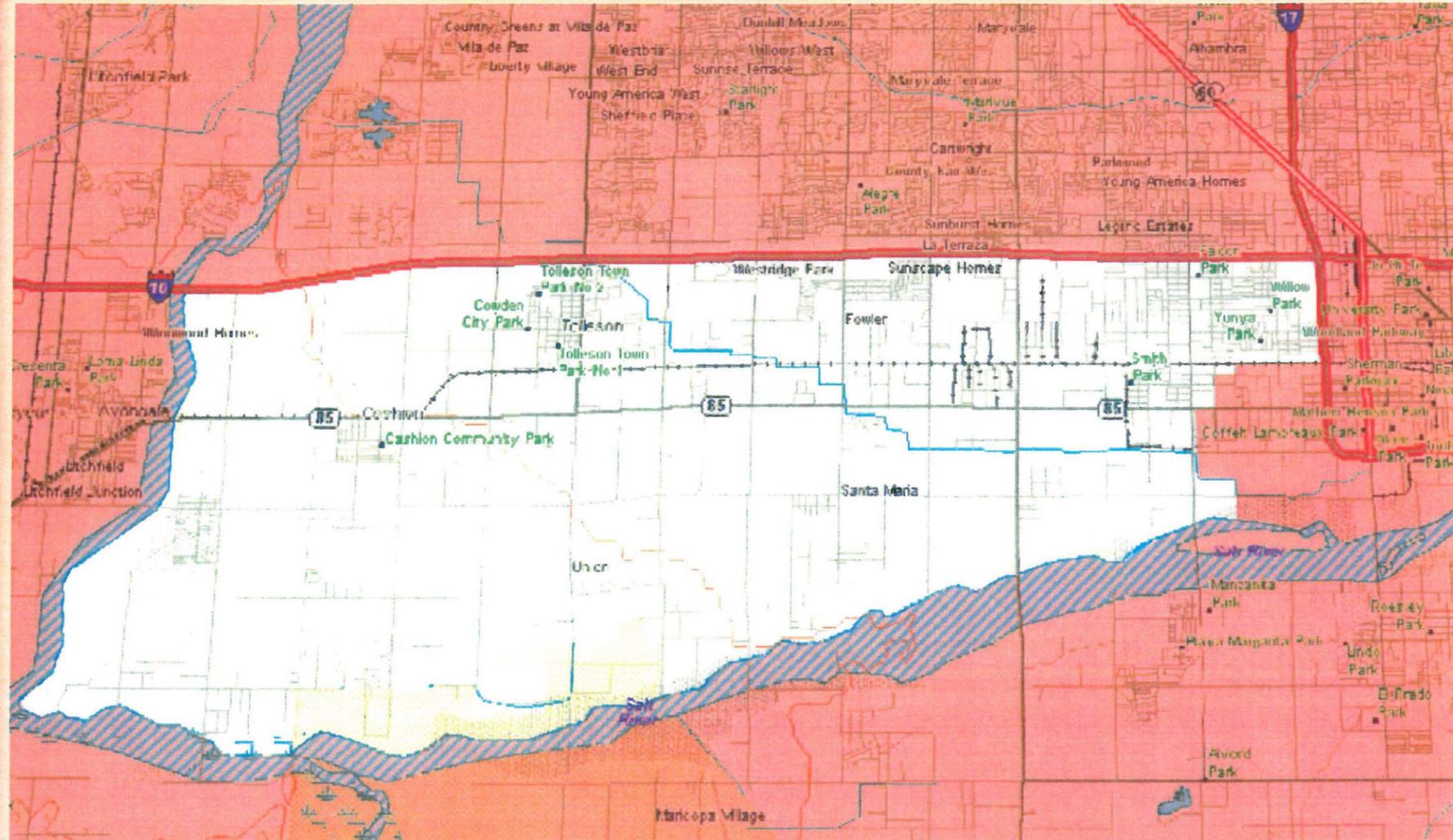
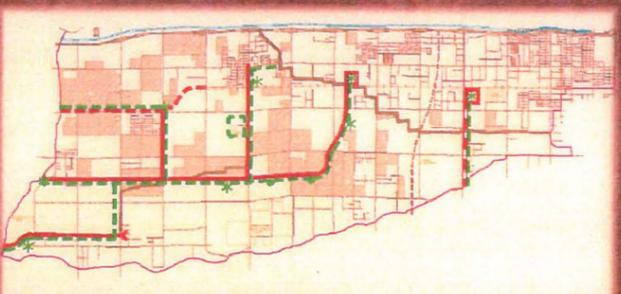
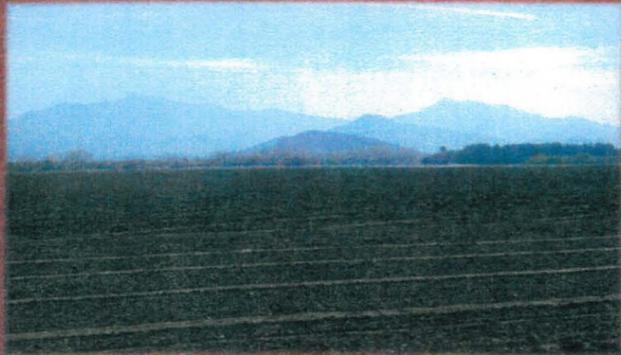


Durango Area Drainage Master Plan Alternatives Analysis Report FCD #99-41

Prepared for:

Flood Control District of Maricopa County



Prepared by:



In Cooperation With:



March, 2001

**Durango Area Drainage Master Plan
Alternatives Analysis Report
FCD #99-41**

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Prepared for:

Flood Control District of Maricopa County

Prepared by:



DIBBLE & ASSOCIATES
CONSULTING ENGINEERS



In Cooperation With:

McCloskey ♦ Peltz, Inc.
LANDSCAPE ARCHITECTS

and

SWA Environmental
Inc. Consultants



March 2001

**DURANGO AREA DRAINAGE MASTER PLAN
ALTERNATIVES ANALYSIS REPORT**

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LIST OF APPENDICES

Tres Rios Project, Selected Alternative Exhibit
Community Questionnaire 1

ABBREVIATIONS

ADMP - Area Drainage Master Plan
 ADOT - Arizona Department of Transportation
 APS - Arizona Public Service
 BFC - Buckeye Feeder Canal
 BID - Buckeye Irrigation District
 cfs - cubic feet per second
 DDMSW - Drainage Design Management System for Windows
 FCDMC - Flood Control District of Maricopa County
 HEC-1 - Hydrologic Engineering Center - Flood Hydrograph
 Package Computer Program
 IGA - InterGovernmental Agreement
 MCDOT - Maricopa County Department of Transportation
 MOU - Memorandum of Understanding
 NAMU - Natural Appearing Multi-Use
 NPDES - National Pollutant Discharge Elimination System
 RID - Roosevelt Irrigation District
 SRP - Salt River Project
 UPRR - Union Pacific Railroad



DURANGO AREA DRAINAGE MASTER PLAN ALTERNATIVES ANALYSIS REPORT

I. INTRODUCTION

A. Objective

This Alternatives Analysis Report has been prepared for the Flood Control District of Maricopa County (FCDMC) as part of the Durango Area Drainage Master Plan (ADMP). The project location is shown on **Figure I-1**. The purpose of the project is to quantify the extent of flooding problems and develop alternative solutions to the flooding problems. The ADMP will evaluate the drainage area, identify structural and non-structural alternatives, and develop a preferred solution. The plan will develop and identify preliminary costs, alignments, typical sections, right-of-way requirements, utility conflicts, environmental issues, landscape design concepts, and potential project participants for the preferred alternatives. Alternatives will address mitigation of flooding along the Buckeye Feeder Canal, the Roosevelt Irrigation District (RID) Canal, and the Union Pacific Railroad (UPRR). The project includes delineation of the 100-year floodplain for the Buckeye Feeder Canal (BFC) from the Agua Fria River eastward to 91st Avenue and an extension of the Tolleson floodplain delineation along the UPRR extending from 69th Avenue to 35th Avenue. The new floodplain delineations are documented in a separate report.

B. Study Area

The study area is within Maricopa County and includes portions of the City of Phoenix, the City of Tolleson, the City of Avondale, and unincorporated Maricopa County. The jurisdictional boundaries are depicted on **Figure I-2**. The study area encompasses approximately 53 square miles bounded by the Interstate 10 freeway on the north, the Salt and Gila Rivers on the south, the Agua Fria River on the west, and the

Interstate 17 freeway on the east. The study area has been divided into three geographic areas.

The **Northern Study Area** extends the full width of the study area from the Agua Fria River eastward to I-17 and from I-10 southward to the UPRR at approximately Buckeye Road. The **Southwest Study Area** extends from the Agua Fria River eastward to approximately 83rd Avenue and from the UPRR southward to the Gila River. The **Southeast Study Area** extends from approximately 83rd Avenue eastward to I-17 and from the UPRR southward to the Salt River.

C. Existing Data & Reports

Portions of the Durango area have been studied on previous occasions. The following is a description of some of the more significant studies in the study area:

The *Floodplain Delineation of the Tolleson Area*, was completed in May, 1999, and included hydrologic analysis of the entire Durango study area with mapping and delineation of the floodplain along the north side of the UPRR railroad.

The *Tolleson - SPRR and Van Buren Street at 91st Ave, Candidate Assessment Report* was completed in August, 1999, and analyzes/evaluates solutions for the flooding problems in the downtown Tolleson area.

The *Drainage Concept Report, 115th Ave - Gila River Bridge to MC 85*

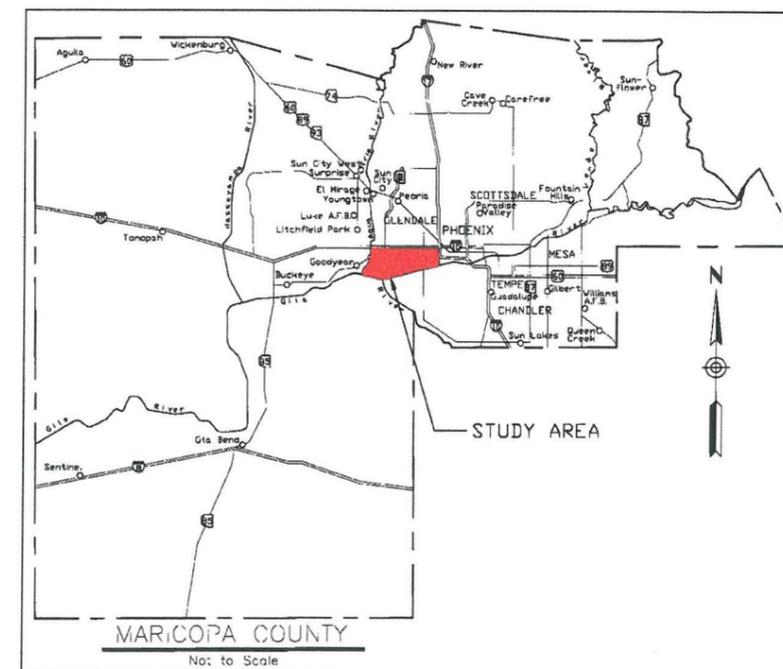


Figure I-1. - Project Location

was completed in March, 1998, as a part of the 115th Avenue improvement project by MCDOT, and recommended a set of improvements to the BFC to accommodate storm drainage.

The *City of Phoenix - Estrella Village Plan*, was adopted by the Phoenix City Council in March, 1999. This overall plan includes proposed land use and infrastructure, as well as roadway, landscaping, and multi-use trail guidelines and opportunities.

The *Salt-Gila River Floodplain Delineation Restudy*, was completed in May, 1999, and re-delineated the floodplain of the Salt and Gila Rivers from Mesa to Buckeye.

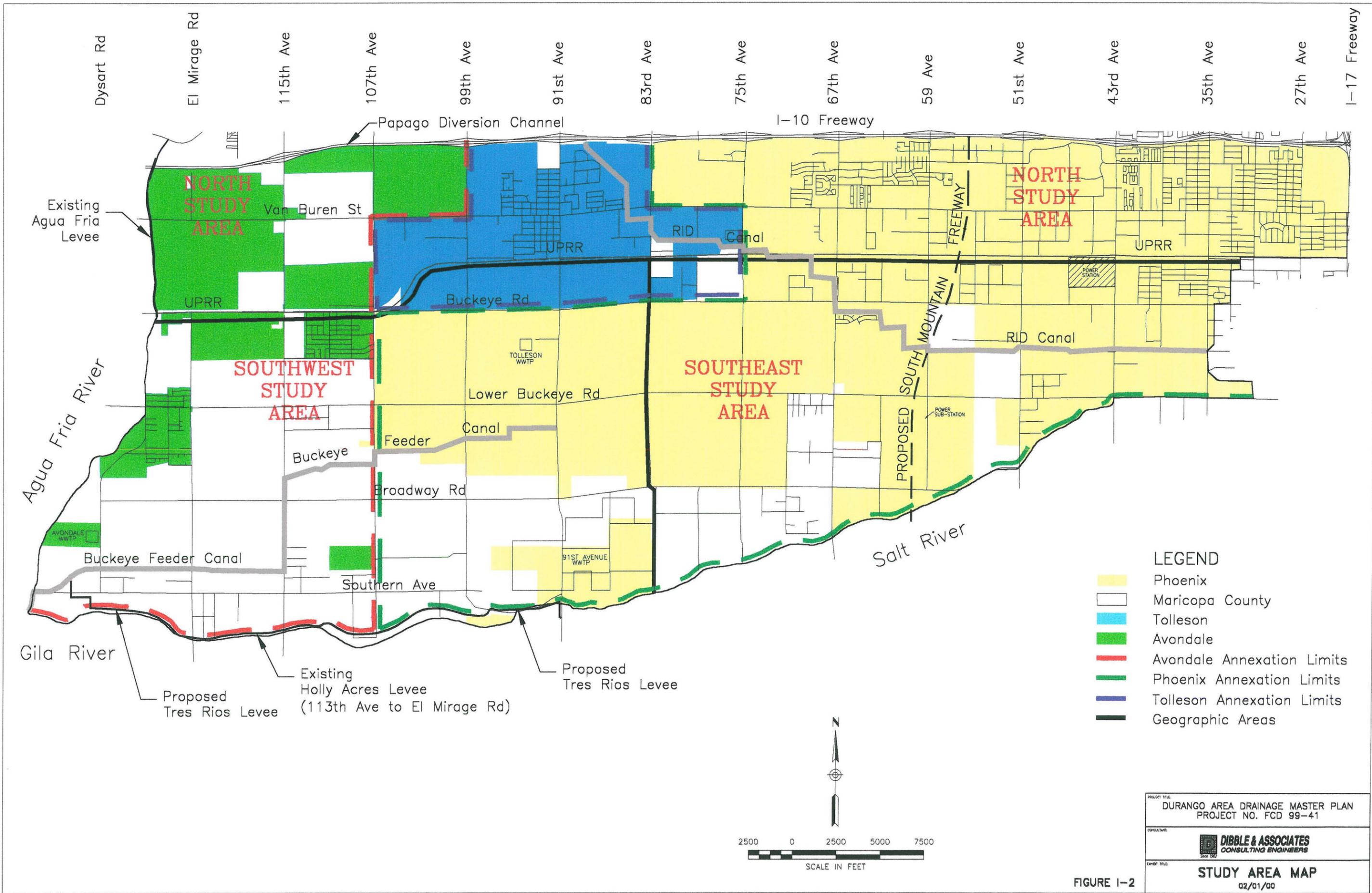


FIGURE I-2

| | |
|----------------|--|
| PROJECT TITLE: | DURANGO AREA DRAINAGE MASTER PLAN PROJECT NO. FCD 99-41 |
| CONSULTANT: | DIBBLE & ASSOCIATES CONSULTING ENGINEERS |
| DATE: | 02/01/00 |

The *Agua Fria River Floodplain Delineation Restudy*, was completed in October, 1996, and re-delineated the floodplain of the Agua Fria River from the New Waddell Dam to the Gila River confluence.

The mapping used for this study was based upon aerial mapping performed in April, 1994 for the *Maryvale Area Drainage Master Study* (FCD 93-33).

D. Project Coordination

A Review Committee was established by the FCDMC to provide coordination and input throughout the project. The Review Committee consists of representatives of the agencies that will be impacted by the project and have an interest in its outcome. 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

| <u>Agency</u> | <u>Representative</u> |
|--|--|
| City of Avondale | Mr. Jim Mitchell |
| Flood Control District of Maricopa County | Mr. Greg Jones |
| Maricopa County Dept of Parks & Recreation | Mr. Dave Konopka |
| Maricopa County Dept of Planning & Dev. | Mr. Matthew Holme |
| Maricopa County Dept of Transportation | Mr. Mike Smith |
| City of Phoenix | Mr. Ray Dovalina / Ms. Christine Hood |
| Roosevelt Irrigation District | Mr. Stan Ashby |

Buckeye Irrigation Company
Salt River Project - Water
Salt River Project - Power
City of Tolleson

U.S. Army Corps of Engineers

Mr. Jackie Meck
Mr. Steven Tanis
Mr. Bill Phillips
Mr. Manuel Dominguez /
Mr. Woody Scoutten
Mr. John Drake /
Mr. Mike Ternak

In addition to the Review Committee, public input was solicited at two public open house meetings held in the project study area. The first 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. The second open house was held immediately following the final selection of a preferred alternative, to allow opportunity for comment on the selected alternative.

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:

| <u>Phase</u> | <u>Products</u> |
|-----------------------|---|
| 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 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. Greg Jones, P.E., Project Manager, Mr. Chris Perry, 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. Jason Mikkelsen, EIT, and Mr. Dan Frank, EIT, Project Engineers.

Dibble and Associates was assisted by McCloskey-Peltz, Inc. for landscape analysis and by SWCA, Inc. Environmental Consultants for environmental analysis. Individuals from MPI who have contributed to the project include: Ms. Diane McCloskey, RLA, Principal. Individuals from SWCA who have contributed to the project include: Mr. Ken Houser, Project Manager, Ms. Melissa Keane, and Mr. Mike List.

II. HYDROLOGY

Introduction

The hydrology for this study was developed based on existing conditions hydrology from the *Floodplain Delineation of the Tolleson Area*, May 1999. The existing conditions hydrology was updated as part of this project to reflect changes in land-use and routing which have occurred since the original study. The reader is encouraged to review the full text of the above mentioned hydrology report for additional details not presented here.

Following completion of the existing conditions model update, the updated existing conditions model was then modified to reflect changes in flow routing from the channels, storm drains, and detention basins identified in the alternative screening process.

Hydrology Model Update

The U.S. Army Corps of Engineers, *HEC-1 Flood Hydrograph Package* (HEC-1) computer program was used to develop this model. Guidance is given in the *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology* (Hydrology Manual) for application of the HEC-1 program within Maricopa County. Additionally, the computer program *Drainage Design Management System for Windows* (DDMSW), developed by the District, was used to modify land use parameters which have changed due to development. Land use data has been updated based on field observations and color aerial photos as of February 15, 2000. The land use data was input into the District's GIS system to generate the area of each land use type per subbasin for input into the DDMSW. The soil loss parameters were also adjusted based on the effective impervious area and the percent of vegetative cover. While rainfall losses due to soil types have remained unchanged since the

original study, there have been minor changes to the subbasin boundaries which have been accounted for within DDMSW. The existing drainage sub-area boundaries with HEC-1 routing are shown on **Figure II-1**.

Point precipitation rainfall values are taken from NOAA Atlas II, Volume VIII. The PREFRE program within DDMSW was used in conjunction with the precipitation isopluvial maps contained in the Hydrology Manual to establish the point precipitation values shown below.

Point Values (in)

| Duration | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|----------|------|------|-------|-------|-------|--------|
| 5 MIN | 0.33 | 0.43 | 0.49 | 0.59 | 0.67 | 0.74 |
| 10 MIN | 0.49 | 0.64 | 0.75 | 0.90 | 1.02 | 1.14 |
| 15 MIN | 0.59 | 0.80 | 0.95 | 1.15 | 1.30 | 1.46 |
| 30 MIN | 0.78 | 1.08 | 1.28 | 1.55 | 1.76 | 1.97 |
| 1 HOUR | 0.96 | 1.33 | 1.58 | 1.93 | 2.20 | 2.47 |
| 2 HOUR | 1.05 | 1.46 | 1.74 | 2.13 | 2.43 | 2.73 |
| 3 HOUR | 1.11 | 1.55 | 1.85 | 2.27 | 2.58 | 2.90 |
| 6 HOUR | 1.22 | 1.72 | 2.06 | 2.52 | 2.88 | 3.23 |
| 12 HOUR | 1.34 | 1.90 | 2.28 | 2.81 | 3.21 | 3.61 |
| 24 HOUR | 1.45 | 2.09 | 2.51 | 3.09 | 3.54 | 3.99 |

Numerous changes to the structure of the HEC-1 model were also made. These changes mostly involved divert and combine statements with some major changes to the overall sequence of the model. Diverts are widely used in this model to direct flow at key concentration points to other parts of the model. Some examples include; 1) flow splits at arterial street intersections, 2) diverts of UPRR overflows, 3) on-site retention from new subdivisions being diverted out of the model, and 4) diverts to route flow around code sequence for the sake of modeling.

When a hydrograph is diverted into two hydrographs, such as occurs at a flow split location, the hydrograph that is carried forward in the next model step retains the total accumulated tributary area for purposes of aerial reduction of rainfall values. The diverted hydrograph is typically retrieved into the model sequence at some subsequent modeling point. The drainage area tributary to the diverted hydrograph is not retained when the hydrograph is retrieved and combined with a new hydrograph. As a result, the tributary area must be manually entered, when appropriate, to ensure proper application of the aerial reduction factors. Locations in the model where the areas are manually set are denoted by an "@" symbol in front of the HEC-1 ID for concentration points (@CPRJ for example).

Storage of runoff due to on-site retention was incorporated into the model for newer developments where the existence of on-site retention could be confirmed. This was accomplished by reviewing aerial photos and comparing them to drainage reports. If developments had been built or were under construction as of the photo date then 80% of their retention volume was considered to be effective.

Hydrograph routing within the model is based on channel storage routing using data from the HEC-RAS floodplain delineation model for routing along the UPRR from 69th Avenue to 35th Avenue and within the BFC from the Gila River outfall to 91st Avenue. The BFC routing assumes the culverts are plugged.

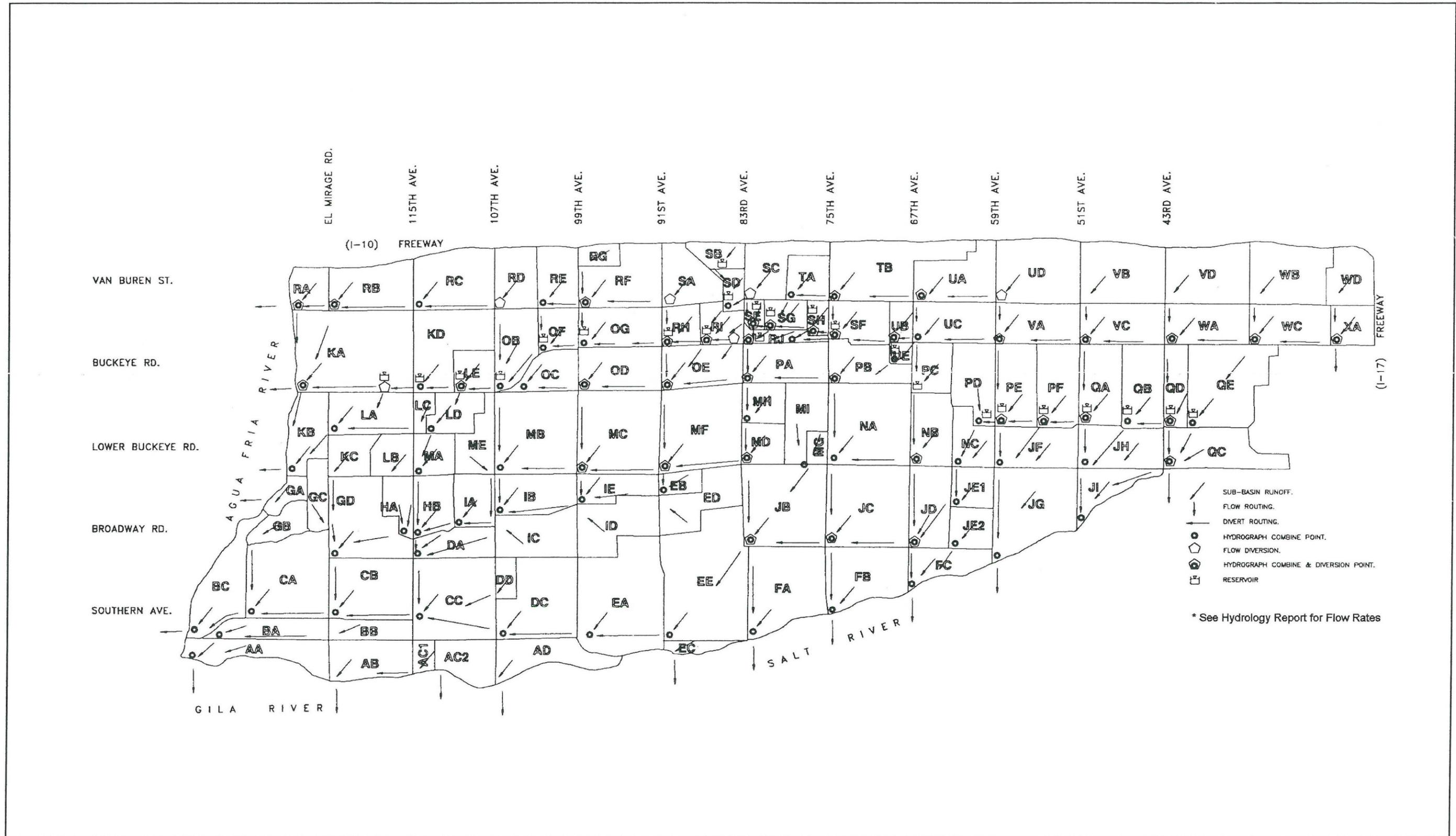


Figure II-1. - Existing Drainage Sub-Area Boundaries

III. EXISTING CONDITIONS

A. Introduction

Existing conditions within the study area have been documented in the *Data Collection Report*, submitted under separate cover as part of this project. The Data Collection Phase of the ADMP included identifying known flooding locations and collecting data regarding existing and proposed drainage facilities, major natural washes, and existing utilities. The data collection effort also included identification of planned residential developments, recreational facilities, landscape and visual resources assessment and an environmental overview within the study area. The reader is referred to the *Data Collection Report* for a detailed description of existing conditions. This section summarizes the existing flooding problems and existing drainage facilities within the study area.

B. Areas of Flooding

Areas of flooding within the study area have been delineated as FEMA floodplains along the Salt, Gila, and Agua Fria Rivers, along the upstream embankment of the RID Canal and along the UPRR. Existing FEMA floodplains are shown on **Figure III-1**. Additionally local flooding problems have been reported and are known to exist along the BFC, along 91st Avenue between Interstate 10 and the UPRR, and along Van Buren Street in the vicinity of 95th and 96th Avenues.

Buckeye Feeder Canal

The BFC along 115th Ave is a known flooding area due to the limited capacity of the canal to convey storm water and features within the canal such as culverts which restrict the flow. The BFC floodplain is being delineated as part of this project from the Gila River to 91st Avenue.

91st Avenue

The intersection of 91st Avenue and Van Buren is a known flooding problem due to the inadequate conveyance capacity of 91st Avenue between Van Buren Street and the UPRR. There is an existing SRP irrigation ditch along the east side of 91st Avenue which historically intercepts storm water flows generated east of 91st Avenue. This ditch is not designed for storm flows and the culvert and pipe downstream of Van Buren Street restrict the flow, resulting in ponding, overtopping of the irrigation facilities, and flooding along 91st Avenue and Van Buren Street including the intersection. The historic photo below shows a view of 91st Avenue just north of Van Buren Street during a 1966 storm.



91st Avenue north of Van Buren Street during 1966 storm

Van Buren Street

In the vicinity of 95th and 96th Avenues, Van Buren Street is a known flooding problem due to ponding in the area. Runoff that accumulates

in this area comes from the east on Van Buren Street, from 91st Avenue, and from the subdivisions north of the street. Lack of an existing storm drain system has resulted in poor conveyance of storm flows through the area. The historic photo below shows a view of a residential neighborhood in Tolleson north of Van Buren Street during a 1966 storm.



Tolleson Residential neighborhood north of Van Buren street during 1966 storm

C. Existing and Planned Facilities

The drainage pattern is predominantly overland in a northeast to southwest direction accumulating along the RID Canal and along the UPRR eventually reaching the Salt and Gila Rivers on the south and the Agua Fria River on the west. The few drainage facilities that exist within the study area are described in the following paragraphs.

Papago Diversion Channel

The ADOT Papago Diversion Channel drains to the west along the north side of Interstate 10 and defines the north limit of the study area. This channel captures flow from the north and diverts it west to the Agua Fria River. Most of the storm drains from the north tie into the channel, although some pass to the south unintercepted.

Agua Fria Levee

The Agua Fria Levee extends from north of Interstate 10 south to Buckeye Road near the UPRR. The levee is designed to convey the 100 year storm flow in the river without overtopping the banks.

Holly Acres Levee

The Holly Acres Levee is an existing bank protection project on the Gila River, extending from 113th Avenue downstream to El Mirage Road. The levee was designed to accommodate a flow of 115,000 cubic feet per second (cfs) with three feet of freeboard, however at approximately 100,000 cfs, the river flows over the north bank at 99th Ave and around the Holly Acres Levee. The levee is not in danger of being overtopped since it is outflanked before the river level rises high enough. The outflanking is not likely to cause damage to the levee, as it is armored with stones on both sides.

Tres Rios Project

The Tres Rios project is an ongoing project in the Salt/Gila River with an effort to restore critical riparian and wetland habitats that have been lost in the region as a result of water resources development in the Phoenix metropolitan area. The project extends from the 91st Ave wastewater treatment plant to just downstream of the confluence with the Agua Fria River. The project has completed the feasibility study phase and identified potential benefits for flood control, including bank

protection levees along the Salt/Gila River from approximately 91st Avenue to Dysart Road, then extending northward to the Avondale WWTP located south of Broadway Road. An exhibit showing the selected alternative for the Tres Rios project is included in the **Appendix** of this report.

South Mountain Freeway (Loop 202)

The possibility exists for a future Loop 202 Freeway extension to the south, approximately along the 59th Ave alignment, which may block westerly drainage within the study area. It is anticipated that the design for the freeway will include collector channels and basins to intercept the runoff, retain the flows, and drain south to the Salt River.

City of Phoenix Storm Drains

The City of Phoenix has previously constructed several storm drains in the study area which were designed to accommodate a 2-Year design storm prior to the construction of the Papago Diversion Channel with the Interstate 10 freeway. Large diameter storm drains are present in the major north-south arterial roadways from 27th Avenue to 67th Avenue and in Buckeye Road from 27th Avenue to 67th Avenue. With the construction of the Papago Diversion Channel along the freeway, some of the previous flow in the storm drains is now diverted, and the existing pipe has capacity beyond a 2-Year design storm event.

Other Facilities

Other facilities receive and convey runoff by virtue of the fact that they are within the path of the runoff even though they are not designed for drainage. Existing features that receive runoff are the BFC, and several small Salt River Project (SRP) irrigation ditches along agricultural properties. All of the canals in the project area are designed for irrigation delivery rather than storm drainage. This results in flooding

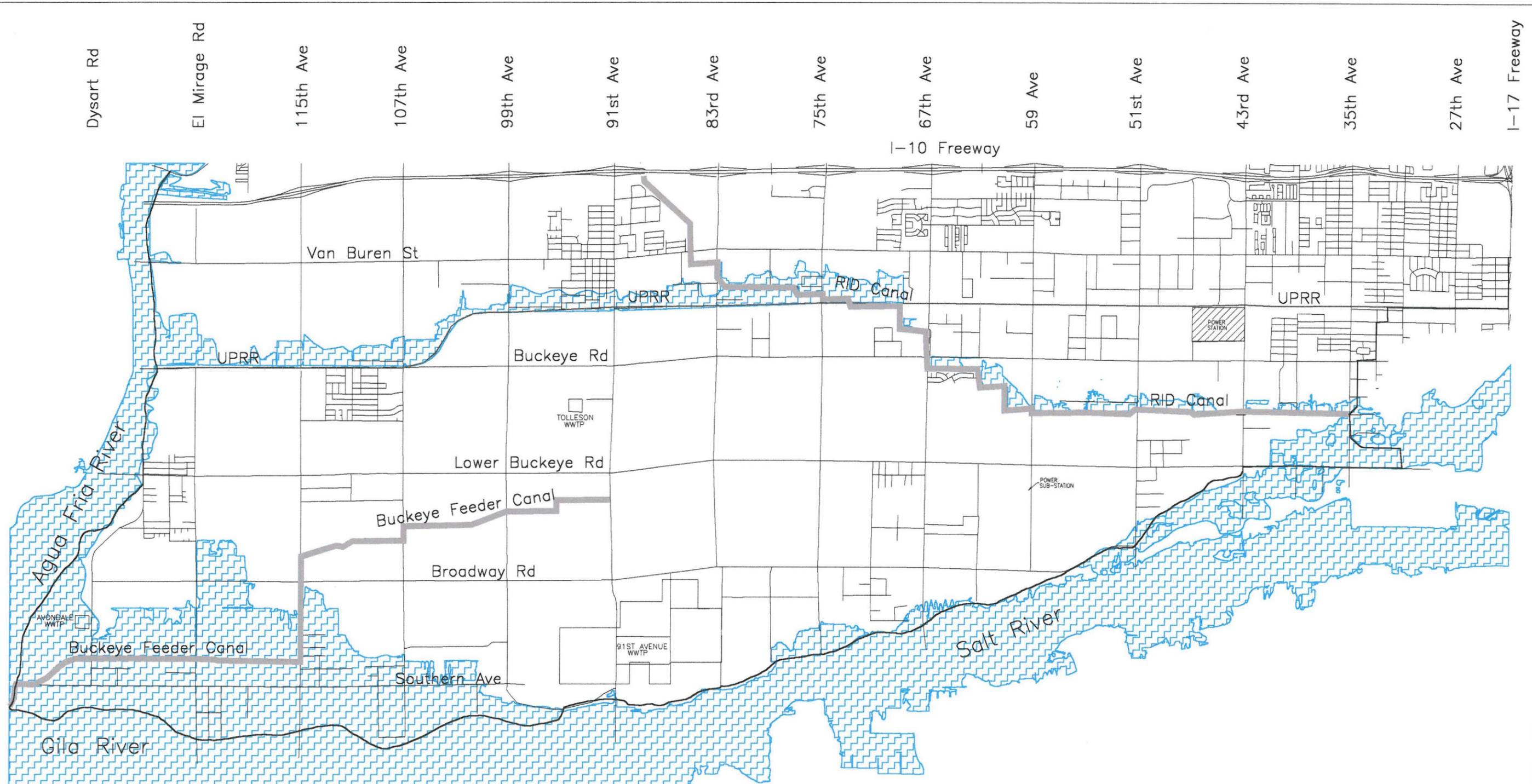
when runoff exceeds the capacity of the canals. Runoff that is intercepted by the railroad embankment makes its way westerly along the face of the embankment. Runoff flowing west along the embankment ponds behind section line roads that have raised profiles to pass over the railroad. The flow breaks out to the south when the ponding elevation exceeds the height of the embankment. None of the cross-roads have culverts of adequate size to drain nuisance flows through the roadway embankment.

D. Runoff Quantities

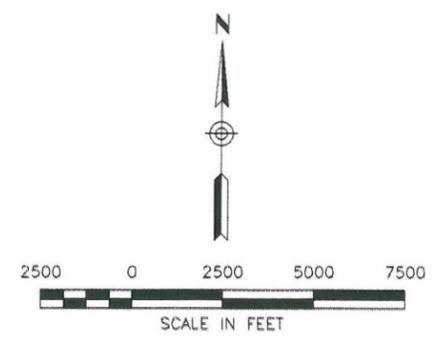
Runoff quantities from the 100-year, 6 and 24-hour storms are summarized in **Table 1** for key concentration points throughout the study area.

Table 1 - 100-Year Runoff Quantities

| LOCATION | Existing Q100, 6-hr (CES) | Existing Q100, 24- hr (CES) |
|---------------------------------|---------------------------------|--------------------------------------|
| UPRR at: | | |
| 35 th Avenue | 1791 | 1400 |
| 51 st Avenue | 1562 | 1494 |
| 67 th Avenue | 710 | 659 |
| 75 th Avenue | 1485 | 1384 |
| 83 rd Avenue | 1408 | 1338 |
| 99 th Avenue | 1256 | 1218 |
| 115 th Avenue | 447 | 457 |
| Agua Fria River | 1085 | 898 |
| RID Canal at: | | |
| 35 th Avenue | 1212 | 899 |
| 51 st Avenue | 1517 | 1200 |
| 59 th Avenue | 1216 | 1012 |
| Buckeye Feeder Canal at: | | |
| 99 th Avenue | 623 | 664 |
| 107 th Avenue | 942 | 1060 |
| 115 th Avenue | 895 | 1013 |
| El Mirage Rd | 1123 | 1486 |
| Dysart Rd | 1066 | 1406 |
| Agua Fria River | 1019 | 1335 |
| Van Buren Sreet. at: | | |
| 75 th Avenue | 1037 | 814 |
| 99 th Avenue | 767 | 608 |
| 115 th Avenue | 374 | 301 |
| Buckeye Road at: | | |
| 83 rd Avenue | 698 | 435 |
| 99 th Avenue | 681 | 572 |
| Lower Buckeye Road at: | | |
| 43 rd Avenue | 2112 | 1728 |
| 51 st Avenue | 1210 | 1124 |
| 59 th Avenue | 846 | 1187 |
| 75 th Avenue | 876 | 782 |
| 99 th Avenue | 696 | 712 |
| Broadway Road at: | | |
| 67 th Avenue | 1133 | 1026 |
| 115 th Avenue | 857 | 995 |
| Southern Avenue at: | | |
| 91 st Avenue | 1246 | 1118 |
| 115 th Avenue | 1209 | 1610 |



LEGEND
 EXISTING FEMA FLOODPLAIN



| | |
|----------------|--|
| PROJECT TITLE: | DURANGO AREA DRAINAGE MASTER PLAN PROJECT NO. FCD 99-41 |
| CONSULTANT: |  DIBBLE & ASSOCIATES CONSULTING ENGINEERS |
| EXHIBIT TITLE: | EXISTING FEMA FLOODPLAINS 02/01/00 |

FIGURE III-1

IV. STORM WATER MANAGEMENT ALTERNATIVES

A. Introduction

Storm water management alternatives were identified through a brainstorming session held with the Review Committee on February 23, 2000 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.

Although the study area was divided into three geographic areas (north, southeast, and southwest), for planning and evaluation purposes the area is studied as one complete drainage system. This is done to allow consideration of alternatives that cross the geographic boundaries. An Existing Constraints Map, shown on **Figure IV-1**, was used to show the planning constraints identified in the Data Collection Phase. Among the items depicted on the map were existing and planned development, existing and planned utilities, and known flooding areas. Environmental constraints, and archaeological and historical constraints were also considered based on maps from the *Data Collection Report* previously prepared for this study. Blueprints of the Existing Constraints Map were used to mark alternatives as they were identified. The brainstorming session was intended to be a creative setting to generate possible alternatives. As a result, several alternatives were generated by the review committee (Identified as Alternatives B-1 through B-6), in addition to the presentation of several "seed" alternatives which were generated in advance by the consultant team (Identified as Alternatives S-1 through S-7). 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 UPRR and BFC corridors. Otherwise, an alignment that makes use of existing or planned roadway alignments, along a section line or a 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 UPRR and the RID Canal flows westerly along the railroad or 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.

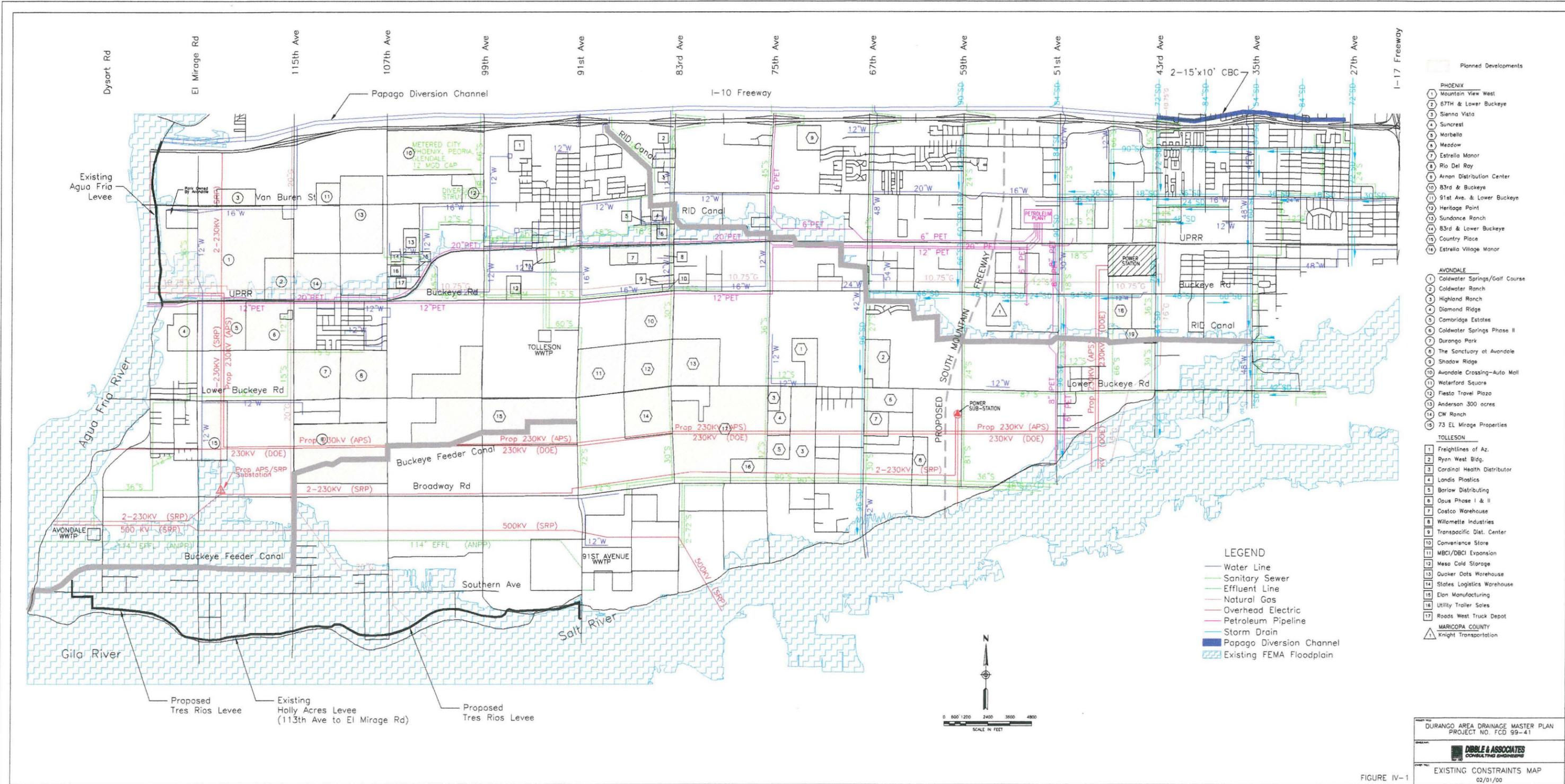


FIGURE IV-1

C. Flood Control Objectives

Although the three planning areas are distinct, the potential exists for viable flood control alternatives that cross the boundaries between the north, southeast, and southwest areas and combine runoff generated within each area. The alternatives are therefore developed with the entire project study area in mind rather than the smaller study area boundaries identified.

North Study Area

Runoff generated in the north study area accumulates along the UPRR and ponds until it is deep enough to either overflow the major streets to the west, overtop the railroad to the south, or a combination thereof. There is a significant flow overtopping the railroad east of 51st Avenue. More typically, runoff makes its way west along the upstream railroad embankment. The objective of alternatives in the north area is to alleviate the flooding from ponding and conveyance along the UPRR. Specific trouble spots have been identified in downtown Tolleson at 91st, 96th and 99th Avenues.

Southwest Study Area

The BFC is the dominant drainage feature in the southwest area. The BFC is an SRP owned and operated tailwater ditch which typically conveys 40 to 80 cubic feet per second (cfs) of tailwater runoff. The BFC was not designed to convey storm water. However, the BFC is located at a low point in the terrain and receives runoff during storm events. The BFC has an existing capacity of approximately 115 cfs versus a design storm event which generates between 330 and 1600 cfs. The flooding problems associated with the BFC are aggravated by new developments being planned in the area.

The existing Holly Acres levee and the planned Tres Rios levee along

the Gila River must be addressed in a plan for the southwest area. Interior drainage accumulating on the land side of the levees must be planned for. The objective for alternatives in the southwest area is to alleviate flooding along the BFC and address the interior drainage associated with the Holly Acres/Tres Rios levee. Pending development has been delayed due to liability concerns from SRP associated with development runoff being directed into the BFC.

Southeast Study Area

The southeast area is largely within the City of Phoenix and drains southerly to the Salt River. Existing large diameter storm drains exist in the eastern portion of the southeast area draining from the I-10 freeway south to the River. An opportunity is presented by the planned South Mountain Freeway to cooperate with ADOT in developing a regional drainage concept for the southeast area. The objective in the southeast area is to identify a drainage concept to be implemented as development takes place within the area and to identify opportunities for joint projects with the City of Phoenix and ADOT.

D. General Landscape Themes

Based on information presented in the Data Collection Report, including existing landscape character, future desired landscape character, visual resources, vegetation survey, cultural data, historical data, and prehistorical data, this section presents general landscape themes which have been developed for flood control alternatives within the study area.

Two approaches are considered for the landscape design of the Durango area as schematically illustrated in **Figure IV-2**.

Approach 1 features a single common landscape theme which would be applied to the entire study area. The various flood control facilities

would exhibit this single theme and a consistent landscape treatment. With a single common theme, the flood control facility would assume identifiable characteristics of its own which may or may not bear a direct relationship to the areas in which it occurs. For this approach to be viable, it must be determined that there is a single strong theme appropriate for the entire study area.

Approach 2 features mixed themes such as might occur in the transition from industrial / developed areas to agricultural / residential areas to river / natural areas. This approach features a combination of different themes introduced throughout the study area which would bear a relationship to the areas in which they occur. The different themes would be linked by common design elements which unify the facility as a whole and provide transitions from one theme area to another. It is possible that materials may remain consistent throughout the entire area with the different themes representing different arrangements, densities, and special emphasis elements.

Landscape Theme Objectives

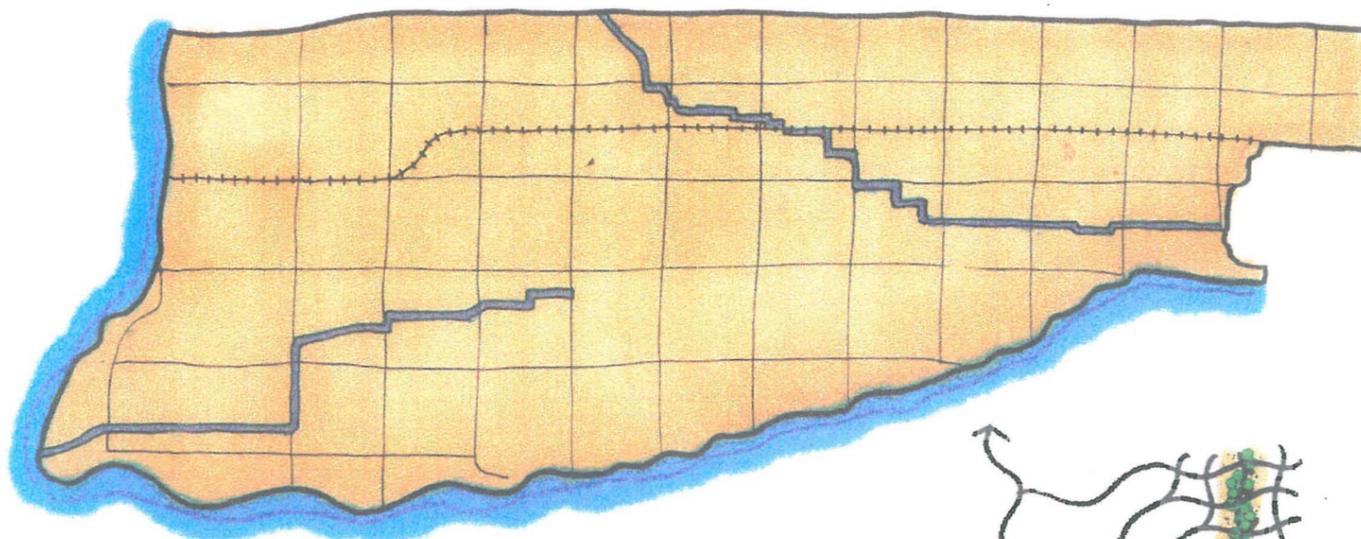
Landscape theme objectives for the Durango area include the following:

- Develop an overall landscape theme for each flood control alternative whether it be a single common theme or mixed themes.
- Protect or enhance local community character.
- Provide visual connectivity for the flood control facilities through the use of an aesthetic grading approach and common materials both hardscape and planting for the entire alignment. Arrangements, densities, and themes for special emphasis areas may vary.
- Incorporate areas or nodes of special emphasis or uses.
- Themes should be consistent with and reinforce where possible the guidelines presented in the Estrella Village Plan, as well as guidelines of the City of Tolleson and City of Avondale as applicable.

LANDSCAPE DESIGN APPROACH

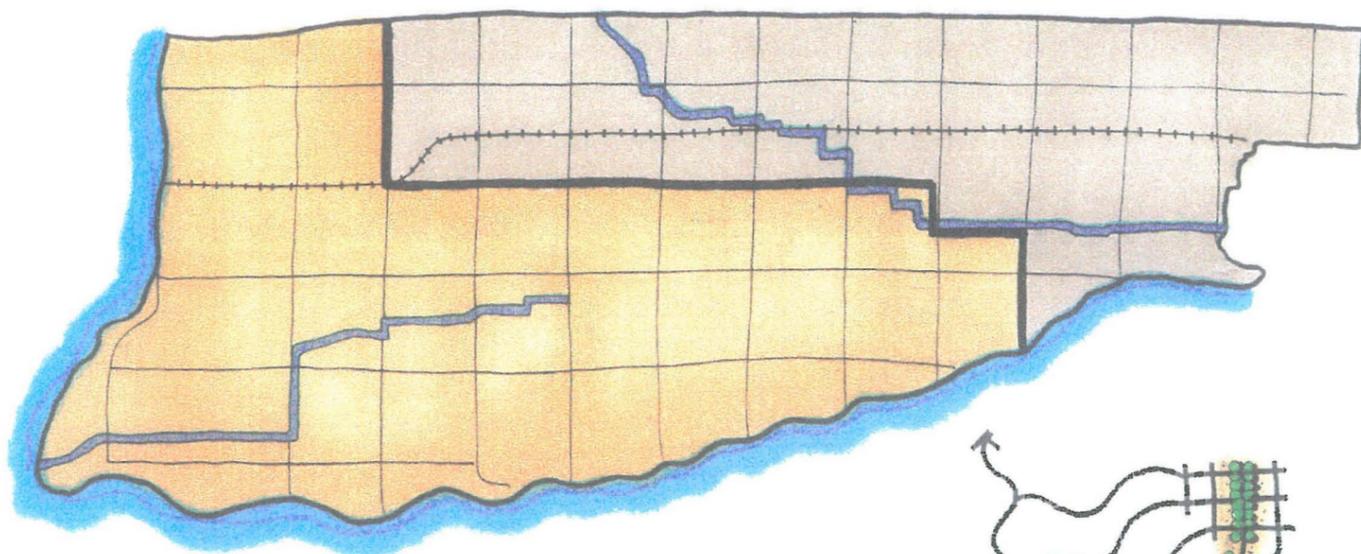
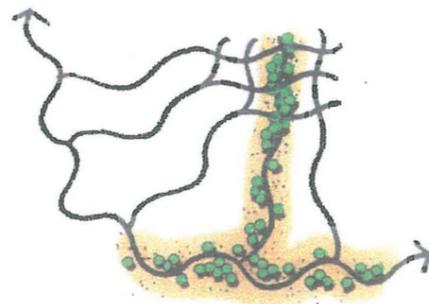
LANDSCAPE THEME OBJECTIVES

- DEVELOP OVERALL THEME
- PROTECT LOCAL COMMUNITY CHARACTER -- VISUAL CONNECTIVITY THROUGH THE USE OF COMMON MATERIALS BOTH HARDSCAPE AND PLANTING FOR ENTIRE ALIGNMENT. ARRANGEMENTS AND DENSITIES MAY CHANGE.
- INCORPORATE AREAS OR NODES OF SPECIAL EMPHASIS



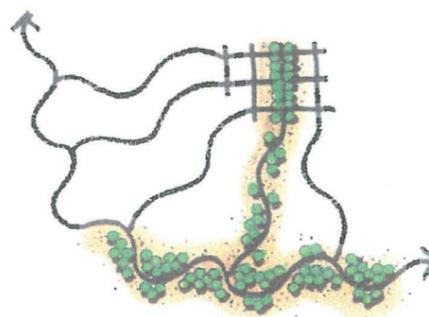
OPTION 1 - SINGLE COMMON THEME

SINGLE COMMON THEME APPLIED TO ENTIRE STUDY AREA



OPTION II - MIXED THEMES

TRANSITION FROM INDUSTRIAL/DEVELOPED TO AG/RESIDENTIAL TO RIVERS/NATURAL



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| <p>McCluskey • Peitz, Inc. LANDSCAPE ARCHITECTS</p> |
| <p>LANDSCAPE DESIGN APPROACH</p> |

FIGURE IV-2

Description of Potential Landscape Themes

The potential landscape themes described herein represent possible typical concepts for the landscape design of the various flood control alternatives within the Durango area. The themes have a basis in either existing or desired landscape character, visual resources, or cultural, historical, or prehistorical data relevant to the area. The intent is that any of the themes or a combination of themes could be applied to any alternative. However, because of location or other characteristics of an alignment certain themes may be more appropriate for certain locations within the study area. It should be noted that the Flood Control District's *Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects* was not a limiting factor in the development of the landscape themes described herein. The District's policy would include only a portion of the amenities being suggested. The following outlines key components for each general landscape theme.

Park-Like Theme (Figure IV-3)

Overall theme: turf green belt (like Scottsdale's Indian Bend Wash).

- Emphasis on active recreation with maximal turf.
- Multi level and aesthetic grading of basins and channels.
- Turf low flow channel.
- Gentle undulating side slopes (4:1 to 8:1).
- Park amenities including ramadas, benches, lighting, signage, play equipment, etc.
- Multi-use Trail.
- Primary plant palette - canopy shade trees combining evergreen and deciduous varieties such as Chinese Pistache, Oak, Sissoo, Mesquite, and Ash.
- Special emphasis plantings could consist of palms and / or flowering / color trees.
- General scheme reflects an informal arrangement - visual interest,

shade for potential users, preservation of mountain views, and screening where needed.

- Minimize hard structures. Features / structures designed to blend using natural materials or materials which are colored / stained and / or textured to be compatible.

Modified Sonoran Desert Theme (Figure IV-4)

Overall theme: modified natural.

