WHITE TANKS FRS #3

Design Issues/ Basin Alternatives Report

Volume I

Prepared by:

URS

Submitted August 2001

Flood Control District of Maricopa County

Project No. E1-15448007.00

Contract No. FCD 98-11 PCN 4700430

DESIGN ISSUES AND BASIN ALTERNATIVES REPORT VOLUME I

WHITE TANKS FRS #3 MODIFICATIONS DESIGN PROJECT

Prepared for
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Contract # FCD98-11
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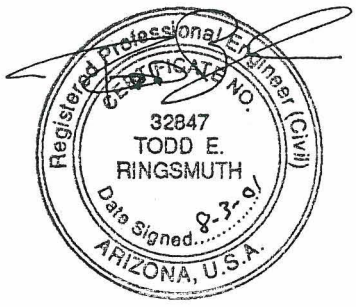

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

White Tanks Flood Retarding Structure (FRS) #3 is located on alluvial fan deposits east of the White Tank Mountains, approximately 20 miles west of Phoenix, Arizona. The north end of the embankment is approximately 1 mile south of the intersection of Northern Avenue and the Beardsley Canal in Maricopa County (Figure 1-1). Since its construction in 1954, the crest of the dam has settled approximately 3.6 feet at the north end of the alignment. This settlement is in response to regional land subsidence associated with excessive groundwater withdrawal in the area. The amount of settlement appears to decrease steadily along the alignment until virtually no settlement is observed at the southern end of the embankment. Transverse and, to a lesser extent, longitudinal cracks have been observed through the embankment.

The fact that the dam has experienced such settlement and cracking problems, along with the safety and inspection requirements by federal and state agencies, prompted the Flood Control District of Maricopa County (District) to consider engineered dam replacement alternatives. Interim dam safety measures were developed so that the dam would perform its functions adequately and safely, while a dam replacement option is being studied, designed, funded, and implemented. The dam replacement alternatives being considered and discussed in this report consist of the excavation of single or multiple basins. The basin(s) will provide the storage capacity expected for the 100-year, 24-hour storm event. The basin design alternatives also present multi-use recreational concepts that could potentially be developed by a project partner.

1.2 AUTHORIZATION

The District selected URS-Dames & Moore to serve as the engineering and design consultant for the project. URS-Dames & Moore was informed of the selection on June 16, 1998. Following finalization of the Scope of Work and contract negotiations, Contract FCD98-11 was awarded by the District and URS-Dames & Moore received formal Notice to Proceed on September 11, 1998. On October 6, 1999 URS-Dames & Moore received authorization from the District to proceed with the scope of work detailed in Change Order Nos. 5, which provides additional services needed for developing basin alternatives.

1.3 SCOPE OF WORK

The overall objective of the project is to provide concepts and alternatives for replacement of White Tanks FRS #3 while safely maintaining the 100-year, 24-hour flood control capability, and meet the regulations and standards of the NRCS and ADWR. This objective will be achieved

by completing a series of tasks presented in the project Scope of Work (SOW) as detailed in the October 6, 1999 Change Order No. 5 and subsequent change orders.

1.4 OTHER AGENCIES

- Agencies overseeing or involved in the Project

The following are the primary agencies involved in the project:

1. **Flood Control District of Maricopa County** - The District presently owns and operates White Tanks FRS #3 and is funding the design phase of the project. Tom Renckly, P.E. serves as the Project Manager for the District.

2. **Natural Resources Conservation Service** - The NRCS constructed White Tanks FRS #3 in 1954. The NRCS may serve as a funding agency for the construction phase of the project. Noller Herbert, P.E. in the Phoenix office of the NRCS serves as the primary point of contact for the project.

3. **Arizona Department of Water Resources** - ADWR is responsible for the safety of dams in the State of Arizona. Due to its height and reservoir capacity, White Tanks FRS #3 falls under the jurisdiction of ADWR. Interim dam safety measures are being undertaken to meet specific ADWR concerns during the period that the District evaluates the feasibility of dam rehabilitation or basin construction. ADWR will also be involved with issues concerning breaching the existing dam in the event of basin construction. Jon Benoist is the Supervisor for the Dam Safety Section of ADWR. Michael Greenslade, P.E. is ADWR's primary point of contact for White Tanks FRS #3.

1.5 PURPOSE OF DESIGN ISSUES AND BASIN ALTERNATIVES REPORT

The overall objective of the Design Issues and Basin Alternatives Report (DIBAR) is to present basin alternatives, evaluate basin design issues, and present recreational concepts to coordinate with the basin designs. The development of the basin alternatives followed review and discussion of the five basin concepts presented in the Basin Concepts Design Issues Memorandum (DIM), dated February 10, 2000. The DIM has been incorporated into this report. The basin alternatives are evaluated against project constraints such as flood control, environmental impacts, aesthetics, and cost. This report does ***not*** recommend a preferred alternative for the project.

2.0 BASIN CONCEPTS

Five basin concepts were developed based on an evaluation of environmental resource, design, and multi-use issues. The following sections discuss the evaluation of these issues and present the resulting basin concepts. Details of the environmental and cultural resources studies are presented in separate reports prepared by URS-Dames & Moore: the General Environmental Report for the White Tanks FRS #3 and the Cultural Resources Inventory for the White Tanks FRS #3, Maricopa County Arizona.

2.1 ENVIRONMENTAL RESOURCES

The District proposes to replace the existing dam with a single or multiple flood control basins that also will provide recreational opportunities. For purposes of this study, five environmental resource areas were evaluated: land use, socioeconomics, visual, biological, and cultural resources. Land use and socioeconomic conditions were combined into a general environmental category. The study area for these resources encompassed lands within a 5-mile radius of White Tanks FRS #3 and also identified potentially relevant existing and proposed recreational developments within an even broader area, which included portions of the Agua Fria and Gila rivers. Visual, cultural, and biological resources were considered individually. The study area for these resources generally was confined to a 2.5-square-mile parcel immediately proximal to White Tanks FRS #3; an 80-acre parcel located at the southeast corner of Olive Avenue and Beardsley Canal; and a small area surrounding the proposed Waterfall Wash Diversion. Following the acquisition of baseline data, individual resource qualities were used to identify opportunities for, and constraints to, the development of landscape recreation design concepts.

2.1.1 General Environmental Analysis

Potential regional influences are depicted on a series of geographic information systems (GIS) Arc/Info maps and cover the larger study area. Figure 2-1 portrays the land jurisdiction and ownership identified in the study area. Existing and future infrastructure, residences, and mixed uses are depicted on Figures 2-2 and 2-3, respectively. These maps show the expected population flux within the study area, which will influence future development including recreational needs. Figure 2-4 illustrates existing recreational opportunities and future potentials that eventually may be linked to the White Tanks FRS #3 recreational development.

2.1.2 Visual Resources

2.1.2.1 Landscape Character Unit Description

There are several unique landscape character units found within the study area as shown on Figure 2-5. Each of the units displays unique physical features including landform, vegetation, color, and/or cultural (manmade) disturbances. The units consist primarily of desert washes and creosote plain landscapes characterized by dry sandy drainages cutting across areas of relatively flat desert scrub areas. Additional units include a basin area identified by a relatively smooth depressed area that sometimes holds water. This basin was created by the construction of White Tanks FRS #3 which has sharp uniform edges and a flat top that contrast sharply with the surrounding desert washes and plains landscapes. A substantially disturbed area exhibits numerous manmade "scars" including trenches, pits, roads, and an industrial area where offices, storage buildings, and so forth were erected to support past and present proving grounds for heavy machinery by others (non-District related activities).

2.1.2.2 Views

The landscapes in the White Tanks FRS #3 vicinity are open and expansive, permitting extensive views and vistas of adjacent landscapes. There are several views into and out of the smaller study area as shown on Figure 2-6. The views from within the study area to adjacent landscapes take advantage of elevated terrain along the existing embankment (dam). The change in elevation allows for panoramic views to the west/northwest of the White Tank Mountains and foothills leading up to the mountains. The White Tank Mountains display several unique features, including sharp peaks and steep slopes with areas of rock outcrops. Additionally, there are panoramic views to the east/southeast/south of agricultural lands as well as the distant Sierra Estrella Mountains. The agricultural lands consist of a patchwork of colors ranging from shades of green to brown/tan. Views of the Caterpillar proving grounds to the west show several areas where the landscape has been "scarred" as a result of equipment testing.

Advantage should be taken of these views of undisturbed landscapes when considering future design concepts and modifications in the vicinity of White Tanks FRS #3. Likewise, views where there is extensive "scarring" should be avoided or screened when possible, unless efforts are taken to mitigate the disturbance.

2.1.3 Cultural Resources

Cultural resources can be either prehistoric or historic in age and include sites, buildings, structures, districts, and objects as those properties are defined by the National Historic

Preservation Act. Not all cultural resources warrant preservation or protection. The importance or significance of cultural resources is assessed in consideration of criteria for listing on the National Register of Historic Places (National Register).

An intensive pedestrian survey to identify archaeological and historical resources was undertaken to include all acreage that had not been inspected during earlier studies. In addition, the importance of White Tanks FRS #3 and Beardsley Canal were assessed. White Tanks FRS #3 is close to 50 years old, and thus possibly of historic significance. Beardsley Canal was constructed approximately 75 years ago. The historic significance of White Tanks FRS #3 and Beardsley Canal are addressed in the Cultural Resources Inventory prepared by URS (August 2001).

Twenty-two isolated occurrences were recorded. These are artifacts (for example, a prehistoric ceramic sherd or fragments of a historic bottle or can) or small features (for example, a rock pile) that reflect human activity but fall below the threshold for identification as archaeological sites. None of the isolated artifacts are regarded as significant.

A single prehistoric-age archaeological site was recorded within the area proposed for Concept 2 development. It was recorded and designated site AZ T:7:246 (ASM). The site is a low-density scatter of prehistoric sherds, with a small number of flaked stone items also present. Although no surface features were defined, there is potential depth to the site sediments and thus, potential for subsurface cultural remains. Additional studies could yield important information about regional and local subsistence, resource utilization and production, and chronology. Therefore, the site is recommended as potentially eligible for listing on the National Register on the basis of its information potential. Details of the archaeological site are provided in the Cultural Resources Inventory (URS 2001).

A single historic-age archaeological site was recorded and designated site AZ T:7:175 (ASM). The site is a surface accumulation of trash and metal fragments, with the remains of several concrete features. Because recording has essentially exhausted the information potential of the site, it is recommended as not eligible for National Register listing. Likewise, the assessment of White Tanks FRS#3 and Beardsley Canal concludes the structures do not retain sufficient integrity (because of alterations subsequent to their initial construction) to be considered for National Register listing.

No opportunities such as public interpretation of an interesting archaeological site or historic building were discovered, and we conclude just one site, AZ T:7:246 (ASM), warrants additional investigations. Mitigation measures for this site are discussed in the Cultural Resources Inventory (URS 2001).

2.1.4 Biological Resources

A reconnaissance survey of the study area was undertaken to assess the vegetation resources and to make note of any wildlife species that might be observed. Lists of potentially occurring plants, mammals, birds, and herpetofauna were generated using existing literature on the distribution of habitat requirements of Arizona flora and fauna.

The vegetation of the entire area falls into the Lower Colorado River Valley subdivision of Sonoran desertscrub. A number or xeroriparian washes dissect the area and a bosque occurs northwest of White Tanks FRS #3. Blue paloverde is the most common tree species along the washes; interfluvial flats are dominated by creosote. Species of special concern are those listed as threatened or endangered or otherwise sensitive plants known to exist within Maricopa County. Those that could occur within the White Tanks FRS #3 study area include the lowland leopard frog, Sonoran tortoise, California leaf-nosed bat, lesser long-nosed bat, southern yellow bat, peregrine falcon, cactus ferruginous pygmy-owl, and crested saguaro.

The field reconnaissance determined that of these species, just the pygmy-owl is a potential concern in the vicinity of White Tanks FRS #3. The project area does contain pygmy-owl habitat components, such as a bosque and stringers of trees along dry washes (Figure 2-8), and therefore, our conservative recommendation to the District is to undertake the surveys if the need for a permit from the USACE is anticipated. In support of this recommendation, Sallie McGuire of the US Army Corps of Engineers indicated to the District, during a discussion held in April 2001, that she would require a pygmy owl survey for big projects such as master plan communities, even if the area were outside of the designated zones. She also noted that if a federal agency sponsors the project, a survey will most likely be required. It is important to be aware that the *surveys require two years to complete* and *at least one of the surveys must be conducted between February 15 and April 15*. Details of the pygmy-owl findings and recommendations are provided in the General Environmental Report (URS 2001).

2.2 REGIONAL ANALYSIS AND RECREATION CONCEPT DEVELOPMENT

The overall objective of the regional analysis—and the recreation design concepts developed in consideration of that analysis—was to identify recreational uses. These uses were to be consistent with the primary need to provide flood protection. Inventoried information regarding existing and future land uses, visual resources, and potentially relevant projects within the vicinity of White Tanks FRS #3 was utilized to assess anticipated community recreational needs. This information allowed for the development of a range of concepts that meet community recreational needs and can be incorporated into a flood retention basin design. There were no cultural resource opportunities or constraints identified. Biological issues, specifically potential

impacts on cactus ferruginous pygmy-owl, were recognized and will need to be considered in conjunction with all of the basin designs.

2.3 BASIN CONCEPTS

2.3.1 Concept 1 – Single Basin, Active Use

Concept 1 would entail developing the site as an active recreation facility by creating a major sports complex, an equestrian facility, and a golf course as shown on Figure 2-9. Stormwater retention would be concentrated into the lowest, flattest part of the project area. Runoff would be brought into the basin by the wash channels; then a series of terraces would allow the park, soccer fields, and parts of the golf course to be integrated into the basin, while only being inundated during large flood events.

2.3.2 Concept 2 – Single Basin, Passive Use

Concept 2, shown on Figure 2-10, would entail developing the site for passive recreation, wildlife habitat, and native plant open space. The lakes and streams in the park would use diverted water from the Beardsley Canal to supply and circulate the water, as well as providing water storage for the canal. The retention basin would be located on the lowest, mildest slope of the site, with flat side slopes that spread out over a large area. Vegetation islands would be scattered throughout the basin to provide wildlife habitat and break up the visual size of the basin.

2.3.3 Concept 3 – Multiple Basins, Active Use

Concept 3, shown on Figure 2-11, would entail developing the site as an active use recreation attraction by creating a major sports complex, an equestrian facility, and a golf course. Two retention basins would be excavated: a northern basin, which would be grassed and integrated into the park and sports complex, and a southern basin that would be revegetated with natural plants. Runoff would be brought into the northern basin by the wash channel and as the water rises, it would gradually inundate some of the soccer fields. As for the southern basin, a major flood event would encroach onto non-played parts of the golf course.

2.3.4 Concept 4 – Multiple Basins, Passive Use

Concept 4, shown on Figure 2-12, contains three shallower retention basins that would be developed into three distinct-use areas linked together by the Beardsley Canal. A sports complex would provide athletic fields and courts for different kinds of activities. The stormwater recharge basins would combine the need for groundwater recharge and wildlife habitat. A park would

provide passive recreation and learning opportunities while integrating with a softened dam remnant. The northern basin would provide an opportunity for hiking and lowland trail riding from the nearby equestrian facility.

2.3.5 Concept 5 – Single Basin, Passive Use

Concept 5, shown on Figure 2-13, would entail developing the site for minimal passive recreational uses. A large single basin would be located adjacent to the existing dam and breach the dam in several locations. The remaining areas of the dam would be blended with some of the resulting spoils to create high points and overlooks. The site would be revegetated to a native desert condition with a blend of four general seed mixes that follow the water distribution patterns of the site.

2.3.6 Aesthetic and Cost Evaluation of Engineering Components

The basin concepts incorporate several engineering components, which are discussed in detail in Section 5.0. Table 2-1 provides an evaluation of the aesthetic values and cost impacts of these components. A discussion of the aesthetic values, as they relate to the passive and active recreation uses incorporated into the basin concepts, is provided below.

- Basin Configuration: Placement of the basin in an area of mild land slopes (0.5 percent or less) will reduce the quantity and cost of excavation. Constructing a basin with flatter side slopes will result in a more aesthetic design.

- Drainage Options: Full drainage of the basin(s) would be preferred for a active use recreation facility. The presence of standing water may be more acceptable for a passive use recreation facility.

- Total drainage would be preferred due to the presence of active-use facilities to minimize the presence of standing water.

- Inlet Structures: The structure will likely be constructed of concrete, but can conform to an active or passive recreation use facility.

- Sediment Basins: The design of the sediment basins can conform to an active or passive recreation use facility. The issue will be the method and frequency of maintenance. Sediment basins can work in conjunction with flood control basins, bust active facilities should not be placed in the sediment basins. Passive-use trails could be placed within sediment basins.

- Impoundment Dike: The dike will likely be of minimal height (less than 6-ft tall) and could be covered by soil to minimize any visual impact.

- Disposal of Excavated Material: Excavated material can be disposed of on or off site. Using the material on site provides opportunities for creating recreational features and improving aesthetic value.

- Land Acquisition: The need for additional land can be minimized by the single-basin concept and through management of the placement of excavated material. Multiple-basin concepts inherently require the need for additional land.

3.0 BASIN ALTERNATIVES

Three basin alternatives were developed from the basin concepts to incorporate selected basin configurations and multi-use recreational options. Alternative 1 consists of a single basin with a passive-use recreational orientation; Alternative 2 consists of two basins with a active-use recreational orientation; and Alternative 3 consists of two basins with a mixed-use (both active and passive) recreational orientation. Table 3-1 provides a summary of the design elements for each alternative, including basin characteristics (e.g., location, size, and number), diversion schemes, and improvement of existing conveyance systems.

The recreation options provided with each alternative are intended to provide ideas for potential future development of the basin and adjacent area. Development of a recreational option at the site would be performed by partners interested in working with the District.

3.1 ALTERNATIVE 1 – PASSIVE-USE RECREATION

3.1.1 Description

Alternative 1 consists of a single basin located immediately upstream of the existing White Tanks FRS #3 and primarily on District property. Alternative 1 was developed from Concept 5 and presents a passive-use recreation option. The landscape, recreation, and design details of Alternative 1 are shown in plan, section, and perspective views on Figures 3-1, 3-2, and 3-3, respectively. Details of the basin design are presented in Section 4.0 and summarized on Table 3-2.

The main design and recreation features of Alternative 1 include the following:

- A single large basin located primarily on District property, with a design storage requirement of 1,634 acre-feet.
- The basin incorporates low flow channels, sediment basins, and potential reconstruction of natural washes.
- Figure 3-4 provides details of the diversion schemes incorporated in basin sizing. A diversion within Waterfall Wash diverts approximately half of its tributary area to McMicken Dam, providing a reduction of required storage in the basin.

- The site contains a primitive parking lot and trailhead, with scenic overlooks located on top of the landscape berms to provide views. The native multi-use trails meander around the landscape berms and into the retention basin.

- A recharge basin is located within the retention basin to provide an opportunity for recharge from adjacent sources, such as Beardsley Canal.

- The stormwater channel along the west side of Beardsley Canal will be improved between the basin and a point one-half mile north of Northern Avenue to contain design peak flows. The improvement also includes increasing the flow capacity beneath a proposed bridge crossing at Northern Avenue.

- The site would consist of four landscape character zones: upland sonoran desert, desert wash, retention basin, and low flow area.

- Stormwater runoff from the tributary area is completely retained in the basin. This alternative does not incorporate the diversion of water east of Beardsley Canal.

3.1.2 Opportunities and Constraints

The main opportunities and constraints attributed to Alternative 1 are listed below:

- Alternative 1 requires the least amount of additional land that must be purchased for placement of the basin and excavated spoils.

- Placing the basin upstream of the existing dam reduces the issues (i.e., flood risk, spoils placement) related to construction sequencing and dam breach.

- With the improved stormwater channel along Beardsley Canal, breakout over the canal during the 100-year storm will no longer occur.

- The basin outlet only provides partial drainage of stormwater. The presence of water during all flood events will result in potential mosquito nuisance and public safety issues.

- The passive-use recreation option minimizes the development of the basin (i.e., structures) and provides a natural landscape that blends with the surrounding area.

3.2 ALTERNATIVE 2 – ACTIVE-USE RECREATION

3.2.1 Description

Alternative 2 consists of two basins located at the existing White Tanks FRS #3 and on District property, Maricopa Water District (MWD) property, and State Land. Alternative 2 was developed from Concept 3 and presents an active-use recreation option. The details of Alternative 2 are shown in plan, section, and perspective views on Figures 3-5, 3-6, and 3-7, respectively. Details of the basin design are presented in Section 4.0 and summarized on Table 3-2.

The main design and recreation features of Alternative 2 include the following:

- Two basins located on District property, over 200 acres of MWD property, and over 200 acres of State Land.
- The north basin has a design storage requirement of 531 acre-feet. The south basin has a design storage requirement of 478 acre-feet.
- The basin incorporates low flow channels, sediment basins, and potential reconstruction of natural washes.
- Figure 3-8 provides details of the diversion schemes incorporated in basin sizing. A diversion within Waterfall Wash diverts approximately half of its tributary area to McMicken Dam. A diversion at Olive Avenue conveys 1,300 cfs east across Beardsley Canal. These diversions provide for a reduction of required storage in the basin.
- The design incorporates side-channel weirs to allow low flows to bypass the basins, keeping the basins dry during frequent storm events. The bypass channels convey flow south to a Camelback Road where flow is diverted east across Beardsley Canal. The design flow for the bypass channels was 1,500 cfs.
- The north basin incorporates the soccer fields of the sports complex into the basin storage area. The fields would remain dry during more frequent storms and only become inundated with large storm events. The south basin will integrate with a golf course around and within the basin.
- Equestrian facilities will be centrally located to provide access to Beardsley Canal and the basin project area. Interpretive hiking trails will also be coordinated with a community park.

- The stormwater channel along the west side of Beardsley Canal will be improved between the basin and a point one-half mile north of Northern Avenue to contain design peak flows. The improvement also includes increasing the flow capacity beneath a proposed bridge crossing at Northern Avenue.

- The site would consist of five landscape character zones: upland sonoran desert, desert wash, retention basin, low flow area, and park.

3.2.2 Opportunities and Constraints

The main opportunities and constraints attributed to this alternative are listed below:

- Alternative 2 requires the purchase of a large amount of both State Land and Maricopa Water District property.

- With the improved stormwater channel along Beardsley Canal, breakout over the canal during the 100-year storm will no longer occur.

- The basin design provides for nearly complete drainage of stormwater.

- The use of bypass channels to convey low flows past the basins significantly reduced the design storage requirement.

- The use of bypass channels will prevent small storm flows from entering the basins and keep them dry until larger storms occur, thus allowing more frequent recreational uses within the basins.

- The south basin is centered on the existing dam, which will result in issues (i.e., flood risk, spoils placement) related to construction sequencing and dam breach.

- The passive-use recreation option minimizes the development of the basin (i.e., structures) and provides a natural landscape that blends with the surrounding area.

- This alternative provides for a physical separation of the two basins and allows the active recreational facilities to be spread out over a larger area. In addition, both a north and south access to the site are provided.

- A significant portion of the increased basin cost compared to Alternative 1 is a result of the increased land acquisition required. The recreation facilities shown in Alternative 2 represent a high cost.

3.3 ALTERNATIVE 3 – MIXED-USE RECREATION

3.3.1 Description

Alternative 2 consists of two basins: the Main Basin located immediately downstream of the existing White Tanks FRS #3; and the Olive Basin located at the southeast corner of Olive Avenue and Beardsley Canal. Alternative 3 was developed from Concept 2 and presents a mixed-use recreation option. The details of Alternative 3 are shown in plan, section, and perspective views on Figures 3-9, 3-10, and 3-11, respectively. Details of the basin design are presented in Section 4.0 and summarized on Table 3-2.

The main design and recreation features of Alternative 3 include the following:

- Two basins located on District property, over 400 acres of MWD property, and small portion on State Land.
- The Main Basin has a design storage requirement of 1,158 acre-feet. The Olive Basin has a design storage requirement of 505 acre-feet.
- The basin incorporates low flow channels, sediment basins, and potential reconstruction of natural washes.
- Figure 3-12 provides details of the diversion schemes incorporated in basin sizing. A diversion at Northern Avenue conveys 1,300 cfs east across Beardsley Canal. This diversion provides for a reduction of required storage in the Main Basin.
- A diversion at Olive Avenue conveys a peak flow of 4,279 cfs and a volume of 505 acre-feet east across Beardsley Canal to the Olive Basin.
- The Olive Basin is shown as mainly a passive-use recreation area. A small equestrian staging area is also provided near the Olive Basin.
- The Main Basin is shown with both passive-use areas and active-use recreation facilities. The basin incorporates wildlife habitat, wetland areas, and scenic overlooks. A community park provides hiking trails, playgrounds, soccer and softball fields, and ball courts.
- The stormwater channel along the west side of Beardsley Canal will be improved between the basin and a point one-half mile north of Northern Avenue to contain design peak flows. The improvement also includes increasing the flow capacity beneath a proposed bridge crossing at Northern Avenue.
- The site would consist of six landscape character zones: upland sonoran desert, desert wash, retention basin, low flow area, park, and wetland.

3.3.2 Opportunities and Constraints

The main opportunities and constraints attributed to this alternative are listed below:

- Alternative 3 requires the purchase of a large amount Maricopa Water District property.
- With the improved stormwater channel along Beardsley Canal, breakout over the canal during the 100-year storm will no longer occur.
- The Main Basin outlet only provides partial drainage of stormwater. The presence of water during all flood events will result in potential mosquito nuisance and public safety issues.
- The Olive Basin design provides for nearly complete drainage of stormwater.
- Placing the Main Basin nearly entirely downstream of the existing dam reduces the issues (i.e., flood risk, spoils placement) related to construction sequencing and dam breach.
- The Olive Basin provides an opportunity to contain stormwater further upstream and reduce the size of the Main Basin.
- The separation of the basins allows for the system to be viewed as more of a north-south recreational facility with tie-ins to other facilities, such as McMicken Dam.
- The passive-use recreation option minimizes the development of the basin (i.e., structures) and provides a natural landscape that blends with the surrounding area.
- A significant portion of the increased basin cost compared to Alternative 1 is a result of the increased land acquisition required. The recreation facilities shown in Alternative 3 represent a high cost.
- By locating the Main Basin nearer to Beardsley Canal, where the land slope is slightly less, there will be a reduction in the excavation volume required during basin construction.

3.4 COST ANALYSIS

A detailed cost evaluation was performed for the 3 basin alternatives to develop a preliminary construction cost estimate. Table 3-3 presents cost estimates for each alternative, indicating the basin and drainage construction cost and recreational facilities cost separately. The detailed breakdown of the costs is provided in Appendix A. The cost estimates presented herein reflect

the conceptual engineering and design information presented in this report. The cost estimates outline the quantities, unit prices, and total capital costs associated with the construction activities for the 3 alternatives.

The basis for estimate of the engineering design components is detailed in Section 4.0. The basis for estimate of the recreational facilities are discussed in Section 3.0. It is our understanding that the cost estimates presented in this report will be one of the tools the District would use to evaluate the technical and financial feasibility of the basin(s) alternative for dam replacement.

These preliminary-level estimates have been prepared with an accuracy of ±30 percent. A contingency factor of 20 percent has been added to the basin and drainage construction, as is typical in the industry for estimates based on conceptual design information. A 30 percent contingency was added for the public-use amenities due to possible fluctuations in design and construction material selection for final design. The contingency is included to reflect the degree of uncertainty associated with the quantity and unit price for each line item, uncosted activities associated with the specific line item, and to provide an allowance for unforeseen (or unidentified) activities.

Many of the unit prices presented in the cost estimate are broadly based on assumptions made regarding the sequence and schedule (duration) of activities for this project. The dependency of unit pricing, as they apply, was briefly considered based on our experience on other similar projects. However, the schedule of individual activities and overall project schedule is omitted from this report submittal.

3.4.1 Structures East of Beardsley Canal

The development of each basin alternative has some impact to the sizing of stormwater control structures east of Beardsley Canal. These impacts result from improvements to stormwater channels west of the canal and diversion of stormwater over the canal to the east. URS Corporation is currently evaluating the location and sizing of channels and basins for this area under the White Tanks/Loop 303 Area Drainage Master Study. Appendix B provides a memorandum detailing the cost impacts to structures east of Beardsley Canal for each alternative. This section provides a brief discussion of the proposed improvements and diversions, and the resulting impacts.

Each basin alternative includes the improvement of the existing stormwater channel along the west side of Beardsley Canal. This channel conveys stormwater from Olive Avenue south to the White Tanks FRS #3. Based on current hydrologic models, stormwater flows from the White Tanks Mountains will overtop the Beardsley Canal during the 100-year flood at two locations:

midway between Olive and Northern Avenues; and at Northern Avenue. The channel improvements will consist of channel widening and the construction of a bridge structure at Northern Avenue. These improvements will significantly reduce 100-year flows immediately to the east of the canal and will allow certain property developers to decrease or eliminate some stormwater controls. The resulting cost savings to the developers may provide an opportunity for the District to evaluate cost sharing opportunities with the upstream improvements. The District requested that these channel improvements be considered as the baseline case when evaluating impacts east of Beardsley Canal.

Alternative 1 consists of only the channel improvements along the west side of Beardsley Canal (baseline case) and, therefore, does not have any cost impacts to stormwater structures east of the canal. Alternative 2 consists of two diversion across Beardsley Canal: 1,300 cfs at Olive Avenue and 1,500 cfs at Camelback Avenue. These diversions result in an estimated cost increase of $20.6 million for the stormwater control structures east of the canal. Alternative 3 consists of one diversion across Beardsley Canal: 1,300 cfs at Northern Avenue. This diversion results in an estimated cost increase of $12.7 million for the stormwater control structures east of the canal.

