647,823	$4,228,376	$1,946,606	$6,822,804
SEC-4	1128	1128	*	*	6100	0.00050	E	0.0400	100	4.5	6	569.3	154.8	0.16	Sub	2.0	1.1	5.6	212270	$11	$2,334,975	0	$310	$0	12200	$12	$146,400	0	$25	$0	937,792	$2.20	$2,063,142	25.0	Res.	$0.60	$693,145	$4,544,517	$2,063,142	$7,297,805
SEC-5	815	815	*	*	2715	0.00070	E	0.0400	60	4.3	6	373.3	112.8	0.18	Sub	2.2	1.1	5.4	65316	$11	$718,467	0	$310	$0	5430	$12	$65,160	0	$25	$0	395,889	$2.20	$872,092	9.0	Res.	$0.60	$234,682	$1,466,216	$872,092	$2,564,194
SEC-6	406	406	*	*	3375	0.00050	E	0.0400	20	4.2	6	189.4	71.0	0.18	Sub	2.1	1.1	5.3	46765	$11	$514,418	0	$310	$0	6750	$12	$81,000	0	$25	$0	241,923	$2.20	$581,269	7.8	Res.	$0.60	$215,480	$2,044,822	$581,269	$2,841,570
SEC-7	972	972	*	*	3000	0.00050	E	0.0400	50	4.3	6	504.6	142.9	0.16	Sub	1.9	1.1	5.4	65244	$11	$1,031,188	0	$310	$0	6000	$12	$72,000	0	$25	$0	428,081	$2.20	$941,734	12.0	Res.	$0.60	$380,491	$4,343,213	$1,854,088	$6,577,792
SEC-8	972	972	*	*	6225	0.00050	E	0.0400	60	4.3	6	504.6	142.9	0.16	Sub	1.9	1.1	5.4	134520	$11	$2,128,715	0	$310	$0	12450	$12	$149,400	0	$25	$0	884,811	$2.20	$1,946,143	24.9	Res.	$0.60	$787,584	$1,210,022	$1,946,143	$3,977,688
SEC-9	621	621	*	*	2800	0.00050	E	0.0400	35	4.4	6	286.3	88.0	0.20	Sub	2.2	1.1	5.5	52753	$11	$580,279	0	$310	$0	5600	$12	$67,200	0	$25	$0	254,811	$2.20	$608,143	7.9	Res.	$0.60	$287,584	$1,210,022	$781,184	$2,278,196
SEC-10	621	621	*	*	4600	0.00050	E	0.0400	35	4.5	6	277.9	86.6	0.19	Sub	2.2	1.1	5.6	79921	$11	$879,732	0	$310	$0	8855	$12	$66,000	0	$25	$0	255,088	$2.20	$781,184	11.3	Res.	$0.60	$268,026	$1,707,825	$781,184	$2,757,035
SEC-11	256	256	*	*	2500	0.00050	E	0.0400	10	4.5	6	164.8	64.4	0.13	Sub	1.6	1.1	5.6	31629	$11	$347,925	0	$310	$0	7000	$12	$83,800	0	$25	$0	159,007	$2.20	$349,815	5.5	Res.	$0.60	$143,512	$757,640	$349,815	$1,250,966
SCC-1	1175	1175	*	*	3000	0.00080	E	0.0400	80	4.5	6	478.4	134.6	0.20	Sub	2.5	1.1	5.6	85781	$11	$987,682	0	$310	$0	6000	$12	$72,000	0	$25	$0	401,313	$2.20	$882,888	11.4	Res.	$0.60	$298,457	$1,942,481	$882,888	$3,123,826
SCC-2	1175	1175	1218.0	1222.0	3500	0.00057	E	0.0400	85	4.6	6	515.2	140.7	0.18	Sub	2.2	1.2	5.7	199845	$11	$2,100,384	0	$310	$0	11988	$12	$143,799	0	$25	$0	835,457	$2.20	$1,838,006	19.4	Res.	$0.60	$606,774	$3,178,840	$1,648,168	$5,134,781
SCC-3	732	732	*	*	5793	0.00050	E	0.0400	60	4.5	6	389.8	114.5	0.16	Sub	1.9	1.1	5.6	144925	$11	$1,580,658	0	$310	$0	11584	$12	$138,992	0	$25	$0	958,705	$2.20	$1,449,158	22.0	Res.	$0.60	$688,888	$1,719,650	$1,449,158	$3,857,696
SCC-4	294	294	1226.0	1228.0	5947	0.00050	E	0.0400	10	4.2	6	148.2	61.4	0.13	Sub	1.5	1.1	5.3	67838	$11	$747,314	0	$310	$0	11894	$12	$149,328	0	$25	$0	360,850	$2.20	$793,869	12.4	Res.	$0.60	$325,072	$1,691,911	$793,869	$2,810,852
SCC-5	1154	1154	1228.0	1228.8	6085	0.00050	E	0.0400	100	4.5	6	578.2	155.3	0.16	Sub	2.0	1.2	5.7	213988	$11	$2,355,873	0	$310	$0	12139	$12	$145,560	0	$25	$0	935,040	$2.20	$2,057,088	26.0	Res.	$0.60	$378,758	$4,856,520	$2,057,088	$7,292,367
SAA-1	1175	1175	1232.0	1252.0	13728	0.00140	E	0.0400	60	4.4	6	378.4	119.3	0.3	Sub	3.1	1.1	5.5	335576	$11	$3,691,334	0	$310	$0	27456	$12	$329,472	0	$25	$0	1,552,747	$2.20	$3,416,044	45.6	Res.	$0.60	$1,191,153	$7,439,600	$3,416,044	$12,044,846
SAA-2	1175	1175	*	*	3000	0.00080	E	0.0400	80	4.5	6	478.4	134.6	0.20	Sub	2.5	1.1	5.6	85781	$11	$987,682	0	$310	$0	6000	$12	$72,000	0	$25	$0	401,313	$2.20	$882,888	11.4	Res.	$0.60	$298,457	$1,942,481	$882,888	$3,123,826
SGR-1	1448	1448	1210.0	1215.0	13726	0.00050	E	0.0250	80	4.4	6	478.6	133.8	0.3	Sub	3.1	1.1	5.5	485415	$11	$5,459,868	0	$310	$0	27456	$12	$329,472	0	$25	$0	1,838,822	$2.20	$4,038,008	52.6	Res.	$0.60	$1,368,416	$8,817,667	$4,038,008	$14,224,510
SGR-2	1448	1448	1232.0	1252.0	8228	0.00500	E	0.0400	100	5.2	6	676.1	162.7	0.17	Sub	2.1	1.3	6.5	214217	$11	$2,358,396	0	$310	$0	10680	$12	$128,720	0	$25	$0	838,345	$2.20	$1,844,360	23.5	Res.	$0.60	$914,169	$4,327,485	$1,844,360	$6,786,815