- Combination of active and passive recreational areas.
- Turf limited to active recreation areas with planted and decomposed granite sideslopes and passive use areas.
- Multi level and aesthetic grading of basins, channels, and low flow channel. Low flannel channel may be turf or natural rock material depending on location.
- Natural forms.
- Gentle undulating sideslopes (4:1 to 8:1).
- Park amenities including ramadas, benches, lighting, signage, play equipment, etc.
- Multi-use Trail.
- Informal arrangement of modified Sonoran Desert Plant palette consisting of Mesquite, Palo Verde, Acacia, Sissoo, and Oak trees with massings of compatible low water use arid region shrubs, ground covers, and accent plantings designed to maximize visual interest, variety, color, and texture.
- Special emphasis plantings could consist of palms and / or flowering / color trees.
- Minimize hard structures. Features designed to blend using natural materials or materials which are colored / stained and / or textured to be compatible.

Natural Theme (Figure IV-5)

Overall theme: natural appearing.

- Natural, organic landforms and layout.
- Possible natural water features with permanent source of water.
- Public education opportunities.
- Natural transitions.
- Native plant palette featuring Cottonwood and Willow trees and a riparian shrub palette along low flow areas (provided the water table is high enough to sustain this type of vegetation) transitioning to Mesquite bosque and then to a Mesquite and Palo Verde mix with a native indigenous palette of shrubs, groundcovers, and grasses in the more upland areas.
- Potential for bird and wildlife habitat improvement.
- Extensive use of natural materials reflective of native river environment - river run rock, stone and wood for site features and structures.

Formal Promenade Theme (Figure IV-6)

Overall theme: formal (Like Pecan tree wind rows and historic canals).

- Formal straight alignment and arrangement.
- Formal rows of a single species of canopy tree such as Chinese Pistache or Sissoo.
- Formal arrangement of complimentary and accent trees for nodes - palms and or flowering / color trees.
- Understory treatment may be a combination of turf, decomposed granite, and low shrubs and grasses in a formal uniform arrangement.
- Formal architectural features and or structures.

Themes for Special Emphasis Areas (Figure IV-7)

The first four themes represent design options for the overall landscape scheme of the proposed flood control facility alternatives. Themes for special emphasis areas can also be incorporated and combined with the

overall themes. Examples of themes for special emphasis areas applicable to the Durango area include the following:

Agricultural Heritage

- Design intent is preservation of open space / open character of existing agricultural areas with large set backs for channels and basins.
- Preserve mountain views.
- Concentration of larger and or accent plantings at nodal areas i.e. Date Palms or Chinese Pistache.
- Buildings, hardscape elements, design details, public art, and structures to reflect an agrarian theme.
- Historic mills could also be incorporated.
- Public education opportunity - agricultural history and significance of agriculture to the Durango area.

Historic Canal Theme

- Formal tree lined promenade.
- Hardscape elements, design details, bridges, structures, with designs reminiscent of historic canals.
- Public education opportunity - history and significance of canals to the Durango area.

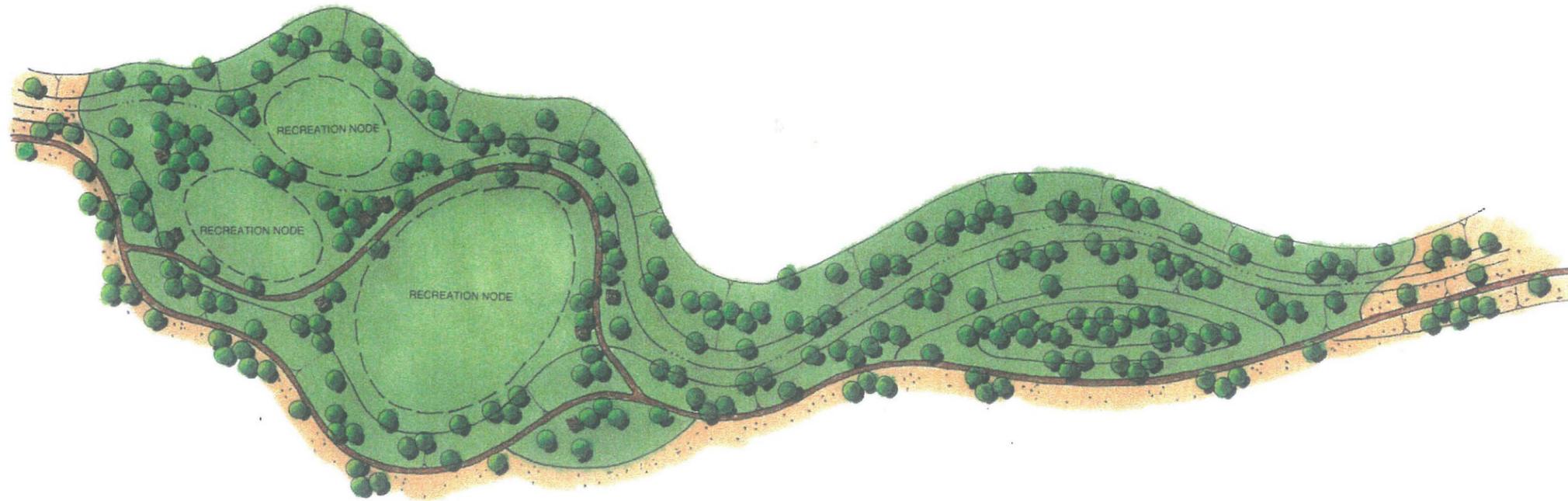
Railroad Theme

- Formal planting and hardscape arrangement with buildings, hardscape elements, design details, bridges, public art, signage, and structures featuring a railroad theme.
- Appropriate for alternatives following the alignment of the UPRR.
- Possible future light rail corridor.
- Public education opportunity - history and significance of the railroad to the Durango area.

Native American Theme

- Natural materials and layout.
- Hardscape elements, design details, public art, signage, bridges, structures, and logos / symbols featuring a Native American theme.
- Public education opportunity - history and significance of the Native Americans to the Durango area.

PARK-LIKE THEME



DESCRIPTION OF MAJOR DESIGN ELEMENTS

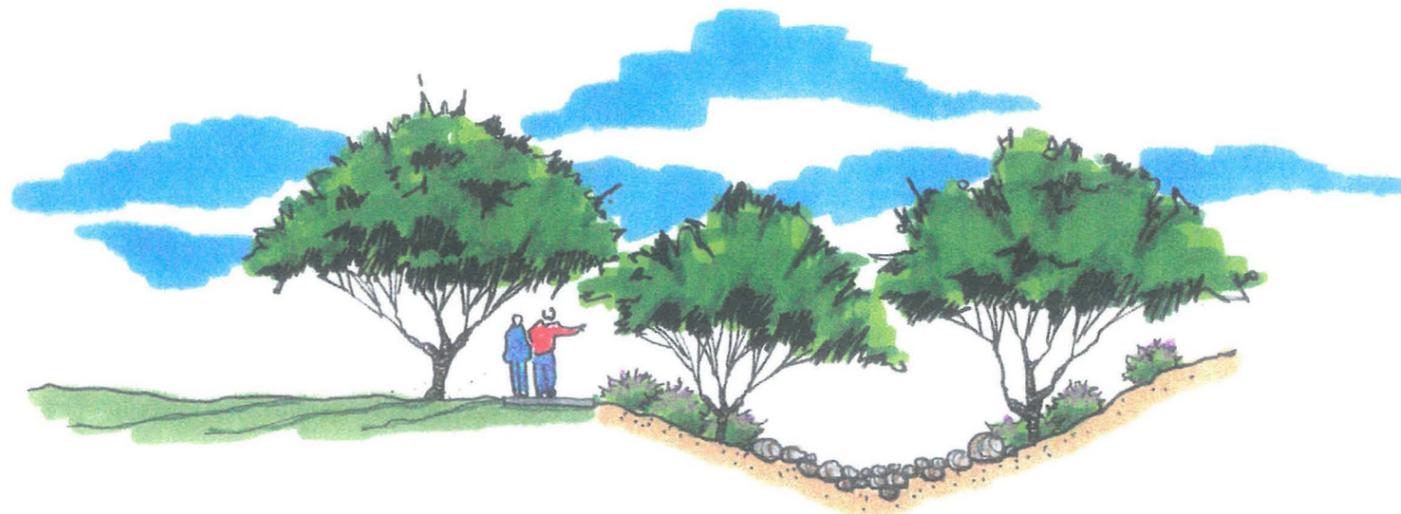
- OVERALL THEME — TURF GREEN BELT
- EMPHASIS ON ACTIVE RECREATION
- PARK AMENITIES
- TREE PALETTE — CHINESE PISTACHE, OAK, SISSOO, MESQUITE, ASH
- INFORMAL ARRANGEMENT — PROVIDE SHADE FOR USERS, DIRECT VIEWS
- GENTLE UNDULATING SIDESLOPES
- MULTI USE TRAIL
- MINIMIZE HARD STRUCTURES. FEATURES DESIGNED TO BLEND USING NATURAL MATERIALS OR MATERIALS WHICH ARE COLORED, STAINED, AND/OR TEXTURED TO BE COMPATIBLE.

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| <p>PARK-LIKE LANDSCAPE THEME</p> |

FIGURE IV-3

MODIFIED SONORAN DESERT THEME



DESCRIPTION OF MAJOR DESIGN ELEMENTS

- OVERALL THEME – MODIFIED NATURAL
- COMBINATION OF ACTIVE AND PASSIVE RECREATION AREAS
- PARK AMENITIES
- INFORMAL ARRANGEMENT OF MODIFIED SONORAN DESERT PLANT PALETTE CONSISTING OF MESQUITE, PALO VERDE, ACACIA, SISSOO, OAK, COTTONWOOD, AND WILLOW TREES WITH MASSINGS OF COMPATIBLE LOW WATER USE ARID REGION SHRUBS, GROUNDCOVERS AND ACCENT PLANTINGS DESIGNED TO MAXIMIZE VISUAL INTEREST, VARIETY, COLOR, AND TEXTURE.
- GENTLE UNDULATING SIDESLOPES
- NATURAL FORMS
- MULTI USE TRAIL
- MINIMIZE HARD STRUCTURES. FEATURES DESIGNED TO BLEND USING NATURAL MATERIALS OR MATERIALS WHICH ARE COLORED, STAINED, AND/OR TEXTURED TO BE COMPATIBLE.

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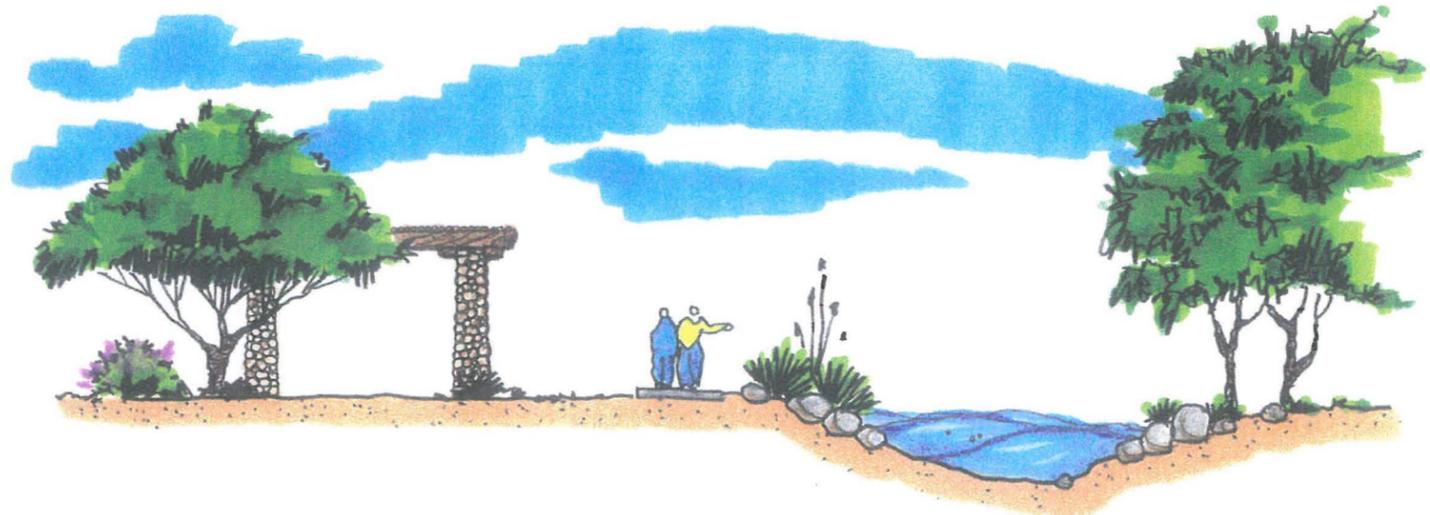
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PROJECT NO. FCD 99-41

McCloskey • Peltz, Inc.
LANDSCAPE ARCHITECTS

MODIFIED SONORAN DESERT
LANDSCAPE THEME

FIGURE IV-4

NATURAL THEME



DESCRIPTION OF MAJOR DESIGN ELEMENTS

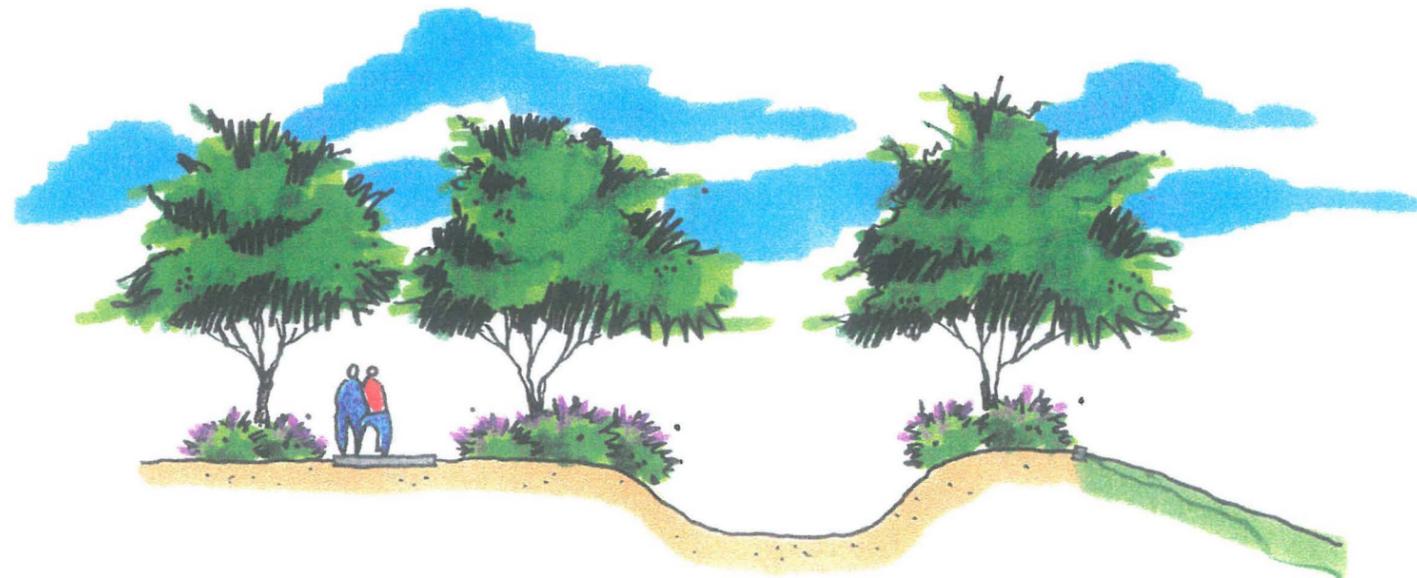
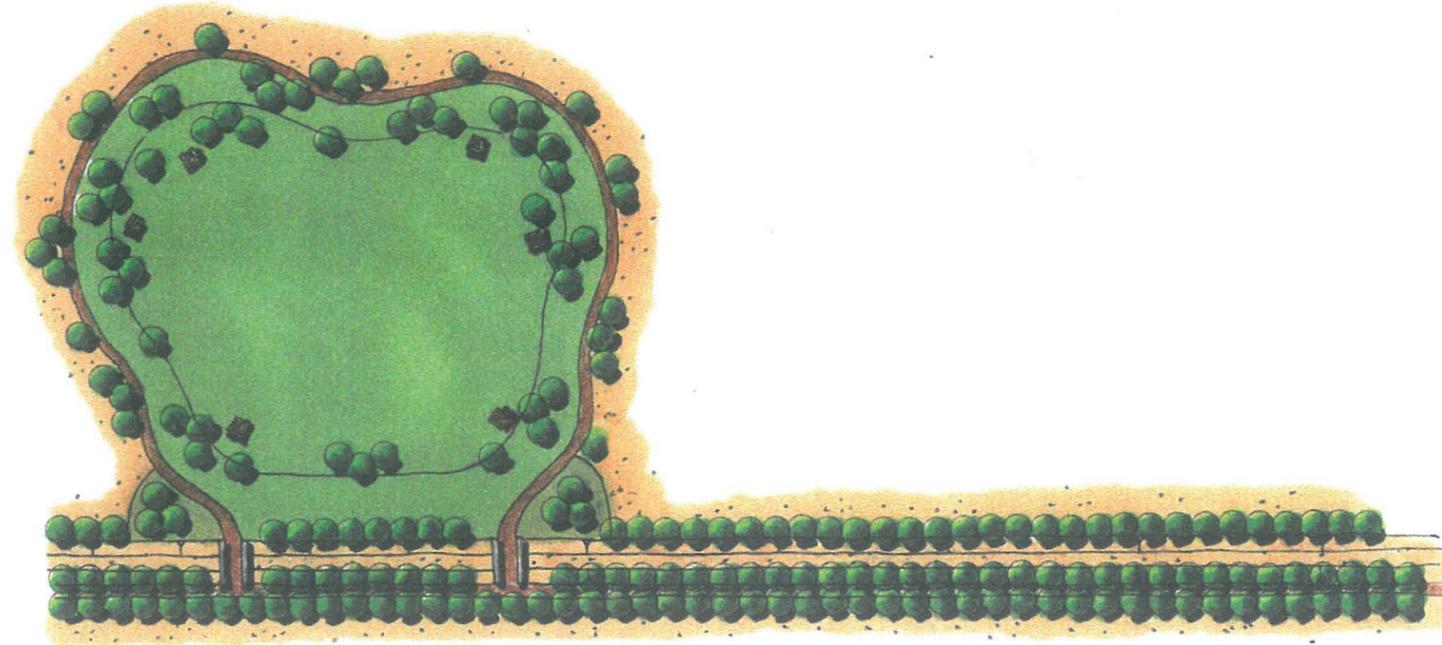
- OVERALL NATURAL APPEARING THEME
- NATURAL ORGANIC LANDFORMS AND LAYOUT
- NATURAL WATER FEATURES
- PUBLIC EDUCATION OPPORTUNITIES
- NATIVE PLANT PALETTE FEATURING COTTONWOOD AND WILLOW TREES AND A RIPARIAN SHRUB PALETTE ALONG LOW FLOW AREAS TRANSITIONING TO MESQUITE AND PALO VERDE TREES WITH A NATIVE INDIGENOUS SHRUB PALETTE IN UPLAND AREAS.
- BIRD AND WILDLIFE HABITAT IMPROVEMENT
- EXTENSIVE USE OF NATURAL MATERIALS – RIVER RUN ROCK, STONE, AND WOOD FOR SITE FEATURES AND STRUCTURES

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| PROJECT TITLE | DURANGO AREA DRAINAGE MASTER PLAN PROJECT NO. FCD 99-41 |
| DESIGNER | McCloskey • Peltz, Inc. LANDSCAPE ARCHITECTS |
| DATE | NATURAL LANDSCAPE THEME |

FIGURE IV-5

FORMAL PROMENADE THEME



DESCRIPTION OF MAJOR DESIGN ELEMENTS

- OVERALL FORMAL THEME
- FORMAL STRAIGHT ALIGNMENT
- FEATURES FORMAL ROWS OF SINGLE SPECIES CANOPY TREES SUCH AS CHINESE PISTACHE OR SISSOO
- LIKE EXISTING PECAN TREE WINDBREAKS
- UNDERSTORY TREATMENT MAY BE COMBINATION OF TURF, DECOMPOSED GRANITE, AND LOW GREEN SHRUBS AND GRASSES IN A FORMAL ARRANGEMENT
- FORMAL ARRANGEMENT OF COMPLIMENTARY AND ACCENT TREE(S) FOR NODES
- FORMAL ARCHITECTURAL FEATURES AND STRUCTURES

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| <p>McCloskey • Peitz, Inc. LANDSCAPE ARCHITECTS</p> |
| <p>FORMAL PROMENADE LANDSCAPE THEME</p> |

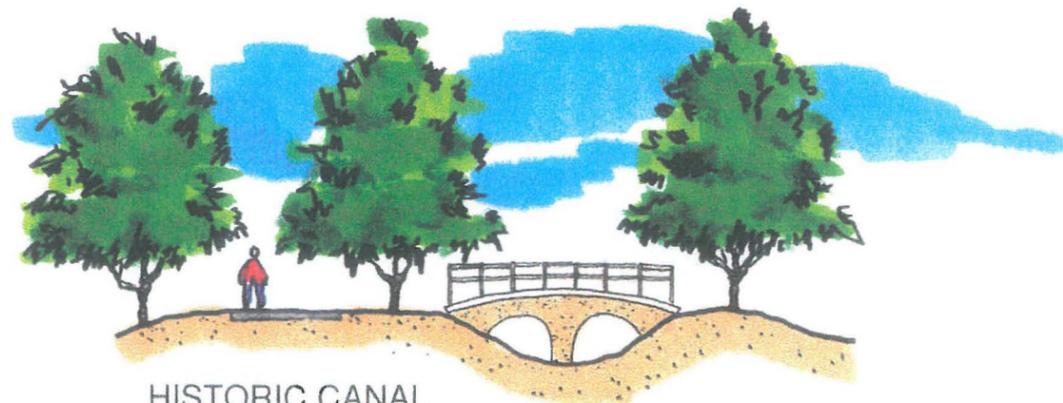
FIGURE IV-6

THEMES FOR SPECIAL EMPHASIS AREAS



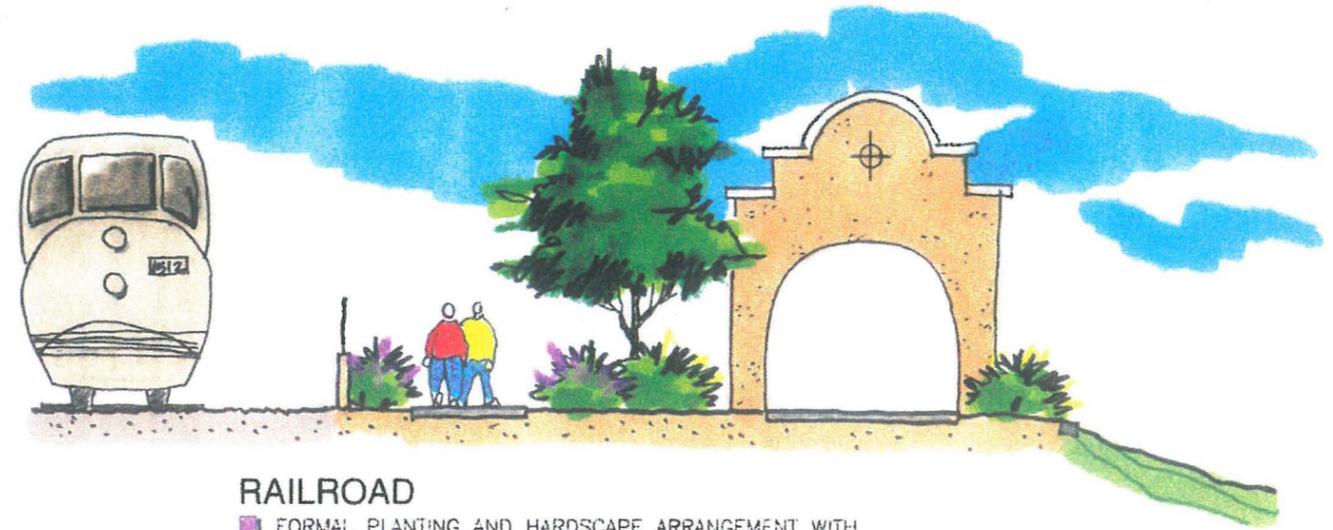
AGRICULTURAL HERITAGE

- DESIGN INTENT IS PRESERVATION OF OPEN SPACE / OPEN CHARACTER OF AGRICULTURAL AREAS WITH LARGE SETBACKS FOR CHANNELS AND BASINS
- PRESERVE MOUNTAIN VIEWS
- CONCENTRATION OF LARGER AND/OR ACCENT PLANTINGS AT NODAL AREAS I.E. DATE PALMS, CHINESE PISTACHE
- BUILDINGS, HARDSCAPE ELEMENTS, DESIGN DETAILS, PUBLIC ART AND STRUCTURES TO REFLECT AN AGRARIAN THEME
- PUBLIC EDUCATION OPPORTUNITY -- AGRICULTURAL HISTORY AND SIGNIFICANCE OF AGRICULTURE TO THE DURANGO AREA



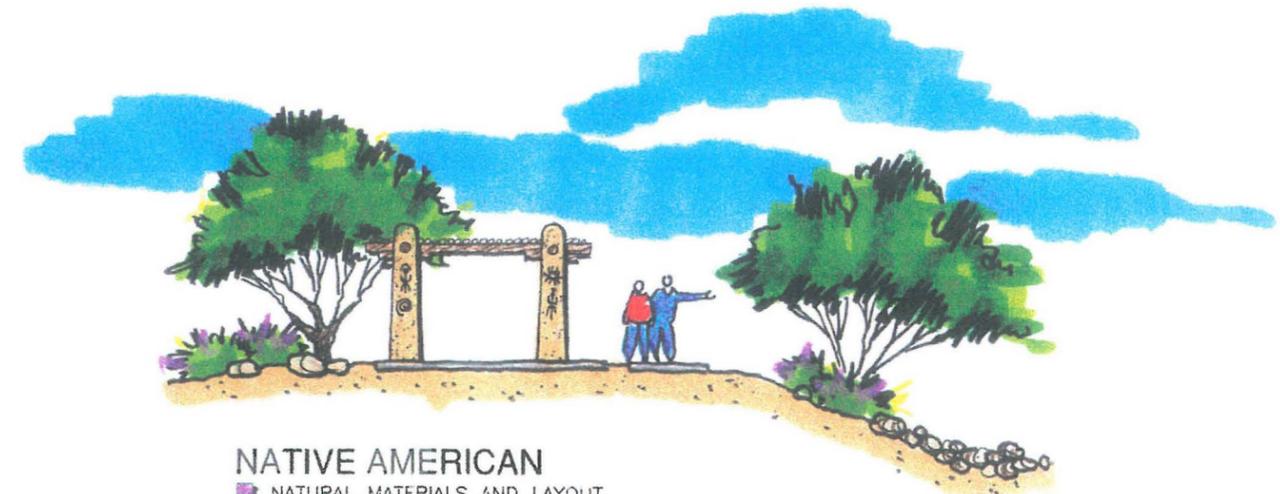
HISTORIC CANAL

- FORMAL TREE LINED PROMENADE
- HARDSCAPE ELEMENTS, DESIGN DETAILS, BRIDGES, STRUCTURES, WITH DESIGNS REMINISCENT OF HISTORIC CANALS
- PUBLIC EDUCATION OPPORTUNITY -- HISTORY AND SIGNIFICANCE OF CANALS TO THE DURANGO AREA



RAILROAD

- FORMAL PLANTING AND HARDSCAPE ARRANGEMENT WITH BUILDINGS, HARDSCAPE ELEMENTS, DESIGN DETAILS, BRIDGES, PUBLIC ART AND STRUCTURES FEATURING A RAILROAD THEME.
- PUBLIC EDUCATION OPPORTUNITY -- HISTORY AND SIGNIFICANCE OF THE RAILROAD TO THE DURANGO AREA
- POSSIBLE FUTURE LIGHT RAIL CORRIDOR



NATIVE AMERICAN

- NATURAL MATERIALS AND LAYOUT
- HARDSCAPE ELEMENTS, DESIGN DETAILS, PUBLIC ART, BRIDGES, STRUCTURES, AND LOGOS/SYMBOLS FEATURING A NATIVE AMERICAN THEME
- PUBLIC EDUCATION OPPORTUNITY -- HISTORY AND SIGNIFICANCE OF NATIVE AMERICANS TO THE DURANGO AREA

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DURANGO AREA DRAINAGE MASTER PLAN
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LANDSCAPE ARCHITECTS

LANDSCAPE THEMES FOR
SPECIAL EMPHASIS AREAS

FIGURE IV-7

E. General Environmental Issues

The environmental overview compiled in preparing the Durango ADMP included evaluations of ecology, historical and pre-historical themes, archaeology, socioeconomic factors, and hazardous materials within the project area. Each of these issues are summarized briefly in the remainder of this section, and described in greater detail in sections specific to individual storm water management alternatives.

Ecology

General reconnaissance surveys of the project area identified potentially sensitive biological resources, vegetation communities, and potential habitat for special interest species in areas along the Salt/Gila and Agua Fria Rivers. Approximately 95 percent of the project area has been disturbed by various human activities to the extent that non-native plant and animal species dominate the area. Little biological resource value is recognized in the urban and industrial areas, while agricultural areas provide habitat for rodents, granivorous birds, and raptors. Existing natural vegetation in the Durango area is essentially limited to intermittent riparian areas along the Gila, Salt, and Agua Fria Rivers. Vegetation communities are shown on Figure V-1 in the *Data Collection Report* submitted under separate cover for this study. A diverse population of birds and mammals (native and non-native) exists in and around the constructed wetland near the 91st Avenue Wastewater Treatment Plant. These areas may represent potential suitable habitat for some special interest species. It is believed that the presence of competitive, non-native aquatic species would preclude the establishment of native aquatic species in this constructed wetland. (Minckely, 1991)

Cultural Resources

Prehistorical

The prehistoric Hohokam culture occupied the Durango area for approximately 1,000 years, until around A.D. 1450. Evidence of their occupation has been documented in the various irrigation canals, village sites, and other artifacts distributed throughout the project area, shown on Figure V-2 in the *Data Collection Report* submitted under separate cover for this study. Development in the last 150 years has disturbed or destroyed much surface evidence of prehistoric peoples, however, abundant and unexamined subsurface features are likely to exist. The preservation and study of the prehistoric features within the Durango area are considered important in understanding the culture of the Hohokam, in fact, the Durango area lies within the Hohokam core area (Gumerman, 1991).

Historical

More recent development of the Durango area began in the 1860s with the surveying of the land and attempts to irrigate the Salt River Valley. Completion of the Theodore Roosevelt Dam on the Salt River in 1911 established a secure source of water for the Valley and encouraged further settling and development of the area. The Durango area was populated with approximately 80 farmhouses by the 1930s. Railways and highways were established to serve the farms and move crops and livestock. Residential subdivisions were established in the north eastern portion of the study area in the 1940s to house employees of defense plants and other industries. Between the period of 1911 and 1950, 14 dams and diversions had been built upstream of the Durango drainage area on the Salt, Gila, Agua Fria, and Verde rivers to reclaim the arid lands of Arizona (Rogge et al., 1994), and effectively drying up the natural flow of the rivers.

Social and Economic

Minority and low-income groups within the project area were identified through analysis of U.S. Census Bureau and Arizona Department of Economic Security data. The data were reviewed with respect to the 61 Census Block Groups that lie within the project area. Significant low-income populations were identified in approximately 18 percent of the block groups. Approximately 90 percent of the Durango area is populated with significant numbers of ethnic minorities. Significant proportions of minors and elderly individuals were identified in approximately 40 of the block groups in the Durango area.

Hazardous Materials

A database search of 24 electronic environmental databases was completed to identify areas of sites of hazardous materials storage, as well as facilities which generate, treat, or dispose of hazardous waste. The databases searched include those associated with federal, state, and local environmental tracking, regulatory, and/or enforcement agencies and emergency responders. Several hundred facilities within the project area were identified in the database search, as is typical of an area with a history of industrial and commercial development. Identification of a facility on the list(s) may only indicate that the facility is complying with registration requirements and does not necessarily indicate that the facility is adversely affecting human health or the environment. Additional research about specific facilities would be necessary to evaluate their potential effects on the project area. Most sites within the surrounding project area were found in the following databases:

- *Hazardous Materials Information Reporting System* - a database that contains hazardous material spill incidents that have been reported to the U.S. Department of Transportation.

- *Resource Conservation and Recovery Information System* - a database that contains information on hazardous waste handlers that are regulated by the EPA under RCRA.

- *Facility Index System/Facility Identification Initiative Program* an EPA site list that contains information on various facilities and guidance to other sources that contain additional facility details.

- *Leaking Underground Storage Tank List* - a record that contains an inventory of reported leaking underground storage tank incidents.

- *Hazardous Material Logbook* - a list that documents chemical spills and incidents.

- *Underground Storage Tank Listing* - a list of registered underground storage tank sites.

Complete results from the Hazardous Material Database Search can be found in the *Data Collection Report* for this project submitted under separate cover (March 2000). The proposed project routes are designed not to impact any hazardous sites found in the database search.

General Environmental Summary

The overall environmental impacts to the study area will be minimal due to the proposed projects. There will be no significant environmental impact due to hazardous materials within the alternatives' surrounding areas. The study area, as stated, is 95% disturbed with little vegetation and low biological resource value. The only potential habitat impacts for sensitive species are in areas along the Salt and Agua Fria Rivers and will be minimized with project planning. Although there are cultural resources present within the area, activities are planned for maximum avoidance.

F. Potential Alternatives

This section summarizes the drainage alternatives identified during the brainstorming session (Alternatives B-1 through B-6) as well as the seed alternatives presented by the consultant team (Alternatives S-1 through S-8).

The objective within the study area is to evaluate opportunities for structural or non-structural solutions, which can mitigate the impacts of the existing FEMA floodplain and provide for a regional drainage system. Residential and industrial development is occurring at a rapid pace in the study area, and provides a challenge in determining alternatives for the drainage solutions.

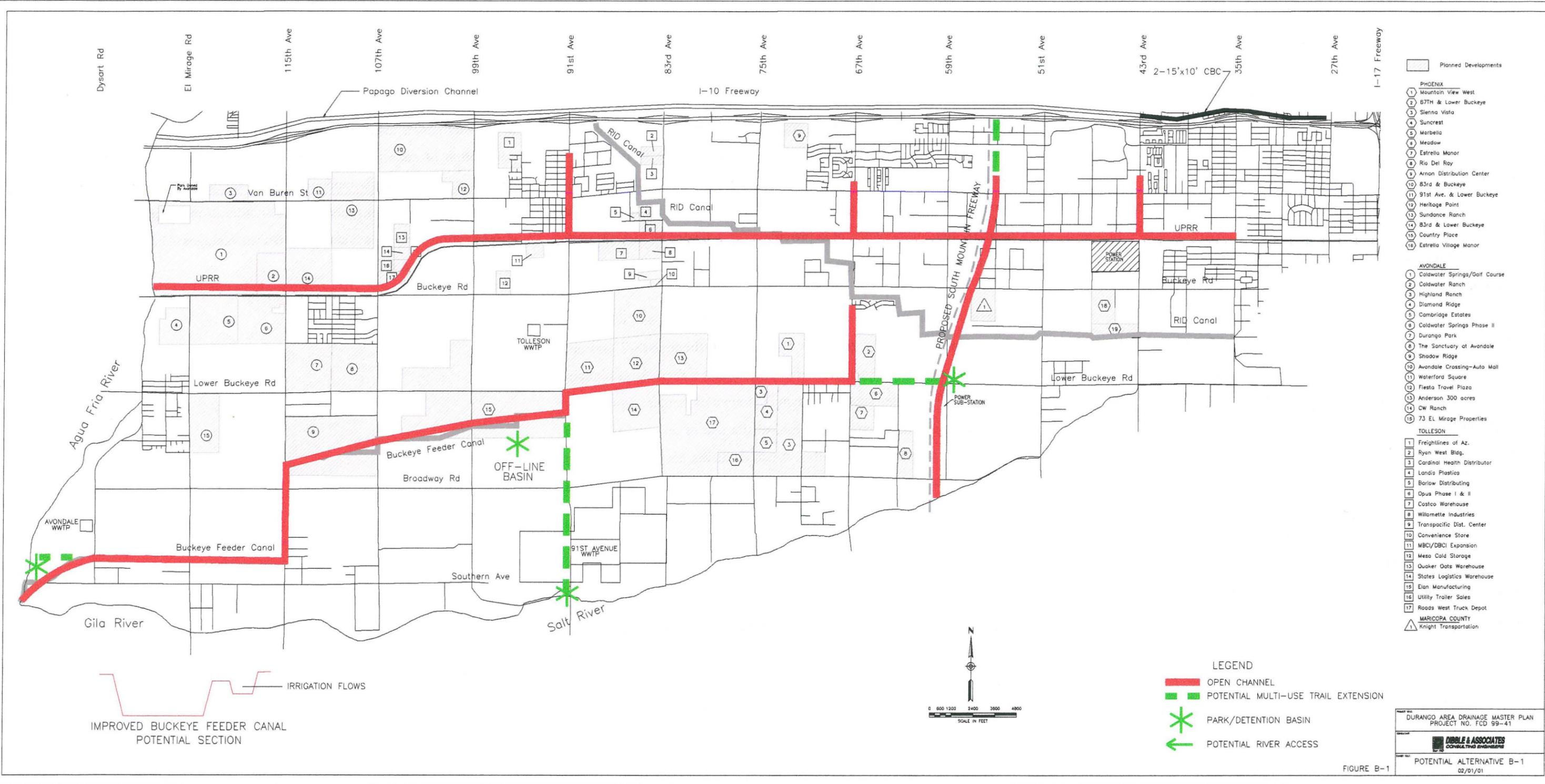
Several alternatives were identified for the entire study area, which are shown on **Figures B-1 through B-5** and **S-1 through S-7** and are summarized in the following sections. Many of the alternatives contain common components such as a channel along a particular alignment, a detention basin in a certain location, or the use of an existing storm drain system. Additionally, all of the alternatives are proposed to be natural appearing multi-use facilities, unless specifically stated otherwise, even though some of the exhibits do not show the trail/multi-use alignments along the channel alignments. The use of natural appearing multi-use channels is considered to be an advantage.

There are two alternatives not shown on figures, but also summarized in the following sections. Alternatives B-6 and S-8 are potential alternatives that are non-structural in nature, and are included for further evaluation along with the structural potential alternatives.

A relative cost of "low", "medium", or "high" is identified with each of the alternatives. These relative costs are based on the total length of

channel and the channel type for each alternative. The relative cost considers capital cost only and does not take into account any damage costs that are incurred or avoided by a particular alternative or the annual maintenance costs.

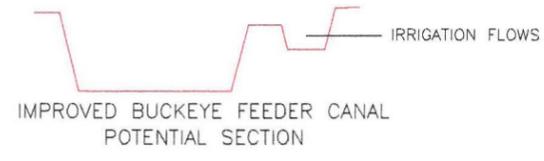
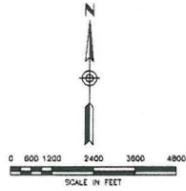
Since the area is being evaluated as one complete drainage system, each of the alternatives listed in the following sections, includes a complete description of each of the components contained in the alternative. Therefore a particular component may be described in more than one alternative. The engineering considerations, environmental considerations, and the advantages and disadvantages of each alternative are also discussed.



- Planned Developments
- PHOENIX**
- 1 Mountain View West
 - 2 67th & Lower Buckeye
 - 3 Sierra Vista
 - 4 Suncrest
 - 5 Marbella
 - 6 Meadow
 - 7 Estrella Manor
 - 8 Rio Del Rey
 - 9 Arroyo Distribution Center
 - 10 83rd & Buckeye
 - 11 91st Ave. & Lower Buckeye
 - 12 Heritage Point
 - 13 Sundance Ranch
 - 14 83rd & Lower Buckeye
 - 15 Country Place
 - 16 Estrella Village Manor
- AVONDALE**
- 1 Coldwater Springs/Golf Course
 - 2 Coldwater Ranch
 - 3 Highland Ranch
 - 4 Diamond Ridge
 - 5 Cambridge Estates
 - 6 Coldwater Springs Phase II
 - 7 Durango Park
 - 8 The Sanctuary at Avondale
 - 9 Shadow Ridge
 - 10 Avondale Crossing-Auto Mall
 - 11 Waterford Square
 - 12 Fiesta Travel Plaza
 - 13 Anderson 300 acres
 - 14 CW Ranch
 - 15 73 El Mirage Properties
- TOLLESON**
- 1 Freightlines of Az.
 - 2 Ryan West Bldg.
 - 3 Cardinal Health Distributor
 - 4 Landis Plastics
 - 5 Barlow Distributing
 - 6 Opus Phase I & II
 - 7 Costco Warehouse
 - 8 Willamette Industries
 - 9 Transpacific Dist. Center
 - 10 Convenience Store
 - 11 MBCI/DBCI Expansion
 - 12 Mesa Cold Storage
 - 13 Quaker Oats Warehouse
 - 14 States Logistics Warehouse
 - 15 Elan Manufacturing
 - 16 Utility Trailer Sales
 - 17 Roads West Truck Depot
- MARICOPA COUNTY**
- 1 Knight Transportation

LEGEND

- OPEN CHANNEL
- POTENTIAL MULTI-USE TRAIL EXTENSION
- * PARK/DETENTION BASIN
- ← POTENTIAL RIVER ACCESS



1. Alternative B-1 (Figure B-1)

Relative Cost: High

Description:

Alternative B-1 consists of three main open channel alignments to convey runoff. The first channel alignment includes the north side of the UPRR from 35th Avenue to the Agua Fria River with smaller tributary channels along 43rd Avenue, 67th Avenue, and 91st Avenue. The second channel alignment extends from the corner of the RID canal and 67th Avenue south to Lower Buckeye, then west to 91st Avenue and Lower Buckeye, and south to meet the beginning of the BFC which would be improved to the west out to the confluence of the Agua Fria and Gila Rivers. The third channel alignment is along the proposed South Mountain Freeway alignment from Van Buren Street south to the Salt River. The first two open channels are Natural Appearing Multi-use (NAMU) channels which promote an environmentally friendly method of flood control. An offline detention basin is included between 91st Avenue and 99th Avenue south of the BFC channel.

Engineering Considerations:

This alternative has some redundancy in channel alignments with the crossing of the railroad and freeway channels. More realistically, the channels would be reconfigured to eliminate any crossings, increasing efficiency of the drainage system. The freeway alignment could be constructed by ADOT as part of the proposed freeway project. Existing development is extremely heavy along the railroad, east of 75th Avenue. Crossing the RID canal with an open channel along the railroad may be difficult.

Advantages:

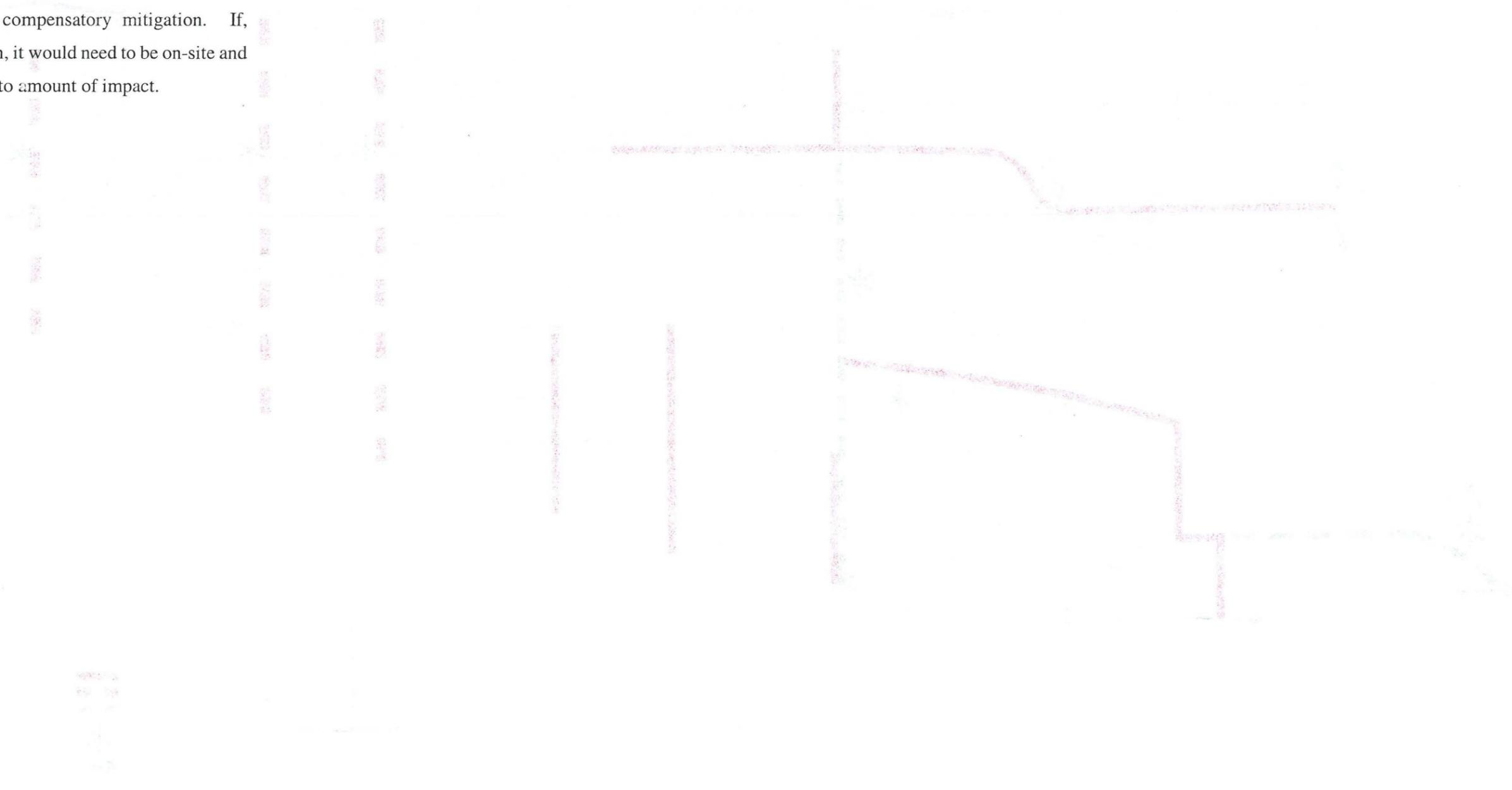
- Use of existing BFC alignment
 - May save money on right-of-way costs
 - Beneficial to SRP: no storm water in irrigation facilities
- Possible cost sharing with ADOT on proposed freeway alignment
- Railroad alignment is well suited to convey runoff currently ponding behind embankment because the elevated tracks act as a natural barrier for one side of a channel
- Utilizes the South Mountain Freeway corridor, a potential multi-use trail with regional connections
- Allows opportunities for river access and links to the regional trail system corridor along both the Salt/Gila and Agua Fria Rivers
- With the link between the BFC and the RID Canal corridors there results an opportunity for a completely linked trail system which serves a large portion of the Durango study area
- Allows the opportunity to increase aesthetic value and preserve open space along the railroad corridor much of which is in industrial areas.
- Utilizes many suggested trail corridors identified on City of Phoenix planning documents
- Allows the opportunity to preserve community open space in existing agricultural areas with multiple use trail linkages to neighborhood and community parks and the Estrella Village Core
- Avoids locations of most known prehistoric village sites and historic sites within the study area
- Minimal detrimental effects on riparian areas or areas of native vegetation
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas
- No known historic sites would be impacted under this alternative

Disadvantages:

- Use of existing BFC alignment may be longer than necessary to convey the runoff to an outfall location and drop structures along 115th Avenue would be required. Turning the channel south at approximately 117th Avenue down to the Gila River, per the 115th Avenue Drainage Concept Report, would result in a shorter path, saving money on construction costs.
- A pipe system would have to be constructed for SRP to collect the tailwater from the agricultural fields that the BFC is currently used for
- North-south alignment poses significant utility conflicts such as the 99" sewer line in Broadway Road
- Channel north of the railroad would be costly to construct east of 75th Avenue due to the high density of buildings and existing development. Existing buildings and development have resulted in minimal to no contiguous available channel corridors adjacent to the railroad in this area.
- Emphasis on conveyance means channel sizes will have to be large enough to convey the full 100 year unattenuated flow, resulting in higher right-of-way costs
- Criss-crossing of channels is complex and unnecessary
- Emphasis on east-west corridors does not best maximize the opportunity to preserve and enhance the existing mountain views to the south
- May encounter numerous hazardous materials sites in northeastern portion of proposed pathway. Generally, the majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed.
- Passes through the Pueblo Del Alamo (between Buckeye and Broadway roads and between 51st and 63rd Avenue) and Fowler Ruin (between 67th and 75th Avenue and between McDowell and Buckeye

roads), and several Hohokam canal prehistoric sites. These sites would not be impacted by this alternative. Estimated cost for mitigation of this type of previously recorded sites cannot be made until site-specific testing is conducted.

- NPDES and 404 permit/mitigation required for multiple discharges to Salt, Gila, and Agua Fria Rivers. Nationwide Permits for outfall structures typically do not require compensatory mitigation. If, however, the Corps requires mitigation, it would need to be on-site and in-kind, with a 1:1 ratio of mitigation to amount of impact.





2. **Alternative B-2** (Figure B-2)

Relative Cost: High

Description:

Alternative B-2 proposes a set of north-south channels or pipes in the eastern portion of the study area on 35th Avenue, 51st Avenue and 59th Avenue from Interstate 10 to the Salt River. North-south channels would be along the 71st Avenue and 79th Avenue alignments from Lower Buckeye Road to the Salt River and on 91st Avenue from Broadway Road to the Salt River. Two main east-west channels are included for the western portion of the study area. The first would be the north side of the UPRR from 75th Avenue to the Agua Fria River with a smaller tributary channel along 91st Avenue. The second would be along the alignment of the BFC from 91st Avenue to approximately 1/4 mile west and 1/4 mile north of 115th Avenue and Southern Avenue, at which point the channel would turn south and outfall into the Gila River. Eight parks / detention basins and a semi-linked trail system are included along the channel alignments of this alternative.

Engineering Considerations:

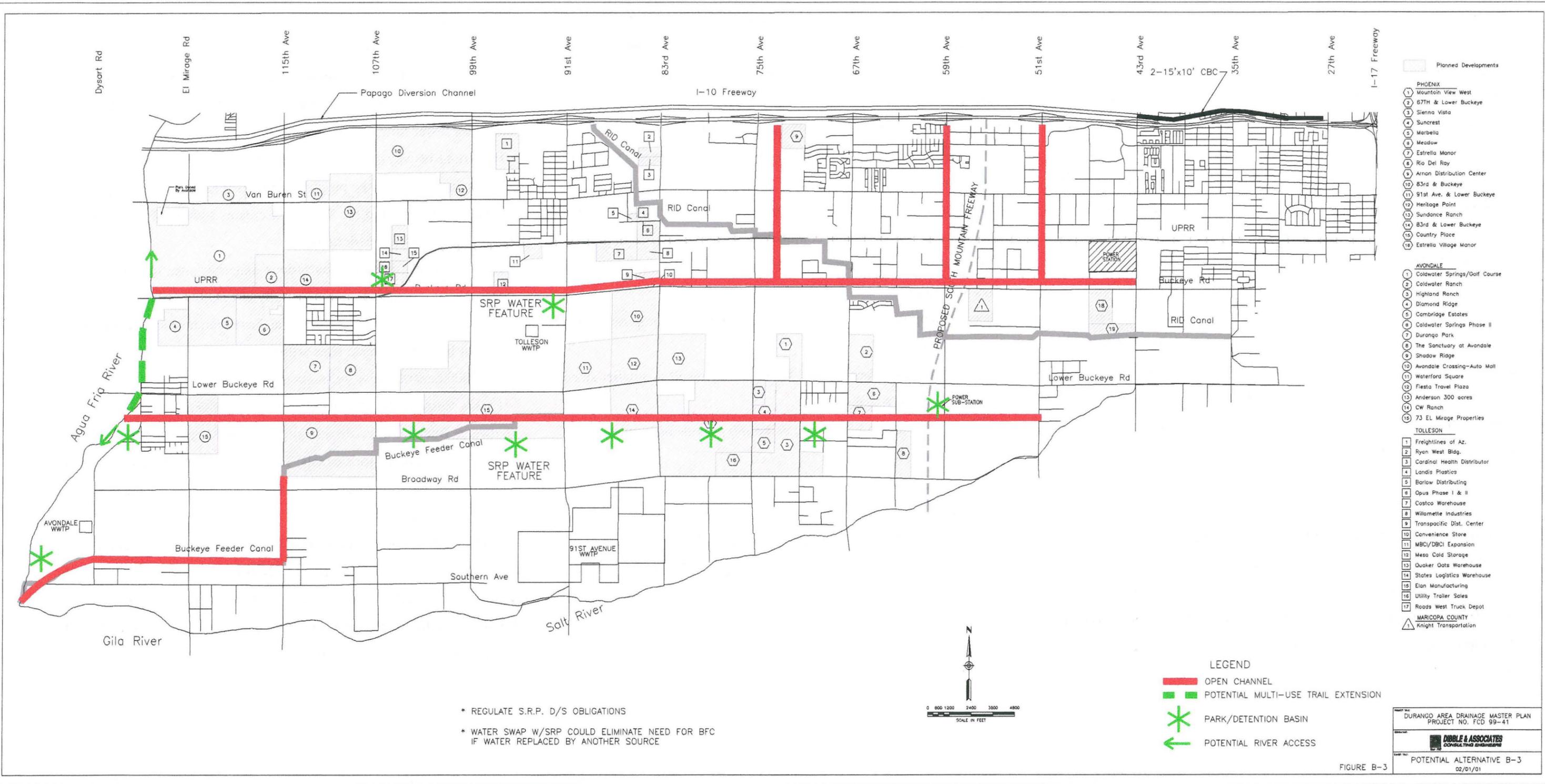
Existing Development in the northeast region of the study area is heavy. The use of frequent alignments will have an overall result of smaller channels with lower flows, however right-of-way costs tend to increase. The BFC alignment passes through the middle of several proposed developments that may have zoning plans approved already.

Advantages:

- Possible use of the existing storm drain system in the eastern portion of the study area, saving money on construction and right-of-way costs
- Partial use of the BFC alignment along with turning the channel south near 115th Avenue and Southern Avenue saving money on construction and right-of-way costs
- Frequent spacing will result in smaller channels
- Solutions are located and spaced in a manner to encompass the entire Durango study area
- Parks and semi-linked trail system also provide recreational opportunities to the public in conjunction with a flood control project.
- North south alignments offer greater opportunity to preserve mountain views to the south
- Maximizes opportunities for river access along trails proposed in the Estrella Village Plan.
- Larger quantity of flood control features may result in smaller sized facilities with less visual impact
- Opportunity to increase aesthetic value and provide open space along the railroad corridor
- Minimal detrimental effects on riparian areas or areas of native vegetation
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas

Disadvantages:

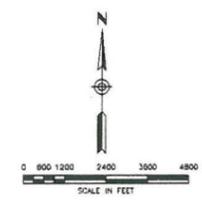
- If the existing storm drain pipes can not be used, construction cost of open channels in the eastern portion of the study area due to existing development will be high
- New north-south storm drain pipes will likely be difficult to construct in the eastern portion of the study area, due to existing large diameter east-west sewer lines
- High right-of-way cost due to frequent spacing of channels
- Two penetrations of the proposed Tres Rios Levee will be required
- Multiple outfalls into the Salt River creates additional issues due to possible 404 Permit restrictions
- May encounter numerous hazardous materials sites in northeastern portion of proposed pathway. Generally, the majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed.
- Passes through the Pueblo Del Alamo Hohokam, prehistoric site (between Buckeye and Broadway roads and between 51st and 63rd Avenue) and 11 prehistoric canals. Estimated cost for mitigation of this type of previously recorded site cannot be made until site-specific testing is conducted.
- NPDES and 404 permit/mitigation required for multiple discharges to Salt, Gila, and Agua Fria Rivers. Nationwide Permits for outfall structures typically do not require compensatory mitigation. If, however, the Corps require mitigation, it would need to be on-site and in-kind, with a 1:1 ratio of mitigation to amount of impact.