4.0 BASIN DESIGN ISSUES

Development of the basin alternatives required a detailed evaluation of the issues related to basin design. The design issues include basin location and sizing, constructability, land acquisition, downstream flooding, and detailed engineering of basin components. Evaluation of the design issues were integral in developing the basin costs and understanding the feasibility of the basin alternatives.

4.1 GEOTECHNICAL INVESTIGATION AND ANALYSIS

This section provides information on geotechnical issues identified for the project. The geotechnical issues evaluated include excavation conditions that would be encountered during basin construction, the potential for commercial sand and gravel mining of the excavated material, and seepage and infiltration parameters.

4.1.1 Excavation Conditions and Effort

Excavation conditions were evaluated using field exploration methods, which were in the form of borings, test pits, and seismic refraction surveys. Borings and test pits were performed in 1998, and again in 1999, while seismic refraction survey work was performed in 1999. Boring logs, test pit logs, and the seismic refraction survey report are provided in Appendix C.

4.1.1.1 Borings

The 1999 exploration included six borings located in the vicinity of White Tanks FRS #3, as shown on Figure 4-1. Borings were drilled with a truck-mounted rig using auger methods. Samples were obtained by standard split barrel methods, the Standard Penetration Test (ASTM D1586). Standard Penetration Tests (SPT) in these borings generally show low SPT values in the top 10 to 15 feet where the soil is generally fine, silty sand. SPT values vary from 5 to 34 blows per foot in the top 5 feet, which indicates a relative density from loose to dense. At a depth of 10 feet, SPT varies from 5 to greater than 50 blows per foot, indicating relative density that varies from loose to very dense. SPT generally increases below 15 feet to 30 or greater blows per foot, although some borings indicate an SPT lower than 30 at these depths. Higher relative densities with an SPT greater than 50 blows per foot were encountered at depths greater than 20 feet.

SPT and drilling efforts generally indicate soil that can be easily excavated from the top 10 feet, with a moderate excavation effort required at depths greater than 10 feet.

4.1.1.2 Test pits

The 1999 exploration included three test pits as shown on Figure 4-1. Test pits were excavated with a track-mounted excavator to depths of 16 to 20 feet and indicated similar soil conditions as those shown in the borings. Easy to moderate effort was needed to excavate the test pits to depths of 16 to 20 feet. None of the pits reached refusal, or material that the excavator could not remove from the pit. Difficult excavation was encountered in only one pit, TP-1, near a depth of 16 feet.

4.1.1.3 Seismic Survey

The 1999 exploration included a seismic refraction survey, which consisted of six separate lines of geophones, each 120 feet long. The survey resulted in shear wave velocity measurement through the soil profile. Seismic lines are shown on Figure 4-1.

Survey results show that at a depth of 0 to 5 feet, velocity varies from 1,141 to 1,175 feet per second (ft/s). At depths of 5 to 20 feet, velocity varies from 1,811 to 2,216 ft/s. Below 20-feet depth, velocity varies from 2,726 to 3,233 ft/s. These velocities generally indicate no ripping required in the top 5 feet, soft ripping possibly required to 20-feet depth, and medium ripping below 20-feet depth. This characterization is based upon medium-weight tractor equipment with 200 to 300-horsepower engine and a 60,000- to 90,000-pound working load.

4.1.2 Sand and Gravel Potential

The site was evaluated for its potential to be developed for sand and gravel sales or as a general fill commercial material source. Depending on the level of interest, the alternatives can range from a full-scale operation where the sand and gravel contractor would excavate and haul the soil offsite, to finding parties that would accept any soil volumes in excess of landscaping needs to be delivered to their location.

URS-Dames & Moore has evaluated sand and gravel mining through exploration (at two different times), and through contacting commercial sand and gravel suppliers. Exploration by use of test pits was performed in the reservoir area in 1998, and again recently in the 1999 exploration discussed above. URS-Dames & Moore previously addressed sand and gravel mining for the District in a memorandum submitted in December 1998. In that assessment, we concluded that commercial mining was probably not viable, primarily due to the silt content in soils encountered. The assessment is supported by an evaluation performed by a representative of the Pioneer Sand Company in their letter dated January 28, 2000 (see Appendix C).

The latest exploration and evaluation supports the previous conclusions about commercial mining. Evaluation of soils encountered in the test pits indicates that the top 10 to 20 feet of soil

is generally very silty, with a relatively high fine fraction. Lab testing generally indicates fine fraction in the range of 54 to 61 percent in the top 10 feet. For commercial sand and gravel sales, such soils would probably require extensive processing in order to wash out fines. Such processing is not economical without a major watercourse close by. Consequently, in the assessment of URS-Dames & Moore and the commercial sand and gravel suppliers, commercial sand and gravel mining appears to be impractical.

4.1.3 Infiltration Potential

Permeability of in-situ soils by means of down-hole permeability tests were evaluated in the borings, while infiltration tests were conducted within the test pits. The permeability tests indicate a coefficient of permeability in the range of 10^{-3} to 10^{-4} centimeters per second (cm/s). Coefficients of permeability in this range indicate fair to low drainage characteristics. In 1998, URS-Dames & Moore performed four single ring infiltrometer tests within the reservoir. These tests showed the sediments to have a coefficient of permeability of approximately 10^{-6} cm/s.

The test results from field explorations represent in-situ soils in their excavated state, without any covering of sediment. The infiltrometer tests represent the infiltration that would likely occur in sediment basins or other portions of a basin after long term deposition of sediments. Sediment basins can be used to reduce sedimentation within the basins and maintain a higher infiltration rate to better meet the drainage requirements of the District and other regulating agencies. Further analysis is needed to quantify the volume of water expected to be lost due to infiltration, which will be incorporated in basin drainage calculations.

4.2 BASIN SIZING AND CONFIGURATION

The sizing of the basins in each alternative is developed from the watershed hydrology and the use of diversions to convey stormwater away from the basin. As a design requirement, the basins must be sized to contain the 100-year, 24-hour runoff volume from their tributary watersheds. In addition, a freeboard of 1-foot will be incorporated into the design. The diversion of stormwater can be a key element to reducing the size of a basin along with associated excavation costs.

Several basin configurations were analyzed using different combinations of shape, size, side slopes, and freeboard options. The configuration analysis also considered basin construction with and without a dike at the downgradient edge. In cases where a dike was considered, the maximum height was less than 6 feet in order to keep the structure out of jurisdiction by Arizona Department of Water Resources (ADWR).

4.2.1 Hydrology

The design criterion for sizing the basin is the 100-year, 24-hour storm event runoff volume. Several analyses have been conducted with runoff estimates from the watershed ranging from 850 to 2,205 acre-feet. The District performed additional hydrologic analyses to refine the runoff estimate to account for site-specific conditions. The District reviewed this analysis and provided an amended estimate for design of 1,968 acre-feet in a report dated May 11, 2000. The information presented in this report is based on the hydrology used in developing a total watershed runoff volume of 1,968 acre-feet.

4.2.2 Diversions

Each basin alternative incorporates a stormwater diversion element to reduce the required storage volume. The diversion elements presented in the alternatives were located upstream of the basins, downstream, or a combination of both. The diversions would convey stormwater to the north, south, or east of the White Tanks FRS #3 watershed. The stormwater volumes diverted, and the resulting basin volumes, are shown on Figures 3-4, 3-8, and 3-12. The calculation packages supporting the hydrologic analyses are provided in Appendix D.

4.2.2.1 Diversion to the North and South

Four diversion options were evaluated that conveyed stormwater to the north and south: two conveyed water north to McMicken Dam (Cholla Wash and Waterfall Wash Diversions), and two conveyed water to the south (Bedrock Wash Diversions). The general locations of the diversion options are shown on Figure 4-2. The diversion of water out of the watershed reduces the total construction cost of the basin, as shown in Table 4-1.

Bedrock Wash Diversion was evaluated as a long and short version, with different volumes diverted to Foothills Basin. The Foothills Basin is located on property owned by a private developer and had insufficient storage capacity for potential volume of stormwater diverted. Therefore, the Bedrock Wash Diversion options were not considered in the basin alternatives.

Cholla and Waterfall Wash Diversions would divert approximately 616 and 333 ac-ft, respectively, to McMicken Dam. The District is currently evaluating the impacts that these diversions would have on the spillway hydraulics of McMicken Dam. Cholla Wash Diversion would capture the flows in Waterfall Wash. Waterfall Wash Diversion was shown to be the most cost effective north/south diversion (see Table 4-1) and was therefore selected to be included in some of the basin alternatives. Waterfall Wash Diversion was not included in Basin Alternative 3

but could be used as a replacement for the Olive Basin. A typical plan and section view of the Waterfall Wash Diversion are shown on Figure 4-3.

4.2.2.2 Diversions to the East of Beardsley Canal

Three diversion options were evaluated that conveyed stormwater to the east of Beardsley Canal: Olive Avenue Diversion, Northern Avenue Diversion, and a basin bypass diversion to Camelback Road. The diversion peak flows and estimated diverted volumes are shown on Figures 3-4, 3-8, and 3-12. The diversion of water out of the watershed reduces the total construction cost of the basin, as shown in Table 4-1.

Each of these diversions were incorporated into the basin alternatives. The Olive Avenue and Northern Avenue Diversions result in stormwater being conveyed east along Northern Avenue. The diversion peak flow was based on the estimated peak flow that would report to these locations under existing conditions for the 100-year flood, approximately 1,300 cfs. However, the volume of stormwater will be significantly increased with the diversions, having the result of requiring larger detention basins in the downstream system and increasing the cost of those facilities by $20.6 million.

The basin bypass diversion to Camelback Road was evaluated with a design peak flow of 1,500 cfs. Side-channel weirs would be used to allow low flows to bypass the basins, which would be conveyed in channels to Camelback Road. Diverting stormwater east along Camelback Road would require larger channels and retention basins in the downstream system and increase the cost of those facilities by $12.7 million.

The estimated cost increases to facilities east of Beardsley Canal is discussed in the memorandum provided in Appendix B.

4.2.3 Basin Storage Volumes

The required design storage capacity resulted from incorporation of selected diversion elements into the watershed hydrology. The diversion elements, volume diverted, and volume conveyed to the basins are shown on Figures 3-4, 3-8, and 3-12. The estimated basin volumes were used in the parametric analysis (see Section 4.2.4) to determine the overall dimensions of the basins presented in the three alternatives. The basin design storage is based on the 100-year, 24-hour inflow volume. The available basin storage includes the 1-ft freeboard provided in the design. Table 3-2 provides the basin design and available storage. Elevation-capacity rating curves for each basin are provided in Appendix E.

4.2.4 Parametric Analysis and Optimization

A parametric analysis was performed to allow for optimization of the basin configuration. The analysis considered the dimensional components of the basin design to determine the impact on excavation volume, which is a major element of basin construction cost.

The first phase of the analysis evaluated the ground surface slope in the project area. Ground slope has a significant impact on the volume of soil that must be excavated. Steeper slopes require greater excavation; and flatter slopes require less excavation. This can be seen in cross-section as the triangle of soil that lies above the actual storage portion of the basin. Figure 4-4 shows ground slopes in the project area between Northern Avenue and Bethany Home Road. Although not shown on this figure, ground slope west of Beardsley Canal north of Olive Avenue are above 2.5 percent. The ground slope east of Beardsley Canal along Olive Avenue remain generally low, around 1 to 2 percent. Ideal basin construction locations are at the existing dam location, south east of the dam, and along the east side of Beardsley Canal.

The second phase of the analysis evaluated the cross-section of the basin. Five cross-sections were evaluated, as shown in Figure 4-5, and consisted of the following:

- Option I – Construction of a maximum 5-ft tall embankment at the downstream edge of the basin and providing storage with zero freeboard.
- Option II – Construction of a maximum 5-ft tall embankment at the downstream edge of the basin and providing storage with 3 ft of freeboard.
- Option III – Construction of a maximum 3-ft tall embankment at the downstream edge of the basin and providing storage with 3 ft of freeboard.
- Option IV – Construction the basin without an embankment at the downstream edge and providing storage with zero of freeboard.
- Option V – Construction the basin without an embankment at the downstream edge and providing storage with 3 ft of freeboard.

Factors used in selecting the preferred cross-section included minimizing excavation and District design requirements. The results of the evaluation led to the selection of a version of Option II and includes the following basin design components.

- A 5-ft tall dike would be placed at the downstream edge of the basin to minimize excavation volumes.
- The basin would be designed with a 1-ft freeboard.

The third phase of the analysis evaluated variations of the basin length, width, depth. The ground slope and basin side slopes remained fixed for the analysis. Three variations were evaluated for each basin:

1. Basin length and width were taken from the reference Basin Concept drawings. The depth was adjusted to obtain the required volume.

2. Basin length was taken from the reference Basin Concept drawings. The basin width and depth were optimized to obtain the required volume.

3. Basin length, width, and depth were optimized to obtain the required volume.

Details of the third phase parametric analysis are provided in Appendix D. Although a basin side slope of 6:1 (horizontal:vertical) was used, the actual side slopes of the constructed basin may vary from 4:1 to 8:1.

4.3 BASIN GRADING PLANS

Specific dimensions were selected for each of the basins based on the parametric analysis and optimization. Detailed grading plans were developed to confirm the basin dimensions and adjust them to achieve the design requirements. The grading plans for the basin alternatives are shown on Figures 4-6, 4-7, and 4-8. The basin design requirements included:

- Storage capacity for the 100-year, 24-hour runoff volume (see Table 3-2);
- A freeboard of 1 ft.
- Average basin side slopes of 6:1 (H:V). Actual design side slopes could vary between 4:1 and 8:1.

The grading plans were used to represent the design volumes and estimate the quantity of excavated material (spoils). Several cross-sections were used to verify the excavated soil volumes. The spoils piles were spread around the basins in areas matching those presented on the color renderings of the alternatives. The dimensions of the spoils piles are based on the volume of excavated soils plus 20 percent to account for bulking. Appendix E provides elevation-volume curves for the basins of the 3 alternatives.

4.4 BASIN DRAINING

The basins in each alternative will have a varying degree of volume that can be drained by a low-level, gravity flow pipeline. The storage volume that can be drained from a basin generally

ranges from 80 to 90 percent, the one exception being the main basin in Alternative 3 that can only drain approximately 20 percent of the storage volume (see Table 3-2). The volume that can be drained is controlled by the basin depth and the natural topography. The slope of the drain pipe was made as flat as possible, while keeping a flow velocity between 2 and 5 feet per second needed for cleaning the pipe of sediments. A typical inlet and outlet for the low-level drain are shown on Figures 4-9 and 4-10, respectively.

The District requires drainage to be complete within 36 hours, while the Arizona Department of Health Services (ADHS) requires drainage to be complete within 72 hours. If drainage within these time frames is not possible, a maintenance plan that involves the addition of larvicides for mosquito control should be implemented. The draining time for the basins presented in the alternatives ranges from 5 to 10 days (see Table 3-2), based on a single 36-inch pipeline.

4.5 DESIGN COMPONENTS

The engineering design components of the basin alternatives consist of the major structures integral to the operation of the basin. Their specific design must meet the requirements of the design criteria discussed previously in the report. In addition, the details of the components were determined based on both design and aesthetic needs. The design details were used to develop the cost estimates provided in Appendix A.

4.5.1 Inlet Structures

The construction of inlet structures at locations of inflow into the basin would ensure the protection of side slopes against erosion and head cutting. Several alternatives for an inlet structure were evaluated, including baffle chute, vertical concrete, sloping concrete or soil cement, and natural soil on flat slopes. Table 2-1 includes a general discussion of cost and aesthetics for the different material types.

A soil cement inlet structure was selected as the preferred design for use in each alternative. Figure 4-11 illustrates a typical design for a soil cement inlet structure. This mixture of soil and cement produces a natural looking material that can fit both active and passive concepts. It would prove durable especially if combined with a reduction of the natural channel slope upstream of the basin.

The inlet structure design used in Basin Alternative 2 function as a component of the side-channel weir. The weir allows low flows in the channels to bypass the basins and continue downstream to the Camelback Road Diversion. The weir and inlet structure are constructed with soil cement to provide a rigid and non-erodible design. A box culvert through an embankment,

within the channel, at the downstream end the weir serves to control the flow in the channel, causing flow to back up over the weir and into the basin. Figure 4-12 illustrates a typical design of the side channel weir and related control structures.

4.5.2 Drain Pipe

A drain pipe would be installed for the basin to provide partial drainage of stormwater collected in the basin. Draining of stormwater is necessary as a safety measure, in the event of multiple storm events, and for aesthetic and health protection purposes. Ground slopes downstream of the basins limit the ability of the basins to be drained completely.

Figures 4-6, 4-7, and 4-8 include the layout and orientation for the outlet pipes of the different alternatives. Details for a typical trash rack and slide gate at the inlet of the drain pipe are shown in Figure 4-10. Typical cross sections of the outlet headwall are shown in Figure 4-11. The following design criteria were considered in the evaluation and design of the drain pipe:

- A standard 36-inch concrete pipe was used for comparison of drainage time of the 3 alternatives. Final plan formulation will need to evaluate drain-down requirements to select the number and size of pipes.

- Requirements by the District include a 2 to 5 feet per second range for cleaning velocity, with a typical value of 3 feet per second to be maintained when possible. Invert elevations at the inlet and outlet of the drain pipe were set to provide a slope of 0.5 percent, which produced a cleaning velocity in the pipe that meets or exceeds the above requirements.

- Layout and orientation of the pipe was influenced by the basin layout, topography of the area, and pipe slope.

4.5.3 Impoundment Dike

An impoundment dike constructed along the downstream edge of the basin provide additional storage capacity while reducing the total excavation volume. The downstream height of the impoundment dike is to remain below the ADWR regulated height of 6 feet. Three design alternatives for construction of an impoundment dike were considered: non-erodible built of concrete or roller compacted concrete (RCC), erodible built with earthen or natural material, and no dike. A general evaluation of cost and aesthetics for each was listed in Table 2-1.

Results of the parametric analysis and optimization (see Section 4.2.4) suggested that the use of a dike was an important cost reduction feature. Figure 4-13 shows a typical 5-foot RCC

impoundment dike proposed for the 3 alternatives. The dike would also serve as the overflow structure for the basin, with the RCC material provided resistance to erosion. The RCC structure would be covered by native material and vegetated while maintaining the ADWR requirement for a maximum height of less than 6 feet at a segment of the dike. Downstream protection at the overflow locations consists of an RCC pad covered by native material. Figures 4-6, 4-7, and 4-8 show the general locations of the impoundment dikes for each basin alternative.

4.5.4 Sediment Basins

Inflows into a the detention basin act as conveyors for soil particles of different sizes. The volume and size of those particles depend mainly on the inflow volume and velocity. Over time, sediments will accumulate in the basin and reduce its storage capacity. Sediment basins can be constructed within the basin or upstream within the channel. The size of the sediment basin to be constructed depends mainly on flow rate (design storm), particle size to be captured, and the type and frequency of implementation of a sediments removal plan.

The District recommended placing the sediment basins within the detention basins at the bottom of the inlet structures. The size of the detention basin will be sufficient to contain the 10-year sediment loading volume and require maintenance to remove sediments over time. Annual sediment loading rates developed by the NRCS for the White Tanks FRS #3 watershed were used to calculate the total 10-year sediments loading volume for the total watershed area. The sediment inflow for each detention basin was proportioned from the total sediment based on the peak flow at the different inlet structures. The total sediment volume that would accumulate over the period of 10 years was estimated to be about 60 acre-feet. The locations and approximate sizes of the detention basins are shown for each basin alternative on Figures 4-6, 4-7, and 4-8. Details of this calculation are included in a calculation package in Appendix D.

4.5.5 Stormwater Conveyance Channels

A system of channels is used in each alternative for conveying inflows from the watershed into the basins or, in the case of Alternative 2, downstream of the basins. Existing channels would need to be improved to provide the necessary capacity for the 100-year, 24-hour flows of the revised hydrology (see Section 4.2) . In addition, small channels or ditches would need to be constructed along the upstream side of the spoils piles to minimize ponding after storms and direct stormwater to the larger channels

Major channel components consist of the North Inlet Channel, Bethany Home/Camelback Channel, and the shorter channel sections upstream of the basins. The channel sections within the project area between Northern Avenue and Bethany Home Road are shown on Figures 4-6, 4-7,

and 4-8. The material used for erosion protection on the channel side slopes consists of buried soil cement and rip rap, depending on the channel design flow rates. Typical channel cross sections are shown on Figure 4-14. Details of the channel design parameters for major channels in each alternative are provided in Table 4-2.

The North Inlet Channel currently conveys stormwater to White Tanks FRS #3 along the west side of Beardsley Canal. Current hydrologic analyses show this channel overflows at Northern Avenue and the point where Cholla Wash intersects Beardsley Canal. The improvements include widening of the channel, protection of the channel side slopes against erosion, and improvement of the bridge crossing at Northern Avenue. Soil cement would be placed only on the east bank of the channel to protect Beardsley Canal from erosion. The west bank of the channel would allow for some erosion to occur.

The Bethany Home/Camelback Channel would be constructed as part of Alternative 2 in order to convey stormwater to the Camelback Road Diversion. The maximum design flow is 1,500 cfs. Erosion protection on the channel side slopes would consist of buried rip rap. The channels upstream of the basins must convey large peak flows and maintain stable alignments. Portions of these channels convey stormwater through the spoils piles. These channels would be constructed with buried soil cement as the means of bank erosion protection.

Providing erosion protection for the banks of the channels, and allowing natural scouring of the channel bottom, was the design approach for the conveyance channels. The costs of channel construction were estimated based on the channel sizing analysis provided in Appendix D.

4.6 LAND ACQUISITION

The land acquisition requirements differ significantly for each of the basin alternatives. The basins and related structures (spoils piles, conveyance channels, recreational facilities) would be developed on existing District property, State Trust Land, and Maricopa Water District (MWD) property. The amount of land needed for each alternative is provided with the basin alternative cost estimates in Appendix A. Figures 4-15, 4-16, 4-17 show the land acquisition needs for the main project areas. The location and approximate land acquisition boundaries for Waterfall Wash Diversion and the North Inlet Channel are shown on Figures 4-18 and 4-19, respectively.

4.7 HALF-PMF ROUTING

Half of the Probable Maximum Flood (half-PMF) was routed through the basins for each alternative. Previous analyses were performed to evaluate the effect of routing the half-PMF through the existing dam. The half-PMF peak flows out of the basins of the different alternatives

were relatively high in comparison to the peak flows out of the existing dam. This is mainly due to the higher storage volume available behind the current dam than the storage volumes of the basins in the three alternatives. In addition, the watershed size for the half-PMF model for the dam was only 16.9 square miles, where the basin models used a watershed area of 20.5 square miles.

Figures 4-20, 4-21, and 4-22 illustrate the effect of routing the half-PMF through the dam and the basins of the three alternatives. During the half-PMF, the breakout across Beardsley Canal at Cholla Wash will be reduced with the improvement of the North Inlet Channel.

4.8 DAM BREAK ANALYSIS

The development of the basins reduces the potential impact from flooding downstream of the flood retention structure due to a dam break. The existing dam has the potential for a large flood wave to occur in the event of a dam failure. The basins will only have a small dike (less than 6 ft tall), with most of the storage capacity below the base of the dike. Therefore, only a small volume of water could exit the basin during a dam failure. The downstream flooding due to dike failure is significantly reduced for Alternatives 1 and 2. The potential flooding in Alternative 3 is reduced at the existing dam site, but the creation of the Olive Basin provides the potential for flooding due to dam failure where none was present previously. However, the potential flooding from the dam failure at the Olive Basin should be small.

4.9 DAM BREACH

With the development of the basin alternatives, the existing dam will no longer be needed and can be removed. The breaching of the dam will be performed according to requirements established by ADWR. The complexity of dam breach varies with each alternative due to the location of the basin. In some cases, an increased level of risk may need to be accepted by the District due temporary reduction in storage behind the existing dam during basin construction. In each alternative the dam structure is blended into the contouring of the spoils piles with the breach located at lower contours.

The basin in Alternative 1 is located almost entirely upstream of the existing dam. The design storage could be achieved in the basin prior to breaching of the dam. The placement of spoils piles with the flood storage area of the dam is offset by the excavated volume of the basin.

The north basin in Alternative 2 is located outside of the 100-year flood pool of the existing dam. However, a majority of the spoils from the north and south basins will be placed within the flood pool. The south basin is centered on the existing dam. A significant portion of the basin will need

to excavated prior to breaching the dam. A detailed evaluation of the construction sequence will need to occur for this alternative. Breaching of the dam would occur following completion of the north basin and toward the latter part of the south basin construction.

The main basin in Alternative 3 is located almost entirely downstream of the existing dam. However, the location of spoil piles upstream of the dam and within the 100-year flood pool may reduce storage capacity during construction. Breaching of the dam would occur following completion of the main and Olive Basins.

5.0 ENVIRONMENTAL CONSEQUENCES

Environmental impacts, or modifications to the environment that are brought about by an outside action, can be beneficial or adverse. This section contains a brief look at the scientific and analytical basis for the predicted environmental consequences of the three action alternatives. Table 5-1 provides a summary and comparison of the environmental consequences for each alternative. The General Environmental Report for the White Tanks FRS #3, provided separately, examines the environmental consequences in greater detail.

5.1 LAND USE UTILITIES, AND TRANSPORTATION

Potential impacts were evaluated for existing and planned land uses based on the issues and concerns that emerged during the concepts planning process. Impacts have been defined to include physical restrictions on an existing and planned land use or incompatibility with existing land use and transportation plans.

5.1.1 Alternative 1

Alternative 1 focuses on passive recreation. The plans associated with Alternative 1 (totaling approximately 565 acres) would include a native multi-use trail, scenic overlooks, and restored wildlife habitat. Implementation would create minimal disturbance on surrounding land use and existing transportation corridors. Access to White Tanks FRS #3 recreation facilities would occur from Northern Avenue. This plan is compatible with surrounding land uses.

5.1.2 Alternative 2

Approximately 839 acres of extensive sports complexes, a multi-use trail system, and a golf course are proposed recreation elements under Alternative 3. Access to recreation facilities would occur at two proposed major park entry features accessed from Northern Avenue and Bethany Home Road.

5.1.3 Alternative 3

Alternative 3 would provide a balanced set of uses (between active and passive recreation) and would meet demands that likely are to be associated with projected residential development north and west of the White Tanks FRS #3, including the desire for open space and recreational facilities. Plans include the development of 774 acres that would include an environmental education center, observation facilities, improved wildlife habitat, hiking trails (possible connectors to future developments), concrete circulation path, native multi-use trails, scenic

overlooks, adult and jr. soccer fields, softball and little league fields, basketball courts, sand volleyball, playgrounds, turf, and horseback riding trails.

Access to White Tanks FRS #3 facilities would occur from Northern Avenue, Olive Avenue, and Bethany Home Road. The development of multiple access points would improve access to the various recreation facilities of White Tanks FRS #3. There is expected to be a slight increase in traffic with the implementation of this alternative, however, this increase is anticipated to be negligible relative to total projected volumes in the area after total build out. This plan also is compatible with the surrounding land uses and open space.

5.1.4 Summary

The boundaries of all alternatives and access to facilities are contained within the land currently owned or to be acquired by the District, and no physical conflict with or restrictions on adjacent land uses are anticipated. Existing land uses east of White Tanks FRS #3 would be buffered from the park by the Beardsley Canal. Planned land uses to the north and the southwest generally are compatible with recreation facilities, including residential and commercial uses, and additional recreation facilities.

Implementation of the more active alternatives would generate traffic in and out of White Tanks FRS #3 over the long term, although changes in traffic volumes would become more certain as plans become more specific. Given the projected level of traffic increase in the are due to development and population growth, it is anticipated that White Tanks FRS #3 would contribute a negligible increase to the total traffic. As development of White Tanks FRS #3 becomes denser, particularly on the southwest and north, the County should evaluate the need for a traffic signal or other measures to address access issues related to event traffic. In addition, to address access issues that may arise, as plans become more specific, construction routes would be pre-approved by White Tanks FRS #3 and the District and shown on construction drawings.

5.2 VISUAL RESOURCES

There is potential for both positive and negative effects on visual resources within the project area, as well as to adjacent visual resources such as existing and future parks, roads, businesses, institutions, and residences. Effects on visual resources will occur through direct alteration of the landscape components such as earth grading, vegetation removal, and placing structures in the landscape. Effects also could occur indirectly through visible elements that are imposed on the surroundings within and adjacent to the project area, such as diffuse or direct light from light standards, non-harmonious placement of facilities, or use of materials that cause glare, high color contrast, or silhouetting against the sky.

5.2.1 Alternative 1

Alternative 1 focuses on retaining and restoring the natural Sonoran Desert landscape. This is accomplished by taking advantage of the existing intact landscape features (i.e., washes and drainages) and complimenting them with the design of the basin and berms. The hard lines of the existing embankment (dam) are softened by adding berms along the edges, which result in a more natural appearing landscape and helps define the basin. Additionally, this alternative enhances degraded landscapes by restoring native vegetation and creating visual interest/complexity through variations in terrain (i.e., berms and basin). Accents to the landscape would be provided through the use of native vegetation, including mesquite trees, palo verde trees, ironwood trees, saguaro, etc. Visitors to this site would find opportunities to experience this landscape through a network of trails, which traverse the landscape. Overall, this alternative creates a unique "sense of place" for those who desire to experience a passive Sonoran Desert landscape (e.g. vegetation and wildlife).

5.2.2 Alternative 2

This alternative focuses on developing the site into several active use recreation areas. Additionally, there are areas of passive use natural Sonoran Desert landscape integrated into the design. The active use recreation areas range from an 18-hole golf course, equestrian center, and district park/sports complex (i.e., baseball/softball fields, soccer fields, swimming pool, etc.) The passive use areas, consisting of berms and basins, would help break-up the intensity and dominance of the recreation facilities, while adding visual interest/complexity to the landscape. The recreation and natural Sonoran Desert areas would be accented through the use of native vegetation as presented in alternative one. Alternative 2 enhances the existing degraded landscapes within the site. Visitors would be able to experience this landscape in a variety of ways both active and passive, which adds to the uniqueness of the design. The dominance of the recreation activities drives the visitor's experience in this landscape setting, while the passive use areas add to the overall "sense of place" within the landscape setting.