CULVERT CAPACITIES AND COSTS

I.D.	Design Q (cfs)	Q (cfs)	(H/W width (ft.)	Skew Angle (degrees)	Length (ft.)	Slope (ft./ft.)	Material Barrel Type	Manning's 'n' Value	Number of Barrels	Culvert Diameter/ Height	Width	Barrel Material	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Inlet Headwall	Unit Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (Ea.)	Outlet Headwall Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land & Landscape Costs
SST-C1	57	57	116	90	110	0.01000	C	0.012	1	4	6	RCBC	2.7	2.82	0.55	IC	110	$300	$33,000	1	$3,200	$3,200	1	$5,700	$5,700	0.0	MIX	$0.00	$0	$41,900	$0	$41,900
SST-C2	57	57	116	90	110	0.01000	C	0.012	1	4	5	RCBC	2.7	2.82	0.55	IC	110	$300	$33,000	1	$3,200	$3,200	1	$5,700	$5,700	0.0	MIX	$0.00	$0	$41,900	$0	$41,900
SST-C3	667	667	116	90	110	0.01600	C	0.012	3	6	6	RCBC	4.6	4.59	0.77	IC	110	$1,200	$132,000	1	$8,200	$8,200	1	$13,800	$13,800	0.0	MIX	$0.00	$0	$154,100	$0	$154,100
SST-C4	667	667	116	90	110	0.01600	C	0.012	3	6	6	RCBC	4.6	4.59	0.77	IC	110	$1,200	$132,000	1	$8,200	$8,200	1	$13,800	$13,800	0.0	MIX	$0.00	$0	$154,100	$0	$154,100
SST-C5	885	885	116	45	155	0.01600	C	0.012	4	4	6	RCBC	4.5	4.45	1.16	IC	155	$1,400	$217,700	1	$4,800	$4,800	1	$7,700	$7,700	0.0	MIX	$0.00	$0	$231,400	$0	$231,400
SST-C6	489	489	116	45	155	0.01600	C	0.012	2	4	6	RCBC	4.5	5.54	1.39	IC	155	$908	$124,451	1	$3,800	$3,800	1	$7,700	$7,700	0.0	MIX	$0.00	$0	$136,851	$0	$136,851
SEC-C3	1301	1301	116	90	110	0.01600	C	0.012	4	4	10	RCBC	5.1	5.35	1.44	IC	110	$1,800	$198,000	1	$5,600	$5,600	1	$11,100	$11,100	0.0	MIX	$0.00	$0	$214,700	$0	$214,700
SEC-C4	1301	1301	116	90	144	0.01600	C	0.012	4	4	10	RCBC	4.5	5.35	1.44	IC	144	$1,800	$258,671	1	$5,600	$5,600	1	$11,100	$11,100	0.0	MIX	$0.00	$0	$275,171	$0	$275,171
SEC-C5	1128	1128	116	90	110	0.01600	C	0.012	4	4	10	RCBC	4.5	4.71	1.16	IC	110	$1,800	$198,000	1	$4,800	$4,800	1	$8,800	$8,800	0.0	MIX	$0.00	$0	$211,600	$0	$211,600
SEC-C6	815	815	116	90	127	0.01600	C	0.012	3	4	10	RCBC	4.5	4.59	1.15	IC	127	$1,400	$177,824	1	$4,800	$4,800	1	$8,800	$8,800	0.0	MIX	$0.00	$0	$191,594	$0	$191,594
SEC-C7	972	972	116	90	110	0.01600	C	0.012	3	4	8	RCBC	4.6	7.15	1.79	IC	110	$1,400	$154,000	1	$4,800	$4,800	1	$8,800	$8,800	0.0	MIX	$0.00	$0	$167,600	$0	$167,600
SEC-C8	972	972	116	90	110	0.01600	C	0.012	3	4	8	RCBC	4.6	7.15	1.79	IC	110	$1,400	$154,000	1	$4,800	$4,800	1	$8,800	$8,800	0.0	MIX	$0.00	$0	$167,600	$0	$167,600