- Planned Developments**
- PHOENIX**
- 1 Mountain View West
 - 2 B7TH & Lower Buckeye
 - 3 Sierra Vista
 - 4 Suncrest
 - 5 Marbella
 - 6 Meadow
 - 7 Estrella Manor
 - 8 Rio Del Rey
 - 9 Arnon Distribution Center
 - 10 83rd & Buckeye
 - 11 91st Ave. & Lower Buckeye
 - 12 Heritage Point
 - 13 Sundance Ranch
 - 14 83rd & Lower Buckeye
 - 15 Country Place
 - 16 Estrella Village Manor
- AVONDALE**
- 1 Coldwater Springs/Golf Course
 - 2 Coldwater Ranch
 - 3 Highland Ranch
 - 4 Diamond Ridge
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 - 13 Quaker Oats Warehouse
 - 14 States Logistics Warehouse
 - 15 Elan Manufacturing
 - 16 Utility Trailer Sales
 - 17 Roads West Truck Depot
- MARICOPA COUNTY**
- ▲ Knight Transportation

* REGULATE S.R.P. D/S OBLIGATIONS

* WATER SWAP W/SRP COULD ELIMINATE NEED FOR BFC IF WATER REPLACED BY ANOTHER SOURCE



- LEGEND**
- OPEN CHANNEL
 - POTENTIAL MULTI-USE TRAIL EXTENSION
 - * PARK/DETENTION BASIN
 - ← POTENTIAL RIVER ACCESS

3. **Alternative B-3** (Figure B-3)

Relative Cost: High

Description:

Alternative B-3 consists of 2 main east-west open channels following Buckeye Road from 43rd Avenue to the Agua Fria River and the major powerline corridor between Broadway and Lower Buckeye Roads from 51st Avenue to the Agua Fria River. Additional tributary channels would be constructed along 51st Avenue, 59th Avenue, and east of 75th Avenue from Interstate 10 to the proposed channel along Buckeye Road. The BFC alignment would be used to convey runoff from 115th Avenue and Broadway out to the confluence of the Agua Fria and Gila Rivers. Two major detention basins would be utilized to attenuate the peak flows in the major channels. One would be near the Tolleson wastewater treatment plant and the other approximately one mile south near the powerline corridor. Additionally, seven parks are included along the alignment of the major channels. One option within this alternative is to eliminate the downstream SRP obligation to supply water to the Buckeye Irrigation District (BID) by having it replaced by another source such as the 91st Avenue wastewater treatment plant, therefore allowing the BFC to be open for flood control.

Engineering Considerations:

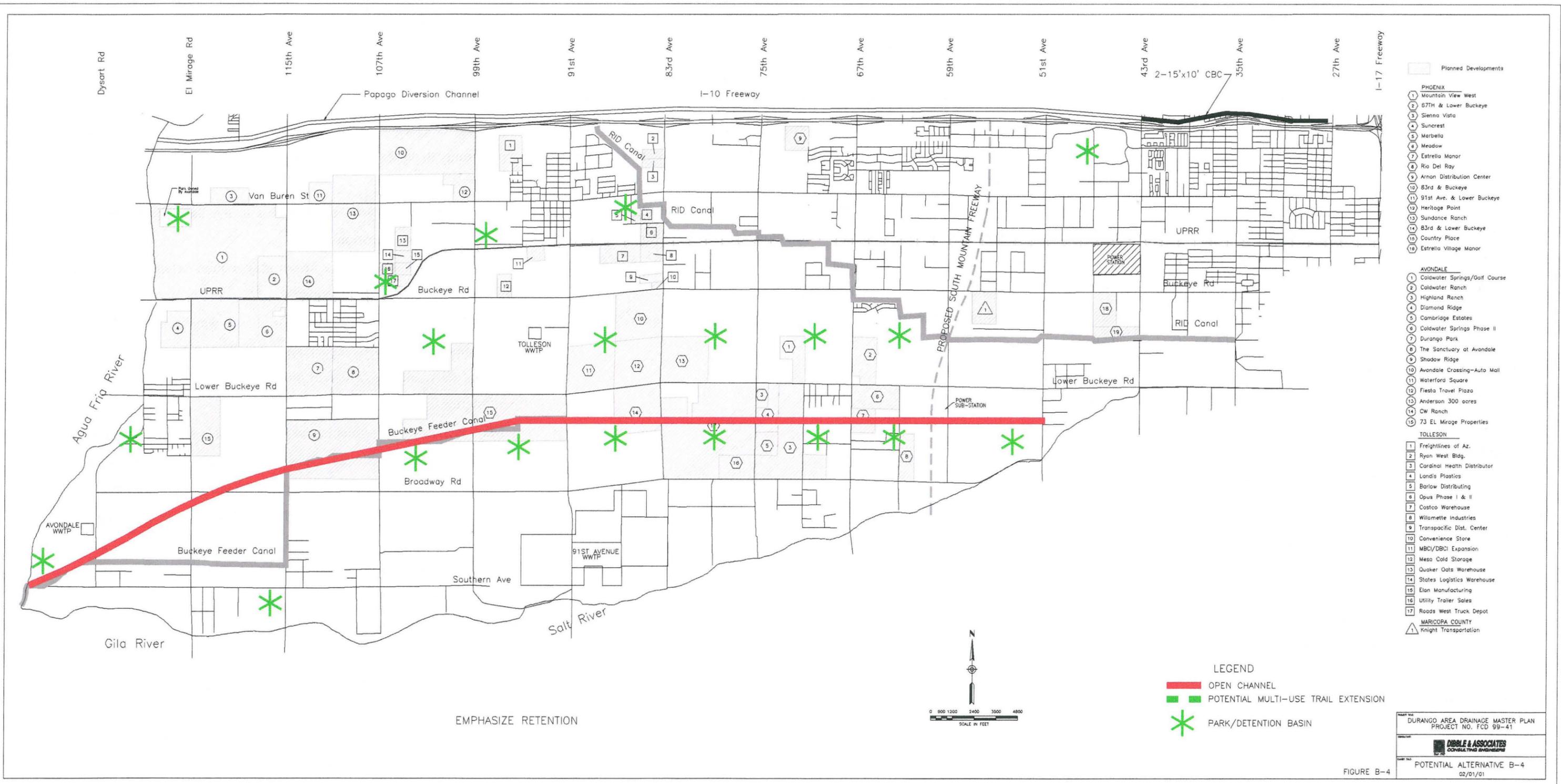
Heavy existing development along Buckeye Road may limit the use of an open channel east of 75th Avenue. Constructing a crossing of the railroad near the curve at 107th Avenue may be difficult. The use of only two main channels will result in an overall increase in the size of the channels to handle the concentrated flows.

Advantages:

- Use of the powerline corridor for a flood control channel provides an opportunity for multiple uses within a common easement, saving money on right-of-way costs
- Only one penetration will be required in the proposed Tres Rios Levee
- Numerous opportunities to incorporate or link to planned neighborhood and community park/open spaces
- Possibility of an additional visual amenity for the Durango study area consisting of a SRI water feature
- Avoids potential impacts to riparian habitat along Salt River
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas
- Minimal detrimental effects on riparian areas or areas of native vegetation

Disadvantages:

- Construction of a channel along Buckeye Road will be tight in the eastern portion of the study area and would likely have to be a concrete or piped facility
- East-west alignment of a channel in the powerline alignment, is not the shortest distance to an outfall
- Primary emphasis on east-west corridors does not best maximize the opportunity to preserve and enhance the existing mountain views to the south.
- There is no direct north-south access to the Salt/Gila River which allows for public recreation
- Use of a transmission line corridor may require extensive landscape mitigation to improve scenic quality
- Alignment along Buckeye Road right of way is a less desirable environment for a multi-use recreational trail from the standpoint of the health, safety, and enjoyment of the trail user, due to heavy traffic and will require a buffer zone
- May encounter numerous hazardous materials sites in northeastern portion of proposed pathway. Generally, the majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed.
- Passes through approximately 12 Hohokam canal and 2 Hohokam village prehistoric sites. Estimated cost for mitigation of this type of previously recorded sites cannot be made until site-specific testing is conducted.
- NPDES and 404 permit/mitigation required for multiple discharges to Salt, Gila, and Agua Fria Rivers. Nationwide Permits for outfall structures typically do not require compensatory mitigation. If, however, the Corps require mitigation, it would need to be on-site and in-kind, with a 1:1 ratio of mitigation to amount of impact.



4. **Alternative B-4** (Figure B-4)

Relative Cost: *Medium*

Description:

Alternative B-4 primarily emphasizes retention and consists of numerous parks used as retention and detention basins. A single open channel is included to convey flows captured in the retention and detention basins and would be aligned along the powerline easement between Lower Buckeye and Broadway Roads, from 51st Avenue to the BFC, then approximately following the BFC Alignment to 115th Avenue, and continuing in a southwest direction re-joining the BFC alignment near Dysart Road and outfalling at the confluence of the Agua Fria and Gila Rivers.

Engineering Considerations:

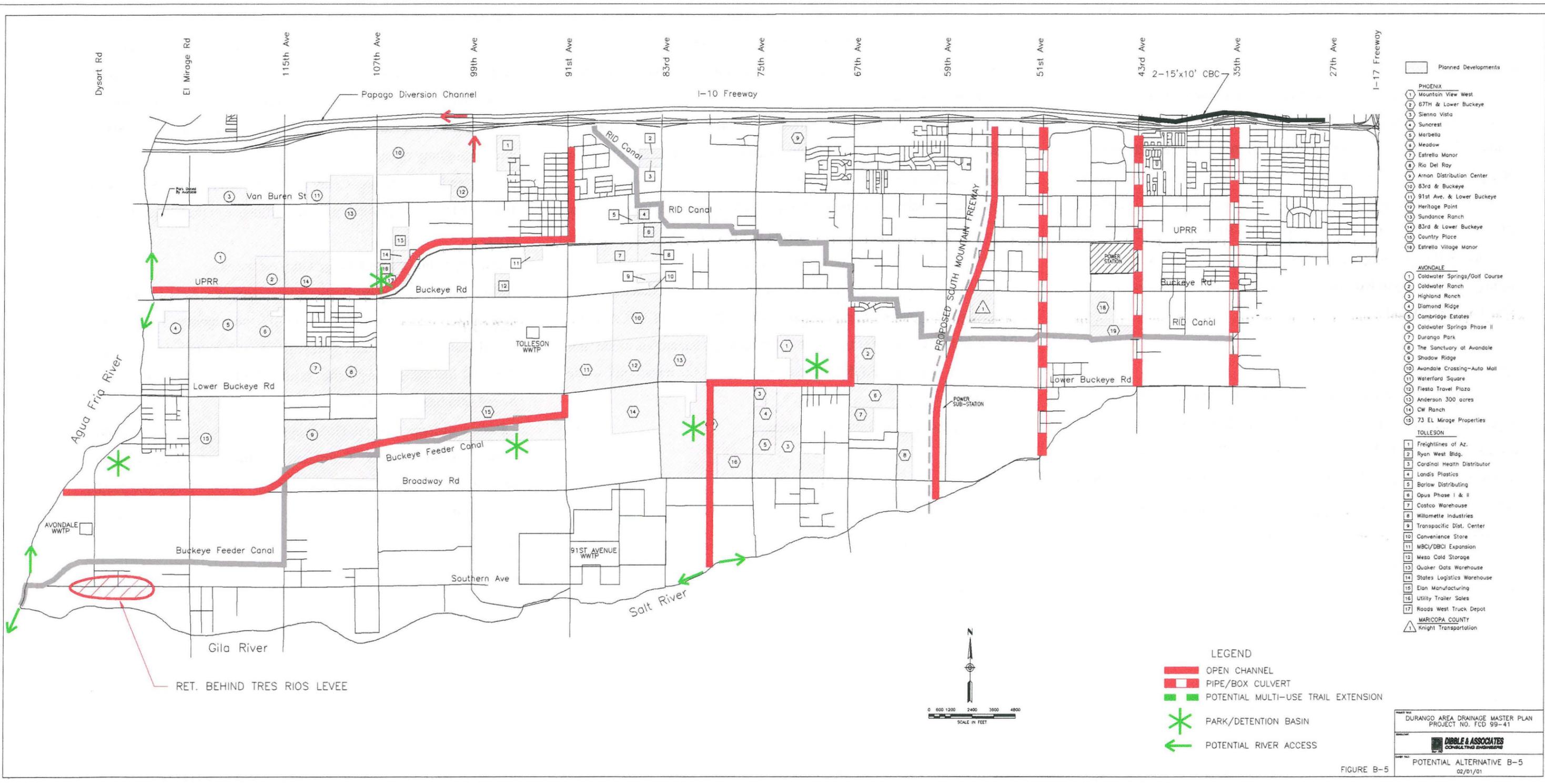
The use of a high number of retention or detention basins will result in a higher overall land cost. A solution such as drywells or tributary drains would have to be developed to drain all of the basins within 36 hours. Concentrating all of the flow into one alignment may result in a very large channel. Businesses and homeowners in the north study area will receive little or no benefit from the improvements.

Advantages:

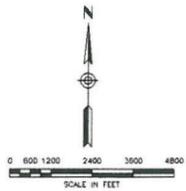
- Use of retention and detention basins may be environmentally friendly if created for multiple use opportunities such as parks and sports fields
- Only one penetration will be required in the proposed Tres Rios levee
- Open spaces may allow opportunities to preserve some panoramic mountain views
- Avoids potential impacts to riparian habitat along Gila and Salt Rivers
- Minimal detrimental effects on riparian areas or areas of native vegetation due to single discharge point
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas
- Avoids heaviest concentration of potential hazardous materials sites. Generally, the majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed
- No anticipated environmental impacts

Disadvantages:

- Does not directly address many of the known flooding problems or provide for a complete regional drainage solution
- Not a complete system. Will require several smaller tributary pipes and channels to convey runoff to the retention and detention basins
- Channel alignment cuts through several planned developments
- Offers fewer trail linkages between the planned parks / neighborhood and community open space areas or to regional trail systems
- A single discharge point may adversely affect the operations of the Buckeye Irrigation Company at the confluence of the Gila and Agua Fria Rivers
- Few opportunities for linkages to river access
- May encounter numerous hazardous materials sites in northeastern portion of proposed pathway. Generally, the majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed.
- Passes through several Hohokam canals and the two Pueblo Del Alamo prehistoric sites. Estimated cost for mitigation of this type of previously recorded sites cannot be made until site-specific testing is conducted.



- Planned Developments
- PHOENIX**
- Mountain View West
 - 67th & Lower Buckeye
 - Sienna Vista
 - Suncrest
 - Marbella
 - Meadow
 - Estrella Manor
 - Rio Del Rey
 - Arnon Distribution Center
 - 83rd & Buckeye
 - 91st Ave. & Lower Buckeye
 - Heritage Point
 - Sundance Ranch
 - 83rd & Lower Buckeye
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- Coldwater Springs/Golf Course
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 - States Logistics Warehouse
 - Elon Manufacturing
 - Utility Trailer Sales
 - Roads West Truck Depot
- MARICOPA COUNTY**
- Knight Transportation



DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

DOUBLE & ASSOCIATES
CONSULTING ENGINEERS

POTENTIAL ALTERNATIVE B-5
02/01/01

5. **Alternative B-5** (Figure B-5)

Relative Cost: High

Description:

Alternative B-5 consists of a combination of open channels, existing storm drain pipes, and detention basins. In the eastern portion of the study area, the existing storm drains in 35th Avenue, 43rd Avenue, and 51st Avenue would be utilized to convey runoff south to the Salt River. Four open channels would be built to convey runoff. The first along the alignment of the proposed South Mountain Freeway. The second alignment is from 67th Avenue and the RID Canal south to Lower Buckeye Road, west to 79th Avenue, and south to outfall at the Salt River. The third channel alignment is from 91st Avenue south of Interstate 10 to the UPRR, then west along the north side of the railroad with an outfall at the Agua Fria River. The last alignment is following the approximate BFC alignment from 91st Avenue to 115th Avenue, then following the powerline easement west to outfall at the Agua Fria River. Detention basins would be constructed in the vicinities of 71st Ave and Lower Buckeye Road, 79th Ave and the powerline easement, 95th Avenue just south of the BFC, 107th Avenue north of the UPRR, and Dysart and Broadway Roads. A retention basin would also be constructed behind a proposed Tres Rios levee to accommodate the interior drainage near the confluence of the Gila and Agua Fria Rivers.

Engineering Considerations:

The use of frequent alignments will have an overall result of smaller channels with lower flows, however right-of-way costs tend to increase. The freeway alignment could be constructed as a main drainage feature, by ADOT as part of the proposed freeway project.

Advantages:

- Use of existing storm drains which may save money on right-of-way costs
- Use of the proposed South Mountain Freeway alignment provides a possible cost sharing opportunity with ADOT
- Partial use of the BFC and powerline alignments which may save money on construction and right-of-way costs
- Only one levee penetration will be required
- Solutions are located and spaced in a manner to encompass the entire Durango study area
- Use of South Mountain Freeway corridor and potential for regional trail linkage as well as linkage to proposed Estrella Village Core
- Opportunity to preserve planned neighborhood and community open spaces in existing agricultural areas
- Combination of north-south and east-west alignments offers greater opportunity to take advantage of views in various directions
- Multiple opportunities for river access
- Larger quantity of flood control features may result in smaller sized facilities with less visual impact
- Opportunity to increase aesthetic value and provide open space along the railroad corridor
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas

Disadvantages:

- Does not fully address the known flooding problem north of the UPRR and RID Canal between 67th Avenue and 83rd Avenue
- Does not represent a linked multi-modal trail system. There is no connection provided between the RID Canal and BFC
- Use of the transmission line corridor poses a landscape mitigation challenge
- North-south alignment poses significant utility conflicts such as the 99" sewer line in Broadway Road
- May encounter numerous hazardous materials sites in northeastern portion of project area. The majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed.
- Passes through approximately 13 Hohokam canals and 3 Hohokam prehistoric village sites. Estimated cost for mitigation of this type of previously recorded sites cannot be made until site-specific testing is conducted.
- NPDES and 404 permit/mitigation required for multiple discharges to Salt, Gila, and Agua Fria Rivers. Nationwide Permits for outfall structures typically do not require compensatory mitigation. If, however, the Corps require mitigation, it would need to be on-site and in-kind, with a 1:1 ratio of mitigation to amount of impact.

6. Alternative B-6

Relative Cost: Low

Description:

Alternative B-6 is a non-structural alternative which consists of restricting development in the floodplain and purchasing homes and buildings currently prone to flooding. As development grows in the study area, enforcement of the local storm retention requirement within each jurisdiction would diminish the runoff into adjacent lands, resolving some of the existing flooding problems.

Engineering Considerations:

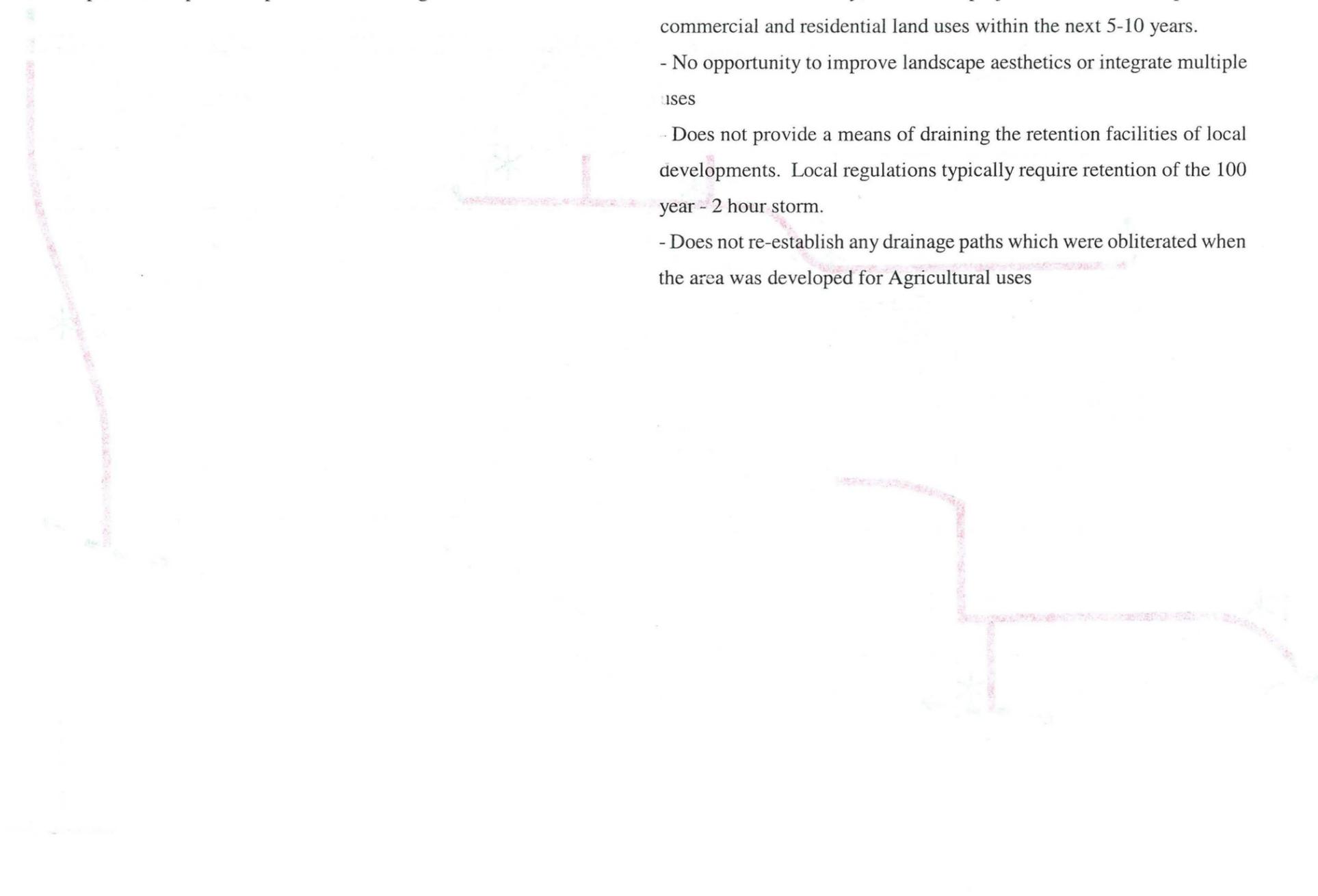
This alternative may require additional engineering studies to delineate and refine the floodplains throughout the study area. For future enforcement of the local storm retention requirements, the 100 year storm duration is typically less than that of the 100 year, 24 hour storm used for regional flood control design, resulting in a higher level of risk to residents.

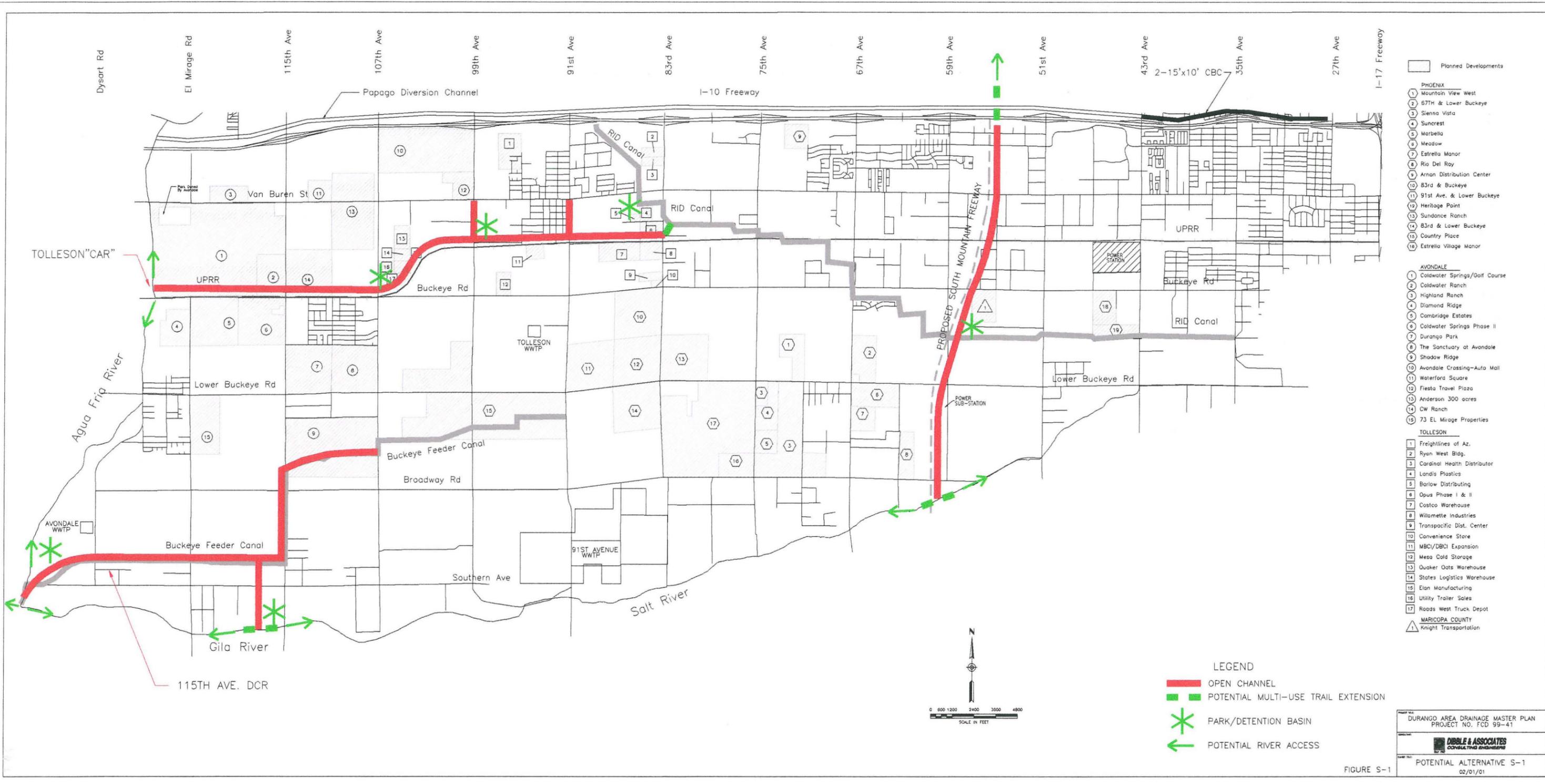
Advantages:

- Low capital cost
- Avoids all hazardous materials sites and prehistoric sites
- NPDES and 404 permit/mitigation not required
- Avoids potential impacts to riparian habitat along Gila and Salt Rivers

Disadvantages:

- High level of risk acceptance
- Does not address the known flooding problems described in section III
- Does not provide a regional drainage solution for the developed farmland. Additionally, this area is projected to be redeveloped with commercial and residential land uses within the next 5-10 years.
- No opportunity to improve landscape aesthetics or integrate multiple uses
- Does not provide a means of draining the retention facilities of local developments. Local regulations typically require retention of the 100 year - 2 hour storm.
- Does not re-establish any drainage paths which were obliterated when the area was developed for Agricultural uses





- Planned Developments**
- PHOENIX**
- 1 Mountain View West
 - 2 67th & Lower Buckeye
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 - 9 Arnon Distribution Center
 - 10 83rd & Buckeye
 - 11 91st Ave. & Lower Buckeye
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 - 14 States Logistics Warehouse
 - 15 Elan Manufacturing
 - 16 Utility Trailer Sales
 - 17 Roads West Truck Depot
- MARICOPA COUNTY**
- 1 Knight Transportation

LEGEND

- OPEN CHANNEL
- - - POTENTIAL MULTI-USE TRAIL EXTENSION
- ✱ PARK/DETENTION BASIN
- ← POTENTIAL RIVER ACCESS

DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

POTENTIAL ALTERNATIVE S-1
02/01/01

FIGURE S-1

7. **Alternative S-1** (Figure S-1)

Relative Cost: *Medium*

Description:

Alternative S-1 includes the preferred alternatives from two previous studies (*Tolleson Candidate Assessment Report* and *115th Avenue Drainage Concept Report*) and consists of three main open channel alignments to convey runoff. The first channel alignment includes the north side of the UPRR from 83rd Avenue to the Agua Fria River with smaller tributary channels along 91st Avenue and 99th Avenue as described in the *Tolleson Candidate Assessment Report*. The second channel alignment would be along the BFC from 107th Avenue to approximately 1/4 mile west of 115th Avenue with an outfall in the Gila River to the south as described in the *115th Ave Drainage Concept Report*. The third channel alignment would be along the proposed South Mountain Freeway alignment from Interstate 10 south to the Salt River. Five potential park / detention basin locations are identified along the channel alignments and a potential multi-use trail is identified along the alignment of the existing BFC.

Engineering Considerations:

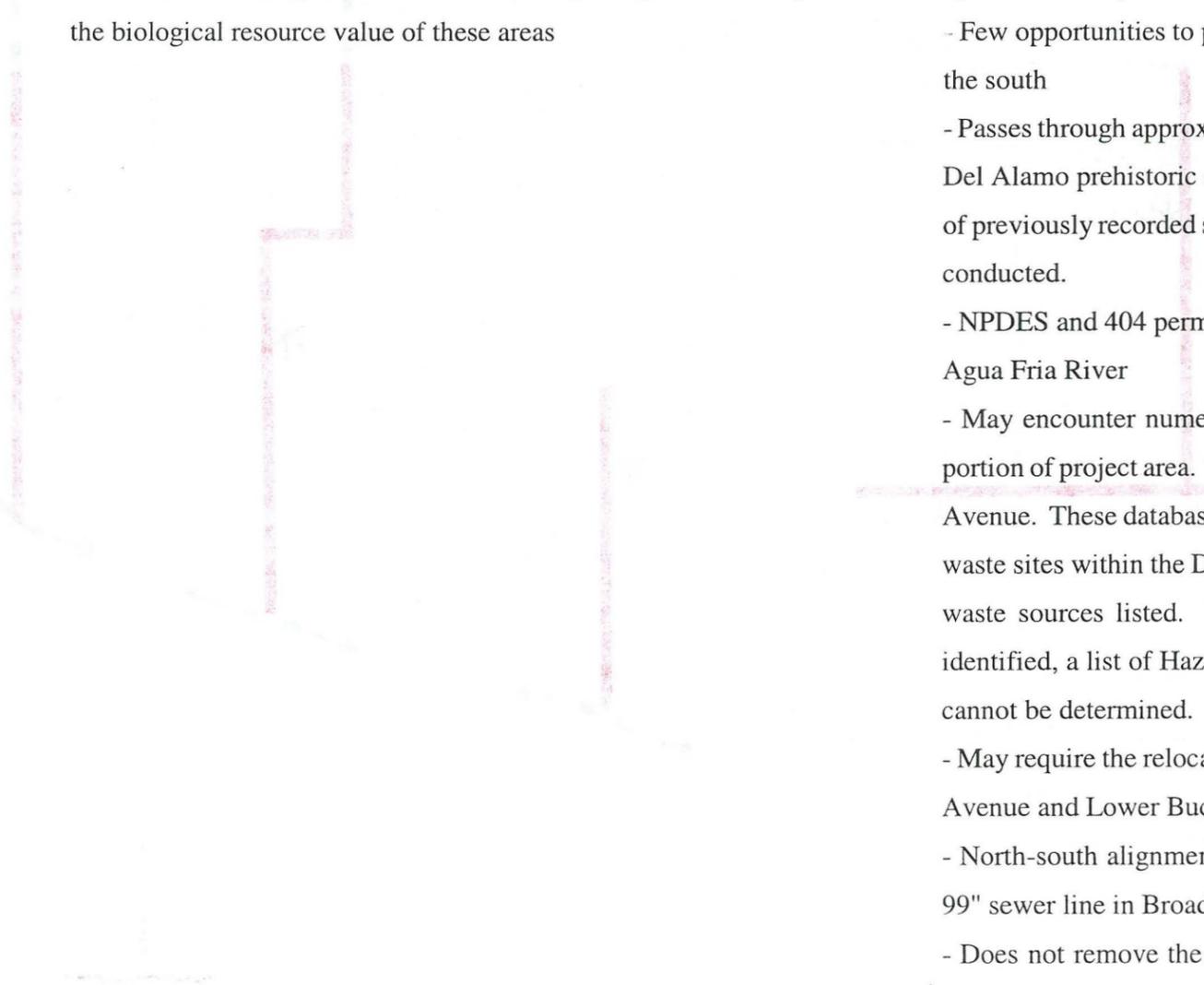
The freeway alignment could be constructed by ADOT as part of the proposed freeway project. Rapidly developing areas in the south-central region of the study area will have to extend the improvements or find a way to tie in to them to utilize a regional outfall.

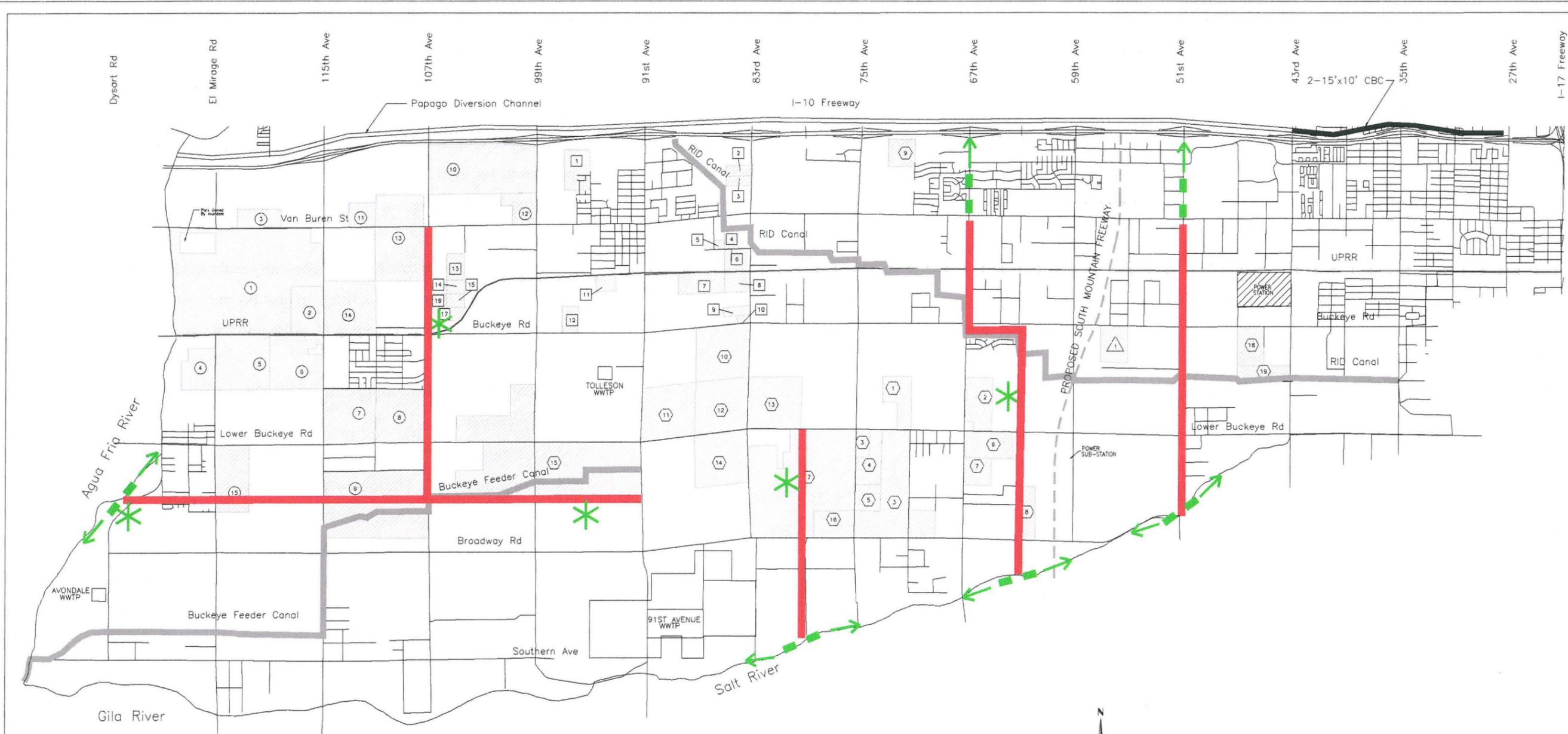
Advantages:

- The two previous studies adequately address the drainage issues for the particular area they apply to and can be easily adapted into the overall drainage solution
- Use of the proposed South Mountain Freeway alignment provides a possible cost sharing opportunity with ADOT
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas

Disadvantages:

- The two previous studies do not fully address all of the drainage problems for the entire study area and will need to be enhanced to provide a complete regional drainage solution
- Two penetrations will be required in the proposed Tres Rios levee
- Non-linked multi-modal trail system
- Few opportunities to access potential community park sites or open space areas for joint use and involvement of project partners
- Few opportunities to preserve or enhance existing mountain views to the south
- Passes through approximately 12 Hohokam canals and the two Pueblo Del Alamo prehistoric sites. Estimated cost for mitigation of this type of previously recorded sites cannot be made until site-specific testing is conducted.
- NPDES and 404 permit/mitigation required for multiple discharge to Agua Fria River
- May encounter numerous hazardous materials sites in northeastern portion of project area. The majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed. Until the exact location of this alternative is identified, a list of Hazardous Material sites and associated mitigation cannot be determined.
- May require the relocation of an APS power substation located at 59th Avenue and Lower Buckeye Road
- North-south alignment poses significant utility conflicts such as the 99" sewer line in Broadway Road
- Does not remove the floodplain along the north side of the railroad from 81st Avenue to 27th Avenue

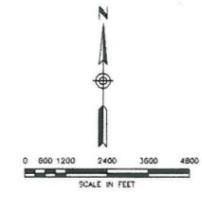




- Planned Developments
- PHOENIX
 - 1 Mountain View West
 - 2 87TH & Lower Buckeye
 - 3 Sienna Vista
 - 4 Suncrest
 - 5 Marbella
 - 6 Meadow
 - 7 Estrella Manor
 - 8 Rio Del Ray
 - 9 Arnon Distribution Center
 - 10 83rd & Buckeye
 - 11 91st Ave. & Lower Buckeye
 - 12 Heritage Point
 - 13 Sundance Ranch
 - 14 83rd & Lower Buckeye
 - 15 Country Place
 - 16 Estrella Village Manor
- AVONDALE
 - 1 Coldwater Springs/Golf Course
 - 2 Coldwater Ranch
 - 3 Highland Ranch
 - 4 Diamond Ridge
 - 5 Cambridge Estates
 - 6 Coldwater Springs Phase II
 - 7 Durango Park
 - 8 The Sanctuary at Avondale
 - 9 Shadow Ridge
 - 10 Avondale Crossing-Auto Mall
 - 11 Waterford Square
 - 12 Fiesta Travel Plaza
 - 13 Anderson 300 acres
 - 14 CW Ranch
 - 15 73 EL Mirage Properties
- TOLLESON
 - 1 Freightlines of Az.
 - 2 Ryan West Bldg.
 - 3 Cardinal Health Distributor
 - 4 Landis Plastics
 - 5 Barlow Distributing
 - 6 Opus Phase I & II
 - 7 Costco Warehouse
 - 8 Willamette Industries
 - 9 Transpacific Dist. Center
 - 10 Convenience Store
 - 11 MBI/DBCI Expansion
 - 12 Mesa Cold Storage
 - 13 Quaker Oats Warehouse
 - 14 States Logistics Warehouse
 - 15 Elan Manufacturing
 - 16 Utility Trailer Sales
 - 17 Roads West Truck Depot
- MARICOPA COUNTY
 - 1 Knight Transportation

LEGEND

- OPEN CHANNEL
- - - POTENTIAL MULTI-USE TRAIL EXTENSION
- * PARK/DETENTION BASIN
- POTENTIAL RIVER ACCESS



DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

DDBLE & ASSOCIATES
CONSULTING ENGINEERS

POTENTIAL ALTERNATIVE S-2
02/01/01

FIGURE S-2

8. Alternative S-2 (Figure S-2)

Relative Cost: *Medium*

Description:

Alternative S-2 consists of a set of north-south channels in the eastern portion of the study area and 2 main channels in the western portion of the study area. Channel alignments are included along 51st Avenue from Van Buren Street to the Salt River, along 67th Avenue from Van Buren Street to Buckeye Road then turning east to 71st Avenue and south to the Salt River, along 79th Avenue from Lower Buckeye Road to the Salt River, along the powerline easement south of Lower Buckeye Road from 91st Avenue to the Agua Fria River, and along 107th Avenue from Van Buren Street to the powerline easement alignment. Five parks, used as detention basins, are proposed along the channel alignments. Potential trail alignments could be extended from the channel alignments.

Engineering Considerations:

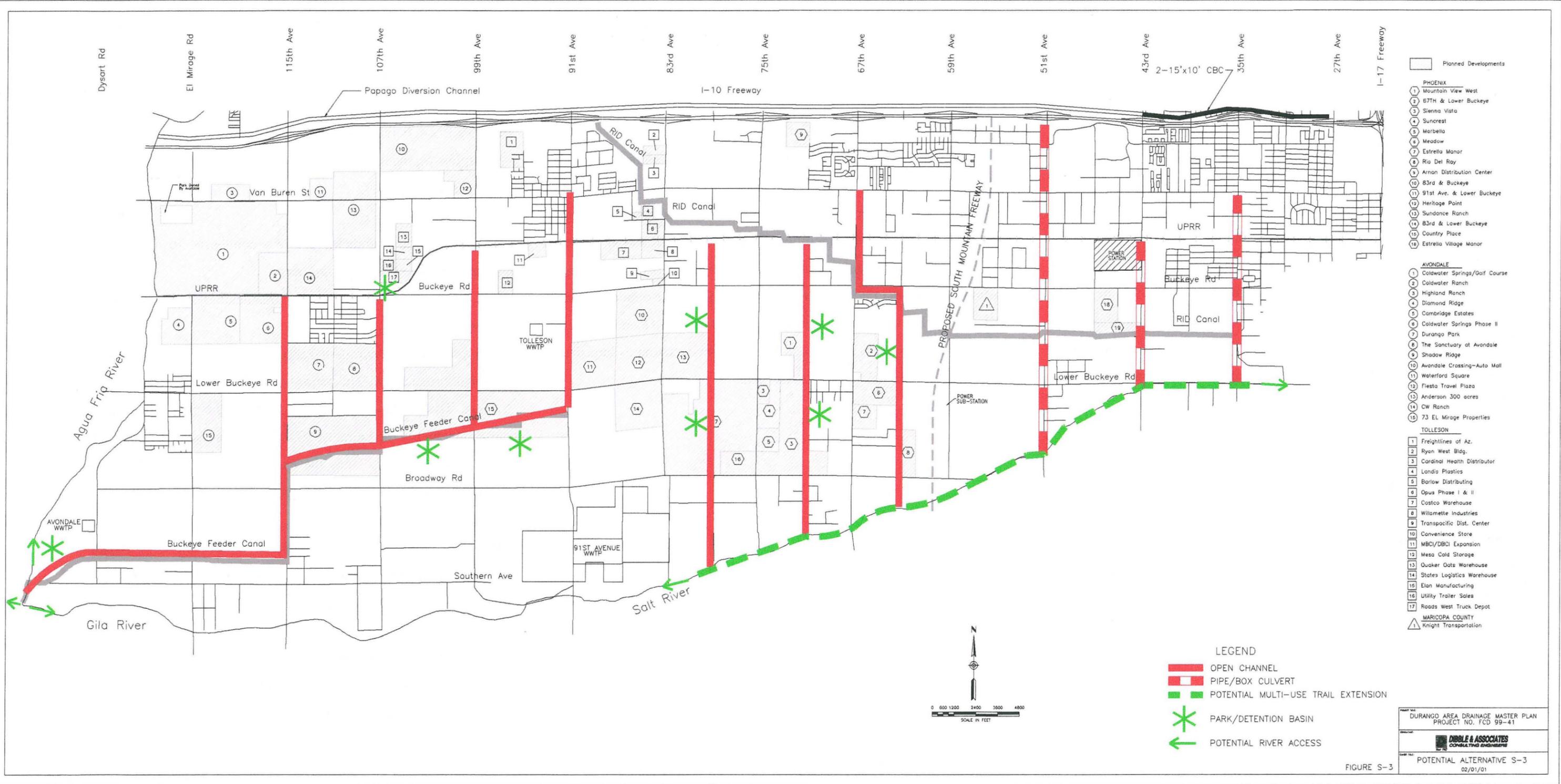
This alternative adequately addresses most of the existing drainage problems, but conveys the flows along alignments that are different than the natural drainage flow paths. Coordination with developers and existing homeowners will be required to determine the exact alignment along the powerline corridor.

Advantages:

- 51st Avenue alignment could possibly utilize the existing storm drain system in the street. 51st Avenue alignment is hydraulically significant because of the overflow of runoff over the railroad at that point.
- Alignment of channels at half-mile streets such as 63rd Avenue and 79th Avenue, rather than along major streets. This is desirable from a multi-use opportunity viewpoint
- No penetrations of the proposed Tres Rios levee will be required
- Multiple opportunities for river access
- Opportunity to preserve community open space in existing agricultural areas since the storm water facilities are co-located with parks. Storm water facilities which are co-located with proposed parks enhance the likelihood of project partners, funding, and multiple use opportunities.
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas

Disadvantages:

- Does not address the local flooding problems such as the intersection of 91st Avenue and Van Buren Street or along the RID canal and the UPRR.
- Does not take advantage of the drainage facilities currently being constructed as part of the Coldwater Springs development along Buckeye Road, between 115th Avenue and the Agua Fria River
- Multiple crossings of significant utilities such as the 99" sewer line in Broadway Road
- Non-linked system.
- Straight, linear alignments are less conducive to a more natural appearing multi-use design approach
- Use of roadway alignments is less desirable for multi-use trail corridors
- May encounter numerous hazardous materials sites in northeastern portion of project area. The majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed. Until the exact location of this alternative is identified, a list of Hazardous Material sites and associated mitigation cannot be determined.
- Passes through several Hohokam canals and the La Cienega and Pueblo Del Alamo prehistoric sites. Estimated cost for mitigation of this type of previously recorded sites cannot be made until site-specific testing is conducted.
- Will require relocation of a large number of residents and the Lakin Milling operation between Dysart Road and El Mirage Road
- Does not remove the floodplain on the north side of the railroad from 103rd Avenue to 27th Avenue



9. Alternative S-3 (Figure S-3)

Relative Cost: High

Description:

Alternative S-3 consists of a set of north-south channels and pipes at approximately 1-mile spacing throughout the study area, with an improved channel along the BFC alignment. The north-south pipes would be along 35th Avenue from Van Buren Street to the Salt River, 43rd Avenue from the UPRR to the Salt River, and 51st Avenue from Interstate 10 to the Salt River. The north-south channels would be along 67th Avenue from Van Buren Street to Buckeye Road to 63rd Avenue to the Salt River, 71st Avenue from the UPRR to the Salt River, 79th Avenue from the UPRR to the Salt River, 91st Avenue from Van Buren Street to the improved BFC, 99th Avenue from the UPRR to the improved BFC, 107th Avenue from the UPRR to the improved BFC, and 115th Avenue from the UPRR to the improved BFC. Nine potential park / detention basin locations are identified along the channel alignments and potential multi-use trails are identified along the alignment of the existing BFC and along the Salt River from 35th Avenue to 79th Avenue.

Engineering Considerations:

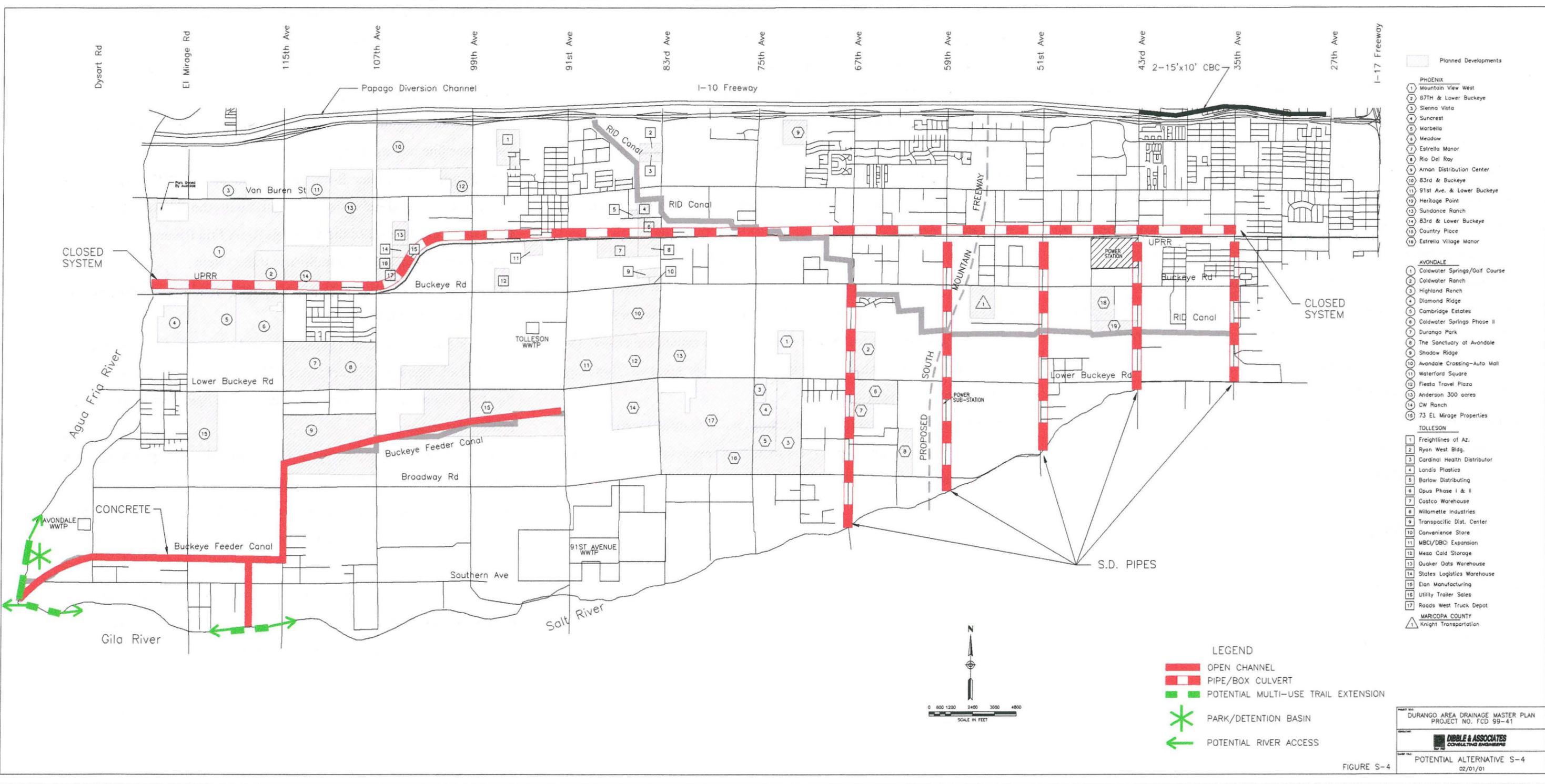
The use of frequent alignments will have an overall result of smaller channels with lower flows, however right-of-way costs tend to increase. The high number of outfalls to the Salt River may be a concern in regards to obtaining 404 permits.

Advantages:

- Frequent use of channels in the north-south direction, resulting in smaller channel sizes throughout the study area and less visual impact
- Existing storm drains could be utilized along the specified alignment in the eastern portion of the study area
- Only one penetration of the proposed Tres Rios levee will be required
- Frequency of features provides good coverage for the entire study area
- Multi-use trail along the Salt River fits well into the Maricopa County regional trail system
- Frequent north south alignments allow opportunities to take advantage of mountain views
- Multiple access opportunities to the Salt and Gila Rivers
- Numerous opportunities to preserve community open space within existing agricultural areas and open lands since the storm water facilities are co-located with parks. Storm water facilities which are co-located with proposed parks enhance the likelihood of project partners, funding, and multiple use opportunities.
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas

Disadvantages:

- If the existing storm drain pipes can not be used, construction cost of open channels in the eastern portion of the study area due to existing development will be high
- Use of frequent channels will result in higher right-of-way costs, and more implementation issues
- North-south alignments pose significant utility conflicts such as the 99" sewer line in Broadway Road
- Discharging of higher flows at the end of the BFC may require mitigation to avoid liabilities associated with the Buckeye Diversion Dam in the confluence of the Gila and Agua Fria Rivers
- Does not provide a linked multi-use trail system
- Multiple outfalls into the Salt River creates additional issues due to possible 404 Permit restrictions
- Passes through several Hohokam canals and the La Cienega and Pueblo Del Alamo prehistoric sites. The estimated cost for mitigating this type of previously recorded site cannot be made until site-specific testing is conducted.
- May encounter numerous hazardous materials sites in northeastern portion of project area. The majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed. Until the exact location of this alternative is identified, a list of Hazardous Material sites and associated mitigation cannot be determined.
- Minimum opportunity for public access to the Agua Fria River



Planned Developments

- PHOENIX**
- 1 Mountain View West
 - 2 67th & Lower Buckeye
 - 3 Sienna Vista
 - 4 Suncrest
 - 5 Marbella
 - 6 Meadow
 - 7 Estrella Manor
 - 8 Rio Del Rey
 - 9 Aron Distribution Center
 - 10 83rd & Buckeye
 - 11 91st Ave. & Lower Buckeye
 - 12 Heritage Point
 - 13 Sundance Ranch
 - 14 83rd & Lower Buckeye
 - 15 Country Place
 - 16 Estrella Village Manor

- AVONDALE**
- 1 Coldwater Springs/Golf Course
 - 2 Coldwater Ranch
 - 3 Highland Ranch
 - 4 Diamond Ridge
 - 5 Cambridge Estates
 - 6 Coldwater Springs Phase II
 - 7 Durango Park
 - 8 The Sanctuary at Avondale
 - 9 Shadow Ridge
 - 10 Avondale Crossing-Auto Mall
 - 11 Waterford Square
 - 12 Fiesta Travel Plaza
 - 13 Anderson 300 acres
 - 14 CW Ranch
 - 15 73 EL Mirage Properties

- TOLLESON**
- 1 Freightlines of Az.
 - 2 Ryan West Bldg.
 - 3 Cardinal Health Distributor
 - 4 Landis Plastics
 - 5 Barlow Distributing
 - 6 Opus Phase I & II
 - 7 Costco Warehouse
 - 8 Willamette Industries
 - 9 Transpacific Dist. Center
 - 10 Convenience Store
 - 11 MBCI/DBCI Expansion
 - 12 Mesa Cold Storage
 - 13 Quaker Oats Warehouse
 - 14 States Logistics Warehouse
 - 15 Elan Manufacturing
 - 16 Utility Trailer Sales
 - 17 Roads West Truck Depot
- MARICOPA COUNTY**
- 1 Knight Transportation

LEGEND

- OPEN CHANNEL
- PIPE/BOX CULVERT
- POTENTIAL MULTI-USE TRAIL EXTENSION
- PARK/DETENTION BASIN
- POTENTIAL RIVER ACCESS

DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

POTENTIAL ALTERNATIVE S-4
02/01/01

FIGURE S-4

10. **Alternative S-4** (Figure S-4)

Relative Cost: High

Description:

Alternative S-4 consists of a mostly closed drainage system along with an improved, concrete lined, BFC. Existing or new storm drain pipes would be constructed from the UPRR to the Salt River in 35th Avenue, 43rd Avenue, 51st Avenue, 59th Avenue, and 67th Avenue. A closed box system is included along the north side of the UPRR from 35th Avenue to the Agua Fria River. Major flows in the BFC would be diverted south to the Gila River while tailwater irrigation flows continued out to the confluence of the Gila and Agua Fria Rivers. A park / detention basin and multi-use trail are included along the improved BFC alignment.