5.2.3 Alternative 3

This alternative combines features of Alternatives 1 and 2 to create a landscape which reflects the unique attributes of a natural passive Sonoran Desert setting while providing limited opportunities for active use recreation. The passive areas include a series of berms and basins, accented with native vegetation to provide visual interest/complexity into the landscape, as well as an interpretive wetland. The active recreation areas include soccer fields, baseball/softball fields, and playgrounds. The visitor's "sense of place" would be defined by the type of activity in

which they are participating. The natural passive areas would allow visitors to experience Sonoran Desert vegetation and wildlife independent of the active areas.

5.2.4 Summary

All three alternatives would enhance the visual appeal of the site as it exists today. This is due primarily to increasing the visual interest/complexity of the landscape setting. All of the alternatives would improve previously degraded landscapes and allow for areas which would provide high quality Sonoran Desert landscapes. These natural landscapes include variable terrain, native vegetation, and washes/drainages which are consistent with the character of the area. The natural areas provide preservation and enhancement of on-site and off-site views including panoramic views of the White Tank Mountains. Alternative 1 would deviate the least from the existing landscape character of the area and retain its unique "sense of place". Alternatives 2 and 3 would deviate slightly with the character of the area, with Alternative 2 having the greatest degree of change from the existing landscape character. However, Alternatives 2 and 3 would still have an identifiable "sense of place" and may be more consistent with future development plans for the area (i.e., more residential and commercial development patterns). Appropriate mitigation measures for Alternative 2 and Alternative 3 would result in minimal impacts to on-site and off-site views.

5.3 BIOLOGICAL RESOURCES

5.3.1 Cactus Ferruginous Pygmy-Owl Surveys

Guidelines for survey protocol are under the direction of the U.S. Fish and Wildlife Service (FWS). A new guideline was issued in 2000, which designated three survey zones in Arizona with slightly different survey recommendations in each zone. Zone 1 includes areas within the current range of pygmy-owls where the chance of finding an owl is high. Zone 2 includes areas within the current range of the pygmy-owl where the chance of finding an owl is moderate. Zone 3 includes areas within the historical range of the pygmy-owl where the chance of detecting an owl is low.

FWS recommends surveying for pygmy-owls where projects will impact potential habitat for the owl. This habitat includes areas below 4,000 feet elevation within the following vegetation communities:

- Riparian vegetation—broadleaf, riparian gallery forests of cottonwoods, willows, mesquites, ash, or other trees growing along watercourses

- Sonoran desertscrub—characterized by braided wash systems and vegetation that is dense and well structured; key species include mesquite, foothill and blue palo verdes, ironwood, saguaro, organ pipe cactus, and various other shrubs and cacti

- Semidesert grasslands—containing wooded drainages with mesquite, hackberry, ash, and a limited number of saguaros

Three surveys per year for two consecutive years should be completed prior to the removal of potential pygmy-owl habitat. All surveys must be completed between January 1 and June 30, with at least one survey completed during the period between February 15 and April 15. Surveys also must be spaced at least 15 days apart. Surveys can be completed from one hour before sunrise to two hours after sunrise or from one hour before sunset to one hour after sunset. Surveys also can be completed within two days of a full moon at any time the moon is visible.

Surveys are completed at survey stations placed between 150 and 400 meters apart, depending on the location of surveys. Surveys completed in rural areas where noise levels are low can be placed 0.25 mile (400 meters) apart (0.5 mile apart if electronic listening devices are used). In urban areas survey stations should be placed no more than 150 meters apart. At each survey station, at least 15 minutes are spent listening and looking for pygmy-owls. The first two minutes are spent observing quietly. For 10 minutes, the surveyor alternately plays taped calls of a pygmy-owl for 30 seconds and observes for 90 seconds. The last three minutes at each survey station are spent observing quietly.

Surveys are valid from the date of completion for the second year until December 31 of that year. If potential habitat, that will be removed or disturbed for a project, is still present on January 1, an additional year of surveys should be completed.

These protocols established by FWS indicate that surveys are required only in areas within the current or historic range of the pygmy-owl. However, some federal agencies may require surveys prior to providing approvals or permits for study areas where suitable habitat is present *even when the study area in question is beyond the delineated survey zones* (personal communication, April 2000, Larry Flatau, USACE). The study area is near but outside of Survey Zone 3. It does contain pygmy-owl habitat components, and therefore, our conservative recommendation to the District is to undertake the surveys if the need for a permit from the USACE is anticipated. In support of this recommendation, Sallie McGuire of the US Army Corps of Engineers indicated to the District, during a discussion held in April 2001, that she would require a pygmy owl survey for big projects such as master plan communities, even if the area were outside of the designated zones. She also noted that if a federal agency sponsors the project, a survey will most likely be required. It is important to be aware that the *surveys require two years to complete* and *at least*

one of the surveys must be conducted between February 15 and April 15. Details of the pygmy-owl findings and recommendations are provided in the General Environmental Report (URS 2001).

5.3.2 Alternative 1

Alternative 1 emphasizes passive use of the site and rehabilitation through the planting of native species. It contains the most environmentally compatible elements of the three alternatives. It also has the fewest negative elements such as increased traffic and extensive landscape modifications.

The area's attractiveness to wildlife can be enhanced by allowing emergent vegetation to develop in areas of the basin. This would require the basin to be designed with sloping sides and some fluctuation in water level. Created wetlands can be managed to avoid mosquito breeding while being extremely attractive to wildlife and outdoor enthusiasts.

5.3.3 Alternative 2

Extensive modification of the habitat would be required for building sports facilities and supporting infrastructure under Alternative 2. This will be a direct and permanent effect. The proposed golf course would prove an inviting source of food and water to wildlife. Their use may be considered undesirable by the patrons. The course also would introduce exotic plant competitors and require the use of chemical additives that would adversely impact natural areas. The higher level of development would increase the use of all areas, including the passive recreation features.

5.3.4 Alternative 3

Alternative three has the challenge of keeping passive recreation features in the presence of high-volume use and in a smaller area. This would require greater infrastructure in the passive areas such as walkways to control access and more extensive interpretative features. Planting of native species may be more intensive to counteract the pressure from greater use. It is important to keep access roads away from natural areas as they have significant direct and indirect effects on natural areas.

5.4 CULTURAL RESOURCES

The criteria defined by regulations for Protection of Historic Properties (36 CFR Part 800) were used to assess effects of the alternative plans on historic properties. Those regulations define effects as direct or indirect alterations of the characteristics of a historic property that make it

eligible for inclusion in the National Register of Historic Places. Such effects that diminish a property's integrity of location, design, setting, materials, workmanship, feeling, or association are considered to be adverse.

The potential for indirect impacts on cultural resources was considered. Any cultural properties within the project area have been or will be affected by recent and ongoing urban development. Within that context, recreational development within the White Tanks FRS #3 area is unlikely to have any significant indirect effects on cultural resources.

5.4.1 Alternative 1

Due to inclement weather, the Waterfall Wash diversion portion of Alternative 1, the single basin, passive use alternative, has not yet been surveyed for archaeological or historical resources. The area encompassing the basin has been surveyed, and within this portion, no impacts to cultural resources are anticipated. Thus, no mitigation measures should be required unless buried archaeological resources or human remains or funerary objects are discovered during construction.

5.4.2 Alternative 2

A single historic archaeological site was discovered within the area proposed for development of Alternative 2, the multiple basin, active use alternative. The site, AZ T:7:175 (ASM) is recommended ineligible for listing on the National Register. Thus, no mitigation measures should be required unless buried archaeological resources or human remains or funerary objects are discovered during construction.

5.4.3 Alternative 3

A single prehistoric archaeological site was discovered within the Olive Basin area proposed for development as part of Alternative 3, the multiple basin, mixed use alternative. The site, AZ T:7:246 (ASM) is recommended as potentially eligible for National Register listing, and therefore, impacts to the site might be considered adverse. Certainly, construction of the basin would destroy the site if Alternative 3 were selected. Measures to mitigate potential adverse effects might include controlled collection and recording of artifacts found on the ground surface and archaeological test excavations to determine the potential for buried archaeological materials and features. Based on the results of the test excavations, full-scale excavations also might be warranted. Additionally, as is true of the first two alternatives, if buried archaeological resources or human remains or funerary objects are discovered during construction, additional mitigation measures might be necessary.

5.5 SOCIOECONOMIC RESOURCES

Development of White Tanks FRS #3 would create changes in recreation opportunities for residents within existing and future developed areas within the five-mile radius surrounding White Tanks FRS #3. Among such changes would be the conversion of a flood detention basin into an area designed for the recreation use and benefit of local residents and area visitors. Those living and working within the radius would most directly experience the benefits of these recreation opportunities.

Positive short-term impacts on local services may occur from the increase in construction laborers. Construction firms may hire local skilled workers, which also would provide a positive impact on the local as well as regional economy. The increase in recreational opportunities also would create positive impacts on local businesses with the influx of visitors patronizing local businesses.

In suburban areas, property values tend to be enhanced on parcels adjacent to or near recreational open space. There also can be an increase in social amenity values from increased recreation activities. Aesthetic improvements will increase the social value of the area.

5.5.1 Alternative 1

Alternative 1 emphasizes passive recreation and would involve minimal changes to the existing operation and uses of White Tanks FRS #3 in comparison to the other action alternatives. Costs associated with implementing Alternative 1 include recreation design elements such as native multi-use trail and various scenic overlooks and operation and maintenance. Specific costs for implementing Alternative 1 are uncertain due to a lack of recreation design specifics, but it is anticipated that costs would be the least when compared to the other action alternatives. Approximately 185 acres of the total 565 acres would need to be acquired from the ASLD.

5.5.2 Alternative 2

Alternative 2 focuses on active use recreation elements and would include the installation of a golf course, extensive sports complexes, and a multi-use trail system. If developed, the golf course and sports complexes would have the ability to generate revenue from user fees. Costs and revenues generated from recreational uses (e.g., user fees and special events) may positively impact the local economy. Local businesses also may experience an increase in revenue due to the infiltration of visitors to White Tanks FRS #3.

Due the development of extensive recreation facilities, the probable costs associated with the implementation of Alternative 2 are the highest amongst the three alternatives. Alternative 2 would require the acquisition of approximately 459 acres from the ASLD.

5.5.3 Alternative 3

A balance between active and passive recreation uses is proposed under Alternative 3. Proposed recreational facilities include an environmental education facility, scenic overlooks, multi-use trail system, basketball courts, soccer fields, and softball/baseball fields. Costs and revenues generated from recreational uses (e.g., user fees and special events) may positively impact the local economy. Local businesses also may experience an increase in revenue due to the infiltration of visitors to White Tanks FRS #3.

Implementation of Alternative 3 would require the acquisition of approximately 394 acres from the ASLD and MWD.

5.5.4 Summary

Overall, the recreational development of White Tanks FRS #3 is expected to result in economic and social benefits for the local community. The cost associated with Alternative 2, the most developed alternative, are higher than the other alternatives. Funding for implementation of all action alternatives would occur as available. The District, in conjunction with partnerships, will fund the proposed recreational development. With the action alternatives, local construction firms may be hired to complete the development within White Tanks FRS #3, thus contributing to the local as well as county economy.

5.6 ENVIRONMENTAL JUSTICE

Title IV of the Civil Rights Act of 1964 and related statutes ensure that individuals are not excluded from participation in, denied the benefits of, or subjected to discrimination under any program or activity receiving federal assistance on the basis of race, color, national origin, age, sex, or disability. Executive Order 12898 on Environmental Justice directs that programs, policies, and activities not have a disproportionately high and adverse human health and environmental effect on minority and low-income populations. The proposed recreational development of White Tanks FRS #3 would not result in significant social and economic impacts on the surrounding area. No minority or low-income residences or businesses would be relocated or directly impacted. Therefore, the project is not anticipated to have any disproportionately high and adverse effects on populations protected by Title IV of the Civil Rights Act. All recreationalists would benefit from the proposed development.

5.7 MITIGATION MEASURES

Mitigation measures have been suggested to address potential project-related issues and impacts. The project proponents should commit to undertake these measures to protect resources as standard practice for the entire project. Specific mitigation measures for each resource are shown in Table 5-2. In particular, there are several key mitigation commitments that should be implemented, as follows:

- *Habitat protection and enhancement* – This measure is designed to address concerns about the health of sensitive vegetation communities over time. Enhancement would occur throughout the park with a particular focus on the are designated for passive uses. The District would evaluate habitat and conduct surveys as required by the USFWS for special status species with the potential to occur on site

- *Pond design and development of a vector control management plan* – These measures are designed to address concerns regarding a potential increase in the mosquito population that could occur near newly located ponds. To address this issue, ponds would be lined with a 90-degree angle wall that is tapered; this would prevent vegetation growth that could develop into mosquito habitat. To address mosquito populations that develop after flood events, a vector control management plan would be developed and implemented by the District in consultation with Maricopa County Vector Control Division.

- *Detailed design and implementation* – As facilities are designed in greater detail, if federal funds are used the lead federal agency will determine whether National Environmental Policy Act (NEPA) compliance is needed.

5.8 WATERS OF THE UNITED STATES

The construction activities that would take place for each of the three basin alternatives would have a varying degree of impact on designated Waters of the United States. A permanent impact would occur where spoils piles are placed in washes and behind the existing dam. Temporary impacts may occur during construction of the basins and channels. Figures 5-1, 5-2, and 5-3 show the approximate areas of impact of each alternative. The estimated area of impact for Alternative 1 is 24 acres; Alternative 2 is 34 acres; and Alternative 3 is 56 acres.

5.9 404 / 401 ISSUES

The project will require a 401 Permit from Arizona Department of Environmental Quality and a 404 Permit from the U.S. Army Corp of Engineers prior to construction of the basin alternatives. The purpose of the 401 permit is to ensure that the proposed construction activities do not violate

state surface water quality standards. The purpose of the 404 permit is to protect the chemical, physical, and biological integrity of the Waters of the US. The District is responsible for filing the 401 and 404 permit applications.

TABLES

TABLE 2-1
COST AND AESTHETIC EVALUATION OF DESIGN COMPONENTS

Design Component	Design Alternative	Cost Evaluation			Aesthetic Evaluation			Total Points
		High	Moderate	Low	Poor	Fair	Good	
		1	3	6	1	3	6	
Basin Configurations	3:1 side slopes			✓		✓		9
	6:1 side slopes		✓			✓		6
	10:1 side slopes	✓					✓	7
	0.5 percent ground slope			✓		✓		9
	1 percent ground slope		✓			✓		6
	2 percent ground slope	✓				✓		4
Drainage Options	Total Drainage via outlet pipe	✓					✓	7
	Partial Drainage			✓		✓		9
Inlet Structures	Concrete inlet structure (baffle chute for example) with no reduction of upstream natural channel slope	✓			✓			2
	Riprap inlet structure with reduction of upstream natural channel slope		✓			✓		6
	Soil cement structure with reduction of upstream natural channel slope		✓				✓	9
	Natural material with reduction of side slope and upstream natural channel		✓				✓	9
Sediment Basin	Internal sediment basin		✓				✓	9
	External sediment basin	✓				✓		4
Impoundment Dike	Non-erodible (concrete core)	✓			✓			2
	Erodible (natural material)		✓			✓		6
	None			✓		✓		9
Disposal of Excavated Materials	On-site			✓		✓		9
	Off-site	✓				✓		4
Land Acquisition	Single Basin (within FCDMC property)		✓			✓		6
	Multiple Basins (additional land is needed outside FCDMC property)	✓					✓	7

Note: Impacts of operation and maintenance costs will be considered in the Final Plan Formulation of White Tanks FRS #3.

TABLE 3-1
BASIN ALTERNATIVES DESIGN ELEMENTS

		Upstream Elements					General Elements		Downstream Elements
Alternative	Recreation Option	Waterfall Wash Diversion	Olive Basin	1,300 cfs Diversion	Beardsley Channel Improvement[1]	Northern Bridge Improvement	WT #3 Basin(s)	Overchute	Camelback Diversion (Basin Bypass)
1	Passive-use	Divert flow to McMicken	No basin	No diversion.	Rehab the channel to increase capacity from 5,141 cfs (from PBS&J report) to 8,063 cfs.	Rehab bridge at Northern Avenue to handle 8,063 cfs instead of 5,141 cfs.	Single basin with a storage volume of 1,634 ac-ft.	None for this alternative.	None for this alternative.
2	Active-use	Divert flow to McMicken	No basin	Diversion at Olive Avenue over Beardsley Canal (1,300 cfs). Volume diverted is 138 ac-ft.	Rehab the channel to increase capacity from 5,141 cfs (from PBS&J report) to 6,763 cfs.	Rehab bridge at Northern Avenue to handle 6,763 cfs instead of 5,141 cfs.	Two "dry" basins that capture high flows, with low flows diverted to Camelback Road. Storage volume of upper basin is 531 ac-ft. Storage volume of lower basin is 478 ac-ft.	1 - At Olive Avenue over Beardsley Canal (1,300 cfs). 2 - At Camelback Road over Beardsley Canal (1,500 cfs).	Connection consists of three channels containing low flows (1,500 cfs) that bypass basins and enter a single channel conveying flow to Camelback Road.
3	Mixed-use	No flow diversion to McMicken	All flow from Waterfall Wash is diverted to Olive Basin, located southeast of Olive Avenue and Beardsley Canal intersection. Olive Basin storage volume is 502 ac-ft.	Diversion at Northern Avenue over Beardsley Canal (1,300 cfs). Volume diverted is 305 ac-ft.	Rehab the channel to increase capacity from 5,141 cfs (from PBS&J report) to 6,512 cfs.	Rehab bridge at Northern Avenue to handle 5,212 cfs instead of 5,141 cfs.	Single basin at White Tanks FRS #3 location with a storage volume of 1,158 ac-ft.	1 - At Olive Avenue over Beardsley Canal (4,279) to the Olive Basin. 2 - At Northern Avenue Road over Beardsley Canal (1,300 cfs).	None for this alternative.

Notes: 1 – The Beardsley Channel is the stormwater control channel that runs parallel to, and west of, Beardsley Canal. Rehabilitation of the channel would include the half-mile section north of Northern Avenue.
2 – All flow rates and volumes are based on the 100-year, 24-hour storm event.

TABLE 3-2
BASIN DESIGN DETAILS SUMMARY

Issues		Alternative 1	Alternative 2		Alternative 3	
			North Basin	South Basin	Main Basin	Olive Basin
Intended Recreational Use		Passive	Active		Mixed	
Basin Storage Requirements (ac-ft) [100-year, 24-hour runoff volume]		1,634	531	478	1,158	505
Available Storage (ac-ft)		1,752	647	586	1,342	580
Draining Time (days)		10.1	7.3	6	5.5	6.2
Water Volume Remaining after Draining		396	45	90	874	76
Diversion		Waterfall Wash Diversion to McMicken	Waterfall Wash Diversion to McMicken 1,300 cfs at Northern Avenue 1,500 cfs to Camelback Road		1,300 cfs at Northern Avenue	
Number of Inlet Structures		3	1	2	2	1
Number of Sediment Basins		3	1	2	2	1
Land Acquisition	MWD property	32	214		389	
	State Land	165	247		24	
	Private Land	20	30		20	
Dam Breach Impact on Construction Sequence		Moderate	None	High	Low	None
Impact on the Waters of the U.S. (acres)		24	34		56	

Note: A – Draining of basin refers to the controlled draining through an outlet pipe.

TABLE 3-3
BASIN ALTERNATIVES
CONSTRUCTION COST ESTIMATE

Alternative	Basin and Drainage Construction Cost	Recreational Facilities Cost
1	$18.13 million	$1.29 million
2	$27.97 million	$45.84 million
3	$27.81 million	$14.96 million

TABLE 4-1
DIVERSIONS COST REDUCTION EFFECT ON PROJECT COST

Diversion	Volume Diverted (ac-ft)	Diversion Cost ($)[C]	Basin Excavation Cost Reduction ($)[B]	Project Cost Savings ($)[C]
Diversions to the North and South				
Cholla Wash	616	2.5 million	5.3 million	2.8 million
Waterfall Wash	333	730,000	2.9 million	2.2 million
Bedrock Wash (short)	370	1.4 million	3.2 million	1.8 million
Bedrock Wash (long)	550	2.8 million	4.7 million	1.9 million
Diversions to the East of Beardsley Canal				
Olive Avenue	138	350,000[D]	1.2 million	900,000[E]
Northern Avenue	305	350,000[D]	2.6 million	2.3 million[E]
Basin Bypass to Camelback Road[A]	487	2.2 million[D]	4.2 million	2.0 million[E]

Notes:

A – The diversion cost includes all aspects of the basin bypass (i.e., side channel spillways, channels, canal overchutes).

B – The basin excavation cost reduction is based on basin and drainage construction for Alternative 1. $18 million - $4 million / 1634 ac-ft = $8,600 per ac-ft (total cost - land cost / basin storage = cost per ac-ft). This cost analysis assumes that cost reduction will be shared with all elements of the basin design.

C – The estimated costs for Waterfall Wash Diversion and the Diversions to the East of Beardsley Canal were developed with significantly greater detail than the other diversions. This may result in some variations with the overall estimate of project cost savings.

D – The diversion cost does not include the increased cost impact to facilities east of Beardsley Canal. Olive and Northern Avenue Diversions increase facility costs by $20.6 million; the Basin Bypass to Camelback Road increases facility costs by $12.7 million.

E – Developers of properties east of Beardsley Canal will benefit from reduced flows if these diversions are **NOT** constructed and there may be cost sharing opportunities with the basin construction (e.g., north inlet channel).

TABLE 4-2
DESIGN PARAMETERS OF STORMWATER CONVEYANCE CHANNELS

Peak flow (cfs)[1]	Flow depth (ft)	Freeboard (ft)[2]	Channel design depth (ft)	Channel bottom width (ft)	Channel side slopes (H:V)	Manning's roughness	Channel slope (percent)	Flow velocity (ft/sec)
BASIN ALTERNATIVE 1								
8,063	4.67	1.41	6.1	200	4:1	0.04	0.65	7.9
9,472	4.52	1.37	5.9	250	4:1	0.04	0.65	7.8
2,720	3.93	1.12	5.1	100	4:1	0.04	0.50	6.0
5,016	4.05	1.17	5.3	180	4:1	0.04	0.50	6.3
BASIN ALTERNATIVE 2								
1,142	3.19	1.00	3.2	50	4:1	0.04	0.65	5.7
6,763	4.95	1.49	6.5	150	4:1	0.04	0.65	8.1
8,127	4.69	1.42	6.1	200	4:1	0.04	0.65	7.9
2,720	3.93	1.12	5.1	100	4:1	0.04	0.50	6.0
5,016	4.05	1.17	5.3	180	4:1	0.04	0.50	6.3
1,500	3.34	1.00	3.4	50	4:1	0.04	0.50	5.8
BASIN ALTERNATIVE 3								
6,512	4.84	1.46	6.3	150	4:1	0.04	0.65	7.9
5,212	4.25	1.27	5.5	150	4:1	0.04	0.65	7.3
6,643	4.90	1.47	6.4	150	4:1	0.04	0.65	8.0
2,720	3.93	1.12	5.1	100	4:1	0.04	0.50	6.0
9,206	4.45	1.34	5.8	250	4:1	0.04	0.50	7.7
5,016	4.05	1.17	5.3	180	4:1	0.04	0.50	6.3

Notes:

1. This table can be used in conjunction with Figures 3-4, 3-8, and 3-12 to identify channel locations and their respective dimensions.
2. Channel freeboard is calculated using equation provided in the Drainage Design Manual for Maricopa County, Volume II, Hydraulics.

TABLE 5-1
COMPARISON OF ENVIRONMENTAL CONSEQUENCES

Resource	Alternative 1	Alternative 2	Alternative 3
General Amenities	Alternative 1 focuses on passive recreation including native multi-use trails, scenic overlooks, and restored wildlife habitat.	Alternative 2 focuses on active recreation uses and includes a district park and extensive sports complexes (i.e., baseball/softball fields, soccer fields, swimming pools), a multi-use trail system, equestrian center, and 18-hole golf course.	Alternative 3 is designed as a balance between active and passive recreational uses. This alternative includes an environmental education center, observation facilities, improved wildlife habitat, hiking trails, scenic overlooks, and a sports complex (i.e., adult and junior. soccer fields, softball and little league fields, basketball courts, sand volleyball, playgrounds, turf, and horseback riding trails).
Land Use and Transportation	The total project area for Alternative 1 encompasses approximately 565 acres. Access to White Tanks FRS #3 recreation facilities would occur from Northern Avenue. Alternative 1 would be compatible with surrounding land uses.	The total project area for Alternative 2 encompasses approximately 836 acres. Access to recreation facilities would occur at two proposed major park entry features accessed from Northern Avenue and Bethany Home Road.	The total project area for Alternative 3 encompasses approximately 774 acres. Access to recreational facilities would occur from Northern Avenue, Olive Avenue, and Bethany Home Road. Slight increase in traffic with implementation of this alternative.
Visual	Alternative 1 focuses on retaining and restoring the natural Sonoran Desert landscape. Native vegetation would be restored, and on-site and off-site views would be preserved.	Alternative 2 would not preserve on-site and off-site views. The active, developed nature of this alternative would create visual clusters and increase visible lighting and glare. Night lighting could affect existing and future adjacent residential areas.	Alternative 3 combines the features of Alternatives 1 and 2. Impacts would be similar to Alternative 2; however, the natural passive areas would allow visitors to experience Sonoran Desert vegetation and wildlife independent of the active areas.

TABLE 5-1 (Continued)
COMPARISON OF ENVIRONMENTAL CONSEQUENCES

Resource	Alternative 1	Alternative 2	Alternative 3
Biological	Alternative 1 focuses on rehabilitation through planting and protecting native vegetation. The site would be a refuge for migrating birds and for wildlife in surrounding areas. Negative factors such as increased traffic and constructed facilities would be minimized.	Alternative 2 has a highly modified focus. It would introduce exotic plantings and permanent structures. The golf course would be attractive to wildlife, providing food, cover, and water. Increased human activity will reduce the quality of natural areas.	Alternative 3 is highly problematic. The natural areas are smaller than in Alternative 1 but the human use is higher. Sports fields would provide food and water for some wildlife thus having a positive impact on wildlife. The environmental education facility also should benefit the natural areas by heightening public awareness.
Cultural	The Waterfall Wash diversion portion of Alternative 1 has not yet been surveyed for archaeological or historical resources. The area encompassing the basin has been surveyed and no impacts are anticipated.	A single historic archaeological site was discovered; however, the site [AZ T:7:175 (ASM)] is recommended ineligible for listing on the National Register of Historic Places.	A single prehistoric archaeological site was discovered within Olive Basin. The site [AZ T:7:246 (ASM)] is recommended as potentially eligible for National Register listing, and therefore, impacts on the site might be considered adverse.
Socioeconomic	Specific costs for implementing Alternative 1 are uncertain due to a lack of recreation design specifics; however, it is anticipated that costs would be the least when compared to the other action alternatives. Approximately 185 acres would need to be acquired from the Arizona State Land Department.	Due to the development of extensive recreation facilities, the probable costs associated with the implementation of Alternative 2 are the highest among the three alternatives. Alternative 2 also would require the acquisition of approximately 459 acres from the Arizona State Land Department.	Implementation of Alternative 3 would require the acquisition of approximately 394 acres from the Arizona State Land Department and Maricopa Water District.

TABLE 5-2
RESOURCE-SPECIFIC MITIGATION MEASURES

Resource	Mitigation Measures
General	Mitigation measures for potential impacts related to floodwater mosquitoes could include the following: • Ensure that larvae are managed within 48 hours after a storm event, before they develop into adult mosquitoes (Olson 2000) • Develop an action plan for time periods immediately after storm events • Map areas that are prone to flooding • Provide for vector control in the operation and maintenance budget for White Tanks FRS #3
Land Use	Construction access will be pre-approved by the District and shown on construction drawings
Visual	As specific designs develop, select lighting fixtures and locations to minimize impacts on adjacent residences
Biological	Salvage and or transplant large trees, such as ironwoods, palo verde, and mesquite within White Tanks FRS #3 basin. A list of potentially occurring species is provided in the General Environmental Report for White Tanks FRS #3 (URS, August 2001).
Cultural	• Prior to construction, instruct all supervisory personnel on the protection of cultural resources • Stop construction activities if previously unknown cultural resources are encountered, and notify the District. Additional mitigation measures may be necessary to protect any additional cultural resources
Recreation	Provide signage to educate trail users on minimizing conflicts between horses, bikes, and hikers.

FIGURES

STUDY BOUNDARY

TUTHILL ROAD

STUDY BOUNDARY

McMICKEN DAM

JACKRABBIT TRIAL

WHITE TANKS FRS #3

STUDY BOUNDARY

BEARDSLEY CANAL

BEARDSLEY CANAL

BETHANY HOME ROAD

GLENDALE AVE.

NORTHERN AVE.

OLIVE AVE.

PEORIA AVE.