SEC-C9	972	972	116	90	110	0.01600	C	0.012	3	4	10	RCBC	4.5	5.54	1.39	IC	127	$1,000	$127,017	1	$4,300	$4,300	1	$7,700	$7,700	0.0	MIX	$0.00	$0	$138,617	$0	$138,617
SEC-C10	621	621	116	45	155	0.00500	C	0.012	2	4	10	RCBC	4.4	5.54	1.39	IC	155	$1,000	$155,563	1	$4,300	$4,300	1	$7,700	$7,700	0.0	MIX	$0.00	$0	$167,563	$0	$167,563
SEC-C11	621	621	116	45	156	0.00500	C	0.012	2	4	6	RCBC	4.5	4.67	1.17	TW	127	$500	$76,190	1	$3,500	$3,500	1	$4,400	$4,400	0.0	MIX	$0.00	$0	$88,190	$0	$88,190
SCC-C1	1175	1175	116	90	127	0.01600	C	0.012	4	4	10	RCBC	4.5	4.85	1.21	IC	127	$1,800	$228,631	1	$5,600	$5,600	1	$11,100	$11,100	0.0	MIX	$0.00	$0	$245,331	$0	$245,331
SCC-C2	732	732	116	90	144	0.01600	C	0.012	3	4	10	RCBC	4.6	4.38	1.07	IC	144	$1,400	$201,033	1	$4,800	$4,800	1	$8,800	$8,800	0.0	MIX	$0.00	$0	$214,733	$0	$214,733
SCC-C3	224	224	116	90	144	0.01600	C	0.012	2	4	6	RCBC	4.5	3.79	0.82	TW	144	$600	$86,157	1	$3,300	$3,300	1	$6,400	$6,400	0.0	MIX	$0.00	$0	$98,857	$0	$98,857
SCC-C4	224	224	116	90	144	0.01600	C	0.012	2	4	4	RCBC	4.2	4.79	1.18	IC	633	$2,600	$1,657,898	1	$3,800	$3,800	1	$8,400	$8,400	0.0	MIX	$0.00	$0	$1,845,948	$0	$1,845,948
SCC-C5	294	294	116	90	112	0.01600	C	0.012	4	4	10	RCBC	4.4	4.79	1.20	IC	112	$1,800	$201,654	1	$5,600	$5,600	1	$11,100	$11,100	0.0	MIX	$0.00	$0	$217,754	$0	$217,754
SCC-C6	1154	1154	116	90	112	0.01600	C	0.012	4	4	10	RCBC	4.4	4.79	1.20	IC	112	$1,800	$201,654	1	$5,600	$5,600	1	$11,100	$11,100	0.0	MIX	$0.00	$0	$217,754	$0	$217,754
SCC-C7	1154	1154	116	90	112	0.01600	C	0.012	4	4	10	RCBC	4.4	4.79	1.20	IC	112	$1,800	$201,654	1	$5,600	$5,600	1	$11,100	$11,100	0.0	MIX	$0.00	$0	$217,754	$0	$217,754
SCC-C8	537	537	116	90	112	0.00500	C	0.012	2	4	6	RCBC	4.5	5.88	1.48	IC	112	$900	$99,359	1	$3,800	$3,800	1	$7,000	$7,000	0.0	MIX	$0.00	$0	$109,159	$0	$109,159
SGR-C1	1448	1448	116	90	116	0.00500	C	0.012	4	6	10	RCBC	4.4	4.38	0.82	IC	116	$2,000	$229,600	1	$6,800	$6,800	1	$11,700	$11,700	0.0	MIX	$0.00	$0	$248,100	$0	$248,100
SGR-C2	1448	1448	116	90	116	0.00500	C	0.012	4	6	8	RCBC	5.2	3.70	1.06	IC	116	$2,000	$229,600	1	$6,800	$6,800	1	$11,700	$11,700	0.0	MIX	$0.00	$0	$248,100	$0	$248,100
SAA-C1	1175	1175	116	90	116	0.01600	C	0.012	4	4	10	RCBC	4.4	4.79	1.21	IC	116	$1,800	$188,000	1	$5,600	$5,600	1	$11,100	$11,100	0.0	MIX	$0.00	$0	$214,700	$0	$214,700
SAA-C2	1175	1175	116	90	127	0.01600	C	0.012	4	4	10	RCBC	4.5	5.83	1.21	IC	127	$1,800	$228,631	1	$5,600	$5,600	1	$11,100	$11,100	0.0	MIX	$0.00	$0	$245,331	$0	$245,331