Engineering Considerations:

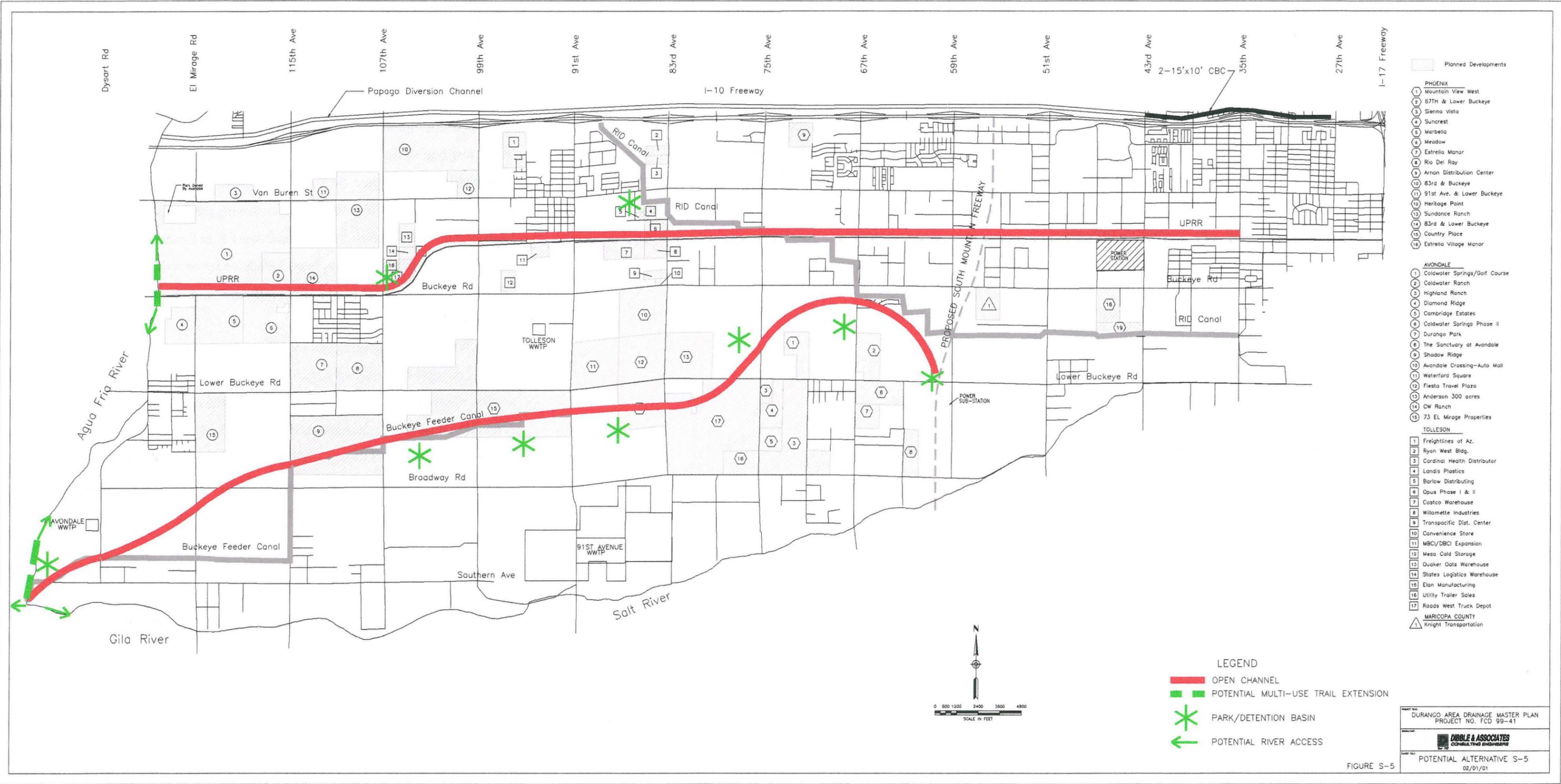
A closed system has less permanent impact through areas of heavy existing development. However, the cost may be extremely high compared to open channels. New and existing storm drains can be constructed within public right-of-way. The use of existing storm drains will be subject to analysis to determine the existing capacity.

Advantages:

- Closed drainage system results in lower right-of-way costs, since pipes and boxes could be built in the existing roadways or very near the existing public right-of-way.
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas

Disadvantages:

- Use of concrete boxes and a concrete lined channel does not promote multiple recreational uses.
- Alignment north of the railroad would still be difficult to construct east of 83rd Avenue due to existing development and other space constraints and would require relocation of multiple businesses
- North-south alignments pose significant utility conflicts such as the 99" sewer line in Broadway Road
- Discharging of higher flows at the end of the BFC may require mitigation to avoid liabilities associated with the Buckeye Diversion Dam in the confluence of the Gila and Agua Fria Rivers
- Two penetrations of the proposed Tres Rios levee will be required
- Few opportunities to preserve views, preserve community open space, or increase landscape aesthetics
- Does not provide a linked trail system
- May encounter numerous hazardous materials sites in northeastern portion of project area. The majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed. Until the exact location of this alternative is identified, a list of Hazardous Material sites and associated mitigation cannot be determined.
- Passes through several Hohokam canals and the Fowler Ruin, Pueblo Del Rio, and Pueblo Del Alamo prehistoric sites. The estimated cost for mitigate of this type of previously recorded sites cannot be made until site-specific testing is conducted.



11. Alternative S-5 (Figure S-5)

Relative Cost: Medium

Description:

Alternative S-5 consists of two main east-west channels which are planned to be natural appearing multi-use (NAMU) facilities. The first channel would be along the north side of the UPRR between 35th Avenue and the Agua Fria River, and the second channel would be a naturally winding alignment from approximately the intersection of the Lower Buckeye Road and the proposed South Mountain Freeway, curving around some proposed developments and meeting the approximate alignment of an improved BFC. Nine potential park / detention basin locations are identified along the channel alignments and a potential multi-use trail is identified along the alignment of the existing BFC.

Engineering Considerations:

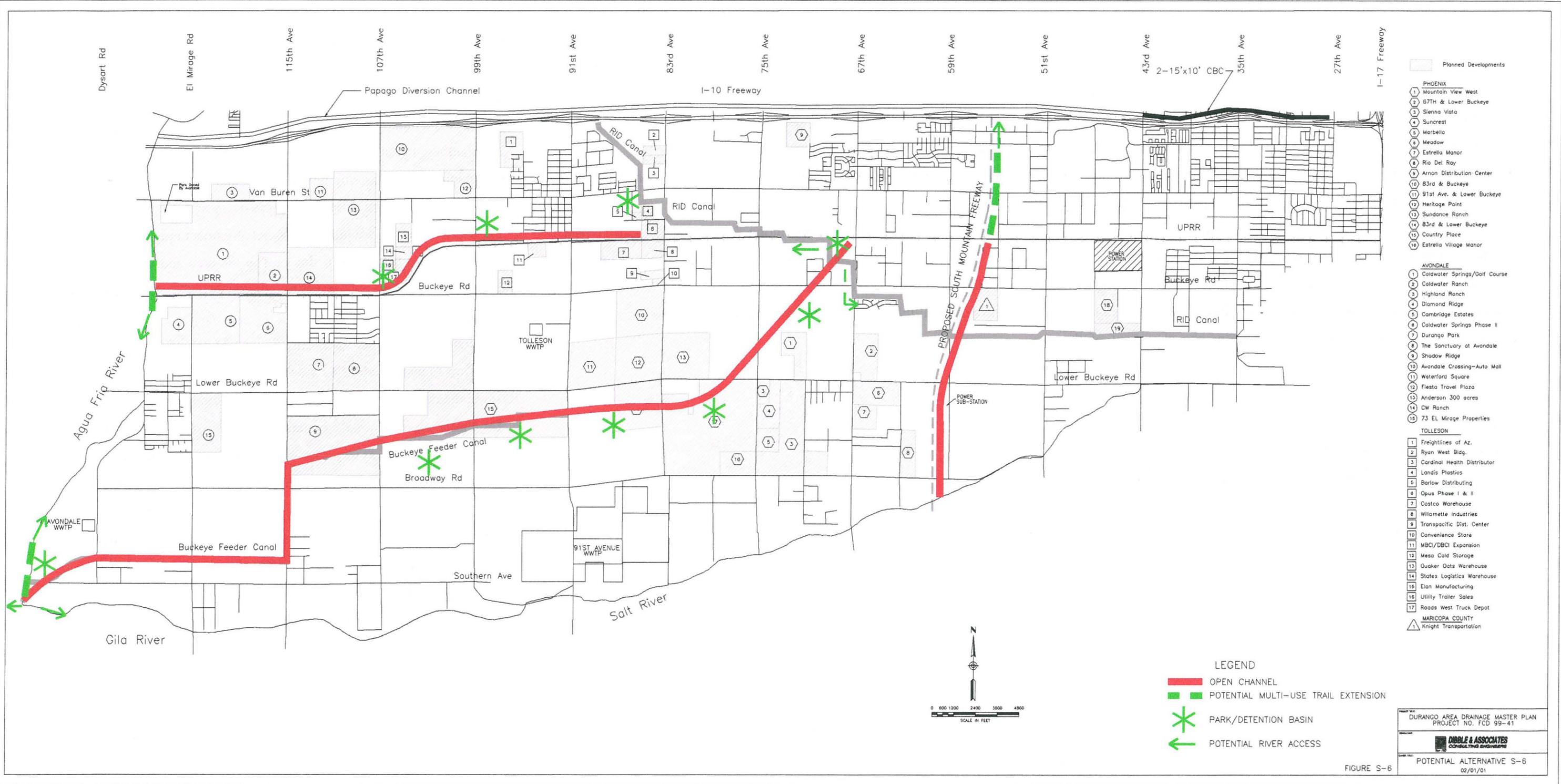
The use of only two main channels will result in an overall increase in the size of the channels to handle the concentrated flows. Existing development is extremely heavy along the railroad, east of 75th Avenue. The alignment of the southern channel is flexible and can be meandered to avoid existing and proposed developments.

Advantages:

- Emphasis of the curvilinear "Natural Appearing Multi-use" channels
- Only one penetration of the proposed Tres Rios levee will be required
- Avoids most of the significant utilities
- Aesthetically pleasing, environmentally friendly, and promotes recreational opportunities
- Opportunity to preserve and link community open space to parks planned within the Estrella Village Core
- Limits potential impacts to riparian areas due to having only two discharge points
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas
- Provides multiple access points to the Agua Fria River

Disadvantages:

- Use of only two major channels throughout the study area will require additional tributary pipes and channels to provide a complete system, i.e. it does not completely address all of the drainage issues for this area
- Channels would be very large to handle the flows from the entire study area, and may not be feasible to construct due to land constraints and right-of-way availability
- Railroad alignment would be especially difficult to construct east of 33rd Avenue due to existing development and other space constraints and would require relocation of multiple businesses
- The second, naturally winding, channel alignment may be difficult to construct due to the slope of the land in the area and would require relocation of multiple homes and businesses near 67th Avenue and the RID canal
- Discharging of higher flows at the end of the BFC may require mitigation to avoid liabilities associated with the Buckeye Diversion Dam in the confluence of the Gila and Agua Fria Rivers
- Emphasis on east west orientation of both alignments does not maximize opportunities to preserve desirable views to the south
- May encounter numerous hazardous materials sites in northeastern portion of project area. The majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed. Until the specific location of this alternative is identified, a list of Hazardous Materials site and associated mitigation cannot be determined.
- Passes through several Hohokam canals and the Fowler Ruin prehistoric site. The estimated cost for mitigate of this type of previously recorded site cannot be made until site-specific testing is conducted.



- Planned Developments
- PHOENIX**
- 1 Mountain View West
 - 2 67th & Lower Buckeye
 - 3 Sienna Vista
 - 4 Suncrest
 - 5 Marbella
 - 6 Meadow
 - 7 Estrella Manor
 - 8 Rio Del Rey
 - 9 Arnon Distribution Center
 - 10 83rd & Buckeye
 - 11 91st Ave. & Lower Buckeye
 - 12 Heritage Point
 - 13 Sundance Ranch
 - 14 83rd & Lower Buckeye
 - 15 Country Place
 - 16 Estrella Village Manor
- AVONDALE**
- 1 Coldwater Springs/Golf Course
 - 2 Coldwater Ranch
 - 3 Highland Ranch
 - 4 Diamond Ridge
 - 5 Cambridge Estates
 - 6 Coldwater Springs Phase II
 - 7 Durango Park
 - 8 The Sanctuary at Avondale
 - 9 Shadow Ridge
 - 10 Avondale Crossing-Auto Mall
 - 11 Waterford Square
 - 12 Fiesta Travel Plaza
 - 13 Anderson 300 acres
 - 14 CW Ranch
 - 15 73 El Mirage Properties
- TOLLESON**
- 1 Freightlines of Az.
 - 2 Ryan West Bldg.
 - 3 Cardinal Health Distributor
 - 4 Land's Plastics
 - 5 Barlow Distributing
 - 6 Opus Phase I & II
 - 7 Costco Warehouse
 - 8 Willamette Industries
 - 9 Transpacific Dist. Center
 - 10 Convenience Store
 - 11 MBI/DBCI Expansion
 - 12 Mesa Cold Storage
 - 13 Quaker Oats Warehouse
 - 14 States Logistics Warehouse
 - 15 Elan Manufacturing
 - 16 Utility Trailer Sales
 - 17 Roads West Truck Depot
- MARICOPA COUNTY**
- 1 Knight Transportation

LEGEND

- OPEN CHANNEL
- - - POTENTIAL MULTI-USE TRAIL EXTENSION
- * PARK/DETENTION BASIN
- ← POTENTIAL RIVER ACCESS

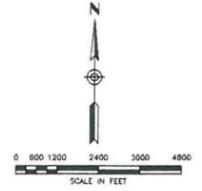


FIGURE S-6

DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

POTENTIAL ALTERNATIVE S-6
02/01/01

12. Alternative S-6 (Figure S-6)

Relative Cost: Medium

Description:

Alternative S-6 consists of three main channels throughout the study area. The first would be along the proposed South Mountain Freeway from the UPRR to the Salt River. The second would start upstream of the RID canal at 67th Avenue and the UPRR and follow a diagonal alignment to south of Lower Buckeye Road where it would meet the BFC alignment out to the confluence of the Gila and Agua Fria Rivers. The third alignment would be along the north side of the UPRR from approximately 85th Ave to the Agua Fria River. Ten potential park / detention basin locations are identified along the channel alignments and a potential multi-use trail is identified along the alignment of the existing BFC, and as an extension of the channel along the proposed South Mountain Freeway.

Engineering Considerations:

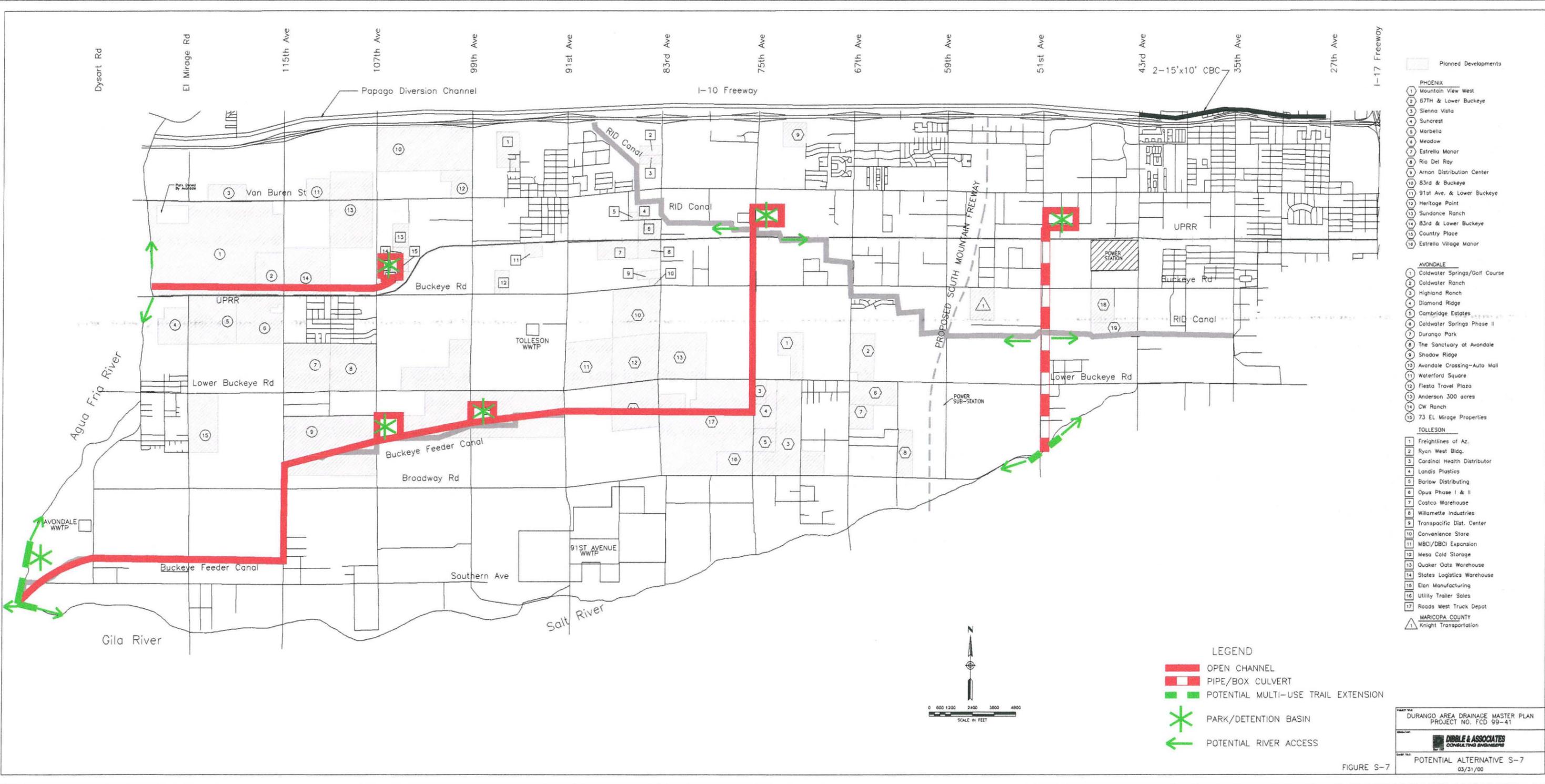
The freeway alignment could be constructed by ADOT as part of the proposed freeway project. High frequency of detention basins will result in smaller channel sizes, but may increase land costs. The middle alignment passes through several proposed developments, which may have zoning plans approved already.

Advantages:

- Use of the proposed South Mountain Freeway alignment provides a possible cost sharing opportunity with ADOT
- Only one penetration of the proposed Tres Rios levee will be required
- Connection of the planned multi-use trails to each other and to existing features such as the RID canal (which may be a future trail) and to a regional system (the South Mountain Freeway and River corridors)
- Alignments in the western portion of the study area do not greatly impact the existing development and are not built along the major roads, which is desirable for multi-use opportunities
- Numerous opportunities to incorporate and preserve community park and open space in existing agricultural areas and open lands
- Opportunity to create improved aesthetic value along the railroad corridor west of 83rd Avenue
- Avoids greatest concentration of hazardous materials sites in northeastern portion of project area. The majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed.
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas

Disadvantages:

- One alignment cuts through several parcels of land and may leave the remaining land undesirable for development, resulting in higher right-of-way costs
- North-south alignment along the proposed freeway alignment poses significant utility conflicts such as the 99" sewer line in Broadway Road and an APS power substation near 59th Avenue and Lower Buckeye Road
- Multiple relocations of homes and businesses along proposed freeway alignment and near 71st Avenue and Buckeye Road
- Impacts existing planned development which will result in higher costs to acquire right-of-way
- Discharging of higher flows at the end of the BFC may require mitigation to avoid liabilities associated with the Buckeye Diversion Dam in the confluence of the Gila and Agua Fria Rivers
- Does not remove the floodplain on the north side of the railroad from 75th Avenue to 27th Avenue
- Limited access to the Salt / Gila River
- Emphasis on east-west alignments offers fewer mountain viewing opportunities
- Passes through several Hohokam canals and the Pueblo Del Alamo prehistoric site. The estimated cost for mitigating this type of previously recorded site cannot be made until site-specific testing is conducted.



13. Alternative S-7 (Figure S-7)

Relative Cost: *Medium*

Description:

Alternative S-7 consists of 3 main channel alignments with a number of key detention basins. The detention basins would be located near the corners of 51st Avenue and the UPRR, 75th Avenue and the RID Canal, and 107th Avenue and the UPRR. Channels or pipes would outlet from the detention basins along 51st Avenue from the UPRR to the Salt River, along 75th Avenue to south of Lower Buckeye Road to an improved alignment of the BFC out to the confluence of the Gila and Agua Fria Rivers, and along the north side of the UPRR from 107th Avenue out to the Agua Fria River. Additional detention basins are included along the BFC alignment to attenuate the peak flows of tributary runoff along the channel alignment. Parks are included at each of the detention basins and multi-use trails would follow the alignments of each of the main channels.

Engineering Considerations:

The BFC alignment passes through the middle of several proposed developments that may have zoning plans approved already. The use of the existing storm drain pipe in 51st Avenue would be subject to a capacity analysis.

Advantages:

- Initial use of detention basins at key locations to pickup large amounts of runoff and attenuate the flows before being sent downstream
- Existing storm drain in 51st Avenue could be utilized to release flows from the detention basin at 51st Avenue and the railroad
- Location of basins at 51st Avenue and 75th Avenue correspond to an efficient hydraulic solution based on flow locations in existing conditions
- Channel north of the railroad with a detention basin at 107th Avenue does not adversely impact any existing or planned development
- Only one penetration of the proposed Tres Rios levee will be required
- Use of the BFC alignment may save money on right-of-way and construction costs
- Opportunity for a semi linked trail system which utilizes the potential of BFC and RID Canals as multi-use trail corridors
- Basins preserve community open space and may allow opportunities to preserve panoramic mountain views
- Detention basins likely to regulate and prolong flows, somewhat buffering impacts to riparian areas from sudden surges of water
- High potential for project partners due to multi-use opportunities of basins

Disadvantages:

- BFC alignment and associated detention basin cuts through several proposed developments
- North-south alignment along 51st Avenue poses significant utility conflicts such as an 87" sewer line in Lower Buckeye Road
- Limited river access
- Alignments adjacent to roadways are less desirable multi-use trail corridors due to heavy traffic
- May encounter numerous hazardous materials sites in northeastern portion of project area. The majority of listed sites are found east of 59th Avenue. These database searches documented 405 different hazardous waste sites within the Durango ADMP area with over 1,000 hazardous waste sources listed. Until the exact location of the alignments in this alternative are identified, a list of Hazardous Materials sites and associated mitigation cannot be determined.
- Passes through several Hohokam canal prehistoric sites. The estimated cost for mitigating this type of previously recorded sites cannot be made until site-specific testing is conducted.

14. Alternative S-8

Relative Cost: *Low*

Description:

Alternative S-8 is a "No Action" alternative. The idea is that the costs of annual damages that would occur by doing nothing, would be less than the annual cost of any improvements.

Engineering Considerations:

This alternative would require a detailed cost-benefit analysis to determine the average annual cost of damages due to flooding.

Advantages:

- No capital cost
- Avoids all potential hazardous materials, sensitive habitats, and cultural resource sites
- NPDES and 404 permits/mitigation not required

Disadvantages:

- Does not address the known flooding issues as previously identified in this report
- Does not provide a regional drainage solution for the rapidly developing area
- Does not remove any of the existing floodplains
- Does not provide a means of draining the retention facilities of local developments. Local regulations typically require retention of the 100 year - 2 hour storm.
- Does not re-establish any drainage paths which were obliterated when the area was developed for Agricultural uses
- No regional drainage solution will result in a compounding effect of higher peak runoff flows and shorter times of concentration as development continues with only the local retention requirements
- No opportunity to improve landscape aesthetics or integrate multiple uses
- No potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas

V. ALTERNATIVES EVALUATION

A. Introduction

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

B. Screening of Alternatives

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 alternatives identified in the brainstorming session and the seed alternatives were reviewed in the field and with available mapping and aerial photos. The hydrology was also carefully considered to determine which alignments would provide the most benefit based on the existing storm flows in the study area. Each potential alignment was traveled by vehicle, noting all of the obstructions and difficulties on a blank study area map. This map was then used to determine which alignments were most feasible from a right-of-way, constructability, and aesthetic enhancement viewpoint. Once all of the feasible alignments were identified, the most promising alignments were grouped together to determine which ones would work with the others to form a complete regional drainage solution.

Several of the identified alignments were found to not be feasible based primarily on existing development and obstructions. Alternative B-6, which is a non-structural alternative, and Alternative S-8, which is a "No Action" alternative were also found to be unfeasible for several reasons. First, they do not provide solutions for the existing flooding

problems that were previously identified. Secondly, they do not provide for a regional drainage system of the study area. Since the area is rapidly growing with new residential and commercial developments, the area needs a regional system to route off-site drainage and drainage in excess of current retention requirements. As a point of fact, many developers are currently tending to shed responsibility for off-site flows, claiming that runoff never reaches the property under development due to a farming berm or other minor diversion on an adjacent property. However, when the adjacent property is developed, the flows are assumed to have been accounted and designed for by the previous developer. Therefore the flow is not accounted for or designed for and will create flooding problems in newly developed areas.

Through the screening process, it was found that there are several elements which are common to each screened alternative, and are necessary for a complete regional drainage solution. Specifically, there are three key park / detention basin locations identified, which are located at the southeast corner of 51st Avenue and the UPRR and also north of the RID canal and the UPRR at approximately 71st Avenue, and a multi-use facility consisting of a retention/detention basin, park, and habitat area near the confluence of the Gila and Agua Fria Rivers, needed to handle the interior drainage of the south portion of the study area after the proposed Tres Rios levee is constructed. Another common element to each of the screened alternatives is the intent to use naturally appearing multi-use (NAMU) channels, including trails along each alignment, to the fullest extent possible.

There are several high voltage overhead power line corridors traversing the study area. There are differing views on the potential opportunity

presented by the power line corridors. The corridors are utilized in several of the potential alternatives as well as in two of the screened alternatives. The use of power line corridors may be seen as an advantage or a disadvantage. The advantage is in the use of an established corridor which may result in right of way acquisition cost savings and multiple beneficial uses. The land area under these large power lines is free of buildings and other obstructions resulting in an open, clear corridor that invites other uses. One disadvantage is in the negative visual element and social perception associated with the towers and overhead lines. Some of the power lines produce an unnerving humming sound that may concern potential users of the corridor. The negative appearance may be mitigated by landscaping approaches that create an overhead canopy to shield the public from the overhead views.

Another disadvantage is the design restrictions that are imposed by the power companies when utilizing a shared right-of-way. The project team met with representatives from the power companies (SRP and APS) to discuss the use of the power line easements for shared flood control right-of-way and multiple use recreational opportunities. The general feeling of the power companies is that they are open to the idea of multiple use activities within and adjacent to a power line easement as long as the power poles were still easily accessible for maintenance purposes. Each power company has guidelines which specify criteria for clearance, grading, side slopes and access ramps. The screened alternatives shown on the following pages are intended to take advantage of a shared right-of-way to the fullest extent possible. In the event that the right-of-way is not available to be shared, or the power companies do not approve of the design plans, all of the alignments shown within a power line easement can be shifted to be adjacent to the

power line easement or slightly realigned as necessary.

Three complete regional drainage alternatives were developed through the screening process. The three alternatives were presented to the public at Public Open House meetings held on April 11 and April 13, 2000 and then presented and recommended at Review Committee Meeting #2 on April 25, 2000. The purpose of this meeting was to approve the three alternatives recommended for further study in the Level II Analysis. Public input from the Open House meetings was presented to the Review Committee. Opportunity was presented at the meeting for questions and discussion. The review committee then approved by a majority vote, the three screened alternatives recommended for further study in the Level II Analysis.

The three screened alternatives are comprised of elements chosen from all of the available alternatives as previously described. These alternatives are shown on **Figures V-1, V-4, and V-7**, and summarized in the following sections.

C. Public Sensing

Public Open House meetings were held at Littleton Elementary School on April 11, 2000 and at Carl Hayden High School on April 13, 2000. 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, existing constraints, potential alternatives, and potential landscape themes. 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 questionnaire was distributed to all attendees. Attendance at the public meetings was relatively low with a total of 13

people attending. The results of Community Questionnaire 1 are summarized in the **Appendix**.

The community questionnaire reflects a general support of the concepts presented. The preferred alternative by those in attendance at the two public meetings is A-1 and the preferred themes are the Park-Like theme, Natural theme, Agricultural Heritage theme, and the Railroad theme. The primary concerns expressed related to consideration of the impacts on existing and planned developments in the area.

D. Alternatives Development (Level II Analysis)

The three alternatives 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. If the ground slope was too steep, causing high velocities in the channel, a milder slope with drop structures is specified. Culverts were placed at existing road crossings and at locations of potential future

roadways.

The required right-of-way width for each channel is computed by adding the required channel top width, increased by ten percent to allow for a natural appearing multi-use meandering channel, plus 32 feet to allow for 16 foot maintenance roads on both sides of the channel.

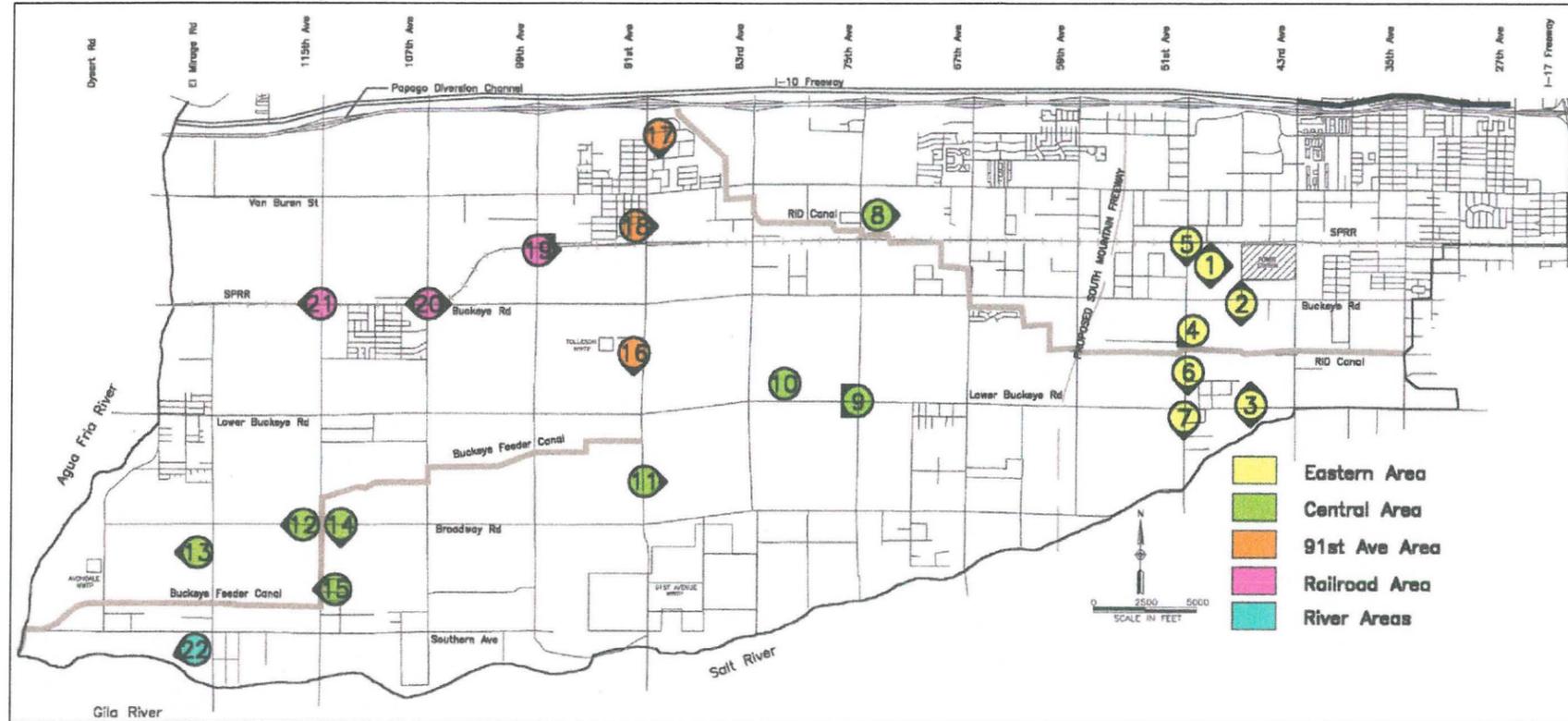
E. Visual Analysis

Supplementary visual analysis was performed for the three screened alternatives to document existing visual conditions specific to those areas. Along with the previous data collected for the study area, results of public sensing, and preliminary engineering analysis, the additional visual analysis provides a basis for determining appropriate landscape themes for each of the alternatives. The analysis consisted of observing the existing visual conditions in the areas along the proposed alternative alignments. Since there are many similarities with regards to the existing visual conditions between the alternatives, the study area is divided into areas which have similar visual conditions or potential similar appropriate landscape themes. Those areas are referred to as follows - Eastern Area, Central Area, 91st Avenue Area, Railroad Area, and River Areas. The **Visual Analysis Photo Key Map** on the following page, identifies the locations of photos presented in this section.

Eastern Area

The eastern portion of the study area consists of flood control alternatives located along and east of the Proposed South Mountain Freeway alignment in the vicinity of 59th Avenue. All alternatives feature a basin southeast of 51st Avenue and the UPRR. Runoff is conveyed to the south along either the 47th Avenue power line corridor, in a channel south of the RID Canal, along the proposed South

Visual Analysis Photo Key Map



to the south are partially obstructed by buildings and power poles. Visual quality varies from one property to the next, however many areas are characterized by industrial developments with outdoor operations or storage yards which are not sufficiently screened and have generally low visual quality. Flood control alternatives in this area could provide a great opportunity to screen objectionable views, preserve desirable view corridors to the south, provide an open space recreational amenity and preserve a landscaped open space corridor and regional trail system link for industrial facility employees in an area relatively devoid of amenities.

Southeast corner of 51st Avenue and UPRR (cont'd)
(Photo key location 1)



(Looking East - adjacent industrial development)

Southeast corner of 51st Avenue and UPRR (Photo key location 1)



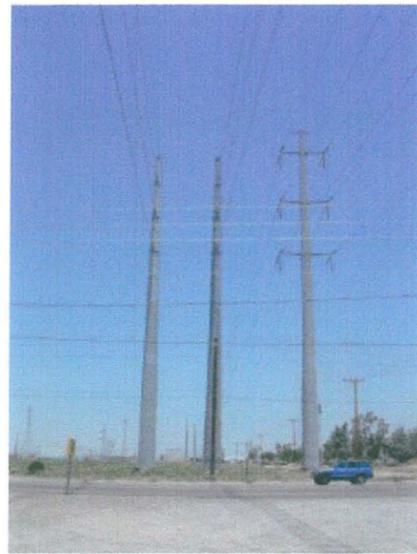
(Looking North - adjacent industrial development)



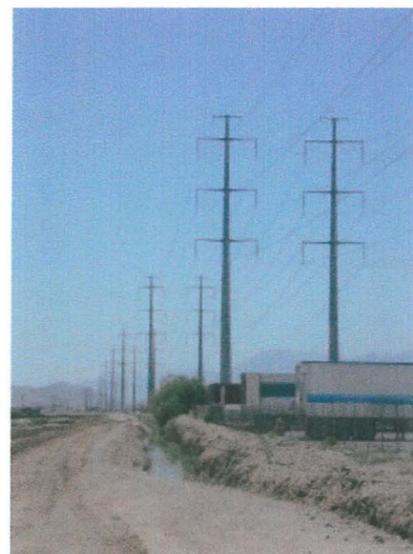
(Looking Southeast - adjacent historic mills and mountain views)

The **Alternative A-1** alignment utilizes primarily the 47th Avenue power line corridor. The 47th Avenue power line corridor contains three rows of tall metal monopoles north of Buckeye Road and two rows south of Buckeye Road. An existing irrigation ditch follows along the east side adjacent to the power line corridor for much of the distance south of Buckeye Road.

47th Avenue power line corridor and Buckeye
(Photo key location 2)



(Looking North)

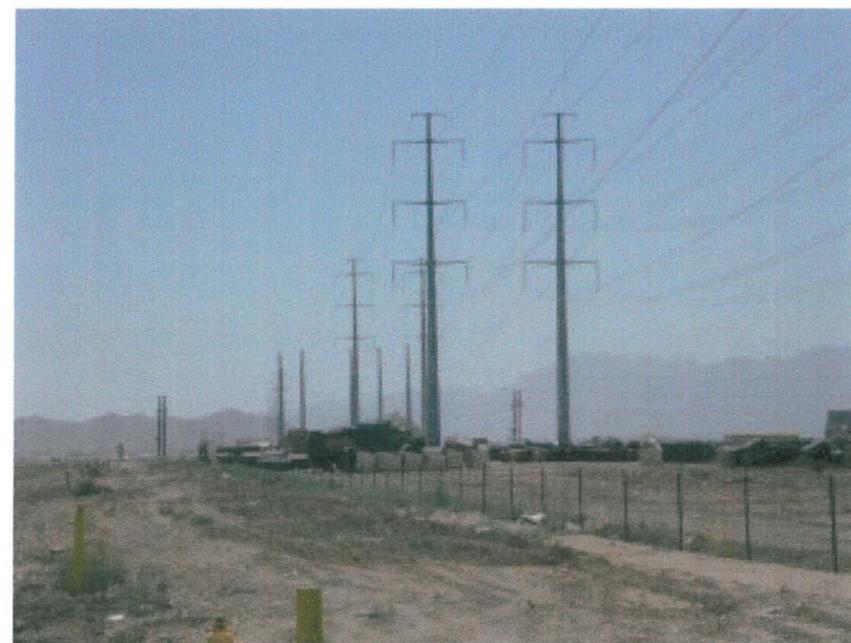


(Looking South)

47th Avenue power line corridor and Lower Buckeye
(Photo key location 3)



(Looking North)



(Looking South)

Alternative A-2 utilizes a corridor to the south and west from the proposed basin site to the proposed South Mountain Freeway corridor. The alignment is located in open agricultural and undeveloped lands which are surrounded by spotted industrial developments.

The RID Canal and 51st Avenue (Photo key location 4)



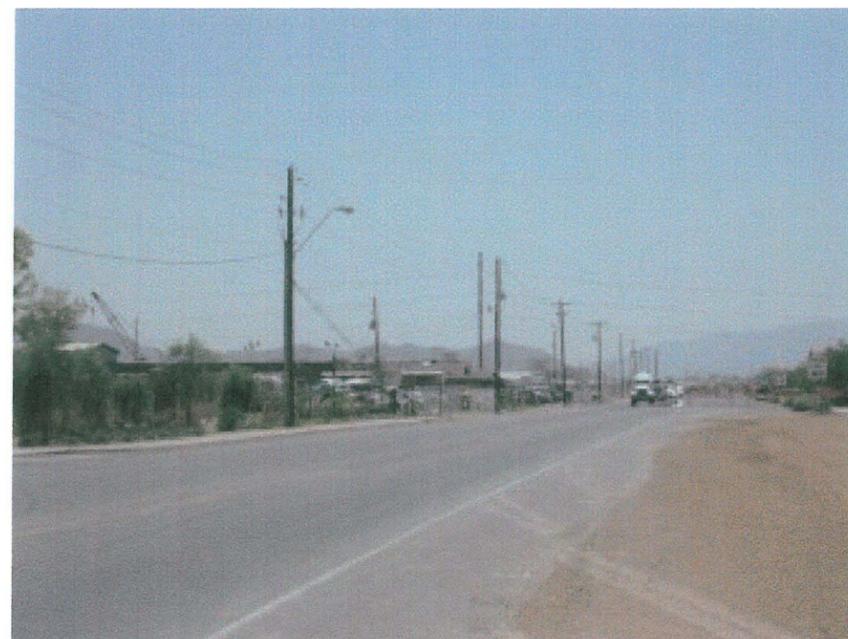
(Looking Southwest)

Alternative A-3, south of the basin site, utilizes piping and box culverts installed within the Buckeye Road and 51st Avenue roadway pavement areas. This portion of **Alternative A-3** would therefore not include associated landscape improvements as part of the flood control facility. The desired multi-use pathway and streetscape landscaping would need to be done in conjunction with street improvements.

51st Avenue (Photo key locations 5, 6, and 7)



(@UPRR Looking South) (location 5)



(@Lower Buckeye Looking South (location 7)

Central Area

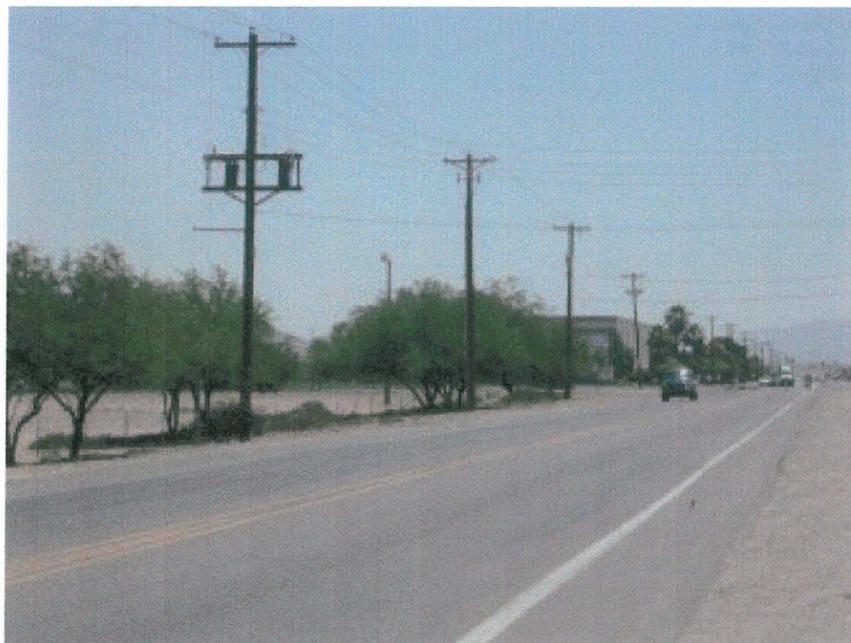
The Central portion of the study area consists of the basin located at 71st Avenue north of the UPRR and the combination of conveyance and or detention facilities to outfalls at the Salt / Gila River or the Agua Fria River. This area is primarily existing agricultural lands which is quickly being developed into residential. Other than the existing Swift Transportation facility which is located northwest of the corner of 75th Avenue and Lower Buckeye, the entire area is planned to become residential with associated support facilities such as schools, parks, and neighborhood commercial. The alternative alignments utilize the existing open agricultural and undeveloped land. The agricultural lands in this area have a wide open character, with little vegetation other than the crop lands, and allow a panoramic vista of the Estrella Mountains to the south. Opportunities to provide parks, trails, and other recreational uses for the planned residential development in this area should be maximized.

71st Avenue Basin (Photo key location 8)

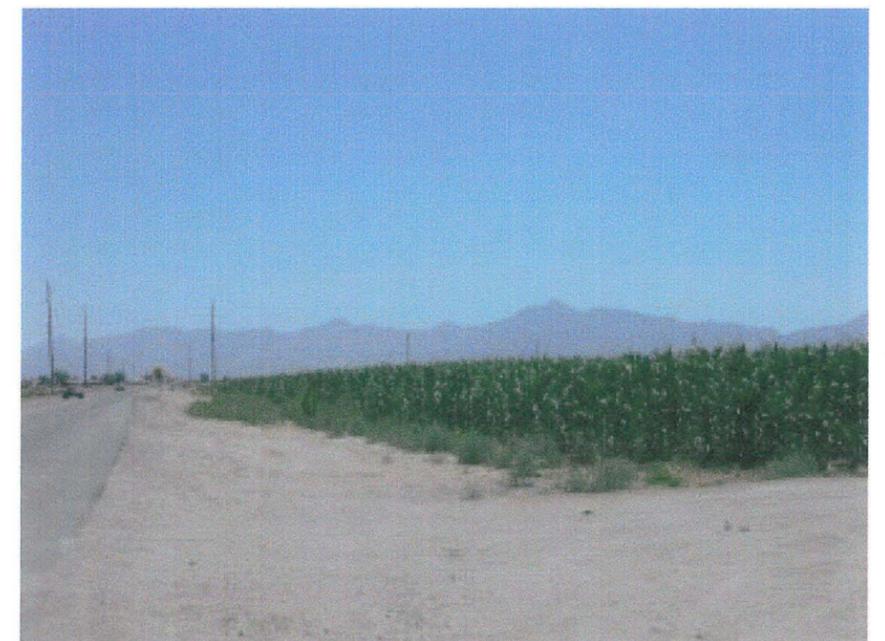


(@75th Avenue Looking East)

Agricultural areas - 75th-83rd Avenue and Lower Buckeye (Photo key locations 9 and 10)



(@RID Looking South) (location 6)



(Ag Area Looking Southwest) (location 9)



(Swift Transportation) (location 9)

Besides one mile roadways, the major corridors in this area are created by transmission lines and the BFC. There are numerous large transmission line corridors through this area most of which consist of tall metal monopoles. There is also a corridor which contains steel tower structures south of Broadway Road, north of the Avondale Waste Water Treatment Plant and west of El Mirage Road. The monopole structures are less visually obtrusive and easier to mitigate than the tower structures. **Alternatives A-1 and A-3** both feature alignments which are adjacent to transmission lines, including the corridor south of Lower Buckeye Road (Alternatives A-1 and A-3), and the corridor on the north side of Broadway Road and 115th Avenue to the corridor South of Broadway Road along the north edge of the Avondale Waste Water Treatment Plant (Alternative A-1).

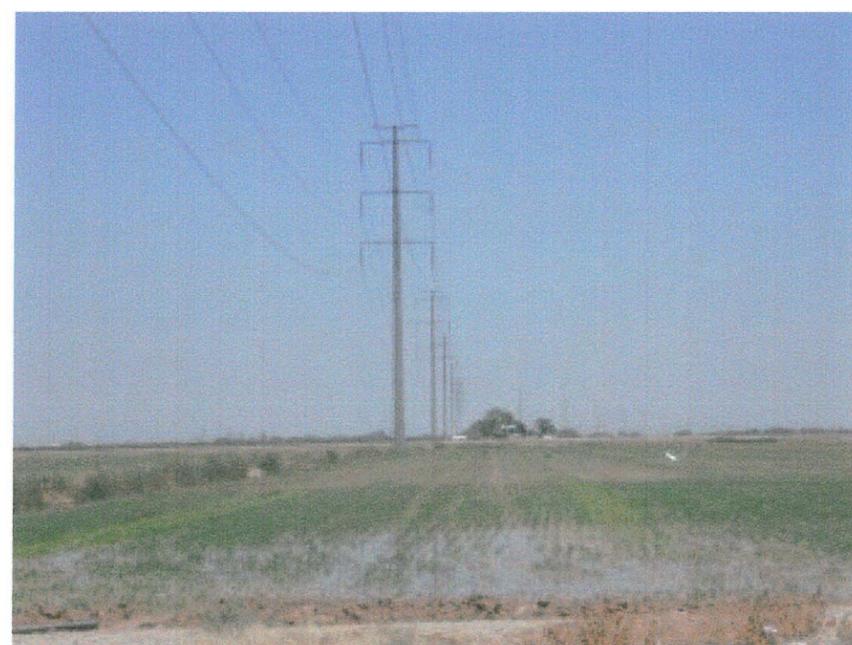


(Broadway and 115th Avenue) (location 12)

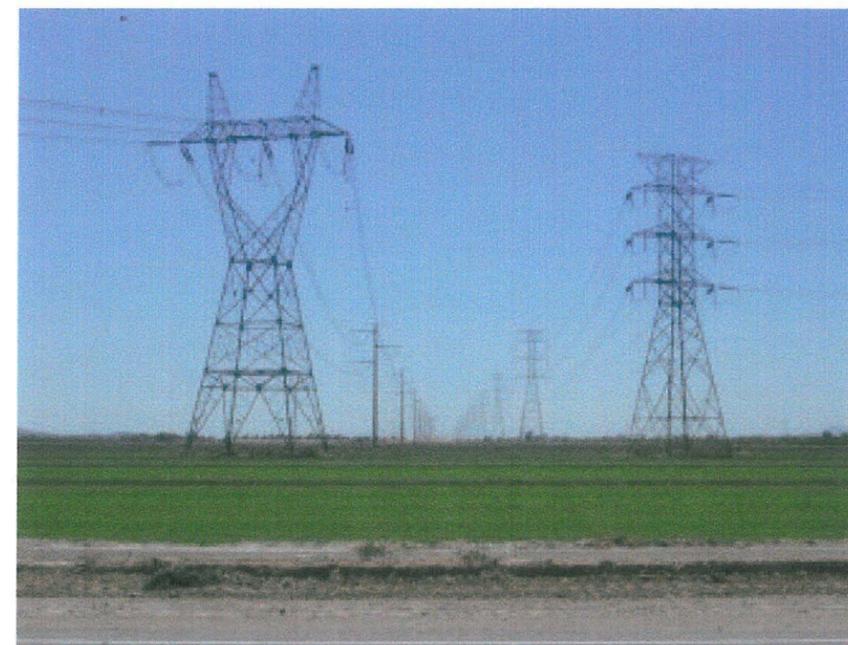
Transmission corridors (Photo key locations 11, 12, and 13)



(New Residential Development - Sundance Ranch) (location 10)



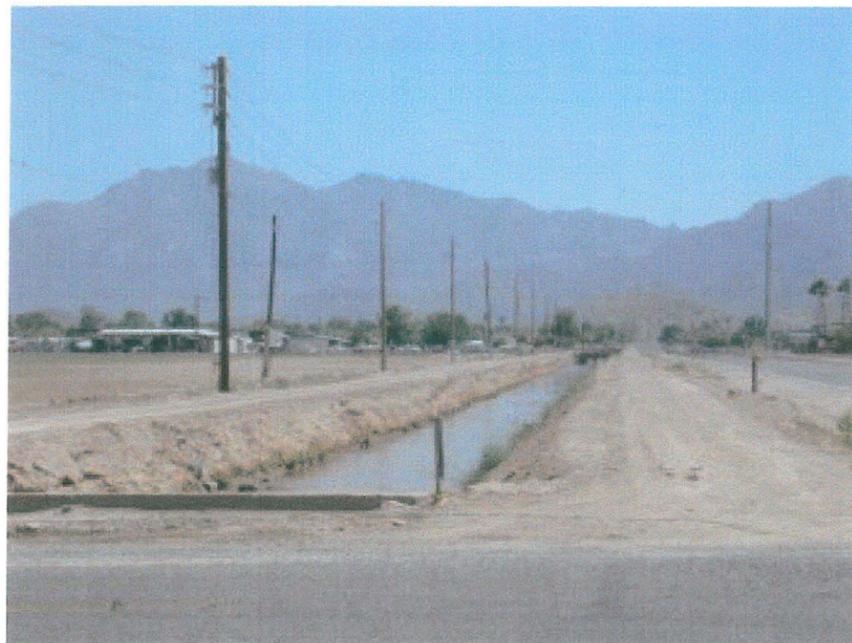
(91st Avenue South of Lower Buckeye) (location 11)



(El Mirage South of Broadway) (location 13)

The BFC is an elevated, unimproved dirt lined ditch. It's route is adjacent to or within existing open agricultural lands and some rural residences. There are currently planned residential developments along the BFC from 91st Avenue to 115th Avenue. All three alternative alignments utilize some portion of the BFC as part of their alignment. **Alternative A-2** uses the entire BFC alignment, **Alternative A-1** uses a small portion between 99th Avenue and 115th Avenue and **Alternative A-3** follows the southern leg from 115th Avenue to the outfall.

Buckeye Feeder Canal (Photo key locations 14 and 15)



115th Avenue South of Broadway (location 14)



@ 115th Avenue Looking West (location 15)

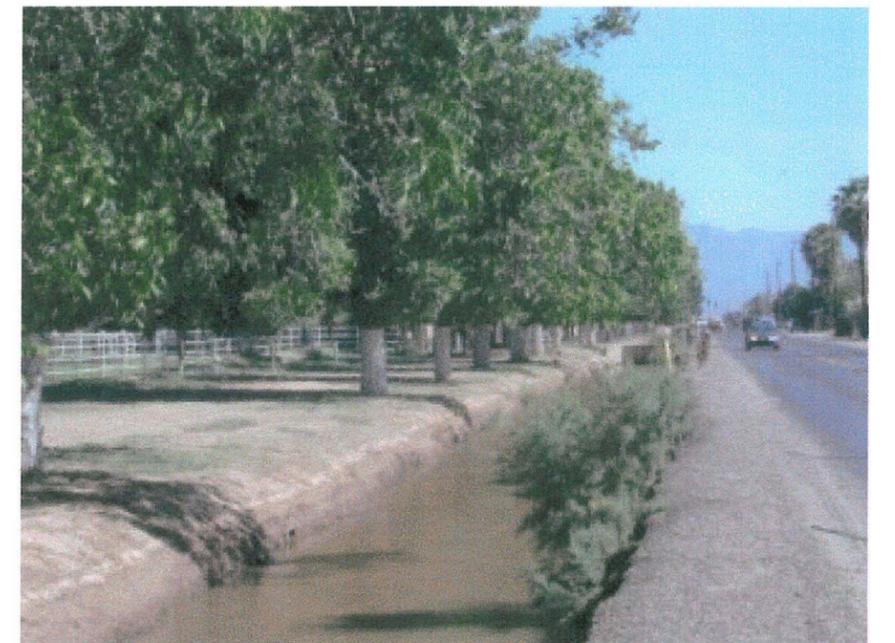
91st Avenue Area

The 91st Avenue area in Tolleson has a unique character within the study area with the existence of the formal wind rows of Pecan trees both adjacent to agricultural fields, the Tolleson Waste Water Treatment Plant and rural residences. Shaded irrigation canals, rows of large scale canopy trees, and turf characterize this corridor. The 91st Avenue corridor also relates to a proposed golf course site development in the vicinity of the Tolleson Waste Water Treatment Plant. **Alternatives A-2** and **A-3** both feature alignments along 91st Avenue.