PERRYVILLE ROAD

NORTH

0 1000 2000 3000 4000

Scale in Feet

WHITE TANKS FRS #3

Flood Control District of Maricopa County

URS

Dames & Moore

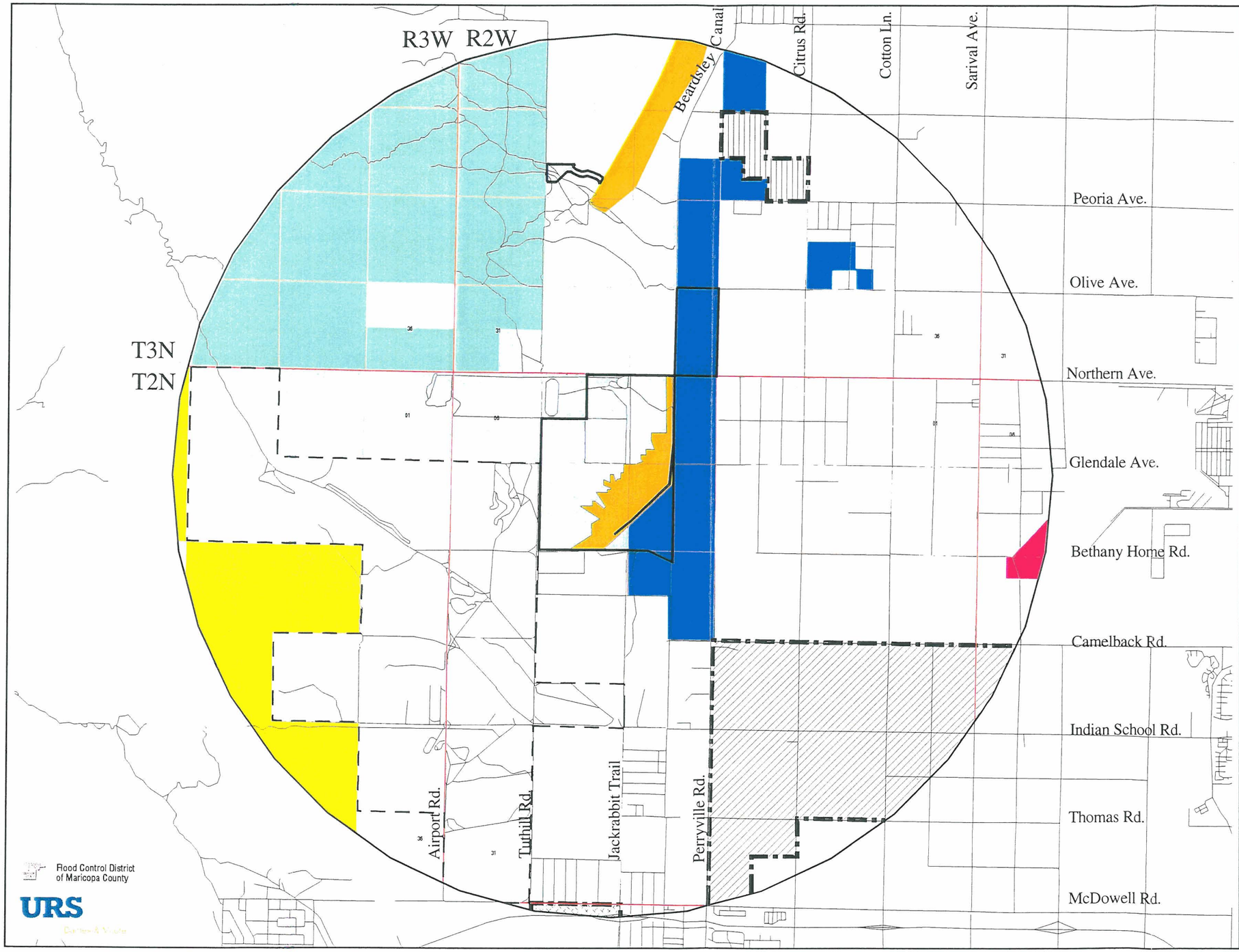
SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

A14341.DWG 12-6-00 XREF:VTOPO

Dames & Moore Job No. 15448-007-058

General Site Location

Figure 1-1



x:\whitetanks\gis\arcls\fmt-owner.aml August 01, 2001

Dames & Moore Job No. 15448-007-058

Legend

- Study Boundary

Surface Ownership

- Private
- State Trust
- Bureau of Land Management
- Military Reservation
- Regional Parks
- Flood Control District of Maricopa County
- Maricopa Water District

Jurisdiction

- City Boundaries
- Buckeye Annexation
- Maricopa County
- City of Buckeye
- City of Goodyear
- City of Surprise

Sources:

Arizona Land Resources Information Systems (ALRIS), 1997.

Maricopa Association of Governments, 1998.

Bureau of Land Management, 1999.

NORTH

0 1 2

Scale in Miles

WHITE TANKS FRS # 3

Surface Ownership and Jurisdiction

Figure 2-1

Legend

- Study Boundary

Land Use

- Residential Low Density
- Residential Medium Density
- Retail/Service
- Mixed Use
- Light Industrial
- Public/Quasi-Public
- Airstrip/Airport
- Irrigated Farmland
- Orchard
- Feedlot/Horse Farm
- Farm Complex/Agriculture Outstructure
- Vacant
- Canal/Dam
- Secondary Roads
- Regional Park
- Recreational Facility
- School
- Pima Substation
- Agriculture Outstructure
- Single Family Dwelling Unit

Sources:

Town of Goodyear, 1999.

Maricopa County, 2000.

Rupp Aerial Photography, Inc. 1998.

Landiscor Aerial Information, 1998.

NORTH

0 1 2

Scale in Miles

WHITE TANKS FRS #3

Flood Control District of Maricopa County

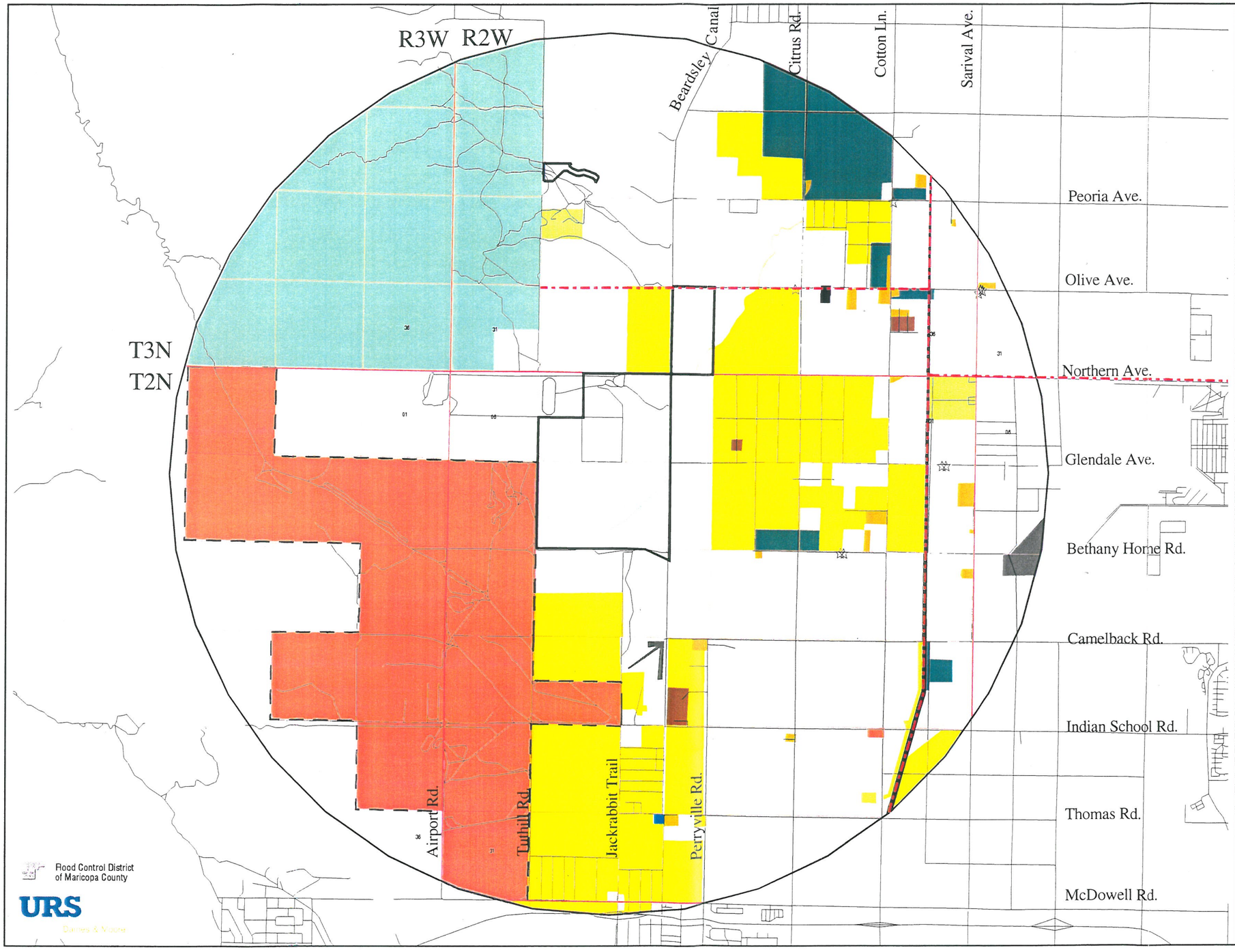
URS Dames & Moore

X:\whitetanks\gis\arcmls\fmt-landuse.aml August 01, 2001

Dames & Moore Job No. 15448-007-058

Existing Land Use

Figure 2-2



Legend

- Study Boundary

Future Land Use

- Residential Low Density
- Multiple Family Housing
- Retail/Service
- Mixed Use
- Light Industrial
- Public/Quasi-Public
- Airstrip/Airport
- Irrigated Farmland
- Orchard
- Feedlot/Horse Farm
- Farm Complex/Agriculture Outstructure
- Vacant
- Canal/Dam
- Secondary Roads
- Recreational Facilities
- Regional Park
- State Highway 303
- School

- Agriculture Outstructure
- Single Family Dwelling Unit
- Buckeye Annexation
- Maricopa County Bicycle Trail

Sources:

Town of Buckeye, 2000.

Town of Goodyear, 1999.

Maricopa County, 2000.

NORTH

0 1 2

Scale in Miles

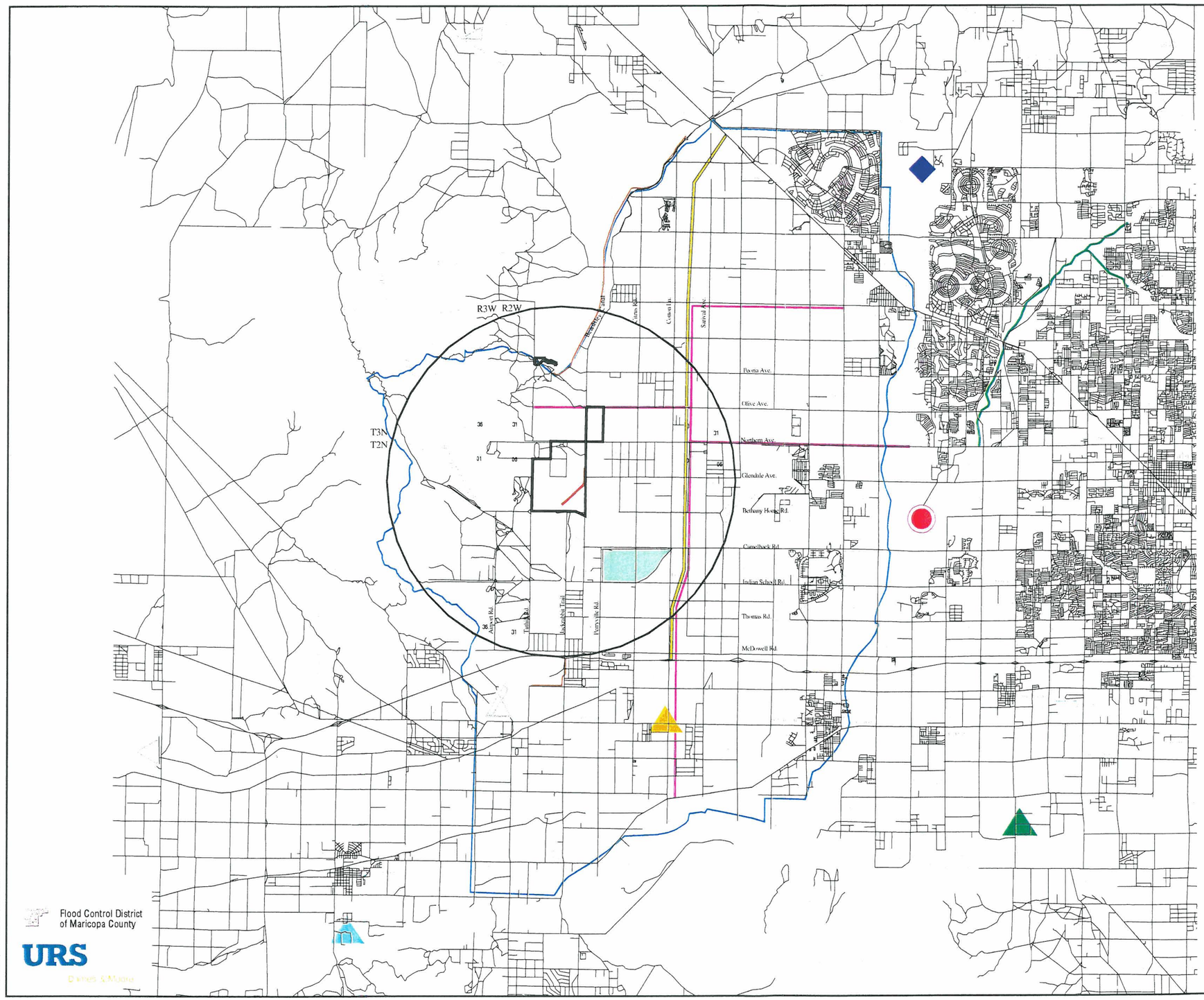
WHITE TANKS FRS # 3

K:\whitetanks\gis\mxds\fmt-futlanduse.mxd August 01, 2001

Dames & Moore Job No. 15448-007-058

Future Land Use

Figure 2-3



Legend

- Study Boundary

Projects

- City of Peoria Trails and Rivers Master Plan
- Maricopa County Bicycle Network Plan
- Loop 303
- Loop 303/White Tanks Area Drainage Master Plan Update
- FCDMC Flood Retarding Structures
- Beardsley Wastewater Treatment Plant
- West Area Water Reclamation Facility
- Tres Rios Constructed Wetlands Demonstration Project
- Goodyear Groundwater Recharge
- Buckeye Town Lake
- Middle New River Watercourse Master Plan
- Special Use Area

Sources:

Maricopa County, 2000.

City of Peoria, 1999.

City of Glendale, 2000.

Flood control District of Maricopa County, 2000.

Maricopa Association of Governments, 1999.

City of Phoenix, 1999.

NORTH

0 1 2
Scale in Miles

Flood Control District of Maricopa County

URS
Dames & Moore

WHITE TANKS FRS #3

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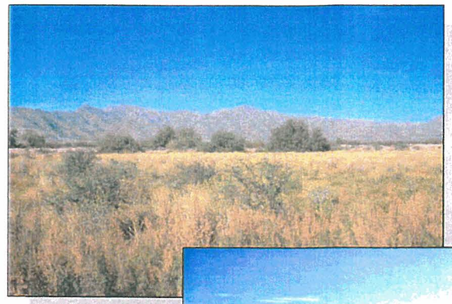
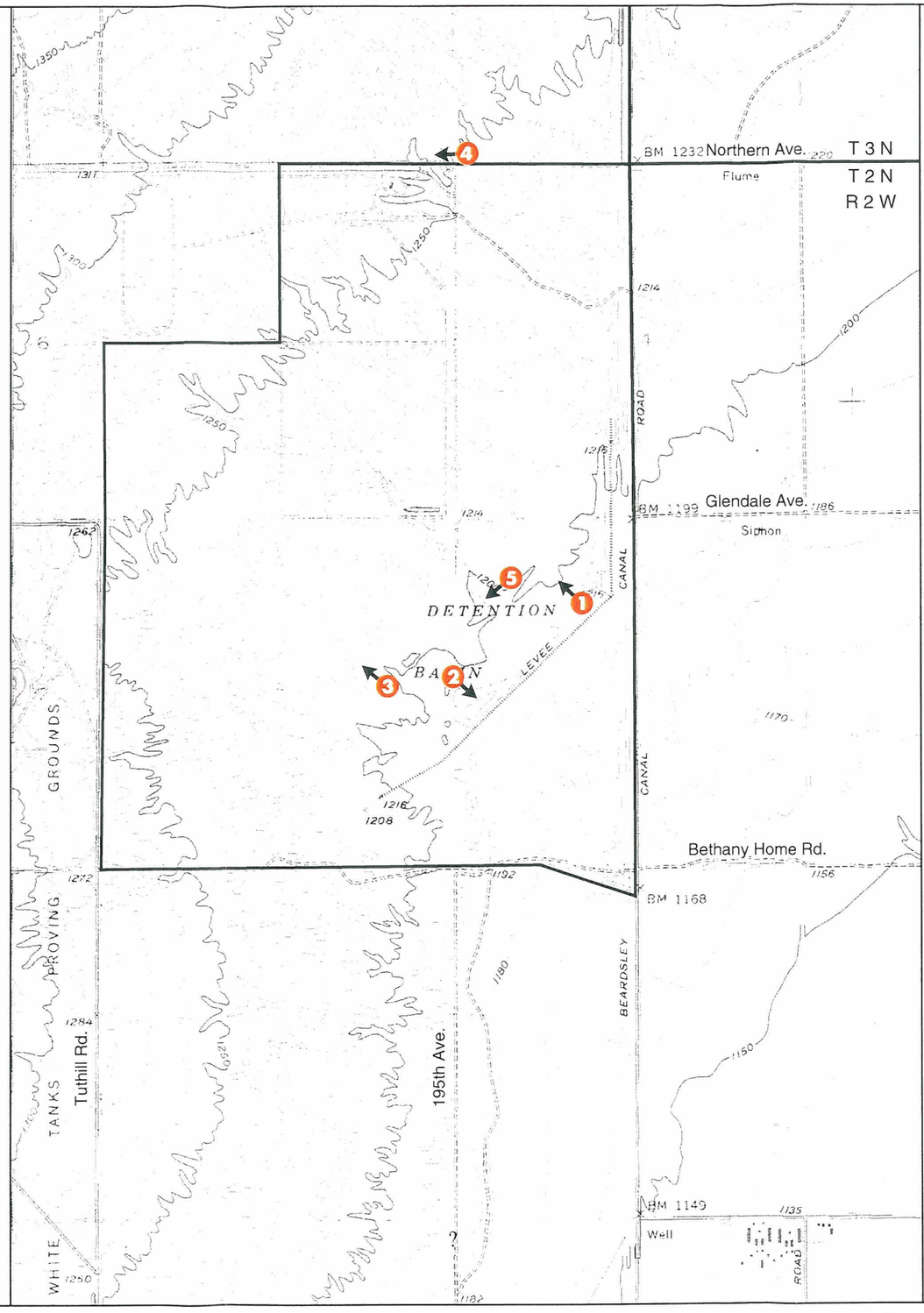
whitetanks
gis
amls/fmt-pot.aml August 01, 2001

Dames & Moore Job No. 15448-007-058

Potentially Relevent Projects

Figure 2-4





Legend

1 Viewpoint Location

Sources:

Waddell, 7.5' USGS Quadrangle
(west-central portion) Arizona 1975

0 1/2 1

Scale in Miles

WHITE TANKS FRS # 3

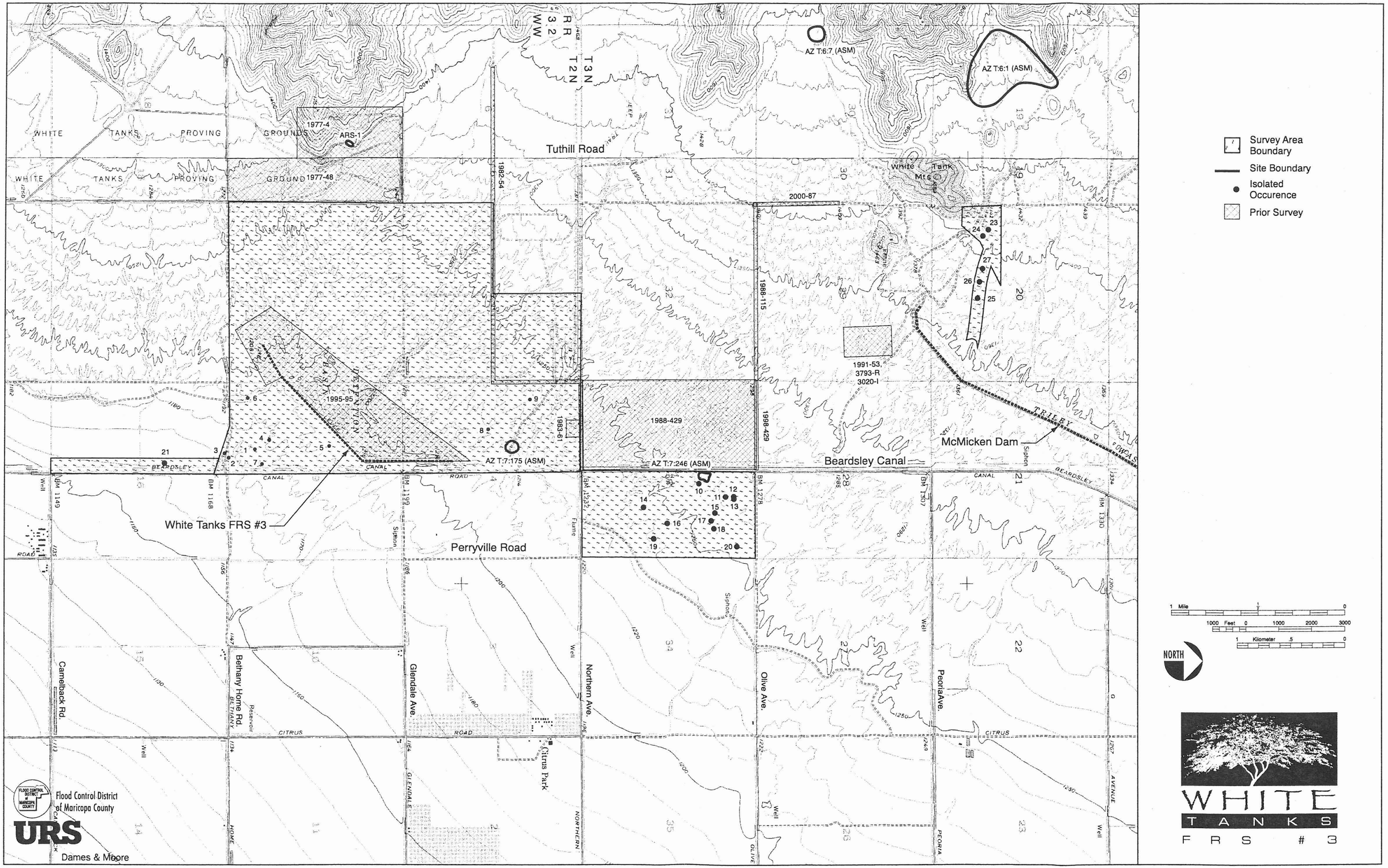
Flood Control District of Maricopa County

URS Dames & Moore

Dames & Moore Job No. 15448-007-058

Typical Views and Photograph Locations

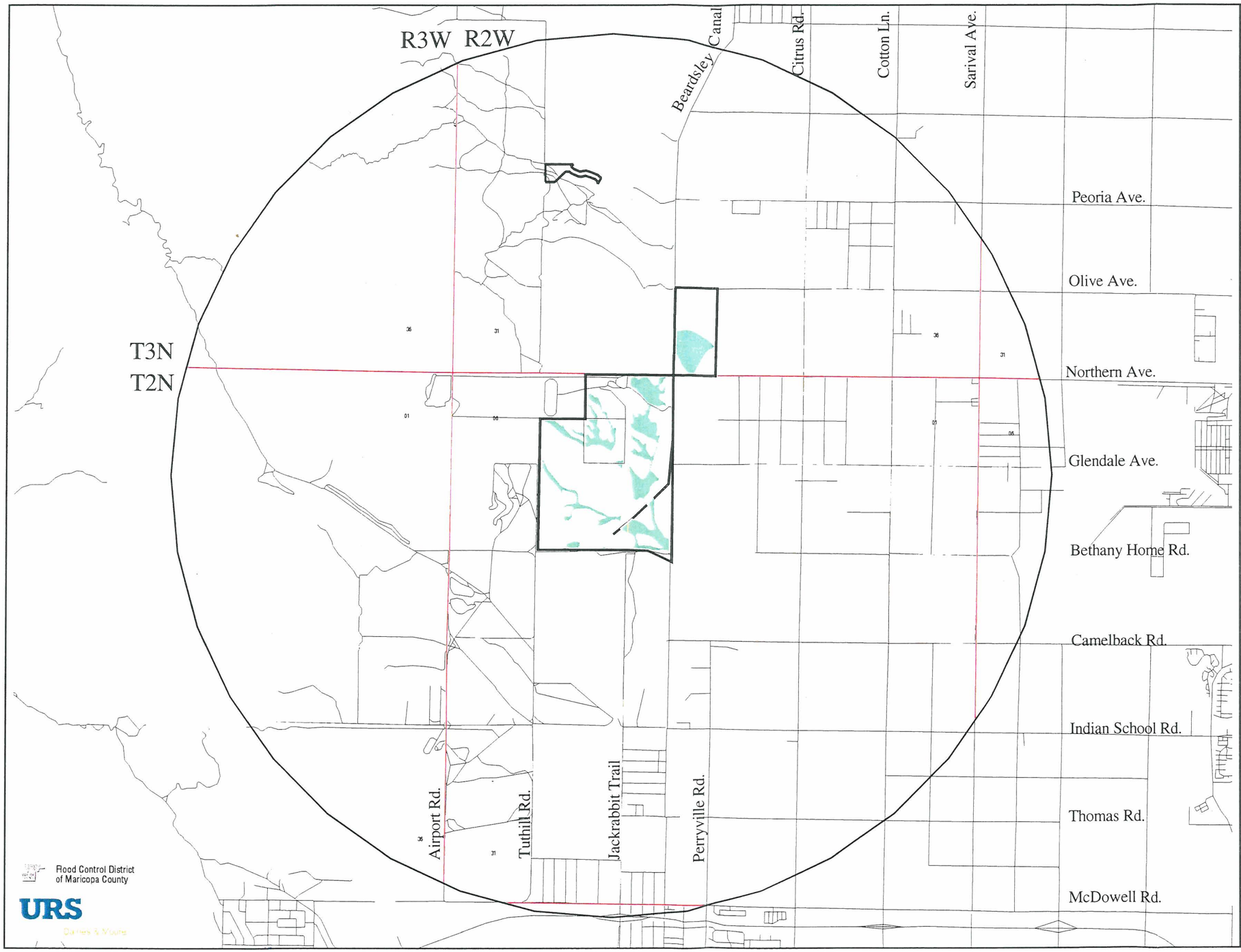
Figure 2-6

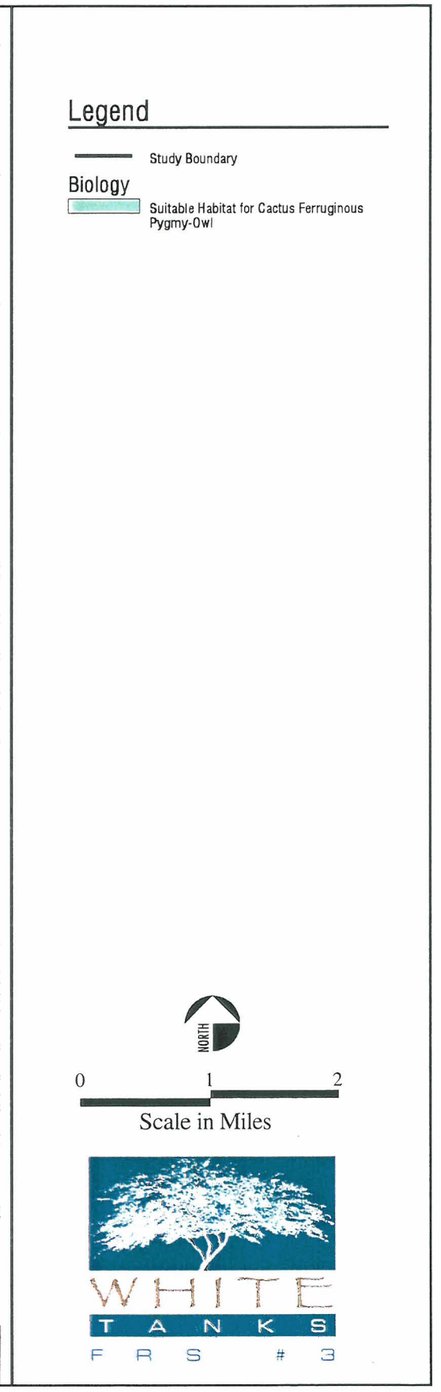


URS Job No. 15448-007-058

Cultural Resources

Figure 2-7





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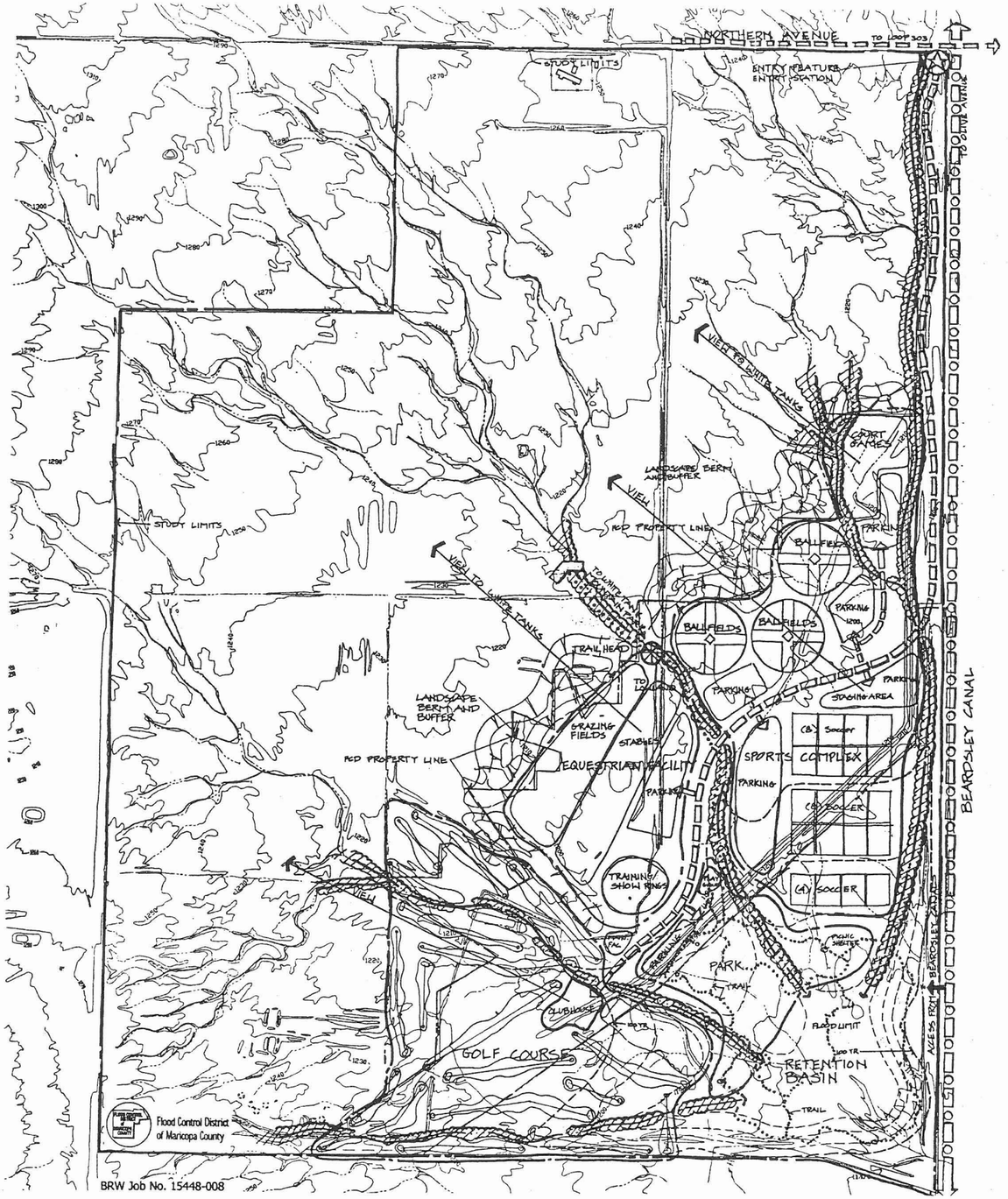
whitetanks
gis
amls/fmt-bio.aml August 01, 2001