DETENTION BASIN QUANTITIES AND COSTS

I.D.	Q In (cfs)	Q Out (cfs)	Length (ft.)	Material Type	Manning's 'n' Value	Outlet Pipe Diameter (ft.)	Volume (Ac-ft)	Detention Basin Excavation (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Landscape Restoration (sf)	Unit Cost ($/sf)	Landscape Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Emergency Spillway Length (ft.)	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Dumped Riprap (cy)	Unit Cost ($/cy)	Riprap Cost	Fence Length (ft.)	Unit Cost ($/ft)	Fence Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land & Landscape Costs
DCRB	1154	48	-	-	-	-	168	393,357	$6	$1,619,942	1120567	$2.20	$2,465,247	1	$1,100	$1,100	356	74	$310.00	22,961	59	$35.00	$3,360.71	4,700	$12.00	56,472	26	Res.	$0.60	$1,131,334	$1,609,815	$2,491,647	$5,516,497
DSRC	2172	111	0	0	-	-	638	1,029,307	$6	$6,175,842	2378391	$2.20	$5,232,459	2	$1,100	$2,200	275	21	$310.00	25,257	162	$35.00	$3,564.78	7,150	$12.00	85,800	54.6	Res.	$0.60	$2,354,592	$5,292,684	$5,292,489	$13,079,765
DSRL	828	89	0	0	-	-	252	405,580	$6	$2,439,360	966854	$2.20	$1,993,318	2	$1,100	$2,200	109	30	$310.00	9,184	37	$35.00	$1,298.35	4,459	$12.00	53,508	20.8	Res.	$0.60	$906,888	$2,565,549	$1,993,318	$5,365,454
SFBSN	NA	NA	0	0	-	-	150	238,773	$6	$1,435,636	1611730	$2.20	$3,545,806	2	$1,100	$2,200	0	0	$310.00	0	0	$35.00	$0.00	4,580	$12.00	54,960	12	Res.	$0.60	$1,088,732	$1,896,556	$3,545,806	$8,531,267
RRBSN	NA	NA	0	0	-	-	130	23,232	$6	$139,392	1288899	$2.20	$2,674,578	2	$1,100	$2,200	0	0	$310.00	0	0	$35.00	$0.00	4,580	$12.00	54,960	30	Res.	$0.60	$1,293,732	$185,592	$2,674,978	$4,354,302