Pecan Trees (Photo key locations 16 and 17)



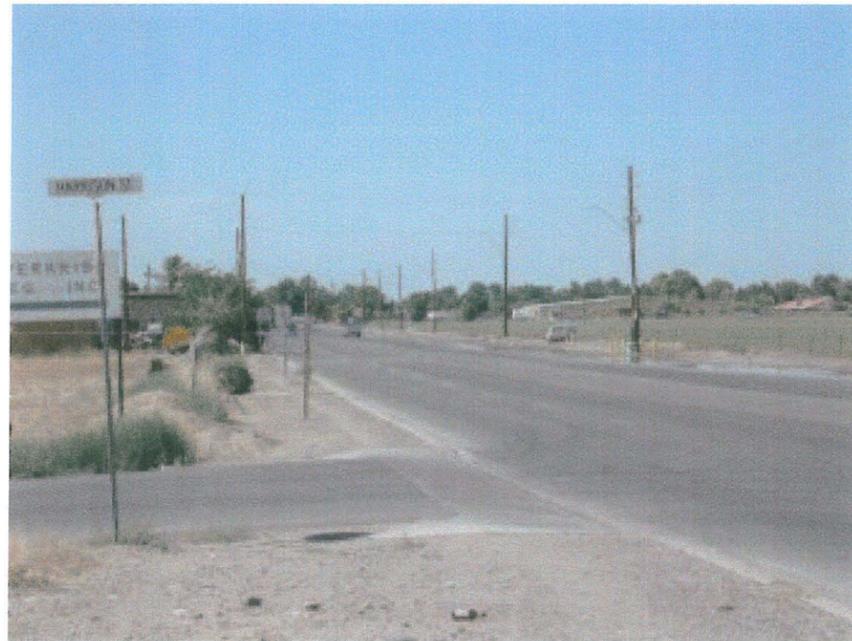
(91st Avenue and Lower Buckeye) (location 16)



(91st Avenue North of Van Buren) (location 17)

Basin Site - Northeast Corner of UPRR and 91st Avenue

(Photo key location 18)



(Looking Northeast)

Union Pacific Railroad at 99th Avenue

(Photo key location 19)



(Looking East)

Union Pacific Railroad at 107th Avenue

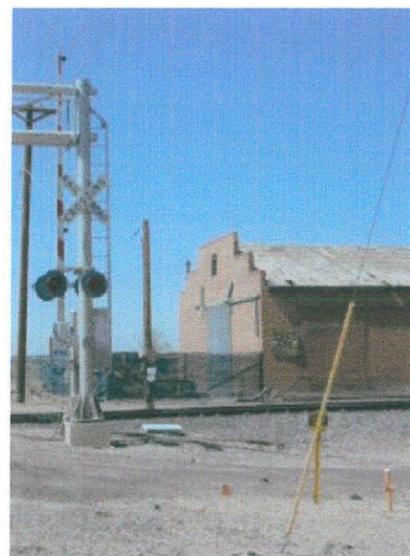
(Photo key location 20)



(Looking East)

Railroad Area

The railroad area consists of the alignments and detention basins which follow the north side of the UPRR. Each of the three alternatives utilizes portions of this alignment. **Alternative A-1** utilizes the longest portion of the railroad frontage as it extends from approximately 85th Avenue, continues to the west through the Coldwater Springs Development and eventually reaches the outfall at the Agua Fria River. **Alternatives A-2** and **A-3** both extend from 99th Avenue to the west. The majority of the railroad frontages consist of industrial type uses with relatively low visual quality. With the potential for the railroad corridor to become a future light rail corridor, opportunities to improve and enhance the visual quality of this corridor should be maximized.



(Looking Northeast)



(Looking West)

Union Pacific Railroad at 115th Avenue

(Photo key location 21)



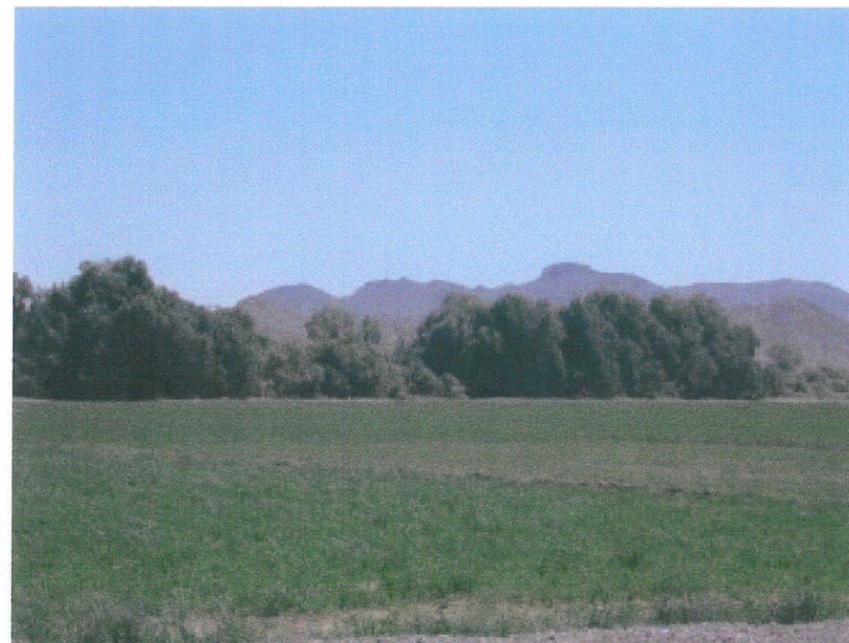
(Looking West)

River Areas

River areas refer to the areas approaching the Salt / Gila Rivers and the Agua Fria River near the outfalls of the various flood control alternatives. These areas vary in existing visual character depending on existing channelization measures which have taken place as well as the amount of available water. Vegetation is dense (at the confluence) to very sparse. Where vegetation opens, there are opportunities for relatively close up mountain views. These areas represent an opportunity to restore the natural character associated with the rivers as well as restore and enhance bird and wildlife habitat. The river areas also have recreational significance as part of the regional trail system planned along those corridors. All three alternatives feature a basin and alignments in the river areas

View to Gila River

(Photo key location 22)



(South of Southern and El Mirage)

F. Description of Alternatives

The alternatives chosen for further evaluation are described below. The cost for each alternative is summarized below in **Table 2**. The total cost includes a 30% contingency on the construction cost which will account for engineering design, construction administration, environmental issues such as 404 permits, cultural resources surveys and hazardous waste surveys, and other minor detail items. **Exhibits A-1 through A-3** at the end of this report, show the plan elements, descriptors, and the detailed cost estimate breakdowns for each alternative.

Table 2 - Summary of Costs

| | Alt A-1 | Alt A-2 | Alt A-3 |
|-------|---------------|---------------|---------------|
| West | \$99,193,145 | \$77,989,682 | \$110,980,152 |
| East | \$15,137,952 | \$33,053,210 | \$31,716,629 |
| Total | \$114,331,097 | \$111,042,892 | \$142,696,781 |

1. **Alternative A-1** (Figure V-1)

Estimated Cost: \$114,331,097

Description:

Alternative A-1 is a modified version of Alternatives B-5, S-6 and S-7 which consists of three main channels with two key detention basins at hydrologically prime locations. The first channel alignment is from the detention basin at 51st Avenue and the UPRR southeast to the powerline corridor along the 47th Avenue alignment, south to outfall at the Salt River. The second channel alignment is from the detention basin at 71st Avenue and the UPRR south and southwesterly on a curvilinear alignment to the power line corridor between Lower Buckeye Road and Broadway Road, then west following the BFC Alignment to 115th Avenue, then southwest and west outfalling into the Agua Fria River approximately 1/4 mile south of Broadway Road. The third channel alignment is along the north side of the UPRR from approximately 85th Avenue west to the Agua Fria River, with tributary channels along 91st Avenue and 99th Avenue from north of Van Buren Street south to the UPRR. A minor channel along 91st Avenue from just south of Broadway Road to the Salt River is included to convey sheet flow drainage from the east into the river upstream of the proposed Tres Rios levee. There are five other potential park / detention basin locations and three possible park locations along the channel alignments.

Engineering Considerations:

The 100-year floodplain will be contained within the banks of the new channels. Existing floodplains will be fully contained along the railroad from the Agua Fria River to 83rd Avenue, along the BFC from 115th Avenue to 91st Avenue, and partially contained along the railroad at 71st Avenue and 49th Avenue. The existing floodplain will be reduced along

the BFC from the Agua Fria River to 115th Avenue.

Final design will need to include coordination with proposed developments with minor adjustments to the channel alignments. Coordination with the power companies will be required to receive approval for construction of drainage and multi-use facilities within and adjacent to powerline corridors. Future maintenance of the channels and detention basins will need to be coordinated with local jurisdiction maintenance departments and could range from \$500,000 to \$750,000 per year based on an estimated unit maintenance cost of \$0.04 per square foot, and depending upon the actual landscaping scheme constructed with the project.

Environmental Considerations:

Cultural Resources

This route passes through, and would likely cause disturbances to several Hohokam canals and the Pueblo Del Rio prehistoric sites along 47th Avenue in the vicinity of the RID canal. This site was previously recorded in the early 1900's and the exact boundaries are not known. The Fowler Ruin is in the vicinity of the basin at 75th Avenue north of the RID canal. Estimating the cost to avoid or mitigate impacts to the cultural resources cannot be made until site specific surveys are completed. This presents potential concerns for preservation of these cultural resources.

Hazardous Materials

This route avoids the highest concentration of potential hazardous materials sites, most of which are located in the northeastern corner of the project area, and along Buckeye, Lower Buckeye, and Broadway Roads. The details of potential hazardous material sites need to be reviewed to minimize encounters with sites that may impact

construction of this project. The time and cost of managing construction in or near such sites would also be similarly minimized.

For this alternative there were 25 hazardous materials sites identified in the database search. More information regarding these sites may be found in the *Data Collection Report* for this study, submitted under separate cover. The route proposed in Alternative A-1 was designed not to impact any hazardous sites found in the database search. There will be no significant environmental impact due to hazardous materials within this alternative's surrounding area. Below is a summary of the sites found within the areas of the proposed route.

11 underground storage tanks were reported (1999). Of the 11 with underground storage tanks:

- One site was also listed as a waste water treatment facility.
- Eight sites were also listed as leaking underground storage tanks.

Eight sites were identified in the Facility Index System Report; this database contains details regarding the listed facilities' information. Of the eight listed in the Facility Index System Report:

- Seven were also listed in the Resource Conservation and Recovery Information System database containing information regarding hazardous waste handlers regulated by the EPA
- One was also listed as a Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) site. This database contains information on potentially hazardous waste sites that have been reported to the EPA.
- One was also listed in the Emergency Response Notification System, a database that records and stores information on

reported releases of oil and hazardous substances.

One site was listed in the CERCLIS database that contains data on potentially hazardous waste sites that have been reported to the EPA. This site was also listed in the ZipAcid database that identifies facilities that are subject to investigations concerning possible contamination of soil, surface water, or groundwater.

One site was identified as an "AZ SPILL" site listed in the Hazardous Material Logbook. This logbook documents chemical spills and incidents, last updated in 1986.

Four sites were listed as locations of dry wells constructed solely for the disposal of storm water. Of these four dry well sites:

- One site was also identified as a ZipAcid site subject to investigations concerning possible contamination of soil, surface water, or groundwater.

Social and Economic

Due to the heterogeneity of the project area, the route suggested in this alternative exhibits virtually no bias with respect to age, income, or ethnic characteristics of the areas through which it passes. Environmental justice considerations would appear to be served through the selection of this alternative.

Ecology

Habitat improvement or beneficial land use/open space development opportunities may exist along the route suggested in this alternative. This alternative incorporates a design component that would direct some storm water directly to the Tres Rios regulating wetland which may affect volume requirements of the wetland and will require special

coordination with the operations of the wetland. Habitat improvements also may be implemented along the construction corridor or at points where the route terminates at river channels. Environmental permits (NPDES and Section 404) would be required because of Clean Water Act regulations to implement this alternative at new outfalls to the Salt and Agua Fria Rivers..

Planned Landscape Character Theme: (Figures V-2 and V-3)

Because of the diversity within the Durango study area and the lack of a single dominant appropriate theme applicable throughout, it is recommended that a mixed theme approach be taken to the landscape design for all three screened alternatives. For each alignment the suggested landscape theme bears a relationship to either the existing landscape character, future desired landscape character, and / or characteristics relating to the culture, history, or prehistory of the area. Based on the information presented in the data collection phase of the project and supplemental corridor analysis, the following themes are proposed for Alternative A-1.

Eastern Area - Modified Sonoran Theme. The eastern area landscape features a detention basin (36 acres) and multi-use trail / channel which follows the alignment of a transmission line corridor. The detention basin should be designed with sufficient turf area, slope plantings, shade trees and park amenities (i.e. ramadas, benches, picnic tables, bbq's, lighting, and recreational / exercise/par course equipment) to facilitate site security and maintenance as well as provide a pleasant and functional environment for lunchtime and recreational uses for employees of adjacent industrial facilities. The channel corridor alignment, adjacent to a north/south transmission line provides an off-road multi-use trail link to proposed regional trails along the banks of the Salt and Gila Rivers. In areas where alignments follow transmission

line corridors, the combination multi-use trail and maintenance road must provide maintenance access to both the channel corridor as well as transmission line poles. Berming and strategic placement of plant materials will not only serve to add visual interest but also provides climate mitigation, mitigation for the adjacent transmission corridor, screening of objectionable views of adjacent industrial facilities and also allows for creation of view corridors of the mountains to the south. Basin and channel side slopes should be graded with gentle undulating side slopes which vary from 4:1 to 8:1 or more where possible. The plant palette will be consistent with the Estrella Village Plan and adjacent existing developments. Primary canopy trees will consist of Mesquite, Palo Verde, and Acacia varieties, with Palms used in areas for special emphasis.

Central Area - Park-Like Theme with Agricultural Heritage Theme incorporated for special emphasis areas. The Central Area is primarily open agricultural lands currently being developed and planned as residential. The flood control facility alignment in this area consists of three detention basins and connecting channel corridor which provides an opportunity to create and preserve valuable community recreational open space for a growing population. All basins and channel corridors should be designed for active recreation with a heavy emphasis on turf and shade trees. Basin 1 (between 91st and 99th Avenue) is 37 acres in size and is located in an area designated for a community park facility per the Estrella Village Plan. Basin 2 (at 71st Avenue south of Buckeye Road) is 29 acres in size and is located in an area designated for a neighborhood park facility per the Estrella Village Plan. Basin 3 (at 71st Avenue on the north side of the UPRR) is 39 acres in size and is located in an area along the railroad corridor designated to develop as industrial. A railroad theme may be utilized for special emphasis areas associated with this basin. The channel corridor connecting the basins utilizes

open agricultural lands in the north / south direction and follows a series of transmission corridors east / west. The channel alignment provides a multi-use trail corridor linking to the proposed regional trail along the Agua Fria River. Strategic tree placement will serve to add visual interest, provide climate mitigation, mitigation for the adjacent transmission corridors, and also allows for creation of view corridors of the mountains to the south. Where possible the trail should be located on the south side of transmission corridors to provide opportunities for unobstructed mountain views to the south. Maintenance access to the transmission line must be maintained. The plant palette will be consistent with the Estrella Village Plan. Primary canopy trees will consist of Mesquite, Oak, Chinese Pistache, Evergreen Elm, Sissoo, and Acacias with Palms also used in areas for special emphasis or significance.

Railroad Area - The Railroad Theme combined with a Park-Like Theme and / or Formal Promenade Theme would be applicable for the corridor and three associated basins which follow along the north side of the UPRR from 85th Avenue to the Coldwater Springs golf course. The three basins sized at 36 acres, 28, and 26 acres, respectively, from west to east provide the opportunity to preserve community recreational open space in Tolleson and Avondale. Together with the basins, the channel corridor along the north side of the railroad will enhance this potential future light rail corridor, provide viewing opportunities for the existing railroad as well as a multi-use trail link to the regional trail system along the Agua Fria River. Amenities and hardscape elements would reflect a railroad theme. The landscape palette would include extensive turf with shade trees (similar palette as that listed for the Central Area above) in both formal and informal arrangements in basin areas and trees with mass shrub plantings in corridor areas. Landscape design should comply with City of Tolleson and City of Avondale guidelines.

River Area - Natural Theme combined with Native American Theme. With its close proximity to the the confluence of the Salt / Gila and Agua Fria Rivers, the basin in the southwest corner of the project area is appropriate for a natural theme which incorporates enhanced bird and wildlife habitat, natural materials, grading consistent with natural landforms, passive recreation uses, and a multi-use trail link to the regional trail system along the river corridors. Site amenities and hardscape elements could reflect a Native American theme or motif. The natural theme may also be used as a transitional area for trail corridors connecting to the regional trail system along the rivers.

Advantages:

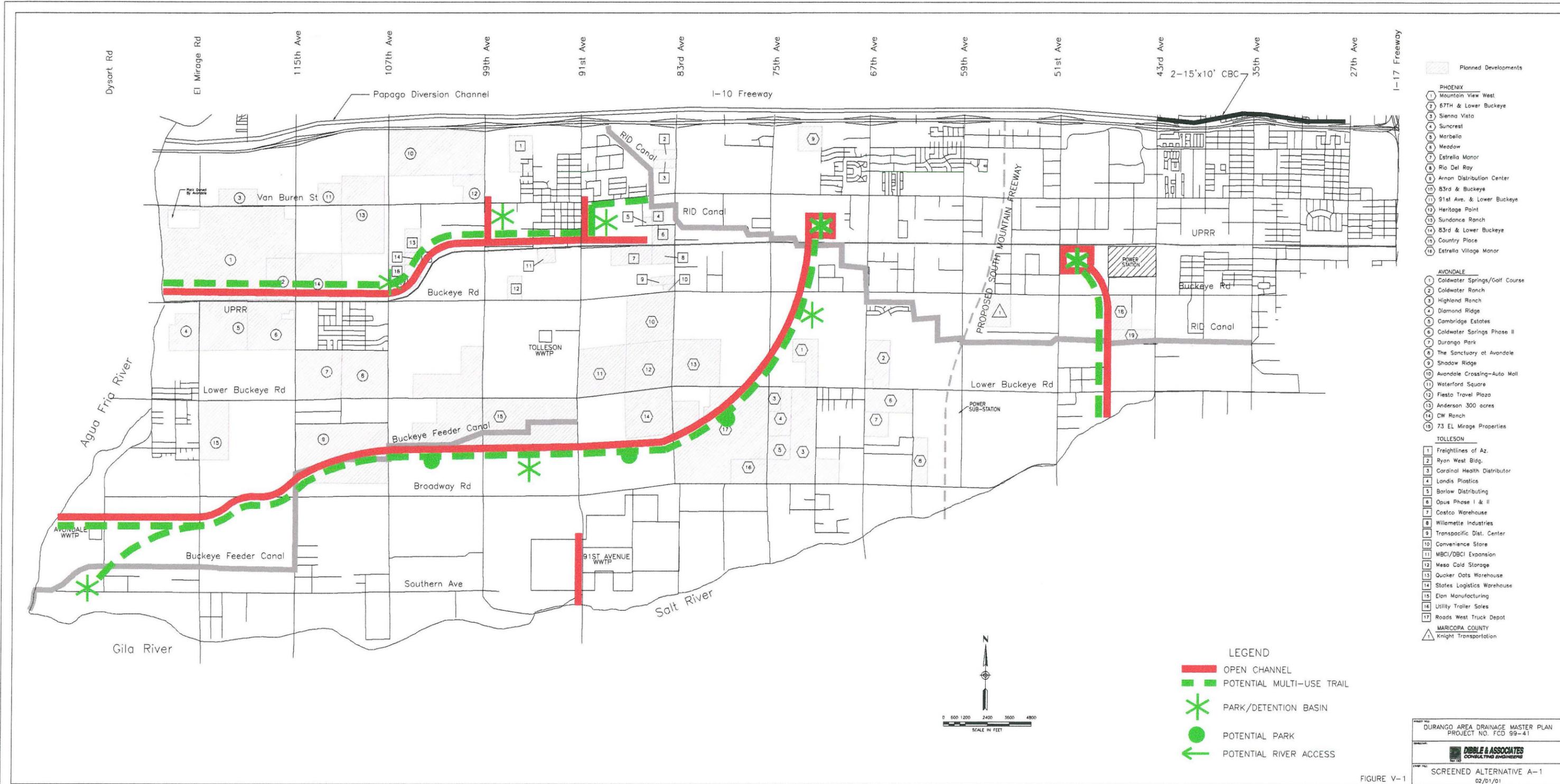
- Contains existing floodplain within the banks of the channels and alleviates flooding in known problem areas.
- Curvilinear alignment of the second channel which promotes the multi-use function of the trail away from major streets
- Provides a linked system which utilizes the potential of the railroad, the BFC, and the RID Canal as multi-use trail corridors and connects potential park/community open space sites
- Opportunity to preserve community open space within existing agricultural areas and open lands since the storm water facilities are co-located with parks. Storm water facilities which are co-located with parks enhance the likelihood of project partners, funding, and multiple use opportunities.
- Opportunity to improve aesthetic value along railroad corridor
- Avoids greatest concentration of potential hazardous materials sites in northeastern portion of project area. The majority of potential hazardous materials sites are located in the northeastern corner of the project area, and along Buckeye, Lower Buckeye, and Broadway Roads. The majority of this route would avoid these areas.
- Discharge has the potential to enhance the Tres Rios wetland along the

Salt River, due to design considerations that would direct some runoff directly to this area provided that this is coordinated with the Tres Rios project

- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas
- Relatively even distribution among income, ethnic, and age groups (No social economic impact)
- No levee penetrations required through the proposed Tres Rios Levee

Disadvantages:

- Implementation of long channel projects may be difficult due to multiple jurisdictional boundary crossings
- Portions of two of the three alignments utilize transmission line corridors which poses a landscape mitigation challenge
- East-west emphasis of alignments allows fewer mountain viewing opportunities and minimal access to the Salt River
- Passes through several Hohokam canals and the Pueblo Del Alamo and Pueblo Del Rio prehistoric sites. The estimated cost for mitigation for this type of previously recorded site cannot be made until site-specific testing is conducted.
- NPDES and 404 permit/mitigation required for the four discharge points to Salt and Agua Fria Rivers



Planned Developments

- PHOENIX**
- 1 Mountain View West
 - 2 67th & Lower Buckeye
 - 3 Sienna Vista
 - 4 Suncrest
 - 5 Marbella
 - 6 Meadow
 - 7 Estrella Manor
 - 8 Rio Del Ray
 - 9 Arroyo Distribution Center
 - 10 83rd & Buckeye
 - 11 91st Ave. & Lower Buckeye
 - 12 Heritage Point
 - 13 Sundance Ranch
 - 14 83rd & Lower Buckeye
 - 15 Country Place
 - 16 Estrella Village Manor

- AVONDALE**
- 1 Coldwater Springs/Golf Course
 - 2 Coldwater Ranch
 - 3 Highland Ranch
 - 4 Diamond Ridge
 - 5 Cambridge Estates
 - 6 Coldwater Springs Phase II
 - 7 Durango Park
 - 8 The Sanctuary at Avondale
 - 9 Shadow Ridge
 - 10 Avondale Crossing-Auto Mall
 - 11 Waterford Square
 - 12 Fiesta Travel Plaza
 - 13 Anderson 300 acres
 - 14 CW Ranch
 - 15 73 El Mirage Properties

- TOLLESON**
- 1 Freightlines of Az.
 - 2 Ryan West Bldg.
 - 3 Cardinal Health Distributor
 - 4 Landis Plastics
 - 5 Barlow Distributing
 - 6 Opus Phase I & II
 - 7 Costco Warehouse
 - 8 Willamette Industries
 - 9 Transpacific Dist. Center
 - 10 Convenience Store
 - 11 MBI/DBCI Expansion
 - 12 Mesa Cold Storage
 - 13 Quaker Oats Warehouse
 - 14 States Logistics Warehouse
 - 15 Elan Manufacturing
 - 16 Utility Trailer Sales
 - 17 Roads West Truck Depot
- MARICOPA COUNTY**
- 1 Knight Transportation

- LEGEND**
- OPEN CHANNEL
 - - - POTENTIAL MULTI-USE TRAIL
 - ✱ PARK/DETENTION BASIN
 - POTENTIAL PARK
 - ← POTENTIAL RIVER ACCESS

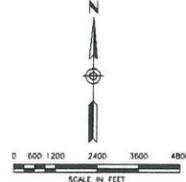


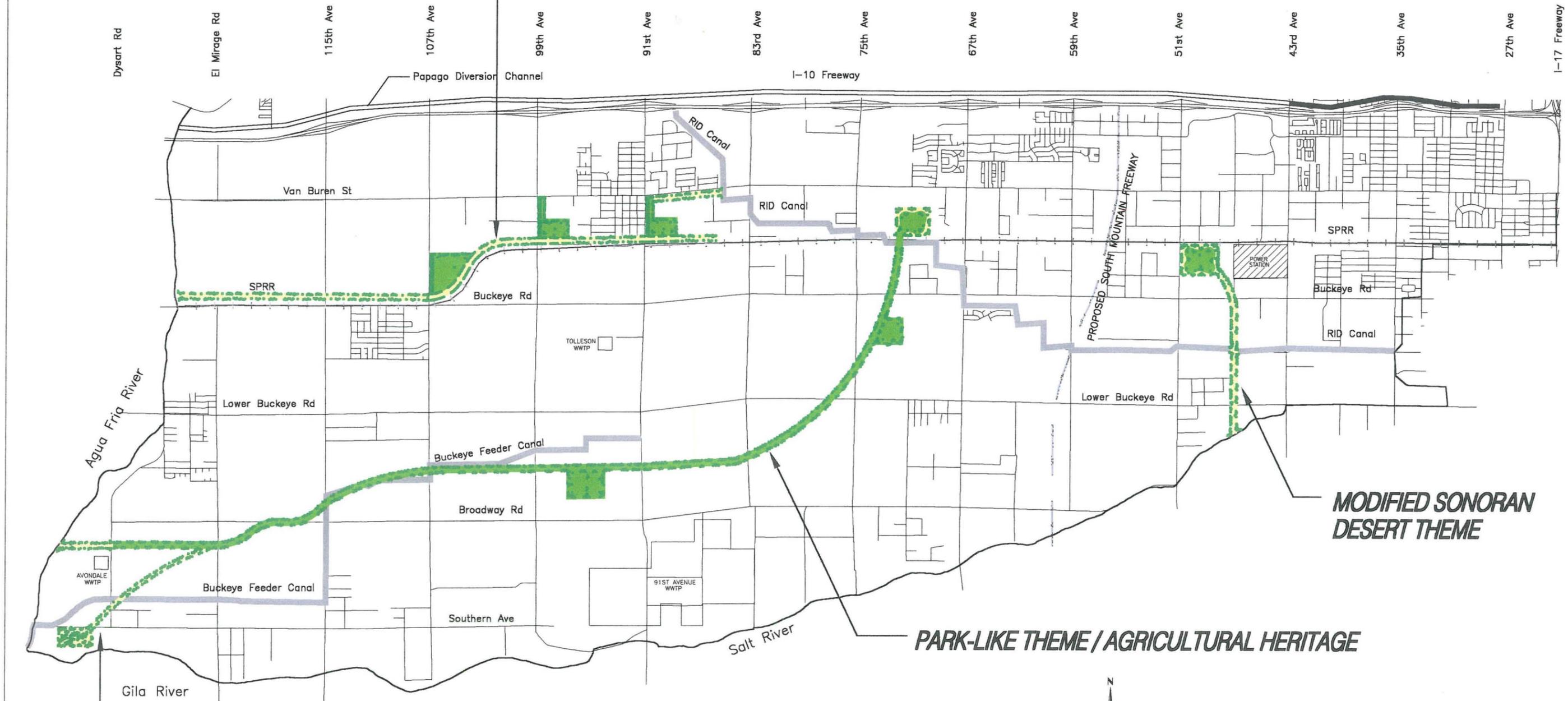
FIGURE V-1

DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

SCREENED ALTERNATIVE A-1
02/01/01

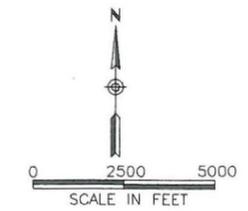
**RAILROAD THEME COMBINED WITH PARK-LIKE
THEME AND FORMAL PROMENADE**



NATURAL THEME / NATIVE AMERICAN

**MODIFIED SONORAN
DESERT THEME**

PARK-LIKE THEME / AGRICULTURAL HERITAGE

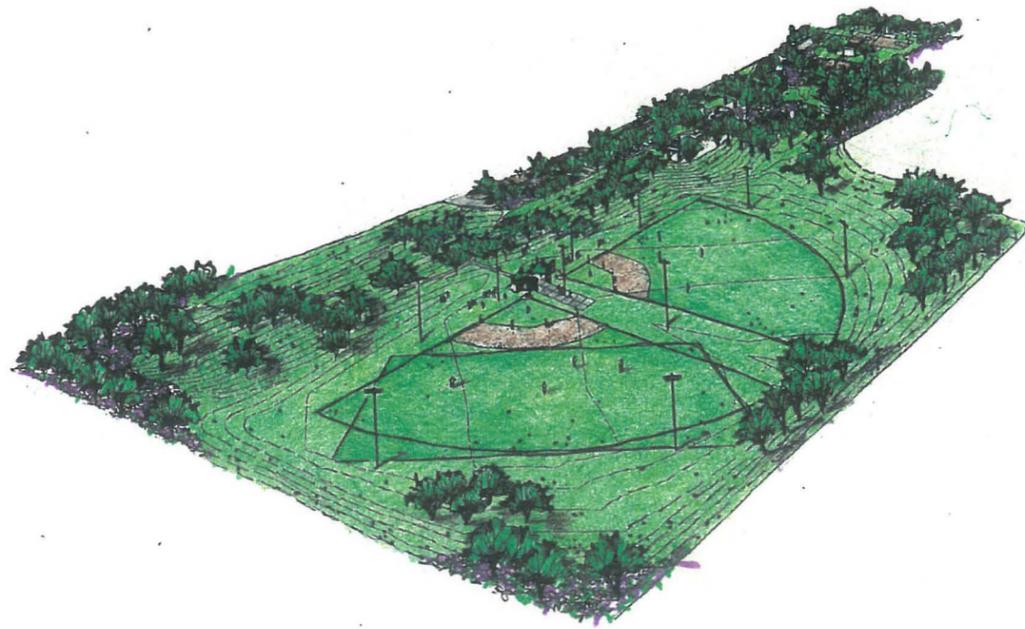


02/01/01

PROJECT TITLE:
DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

CONSULTANT:
McCloskey • Peltz, Inc.
LANDSCAPE ARCHITECTS

FIGURE V-2
**ALTERNATIVE A-1
PROPOSED LANDSCAPE THEMES**



PARK-LIKE THEME



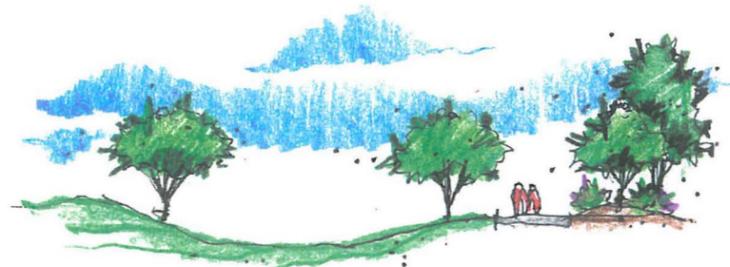
NATURAL THEME



PARK-LIKE THEME (POWER LINE CORRIDOR)



SONORAN DESERT THEME (POWER LINE CORRIDOR)



PARK-LIKE THEME (NON POWER LINE CORRIDOR)



RAILROAD THEME

02/01/01

| | |
|---------------|--|
| PROJECT TITLE | DURANGO AREA DRAINAGE MASTER PLAN PROJECT NO. FCD 99-41 |
| DESIGNER | McCloskey & Peltz, Inc. LANDSCAPE ARCHITECTS |
| CONCEPT TITLE | ALTERNATIVE A-1 LANDSCAPE CHARACTER |

FIGURE V-3

2. **Alternative A-2** (Figure V-4)

Estimated Cost: \$111,042,892

Description:

Alternative A-2 is a modified version of Alternative B-1 which consists of a north-south oriented network of channels with two key detention basins at hydrologically prime locations. An additional key park /detention basin is included at the northeast corner of 91st Avenue and the UPRR. The first channel alignment is along the proposed South Mountain Freeway from Van Buren Street to the Salt River, with a tributary channel from the detention basin at 51st Avenue and the UPRR south and west to meet the proposed South Mountain Freeway channel just south of the RID canal. The second channel alignment is from the detention basin at 71st Avenue and the UPRR south and curvilinear to the 79th Avenue alignment, then south to the Salt River. The third channel alignment is from 91st Avenue and Van Buren Street to the detention basin at 91st Avenue and the UPRR, continuing south to the BFC alignment, then following the BFC alignment out to the west, with the major outfall turning south at approximately the 117th Avenue alignment, but also continuing to the west to outfall at the confluence of the Gila and Agua Fria Rivers. The fourth channel alignment is along the north side of the UPRR from 99th Avenue west to the Agua Fria River. It is recognized that the Coldwater Springs development between 115th Avenue and the Agua Fria river has already begun construction that would take some of the channel water through a golf course in the development. There are three other potential park / detention basin locations and two possible park locations along the channel alignments. It is also planned to extend the trail system around the perimeter of the Tolleson wastewater treatment plant and the proposed golf course associated with it.

Engineering Considerations:

Final design will need to include coordination with proposed developments with minor adjustments to the channel alignments. The freeway alignment could be constructed in conjunction with ADOT as part of the proposed freeway project. Multiple outfalls into the Salt River may raise concern in regard to obtaining 404 permits. Future maintenance of the channels and detention basins will need to be coordinated with local jurisdiction maintenance departments and could range from \$500,000 to \$750,000 per year based on an estimated unit maintenance cost of \$0.04 per square foot, and depending upon the actual landscaping scheme constructed with the project.

Environmental Considerations:

Cultural Resources

This route passes through, and would likely cause disturbances to several Hohokam canals. In addition to the Pueblo Del Rio and Fowler Ruin prehistoric sites identified with Alternative A-1, this alternative also passes through the Pueblo Del Alamo prehistoric site located south of the RID canal along the proposed South Mountain Freeway alignment. This presents potential concerns for preservation of these cultural resources.

Hazardous Materials

This route avoids the highest concentration of potential hazardous materials sites, most of which are located in the northeastern corner of the project area, and along Buckeye, Lower Buckeye, and Broadway Roads. The details of potential hazardous material sites need to be reviewed to minimize encounters with sites that may impact construction of this project. The time and cost of managing construction in or near such sites would also be similarly minimized.

For this alternative, there were 28 hazardous materials sites identified in the database search. More information regarding these sites may be found in the *Data Collection Report*. The route proposed in Alternative A-2 was designed not to impact any hazardous sites found in the database search. There will be no significant environmental impact due to hazardous materials within this alternative’s surrounding area. Below is a summary of the sites found within the areas of the proposed route.

Three leaking underground storage tanks were reported in or before 1999.

10 sites were identified in the Facility Index System Report; this database contains details regarding the listed facilities’ information. Of the 10 listed in the Facility Index System Report:

- Seven were also listed in the Resource Conservation and Recovery Information System; “RCRIS” contains information on hazardous waste handlers that are regulated by the EPA.
- Two were also listed as underground storage tank sites.
- One site was also identified as a “ZipAcid” site subject to investigations concerning possible contamination of soil, surface water, or groundwater.
- One site was also identified as an “AZ SPILL” site listed in the Hazardous Material Logbook. The logbook documents chemical spills and incidents, last updated in 1986.
- One site was also listed as the location of a “dry well” constructed solely for the disposal of storm water.

Four sites were identified as “ZipAcid” sites subject to investigations concerning possible contamination of soil, surface water, or groundwater. Of these four “ZipAcid” sites:

- 1 was also listed as an underground storage tank site.

- Three sites were listed as locations of “dry wells” constructed for the disposal of storm water.

Four sites were listed in the Emergency Response Notification System database, a listing that records and stores information on reported releases of oil and hazardous substances.

Two underground storage tanks were reported.

- One site was listed in the Toxic Chemical Release Inventory system database. TRIS identifies facilities that release toxic chemicals to the air, water, and land under SARA.

- One site was listed in the Hazardous Material Logbook. The logbook documents chemical spills and incidents, last updated in 1986.

Social and Economic

Due to the heterogeneity of the project area, the route suggested in this alternative exhibits virtually no bias with respect to age, income, or ethnic characteristics of the areas through which it passes. Environmental justice considerations would appear to be served through the selection of this alternative.

Ecology

Habitat improvement or beneficial land use/open space development opportunities may exist along the route suggested in this alternative. This alternative incorporates a design component that would direct some storm water directly to the Tres Rios constructed wetland. Habitat improvements also may be implemented along the construction corridor or at points where the route terminates at river channels. Environmental permits (NPDES and Section 404) would be required because of Clean Water Act regulations to implement this alternative at new outfalls to

the Salt/Gila and Agua Fria Rivers.

Planned Landscape Character Theme: (Figures V-5 and V-6)

Based on the information presented in the data collection phase of the project and supplemental corridor analysis, the following themes are proposed for Alternative A-2.

Eastern Area - Modified Sonoran Theme. The eastern area landscape features a detention basin (36 acres) and multi-use trail / channel which utilizes existing undeveloped, agricultural land and the proposed South Mountain Freeway corridor alignment. The detention basin should be designed with sufficient turf area, slope plantings, shade trees and park amenities (i.e. ramadas, benches, picnic tables, bbq's, lighting, and recreational / exercise/par course equipment) to facilitate site security and maintenance as well as provide a pleasant and functional environment for lunchtime and recreational uses for employees of adjacent industrial facilities. The channel corridor alignment provides an off-road multi-use trail link to proposed regional trails along the banks of the Salt and Gila Rivers as well as a regional transportation link. Strategic placement of plant materials will not only serve to add visual interest but also provides climate mitigation, mitigation for the adjacent freeway corridor, screening of objectionable views of adjacent industrial facilities and also allows for creation of view corridors of the mountains to the south. Basin and channel side slopes should be graded with gentle undulating side slopes which vary from 4:1 to 8:1 or more where possible. The plant palette will be consistent with the Estrella Village Plan and adjacent existing developments. Primary canopy trees will consist of Mesquite, Palo Verde, and Acacia varieties, with Palms used in areas for special emphasis.

Central Area - Park-Like Theme with Agricultural Heritage or Railroad

Theme incorporated for special emphasis areas. The Central Area is primarily open agricultural lands currently being developed and planned as residential. The flood control facilities in this area consist of one alignment originating at a basin at 71st Avenue and the UPRR and outfalling to the Salt River between 75th and 83rd Avenue. This alignment consisting of two detention basins with connecting channel corridor provides an opportunity to create and preserve valuable community recreational open space for a growing population. All basins and channel corridors should be designed for active recreation with a heavy emphasis on turf and shade trees. Basin 1 (at 71st Avenue south of Buckeye Road) is 29 acres in size and is located in an area designated for a neighborhood park facility per the Estrella Village Plan. Basin 2 (at 71st Avenue on the north side of the UPRR) is 39 acres in size and is located in an area along the railroad corridor designated to develop as industrial. A railroad theme may be utilized for special emphasis areas associated with this basin. The channel corridor connecting the basins utilizes open agricultural lands in the north/south direction. The channel alignment provides a multi-use trail corridor linking to the proposed regional trail along the Salt /Gila River.

A portion of a second alignment also falls within the Central Area. This includes a corridor along the BFC west of 91st Avenue. This alignment includes one basin (between 91st and 99th Avenue) 37 acres in size and located in an area designated for a community park facility per the Estrella Village Plan. The channel alignment utilizes open agricultural lands and provides a multi-use trail corridor linking to the proposed regional trail along the Salt /Gila River.

Strategic tree placement will serve to add visual interest, provide climate mitigation, and also allows for creation of view corridors of the mountains to the south. The plant palette will be consistent with the

Estrella Village Plan. Primary canopy trees will consist of Mesquite, Oak, Chinese Pistache, Evergreen Elm, Sissoo, and Acacias with Palms also used in areas for special emphasis or significance.

Railroad Area - The Railroad Theme combined with a Park-Like Theme and / or Formal Promenade Theme would be applicable for the corridor and associated basin along the north side of the UPRR from 99th Avenue to the Coldwater Springs golf course. The single basin at 107th Avenue and the UPRR is 36 acres in size and provides the opportunity to preserve community recreational open space in Tolleson. Together with the basin, the channel corridor along the north side of the railroad will enhance this potential future light rail corridor, provide viewing opportunities for the existing railroad as well as a multi-use trail link to the regional trail system along the Agua Fria River. Amenities and hardscape elements would reflect a railroad theme. The landscape palette would include extensive turf with shade trees (similar palette as that listed for the Central Area above) in both formal and informal arrangements in basin areas and trees with mass shrub plantings in corridor areas. Landscape design should comply with City of Tolleson and City of Avondale guidelines.

91st Avenue Area- A portion of an alignment follows 91st Avenue from Van Buren to south of Lower Buckeye and includes one basin at the northeast corner of 91st Avenue and Buckeye Road / UPRR. The character of this existing area is strongly influenced by the existence of formal wind rows of mature Pecan trees. The proposed landscape theme for this area may consist of a combination of the Formal Promenade Theme, Park-Like Theme, Railroad Theme and Historic Canal Theme for the basin and channel / multi-use trail corridor. The landscape palette would consist primarily of formal rows of large scale canopy trees (Chinese Pistache) with a combination of turf (outside right of way) and

low mass shrub plantings along the corridors. The basin would include extensive turf, and shade trees (similar palette as that listed for the Central Area above) in both formal and informal arrangements. Specific design shall comply with applicable municipal landscape guidelines.

River Area - Natural Theme combined with Native American Theme. With its close proximity to the the confluence of the Salt / Gila and Agua Fria Rivers, the proposed basin in the southwest corner of the project area is appropriate for a natural theme which incorporates enhanced bird and wildlife habitat, natural materials, grading consistent with natural landforms, passive recreation uses, and a multi-use trail link to the regional trail system along the river corridors. Site amenities and hardscape elements could reflect a Native American theme or motif. The natural theme may also be used as a transitional area for trail corridors connecting to the regional trail system along the rivers.

Advantages:

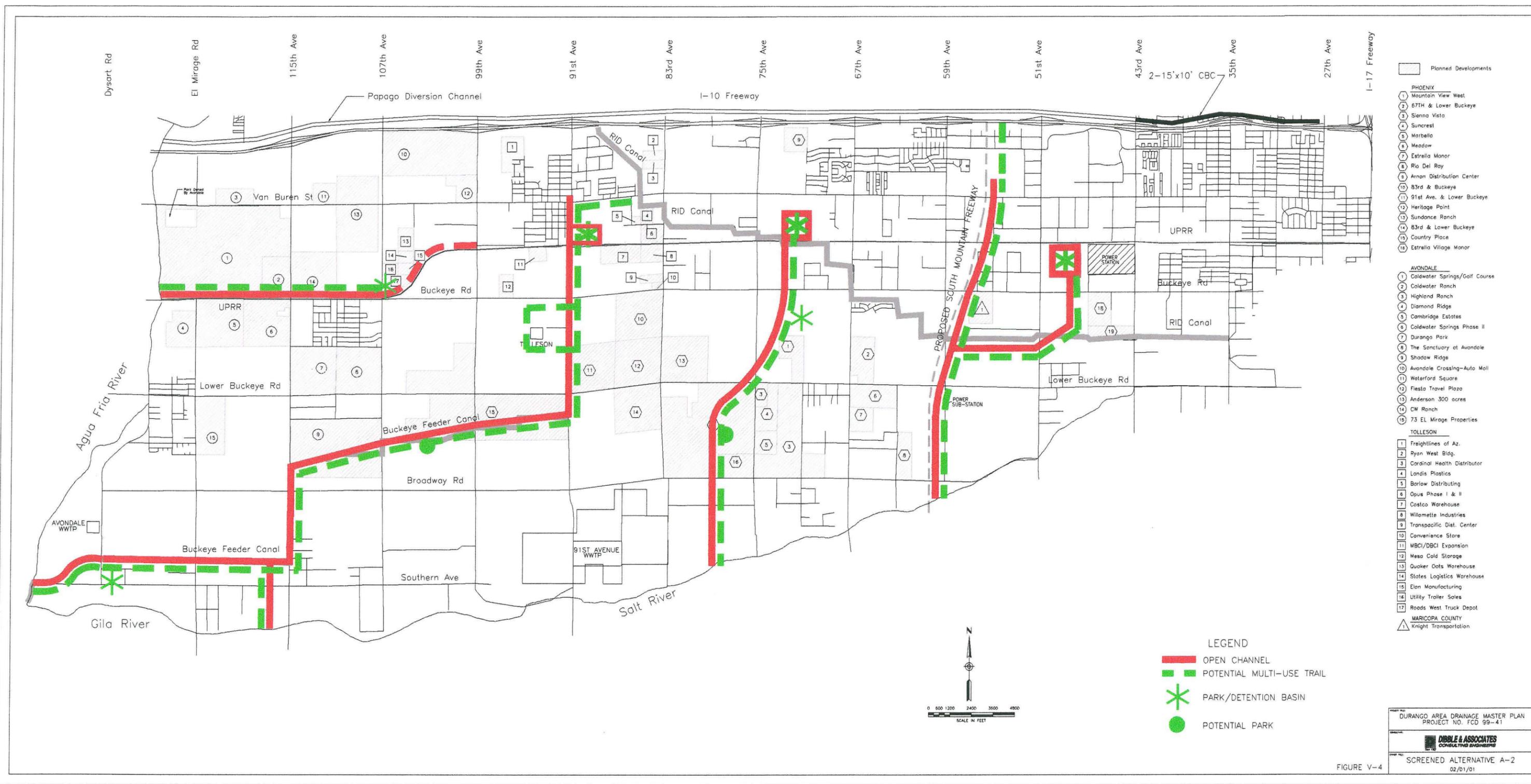
- Contains existing floodplain within the banks of the channels and alleviates flooding in known problem areas.
- Utilizes the proposed South Mountain Freeway corridor allowing for a possible cost sharing partner with ADOT
- None of the alignments in this alternative utilize transmission corridors
- Represents a linked system which utilizes the potential of the BFC and RID Canal as multi-use trail corridors
- Opportunity to preserve community open space within existing agricultural areas and open lands since the storm water facilities are co-located with parks. Storm water facilities which are co-located with proposed parks enhance the likelihood of project partners, funding, and multiple use opportunities.
- Opportunity to improve aesthetic value along a portion of the railroad

corridor

- North-south emphasis on alignments allows greater mountain viewing opportunities and good multi-modal linkages to river access
- Avoids greatest concentration of potential hazardous materials sites in northeastern portion of project area. The majority of potential hazardous materials sites are located in the northeastern corner of the project area, and along Buckeye, Lower Buckeye, and Broadway Roads. The majority of the route avoids these roads.
- Discharge has the potential to enhance the Tres Rios wetland along the Salt River, due to design considerations that would direct some runoff directly to this area and coordination with the Tres Rios project
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas
- Relatively even distribution among income, ethnic, and age groups (No social economic impact)

Disadvantages:

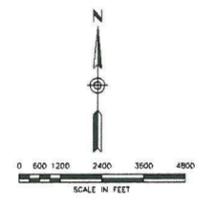
- Channel along the proposed South Mountain Freeway corridor crosses several petroleum gas lines along the railroad
- One levee penetration required through the proposed Tres Rios levee
- Proposed South Mountain Freeway alignment would require relocation of an APS power substation
- Multi-use trail with the channel alignment along the north side of the railroad is linked only to the Agua Fria River levee and not to any other channel alignments in the area
- Passes through several Hohokam canals and prehistoric sites. The estimated cost for mitigation of these type of previously recorded sites cannot be made until site-specific testing is conducted.
- NPDES and 404 permit/mitigation required for the five discharge points to Gila, Salt and Agua Fria Rivers

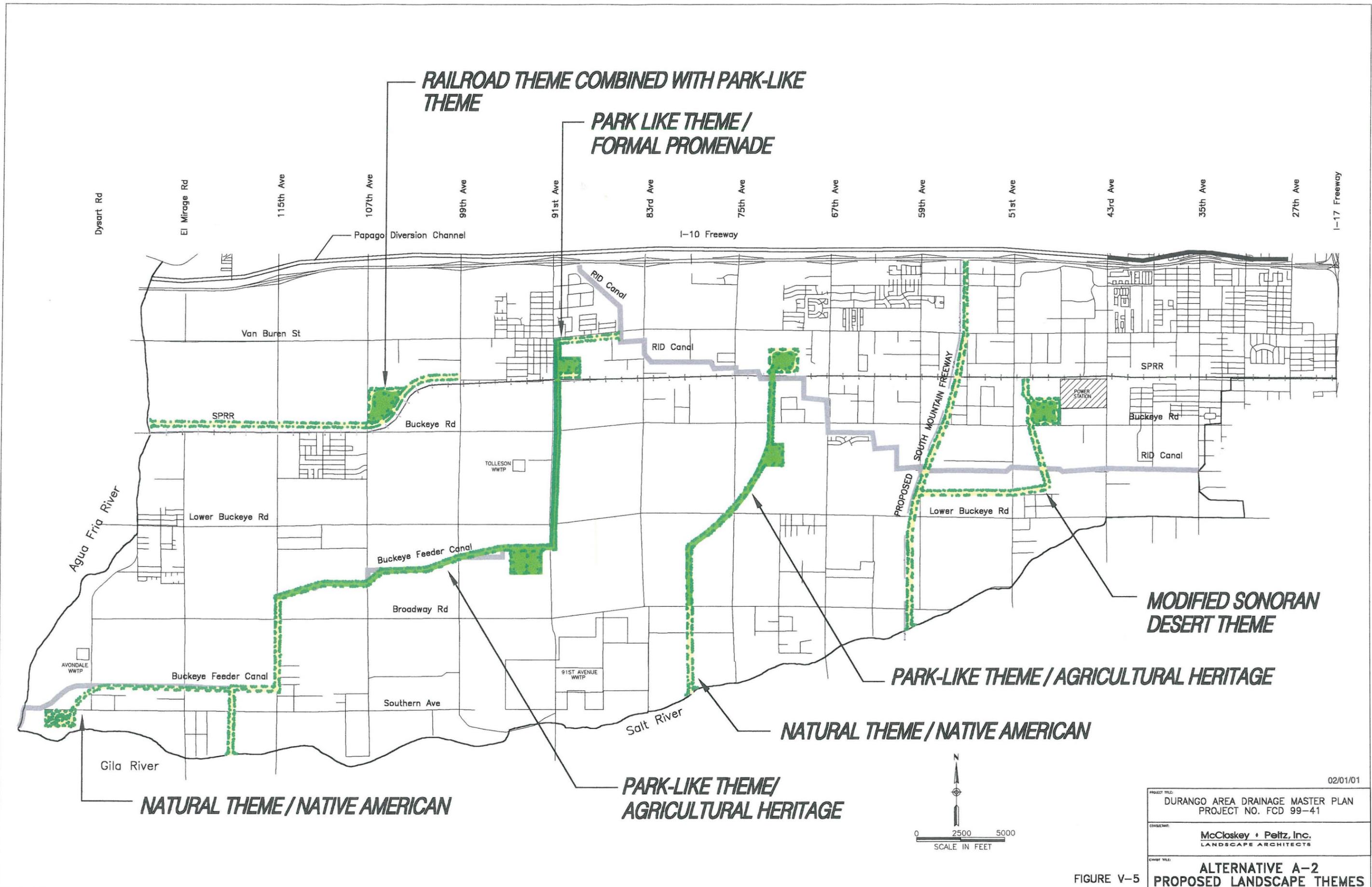


- Planned Developments
- PHOENIX**
- 1 Mountain View West
 - 2 67th & Lower Buckeye
 - 3 Sienna Vista
 - 4 Suncrest
 - 5 Marbella
 - 6 Meadow
 - 7 Estrella Manor
 - 8 Rio Del Ray
 - 9 Arroyo Distribution Center
 - 10 83rd & Buckeye
 - 11 91st Ave. & Lower Buckeye
 - 12 Heritage Point
 - 13 Sundance Ranch
 - 14 83rd & Lower Buckeye
 - 15 Country Place
 - 16 Estrella Village Manor
- AVONDALE**
- 1 Coldwater Springs/Golf Course
 - 2 Coldwater Ranch
 - 3 Highland Ranch
 - 4 Diamond Ridge
 - 5 Cambridge Estates
 - 6 Coldwater Springs Phase II
 - 7 Durango Park
 - 8 The Sanctuary at Avondale
 - 9 Shadow Ridge
 - 10 Avondale Crossing-Auto Mall
 - 11 Waterford Square
 - 12 Fiesta Travel Plaza
 - 13 Anderson 300 acres
 - 14 CW Ranch
 - 15 73 EL Mirage Properties
- TOLLESON**
- 1 Freightlines of Az.
 - 2 Ryan West Bldg.
 - 3 Cardinal Health Distributor
 - 4 Landis Plastics
 - 5 Barlow Distributing
 - 6 Opus Phase I & II
 - 7 Costco Warehouse
 - 8 Willamette Industries
 - 9 Transpacific Dist. Center
 - 10 Convenience Store
 - 11 MBI/DBCI Expansion
 - 12 Mesa Cold Storage
 - 13 Quaker Oats Warehouse
 - 14 States Logistics Warehouse
 - 15 Elan Manufacturing
 - 16 Utility Trailer Sales
 - 17 Roads West Truck Depot
- MARICOPA COUNTY**
- 1 Knight Transportation

LEGEND

- OPEN CHANNEL
- POTENTIAL MULTI-USE TRAIL
- PARK/DETENTION BASIN
- POTENTIAL PARK





**RAILROAD THEME COMBINED WITH PARK-LIKE
THEME**

**PARK LIKE THEME /
FORMAL PROMENADE**

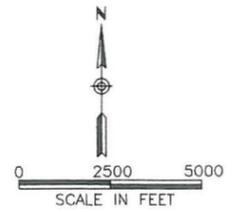
**MODIFIED SONORAN
DESERT THEME**

PARK-LIKE THEME / AGRICULTURAL HERITAGE

NATURAL THEME / NATIVE AMERICAN

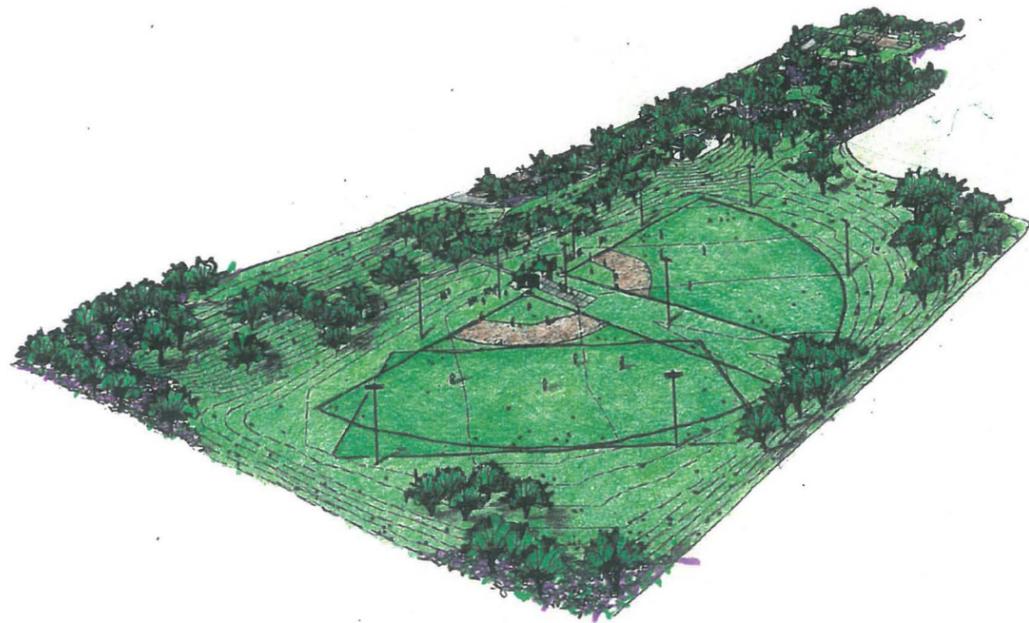
**PARK-LIKE THEME/
AGRICULTURAL HERITAGE**

NATURAL THEME / NATIVE AMERICAN



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|----------------|--|
| PROJECT TITLE: | DURANGO AREA DRAINAGE MASTER PLAN PROJECT NO. FCD 99-41 |
| CONSULTANT: | McCloskey + Peltz, Inc. LANDSCAPE ARCHITECTS |
| DATE: | 02/01/01 |

FIGURE V-5
**ALTERNATIVE A-2
PROPOSED LANDSCAPE THEMES**



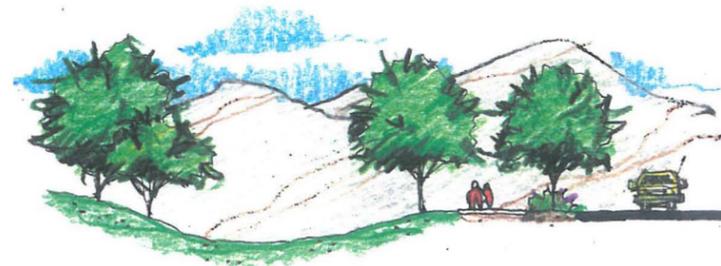
PARK-LIKE THEME



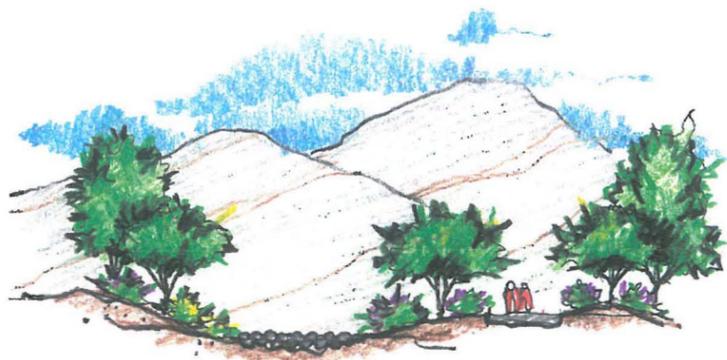
NATURAL THEME



PARK-LIKE THEME (NON POWER LINE CORRIDOR)



FORMAL PROMENADE THEME



SONORAN DESERT THEME (NON POWER LINE CORRIDOR)



RAILROAD THEME

02/01/01

| | |
|----------------|--|
| PROJECT TITLE: | DURANGO AREA DRAINAGE MASTER PLAN PROJECT NO. FCD 99-41 |
| CONSULTANT: | McCloskey + Peltz, Inc. LANDSCAPE ARCHITECTS |
| DRAWING TITLE: | ALTERNATIVE A-2 LANDSCAPE CHARACTER |

FIGURE V-6

3. **Alternative A-3** (Figure V-7)

Estimated Cost: \$142,696,781

Description:

Alternative A-3 is a modified version of Alternatives B-3 and S-3 which also consists of a network of channels with two key detention basins at hydrologically prime locations. Again, an additional key park /detention basin is included at the northeast corner of 91st Avenue and the UPRR. The first alignment proposes to use the existing storm drain in 51st Ave to convey storm water from the detention basin at 51st Avenue and the UPRR south to the Salt River. The second channel alignment is from the detention basin at 71st Avenue and the UPRR south and curvilinear to the powerline corridor between Lower Buckeye Road and Broadway Road, then west to the Agua Fria River. Two tributary channels would be connected to the first channel alignment along 91st Avenue from north of Van Buren to the powerline corridor and along 107th Avenue from north of the UPRR to the powerline corridor. A minor channel alignment is included along the BFC from 115th Avenue west to the confluence of Gila and Agua Fria Rivers. It is recognized that the Coldwater Springs development between 115th Avenue and the Agua Fria river has already begun construction that could take some of the water from 107th Avenue and the UPRR west through a golf course in the development. There are four other potential park / detention basin locations and two possible park locations along the channel alignments. It is also proposed to extend the trail system around the perimeter of the Tolleson wastewater treatment plant and the proposed golf course associated with it.