Dames & Moore Job No. 15448-007-058

Biological Resources

Figure 2-8



BRW Job No. 15448-008

SITE FEATURES

A. SPORTS COMPLEX- 172 ac.
- 12 Ballfields
- 20 Soccer Fields
- Court Games
  - Basketball Courts
  - Volleyball Courts
  - Roller Hockey Rink
  - Tennis Courts
  - Recreation Building
- Tournament Staging Area
- Parking

B. EQUESTRIAN FACILITY- 72.3 ac.
- Stables and Boarding
- Grazing/ Exercise fields
- Training/ Show Rings
- Trailheads
  - to White Tank Mountain Park
  - to Retention Basin (Low Land Riding)
- Hitching Posts
- Oversized Parking Lot for Horse Trailers

C. COMMUNITY PARK- 48.4 ac.
- Playground
- Multi-use Decomposed Granite Trails
- Picnic Shelters/ Shaded Wildlife Viewing Areas
- Revegetate with Native Desert Vegetation
- Parking

D. GOLF COURSE- 178.7 ac.
- 18 Hole Championship Golf Course
- Clubhouse & Grill
- Practice Range & Green
- Maintenance Facility
- Parking

E. RETENTION BASIN- 221 ac.
- Multi-use Decomposed Granite Trails
- Overlook Areas
- Revegetate with Native Desert Vegetation
- Access to Beardsley Canal
- The Basin Contains:
  - 12 Soccer Fields
  - Community Park
  - Driving Range
  - 4 Golf Holes

F. NATIVE DESERT WASH
- Wildlife Habitat
- Provides Link into White Tank Mountain Park

G. BEARDSLEY CANAL
- Access Link to White Tank Mountain Park and Lake Pleasant

H. SITE ISSUES
- Land Acquisition
  - MCWD Land
  - Some State Land
- Spoils
  - Spread spoils over entire non-basin site. The spoils should be used to create topography and to screen visually invasive elements of the site.
- Site Access
  - Vehicular Access from Northern Avenue
  - Pedestrian, Bicycle, & Horse Access from the Beardsley Canal

LEGEND

- Property Line
- Area Division Line
- Access Road
- Beardsley Canal
- Flood Event Line
- Wash Corridor
- Trailhead
- Multi-use Trail
- Dominant View Shed Line
- Landscape Berm
- Entry Feature

Concept Statement

Concept #1 develops the site as an active use recreation attraction for the far west valley region by creating a major sports complex, an equestrian facility, and a golf course. Storm water retention is concentrated into the lowest, flattest part of the site. Run-off is brought into the basin by the wash channels; then a series of terraces allows the park, soccer fields, and parts of the golf course to integrated into the basin, but only inundated during a major flood event.

NORTH

0 400 800 1200

WHITE TANKS FRS # 3

Flood Control District of Maricopa County

URS

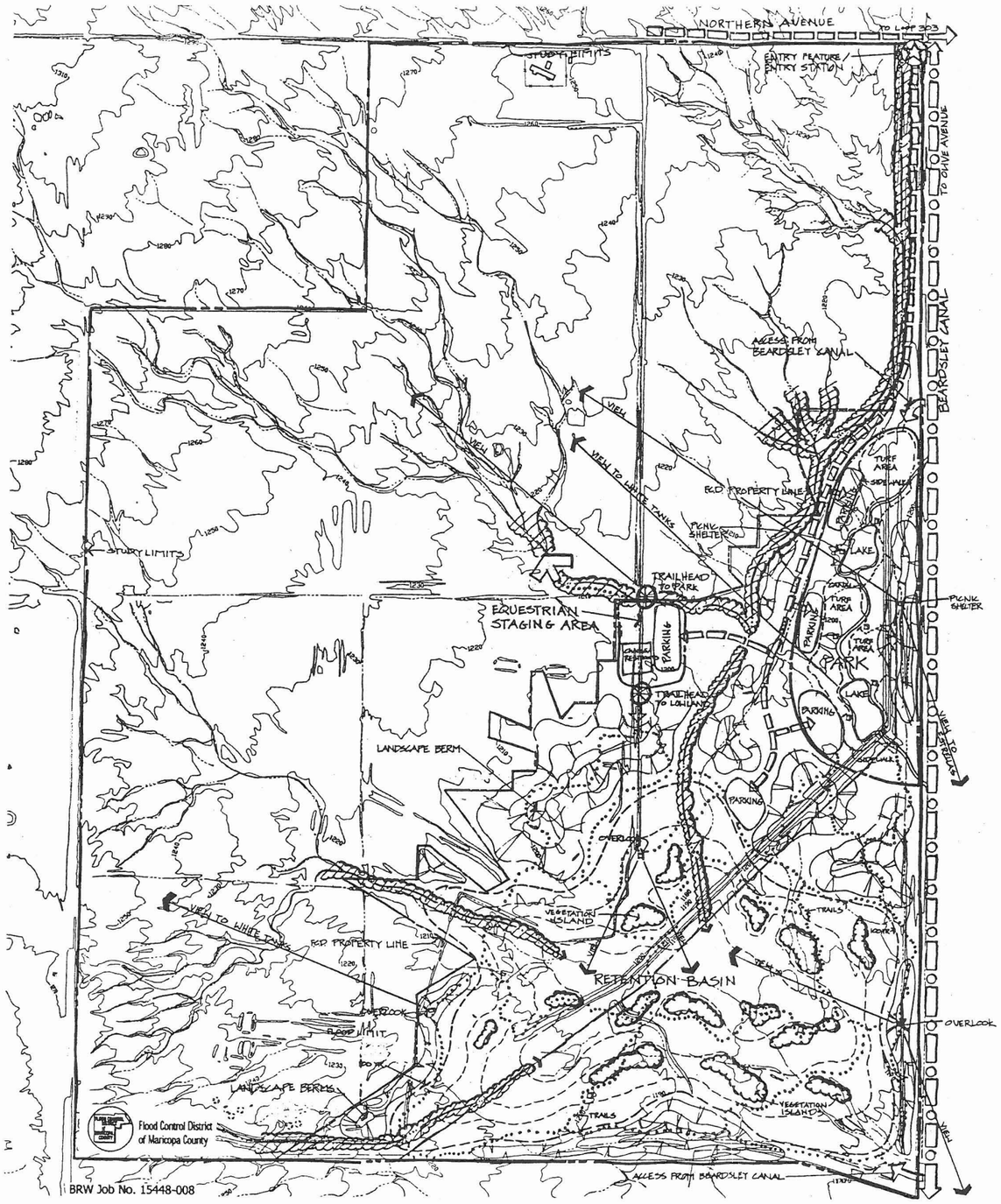
BRW

A14539.DWG 12-11-00

Dames & Moore Job No. 15448-007-058

Concept #1 - Single Basin, Active Use

Figure 2-9



SITE FEATURES

A. COMMUNITY PARK- 73.8 ac.
- 2 Water Feature Lakes & Streams
- Water from the Beardsley Canal
- Concrete Sidewalks
- Open Turf Grass Fields
- Picnic Shelters & Overlooks
- Playground
- Parking

B. EQUESTRIAN STAGING AREA- 11.5 ac.
- Change/ Restrooms
- Trailheads
  - to White Tank Mountain Park
  - to Retention Basin (Low Land Riding)
- Hitching Posts
- Oversized Parking Lot for Horse Trailers

C. RETENTION BASIN- 256 ac.
- Raised Vegetation Islands
  - Wildlife Habitat
  - Visual Relief
- Multi-use Decomposed Granite Trails
- Overlook Areas with Shade Structures
- Revegetate with Native Desert Vegetation
- Access to Beardsley Canal
- Parking

D. NATIVE DESERT WASH
- Wildlife Habitat
- Provide Links with White Tank Mountain Park and Future Developments

E. BEARDSLEY CANAL
- Access Link to White Tank Mountain Park and Lake Pleasant

F. SITE ISSUES
- Land Acquisition
  - MCWD Land
- Spoils
  - Spread spoils over entire non-basin site. The spoils should be used to create topography and to screen the basin from the park and equestrian area.
- Site Access
  - Vehicular Access from Northern Avenue
  - Pedestrian, Bicycle, & Horse Access from the Beardsley Canal

LEGEND
- Property Line
- Area Division Line
- Access Road
- Beardsley Canal
- Flood Event Line
- Wash Corridor
- Trailhead
- Multi-use Trail
- Dominant View Shed Line
- Landscape Berm
- Entry Feature

Concept Statement

Concept #2 develops the site for passive recreation users, wildlife, habitat, and native plant open space. The lakes and streams in the park use diverted water from the Beardsley Canal to supply and circulate the water, as well as providing water storage for the canal. The retention basin is located on the lowest, flattest part of the site and it has flatter slopes that spread out over a larger area. Vegetation islands are scattered through out the basin and are meant to provide wildlife habitat and break up the visual size of the basin.

NORTH
0 400 800 1200

WHITE TANKS FRS # 3

Flood Control District of Maricopa County

URS

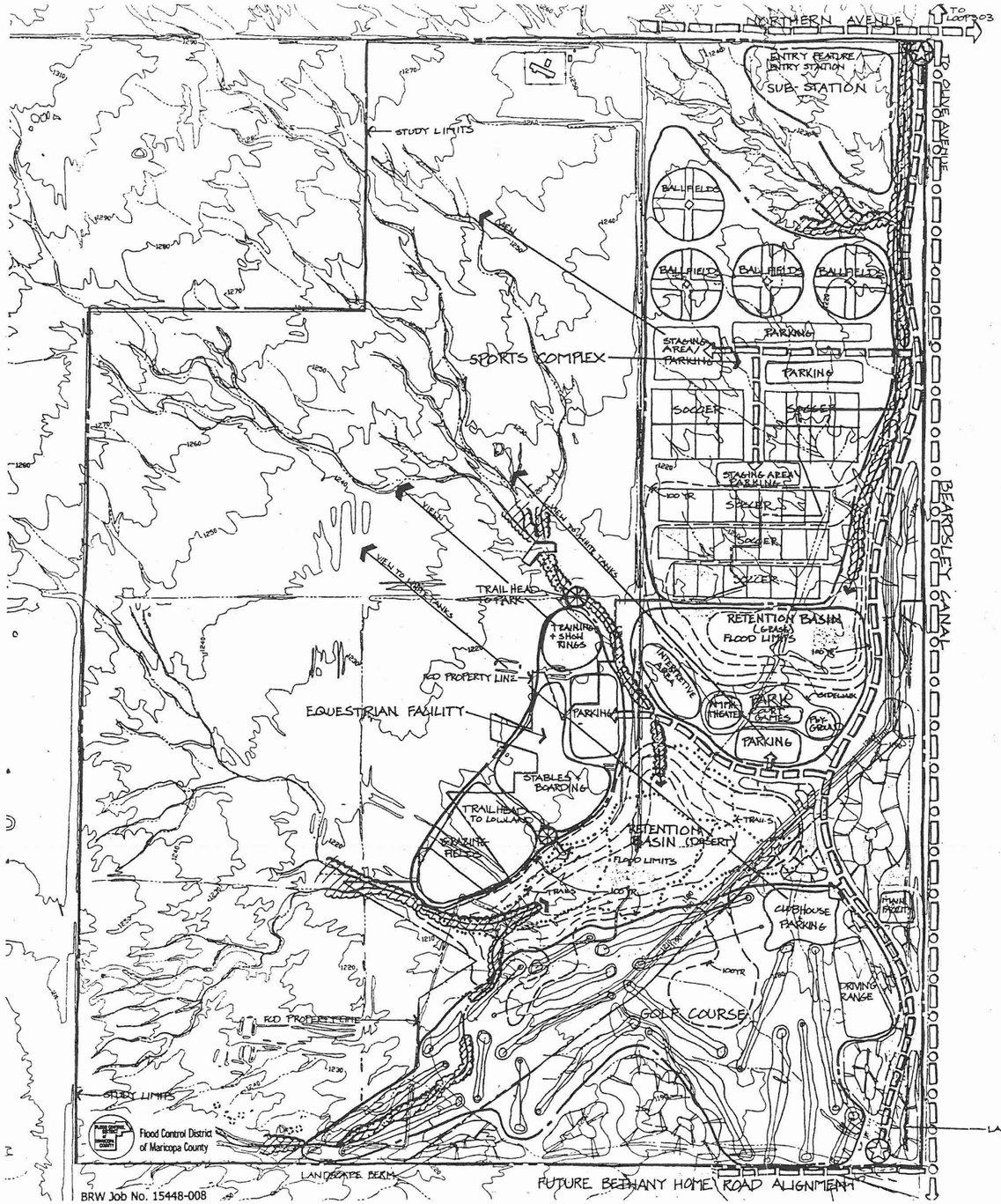
BRW

A14538.DWG 12-11-00

Dames & Moore Job No. 15448-007-058

Concept #2 - Single Basin, Passive Use

Figure 2-10



BRW Job No. 15448-008

SITE FEATURES

A. SUB-STATION- 29 AC.
- Police or Fire Sub-Station
- Municipal Buildings
- Commercial Parcel

B. SPORTS COMPLEX- 190.1 ac.
- 16 Ballfields
- 36 Soccer Fields
- Tournament Staging Areas
- Concrete Sidewalks
- Parking

C. COMMUNITY PARK- 61.8 ac.
- Playground
- Court Games
  - Basketball Courts
  - Volleyball Courts
  - Roller Hockey Rink
  - Tennis Courts
  - Recreation Building
- Amphitheater
- Interpretive/ Educational Center
- Concrete Sidewalks
- Open Turf Grass Fields
- Parking

D. EQUESTRIAN FACILITY- 64.2 ac.
- Stables and Boarding
- Grazing/ Exercise fields
- Training/ Show Rings
- Trailheads
  - to White Tank Mountain Park
  - to Retention Basin (Low Land Riding)
- Hitching Posts
- Oversized Parking Lot for Horse Trailers

E. GOLF COURSE- 207.1 ac.
- 18 Hole Championship Golf Course
- Clubhouse & Grill
- Practice Range & Green
- Maintenance Facility
- Parking

F. RETENTION BASIN- North Basin 92.5 ac.
South Basin 93.2 ac
- Multi-use Decomposed Granite Trails
- Overlook Areas
- Revegetate North Basin with Turf Grass
- Revevetate South Basin with Native Desert Vegetation
- Access to Beardsley Canal
- The Basins Contain:
  - 20 Soccer Fields
  - Non-playing areas of the golf course
  - Open Grass Fields for pick-up field games
  - Multi-use Trails

G. NATIVE DESERT WASH
- Wildlife Habitat
- Provide Links with White Tank Mountain Park and Future Developments

H. BEARDSLEY CANAL
- Access Link to White Tank Mountain Park and Lake Pleasant

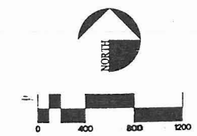
I. SITE ISSUES
- Land Acquisition
  - MCWD Land
  - Some State Land
  - BLM Land
- Spoils
  - Spread spoils over entire non-basin site. The spoils should be used to create topography and to screen visually invasive elements of the site and focus views on the White Tank Mountains.
- Site Access
  - Vehicular Access from Northern Avenue
  - Pedestrian, Bicycle, & Horse Access from the Beardsley Canal

LEGEND

- Property Line
- Area Division Line
- Access Road
- Beardsley Canal
- Flood Event Line
- Wash Corridor
- Trailhead
- Multi-use Trail
- Dominant View Shed Line
- Landscape Berm
- Entry Feature

Concept Statement

Concept #3 develops the site as an active use recreation attraction for the far west valley region by creating a major sports complex, an equestrian facility, and a golf course. The retention basins are split into two smaller basins. The north basin is grassed and integrated into the park and sports complex. Run-off is brought into the basins by the wash channel and as the water rises it will gradually inundate some of the soccer fields. The south basin is revegetated with native plants; a major flood event will encroach onto non-played parts of the golf course.



Flood Control District of Maricopa County

URS

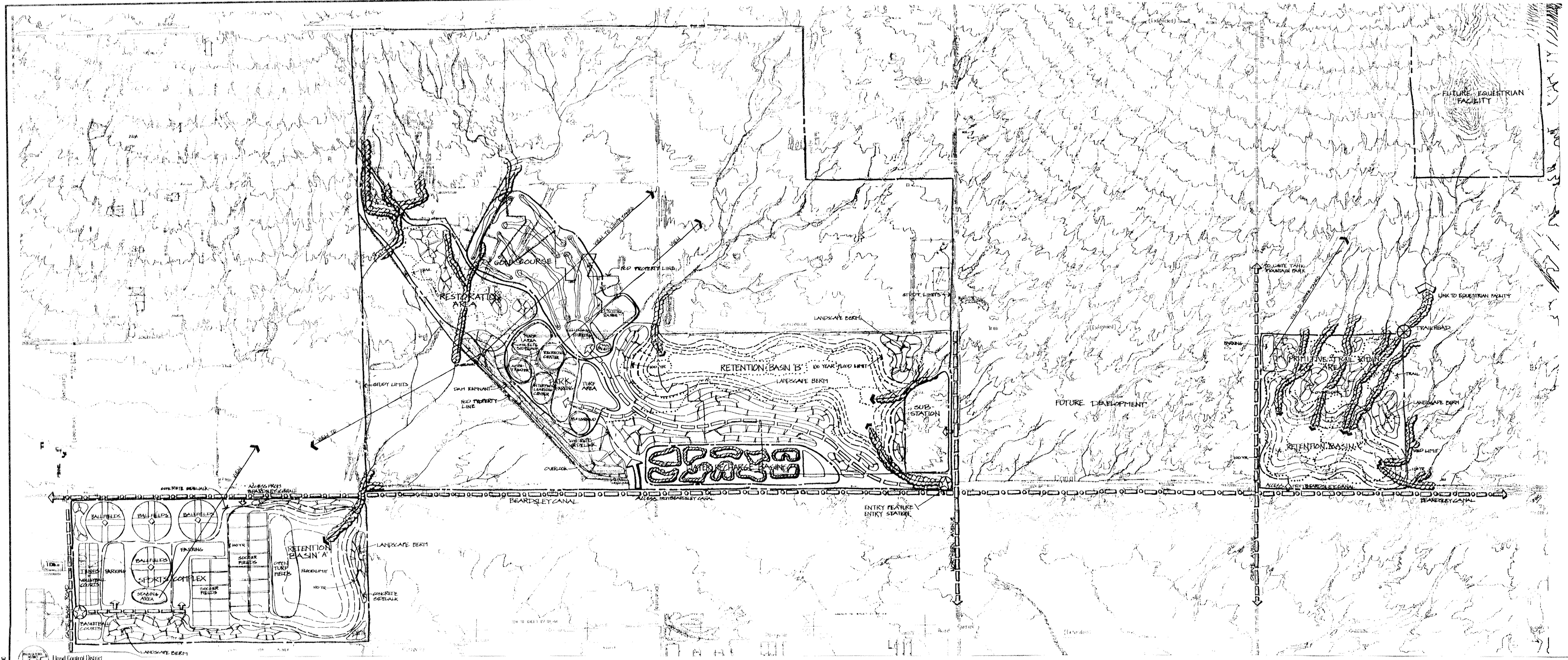
BRW

A14541.DWG 12-11-00

Dames & Moore Job No. 15448-007-058

Concept #3 - Multiple Basin, Active Use

Figure 2-11



SITE FEATURES

A. SPORTS COMPLEX- 308 ac.
- 16 Ballfields
- 24 Soccer Fields
- Tennis Courts
- Volleyball Courts
- Basketball Courts
- Open Turf Grass Fields
- Tournament Staging Areas
- Concrete Sidewalks
- Parking

B. RESTORATION AREA- 75 ac.
- Multi-use Decomposed Granite Trials
- Overlook Points
- Wildlife Habitat 75 ac.
- Sonoran Desert Interpretive Trail

C. COMMUNITY PARK- 50 ac.
- Playground
- Recreation Center
- Amphitheater
- Interpretive/ Educational Center
- Concrete Sidewalks
- Open Turf Grass Fields
- Parking

D. GOLF COURSE- 95.8 ac.
- 9 Hole Golf Course
- Clubhouse & Grill
- Practice Range & Green
- Maintenance Facility
- Parking

E. WATER RECHARGE BASINS- 52.2 ac.
- Small Basins fed by the Beardsley Canal
- Revegetated Side Slopes for Wildlife Habitat & Visual Aesthetic

F. SUB-STATION- 30.3 AC.
- Police or Fire Sub-Station
- Municipal Buildings
- Commercial Parcel

G. PRIMATIVE TRAIL AREA- 159.5 ac.
- Multi-use Decomposed Granite Trails
- Overlook Points
- Trailhead
  - to White Tank Mountain Park
- Hitching Posts

H. RETENTION BASINS-
- Basin 'A'- 104.8 ac.
  - Revegetate Basin with Turf Grass
  - Overlook/ Seating Areas
  - Access from the Beardsley Canal
  - The Basins Contain:
    - 14 Soccer Fields
    - Open Grass Fields for pick-up field games
    - Concrete Sidewalk
- Basin 'B'- 120 ac.
  - Revegetate Basin Side Slopes with Desert Plant Material
  - Wildlife Habitat
  - Multi-use Decomposed Granite Trails
- Basin 'C'- 71.1 ac.
  - Multi-use Decomposed Granite Trails
  - Access to Beardsley Canal
  - Overlook Areas

I. NATIVE DESERT WASH
- Wildlife Habitat
- Provide Links with Future Equestrian Facility and Future Developments

J. BEARDSLEY CANAL
- Provides a Link Between the Three Basin "Parks"
- Access Link to the White Tank Mountain Park and Lake Pleasant

K. SITE ISSUES
- Land Acquisition
  - MCWD Land
  - State Land
  - BLM Land
- Spoils
  - Spread spoils over entire non-basin site. The spoils should be used to create topography and to screen visually invasive elements of the site.
- Site Access
  - Vehicular Access from Camelback Road, Northern Avenue, & Olive Avenue
  - Pedestrian, Bicycle, & Equestrian Access from the Beardsley Canal

LEGEND

- Property Line
- Area Division Line
- Access Road
- Beardsley Canal
- Flood Event Line
- Wash Corridor
- Trailhead
- Multi-use Trail
- Dominant View Shed Line
- Landscape Berm
- Entry Feature

Concept Statement

Concept #4 contains three shallower retention basins that are developed into three distinct use areas linked together by the Beardsley Canal. The sports complex provides athletic fields and courts for organized leagues and recreational players. The storm water recharge basins combine the need for ground water recharge and wildlife habitat. The park provides passive recreation and learning opportunities while integrating with a softened dam remnant. The northern basin provides an opportunity for hiking and low land trail riding from the nearby equestrian facility.

WHITE TANKS FRS #3

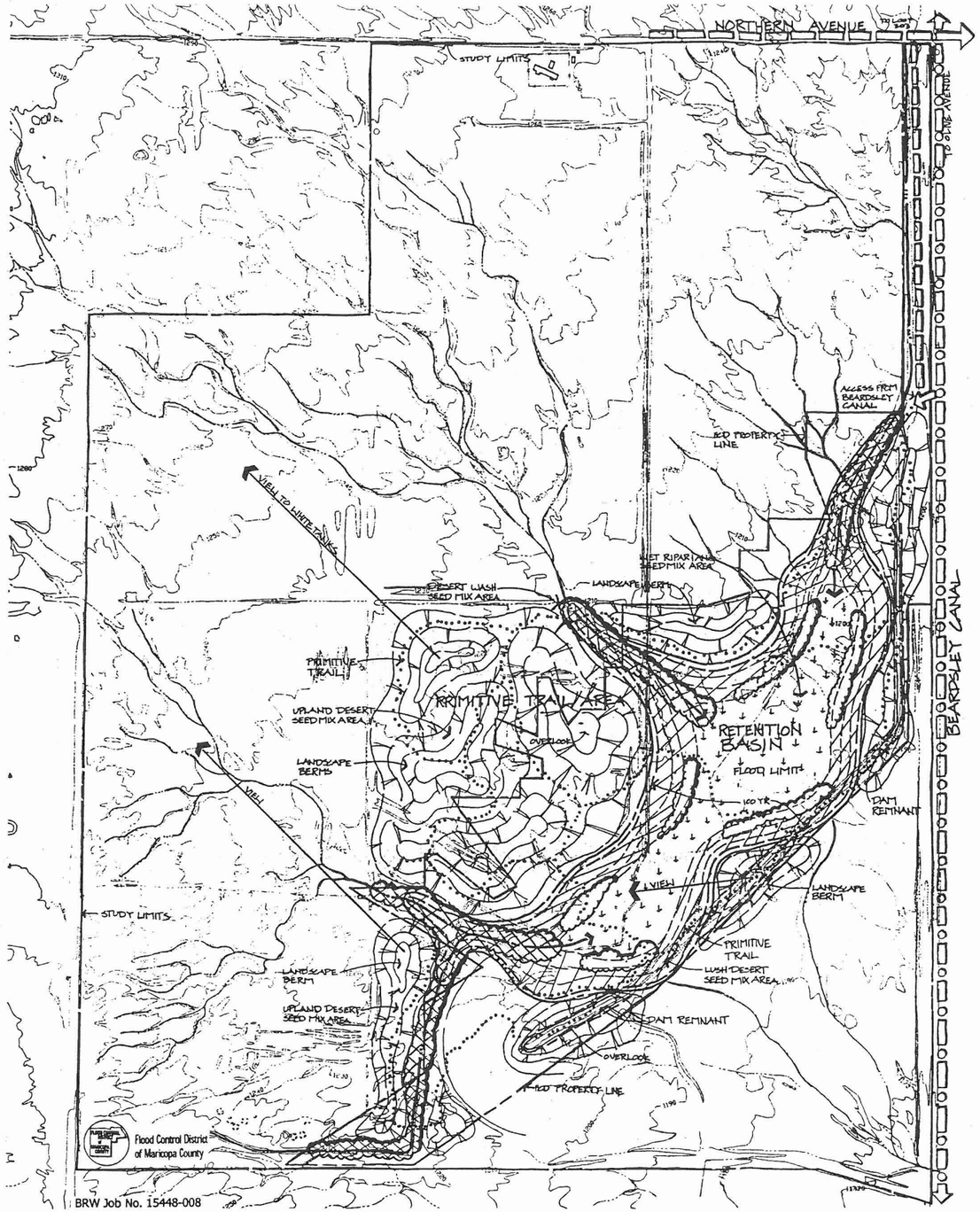
Flood Control District of Maricopa County

URS

Dames & Moore Job No. 15448-007-058

Concept #4 - Multiple Basins, Passive Use

Figure 2-12



BRW Job No. 15448-008

SITE FEATURES

A. PRIMITIVE TRAIL AREA- 221 ac.
- Non-Developed Trails
- Landscape Berms
- Overlook Points
- Wildlife Habitat
- Access from Beardsley Canal

B. RETENTION BASIN- 158 ac.
- Non-Developed Trails
- Wildlife Habitat
- Revegetate with Native Desert Seed Mixes

C. NATIVE DESERT WASH
- Wildlife Habitat
- Provide Links with White Tank Mountain Park and Future Developments

D. BEARDSLEY CANAL
- Access Link to White Tank Mountain Park and Lake Pleasant

E. SITE ISSUES
- Land Acquisition
  - State Land
- Spoils
  - Spread spoils over entire non-basin site. The spoils should be used to create topography and enhance views.
- Site Access
  - Vehicular/ Maintenance Access from Northern Avenue.
  - Pedestrian, Bicycle, & Equestrian Access from the Beardsley Canal
- Revegetation Seed Mixes
  - Upland Desert Seed Mix (landscape berms & non-basin areas)
  - Desert Wash Seed Mix (wash & channel corridors)
  - Lush Desert Seed Mix (25-100 year flood event)
  - Wet Riparian Seed Mix (0-25 year flood event)

LEGEND

- Property Line
- Area Division Line
- Access Road
- Beardsley Canal
- Flood Event Line
- Wash Corridor
- Trail
- Landscape Berms
- Upland Desert Seed Mix Area
- Desert Wash Seed Mix Area
- Lush Desert Seed Mix Area
- Wet Riparian Seed Mix Area
- Dominant View Shed Line

Concept Statement

Concept #5 develops the site for minimal passive recreational uses. A large single basin is located adjacent to the existing dam and branches the dam in several locations. The remaining dam remnants are blended with some of the resulting spoils to create high points and overlooks. The site will be revegetated to a native desert condition with a blend of four general seed mixes that follow the wester distribution patterns of the site.