STORM DRAIN QUANTITIES AND COSTS

I.D.	Q100 (cfs)	Q full (cfs)	Downstream Elevation	Upstream Elevation	Conveyance, K	V full	Length (ft.)	Slope (ft./ft.)	Material Type	Manning's 'n' Value	Number of Pipes/Boxes	Pipe or Box	Pipe Diameter (in.)	Box Height (ft)	Box Width (ft)	Length of Pipe (ft.)	Unit Cost ($/ft.)	Pipe/Box Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Manhole	Unit Cost (Ea.)	Manhole Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Const, Land & Landscape Costs
SST-P1	-	-				-	9,000	-	C	0.0120	1	Pipe	48			8000	$120	$1,080,000		$1,100	$0	16	$3,000	$54,000					$1,134,000	$0	$1,134,000
SST-P2	-	-				-	13,000	-	C	0.0120	1	Pipe	48			13000	$120	$1,560,000		$1,100	$0	20	$3,000	$76,000					$1,636,000	$0	$1,636,000
SST-P3	-	-				-	7,500	-	C	0.0120	1	Pipe	48			7500	$120	$900,000		$1,100	$0	15	$3,000	$45,000					$945,000	$0	$945,000

TOTALS	621.5 Ac.	$19,105,717	$97,521,472	$50,617,838	$167,045,027
CONTINGENCIES AT 30%					$29,256,642
GRAND TOTAL					$196,302,268

* NOTE: Slopes Obtained Directly From HEC-1 Output
30% Contingency is applied to the Total Construction Cost Only

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT # 98-13"

LEGEND

- SEC-1 NEW CHANNEL REACH
- NEW CULVERT
- EXIST DETENTION BASIN
- NEW DETENTION BASIN

0' 1000'2000' 4000' 6000' 8000'
feet

TO ADOT BASIN "K"

SST-C1, SST-P1, SST-C2, SST-1, McQueen Rd, ADOT BASIN "L" BSNL, 1.0 mi

Arizona Ave., SPRR, SCC-3, SCC-4, Consolidated Canal, SCC-5, Cooper Rd, SST-C3, SST-2, SST-C4, Gilbert Rd, Freeway, Santan

SAA-1, SAA-C1, SAA-2, SAA-C2, SCC-1, SCC-2, SCC-C4, SCC-C5, SCC-C6, SCC-P1, SCC-C7, SCC-C8, SCC-C3, SWQ-B1, 1.5

PROPOSED QUEEN CREEK ROAD BASIN QCRB, 1.2 mi

SST-P2, SEC-8, Lindsay Rd, Eastern Canal, SEC-9, SEC-10, Val Vista Dr, SEC-11, SEC-7, SEC-C9, SEC-C10, SEC-C12, SEC-C11, SEC-C8

SEC-4, SEC-5, SEC-6, SEC-3, SEC-2, SEC-C4, SEC-C5, SEC-C6, SEC-C7, SEC-C3

BSNO ADOT BASIN "O", 2.4 mi, SST-3, SST-C5, SST-C6, SST-P3

OPEN CHANNEL FROM MID-AREA

PIPE FROM ADOT BASIN "Q"

SGR-2, SGR-C2, SWQ-B2, 1.3, SGR-C1, SGR-1

1.3 1.5 1.2 = 4.0 ; 1.0 2.4 = 3.4 ; 1700

SPRR, MARICOPA FLOODWAY, EAST

Hunt Highway, Riggs Road, Chandler Heights, Ocotillo Road, Queen Creek Road, Centennial Road, Pecos Road

N

PROJECT DESCRIPTION: SOUTH AREA RECOMMENDED PLAN

CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962

EXHIBIT 16

APPENDIX

HEC-1 Schematic - Eastern Canal North FDS
HEC-1 Schematic - Gilbert-Chandler ADMS
HEC-1 Schematic - Gilbert-Chandler ADMS Addendum

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT # 98-13"

NORTH AREA HEC-1 SCHEMATIC

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

APPENDIX 1

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

HIGLEY AREA
AREA DRAINAGE MASTER PLAN
"FCD CONTRACT # 98-13"

Pecos Road
Williams Field Rd
Ray Road
Prop.Santan Frwy
Warner Road
Elliot Road
Guadalupe Rd
Baseline Rd
Superstition Frwy
ADOT Channel
Higley Road
Recker Road
Power Road
Eastern Canal
SPRR

0' 600' 1200' 2400' 3600' 4800'
FEET

MID AREA HEC-1 SCHEMATIC

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

APPENDIX 2

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HIGLEY AREA AREA DRAINAGE MASTER PLAN

"FCD CONTRACT # 98-13"

0' 1000' 2000' 4000' 6000' 8000'

FEET

SOUTH AREA HEC-1 SCHEMATIC

DIBBLE & ASSOCIATES CONSULTING ENGINEERS

APPENDIX 3

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

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