Engineering Considerations:

Final design will need to include coordination with proposed developments with minor adjustments to the channel alignments. Coordination with the power companies will be required to receive approval for construction of drainage and multi-use facilities within and adjacent to powerline corridors. Future maintenance of the channels and detention basins will need to be coordinated with local jurisdiction maintenance departments and could range from \$500,000 to \$750,000 per year based on an estimated unit maintenance cost of \$0.04 per square foot, and depending upon the actual landscaping scheme constructed with the project.

Environmental Considerations:

Cultural Resources

This route passes through, and would likely cause disturbances to several Hohokam canals and the Fowler Ruin prehistoric site. This presents potential concerns for preservation of these cultural resources.

Hazardous Materials

This route avoids the highest concentration of potential hazardous materials sites, most of which are located in the northeastern corner of the project area, and along Buckeye, Lower Buckeye, and Broadway Roads. The details of potential hazardous material sites need to be reviewed to minimize encounters with sites that may impact construction of this project. The time and cost of managing construction in or near such sites would also be similarly minimized.

For this alternative, there were 37 hazardous materials sites identified in the database search. More information regarding these sites may be found in the *Data Collection Report*. The route proposed in Alternative A-3 was designed not to impact any hazardous sites found in the

database search. There will be no significant environmental impact due to hazardous materials within this alternative's surrounding area. Below is a summary of the sites found within the areas of the proposed route.

13 underground storage tanks were reported in or before 1999. Of the sites with underground storage tanks:

- Seven sites were also listed as leaking underground storage tanks.
- One site was also listed as the location of a "dry well" constructed solely for the disposal of storm water.
- Two sites were also identified as "ZipAcid" sites subject to investigations concerning possible contamination of soil, surface water, or groundwater.

12 sites were identified in the Facility Index System Report; the database contains details regarding the listed facilities' information. Of the 12 sites listed in the Facility Index System Report:

- 10 were also listed in the Resource Conservation and Recovery Information System; (RCRIS) that contains information on hazardous waste handlers regulated by the EPA.
- One was also listed as an underground storage tank.
- Two were also listed as the locations of "dry wells", constructed solely for the disposal of storm water.
- One site was also listed in the Hazardous Material Logbook. The logbook documents chemical spills and incidents, last updated in 1986.
- Four were listed as a "dry well" sites, constructed only for the disposal of storm water.

Three sites were listed in the Emergency Response Notification System database, a listing that records and stores information on reported

releases of oil and hazardous substances.

Two sites were listed in the Hazardous Material Logbook. The logbook was last updated in 1986 and documents chemical spills and incidents.

Three sites were also listed as ZipAcid sites: these facilities are subject to investigations concerning possible contamination of soil, surface water, or groundwater.

Social and Economic

Due to the heterogeneity of the project area, the route suggested in this alternative exhibits virtually no bias with respect to age, income, or ethnic characteristics of the areas through which it passes. Environmental justice considerations would appear to be served through the selection of this alternative.

Ecology

Habitat improvement or beneficial land use/open space development opportunities may exist along the route suggested in this alternative. This alternative incorporates a design component that would direct some storm water directly to the Tres Rios constructed wetland. Habitat improvements also may be implemented along the construction corridor or at points where the route terminates at river channels. Environmental permits (NPDES and Section 404) would be required because of Clean Water Act regulations to implement this alternative at new outfalls to the Salt and Agua Fria Rivers.

Planned Landscape Character Theme: (Figures V-8 and V-9)

Based on the information presented in the data collection phase of the project and supplemental corridor analysis, the following themes are proposed for Alternative A-3.

Eastern Area - Modified Sonoran Theme. The eastern area landscape features a detention basin (36 acres) at 47th Avenue and Buckeye Road and a channel from the UPRR to the basin. South of the basin, the means of conveyance to the outfall at the Salt River, is by means of piping and culverts within roadway pavement areas. Development of a multi-use trail would have to be done as part of roadway improvements. The detention basin should be designed with sufficient turf area, slope plantings, shade trees and park amenities (i.e. ramadas, benches, picnic tables, bbq's, lighting, and recreational / exercise/par course equipment) to facilitate site security and maintenance as well as provide a pleasant and functional environment for lunchtime and recreational uses for employees of adjacent industrial facilities. Strategic placement of plant materials will not only serve to add visual interest but also provides climate mitigation, mitigation for the adjacent transmission corridor, and screening of objectionable views of adjacent industrial facilities. Basin side slopes should be graded with gentle undulating side slopes which vary from 4:1 to 8:1 or more where possible. The plant palette will be consistent with the Estrella Village Plan and adjacent existing developments. Primary canopy trees will consist of Mesquite, Palo Verde, and Acacia varieties, with Palms used in areas for special emphasis.

Central Area - Park-Like Theme with Agricultural Heritage Theme incorporated for special emphasis areas. The Central Area is primarily open agricultural lands currently being developed and planned as residential. The flood control facilities in this area consist of portions of two alignments with detention basins and connecting channel corridors providing an opportunity to create and preserve valuable community recreational open space for a growing population. Alignments featuring this theme would include: the power line alignment which originates at the 71st Avenue / UPRR basin, and heads south through open

agricultural land to the east/west transmission line corridor south of Lower Buckeye Road; and a channel corridor along 107th Avenue from the UPRR to the power line corridor south of Lower Buckeye Road. The three basin sites included as part of Alternative A-3 Central Area are the same as those included in Alternative A-1. All basins and channel corridors should be designed for active recreation with a heavy emphasis on turf and shade trees. Basin 1 (between 91st and 99th Avenue) is 37 acres in size and is located in an area designated for a community park facility per the Estrella Village Plan. Basin 2 (at 71st Avenue south of Buckeye Road) is 29 acres in size and is located in an area designated for a neighborhood park facility per the Estrella Village Plan. Basin 3 (at 71st Avenue on the north side of the UPRR) is 39 acres in size and is located in an area along the railroad corridor designated to develop as industrial. A railroad theme may be utilized for special emphasis areas associated with this basin. The channel corridor connecting the basins utilizes open agricultural lands in the north / south direction and follows a transmission corridor east / west. The channel alignment provides a multi-use trail corridor linking to the proposed regional trail along the Agua Fria River. Strategic tree placement will serve to add visual interest, provide climate mitigation, mitigation for the adjacent transmission corridors, and also allows for creation of view corridors of the mountains to the south. Where possible the trail should be located on the south side of the transmission corridor to provide opportunities for unobstructed mountain views to the south. Maintenance access to the transmission line must be maintained. The plant palette will be consistent with the Estrella Village Plan. Primary canopy trees will consist of Mesquite, Oak, Chinese Pistache, Evergreen Elm, Sissoo, and Acacias with Palms also used in areas for special emphasis or significance.

Railroad Area - The Railroad Theme combined with a Park-Like Theme

and / or Formal Promenade Theme would be applicable for the corridor and two associated basins which follow along the north side of the UPRR from 99th Avenue to the Coldwater Springs golf course. The two basins sized at 36 acres and 28 acres, respectively, from west to east provide the opportunity to preserve community recreational open space in Tolleson and Avondale. Together with the basins, the channel corridor along the north side of the railroad will enhance this potential future light rail corridor, provide viewing opportunities for the existing railroad as well as a multi-use trail link to the regional trail system along the Agua Fria River. Amenities and hardscape elements would reflect a railroad theme. The landscape palette would include extensive turf with shade trees (similar palette as that listed for the Central Area above) in both formal and informal arrangements in basin areas and trees with mass shrub plantings in corridor areas. Landscape design should comply with City of Tolleson and City of Avondale guidelines.

91st Avenue Area- A portion of an alignment follows 91st Avenue from Van Buren to the transmission corridor south of Lower Buckeye and includes one basin at the northeast corner of 91st Avenue and Buckeye/UPRR. The character of this existing area is strongly influenced by the existence of formal wind rows of mature Pecan trees. The proposed landscape theme for this area may consist of a combination of the Formal Promenade Theme, Park-Like Theme, Railroad Theme and Historic Canal Theme for the basin and channel / multi-use trail corridor. The landscape palette would consist primarily of formal rows of large scale canopy trees (Chinese Pistache) with a combination of turf (outside right of way) and low mass shrub plantings along the corridors. The basin would include extensive turf, and shade trees (similar palette as that listed for the Central Area above) in both formal and informal arrangements.

River Area - Natural Theme combined with Native American Theme. With its close proximity to the the confluence of the Salt / Gila and Agua Fria Rivers, the basin in the southwest corner of the project area is appropriate for a natural theme which incorporates enhanced bird and wildlife habitat, natural materials, grading consistent with natural landforms, passive recreation uses, and a multi-use trail link to the regional trail system along the river corridors. Site amenities and hardscape elements could reflect a Native American theme or motif. The natural theme may also be used as a transitional area for trail corridors connecting to the regional trail system along the rivers such the portion of the channel corridor along the BFC west of 115th Avenue.

Advantages:

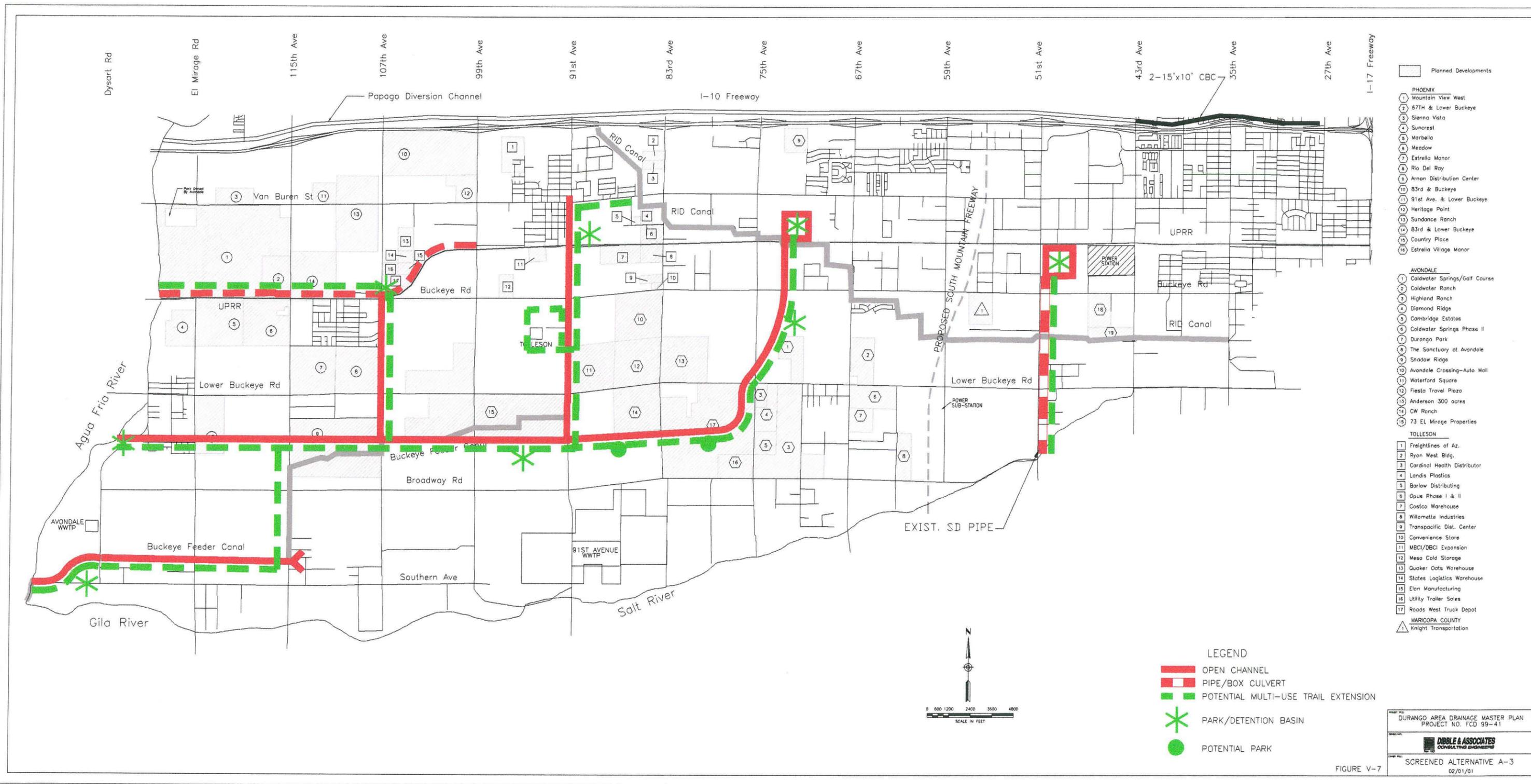
- Contains existing floodplain within the banks of the channels and alleviates flooding in known problem areas.
- Utilization of the existing storm drain pipe in 51st Avenue allows development of multi-use pathway along 51st Avenue as suggested in the Estrella Village planning documents
- Represents a linked system which utilizes the potential of the BFC and RID Canal as multi-use trail corridors
- Combination of north-south and east-west alignments allows mountain viewing opportunities in all directions
- Opportunity to preserve community open space within existing agricultural areas and open lands since the storm water facilities are co-located with parks. Storm water facilities which are co-located with parks enhance the likelihood of project partners, funding, and multiple use opportunities.
- Opportunity to increase aesthetic value for a portion of the railroad corridor
- Avoids greatest concentration of potential hazardous materials sites in

northeastern portion of project area. The majority of potential hazardous materials sites are located in the northeastern corner of the project area, and along Buckeye, Lower Buckeye, and Broadway Roads. The majority of the proposed route avoids these roads.

- Discharge has the potential to enhance the Tres Rios wetland along the Salt River, due to design considerations that would direct some runoff directly to this area provided that this is coordinated with the Tres Rios project
- Potential for habitat improvements along channel outfall locations near the Salt, Gila, or Agua Fria Rivers including revegetation to improve the biological resource value of these areas
- Relatively even distribution among income, ethnic, and age groups (No social economic impact)

Disadvantages:

- Implementation of long channel projects may be difficult due to multiple jurisdictional boundary crossings
- One levee penetration will be required in the proposed Tres Rios levee
- East-west alignment utilizes the powerline corridor which poses a landscape mitigation challenge
- Offers no trail access to the Salt River
- Passes through several Hohokam canals and the Fowler Ruin prehistoric site. The estimated cost for mitigation of these types of previously recorded sites cannot be made until site-specific testing is conducted.
- NPDES and 404 permit/mitigation required for the four discharge points to Salt and Agua Fria Rivers



Planned Developments

- PHOENIX**
- 1 Mountain View West
 - 2 67th & Lower Buckeye
 - 3 Sienna Vista
 - 4 Suncrest
 - 5 Marbella
 - 6 Meadow
 - 7 Estrella Manor
 - 8 Rio Del Rey
 - 9 Aron Distribution Center
 - 10 83rd & Buckeye
 - 11 91st Ave. & Lower Buckeye
 - 12 Heritage Point
 - 13 Sundance Ranch
 - 14 83rd & Lower Buckeye
 - 15 Country Place
 - 16 Estrella Village Manor

- AVONDALE**
- 1 Coldwater Springs/Golf Course
 - 2 Coldwater Ranch
 - 3 Highland Ranch
 - 4 Diamond Ridge
 - 5 Cambridge Estates
 - 6 Coldwater Springs Phase II
 - 7 Durango Park
 - 8 The Sanctuary at Avondale
 - 9 Shadow Ridge
 - 10 Avondale Crossing-Auto Mall
 - 11 Waterford Square
 - 12 Fiesta Travel Plaza
 - 13 Anderson 300 acres
 - 14 CW Ranch
 - 15 73 EL Mirage Properties

- TOLLESON**
- 1 Freightlines of Az.
 - 2 Ryan West Bldg.
 - 3 Cardinal Health Distributor
 - 4 Landis Plastics
 - 5 Barlow Distributing
 - 6 Opus Phase I & II
 - 7 Costco Warehouse
 - 8 Willamette Industries
 - 9 Transpacific Dist. Center
 - 10 Convenience Store
 - 11 MBCI/DBCI Expansion
 - 12 Mesa Cold Storage
 - 13 Quaker Oats Warehouse
 - 14 States Logistics Warehouse
 - 15 Elon Manufacturing
 - 16 Utility Trailer Sales
 - 17 Roads West Truck Depot
- MARICOPA COUNTY**
- 1 Knight Transportation

- LEGEND**
- OPEN CHANNEL
 - PIPE/BOX CULVERT
 - POTENTIAL MULTI-USE TRAIL EXTENSION
 - ✱ PARK/DETENTION BASIN
 - POTENTIAL PARK

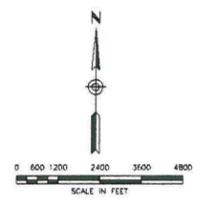
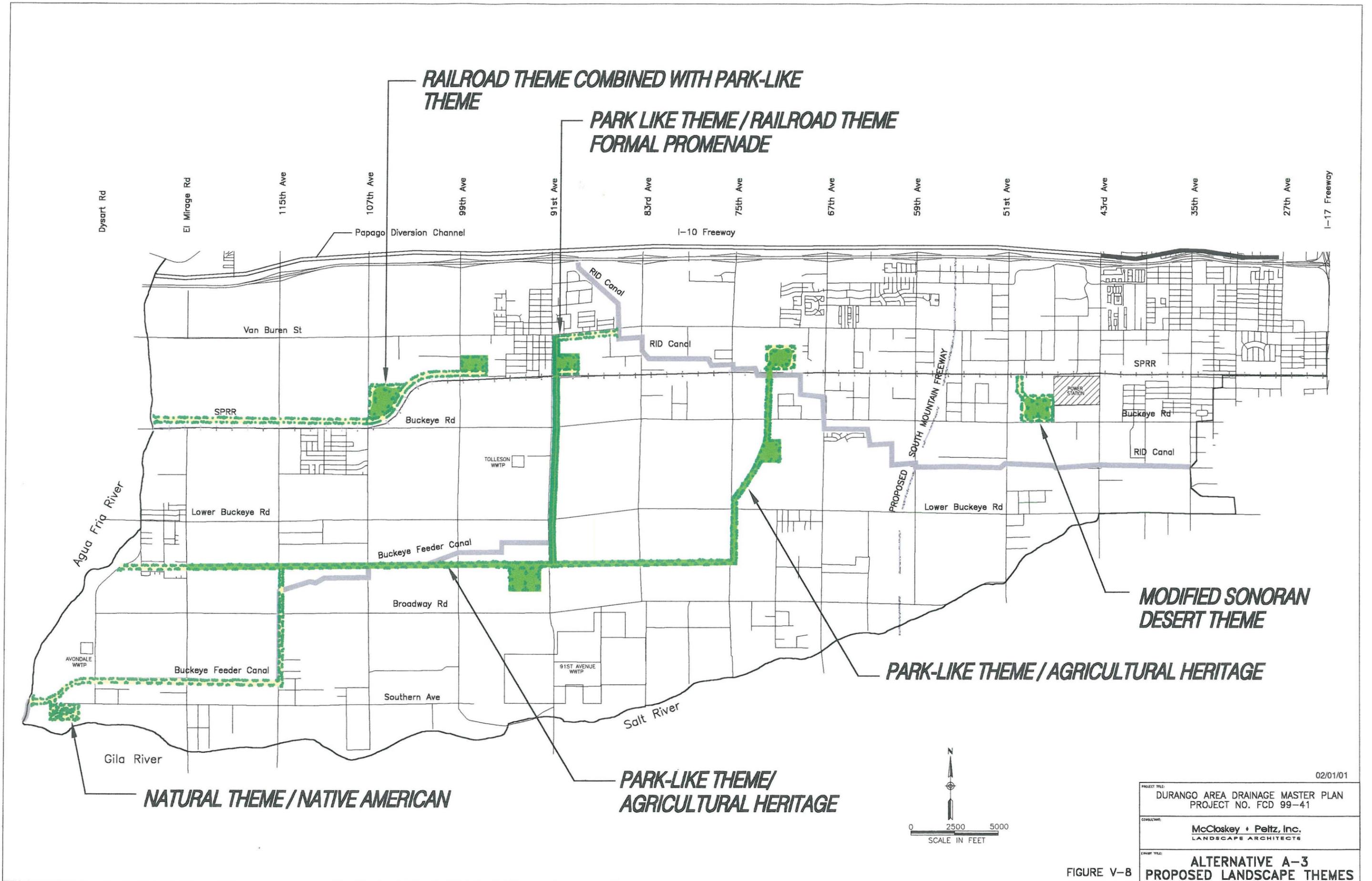


FIGURE V-7

DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

SCREENED ALTERNATIVE A-3
02/01/01



NATURAL THEME / NATIVE AMERICAN

PARK-LIKE THEME / AGRICULTURAL HERITAGE

PARK-LIKE THEME / AGRICULTURAL HERITAGE

MODIFIED SONORAN DESERT THEME

RAILROAD THEME COMBINED WITH PARK-LIKE THEME

PARK LIKE THEME / RAILROAD THEME FORMAL PROMENADE

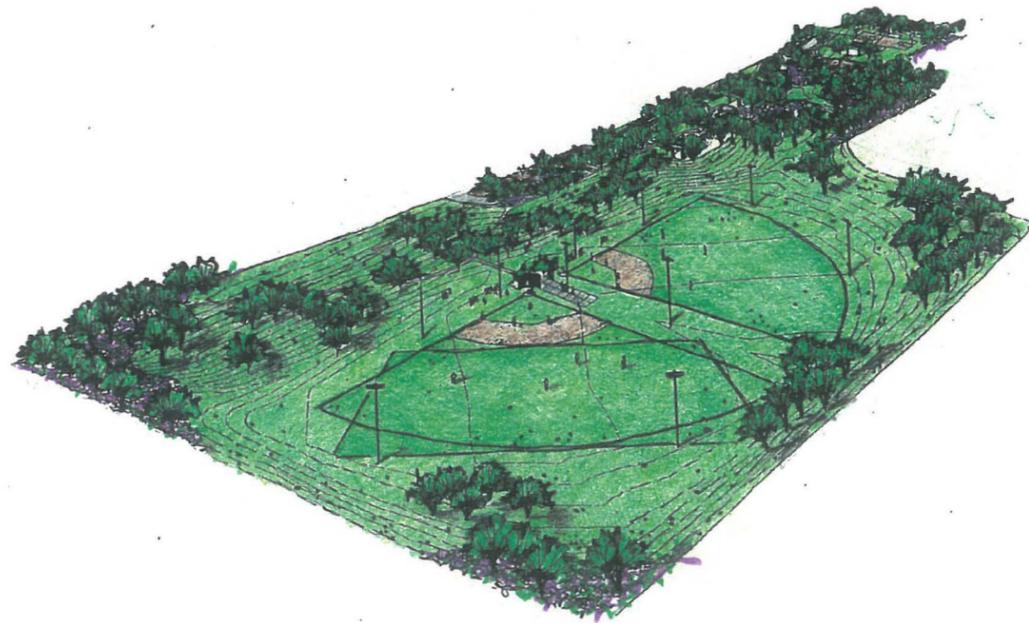
02/01/01

PROJECT TITLE:
DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

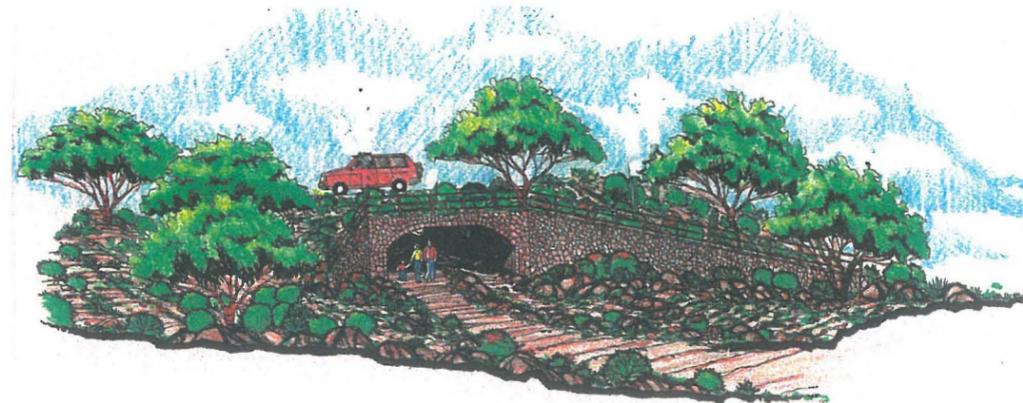
CONSULTANT:
McCloskey + Peltz, Inc.
LANDSCAPE ARCHITECTS

ENRIF TITLE:
**ALTERNATIVE A-3
PROPOSED LANDSCAPE THEMES**

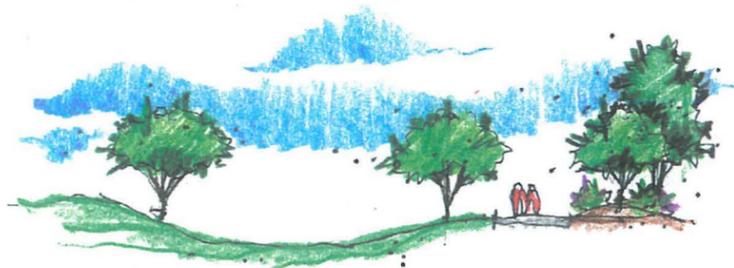
FIGURE V-8



PARK-LIKE THEME



NATURAL THEME



PARK-LIKE THEME (NON POWER LINE CORRIDOR)



SONORAN DESERT THEME (NON POWER LINE CORRIDOR)



FORMAL PROMENADE THEME



PARK-LIKE THEME (POWER LINE CORRIDOR)



RAILROAD THEME

02/01/01

| | |
|----------------|--|
| PROJECT TITLE: | DURANGO AREA DRAINAGE MASTER PLAN PROJECT NO. FCD 99-41 |
| CONSULTANT: | McCloskey + Peltz, Inc. LANDSCAPE ARCHITECTS |
| DESIGN TITLE: | ALTERNATIVE A-3 LANDSCAPE CHARACTER |

FIGURE V-9

G. Evaluation of Alternatives

Method of Evaluation - The evaluation of alternatives is accomplished by subjecting the numerous criteria to professional experience and judgment. To achieve a ranking of alternatives, 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 alternative. Alternatives are then ranked based on scores assigned by the evaluators for each evaluation criterion.

During the screening and evaluation of the alternatives, the alternatives for each region of the study area were found to not all be mutually exclusive of one another. The north and southwest study area alternatives were developed as integrated systems that are required to work together. The study area has therefore been divided into "west" and "east" areas, divided by 67th Avenue, for the alternatives evaluation.

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 alternatives are scored by ranking the alternatives for each criterion according to how well the alternative 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 alternative and criterion. The alternative receiving the highest total score is the preferred alternative.

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

- 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, survey, and other miscellaneous costs. Operation and Maintenance costs are addressed under the Maintenance criteria. A score of three is assigned to the alternative with the least first cost. A score of one is assigned to the alternative with the highest first cost.
- 2. Multiple Use Opportunities** - The alternative that would create multi-use opportunities, provide recreation amenities, develop links between public transportation facilities and routes, and benefit adjacent property owners would be assigned a score of three. A score of one would be given to an alternative with few multi-use opportunities, with limited recreation amenities, which lacks the potential to link public transportation facilities and routes, which requires substantial relocation of residences, and which negatively affects adjacent property owners.
- 3. Acceptability to Local Residents** - The acceptability of a flood control project by the residents, land owners, and developers is important to the overall success of the project. A score of three is assigned to the alternative that would be most acceptable to the public in terms of land acquisitions, visual quality, recreational benefit, and overall flood control. A score of one is assigned to the alternative that would be least acceptable to the public.

- 4. Environmental Impacts** - These environmental considerations refer to the potential impact to areas of high habitat value, high historic value, and wildlife enhancement opportunities. A score of three is assigned to the alternative that will protect areas of high habitat or historic value and provides for the opportunity to enhance habitat. 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.
- 5. Maintenance** - Maintenance is the annual cost for maintenance of the drainage facility. Frequency of maintenance and difficulty of access affect annual maintenance costs. 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.
- 6. Potential for removal of FEMA flood zones** - A primary objective of the project is to remove homes from the FEMA floodplain identified along the RID Canal and the UPRR. A score of three is assigned to the alternative 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 alternative that removes the fewest homes from the floodplain and restores the least amount of land area for future development.
- 7. Implementation Partners** - Opportunities to partner with an agency such as ADOT, or the cities of Phoenix, Tolleson, or Avondale are beneficial to both the Flood Control District and the partnering agency. Initial costs as well as annual maintenance can be shared, and long term flood control and

recreational benefits are realized by the community. A score of three is assigned to the alternative with the best opportunity for partnering and cost sharing. A score of one is assigned to the alternative with the least opportunity for partnering and cost sharing.

8. **Aesthetic Value** - Aesthetic Value is the opportunity to either preserve existing desirable landscape character or improve the aesthetics and visual character of the study area. A score of three is assigned to the alternative that will provide for the greatest opportunity to enhance aesthetics. A score of one would have the most negative impacts on the physical and natural considerations, and provide the fewest opportunities to enhance aesthetics.

Evaluation Matrix - The evaluation matrix in **Figure V-10** was used to rank the three alternatives. Blank copies of Figure V-10 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 alternative are shown. **Figure V-10** contains a separate matrix for each of the two 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 previously 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 alternative is assigned a score. Scores are established by ranking the alternatives in order of how well they meet the evaluation criteria. The alternative that best meets the criteria is assigned a score of 3, the alternative that most poorly meets the criteria is assigned a score of 1, and the remaining alternative 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 is split between the tied alternatives so that the total for all three alternatives is still six. The scores from all evaluators are totaled for each criteria and alternative, multiplied by the weighting factor, and then summed to determine the total score for the alternative. The alternative receiving the highest weighted composite score is the preferred alternative. A different alternative may be selected for each planning area.

Review Committee Meeting No. 3

The matrix evaluation was performed at Review Committee meeting number 3 on July 27, 2000. At the meeting, an overview of the three screened alternatives along with the associated landscape themes were presented. Opportunity was provided for questions and discussion. Committee members expressed concerns regarding the following issues:

- number/location of archaeological sites impacted by the alternatives (alternatives did not avoid archaeological sites)
- public response of the use of transmission line corridors (possible negative response)
- possible realignment of the proposed South Mountain Freeway
- shallow depth and potential conflicts of major utilities in the

study area including a 114" effluent line and major sewer lines.

- observation that there were no natural drainage features within the study area that could be improved resulting in new alignments
- obtaining 404 permits and the potential for mitigation requirements
- elimination of the non-structural and "No Action" alternatives from further consideration in the Level II Analysis, because they may be required in an Alternatives Analysis for a 404 Permit

Because of the particular concern about the elimination of the non-structural and "No Action" alternatives from further consideration, this issue was discussed in detail again at the review committee meeting. The reason for the elimination was based on the overall objectives of the study, such as the need for providing an immediate regional drainage solution for the study area and resolving the existing flooding problems previously noted. Additionally, some of the projects were already moving forward with Memorandums of Understanding (MOU) and Inter-Governmental Agreements (IGA), meaning that a non-structural or "No-Action" alternative was not an option to the agencies involved. The review committee voted by majority to reject the non-structural and/or "No Action" alternative as a fourth alternative to include in the evaluation process.

Following discussion, the evaluation process was presented and 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 V-10**.

| EAST AREA | | | | |
|----------------------------|--------|------------|------------|------------|
| EVALUATION CRITERIA | FACTOR | ALT. A - 1 | ALT. A - 2 | ALT. A - 3 |
| Capital Cost | 2.36 | 32 | 15.5 | 18.5 |
| Multiple use opportunities | 2.55 | 23 | 27 | 16 |
| Acceptability to residents | | | | |
| Environmental Impacts | 2.09 | 26.5 | 18 | 21.5 |
| Maintenance | 2.09 | 29 | 15 | 22 |
| Removal from FEMA Zones | 2.18 | 20.5 | 26 | 19.5 |
| Implementation Partners | 2.18 | 24.5 | 24.5 | 17 |
| Aesthetic Value | 1.82 | 27 | 21.5 | 17.5 |
| | | | | |
| Score | | 397.50 | 323.64 | 286.86 |
| Rank | | 1 | 2 | 3 |
| WEST AREA | | | | |
| EVALUATION CRITERIA | FACTOR | ALT. A - 1 | ALT. A - 2 | ALT. A - 3 |
| Capital Cost | 2.36 | 27 | 24 | 15 |
| Multiple use opportunities | 2.55 | 21.5 | 27 | 17.5 |
| Acceptability to residents | | | | |
| Environmental Impacts | 2.09 | 27 | 19.5 | 19.5 |
| Maintenance | 2.09 | 26 | 25 | 15 |
| Removal from FEMA Zones | 2.18 | 23.5 | 23.5 | 19 |
| Implementation Partners | 2.18 | 27 | 25 | 14 |
| Aesthetic Value | 1.82 | 23.5 | 25 | 17.5 |
| | | | | |
| Score | | 382.27 | 369.77 | 255.95 |
| Rank | | 1 | 2 | 3 |

Figure V-10. - Evaluation Matrix

VI. RECOMMENDED ALTERNATIVE

A. Introduction

The recommended alternative was selected at Review Committee Meeting No. 3. The resulting recommended plan and estimated costs are presented in the following sections.

B. Ranking of Alternatives

The results of the alternatives evaluation are shown on **Figure V-10** in the previous section. The results of the evaluation matrix show that the weighting factors chosen for the evaluation criteria were ranked the same for both the East and West study areas. *Multiple Use Opportunities* and *Capital Cost* were weighted as the top factors of importance for the project. *Aesthetic Value* was weighted as the lowest factor of importance. *Environmental Impacts, Maintenance, Removal from FEMA Zones,* and *Implementation Partners* were weighted relatively neutral. *Acceptability to Residents* was discarded as an evaluation criteria by the review committee because of the review committee uncertainty of voting on behalf of the residents. If a trend can be discerned at all, it would appear to be toward maximizing recreational benefit and minimizing cost with a low value on aesthetics.

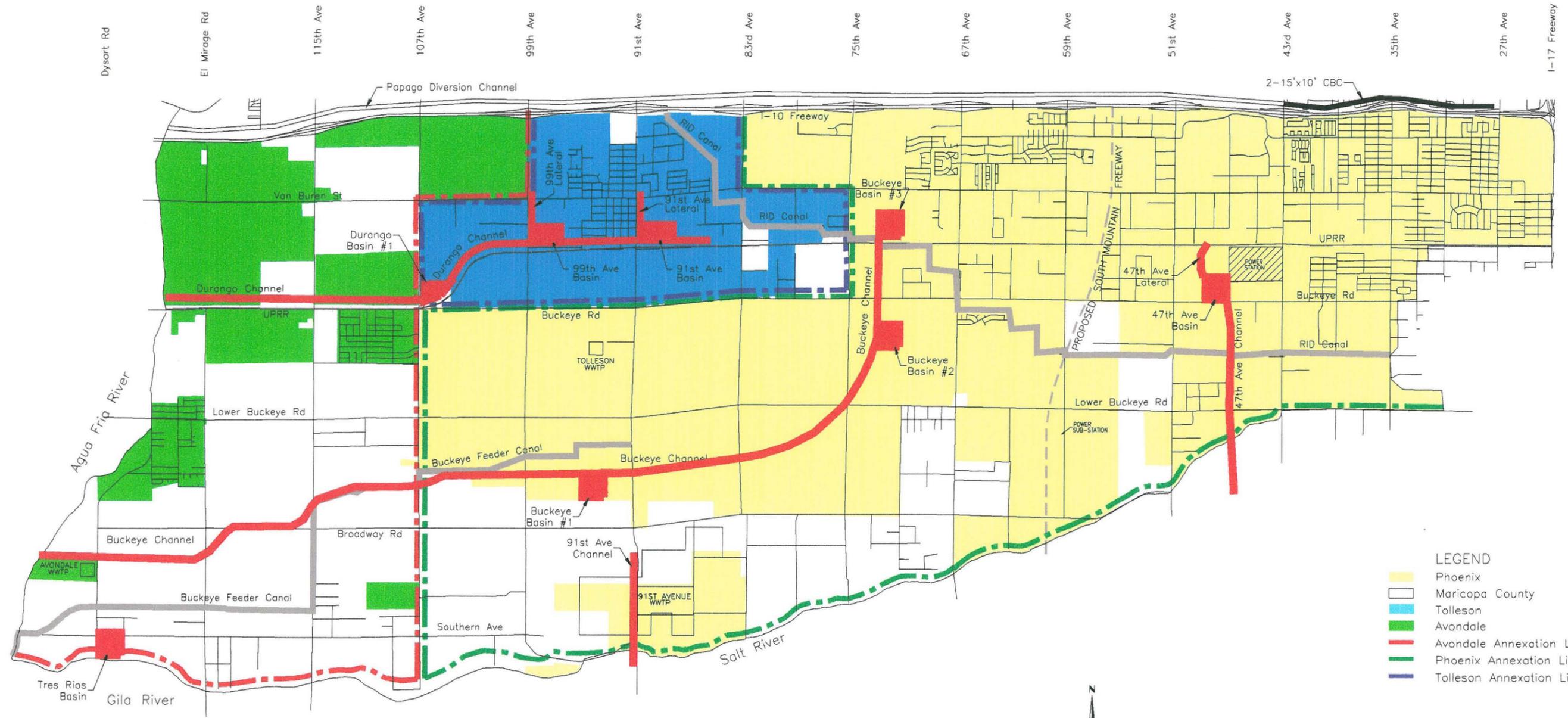
C. Recommended Plan

Screened Alternative A-1 was selected for both the East and West study area. The Recommended Plan is shown on **Figure VI-1**, showing the plan elements and descriptors. The estimated costs are summarized in **Table 3**.

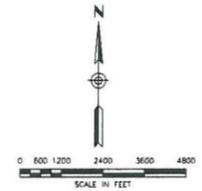
A 15 percent construction contingency is added to the estimated construction costs. Design and construction management costs are estimated as 15 percent of the construction cost. Landscape costs are based on the “ultimate” landscape character themes presented in this report. Estimated landscape costs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

Table 3 - Recommended Alternative - Estimated Costs

| Project | Land Acquisition Cost | Construction Cost | Construction Contingency (15%) | Design & CM (15%) | Landscape Cost | Total |
|------------------------------|-----------------------|-------------------|--------------------------------|-------------------|----------------|----------------------|
| Channels | | | | | | |
| Durango Channel | \$3,624,192 | \$3,665,665 | \$549,850 | \$549,850 | \$5,010,624 | \$13,400,180 |
| 99 th Ave Lateral | \$288,585 | \$339,177 | \$50,877 | \$50,877 | \$372,060 | \$1,101,575 |
| 91 st Ave Lateral | \$284,229 | \$301,882 | \$45,282 | \$45,282 | \$366,444 | \$1,043,119 |
| Buckeye Channel | \$10,755,954 | \$16,785,665 | \$2,517,850 | \$2,517,850 | \$16,778,232 | \$49,355,551 |
| 91 st Ave Channel | \$682,110 | \$629,362 | \$94,404 | \$94,404 | \$934,920 | \$2,435,200 |
| 47 th Ave Channel | \$1,537,866 | \$2,461,502 | \$369,225 | \$369,225 | \$2,796,120 | \$7,533,939 |
| Detention Basins | | | | | | |
| Durango Basins | \$3,906,524 | \$2,638,879 | \$395,832 | \$395,832 | \$7,102,771 | \$14,439,838 |
| Buckeye Basins | \$4,545,426 | \$3,544,496 | \$531,674 | \$531,674 | \$8,264,410 | \$17,417,681 |
| 47 th Ave Basin | \$1,531,047 | \$2,530,188 | \$379,528 | \$379,528 | \$2,783,722 | \$7,604,013 |
| | | | | | | |
| | | | | | | \$114,331,097 |



- LEGEND**
- Phoenix
 - Maricopa County
 - Tolleson
 - Avondale
 - Avondale Annexation Limits
 - Phoenix Annexation Limits
 - Tolleson Annexation Limits



DURANGO AREA DRAINAGE MASTER PLAN
 PROJECT NO. FCD 99-41

DIBBLE & ASSOCIATES
 CONSULTING ENGINEERS

RECOMMENDED PLAN
 02/01/01

FIGURE VI-1

VII. REFERENCES

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EXHIBITS

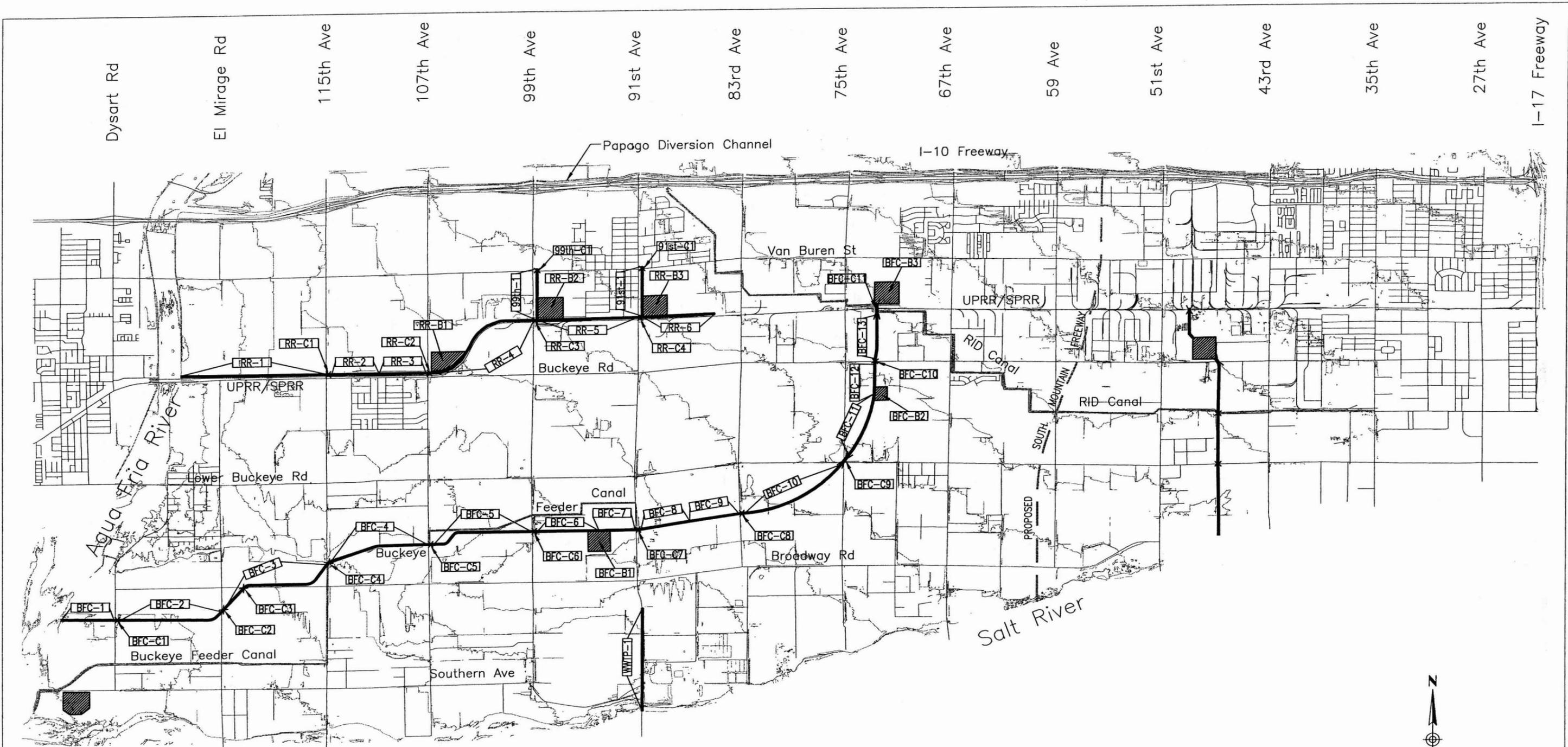
Alternative A-1 West

CHANNEL CAPACITIES AND COSTS

| I.D. | Design Q (cfs) | Q (cfs) | Downstream Ground Elevation | Upstream Ground Elevation | Length (ft) | Ground Slope (ft./ft.) | Design Invert Slope (ft./ft.) | Total Vertical Drop Difference(ft) | No. of Drop Structures | Vertical Drop (ft.) | Material Type | Manning's "n" Value | Bottom Width (ft.) | Depth of Flow (ft.) | Slopeslope (H:1) | Area of Flow (ft.) | Perimeter (ft.) | Froude Number | Type of Flow | Velocity (ft/s) | Freeboard (ft.) | Design Depth (ft) | Top Width (ft) | Proposed R/W Width (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 | Pump Volume (cy) | Unit Cost (\$/cy) | Pump Cost | Landscape Restoration (sq) | Unit Cost (\$/sq) | Landscape Cost | Required Land Acquisition (Ac.) | Zoning | Unit Cost (\$/Ac) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const. Land Acq. Landscape Cost | 30% Const. Contingency | Total |
|--------|----------------|---------|-----------------------------|---------------------------|-------------|------------------------|-------------------------------|------------------------------------|------------------------|---------------------|---------------|---------------------|--------------------|---------------------|------------------|--------------------|-----------------|---------------|--------------|-----------------|-----------------|-------------------|----------------|-------------------------|-----------------------|-------------------|-----------------|----------------------|-------------------|---------------|--------------------|-------------------|------------|------------------|-------------------|-----------|----------------------------|-------------------|----------------|---------------------------------|--------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-------|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RR-2 | 760 | 760 | 986 | 2500 | 0.00140 | 0.00140 | 0.00 | 0 | 0.00 | E | 0.040 | 30 | 4.5 | 6 | 260.0 | 85.2 | 0.24 | Sub | 2.9 | 1.2 | 5.7 | 99 | 150 | 44967 | \$6 | \$269,801 | 0 | \$310 | \$0 | 5000 | \$12 | \$60,000 | 0 | \$35 | \$0 | 295,000 | \$1.80 | \$531,000 | 8.6 | Res / Ag | \$0.99 | \$371,250 | \$329,801 | \$531,000 | \$1,232,051 | \$98,940 | \$1,330,991 | |
| RR-3 | 552 | 552 | 989.5 | 2500 | 0.00140 | 0.00140 | 0.00 | 0 | 0.00 | E | 0.040 | 20 | 4.4 | 6 | 201.8 | 73.1 | 0.23 | Sub | 2.7 | 1.1 | 5.5 | 86 | 130 | 36706 | \$6 | \$220,236 | 0 | \$310 | \$0 | 5000 | \$12 | \$60,000 | 0 | \$35 | \$0 | 245,000 | \$1.80 | \$441,000 | 7.5 | Res / Ag | \$0.99 | \$321,750 | \$280,236 | \$441,000 | \$1,042,986 | \$84,071 | \$1,127,057 | |
| RR-4 | 650 | 650 | 993 | 1000 | 0.00111 | 0.00111 | 0.00 | 0 | 0.00 | E | 0.040 | 25 | 4.7 | 6 | 250.0 | 82.2 | 0.21 | Sub | 2.6 | 1.2 | 5.8 | 96 | 140 | 110279 | \$6 | \$661,672 | 0 | \$310 | \$0 | 12600 | \$12 | \$146,160 | 0 | \$35 | \$0 | 680,400 | \$1.80 | \$1,224,720 | 20.2 | Res / Ag | \$0.99 | \$873,180 | \$812,872 | \$1,224,720 | \$2,910,772 | \$243,861 | \$3,154,633 | |
| RR-5 | 513 | 513 | 1000 | 1010 | 0.00194 | 0.00194 | 0.00 | 0 | 0.00 | E | 0.040 | 10 | 4.5 | 6 | 167.0 | 64.8 | 0.26 | Sub | 3.1 | 1.2 | 5.7 | 78 | 120 | 66479 | \$6 | \$398,874 | 0 | \$310 | \$0 | 10320 | \$12 | \$123,840 | 0 | \$35 | \$0 | 454,080 | \$1.80 | \$817,344 | 14.2 | Res / Ag | \$0.99 | \$613,008 | \$522,714 | \$817,344 | \$1,953,066 | \$156,814 | \$2,109,881 | |
| RR-6 | 460 | 460 | 1010 | 1018 | 0.00218 | 0.00218 | 0.00 | 0 | 0.00 | E | 0.040 | 8 | 4.3 | 6 | 147.0 | 60.6 | 0.27 | Sub | 3.1 | 1.1 | 5.4 | 73 | 120 | 42809 | \$6 | \$256,854 | 0 | \$310 | \$0 | 7340 | \$12 | \$88,080 | 0 | \$35 | \$0 | 322,960 | \$1.80 | \$581,328 | 10.1 | Res / Ag | \$0.99 | \$435,996 | \$344,934 | \$581,328 | \$1,362,258 | \$103,480 | \$1,465,739 | |
| 99th-1 | 487 | 487 | 1000 | 1008 | 0.00302 | 0.00302 | 0.00 | 0 | 0.00 | E | 0.040 | 8 | 4.1 | 6 | 135.8 | 58.3 | 0.31 | Sub | 3.6 | 1.1 | 5.2 | 71 | 110 | 29029 | \$6 | \$174,177 | 0 | \$310 | \$0 | 5300 | \$12 | \$63,600 | 0 | \$35 | \$0 | 206,700 | \$1.80 | \$372,060 | 6.7 | Res / Ag | \$0.99 | \$288,585 | \$287,777 | \$372,060 | \$898,422 | \$71,333 | \$969,755 | |
| 91st-1 | 297 | 297 | 1010 | 1014 | 0.00153 | 0.00153 | 0.00 | 0 | 0.00 | E | 0.040 | 8 | 3.9 | 6 | 120.9 | 55.1 | 0.22 | Sub | 2.5 | 1.0 | 4.9 | 66 | 110 | 25832 | \$6 | \$154,992 | 0 | \$310 | \$0 | 5220 | \$12 | \$62,640 | 0 | \$35 | \$0 | 203,580 | \$1.80 | \$366,444 | 6.6 | Res / Ag | \$0.99 | \$284,229 | \$217,632 | \$366,444 | \$868,305 | \$65,290 | \$933,594 | |
| BFC-1 | 2885 | 2885 | 928 | 930 | 0.00072 | 0.00072 | 0.00 | 0 | 0.00 | E | 0.040 | 200 | 4.8 | 6 | 1102.9 | 258.6 | 0.21 | Sub | 2.6 | 1.2 | 6.0 | 273 | 340 | 177998 | \$6 | \$1,067,989 | 0 | \$310 | \$0 | 5580 | \$12 | \$66,960 | 0 | \$35 | \$0 | 859,320 | \$1.80 | \$1,546,776 | 21.8 | Res / Ag | \$0.99 | \$939,114 | \$1,134,949 | \$1,546,776 | \$3,620,839 | \$340,485 | \$3,961,323 | |
| BFC-2 | 2885 | 2885 | 930 | 934 | 0.00075 | 0.00075 | 0.00 | 0 | 0.00 | E | 0.040 | 200 | 4.7 | 6 | 1085.2 | 257.8 | 0.21 | Sub | 2.7 | 1.2 | 6.0 | 272 | 340 | 334002 | \$6 | \$2,004,010 | 0 | \$310 | \$0 | 10620 | \$12 | \$127,440 | 0 | \$35 | \$0 | 1,635,480 | \$1.80 | \$2,943,864 | 41.4 | Res / Ag | \$0.99 | \$1,787,346 | \$2,131,450 | \$2,943,864 | \$6,862,660 | \$639,435 | \$7,502,095 | |
| BFC-3 | 2885 | 2885 | 934 | 947 | 0.00213 | 0.00150 | 3.87 | 1 | 3.87 | E | 0.040 | 150 | 4.5 | 6 | 805.8 | 205.3 | 0.30 | Sub | 3.6 | 1.2 | 5.7 | 219 | 280 | 292299 | \$6 | \$1,753,797 | 90 | \$310 | \$27,900 | 12180 | \$12 | \$146,160 | 300 | \$35 | \$10,500 | 1,510,320 | \$1.80 | \$2,718,576 | 36.9 | Res / Ag | \$0.99 | \$1,688,148 | \$1,938,357 | \$2,718,576 | \$6,345,081 | \$581,507 | \$6,926,588 | |
| BFC-4 | 2798 | 2798 | 952 | 961 | 0.00175 | 0.00175 | 0.00 | 0 | 0.00 | E | 0.040 | 135 | 4.5 | 6 | 732.2 | 189.9 | 0.32 | Sub | 3.8 | 1.2 | 5.7 | 203 | 260 | 226273 | \$6 | \$1,367,637 | 0 | \$310 | \$0 | 10280 | \$12 | \$123,360 | 0 | \$35 | \$0 | 1,171,920 | \$1.80 | \$2,109,456 | 30.7 | Res / Ag | \$0.99 | \$1,323,036 | \$1,480,997 | \$2,109,456 | \$4,913,489 | \$444,299 | \$5,357,788 | |
| BFC-5 | 2032 | 2032 | 962 | 978 | 0.00300 | 0.00150 | 8.01 | 2 | 4.00 | E | 0.040 | 100 | 4.6 | 6 | 584.7 | 155.8 | 0.29 | Sub | 3.5 | 1.2 | 5.8 | 169 | 220 | 191072 | \$6 | \$1,146,436 | 180 | \$310 | \$55,800 | 10660 | \$12 | \$127,920 | 600 | \$35 | \$21,000 | 1,002,040 | \$1.80 | \$1,803,672 | 26.9 | Res / Ag | \$0.99 | \$1,160,874 | \$1,351,155 | \$1,803,672 | \$4,315,701 | \$405,346 | \$4,721,047 | |
| BFC-6 | 1000 | 1000 | 980 | 987.5 | 0.00235 | 0.00235 | 0.00 | 0 | 0.00 | E | 0.040 | 30 | 4.6 | 6 | 262.9 | 85.7 | 0.31 | Sub | 3.8 | 1.2 | 5.8 | 99 | 150 | 58247 | \$6 | \$349,484 | 0 | \$310 | \$0 | 6380 | \$12 | \$76,560 | 0 | \$35 | \$0 | 376,420 | \$1.80 | \$677,556 | 11.0 | Res / Ag | \$0.99 | \$473,715 | \$426,044 | \$677,556 | \$1,577,315 | \$127,813 | \$1,705,128 | |
| BFC-7 | 1820 | 1820 | 987.5 | 989 | 0.00078 | 0.00078 | 0.00 | 0 | 0.00 | E | 0.040 | 130 | 4.5 | 6 | 713.3 | 185.2 | 0.21 | Sub | 2.6 | 1.2 | 5.7 | 198 | 260 | 82048 | \$6 | \$492,290 | 0 | \$310 | \$0 | 3840 | \$12 | \$46,080 | 0 | \$35 | \$0 | 549,270 | \$1.80 | \$787,968 | 11.5 | Res / Ag | \$0.99 | \$494,205 | \$509,485 | \$787,968 | \$1,820,546 | \$161,511 | \$1,982,057 | |
| BFC-8 | 1585 | 1585 | 990 | 994 | 0.00156 | 0.00156 | 0.00 | 0 | 0.00 | E | 0.040 | 75 | 4.5 | 6 | 463.1 | 130.1 | 0.28 | Sub | 3.4 | 1.2 | 5.7 | 144 | 190 | 74674 | \$6 | \$448,045 | 0 | \$310 | \$0 | 5120 | \$12 | \$61,440 | 0 | \$35 | \$0 | 437,760 | \$1.80 | \$728,064 | 11.2 | Res / Ag | \$0.99 | \$481,536 | \$509,485 | \$728,064 | \$1,719,085 | \$152,846 | \$1,871,931 | |
| BFC-9 | 1585 | 1585 | 994 | 998 | 0.00154 | 0.00154 | 0.00 | 0 | 0.00 | E | 0.040 | 75 | 4.5 | 6 | 464.9 | 130.3 | 0.28 | Sub | 3.4 | 1.2 | 5.7 | 144 | 200 | 75815 | \$6 | \$454,892 | 0 | \$310 | \$0 | 5160 | \$12 | \$62,160 | 0 | \$35 | \$0 | 435,120 | \$1.80 | \$783,216 | 11.9 | Res / Ag | \$0.99 | \$492,820 | \$517,052 | \$783,216 | \$1,813,088 | \$155,116 | \$1,968,204 | |
| BFC-10 | 1141 | 1141 | 998 | 1008 | 0.00173 | 0.00173 | 0.00 | 0 | 0.00 | E | 0.040 | 90 | 4.4 | 6 | 336.4 | 103.6 | 0.28 | Sub | 3.4 | 1.1 | 5.5 | 117 | 170 | 127923 | \$6 | \$767,538 | 0 | \$310 | \$0 | 11540 | \$12 | \$138,480 | 0 | \$35 | \$0 | 796,260 | \$1.80 | \$1,433,268 | 22.5 | Res / Ag | \$0.99 | \$971,091 | \$906,019 | \$1,433,268 | \$3,310,378 | \$271,806 | \$3,582,184 | |
| BFC-11 | 426 | 426 | 1008 | 1017 | 0.00255 | 0.00255 | 0.00 | 0 | 0.00 | E | 0.040 | 8 | 4.1 | 6 | 130.9 | 57.3 | 0.28 | Sub | 3.3 | 1.1 | 5.1 | 69 | 110 | 37408 | \$6 | \$224,448 | 0 | \$310 | \$0 | 7080 | \$12 | \$84,720 | 0 | \$35 | \$0 | 275,340 | \$1.80 | \$495,612 | 8.9 | Res / Ag | \$0.99 | \$384,417 | \$309,168 | \$495,612 | \$1,281,947 | \$79,157 | \$1,361,104 | |
| BFC-12 | 692 | 692 | 1017 | 1023 | 0.00368 | 0.00200 | 2.74 | 1 | 2.74 | E | 0.040 | 20 | 4.5 | 6 | 209.1 | 74.3 | 0.28 | Sub | 3.3 | 1.2 | 5.6 | 88 | 130 | 24757 | \$6 | \$148,546 | 90 | \$310 | \$27,900 | 3260 | \$12 | \$39,120 | 300 | \$35 | \$10,500 | 159,740 | \$1.80 | \$287,532 | 7.9 | Res / Ag | \$0.99 | \$329,888 | \$286,221 | \$462,672 | \$1,078,761 | \$85,866 | \$1,164,627 | |
| BFC-13 | 692 | 692 | 1024 | 1028 | 0.00168 | 0.00168 | 0.00 | 0 | 0.00 | E | 0.040 | 20 | 4.7 | 6 | 222.9 | 76.6 | 0.25 | Sub | 3.1 | 1.2 | 5.9 | 90 | 140 | 38183 | \$6 | \$229,101 | 0 | \$310 | \$0 | 4760 | \$12 | \$57,120 | 0 | \$35 | \$0 | 257,040 | \$1.80 | \$462,672 | 4.6 | Res / Ag | \$0.99 | \$329,888 | \$286,221 | \$462,672 | \$1,078,761 | \$85,866 | \$1,164,627 | |
| WWTP-1 | 716 | 716 | 954 | 972 | 0.00340 | 0.00250 | 4.75 | 1 | 4.75 | E | 0.040 | 15 | 4.6 | 6 | 195.9 | 70.9 | 0.30 | Sub | 3.7 | 1.2 | 5.8 | 85 | 130 | 77294 | \$6 | \$463,762 | 90 | \$310 | \$27,900 | 10600 | \$12 | \$127,200 | 300 | \$35 | \$10,500 | 519,400 | \$1.80 | \$934,920 | 15.8 | Res / Ag | \$0.99 | \$682,110 | \$629,362 | \$934,920 | \$2,246,392 | \$188,809 | \$2,435,200 | |