NORTH

0 400 800 1200

WHITE TANKS FRS # 3

Flood Control District of Maricopa County

URS

BRW

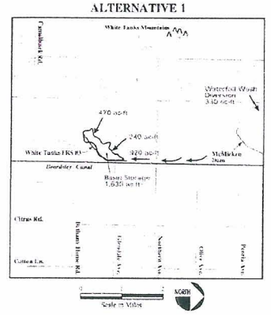
A14540.DWG 12-11-00

Dames & Moore Job No. 15448-007-058

Concept #5 - Single Basin, Passive Use

Figure 2-13

ALTERNATIVE 1



BASIN & CHANNEL ELEMENTS

LANDSCAPE CHARACTER ZONES

UPLAND SONORAN DESERT

Trees
Catclaw Acacia (*Acacia greggii*)
Foothills Palo Verde (*Cercidium microphyllum*)
Ironwood (*Olneya tesota*)
Native Mesquite (*Prosopis velutina*)

Shrubs
White Bursage (*Ambrosia dumosa*)
Saltbush (*Atriplex Sp.*)
Native Fairy Duster (*Calliandra eriophylla*)
Brittlebush (*Encelia farinosa*)
Creosote Bush (*Larrea tridentata*)
Jojoba (*Simmondsia chinensis*)
Globe Mallow (*Sphaeralcea ambigua*)
Golden Eye (*Viguiera deltoidea*)
Graythorn (*Zaryphus obtusifolius*)

Groundcovers
Triangle Leaf Bursage (*Ambrosia deltoidea*)
Desert Marigold (*Baileya multiradiata*)
Pentstemon (*Penstemon Sp.*)
Verbena (*Verbena Sp.*)

Cacti
Saguaro (*Carnegia gigantea*)
Hedgehog Cactus (*Echinocereus enterlianus.*)
Barrel Cactus (*Ferocactus wislizenii*)
Ocotillo (*Fouquieria splendens*)
Cholla (*Opuntia Sp.*

DESERT WASH

Trees
Blue Palo Verde (*Cercidium floridum*)
Foothills Palo Verde (*Cercidium microphyllum*)
Desert Willow (*Chilopsis linearis*)
Native Mesquite (*Prosopis velutina*)

Shrubs
Giant Bursage (*Ambrosia ambrosioides*)
Saltbush (*Atriplex Sp.*)
Desert Hackberry (*Celtis pallida*)
Brittlebush (*Encelia farinosa*)
Desert Lavender (*Hyptis emoryi*)
Chuparosa (*Justicia californica*)
Wolfberry (*Lycium Sp.*)
Jojoba (*Simmondsia chinensis*)
Globe Mallow (*Sphaeralcea ambigua*)
Graythorn (*Zaryphus obtusifolius*)

Groundcovers
Triangle Leaf Bursage (*Ambrosia deltoidea*)
Verbena (*Verbena Sp.*)

RETENTION BASIN

Trees
Mesquite (*Prosopis Sp.*)

Shrubs
Giant Bursage (*Ambrosia ambrosioides*)
Saltbush (*Atriplex Sp.*)
Desert Lavender (*Hyptis emoryi*)
Chuparosa (*Justicia californica*)
Globe Mallow (*Sphaeralcea ambigua*)

Groundcovers
Triangle Leaf Bursage (*Ambrosia deltoidea*)
Salt Grass (*Distichlis spicata*)
Alkali Sacaton (*Sporobolus airoides*)

LOW FLOW AREA

Trees
Screwbean Mesquite (*Prosopis pubescens*)

Shrubs
Giant Bursage (*Ambrosia ambrosioides*)
Quailbush (*Atriplex lentiformis*)

Groundcovers
Seepwing Rush (*Equisetum hyemale*)
Bulrush (*Scirpus maritimus*)
Salt Grass (*Distichlis spicata*)
Alkali Sacaton (*Sporobolus airoides*)
Vine Mesquite (*Panicum obtusum*)

RECREATION CONCEPT STATEMENT

Flood Control District of Maricopa County

URS

BRW

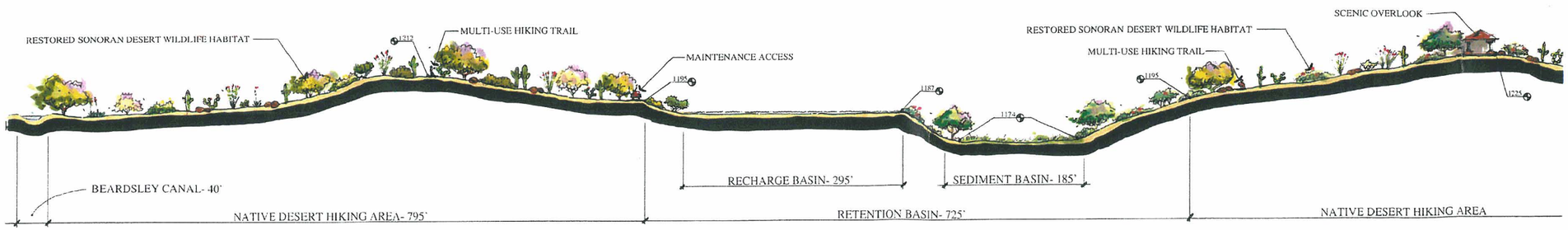
WHITE TANKS FRS # 3

Dames & Moore Job No. 15448-007-058

14426.DWG 12-5-00 IMAGE: \007\brw images\BRW3.TIF

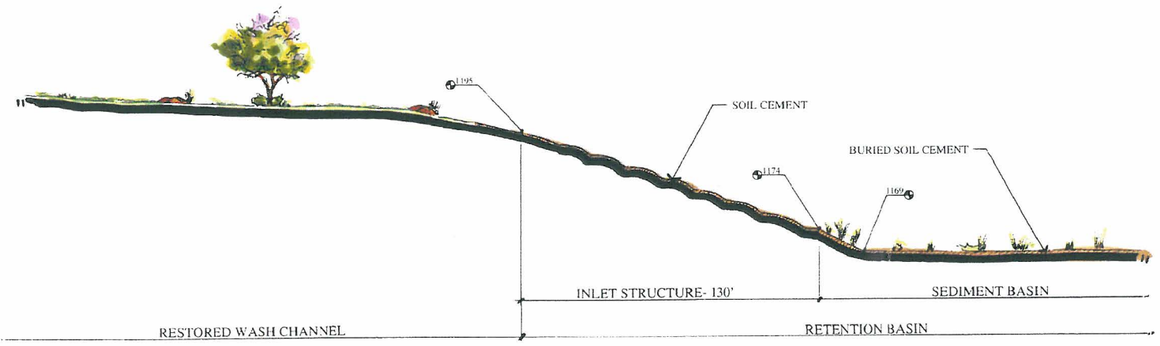
Plan View of Alternative 1 - Single Basin, Passive-use Recreation

Figure 3-1



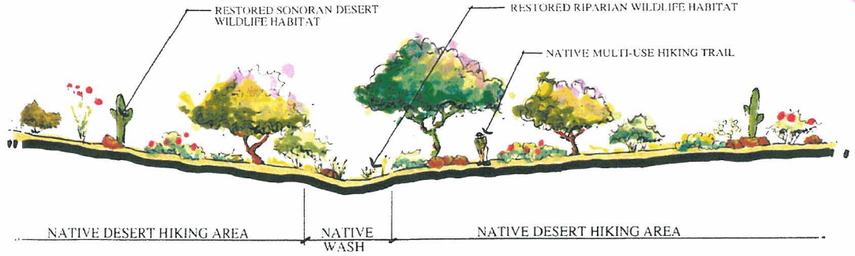
A RECHARGE BASIN & RETENTION BASIN SECTION

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



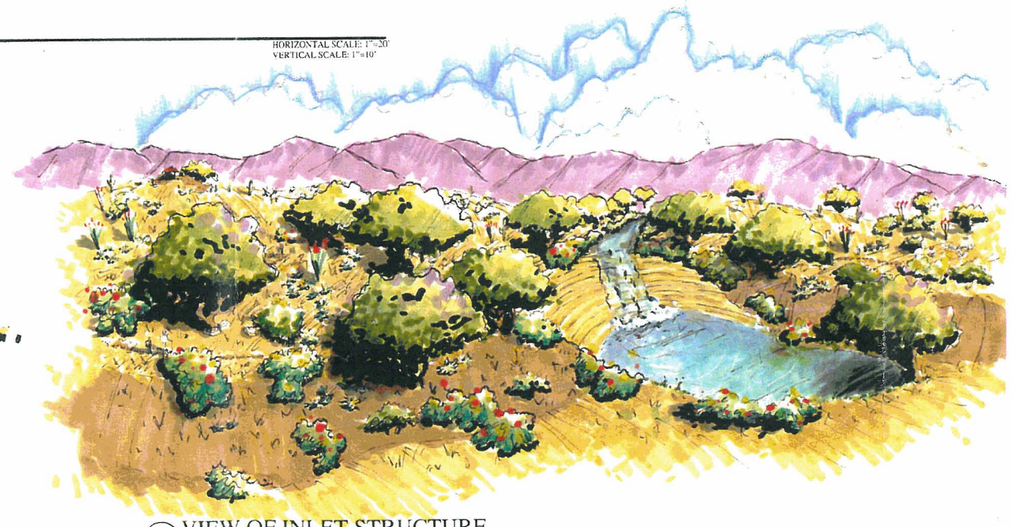
B INLET STRUCTURE SECTION

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=10'



L TYPICAL NATIVE WASH SECTION

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=10'



C VIEW OF INLET STRUCTURE

NTS

Flood Control District of Maricopa County

URS

BRW

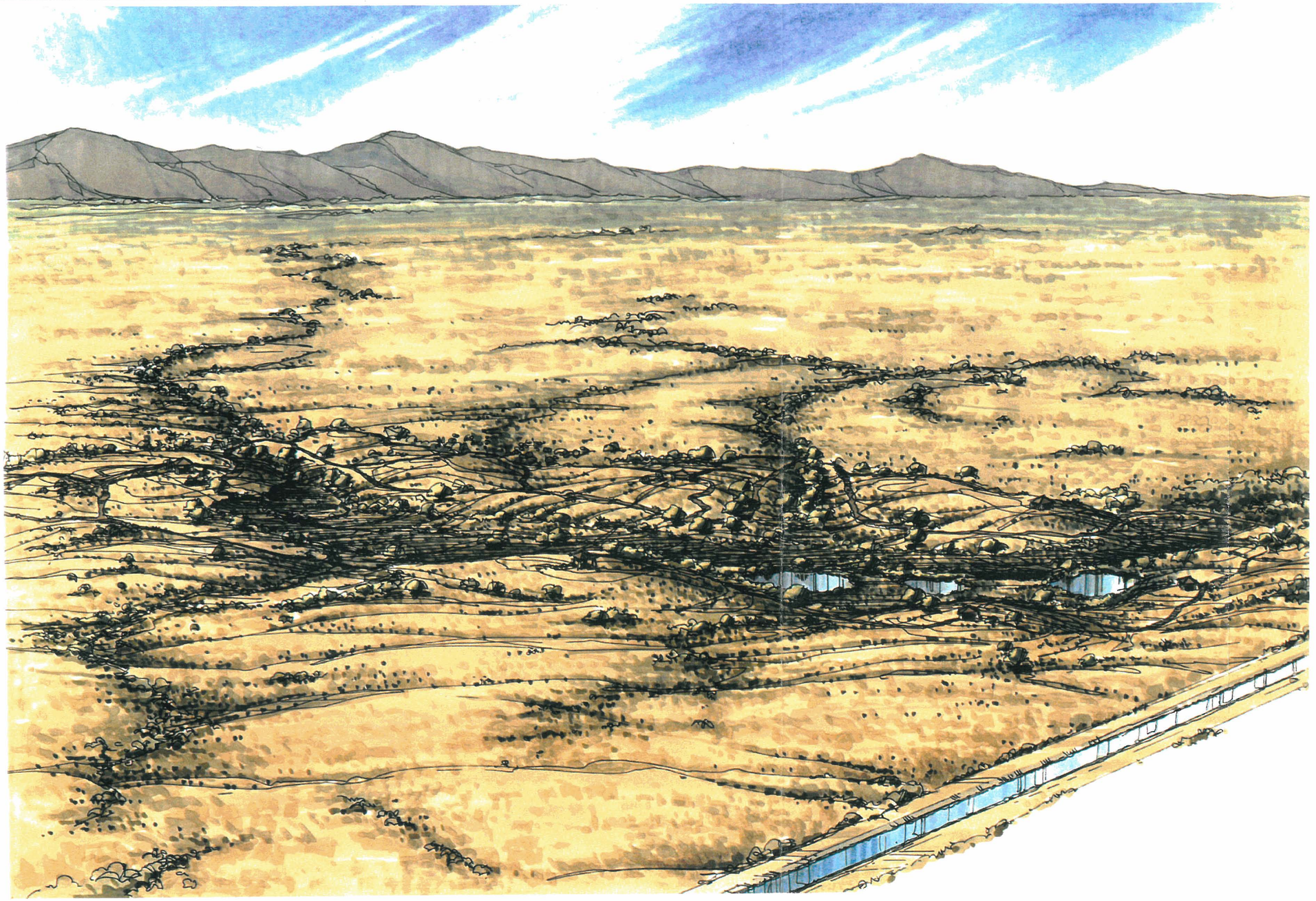
WHITE TANKS FRS #3

14538.DWG 12-6-00 IMAGE: \007\brw images\BRW4.TIF

Dames & Moore Job No. 15448-007-058

Section View of Alternative 1 - Single Basin, Passive-use Recreation

Figure 3-2



Flood Control District of Maricopa County

URS
BRW

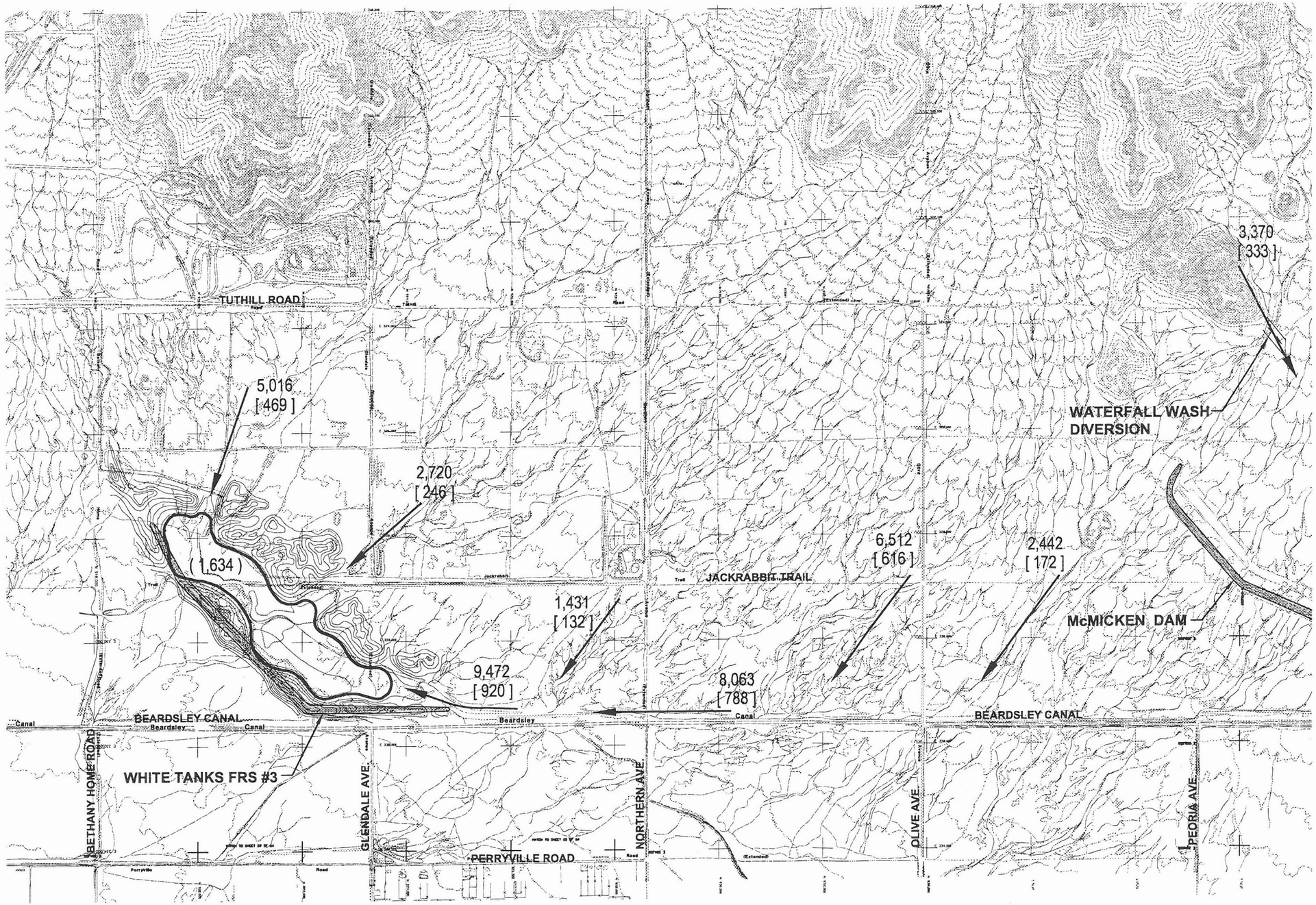
WHITE TANKS FRS #3

14533.DWG 12-6-00 IMAGE: \007\brw images\BASIN1.JPG

Dames & Moore Job No. 15448-007-058

Perspective View of Alternative 1 - Single Basin, Passive-use Recreation

Figure 3-3



Legend:

8,063	Flow Rate and Direction (cfs)
[788]	Flow Volume (ac-ft)
	Basin Outline
(500)	Storage Volume (ac-ft)

Note:

All flows rates and volumes shown on this figure are based on the 100-year, 24-hour storm event.

NORTH

0 1000 2000 3000 4000
Scale in Feet

WHITE TANKS FRS #3

Flood Control District of Maricopa County

URS
Dames & Moore

SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

A14285.DWG 12-5-00 XREF:VTOPO

Dames & Moore Job No. 15448-007-058

Alternative 1 - Flow Rates and Volumes

Figure 3-4

ALTERNATIVE 2
MULTIPLE BASINS, ACTIVE USE

ALTERNATIVE 2

BASIN & CHANNEL ELEMENTS

LANDSCAPE CHARACTER ZONES

UPLAND SONORAN DESERT
Trees
Cardon Acacia (*Acacia greggii*)
Foothills Palo Verde (*Cercidium microphyllum*)
Ironwood (*Olneya tesota*)
Native Mesquite (*Prosopis velutina*)

Shrubs
White Bursage (*Ambrosia dumosa*)
Saltbush (*Atriplex Sp.*)
Native Fairy Duster (*Calliandra eriophylla*)
Burrobrush (*Encelia farinosa*)
Creosote Bush (*Larrea tridentata*)
Jojoba (*Simmondsia chinensis*)
Globe Mallow (*Sphaeralcea ambigua*)
Golden Ewe (*Varilla texana*)
Grey thorn (*Ziziphus obtusifolia*)

Groundcovers
Triangle Leaf Bursage (*Ambrosia deltoidea*)
Desert Marigold (*Baileya multiradiata*)
Pygmycus (*Penstemon Sp.*)
Verbena (*Verbena Sp.*)

Cacti
Saguaro (*Carnegia gigantea*)
Hedgehog Cactus (*Echinocereus engelmannii*)
Barrel Cactus (*Ferocactus wislizenii*)
Ocotillo (*Fouquieria splendens*)
Cholla (*Opuntia sp.*)

DESERT WASH
Trees
Blue Palo Verde (*Cercidium floridum*)
Foothills Palo Verde (*Cercidium microphyllum*)
Desert Willow (*Chilopsis linearis*)
Native Mesquite (*Prosopis velutina*)

Shrubs
Giant Bursage (*Ambrosia ambrosioides*)
Saltbush (*Atriplex Sp.*)
Desert Hackberry (*Celtis pallida*)
Burrobrush (*Encelia farinosa*)
Desert Lavender (*Hyptis emoryi*)
Chuparosa (*Justicia californica*)
Wolfberry (*Lycium sp.*)
Jojoba (*Simmondsia chinensis*)
Globe Mallow (*Sphaeralcea ambigua*)
Graythorn (*Ziziphus obtusifolia*)

Groundcovers
Triangle Leaf Bursage (*Ambrosia deltoidea*)
Verbena (*Verbena Sp.*)

RETENTION BASIN
Trees
Mesquite (*Prosopis Sp.*)

Shrubs
Giant Bursage (*Ambrosia ambrosioides*)
Saltbush (*Atriplex Sp.*)
Desert Lavender (*Hyptis emoryi*)
Chuparosa (*Justicia californica*)
Globe Mallow (*Sphaeralcea ambigua*)

Groundcovers
Triangle Leaf Bursage (*Ambrosia deltoidea*)
Salt Grass (*Distichlis spicata*)
Alkali Sacaton (*Sporobolus airoides*)

LOW FLOW AREA
Trees
Screwbean Mesquite (*Prosopis pubescens*)

Shrubs
Giant Bursage (*Ambrosia ambrosioides*)
Quailbush (*Atriplex lentiformis*)

Groundcovers
Screwbean Rush (*Equisetum hyemale*)
Bulrush (*Scirpus maritimus*)
Salt Grass (*Distichlis spicata*)
Alkali Sacaton (*Sporobolus airoides*)
Vine Mesquite (*Panicum obtusum*)

PARK
Turf Grass and Xeric Landscape Plant Materials

LEGEND

- CONCRETE/PICTURE LATION PATH
- NATIVE MULTI-USE TRAIL
- RAMADAS
- SCENIC OVERLOOK
- TRAILHEAD
- MAINTENANCE ACCESS
- LANDSCAPE BERMS (1' OR 2' CONTOUR INTERVALS)
- DOMINANT VIEW SHED
- RESTORED WASH CHANNEL

BASIN AND CHANNEL DESIGN ELEMENTS

Alternative 2: Two Basins with Equalized Diversion at McMicken Dam and Low Flood Outlets

0 300 600 900

RECREATION CONCEPT STATEMENT
ALTERNATE 2 IS DEVELOPED WITH TWO RETENTION BASINS, WHICH PROVIDE OPPORTUNITIES FOR ACTIVE USE RECREATION ACTIVITIES. THE NORTH BASIN INTEGRATES WITH THE SPORTS COMPLEX BY HOLDING SOCCER FIELDS. AN INTERPRETIVE HIKING TRAIL IS LOCATED ON LANDSCAPE BERMS NEAR THE COMMUNITY PARK. THE EQUESTRIAN FACILITY IS LOCATED BETWEEN THE SOUTH BASIN AND THE BEARDSLEY CANAL TO PROVIDE OPPORTUNITIES FOR HORSEBACK RIDING. THE SOUTH BASIN ALSO INTEGRATES WITH THE GOLF COURSE BY HAVING SOME OF THE COURSE LOCATED WITHIN THE BASINS HIGH WATER MARK

WHITE TANKS FAS # 3

Flood Control District of Maricopa County

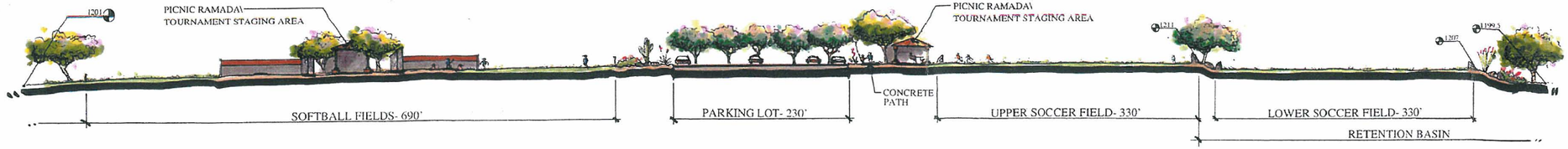
URS BRW

14425.DWG 12-6-00 IMAGE: \007\brw images\BRW1.TIF

Dames & Moore Job No. 15448-007-058

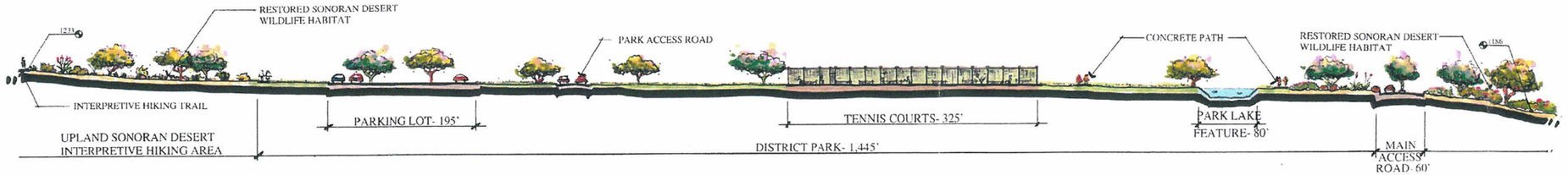
Plan View of Alternative 2 - Multiple Basins, Active-use Recreation

Figure 3-5



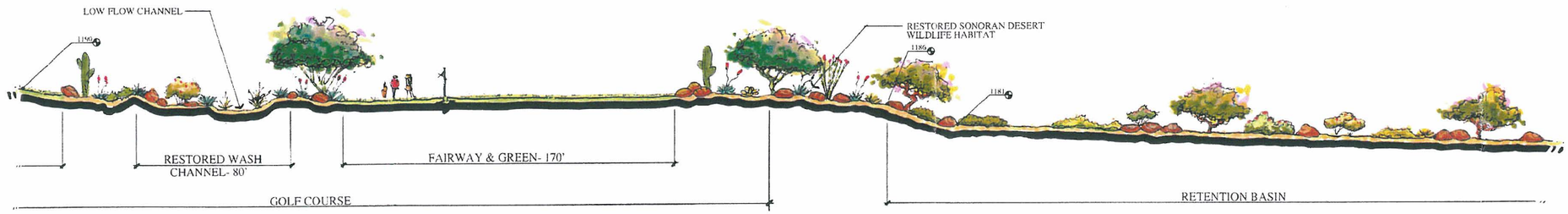
D SPORTS COMPLEX SECTION

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



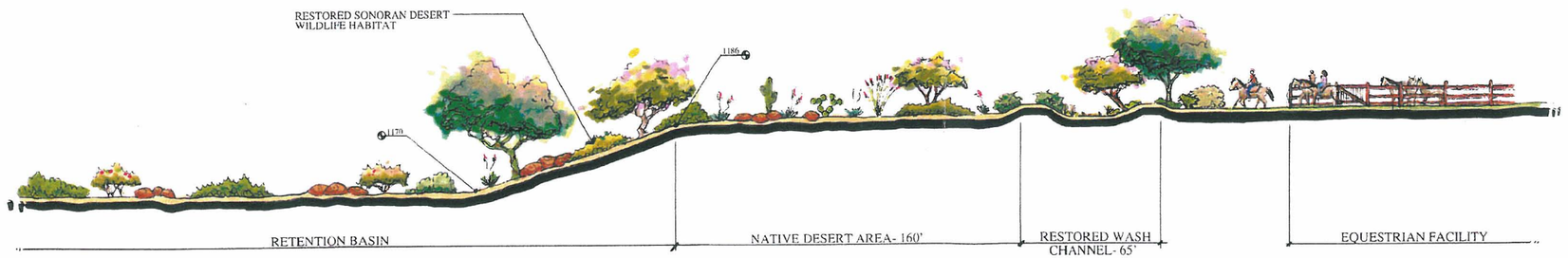
E DISTRICT PARK SECTION

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



F GOLF COURSE & RETENTION BASIN SECTION

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=10'



G EQUESTRIAN FACILITY & RETENTION BASIN SECTION

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=10'