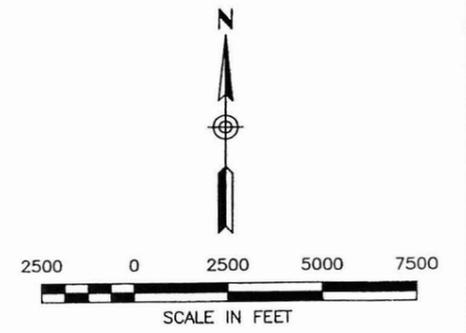
CULVERT CAPACITIES AND COSTS

| I.D. | Design 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 H/W/D | Control | Length of Pipe/Box Culvert (ft.) | Unit Cost (\$/ft) | Pipe/Box Culvert Cost | Inlet Headwall | Inlet Headwall Unit Cost (Est.) | Inlet Headwall Cost | Outlet Headwall | Outlet Headwall Unit Cost (Est.) | Outlet Headwall Cost | Required Land Acquisition (Ac.) | Zoning | Unit Cost (\$/Ac) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const. Land Acq. Landscape Cost | 30% Const. Contingency | Total |
|---------|----------------|-----------------|----------------------|--------------|-----------------|----------------------|---------------------|-------------------|-------------------------|-------|-----------------|-----------------------|--------------------|----------------|---------|----------------------------------|-------------------|-----------------------|----------------|---------------------------------|---------------------|-----------------|----------------------------------|----------------------|---------------------------------|--------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-----------|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RR-C2 | 400 | 110 | 90 | 110 | 0.0050 | C | 0.012 | 2 | 5 | 6 | RCBC | 4.4 | 5.26 | 1.05 | IC | 110 | \$650 | \$71,500 | 1 | \$4,500 | \$4,500 | 1 | \$7,800 | \$7,800 | 0.0 | N/A | \$0.00 | \$0 | \$83,800 | \$0 | \$83,800 | \$25,140 | \$108,940 |
| RR-C3 | 400 | 110 | 90 | 110 | 0.0100 | C | 0.012 | 2 | 5 | 6 | RCBC | 4.7 | 5.25 | 1.05 | IC | 110 | \$650 | \$71,500 | 1 | \$4,500 | \$4,500 | 1 | \$7,800 | \$7,800 | 0.0 | N/A | \$0.00 | \$0 | \$83,800 | \$0 | \$83,800 | \$25,140 | \$108,940 |
| RR-C4 | 300 | 110 | 90 | 110 | 0.0050 | C | 0.012 | 1 | 5 | 10 | RCBC | 4.5 | 4.88 | 0.98 | IC | 110 | \$650 | \$71,500 | 1 | \$4,700 | \$4,700 | 1 | \$8,050 | \$8,050 | 0.0 | N/A | \$0.00 | \$0 | \$84,250 | \$0 | \$84,250 | \$25,275 | \$109,525 |
| 99th-C1 | 487 | 110 | 90 | 110 | 0.0050 | C | 0.012 | 2 | 5 | 8 | RCBC | 4.1 | 4.94 | 0. | | | | | | | | | | | | | | | | | | | |



LEGEND

-  New Channel
-  New Channel Reach Identifier
-  New Culvert
-  New Culvert Identifier
-  New Detention Basin
-  New Detention Basin Identifier



PROJECT TITLE:
DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

CONSULTANT:
 **DIBBLE & ASSOCIATES**
CONSULTING ENGINEERS

EXHIBIT TITLE:
Alternative A-1, West
02/01/00

Alternative A-1 East

CHANNEL CAPACITIES AND COSTS

| I.D. | Design Q (cfs) | Q (cfs) | Downstream Ground Elevation | Upstream Ground Elevation | Length (ft) | Ground Slope (ft/ft) | Design Invert Slope (ft/ft) | Total Vertical Drop Difference(ft) | No. of Drop Structures | Vertical Drop (ft) | Material Type | Manning's "n" Value | Bottom Width (ft) | Depth of Flow (ft) | Sidewalk (ft) | Area of Flow (sf) | Perimeter (ft) | Friction Number | Type of Flow | Velocity (ft/s) | Freeboard (ft) | Design Depth (ft) | Top Width (ft) | Proposed RW Width (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 (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const, Land Acq, Landscape Cost | 30% Const. Contingency | Total |
|--------|----------------|---------|-----------------------------|---------------------------|-------------|----------------------|-----------------------------|------------------------------------|------------------------|--------------------|---------------|---------------------|-------------------|--------------------|---------------|-------------------|----------------|-----------------|--------------|-----------------|----------------|-------------------|----------------|------------------------|-----------------------|-------------------|-----------------|----------------------|-------------------|---------------|-------------------|-------------------|------------|--------------------|-------------------|-------------|----------------------------|-------------------|----------------|---------------------------------|----------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-------------|
| EAST-1 | 1106 | 1106 | 1020 | 1031.5 | 6210 | 0.00185 | 0.00185 | 0.00 | 0 | 0.00 | E | 0.040 | 45 | 4.4 | 6 | 317.9 | 99.0 | 0.29 | Sub | 3.5 | 1.2 | 5.6 | 112 | 160 | 131496 | \$6 | \$788,975 | 0 | \$310 | \$0 | 12420 | \$12 | \$149,040 | 0 | \$35 | \$0 | 993,600 | \$1.80 | \$1,788,480 | 22.8 | Res / Ag | \$0.99 | \$983,664 | \$938,015 | \$1,788,480 | \$3,710,159 | \$281,405 | \$3,991,564 |
| EAST-2 | 527 | 527 | 1031.5 | 1041 | 2480 | 0.00383 | 0.00200 | 4.54 | 1 | 4.54 | E | 0.040 | 12 | 4.4 | 6 | 168.8 | 65.5 | 0.26 | Sub | 3.1 | 1.1 | 5.5 | 78 | 120 | 32020 | \$6 | \$192,120 | 90 | \$310 | \$27,900 | 4960 | \$12 | \$59,520 | 300 | \$35 | \$10,500 | 237,600 | \$1.80 | \$535,680 | 6.8 | Res / Ag | \$0.99 | \$294,624 | \$290,040 | \$535,680 | \$1,120,344 | \$87,012 | \$1,207,356 |
| EAST-3 | 1471 | 1471 | 1045 | 1047 | 1380 | 0.00145 | 0.00145 | 0.00 | 0 | 0.00 | E | 0.040 | 70 | 4.6 | 6 | 446.7 | 125.7 | 0.27 | Sub | 3.3 | 1.2 | 5.8 | 139 | 190 | 39005 | \$6 | \$234,028 | 0 | \$310 | \$0 | 2760 | \$12 | \$33,120 | 0 | \$35 | \$0 | 262,200 | \$1.80 | \$471,960 | 6.0 | Res / Ag | \$0.99 | \$259,578 | \$267,148 | \$471,960 | \$998,686 | \$80,144 | \$1,078,830 |

CULVERT CAPACITIES AND COSTS

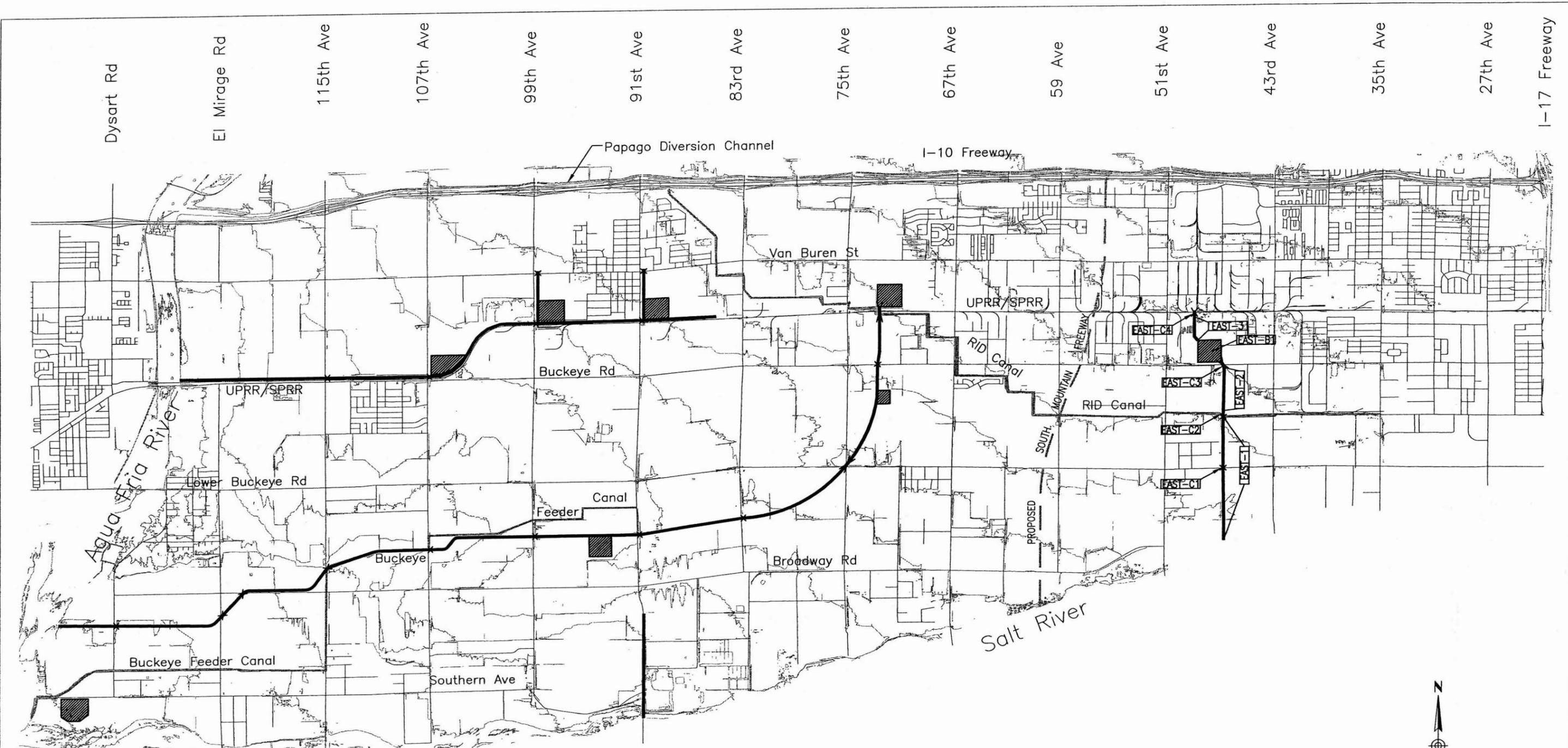
| I.D. | Design Q (cfs) | R/W width (ft) | Slope Angle (degrees) | Length (ft) | Slope (ft/ft) | Material/Barrel Type | Manning's "n" Value | Number of Barrels | Culvert Diameter/ Height | Width | Barrel/Material | Tailwater Depth (ft) | Computed Headwater | Computed HWD | Control | Length of Pipe/ Box Culvert (ft) | Unit Cost (\$/ft) | Pipe/Box Culvert Cost | Inlet Headwall | Inlet Headwall Unit Cost (Ea.) | Inlet Headwall Cost | Outlet Headwall | Outlet Headwall Unit Cost (Ea.) | Outlet Headwall Cost | Required Land Acquisition (Ac.) | Zoning | Unit Cost (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const, Land Acq, Landscape Cost | 30% Const. Contingency | Total |
|---------|----------------|----------------|-----------------------|-------------|---------------|----------------------|---------------------|-------------------|--------------------------|-------|-----------------|----------------------|--------------------|--------------|---------|----------------------------------|-------------------|-----------------------|----------------|--------------------------------|---------------------|-----------------|---------------------------------|----------------------|---------------------------------|--------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-----------|
| EAST-C1 | 1106 | 110 | 90 | 110 | 0.0000 | C | 0.012 | 4 | 5 | 8 | RCBC | 4.4 | 5.39 | 1.08 | IC | 110 | \$1,600 | \$176,000 | 1 | \$6,050 | \$6,050 | 1 | \$10,250 | \$10,250 | 0.0 | N/A | \$0.00 | \$0 | \$192,300 | \$0 | \$192,300 | \$57,690 | \$249,990 |
| EAST-C2 | 781 | 110 | 90 | 110 | 0.0000 | C | 0.012 | 3 | 5 | 8 | RCBC | 4.4 | 5.17 | 1.03 | IC | 110 | \$1,400 | \$154,000 | 1 | \$5,500 | \$5,500 | 1 | \$9,350 | \$9,350 | 0.0 | N/A | \$0.00 | \$0 | \$168,850 | \$0 | \$168,850 | \$50,655 | \$219,505 |
| EAST-C3 | 527 | - | - | 300 | 0.0000 | C | 0.012 | 2 | 5 | 6 | RCBC | N/A | N/A | N/A | IC | 300 | \$650 | \$195,000 | 1 | \$4,500 | \$4,500 | 1 | \$7,800 | \$7,800 | 0.0 | N/A | \$0.00 | \$0 | \$207,300 | \$0 | \$207,300 | \$62,190 | \$269,490 |
| EAST-C4 | 1471 | - | - | 200 | 0.0000 | C | 0.012 | 4 | 5 | 10 | RCBC | 4.6 | 5.63 | 1.13 | IC | 200 | \$1,900 | \$380,000 | 1 | \$6,500 | \$6,500 | 1 | \$11,350 | \$11,350 | 0.0 | N/A | \$0.00 | \$0 | \$397,850 | \$0 | \$397,850 | \$119,355 | \$517,205 |

DETENTION BASIN QUANTITIES AND COSTS

| I.D. | Q In (cfs) | Q Out (cfs) | Outlet Size (ft) | Storage Volume (Ac-ft) | Detention Basin Excavation (cy) | Unit Cost (\$/cy) | Detention Basin Excavation Cost | Landscape Restoration (sf) | Unit Cost (\$/sf) | Landscape Cost | Fence Length (ft) | Unit Cost (\$/ft) | Fence Cost | Required Land Acquisition (Ac.) | Zoning | Unit Cost (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const, Land Acq, Landscape Cost | 30% Const. Contingency | Total |
|---------|------------|-------------|------------------|------------------------|---------------------------------|-------------------|---------------------------------|----------------------------|-------------------|----------------|-------------------|-------------------|------------|---------------------------------|----------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-------------|
| EAST-B1 | 1471 | 527 | 2 - 5x8' | 213.0 | 412,368 | \$6 | \$2,474,208 | 1,546,512 | \$1.80 | \$2,783,722 | 4,665 | \$12.00 | \$55,980 | 35.5 | Res / Ag | \$0.99 | \$1,531,047 | \$2,530,188 | \$2,783,722 | \$6,844,956 | \$750,056 | \$7,604,013 |

| | | | | | | |
|---|-------------|--------------------|--------------------|--------------------|---------------------|---------------------|
| TOTALS (Not Including Contingencies) | 71.2 | \$3,068,913 | \$4,991,690 | \$5,579,842 | \$13,640,445 | \$1,497,507 |
| TOTAL CONTINGENCIES | | | | | | |
| GRAND TOTAL (Alt A-1, East) | | | | | | \$15,137,952 |

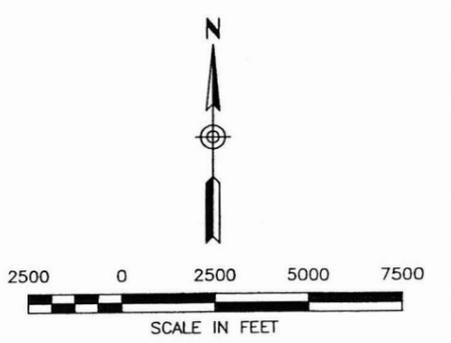
* NOTE: 30% Contingency is only applied to the Total Construction Cost



Gila River

LEGEND

-  New Channel
-  New Channel Reach Identifier
-  New Culvert
-  New Culvert Identifier
-  New Detention Basin
-  New Detention Basin Identifier



PROJECT TITLE:
DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

CONSULTANT:
 **DIBBLE & ASSOCIATES**
CONSULTING ENGINEERS

EXHIBIT TITLE:
Alternative A-1, East
02/01/00

EXHIBIT 2

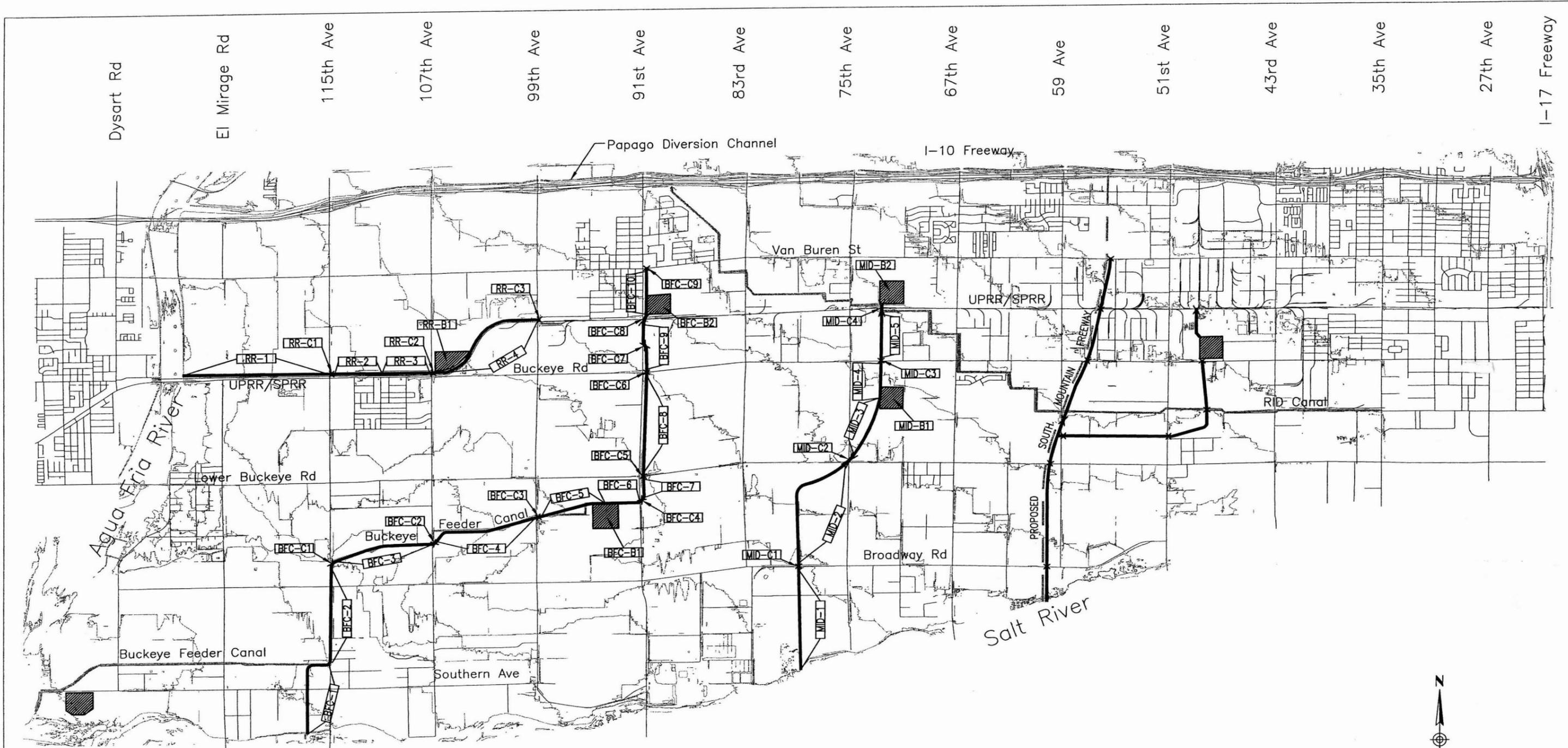
Alternative A-2 West

CHANNEL CAPACITIES AND COSTS

| I.D. | Design Q (cfs) | Q (cfs) | Downstream Ground Elevation | Upstream Ground Elevation | Length (ft.) | Ground Slope (ft./ft.) | Design Invert Slope (ft./ft.) | Total Vertical Drop Difference (ft.) | No. of Drop Structures | Vertical Drop (ft.) | Material Type | Manning's "n" Value | Bottom Width (ft.) | Depth of Flow (ft.) | Slope (ft./ft.) | Area of Flow (sq ft) | Perimeter (ft.) | Flow Number | Type of Flow | Velocity (fps) | Freeboard (ft.) | Design Depth (ft) | Top Width (ft) | Proposed FFW Width (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 (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const. Land Acq. Landscape Cost | 30% Const. Contingency | Total |
|--------|----------------|---------|-----------------------------|---------------------------|--------------|------------------------|-------------------------------|--------------------------------------|------------------------|---------------------|---------------|---------------------|--------------------|---------------------|-----------------|----------------------|-----------------|-------------|--------------|----------------|-----------------|-------------------|----------------|-------------------------|-----------------------|-------------------|-----------------|----------------------|-------------------|---------------|--------------------|-------------------|------------|--------------------|-------------------|-------------|----------------------------|-------------------|----------------|---------------------------------|----------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-------------|
| RR-1 | 760 | 760 | 958 | 984 | 7290 | 0.00357 | 0.00200 | 11.42 | 2 | 5.71 | E | 0.040 | 30 | 4.2 | 6 | 228.4 | 80.6 | 0.29 | Sub | 3.3 | 1.1 | 5.2 | 93 | 140 | 117309 | \$6 | \$703,854 | 180 | \$310 | \$55,800 | 14580 | \$12 | \$174,960 | 600 | \$35 | \$21,000 | 787,320 | \$1.80 | \$1,417,176 | 23.4 | Res / Ag | \$0.99 | \$1,010,394 | \$955,614 | \$1,417,176 | \$3,383,184 | \$286,684 | \$3,669,868 |
| RR-2 | 760 | 760 | 986 | 985.5 | 2500 | 0.00140 | 0.00140 | 0.00 | 0 | 0.00 | E | 0.040 | 30 | 4.5 | 6 | 260.0 | 85.2 | 0.24 | Sub | 2.9 | 1.2 | 5.7 | 99 | 150 | 44967 | \$6 | \$269,801 | 0 | \$310 | \$0 | 5000 | \$12 | \$60,000 | 0 | \$35 | \$0 | 295,000 | \$1.80 | \$531,000 | 8.6 | Res / Ag | \$0.99 | \$371,250 | \$329,801 | \$531,000 | \$1,232,051 | \$98,840 | \$1,330,891 |
| RR-3 | 552 | 552 | 988.5 | 993 | 2500 | 0.00140 | 0.00140 | 0.00 | 0 | 0.00 | E | 0.040 | 20 | 4.4 | 6 | 201.8 | 73.1 | 0.23 | Sub | 2.7 | 1.1 | 5.5 | 86 | 130 | 36706 | \$6 | \$220,236 | 0 | \$310 | \$0 | 5000 | \$12 | \$60,000 | 0 | \$35 | \$0 | 245,000 | \$1.80 | \$441,000 | 7.5 | Res / Ag | \$0.99 | \$321,750 | \$280,236 | \$441,000 | \$1,042,986 | \$84,071 | \$1,127,057 |
| RR-4 | 837 | 837 | 993 | 1000 | 6340 | 0.00110 | 0.00110 | 0.00 | 0 | 0.00 | E | 0.040 | 40 | 4.6 | 6 | 310.0 | 95.8 | 0.22 | Sub | 2.7 | 1.2 | 5.8 | 109 | 160 | 131392 | \$6 | \$788,353 | 0 | \$310 | \$0 | 12680 | \$12 | \$152,160 | 0 | \$35 | \$0 | 811,520 | \$1.80 | \$1,460,736 | 23.3 | Res / Ag | \$0.99 | \$1,004,256 | \$940,513 | \$1,460,736 | \$3,405,505 | \$282,154 | \$3,687,659 |
| BFC-1 | 2306 | 2306 | 929 | 940 | 4480 | 0.00246 | 0.00150 | 4.28 | 1 | 4.28 | E | 0.040 | 120 | 4.5 | 6 | 660.4 | 174.7 | 0.29 | Sub | 3.5 | 1.2 | 5.7 | 188 | 240 | 179280 | \$6 | \$1,075,560 | 90 | \$310 | \$27,900 | 8960 | \$12 | \$107,520 | 300 | \$35 | \$10,500 | 931,840 | \$1.80 | \$1,677,312 | 24.7 | Res / Ag | \$0.99 | \$1,064,448 | \$1,221,480 | \$1,677,312 | \$3,963,240 | \$366,444 | \$4,329,685 |
| BFC-2 | 2306 | 2306 | 940 | 948 | 5060 | 0.00158 | 0.00158 | 0.00 | 0 | 0.00 | E | 0.040 | 120 | 4.4 | 6 | 648.8 | 173.9 | 0.30 | Sub | 3.6 | 1.2 | 5.6 | 187 | 240 | 199406 | \$6 | \$1,196,437 | 0 | \$310 | \$0 | 10120 | \$12 | \$121,440 | 0 | \$35 | \$0 | 1,052,480 | \$1.80 | \$1,894,464 | 27.9 | Res / Ag | \$0.99 | \$1,202,256 | \$1,317,677 | \$1,894,464 | \$4,414,597 | \$395,363 | \$4,809,961 |
| BFC-3 | 2306 | 2306 | 956 | 962 | 5150 | 0.00117 | 0.00117 | 0.00 | 0 | 0.00 | E | 0.040 | 130 | 4.6 | 6 | 731.1 | 186.4 | 0.26 | Sub | 3.2 | 1.2 | 5.8 | 200 | 260 | 225483 | \$6 | \$1,352,895 | 0 | \$310 | \$0 | 10300 | \$12 | \$123,600 | 0 | \$35 | \$0 | 1,174,200 | \$1.80 | \$2,113,560 | 30.7 | Res / Ag | \$0.99 | \$1,325,610 | \$1,476,495 | \$2,113,560 | \$4,915,665 | \$442,949 | \$5,358,614 |
| BFC-4 | 1504 | 1504 | 962.5 | 978 | 5400 | 0.00267 | 0.00150 | 7.46 | 2 | 7.70 | E | 0.040 | 75 | 4.5 | 6 | 452.8 | 129.2 | 0.38 | Sub | 3.3 | 1.2 | 5.6 | 142 | 190 | 154360 | \$6 | \$926,162 | 180 | \$310 | \$55,800 | 10300 | \$12 | \$129,800 | 600 | \$35 | \$21,000 | 853,200 | \$1.80 | \$1,535,760 | 23.6 | Res / Ag | \$0.99 | \$1,015,740 | \$1,132,562 | \$1,535,760 | \$3,684,062 | \$338,789 | \$4,022,851 |
| BFC-5 | 500 | 500 | 980 | 985.5 | 3300 | 0.00162 | 0.00162 | 0.00 | 0 | 0.00 | E | 0.040 | 12 | 4.5 | 6 | 175.4 | 66.7 | 0.24 | Sub | 2.9 | 1.2 | 5.7 | 80 | 120 | 45170 | \$6 | \$271,017 | 0 | \$310 | \$0 | 6780 | \$12 | \$81,360 | 0 | \$35 | \$0 | 298,320 | \$1.80 | \$556,976 | 9.3 | Res / Ag | \$0.99 | \$402,732 | \$352,377 | \$556,976 | \$1,292,085 | \$105,713 | \$1,397,799 |
| BFC-6 | 1368 | 1368 | 985.5 | 988 | 1800 | 0.00139 | 0.00139 | 0.00 | 0 | 0.00 | E | 0.040 | 65 | 4.6 | 6 | 426.6 | 121.0 | 0.26 | Sub | 3.2 | 1.2 | 5.8 | 135 | 190 | 48883 | \$6 | \$293,298 | 0 | \$310 | \$0 | 3600 | \$12 | \$43,200 | 0 | \$35 | \$0 | 284,400 | \$1.80 | \$511,920 | 7.9 | Res / Ag | \$0.99 | \$336,580 | \$336,459 | \$511,920 | \$1,186,999 | \$100,950 | \$1,287,948 |
| BFC-7 | 1115 | 1115 | 988 | 990 | 1120 | 0.00179 | 0.00179 | 0.00 | 0 | 0.00 | E | 0.040 | 45 | 4.5 | 6 | 323.9 | 99.7 | 0.29 | Sub | 3.4 | 1.2 | 5.7 | 113 | 160 | 24108 | \$6 | \$144,849 | 0 | \$310 | \$0 | 2240 | \$12 | \$26,880 | 0 | \$35 | \$0 | 143,360 | \$1.80 | \$258,048 | 4.1 | Res / Ag | \$0.99 | \$177,408 | \$171,529 | \$258,048 | \$606,985 | \$51,459 | \$658,444 |
| BFC-8 | 1115 | 1115 | 991 | 1000 | 5210 | 0.00173 | 0.00173 | 0.00 | 0 | 0.00 | E | 0.040 | 45 | 4.5 | 6 | 327.7 | 100.2 | 0.28 | Sub | 3.4 | 1.2 | 5.7 | 114 | 160 | 113305 | \$6 | \$679,829 | 0 | \$310 | \$0 | 10420 | \$12 | \$125,040 | 0 | \$35 | \$0 | 666,880 | \$1.80 | \$1,200,384 | 19.1 | Res / Ag | \$0.99 | \$825,284 | \$804,869 | \$1,200,384 | \$2,830,517 | \$241,461 | \$3,071,978 |
| BFC-9 | 665 | 665 | 1001 | 1006 | 2530 | 0.00198 | 0.00198 | 0.00 | 0 | 0.00 | E | 0.040 | 15 | 4.7 | 6 | 202.3 | 72.1 | 0.27 | Sub | 3.3 | 1.2 | 5.9 | 86 | 130 | 37854 | \$6 | \$227,125 | 0 | \$310 | \$0 | 5060 | \$12 | \$60,720 | 0 | \$35 | \$0 | 247,940 | \$1.80 | \$446,292 | 7.6 | Res / Ag | \$0.99 | \$382,611 | \$446,292 | \$446,292 | \$1,059,748 | \$86,354 | \$1,146,102 |
| BFC-10 | 594 | 594 | 1008 | 1013.5 | 2350 | 0.00234 | 0.00234 | 0.00 | 0 | 0.00 | E | 0.040 | 10 | 4.6 | 6 | 173.6 | 66.1 | 0.28 | Sub | 3.4 | 1.2 | 5.8 | 80 | 120 | 31372 | \$6 | \$188,232 | 0 | \$310 | \$0 | 4700 | \$12 | \$56,400 | 0 | \$35 | \$0 | 206,800 | \$1.80 | \$372,240 | 6.5 | Res / Ag | \$0.99 | \$279,180 | \$244,632 | \$372,240 | \$896,052 | \$73,390 | \$969,442 |
| MID-1 | 1549 | 1549 | 966 | 989 | 5260 | 0.00437 | 0.00200 | 12.48 | 3 | 4.16 | E | 0.040 | 65 | 4.5 | 6 | 409.6 | 119.3 | 0.32 | Sub | 3.8 | 1.2 | 5.6 | 133 | 180 | 138219 | \$6 | \$829,316 | 270 | \$310 | \$83,700 | 10520 | \$12 | \$126,240 | 900 | \$35 | \$31,500 | 778,480 | \$1.80 | \$1,401,264 | 21.7 | Res / Ag | \$0.99 | \$937,332 | \$1,070,756 | \$1,401,264 | \$3,409,352 | \$321,227 | \$3,730,579 |
| MID-2 | 1138 | 1138 | 990 | 1007 | 2400 | 0.00708 | 0.00200 | 12.20 | 3 | 4.07 | E | 0.040 | 45 | 4.4 | 6 | 315.6 | 98.7 | 0.30 | Sub | 3.6 | 1.2 | 5.6 | 112 | 160 | 50540 | \$6 | \$303,238 | 270 | \$310 | \$83,700 | 4800 | \$12 | \$57,600 | 900 | \$35 | \$31,500 | 307,200 | \$1.80 | \$552,960 | 8.8 | Res / Ag | \$0.99 | \$380,160 | \$476,039 | \$552,960 | \$1,412,812 | \$149,159 | \$1,561,970 |
| MID-3 | 426 | 426 | 1008 | 1017 | 3340 | 0.00269 | 0.00269 | 0.00 | 0 | 0.00 | E | 0.040 | 8 | 4.0 | 6 | 128.2 | 56.7 | 0.29 | Sub | 3.3 | 1.0 | 5.0 | 69 | 110 | 34810 | \$6 | \$208,862 | 0 | \$310 | \$0 | 6680 | \$12 | \$80,160 | 0 | \$35 | \$0 | 466,880 | \$1.80 | \$1,200,384 | 8.4 | Res / Ag | \$0.99 | \$363,726 | \$289,022 | \$1,200,384 | \$2,830,517 | \$241,461 | \$3,071,978 |
| MID-4 | 647 | 647 | 1017 | 1023 | 1850 | 0.00324 | 0.00324 | 0.00 | 0 | 0.00 | E | 0.040 | 12 | 4.3 | 6 | 164.2 | 64.8 | 0.33 | Sub | 3.9 | 1.1 | 5.5 | 78 | 120 | 23477 | \$6 | \$140,860 | 0 | \$310 | \$0 | 3700 | \$12 | \$44,400 | 0 | \$35 | \$0 | 162,800 | \$1.80 | \$293,040 | 5.1 | Res / Ag | \$0.99 | \$219,780 | \$293,040 | \$293,040 | \$689,860 | \$55,578 | \$745,438 |
| MID-5 | 647 | 647 | 1024 | 1028 | 2420 | 0.00165 | 0.00165 | 0.00 | 0 | 0.00 | E | 0.040 | 20 | 4.5 | 6 | 213.4 | 75.1 | 0.25 | Sub | 3.0 | 1.2 | 5.7 | 88 | 130 | 37363 | \$6 | \$224,176 | 0 | \$310 | \$0 | 4840 | \$12 | \$58,080 | 0 | \$35 | \$0 | 237,160 | \$1.80 | \$428,888 | 7.2 | Res / Ag | \$0.99 | \$311,454 | \$282,256 | \$428,888 | \$1,020,598 | \$84,577 | \$1,105,275 |

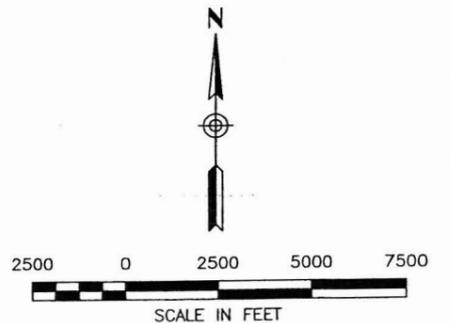
CULVERT CAPACITIES AND COSTS

| I.D. | Design Q (cfs) | Flow Width (ft.) | Shew Angle (degrees) | Length (ft.) | Slope (ft./ft.) | Material/Barrel Type | Manning's "n" Value | Number of Barrels | Culvert Diameter/Height | Width | Barrel/Material | Talwater Depth (ft.) | Computed Headwater | Computed HWWD | Control | Length of Pipe Box Culvert (ft.) | Unit Cost (\$/ft.) | Pipe Box Culvert Cost | Inlet Headwall | Inlet Headwall Unit Cost (Ea.) | Inlet Headwall Cost | Outlet Headwall | Outlet Headwall Unit Cost (Ea.) | Outlet Headwall Cost | Required Land Acquisition (Ac.) | Zoning | Unit Cost (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const. Land Acq. Landscape Cost | 30% Const. Contingency | Total |
|--------|----------------|------------------|----------------------|--------------|-----------------|----------------------|---------------------|-------------------|-------------------------|-------|-----------------|----------------------|--------------------|---------------|---------|----------------------------------|--------------------|-----------------------|----------------|--------------------------------|---------------------|-----------------|---------------------------------|----------------------|---------------------------------|--------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-----------|
| RR-C1 | 760 | 110 | 90 | 110 | 0.0050 | C | 0.012 | 3 | 5 | 8 | RCBC | 4.2 | 5.07 | 1.01 | IC | 110 | \$1,400 | \$154,000 | 1 | \$5,500 | \$5,500 | 1 | \$9,350 | \$9,350 | 0.0 | N/A | \$0.00 | \$0 | \$168,850 | \$0 | \$168,850 | \$30,855 | \$219,505 |
| RR-C2 | 400 | 110 | 90 | 110 | 0.0050 | C | 0.012 | 2 | 5 | 8 | RCBC | 4.4 | 5.26 | 1.05 | IC | 110 | \$850 | \$93,500 | 1 | \$4,500 | \$4,500 | 1 | \$7,800 | \$7,800 | 0.0 | N/A | \$0.00 | \$0 | \$83,800 | \$0 | \$83,800 | \$25,140 | \$108,940 |
| RR-C3 | 811 | 110 | 90 | 110 | 0.0050 | C | 0.012 | 2 | 5 | 8 | RCBC | 4.6 | 5.78 | 1.16 | IC | 110 | \$800 | \$88,000 | 1 | \$4,950 | \$4,950 | 1 | \$8,450 | \$8,450 | 0.0 | N/A | \$0.00 | \$0 | \$101,400 | \$0 | \$101,400 | \$30,420 | \$131,820 |
| BFC-C1 | 2306 | 110 | 45 | 156 | 0.0050 | C | 0.012 | 6 | 5 | 10 | RCBC | 4.4 | 5.80 | 1.16 | IC | 156 | \$2,800 | \$435,576 | 1 | \$7,700 | \$7,700 | 1 | \$13,550 | \$13,550 | 0.0 | N/A | \$0.00 | \$0 | \$456,828 | \$0 | \$456,828 | \$137,048 | \$593,876 |
| BFC-C2 | 2142 | 110 | 60 | 127 | 0.0050 | C | 0.012 | 6 | 5 | 10 | RCBC | 4.6 | 5.51 | 1.10 | IC | 127 | \$2,800 | \$355,648 | 1 | \$7,700 | \$7,700 | 1 | \$13,550 | \$13,550 | 0.0 | N/A | \$0.00 | \$0 | \$376,898 | \$0 | \$376,898 | \$113,609 | \$488,967 |
| BFC-C3 | 928 | 110 | 75 | 114 | 0.0050 | C | 0.012 | 3 | 5 | 10 | RCBC | | | | | | | | | | | | | | | | | | | | | | |



LEGEND

-  New Channel
-  New Channel Reach Identifier
-  New Culvert
-  New Culvert Identifier
-  New Detention Basin
-  New Detention Basin Identifier



| | |
|----------------|--|
| PROJECT TITLE: | DURANGO AREA DRAINAGE MASTER PLAN PROJECT NO. FCD 99-41 |
| CONSULTANT: |  DIBBLE & ASSOCIATES CONSULTING ENGINEERS |
| EXHIBIT TITLE: | Alternative A-2, West 02/01/00 |

Alternative A-2 East

CHANNEL CAPACITIES AND COSTS

| I.D. | Design Q (cfs) | Q (cfs) | Downstream Ground Elevation | Upstream Ground Elevation | Length (ft) | Ground Slope (ft/ft) | Design Invert Slope (ft/ft) | Total Vertical Drop Difference (ft) | No. of Drop Structures | Vertical Drop (ft) | Material Type | Manning's "n" Value | Bottom Width (ft) | Depth of Flow (ft) | Slopeside (H:1) | Area of Flow (ft ²) | Perimeter (ft) | Friction Number | Type of Flow | Velocity (ft/s) | Freeboard (ft) | Design Depth (ft) | Top Width (ft) | Proposed FWW Width (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 | Pump Volume (cy) | Unit Cost (\$/cy) | Pump Cost | Landscape Restoration (sf) | Unit Cost (\$/sf) | Landscape Cost | Required Land Acquisition (Ac.) | Zoning | Unit Cost (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const. Land Acq. Landscape Cost | 30% Const. Contingency | Total |
|--------|----------------|---------|-----------------------------|---------------------------|-------------|----------------------|-----------------------------|-------------------------------------|------------------------|--------------------|---------------|---------------------|-------------------|--------------------|-----------------|---------------------------------|----------------|-----------------|--------------|-----------------|----------------|-------------------|----------------|-------------------------|-----------------------|-------------------|-----------------|----------------------|-------------------|---------------|-------------------|-------------------|------------|------------------|-------------------|-----------|----------------------------|-------------------|----------------|---------------------------------|----------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-------------|
| SMF-1 | 2812 | 2812 | 990 | 1026 | 8550 | 0.00421 | 0.00150 | 23.18 | 4 | 5.79 | m | 0.040 | 150 | 4.5 | 6 | 792.3 | 204.5 | 0.30 | Sub | 3.5 | 1.2 | 5.6 | 218 | 280 | 404234 | \$6 | \$2,425,403 | 360 | \$310 | \$111,600 | 17100 | \$12 | \$205,200 | 1200 | \$35 | \$42,000 | 2,120,400 | \$1.80 | \$3,816,720 | 55.0 | Res / Ag | \$0.99 | \$2,370,060 | \$2,784,203 | \$3,816,720 | \$8,970,983 | \$835,261 | \$9,806,244 |
| SMF-2 | 1109 | 1109 | 1026 | 1044 | 6780 | 0.00265 | 0.00200 | 4.44 | 1 | 4.44 | m | 0.040 | 40 | 4.6 | 6 | 306.5 | 95.4 | 0.30 | Sub | 3.6 | 1.2 | 5.7 | 109 | 160 | 139798 | \$6 | \$838,791 | 90 | \$310 | \$27,900 | 13560 | \$12 | \$162,720 | 300 | \$35 | \$10,500 | 867,840 | \$1.80 | \$1,562,112 | 24.9 | Res / Ag | \$0.99 | \$1,073,952 | \$1,039,911 | \$1,562,112 | \$3,675,975 | \$311,973 | \$3,987,948 |
| SMF-3 | 480 | 480 | 1046 | 1054 | 2500 | 0.00320 | 0.00200 | 3.00 | 1 | 3.00 | m | 0.040 | 12 | 4.2 | 6 | 157.4 | 63.3 | 0.28 | Sub | 3.0 | 1.1 | 5.3 | 76 | 120 | 30409 | \$6 | \$182,457 | 90 | \$310 | \$27,900 | 5000 | \$12 | \$60,000 | 300 | \$35 | \$10,500 | 220,000 | \$1.80 | \$396,000 | 6.9 | Res / Ag | \$0.99 | \$287,000 | \$280,857 | \$396,000 | \$973,857 | \$84,257 | \$1,058,114 |
| EAST-1 | 685 | 685 | 1026 | 1029 | 8500 | 0.00337 | 0.00050 | -1.10 | 0 | 0.00 | m | 0.040 | 50 | 4.7 | 6 | 364.0 | 106.8 | 0.15 | Sub | 1.9 | 1.2 | 5.8 | 120 | 170 | 193776 | \$6 | \$1,162,657 | 0 | \$310 | \$0 | 16400 | \$12 | \$196,800 | 0 | \$35 | \$0 | 1,131,600 | \$1.80 | \$2,036,880 | 32.0 | Res / Ag | \$0.99 | \$1,280,060 | \$1,259,457 | \$2,036,880 | \$4,776,287 | \$407,837 | \$5,184,124 |
| EAST-2 | 522 | 522 | 1031 | 1039 | 2410 | 0.00332 | 0.00200 | 3.18 | 1 | 3.18 | m | 0.040 | 12 | 4.4 | 6 | 147.6 | 65.3 | 0.28 | Sub | 3.1 | 1.1 | 5.5 | 78 | 120 | 30927 | \$6 | \$185,561 | 90 | \$310 | \$27,900 | 4820 | \$12 | \$57,840 | 300 | \$35 | \$10,500 | 212,080 | \$1.80 | \$381,744 | 6.6 | Res / Ag | \$0.99 | \$286,308 | \$281,801 | \$381,744 | \$949,853 | \$84,540 | \$1,034,393 |
| EAST-3 | 1471 | 1471 | 1045 | 1047 | 1340 | 0.00149 | 0.00149 | 0.00 | 0 | 0.00 | m | 0.040 | 70 | 4.5 | 6 | 442.2 | 125.3 | 0.27 | Sub | 3.3 | 1.2 | 5.7 | 139 | 190 | 37537 | \$6 | \$225,221 | 0 | \$310 | \$0 | 2680 | \$12 | \$32,160 | 0 | \$35 | \$0 | 211,720 | \$1.80 | \$381,096 | 5.8 | Res / Ag | \$0.99 | \$252,054 | \$257,381 | \$381,096 | \$890,531 | \$77,214 | \$967,745 |

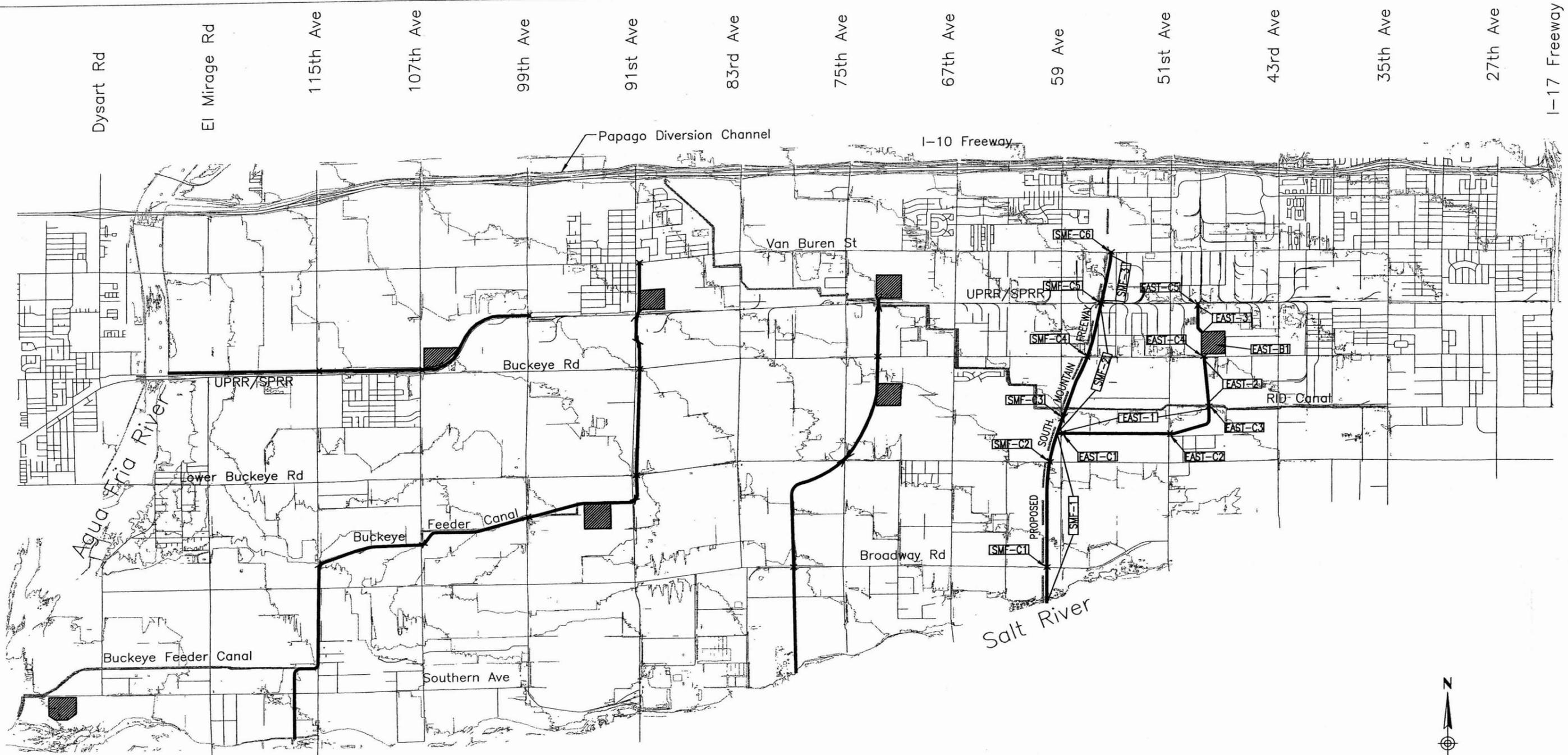
CULVERT CAPACITIES AND COSTS

| I.D. | Design Q (cfs) | FWW 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 FWD | Control | Length of Pipe Box Culvert (ft) | Unit Cost (\$/ft) | Pipe Box Culvert Cost | Inlet Headwall | Inlet Headwall Unit Cost (Ea.) | Inlet Headwall Cost | Outlet Headwall | Outlet Headwall Unit Cost (Ea.) | Outlet Headwall Cost | Required Land Acquisition (Ac.) | Zoning | Unit Cost (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const. Land Acq. Landscape Cost | 30% Const. Contingency | Total |
|---------|----------------|----------------|----------------------|-------------|---------------|----------------------|---------------------|-------------------|-------------------------|-------|-----------------|----------------------|--------------------|--------------|---------|---------------------------------|-------------------|-----------------------|----------------|--------------------------------|---------------------|-----------------|---------------------------------|----------------------|---------------------------------|--------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-----------|
| SMF-C1 | 2812 | 110 | 90 | 110 | 0.0000 | C | 0.012 | 8 | 5 | 10 | RCBC | 4.5 | 5.46 | 1.09 | IC | 110 | \$4,600 | \$506,000 | 1 | \$8,900 | \$8,900 | 1 | \$15,750 | \$15,750 | 0.0 | N/A | \$0.00 | \$0 | \$530,650 | \$0 | \$530,650 | \$159,195 | \$689,845 |
| SMF-C2 | 2812 | 110 | 90 | 110 | 0.0000 | C | 0.012 | 8 | 5 | 10 | RCBC | 4.5 | 5.46 | 1.09 | IC | 110 | \$4,600 | \$506,000 | 1 | \$8,900 | \$8,900 | 1 | \$15,750 | \$15,750 | 0.0 | N/A | \$0.00 | \$0 | \$530,650 | \$0 | \$530,650 | \$159,195 | \$689,845 |
| SMF-C3 | 1109 | 110 | 30 | 220 | 0.0000 | C | 0.012 | 3 | 5 | 10 | RCBC | 4.6 | 5.65 | 1.13 | IC | 220 | \$1,450 | \$319,000 | 1 | \$5,900 | \$5,900 | 1 | \$10,250 | \$10,250 | 0.0 | N/A | \$0.00 | \$0 | \$335,150 | \$0 | \$335,150 | \$100,545 | \$435,695 |
| SMF-C4 | 1109 | 110 | 75 | 114 | 0.0000 | C | 0.012 | 3 | 5 | 10 | RCBC | 4.6 | 5.65 | 1.13 | IC | 114 | \$1,450 | \$165,127 | 1 | \$5,900 | \$5,900 | 1 | \$10,250 | \$10,250 | 0.0 | N/A | \$0.00 | \$0 | \$181,277 | \$0 | \$181,277 | \$54,383 | \$235,660 |
| SMF-C5 | 480 | 110 | 90 | 110 | 0.0000 | C | 0.012 | 2 | 5 | 8 | RCBC | 4.8 | 4.88 | 0.98 | IC | 110 | \$800 | \$88,000 | 1 | \$4,950 | \$4,950 | 1 | \$8,450 | \$8,450 | 0.0 | N/A | \$0.00 | \$0 | \$101,400 | \$0 | \$101,400 | \$30,420 | \$131,820 |
| SMF-C6 | 480 | 110 | 90 | 110 | 0.0000 | C | 0.012 | 2 | 5 | 8 | RCBC | 4.2 | 5.97 | 1.19 | IC | 110 | \$650 | \$71,500 | 1 | \$4,500 | \$4,500 | 1 | \$7,800 | \$7,800 | 0.0 | N/A | \$0.00 | \$0 | \$83,800 | \$0 | \$83,800 | \$25,140 | \$108,940 |
| EAST-C1 | 685 | 110 | 90 | 110 | 0.0000 | C | 0.012 | 2 | 5 | 10 | RCBC | 4.7 | 5.36 | 1.07 | IC | 110 | \$1,050 | \$115,500 | 1 | \$5,300 | \$5,300 | 1 | \$9,150 | \$9,150 | 0.0 | N/A | \$0.00 | \$0 | \$129,950 | \$0 | \$129,950 | \$38,985 | \$168,935 |
| EAST-C2 | 685 | 110 | 90 | 110 | 0.0000 | C | 0.012 | 2 | 5 | 10 | RCBC | 4.7 | 5.36 | 1.07 | IC | 110 | \$1,050 | \$115,500 | 1 | \$5,300 | \$5,300 | 1 | \$9,150 | \$9,150 | 0.0 | N/A | \$0.00 | \$0 | \$129,950 | \$0 | \$129,950 | \$38,985 | \$168,935 |
| EAST-C3 | 522 | 110 | 90 | 110 | 0.0000 | C | 0.012 | 2 | 5 | 8 | RCBC | 4.7 | 5.17 | 1.03 | IC | 110 | \$800 | \$88,000 | 1 | \$4,950 | \$4,950 | 1 | \$8,450 | \$8,450 | 0.0 | N/A | \$0.00 | \$0 | \$101,400 | \$0 | \$101,400 | \$30,420 | \$131,820 |
| EAST-C4 | 522 | 110 | 90 | 110 | 0.0000 | C | 0.012 | 2 | 5 | 8 | RCBC | 0.0 | 5.18 | 1.04 | IC | 110 | \$800 | \$88,000 | 1 | \$4,950 | \$4,950 | 1 | \$8,450 | \$8,450 | 0.0 | N/A | \$0.00 | \$0 | \$101,400 | \$0 | \$101,400 | \$30,420 | \$131,820 |
| EAST-C5 | 1471 | - | - | 200 | 0.0000 | C | 0.012 | 4 | 5 | 10 | RCBC | 4.5 | 5.63 | 1.13 | IC | 200 | \$1,900 | \$380,000 | 1 | \$6,500 | \$6,500 | 1 | \$11,350 | \$11,350 | 0.0 | N/A | \$0.00 | \$0 | \$397,850 | \$0 | \$397,850 | \$119,355 | \$517,205 |

DETENTION BASIN QUANTITIES AND COSTS

| I.D. | Q In (cfs) | Q Out (cfs) | Outlet Size (ft.) | Storage Volume (Ac-ft) | Detention Basin Excavation (cy) | Unit Cost (\$/cy) | Detention Basin Excavation Cost | Landscape Restoration (sf) | Unit Cost (\$/sf) | Landscape Cost | Fence Length (ft) | Unit Cost (\$/ft) | Fence Cost | Required Land Acquisition (Ac.) | Zoning | Unit Cost (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const. Land Acq. Landscape Cost | 30% Const. Contingency | Total |
|---------|------------|-------------|-------------------|------------------------|---------------------------------|-------------------|---------------------------------|----------------------------|-------------------|----------------|-------------------|-------------------|------------|---------------------------------|----------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-------------|
| EAST-B1 | 1471 | 522 | 2 - 5'x8" | 213.0 | 412,368 | \$6 | \$2,474,208 | 1,546,512 | \$1.80 | \$2,783,722 | 4,665 | \$12.00 | \$55,980 | 35.5 | Res / Ag | \$0.99 | \$1,531,047 | \$2,530,188 | \$2,783,722 | \$6,844,956 | \$759,056 | \$7,604,013 |

TOTALS (Not Including Contingencies) 166.7 \$7,190,481 \$11,157,273 \$11,358,274 \$29,706,028 \$3,347,182 \$33,053,210
 TOTAL CONTINGENCIES
 GRAND TOTAL (Alt A-2, East)



Dysart Rd

El Mirage Rd

115th Ave

107th Ave

99th Ave

91st Ave

83rd Ave

75th Ave

67th Ave

59 Ave

51st Ave

43rd Ave

35th Ave

27th Ave

I-17 Freeway

Papago Diversion Channel

I-10 Freeway

Van Buren St

Buckeye Rd

UPRR/SPRR

Lower Buckeye Rd

Buckeye Feeder Canal

Broadway Rd

Salt River

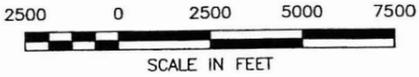
Buckeye Feeder Canal

Southern Ave

Gila River

LEGEND

- New Channel
- XXX-# New Channel Reach Identifier
- ✕ New Culvert
- XXX-C# New Culvert Identifier
- New Detention Basin
- XXX-B# New Detention Basin Identifier



PROJECT TITLE:
DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

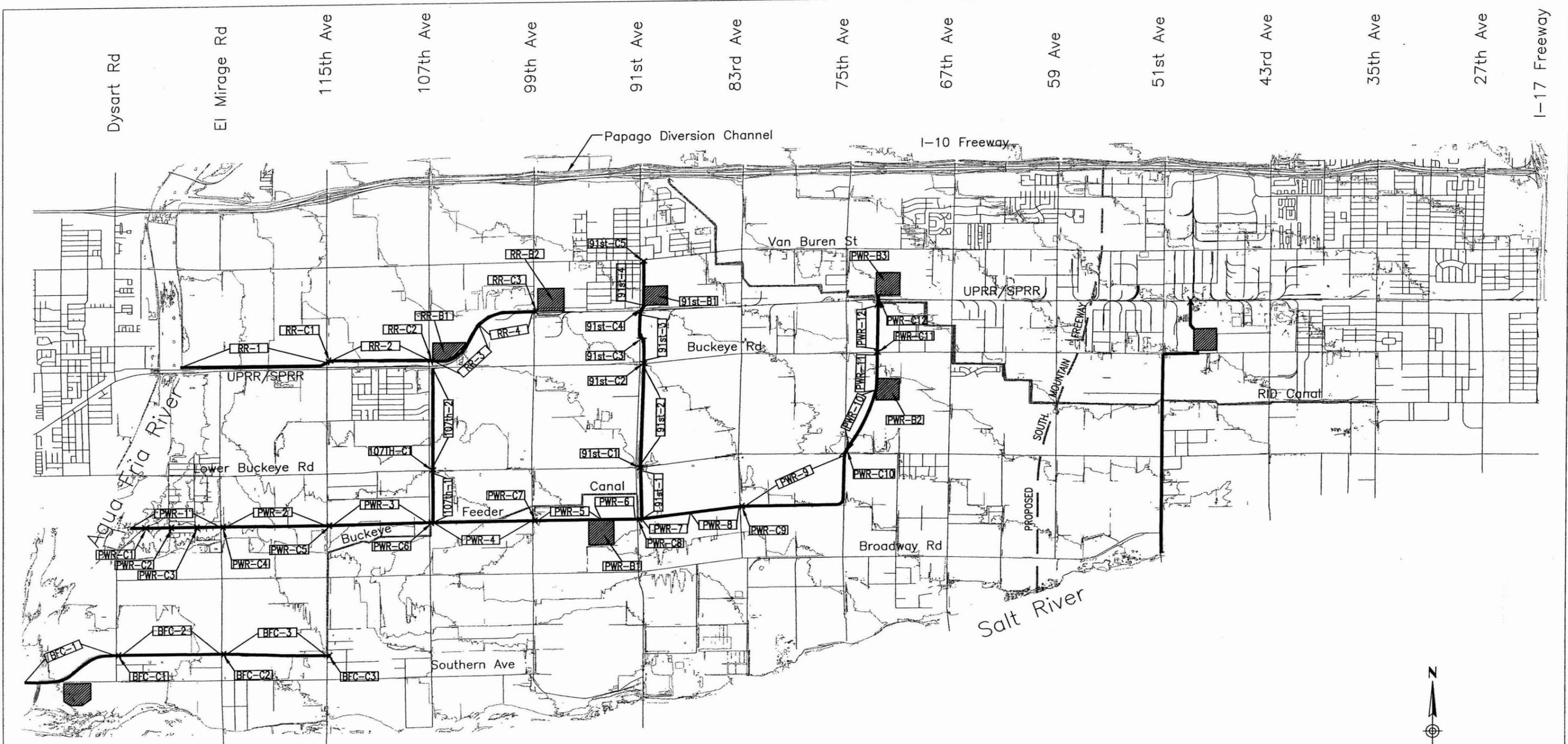
CONSULTANT:
DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

EXHIBIT TITLE:
Alternative A-2, East
02/01/00

Alternative A-3 West

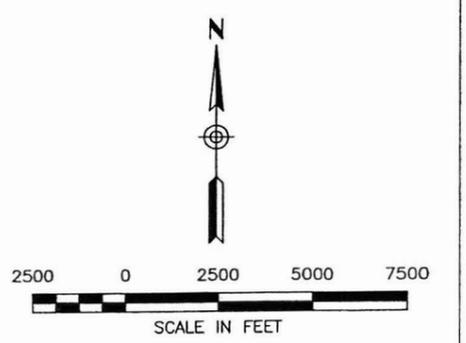
CHANNEL CAPACITIES AND COSTS

| I.D. | Design Q (cfs) | Q (cfs) | Downstream Ground Elevation | Upstream Ground Elevation | Length (ft.) | Ground Slope (ft./ft.) | Design Invert Slope (ft./ft.) | Total Vertical Drop Difference (ft.) | No. of Drop Structures | Vertical Drop (ft.) | Material Type | Manning's "n" Value | Bottom Width (ft.) | Depth of Flow (ft.) | Slopeside (H:1) | Area of Flow (sq ft) | Perimeter (ft.) | Froude Number | Type of Flow | Velocity (ft/s) | Freeboard (ft.) | Design Depth (ft) | Top Width (ft) | Proposed RW Width (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 (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const. Land Acq. Landscape Cost | 30% Const. Contingency | Total |
|--------|----------------|---------|-----------------------------|---------------------------|--------------|------------------------|-------------------------------|--------------------------------------|------------------------|---------------------|---------------|---------------------|--------------------|---------------------|-----------------|----------------------|-----------------|---------------|--------------|-----------------|-----------------|-------------------|----------------|------------------------|-----------------------|-------------------|-----------------|----------------------|-------------------|---------------|--------------------|-------------------|------------|--------------------|-------------------|-------------|----------------------------|-------------------|----------------|---------------------------------|----------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-------------|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RR-1 | 760 | 760 | 958 | 984 | 7410 | 0.00351 | 0.00200 | 11.18 | 2 | 5.59 | m | 0.040 | 25 | 4.4 | 6 | 226.0 | 78.5 | 0.28 | Sub | 3.4 | 1.1 | 5.5 | 92 | 140 | 119208 | \$6 | \$715,248 | 180 | \$310 | \$55,800 | 14820 | \$12 | \$177,840 | 600 | \$35 | \$21,000 | 800,280 | \$1.80 | \$1,440,504 | 23.8 | Res / Ag | \$0.99 | \$1,027,026 | \$989,888 | \$1,440,504 | \$3,437,418 | \$290,966 | \$3,728,384 |
| RR-2 | 760 | 760 | 986 | 993 | 4970 | 0.00141 | 0.00141 | 0.00 | 0 | 0.00 | m | 0.040 | 30 | 4.5 | 6 | 259.4 | 85.2 | 0.24 | Sub | 2.9 | 1.2 | 5.7 | 98 | 150 | 89224 | \$6 | \$535,346 | 0 | \$310 | \$0 | 9940 | \$12 | \$119,280 | 0 | \$35 | \$0 | 988,460 | \$1.80 | \$1,055,628 | 17.1 | Res / Ag | \$0.99 | \$738,045 | \$654,626 | \$1,055,628 | \$2,448,299 | \$196,388 | \$2,644,686 |
| RR-3 | 656 | 656 | 993 | 995 | 3500 | 0.00057 | 0.00057 | 0.00 | 0 | 0.00 | m | 0.040 | 45 | 4.6 | 6 | 333.1 | 100.9 | 0.16 | Sub | 2.0 | 1.2 | 5.8 | 114 | 160 | 76728 | \$6 | \$460,370 | 0 | \$310 | \$0 | 7000 | \$12 | \$84,000 | 0 | \$35 | \$0 | 448,000 | \$1.80 | \$806,400 | 12.9 | Res / Ag | \$0.99 | \$554,400 | \$544,370 | \$806,400 | \$1,905,170 | \$163,311 | \$2,068,481 |
| RR-4 | 656 | 656 | 995 | 1000 | 2760 | 0.00181 | 0.00181 | 0.00 | 0 | 0.00 | m | 0.040 | 20 | 4.5 | 6 | 208.5 | 74.2 | 0.26 | Sub | 3.1 | 1.2 | 5.6 | 87 | 130 | 41773 | \$6 | \$250,635 | 0 | \$310 | \$0 | 5520 | \$12 | \$66,240 | 0 | \$35 | \$0 | 270,480 | \$1.80 | \$486,864 | 8.2 | Res / Ag | \$0.99 | \$355,212 | \$318,875 | \$486,864 | \$1,158,951 | \$95,063 | \$1,254,014 |
| 107b-1 | 874 | 874 | 965 | 970 | 2610 | 0.00192 | 0.00192 | 0.00 | 0 | 0.00 | E | 0.040 | 30 | 4.5 | 6 | 256.8 | 84.8 | 0.28 | Sub | 3.4 | 1.2 | 5.7 | 98 | 140 | 46561 | \$6 | \$279,365 | 0 | \$310 | \$0 | 5220 | \$12 | \$62,640 | 0 | \$35 | \$0 | 281,880 | \$1.80 | \$507,384 | 8.4 | Res / Ag | \$0.99 | \$361,746 | \$342,005 | \$507,384 | \$1,211,135 | \$102,601 | \$1,313,736 |
| 107b-2 | 874 | 874 | 971 | 988 | 5150 | 0.00330 | 0.00200 | 6.70 | 2 | 3.35 | E | 0.040 | 30 | 4.5 | 6 | 252.8 | 84.2 | 0.29 | Sub | 3.5 | 1.2 | 5.6 | 97 | 140 | 90645 | \$6 | \$543,870 | 180 | \$310 | \$55,800 | 10300 | \$12 | \$123,600 | 600 | \$35 | \$21,000 | 556,200 | \$1.80 | \$1,001,160 | 16.6 | Res / Ag | \$0.99 | \$713,790 | \$744,270 | \$1,001,160 | \$2,459,220 | \$223,281 | \$2,682,501 |
| 91st-1 | 1030 | 1030 | 990 | 990 | 2590 | 0.00000 | 0.00075 | -1.94 | 0 | 0.00 | E | 0.040 | 70 | 4.5 | 6 | 438.4 | 124.9 | 0.19 | Sub | 2.3 | 1.2 | 5.7 | 138 | 190 | 71690 | \$6 | \$430,139 | 0 | \$310 | \$0 | 5180 | \$12 | \$62,160 | 0 | \$35 | \$0 | 409,220 | \$1.80 | \$736,596 | 11.3 | Res / Ag | \$0.99 | \$487,179 | \$482,299 | \$736,596 | \$1,716,074 | \$147,690 | \$1,863,763 |
| 91st-2 | 1030 | 1030 | 990 | 1000 | 5220 | 0.00192 | 0.00192 | 0.00 | 0 | 0.00 | E | 0.040 | 35 | 4.6 | 6 | 292.2 | 91.5 | 0.29 | Sub | 3.5 | 1.2 | 5.9 | 105 | 150 | 103706 | \$6 | \$622,235 | 0 | \$310 | \$0 | 10440 | \$12 | \$125,280 | 0 | \$35 | \$0 | 615,960 | \$1.80 | \$1,108,728 | 18.0 | Res / Ag | \$0.99 | \$775,170 | \$747,515 | \$1,108,728 | \$2,631,413 | \$224,255 | \$2,855,668 |
| 91st-3 | 699 | 699 | 1001 | 1006 | 2630 | 0.00190 | 0.00190 | 0.00 | 0 | 0.00 | E | 0.040 | 20 | 4.5 | 6 | 214.6 | 75.3 | 0.27 | Sub | 3.3 | 1.2 | 5.7 | 89 | 130 | 40852 | \$6 | \$245,111 | 0 | \$310 | \$0 | 5260 | \$12 | \$63,120 | 0 | \$35 | \$0 | 257,740 | \$1.80 | \$463,932 | 7.8 | Res / Ag | \$0.99 | \$338,481 | \$308,231 | \$463,932 | \$1,110,644 | \$92,469 | \$1,203,113 |
| 91st-4 | 594 | 594 | 1010 | 1013.5 | 2250 | 0.00156 | 0.00156 | 0.00 | 0 | 0.00 | E | 0.040 | 15 | 4.7 | 6 | 203.3 | 72.2 | 0.24 | Sub | 2.9 | 1.2 | 5.9 | 86 | 130 | 33740 | \$6 | \$202,438 | 0 | \$310 | \$0 | 4500 | \$12 | \$54,000 | 0 | \$35 | \$0 | 220,500 | \$1.80 | \$396,900 | 6.7 | Res / Ag | \$0.99 | \$256,438 | \$256,438 | \$396,900 | \$1,110,644 | \$76,931 | \$1,191,944 |
| PWR-1 | 2978 | 2978 | 940 | 950 | 4590 | 0.00218 | 0.00218 | 0.00 | 0 | 0.00 | E | 0.040 | 150 | 4.2 | 6 | 727.5 | 200.6 | 0.35 | Sub | 4.1 | 1.1 | 5.3 | 213 | 270 | 202060 | \$6 | \$1,212,359 | 0 | \$310 | \$0 | 9180 | \$12 | \$110,160 | 0 | \$35 | \$0 | 1,092,420 | \$1.80 | \$1,966,356 | 28.5 | Res / Ag | \$0.99 | \$1,322,907 | \$1,322,519 | \$1,966,356 | \$4,515,782 | \$396,756 | \$4,912,538 |
| PWR-2 | 2978 | 2978 | 950 | 961 | 5160 | 0.00213 | 0.00213 | 0.00 | 0 | 0.00 | E | 0.040 | 150 | 4.2 | 6 | 732.7 | 200.9 | 0.35 | Sub | 4.1 | 1.1 | 5.3 | 214 | 270 | 229525 | \$6 | \$1,371,148 | 0 | \$310 | \$0 | 10320 | \$12 | \$123,840 | 0 | \$35 | \$0 | 1,228,080 | \$1.80 | \$2,210,544 | 32.0 | Res / Ag | \$0.99 | \$1,379,268 | \$1,494,988 | \$2,210,544 | \$5,084,800 | \$444,496 | \$5,529,296 |
| PWR-3 | 2798 | 2798 | 961 | 962 | 4990 | 0.00200 | 0.00100 | -3.99 | 0 | 0.00 | E | 0.040 | 170 | 4.7 | 6 | 830.3 | 227.1 | 0.24 | Sub | 3.0 | 1.2 | 5.9 | 241 | 300 | 272400 | \$6 | \$1,634,401 | 0 | \$310 | \$0 | 9990 | \$12 | \$119,760 | 0 | \$35 | \$0 | 1,337,320 | \$1.80 | \$2,407,176 | 34.4 | Res / Ag | \$0.99 | \$1,465,030 | \$1,754,161 | \$2,407,176 | \$5,643,397 | \$326,248 | \$6,169,615 |
| PWR-4 | 2029 | 2029 | 965 | 979 | 5130 | 0.00273 | 0.00150 | 6.31 | 2 | 3.15 | E | 0.040 | 100 | 4.6 | 6 | 584.2 | 155.7 | 0.29 | Sub | 3.5 | 1.2 | 5.8 | 169 | 220 | 183737 | \$6 | \$1,102,423 | 180 | \$310 | \$55,800 | 10260 | \$12 | \$123,120 | 600 | \$35 | \$21,000 | 984,440 | \$1.80 | \$1,735,982 | 25.9 | Res / Ag | \$0.99 | \$1,117,314 | \$1,300,343 | \$1,735,982 | \$4,155,649 | \$390,703 | \$4,546,352 |
| PWR-5 | 1426 | 1426 | 980 | 987.5 | 3240 | 0.00231 | 0.00150 | 2.64 | 1 | 2.64 | E | 0.040 | 70 | 4.5 | 6 | 432.0 | 124.3 | 0.28 | Sub | 3.3 | 1.2 | 5.6 | 137 | 190 | 88855 | \$6 | \$533,309 | 90 | \$310 | \$27,900 | 6400 | \$12 | \$77,760 | 300 | \$35 | \$10,500 | 511,920 | \$1.80 | \$921,456 | 14.1 | Res / Ag | \$0.99 | \$609,444 | \$649,469 | \$921,456 | \$2,180,369 | \$194,841 | \$2,375,209 |
| PWR-6 | 2641 | 2641 | 987.5 | 989 | 1850 | 0.00081 | 0.00081 | 0.00 | 0 | 0.00 | E | 0.040 | 190 | 4.5 | 6 | 866.9 | 245.3 | 0.22 | Sub | 2.7 | 1.2 | 5.7 | 258 | 320 | 106781 | \$6 | \$640,568 | 0 | \$310 | \$0 | 3700 | \$12 | \$44,400 | 0 | \$35 | \$0 | 532,800 | \$1.80 | \$959,040 | 13.6 | Res / Ag | \$0.99 | \$568,060 | \$684,968 | \$959,040 | \$2,230,088 | \$205,490 | \$2,435,578 |
| PWR-7 | 1611 | 1611 | 990 | 994 | 2570 | 0.00156 | 0.00156 | 0.00 | 0 | 0.00 | E | 0.040 | 75 | 4.6 | 6 | 469.0 | 130.7 | 0.28 | Sub | 3.4 | 1.2 | 5.8 | 144 | 200 | 75818 | \$6 | \$454,907 | 0 | \$310 | \$0 | 5140 | \$12 | \$61,680 | 0 | \$35 | \$0 | 431,760 | \$1.80 | \$777,168 | 11.8 | Res / Ag | \$0.99 | \$508,860 | \$516,587 | \$777,168 | \$1,802,615 | \$154,976 | \$1,957,591 |
| PWR-8 | 1585 | 1585 | 994 | 998 | 2570 | 0.00156 | 0.00156 | 0.00 | 0 | 0.00 | E | 0.040 | 75 | 4.5 | 6 | 463.7 | 130.2 | 0.28 | Sub | 3.4 | 1.2 | 5.7 | 144 | 190 | 75054 | \$6 | \$450,325 | 0 | \$310 | \$0 | 5140 | \$12 | \$61,680 | 0 | \$35 | \$0 | 406,060 | \$1.80 | \$730,908 | 11.2 | Res / Ag | \$0.99 | \$463,417 | \$406,060 | \$730,908 | \$1,726,330 | \$153,601 | \$1,879,931 |
| PWR-9 | 1141 | 1141 | 998 | 1008 | 7480 | 0.00134 | 0.00134 | 0.00 | 0 | 0.00 | E | 0.040 | 55 | 4.5 | 6 | 372.4 | 110.1 | 0.25 | Sub | 3.1 | 1.2 | 5.7 | 123 | 170 | 180153 | \$6 | \$1,080,919 | 0 | \$310 | \$0 | 14820 | \$12 | \$179,440 | 0 | \$35 | \$0 | 1,029,480 | \$1.80 | \$1,853,064 | 29.1 | Res / Ag | \$0.99 | \$1,255,518 | \$1,259,959 | \$1,853,064 | \$4,386,541 | \$377,988 | \$4,764,528 |
| PWR-10 | 998 | 998 | 1008 | 1017 | 3270 | 0.00275 | 0.00150 | 4.10 | 1 | 4.10 | E | 0.040 | 40 | 4.6 | 6 | 315.1 | 96.5 | 0.26 | Sub | 3.2 | 1.2 | 5.8 | 110 | 160 | 68920 | \$6 | \$413,522 | 90 | \$310 | \$27,900 | 6540 | \$12 | \$78,480 | 300 | \$35 | \$10,500 | 418,560 | \$1.80 | \$753,408 | 12.0 | Res / Ag | \$0.99 | \$517,968 | \$530,402 | \$753,408 | \$1,801,778 | \$158,121 | \$1,960,899 |
| PWR-11 | 692 | 692 | 1017 | 1023 | 1850 | 0.00324 | 0.00150 | 3.23 | 1 | 3.23 | E | 0.040 | 25 | 4.5 | 6 | 234.5 | 79.8 | 0.25 | Sub | 3.0 | 1.2 | 5.7 | 93 | 140 | 30960 | \$6 | \$183,959 | 90 | \$310 | \$27,900 | 3700 | \$12 | \$44,400 | 300 | \$35 | \$10,500 | 199,800 | \$1.80 | \$359,640 | 5.9 | Res / Ag | \$0.99 | \$256,410 | \$266,759 | \$359,640 | \$882,809 | \$80,028 | \$962,837 |
| PWR-12 | 692 | 692 | 1024 | 1028 | 2430 | 0.00165 | 0.00165 | 0.00 | 0 | 0.00 | E | 0.040 | 20 | 4.7 | 6 | 224.6 | 76.9 | 0.25 | Sub | 3.1 | 1.2 | 5.9 | 91 | 140 | 39243 | \$6 | \$235,459 | 0 | \$310 | \$0 | 4860 | \$12 | \$58,320 | 0 | \$35 | \$0 | 292,440 | \$1.80 | \$472,392 | 7.8 | Res / Ag | \$0.99 | \$336,798 | \$293,779 | \$472,392 | \$1,102,969 | \$88,134 | \$1,191,103 |
| BFC-1 | 1588 | 1588 | 915 | 924 | 5020 | 0.00179 | 0.00179 | 0.00 | 0 | 0.00 | E | 0.040 | 70 | 4.5 | 6 | 437.5 | 124.8 | 0.30 | Sub | 3.6 | 1.2 | 5.7 | 138 | 190 | 139542 | \$6 | \$837 | | | | | | | | | | | | | | | | | | | | | |



LEGEND

- New Channel
- New Channel Reach Identifier
- New Culvert
- New Culvert Identifier
- New Detention Basin
- New Detention Basin Identifier



PROJECT TITLE:
DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

CONSULTANT:
 DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

EXHIBIT TITLE:
Alternative A-3, West
02/01/00

Alternative A-3 East

CHANNEL CAPACITIES AND COSTS

| I.D. | Design Q (cfs) | Q (cfs) | Downstream Ground Elevation | Upstream Ground Elevation | Length (ft) | Ground Slope (ft./ft.) | Design Invert Slope (ft./ft.) | Total Vertical Drop Difference(ft) | No. of Drop Structures | Vertical Drop (ft) | Material Type | Manning's "n" Value | Bottom Width (ft.) | Depth of Flow (ft.) | Side Slope (ft:1) | Area of Flow (sq. ft.) | Perimeter (ft.) | Froude Number | Type of Flow | Velocity (fps) | Freeboard (ft.) | Design Depth (ft) | Top Width (ft) | Proposed FFW Width (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 | Pump Volume (cy) | Unit Cost (\$/cy) | Pump Cost | Landscape Restoration (sf) | Unit Cost (\$/sf) | Landscape Cost | Required Land Acquisition (Ac.) | Zoning | Unit Cost (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const. Land Acq. Landscape Cost | 30% Const. Contingency | Total |
|--------|----------------|---------|-----------------------------|---------------------------|-------------|------------------------|-------------------------------|------------------------------------|------------------------|--------------------|---------------|---------------------|--------------------|---------------------|-------------------|------------------------|-----------------|---------------|--------------|----------------|-----------------|-------------------|----------------|-------------------------|-----------------------|-------------------|-----------------|----------------------|-------------------|---------------|-------------------|-------------------|------------|------------------|-------------------|-----------|----------------------------|-------------------|----------------|---------------------------------|----------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-------------|
| 51st-S | 1475 | 1475 | 1045 | 1047 | 1390 | 0.00144 | 0.00144 | 0.00 | 0 | 0.00 | C | 0.040 | 70 | 4.6 | 6 | 448.7 | 125.9 | 0.27 | Sub | 3.3 | 1.2 | 5.8 | 139 | 190 | 39441 | \$6 | \$236,644 | 0 | \$310 | \$0 | 2780 | \$12 | \$33,360 | 0 | \$35 | \$0 | 219,620 | \$1.80 | \$395,316 | 6.1 | Res / Ag | \$0.99 | \$281,459 | \$270,004 | \$395,316 | \$926,779 | \$81,001 | \$1,007,781 |

CULVERT CAPACITIES AND COSTS

| I.D. | Design 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 | Inlet Headwall Unit Cost (Ea.) | Inlet Headwall Cost | Outlet Headwall | Outlet Headwall Unit Cost (Ea.) | Outlet Headwall Cost | Required Land Acquisition (Ac.) | Zoning | Unit Cost (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const. Land Acq. Landscape Cost | 30% Const. Contingency | Total |
|---------|----------------|----------------|----------------------|-------------|-----------------|----------------------|---------------------|-------------------|-------------------------|-------|-----------------|----------------------|--------------------|---------------|---------|---------------------------------|-------------------|-----------------------|----------------|--------------------------------|---------------------|-----------------|---------------------------------|----------------------|---------------------------------|--------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-----------|
| 51st-C1 | 1475 | - | - | 200 | 0.0000 | C | 0.012 | 4 | 5 | 10 | RCBC | 4.6 | 5.64 | 1.13 | IC | 200 | \$1,900 | \$380,000 | 1 | \$6,500 | \$6,500 | 1 | \$11,350 | \$11,350 | 0.0 | N/A | \$0.00 | \$0 | \$397,850 | \$0 | \$397,850 | \$119,355 | \$517,205 |

DETENTION BASIN QUANTITIES AND COSTS

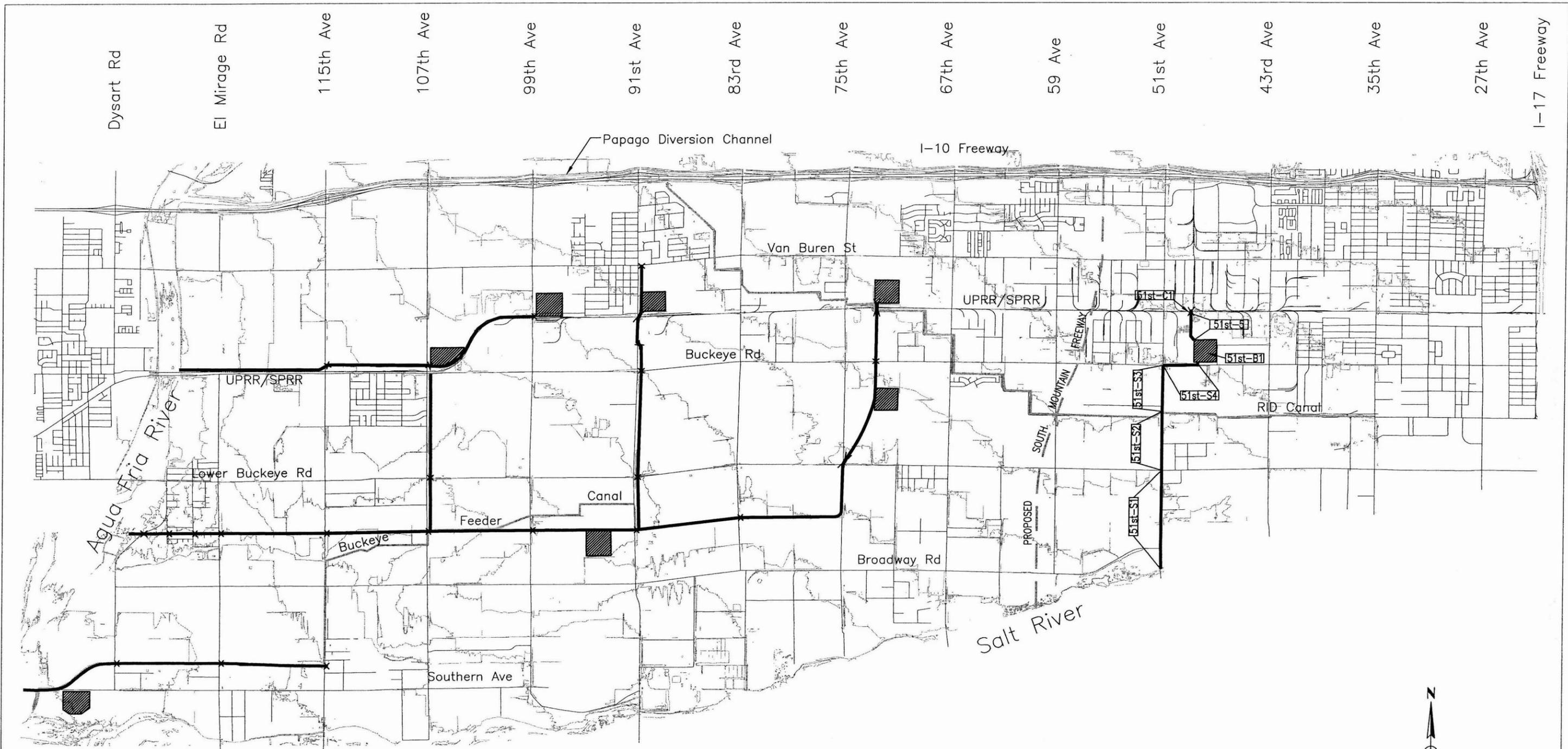
| I.D. | Q In (cfs) | Q Out (cfs) | Outlet Size (ft) | Storage Volume (Ac-ft) | Detention Basin Excavation (cy) | Unit Cost (\$/cy) | Detention Basin Excavation Cost | Landscape Restoration (sf) | Unit Cost (\$/sf) | Landscape Cost | Fence Length (ft) | Unit Cost (\$/ft) | Fence Cost | Required Land Acquisition (Ac.) | Zoning | Unit Cost (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const. Land Acq. Landscape Cost | 30% Const. Contingency | Total |
|---------|------------|-------------|------------------|------------------------|---------------------------------|-------------------|---------------------------------|----------------------------|-------------------|----------------|-------------------|-------------------|------------|---------------------------------|----------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-------------|
| 51st-B1 | 1475 | 521 | 2 - 5'x8' | 213.0 | 412,368 | \$6 | \$2,474,208 | 1,546,512 | \$1.80 | \$2,783,722 | 4,665 | \$12.00 | \$55,980 | 35.5 | Res / Ag | \$0.99 | \$1,531,047 | \$2,530,188 | \$2,783,722 | \$6,844,956 | \$759,056 | \$7,604,013 |

STORM DRAIN QUANTITIES AND COSTS

| I.D. | Q In (cfs) | Q Out (cfs) | Downstream Elevation | Upstream Elevation | Conveyance, K | V full | Length (ft) | Slope (ft./ft.) | Material Type | Manning's "n" Value | Number of Pipe/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 (\$/ft) | Land Acquisition Cost | Total Construction Cost | Landscape Cost | Subtotal Const. Land Acq. Landscape Cost | 30% Const. Contingency | Total |
|---------|------------|-------------|----------------------|--------------------|---------------|--------|-------------|-----------------|---------------|---------------------|----------------------|-------------|---------------------|-----------------|----------------|---------------------|-------------------|---------------|----------|-----------------|---------------|----------|-----------------|--------------|---------------------------------|--------------|-------------------|-----------------------|-------------------------|----------------|--|------------------------|-------|
| 51st-S1 | 1445 | 1032 | 1000.0 | 1012.0 | 20.64 | 4940 | 0.0024 | C | 0.0120 | 2 | Box | 5 | 10 | 9880 | \$1,050 | \$10,374,000 | 1 | \$9,150 | \$9,150 | 10 | \$3,000 | \$30,000 | | | \$0 | \$10,413,150 | \$0 | \$10,413,150 | \$3,123,945 | \$13,537,095 | | | |
| 51st-S2 | 1141 | 846 | 1012.0 | 1020.0 | 11.60 | 2960 | 0.0027 | C | 0.0120 | 1 | Box | 5 | 12 | 2960 | \$700 | \$2,072,000 | 0 | \$0 | \$0 | 6 | \$3,000 | \$18,000 | | | \$0 | \$2,090,000 | \$0 | \$2,090,000 | \$627,000 | \$2,717,000 | | | |
| 51st-S3 | 763 | 357 | 1020.0 | 1024.0 | 8.93 | 1880 | 0.0021 | C | 0.0120 | 1 | Box | 4 | 10 | 1880 | \$600 | \$1,128,000 | 0 | \$0 | \$0 | 4 | \$3,000 | \$12,000 | | | \$0 | \$1,140,000 | \$0 | \$1,140,000 | \$342,000 | \$1,482,000 | | | |
| 51st-S4 | 521 | 642 | 1024.0 | 1028.0 | 16.05 | 2320 | 0.0017 | C | 0.0120 | 2 | Box | 5 | 8 | 4640 | \$800 | \$3,712,000 | 1 | \$4,950 | \$4,950 | 5 | \$3,000 | \$15,000 | | | \$0 | \$3,731,950 | \$0 | \$3,731,950 | \$1,119,585 | \$4,851,535 | | | |

Note: The existing SD pipe has capacity of approximately 455 cfs and is utilized in conjunction with pipes S1, S2, and S3, explaining the lower Q_{out} vs Q_{in}

| | | | | | | | |
|--------------------------------------|------|-------------|--------------|-------------|--------------|-------------|--------------|
| TOTALS (Not Including Contingencies) | 41.6 | \$1,792,506 | \$20,573,142 | \$3,179,038 | \$25,544,686 | \$6,171,943 | \$31,716,629 |
| TOTAL CONTINGENCIES | | | | | | | |
| GRAND TOTAL (All A-3, East) | | | | | | | |

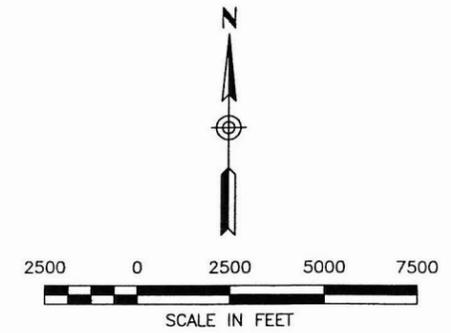


Dysart Rd
 El Mirage Rd
 115th Ave
 107th Ave
 99th Ave
 91st Ave
 83rd Ave
 75th Ave
 67th Ave
 59 Ave
 51st Ave
 43rd Ave
 35th Ave
 27th Ave
 I-17 Freeway

Gila River

LEGEND

- New Channel
- New Channel Reach Identifier
- New Culvert
- New Culvert Identifier
- New Detention Basin
- New Detention Basin Identifier

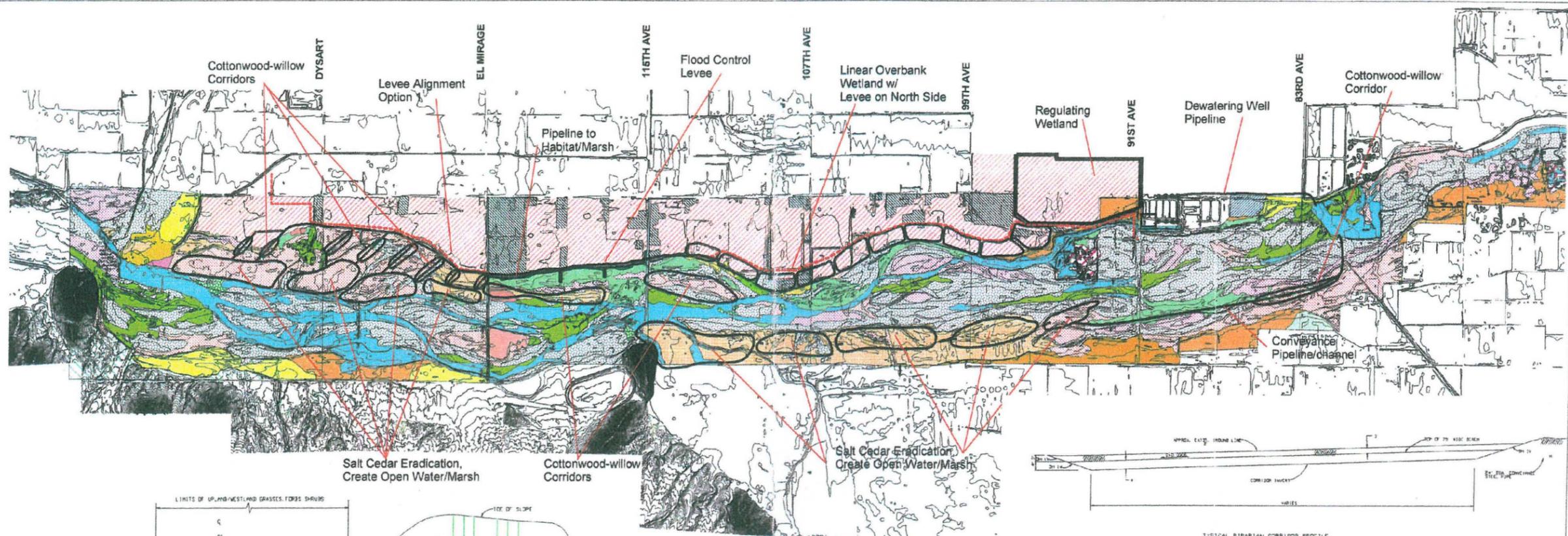


PROJECT TITLE:
 DURANGO AREA DRAINAGE MASTER PLAN
 PROJECT NO. FCD 99-41

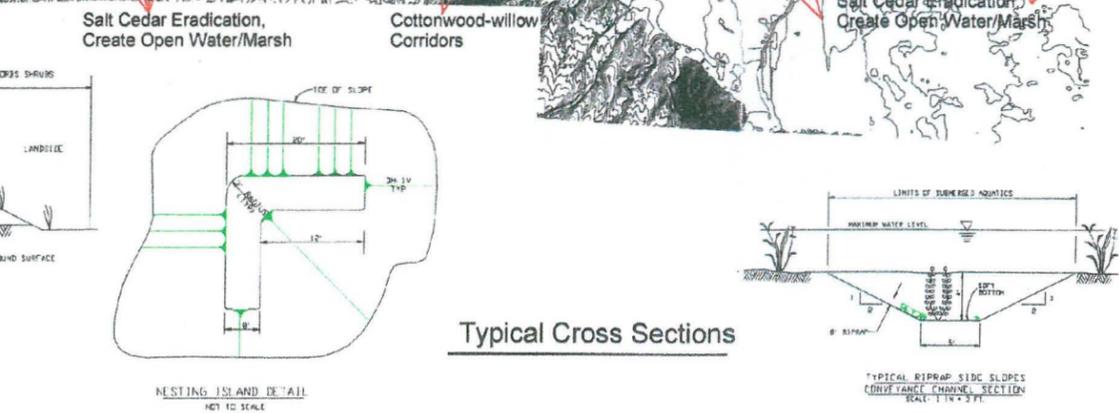
CONSULTANT:
DIBBLE & ASSOCIATES
 CONSULTING ENGINEERS

EXHIBIT TITLE:
Alternative A-3, East
 02/01/00

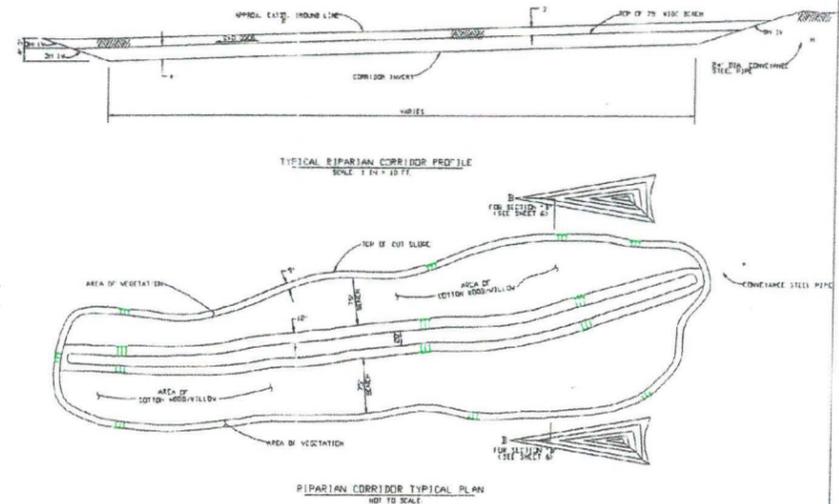
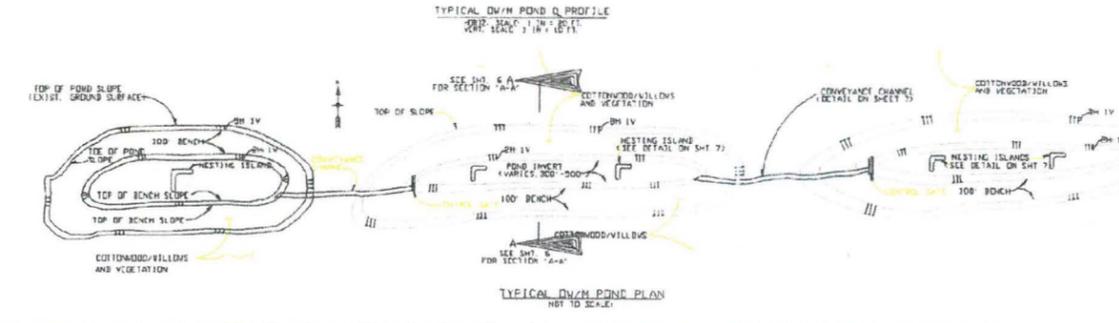
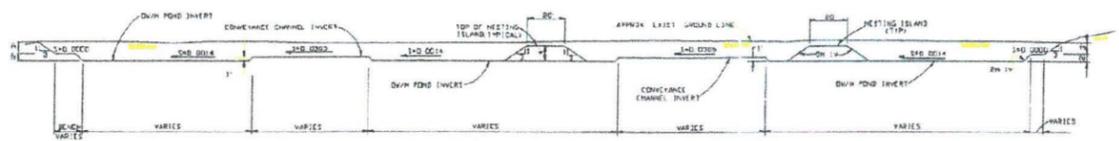
APPENDIX



- HABITAT**
- Agriculture
 - Cobble
 - Cottonwood-Willow II
 - Desert
 - Desert Wash
 - Dike
 - Gravel Mine
 - Hayfield Wetlands
 - Honey Mesquite IV
 - Honey Mesquite V
 - Marsh
 - Mix: Cottonwood-Willow/Salt Cedar II
 - Mix: Cottonwood-Willow/Salt Cedar III
 - Mix: Cottonwood-Willow/Salt Cedar III B
 - Mix: Cottonwood-Willow/Salt Cedar IV
 - Quailbush-Saltbush
 - Quailbush-Saltbush/Salt Cedar
 - Residential
 - Road
 - Salt Cedar
 - Salt Cedar II
 - Salt Cedar III
 - Salt Cedar IV
 - Salt Cedar IV B
 - Salt Cedar V
 - Water



Typical Cross Sections



**Tres Rios, Arizona
Environmental Restoration Project**

Alternative 3.5

4000 0 4000 Feet
1:40000

U. S. ARMY CORPS OF ENGINEERS
Los Angeles District
 TETRA TECH, INC.
Infrastructure Southwest Group

Tres Rios Project, Selected Alternative

Community Questionnaire 1

1. Do you live, work, or have financial interest in the study area? Check all answers that apply.

| | | |
|-------------------------|----|---|
| Live | 4 | |
| Work | 2 | |
| Have Financial Interest | 10 | |
| None of these | | 2 |

Where?

| | | |
|----------|---|---|
| Phoenix | 3 | |
| Avondale | 8 | |
| Tolleson | 1 | |
| County | | 7 |

2. Have you experienced flooding problems? Check one

| | | |
|----------------|---|---|
| Yes | 2 | |
| No | 8 | |
| Not applicable | | 3 |

Explain: An explanation for not applicable answer was "We do engineering/development in this area".

3. Are there any particular valued landscape or natural features which you feel should be preserved or protected? Explain.

Railroad (1), Gila River (1), Agua Fria River (1), mature trees (2), wetland along river (1), bird nesting sites in the wetland (1), horse trails (1), agriculture (3), and the river bottom area south of Southern (1).

4. Are there any particular negative features which you feel should be improved or enhanced? Explain.

"Utilize overhead power corridors to extent possible"
 "Auto access to river to prevent dumping. Need recreational parking areas."
 "River bottom should have horse trails or hiking with controlled vehicular access for emergencies"

5. Which of the following recreational activities do you participate in? (Check all that apply)

| | | |
|---------------------------|----|---|
| Walking | 12 | |
| Soccer | | 2 |
| Jogging / Running | 5 | |
| Softball / Baseball | 4 | |
| Bicycling | 9 | |
| Basketball | 4 | |
| Roller or In-line Skating | 2 | |
| Equestrian | 4 | |
| Other | 3 | |

(Fishing-1, Dog Walks-1, ATV-1)

6. What do you feel would be the greatest benefit of a multi-use pathway? (Check all that apply)

| | | |
|--------------------|---|--|
| Recreation | 9 | |
| Exercise | 9 | |
| Employment Commute | 2 | |
| School Commute | 5 | |
| Shopping Access | 2 | |
| Regional Access | 3 | |
| Other | 1 | |

"A transportation corridor for bikes, electric cars, pedestrians, etc."

7. Do you feel there are any drawbacks to combining a multi-use trail with an overhead power line corridor?

| | | |
|------------|---|--|
| Yes | 1 | |
| No | 9 | |
| No opinion | 1 | |

Explain: For the yes answer the explanation was, "I've heard of health risks, but I'm not sure if they are real or not."

For one of the no answers the explanation was, "Both exist for the benefit of the community."

8. Which landscape theme(s) do you prefer? (Check all that apply)

| | |
|------------------------|---|
| Park-Like Theme | 7 |
| Natural Theme | 7 |
| Agricultural Heritage | 7 |
| Railroad | 6 |
| Modified Sonoran Theme | 3 |
| Formal Promenade | 3 |
| Historic Canal | 3 |
| Native American | 3 |
| Other | 0 |

9. In the evaluation and selection of flood control facilities, which criteria do you feel should be given the greatest consideration in determining the ultimate location and design? Number in order of priority (1=highest priority, 6=lowest priority)

| | |
|-----------------------------|--------------------------------|
| Flood Control Effectiveness | (11-#1, 1-#2, 1-#3) |
| Avg.=1.23 | Overall ranking = 1 |
| Visual Appearance | (2-#1, 2-#2, 2-#3, 3-#4, 1-#5) |
| Avg.=2.75 | Overall ranking = 2 |
| Environmental | (4-#2, 3-#3, 1-#4, 3-#5) |
| Avg.=3.27 | Overall ranking = 3 |
| Recreational | (1-#2, 4-#3, 3-#4, 3-#5) |
| Avg.=3.73 | Overall ranking = 4 |
| Cost | (2-#2, 1-#3, 4-#4, 4-#5) |
| Avg.=3.91 | Overall ranking = 5 |
| Other | (1-#1, 11-#6) |
| Avg.=6.08 | Overall ranking = 6 |

For the category of "Other" being ranked the highest priority, the explanation given was, "Most effective use of water."

For the category of "Other" ranking as the lowest priority, the explanation given was, "Project property values" and "Dollars should not be prohibitive but use what is needed for future generations. It must be effective, preserve the environment, and give open space to a populating area."

10. Please rank the alternatives in order of preference (1=most preferred, 3=least preferred)

| | |
|-----------------|---------------------|
| Alternative A-1 | (6-#1, 1-#2, 2-#3) |
| Avg.=1.56 | Overall ranking = 1 |
| Alternative A-2 | (3-#1, 4-#2, 3-#3) |
| Avg.=2.00 | Overall ranking = 2 |
| Alternative A-3 | (2-#1, 3-#2, 3-#3) |
| Avg.=2.13 | Overall ranking = 3 |

A vote of most preferred for Alternative 2 had the stipulation, "(except 117th Avenue drop to river feature)".

11. Other comments:

"Tailwater discharge - both north and south side require return to Buckeye Feeder Ditch, along the entire feeder ditch."

"Major focus should be on impacts on existing and planned (zoned) development and effective flood control at post development condition (do not oversize facility)."

"Retain excess water to raise local aquifer. Divert and return water that was diverted from Pima use in the 1930's."

"The sooner this starts taking place, the cost will be minimized; however, cost should not be the determining factor in initiation a park-like theme which would improve land values and economy."

"Use of flood waters for replenishing underground aquifers."

"Your alternatives look really good. I really like the softer design and think all of these themes will be better than traditional flood control channel."

"Modify 2 with north south drainage ways."