Flood Control District of Maricopa County

URS
BRW

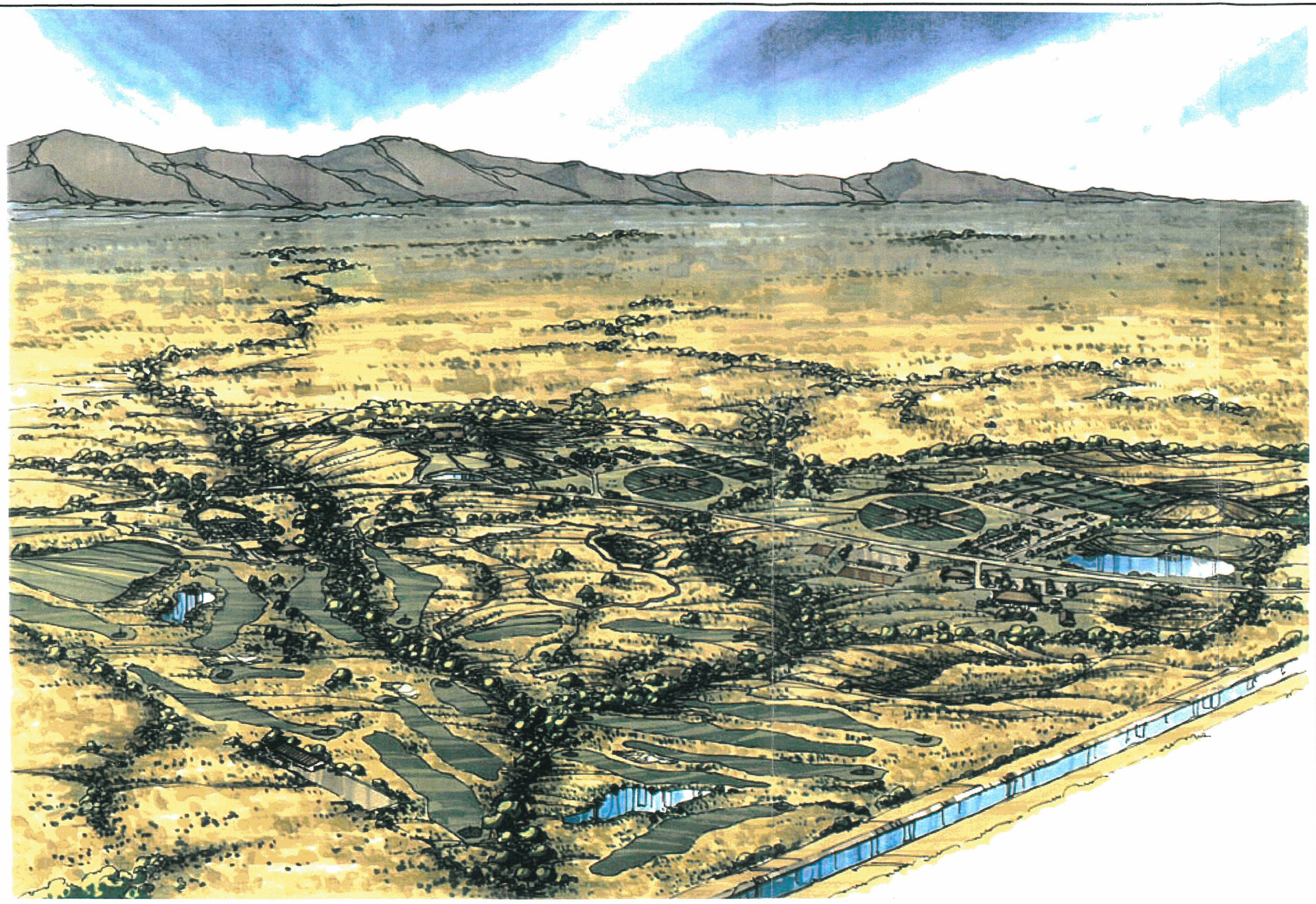
WHITE TANKS FRS # 3

14537.DWG 12-6-00 IMAGE: \007brw images\BRW6.TIF

Dames & Moore Job No. 15448-007-058

Section View of Alternative 2 - Multiple Basins, Active-use Recreation

Figure 3-6



Flood Control District of Maricopa County

URS
BRW

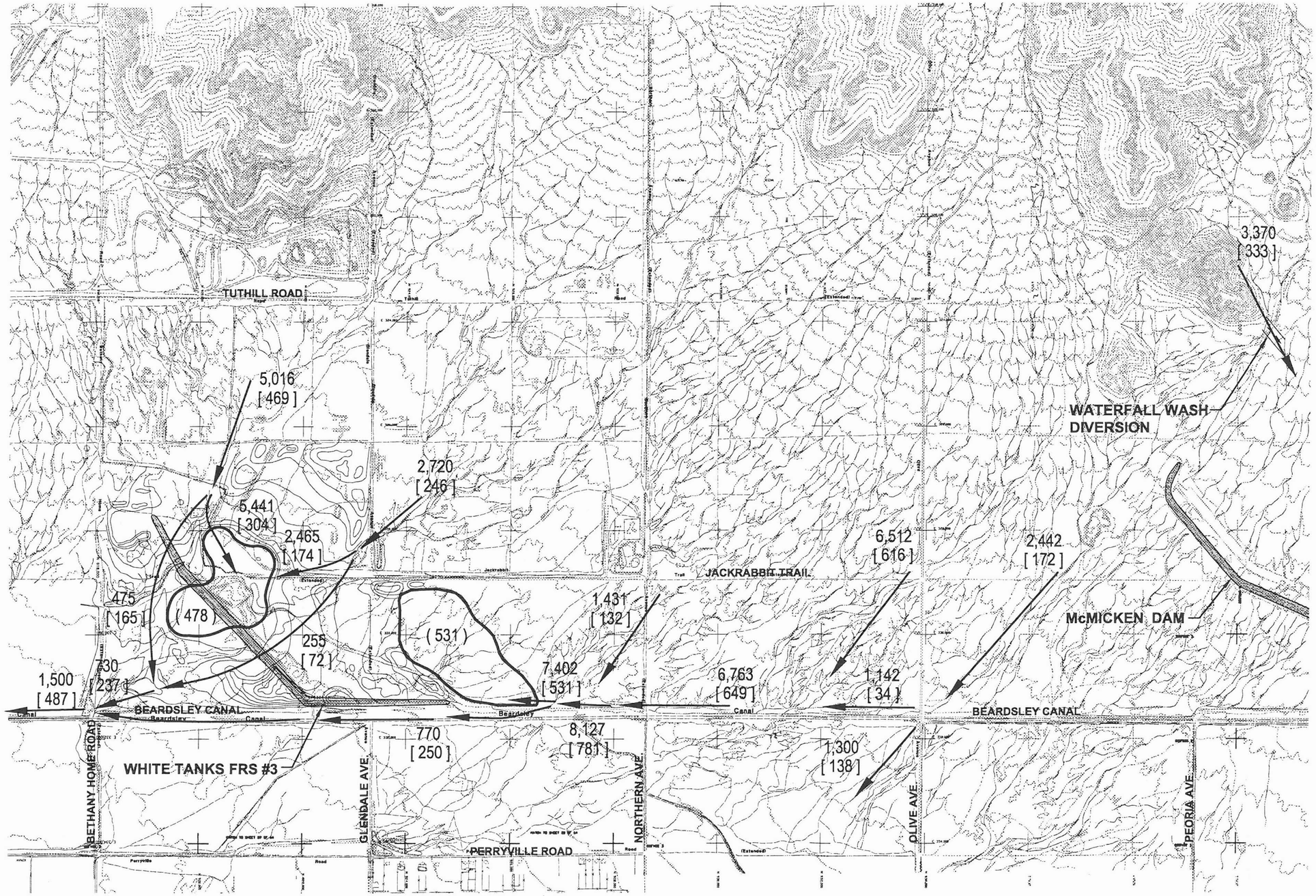
WHITE TANKS FRS # 3

14535.DWG 12-6-00 IMAGE: \007\brw images\BASIN2.JPG

Dames & Moore Job No. 15448-007-058

Perspective View of Alternative 2 - Multiple Basins, Active-use Recreation

Figure 3-7



Legend:

8,063	Flow Rate and Direction (cfs)
[788]	Flow Volume (ac-ft)
	Basin Outline
(500)	Storage Volume (ac-ft)

Note:

All flows rates and volumes shown on this figure are based on the 100-year, 24-hour storm event.

NORTH

0 1000 2000 3000 4000

Scale in Feet

WHITE TANKS FRS #3

Flood Control District of Maricopa County

URS Dames & Moore

SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

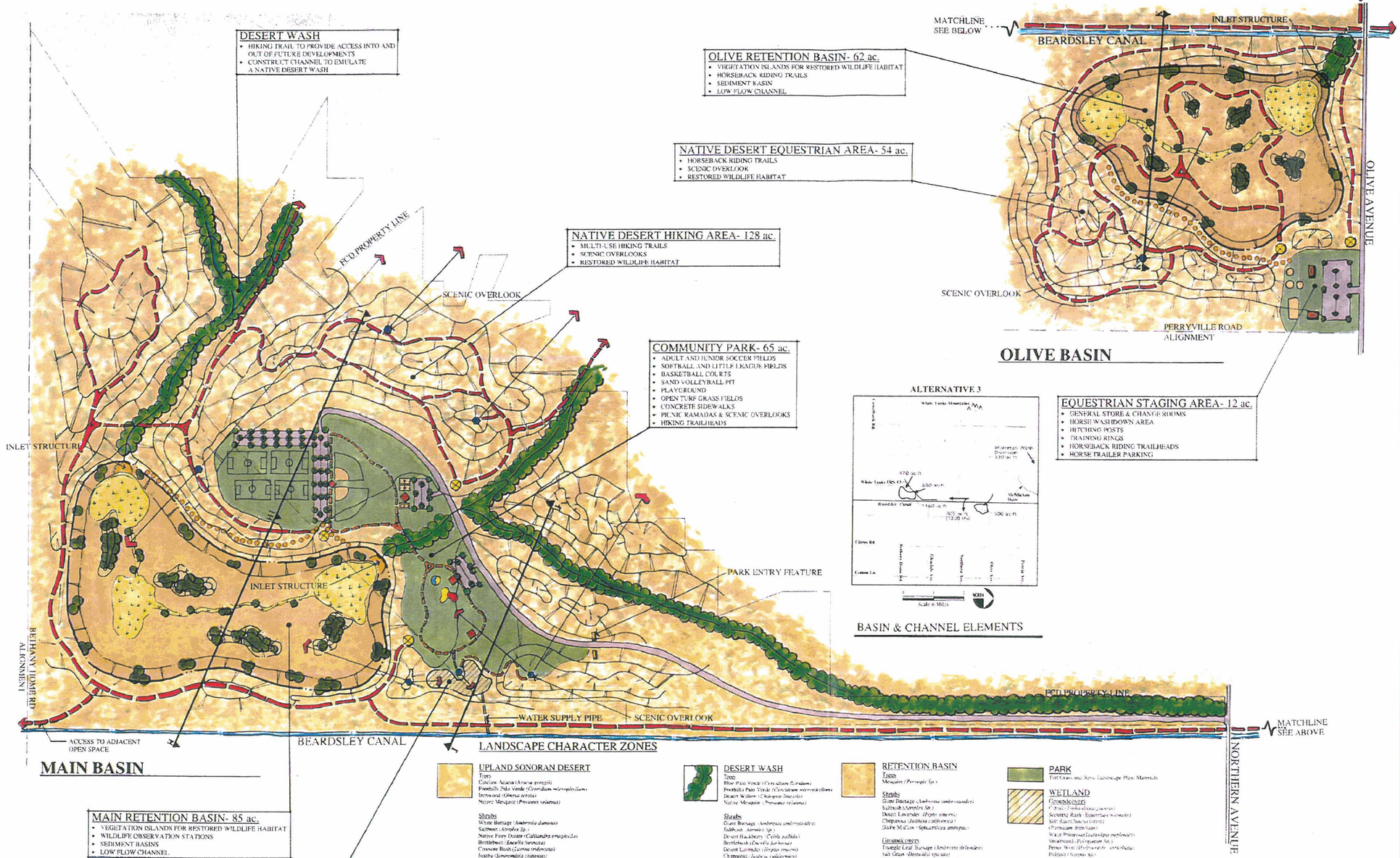
A14342.DWG 12-5-00 XREF:VTOPO

Dames & Moore Job No. 15448-007-058

Alternative 2 - Flow Rates and Volumes

Figure 3-8

ALTERNATIVE 3
MULTIPLE BASINS, MIXED USE



LEGEND
- CONCRETE CIRCULATION PATH
- NATIVE MULTI-USE TRAIL
- RAMADA
- SCENIC OVERLOOK
- TRAILHEAD
- MAINTENANCE ACCESS
- LANDSCAPE BERMS- 10 FT CONTOUR INTERVALS
- DOMINANT VIEW SHED
- RESTORED WASH CHANNEL

BASIN AND CHANNEL DESIGN ELEMENTS

Alternative 3: One Main Basin with Secondary Upstream Basin and One Flood Channel

RECREATION CONCEPT STATEMENT

ALTERNATIVE 3 IS DEVELOPED WITH TWO SEPARATE BASIN SITES WHICH PROVIDE BOTH PASSIVE & ACTIVE RECREATION USE AREAS. AN EQUESTRIAN FACILITY NEAR THE OLIVE BASIN PROVIDES OPPORTUNITIES FOR HORSEBACK RIDING IN THE BASIN, ON THE LANDSCAPE BERMS, OR IN THE WHITE TANKS REGIONAL PARK. THE MAIN BASIN PROVIDES PASSIVE RECREATION USES BY CREATING WILDLIFE HABITAT AND SCENIC OVERLOOKS. A NEARBY COMMUNITY PARK CREATES OPPORTUNITIES FOR BOTH PASSIVE & ACTIVE ACTIVITIES INCLUDING HIKING TRAILS, AN INTERPRETIVE WETLAND, PLAYGROUNDS, AND SOCCER & SOFTBALL FIELDS.

Flood Control District of Maricopa County

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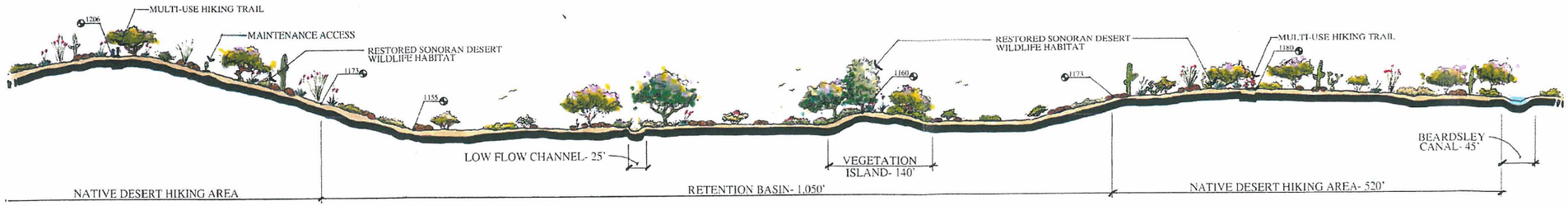
WHITE TANKS FRS # 3

14424.DWG 12-5-00 IMAGE: \007\brw images\BRW2.TIF

Dames & Moore Job No. 15448-007-058

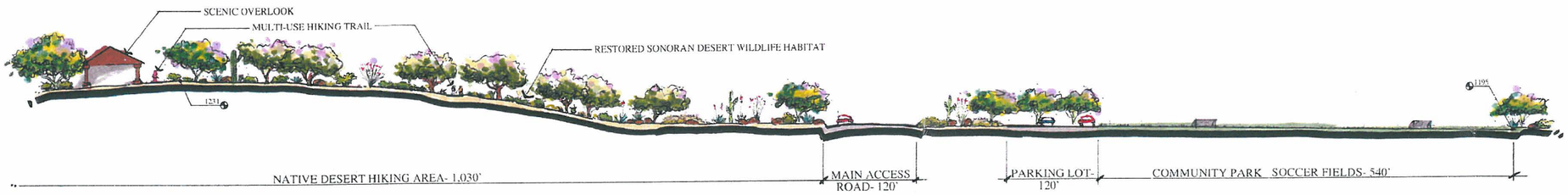
Plan View of Alternative 3 - Multiple Basins, Mixed-use Recreation

Figure 3-9



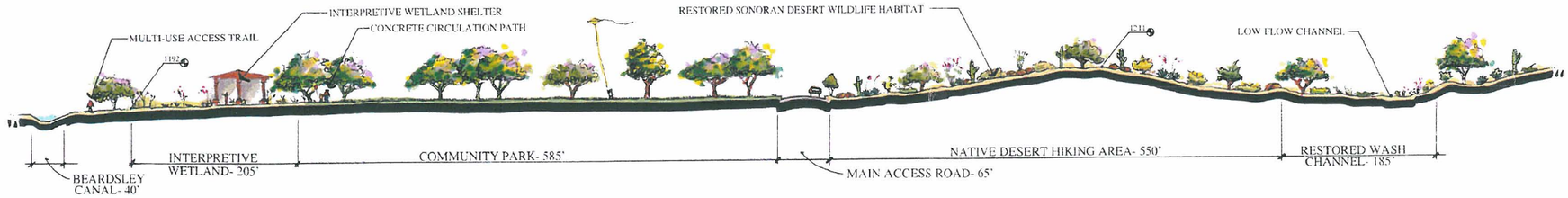
(H) MAIN BASIN SECTION

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



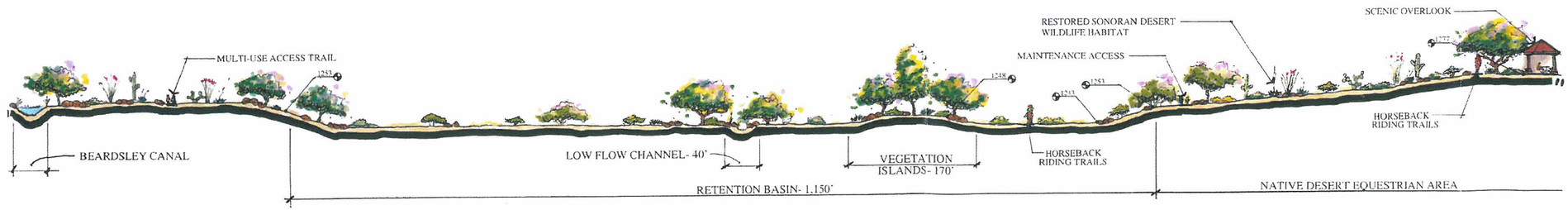
(I) COMMUNITY PARK SECTION

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



(J) WETLAND & WASH SECTION

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



(K) OLIVE BASIN SECTION

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'

Flood Control District of Maricopa County

URS
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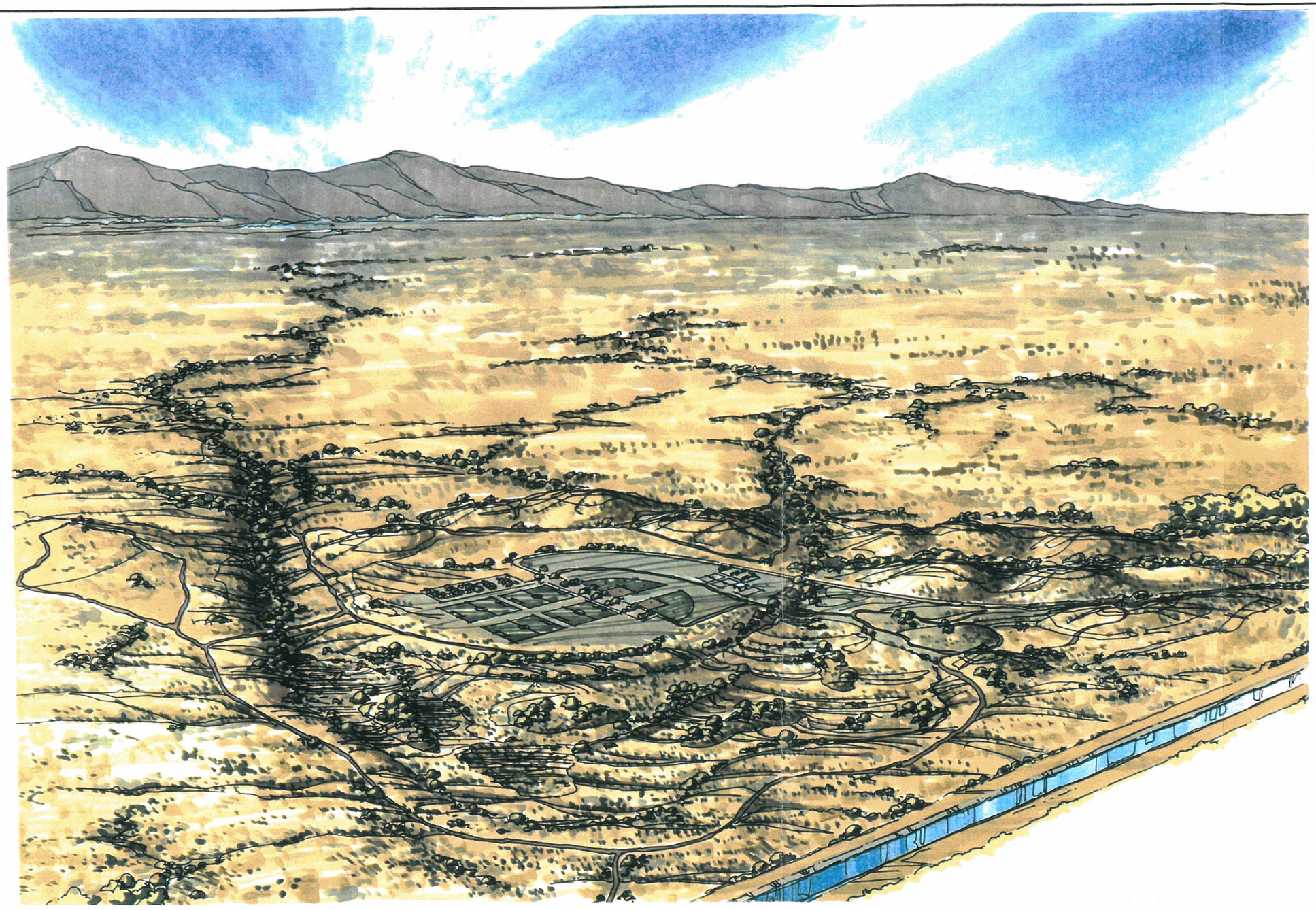
WHITE TANKS
FRS # 3

14536.DWG 12-6-00 IMAGE: \007\brw images\BRW2.TIF

Dames & Moore Job No. 15448-007-058

Section View of Alternative 3 - Multiple Basins, Mixed-use Recreation

Figure 3-10



Flood Control District of Maricopa County

URS

BRW

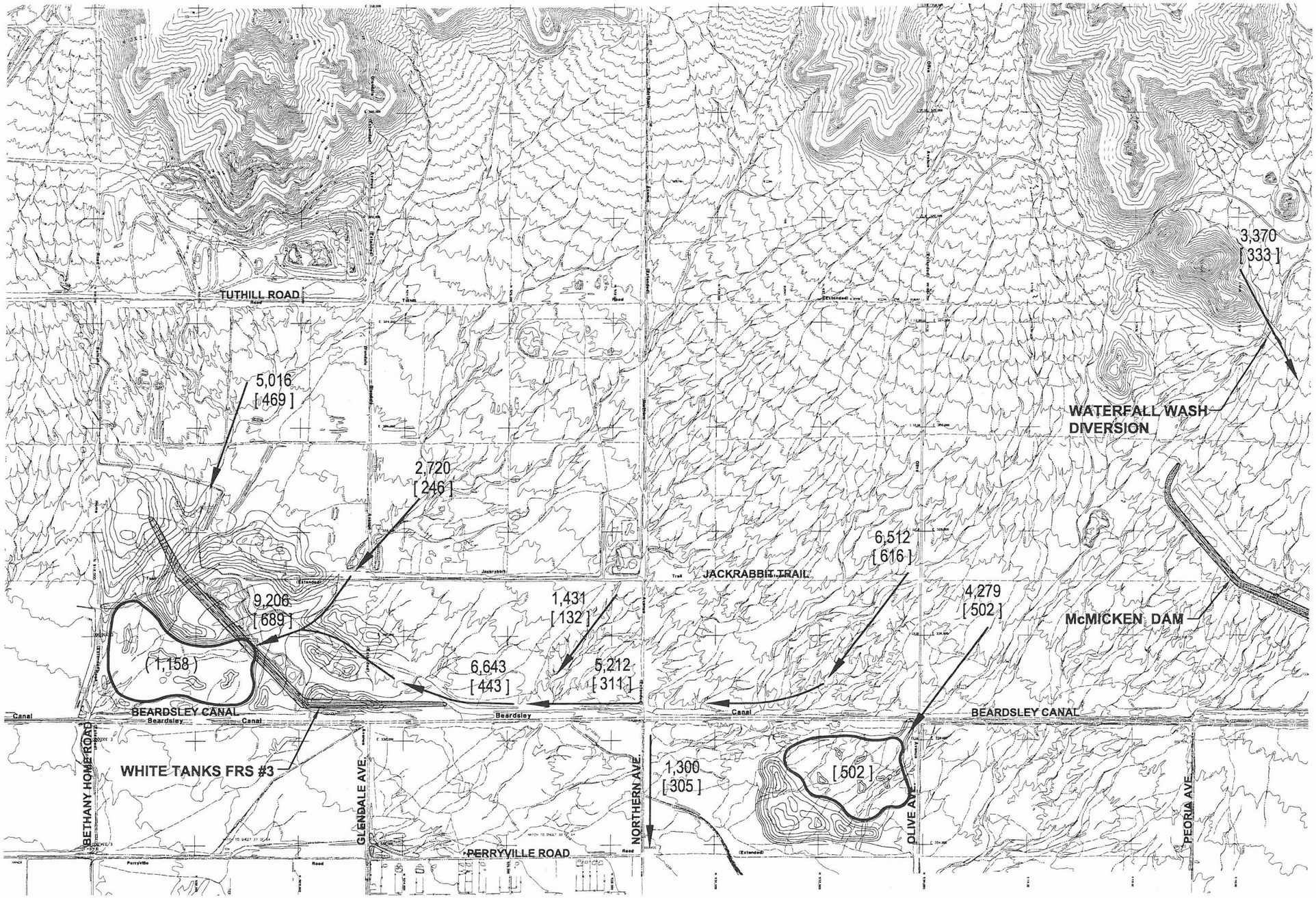
WHITE TANKS FRS #3

14534.DWG 12-6-00 IMAGE: \007\brw images\BASIN3.JPG

Dames & Moore Job No. 15448-007-058

Perspective View of Alternative 3 - Multiple Basins, Mixed-use Recreation

Figure 3-11



Legend:

8,063	Flow Rate and Direction (cfs)
[788]	Flow Volume (ac-ft)
	Basin Outline
(500)	Storage Volume (ac-ft)

Note:

All flows rates and volumes shown on this figure are based on the 100-year, 24-hour storm event.

NORTH

0 1000 2000 3000 4000
Scale in Feet

WHITE TANKS FRS #3

Flood Control District of Maricopa County

URS
Dames & Moore

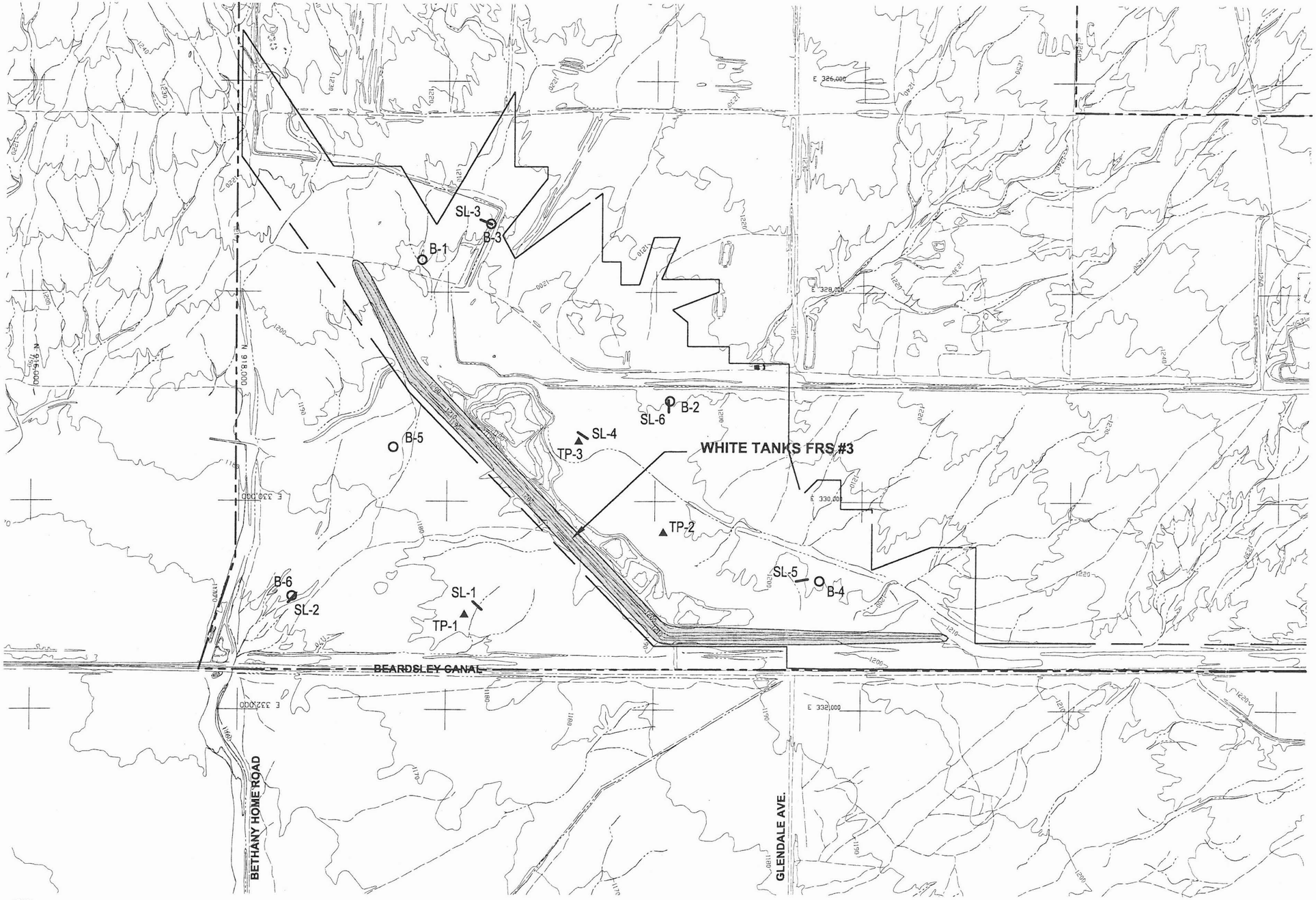
SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

A14343.DWG 12-5-00 XREF:VTOPO

Dames & Moore Job No. 15448-007-058

Alternative 3 - Flow Rates and Volumes

Figure 3-12



LEGEND:

- B-1 — Boring Location and Identification
- TP-1 — Testpit Location and Identification
- SL-1 — Seismic Line and Identification
- FRS #3 Boundary
- Study Boundary

NORTH

0 500 1000 1500 2000
Scale in Feet

WHITE TANKS FRS #3

Flood Control District of Maricopa County

URS
Dames & Moore

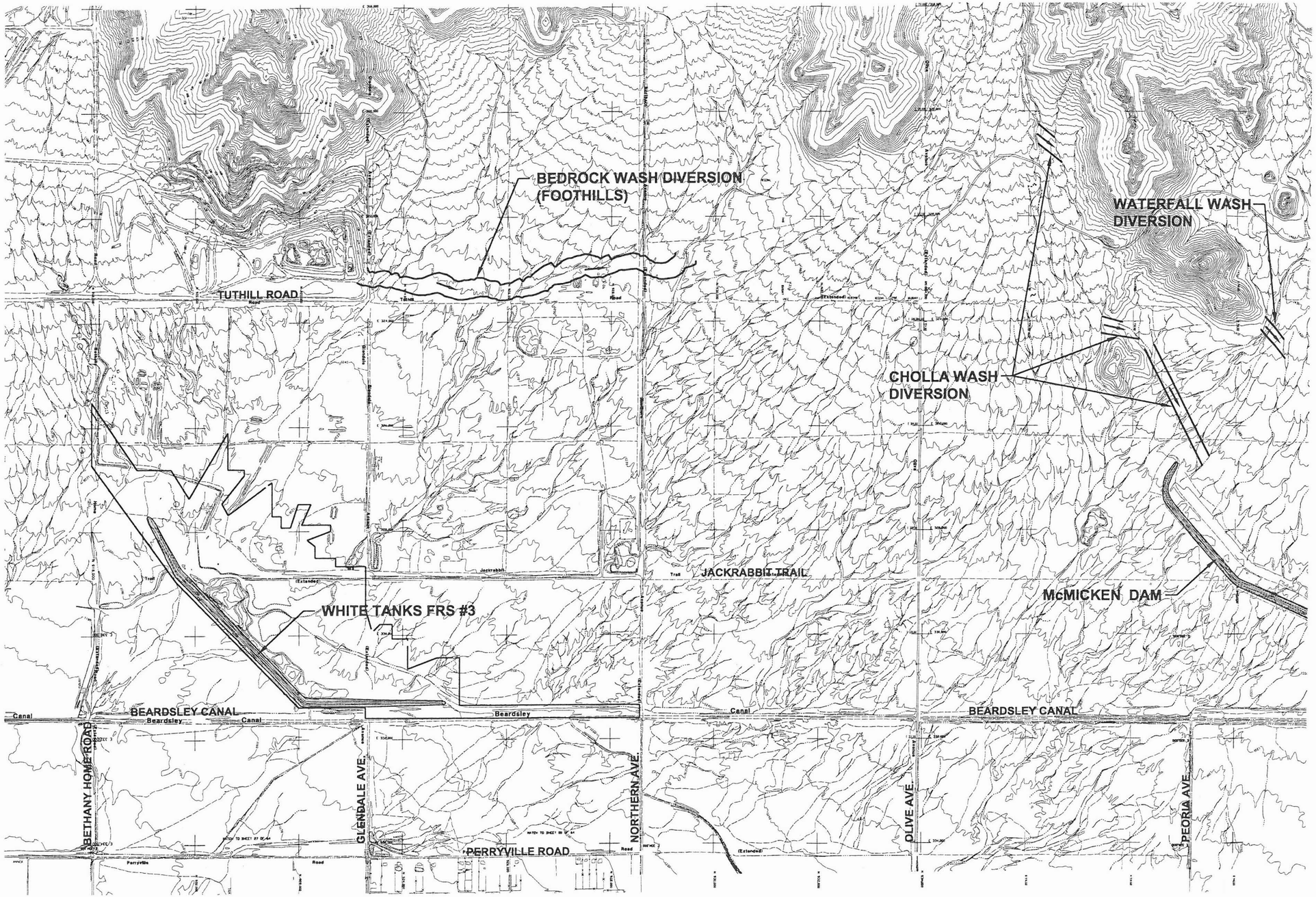
SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

A13696.DWG 12-19-00 XREF:VTOPO

Dames & Moore Job No. 15448-007-058

Location of Borings, Test Pits and Seismic Lines

Figure 4-1



NORTH

0 1000 2000 3000 4000
Scale in Feet

WHITE TANKS FRS #3

Flood Control District of Maricopa County

URS
Dames & Moore

SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

A13680.DWG 1-9-01 XREF:VTOPO

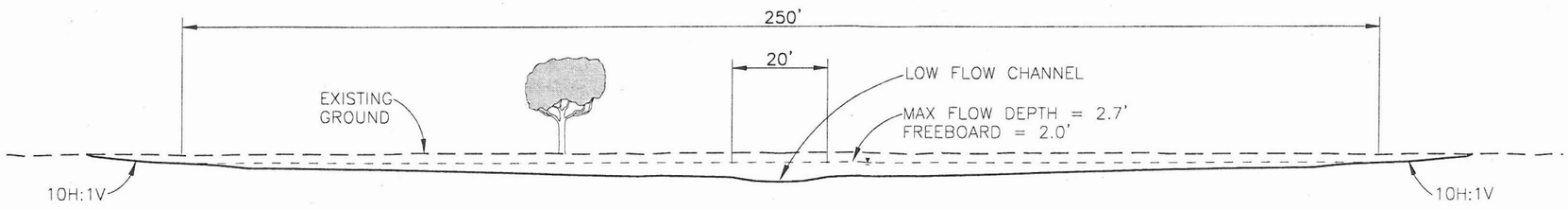
Dames & Moore Job No. 15448-007-058

Potential Diversion Locations

Figure 4-2

Typical Section

0 50 100 150 200
SCALE IN FEET



Typical Section

0 15 30 45 60
SCALE IN FEET

Flood Control District of Maricopa County

URS
Dames & Moore

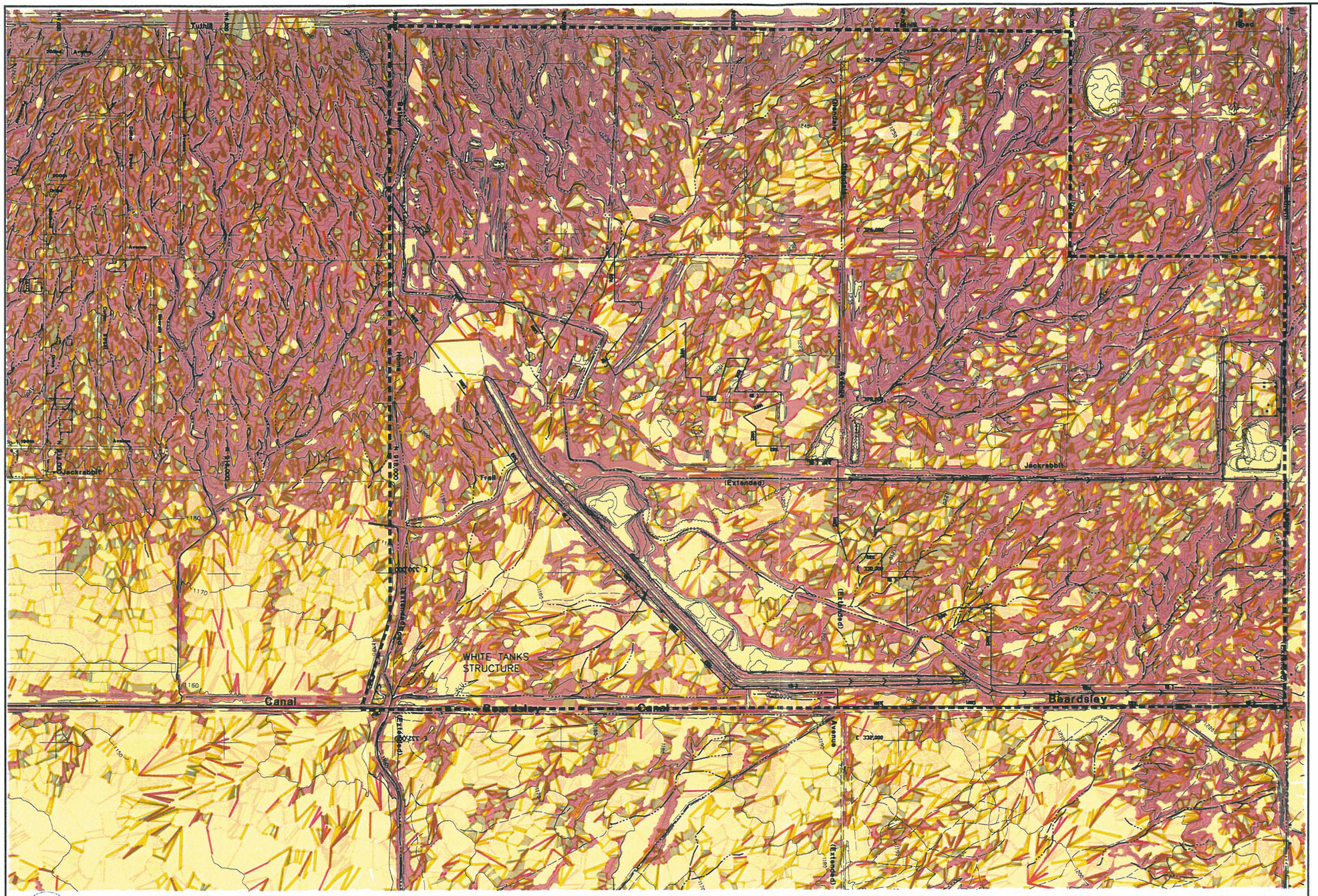
WHITE TANKS FRS # 3

A14513.DWG 1-9-01

Dames & Moore Job No. 15448-007-058

Waterfall Wash Diversion - Plan View and Section

Figure 4-3



LEGEND:

SITE SLOPE LEGEND

Color	Range Begin	Range End	Percent Coverage	Area (Sq. Ft.)
	0.00	0.50	12.2	21512161
	0.50	1.00	9.3	16373901
	1.00	1.50	15.0	26528887
	1.50	2.00	11.6	20494697
	2.00	2.50	9.3	16369710
	2.50	100.00	42.7	75464710

APPROXIMATE PROJECT BOUNDARY

SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

NORTH

0 600 1200

SCALE IN FEET
2 FOOT CONTOUR INTERVAL

WHITE TANKS FRS #3

Flood Control District of Maricopa County

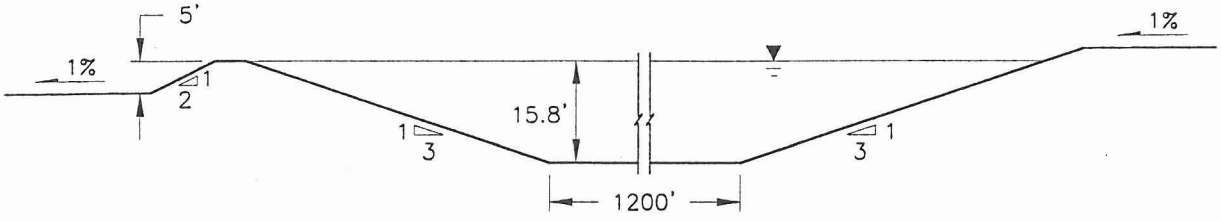
URS
Dames & Moore

SLOPEMAP.DWG 1-10-01

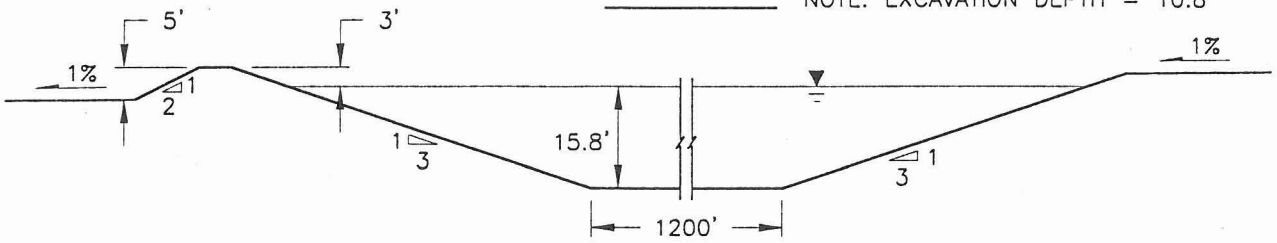
Dames & Moore Job No. 15448-007-058

Slope Classification Site Plan

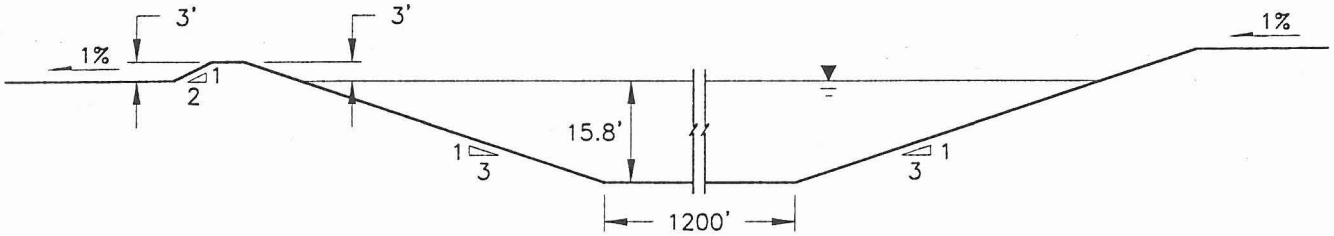
Figure 4-4



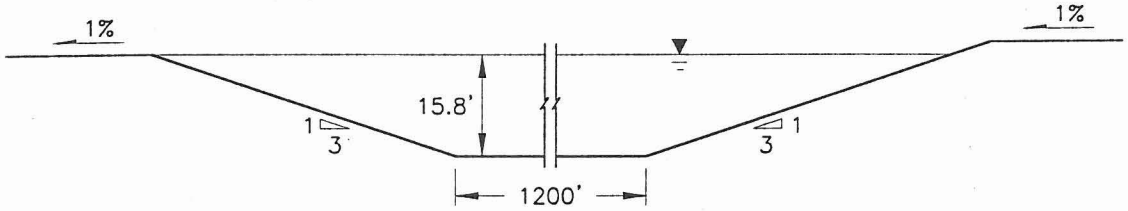
OPTION I NOTE: EXCAVATION DEPTH = 10.8'



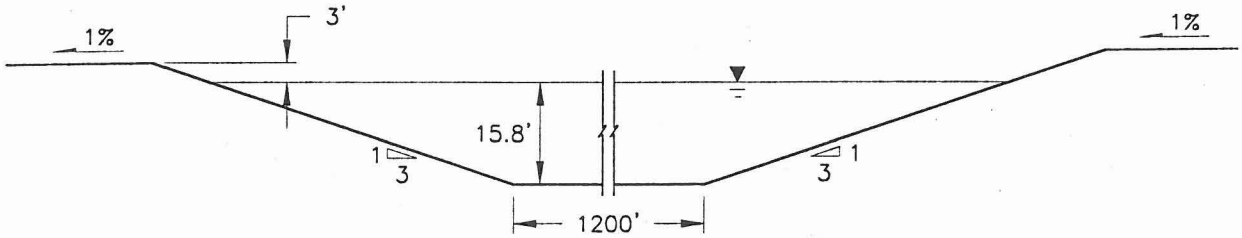
OPTION II NOTE: EXCAVATION DEPTH = 13.8'



OPTION III NOTE: EXCAVATION DEPTH = 15.8'



OPTION IV NOTE: EXCAVATION DEPTH = 15.8'



OPTION V NOTE: EXCAVATION DEPTH = 18.8'

GENERAL NOTES:

1. PARTIAL DRAINAGE.
2. BASIN DIMENSIONS = 1200'x4800'.
3. A DESCRIPTION OF THE BASIN OPTIONS IS PROVIDED IN SECTION 4.2.4 OF THE REPORT.

Flood Control District of Maricopa County

URS

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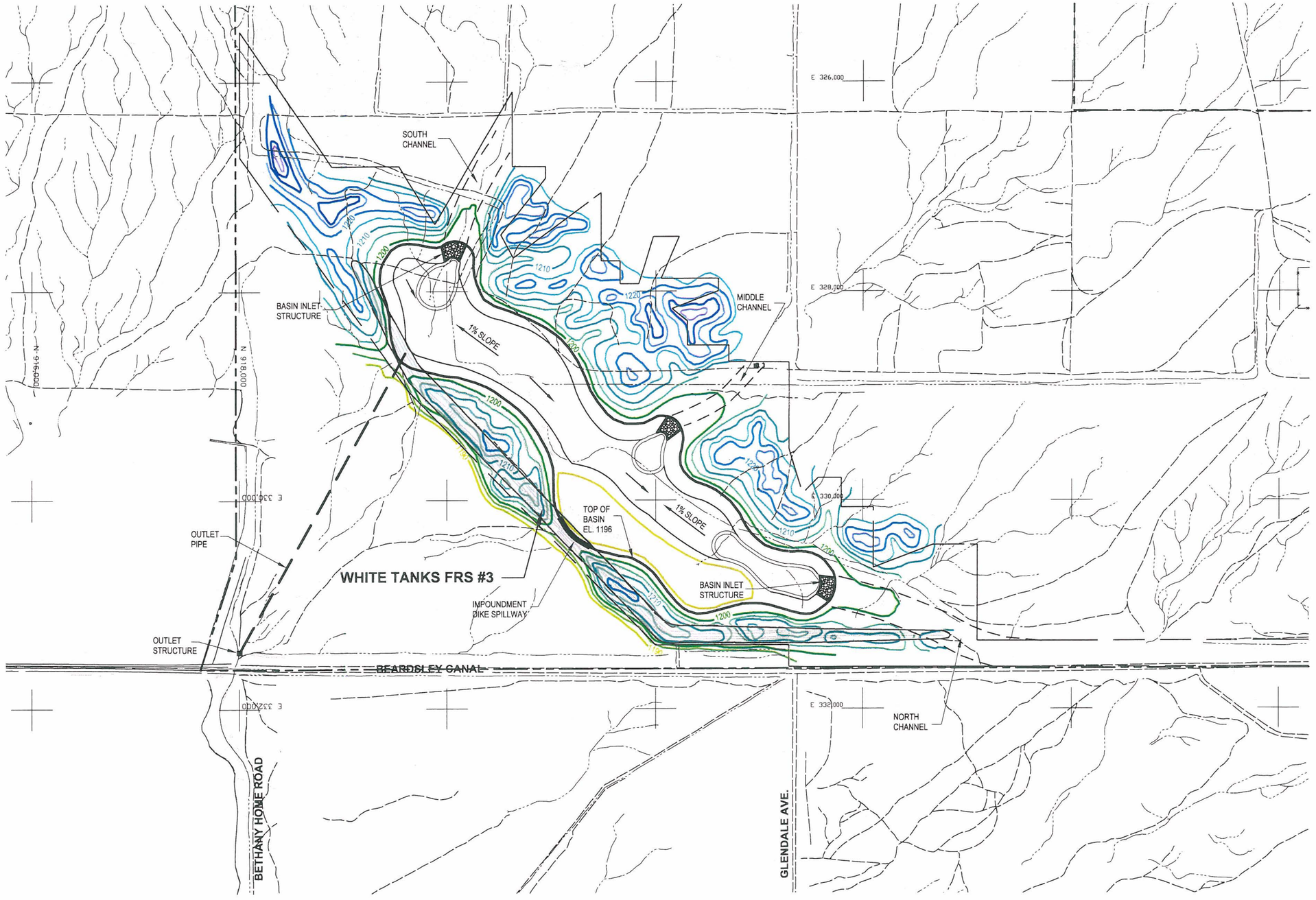
WHITE TANKS FRS # 3

A13681.DWG 1-9-01

Dames & Moore Job No. 15448-007-058

Basin Parametric Evaluation - Basin Option Cross-Sections

Figure 4-5



LEGEND:

- BASIN OUTLINE
- PROPOSED CONTOUR (ft.)
  - 1235
  - 1230
  - 1225
  - 1220
  - 1215
  - 1210
  - 1205
  - 1200
  - 1195
  - 1190
- EXISTING FCDMC PROPERTY BOUNDARY
- STUDY BOUNDARY
- SEDIMENT BASIN

NORTH

0 500 1000 1500 2000
Scale in Feet

WHITE TANKS FRS #3

Flood Control District of Maricopa County

URS
Dames & Moore

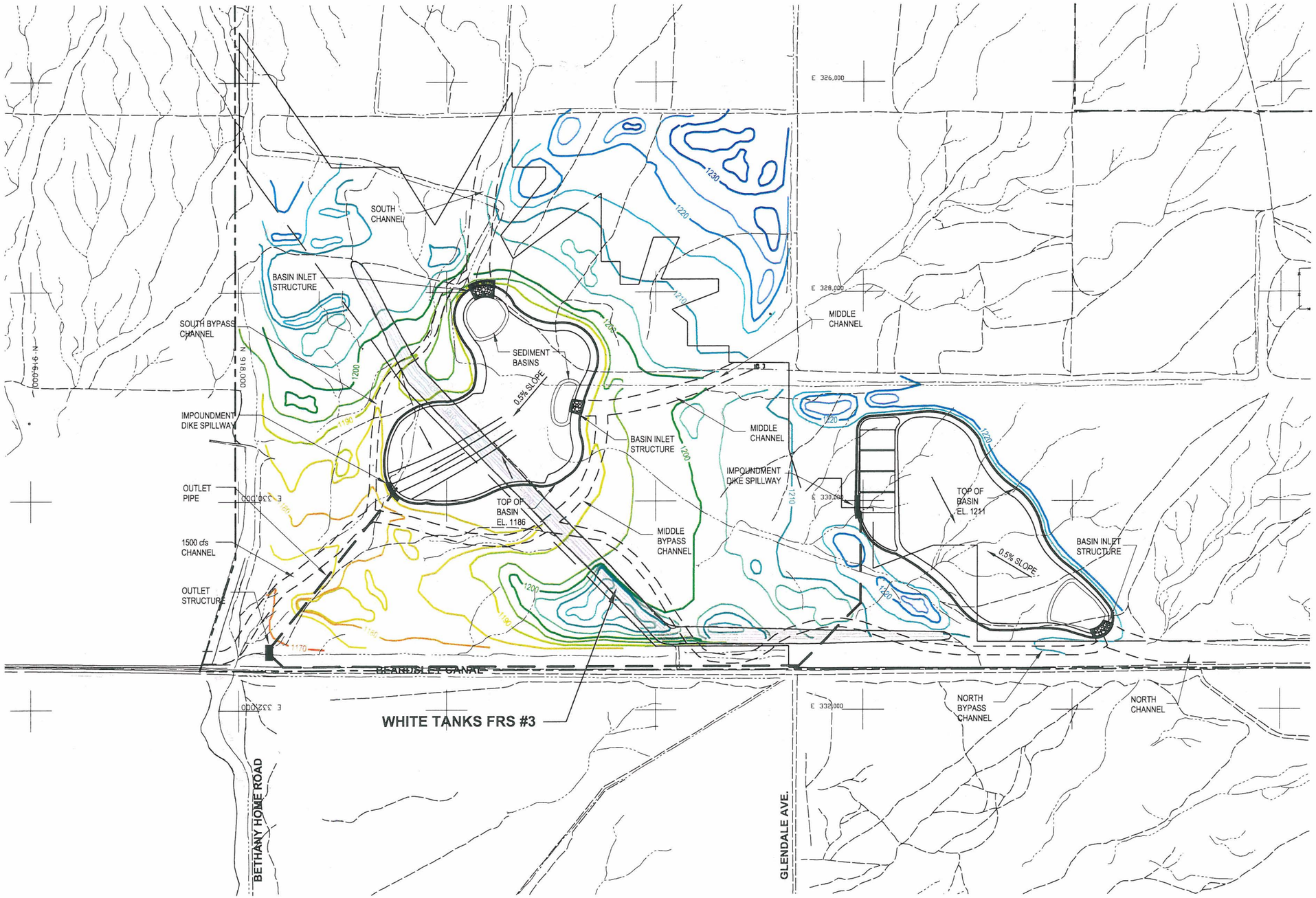
SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

A14344.DWG 1-10-01 XREF:\TOPO

Dames & Moore Job No. 15448-007-058

Alternative 1 - Proposed Topography and Piping Outline

Figure 4-6



LEGEND:

- BASIN OUTLINE
- PROPOSED CONTOUR (ft.)
  - 1235
  - 1230
  - 1225
  - 1220
  - 1215
  - 1210
  - 1205
  - 1200
  - 1195
  - 1190
  - 1185
  - 1180
  - 1175
  - 1170
- EXISTING FCDMC PROPERTY BOUNDARY
- STUDY BOUNDARY
- SEDIMENT BASIN

NORTH

0 500 1000 1500 2000
Scale in Feet

WHITE TANKS FRS #3

SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

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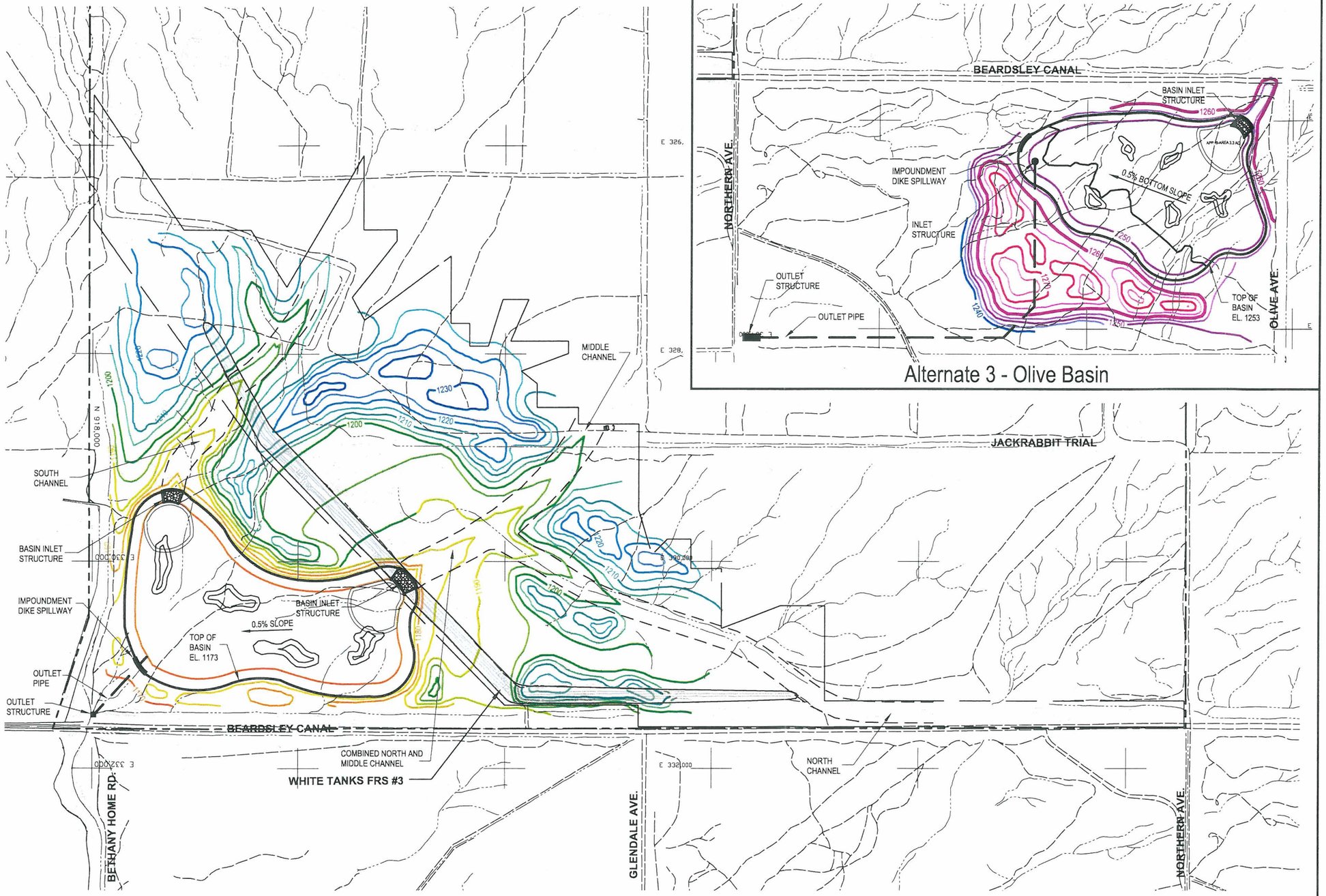
A14345.DWG 1-10-01 XREF-VTOPO

Dames & Moore Job No. 15448-007-058

Alternative 2 - Proposed Topography and Piping Outline

Figure 4-7



LEGEND:

- BASIN OUTLINE
- PROPOSED CONTOUR (ft.)
  - 1260
  - 1255
  - 1250
  - 1245
  - 1240
  - 1235
  - 1230
  - 1225
  - 1220
  - 1215
  - 1210
  - 1205
  - 1200
  - 1195
  - 1190
  - 1185
  - 1180
  - 1175
- EXISTING FCDMC PROPERTY BOUNDARY
- STUDY BOUNDARY
- SEDIMENT BASIN

NORTH

0 500 1000 1500 2000
Scale in Feet

WHITE TANKS FRS #3

SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

Flood Control District of Maricopa County

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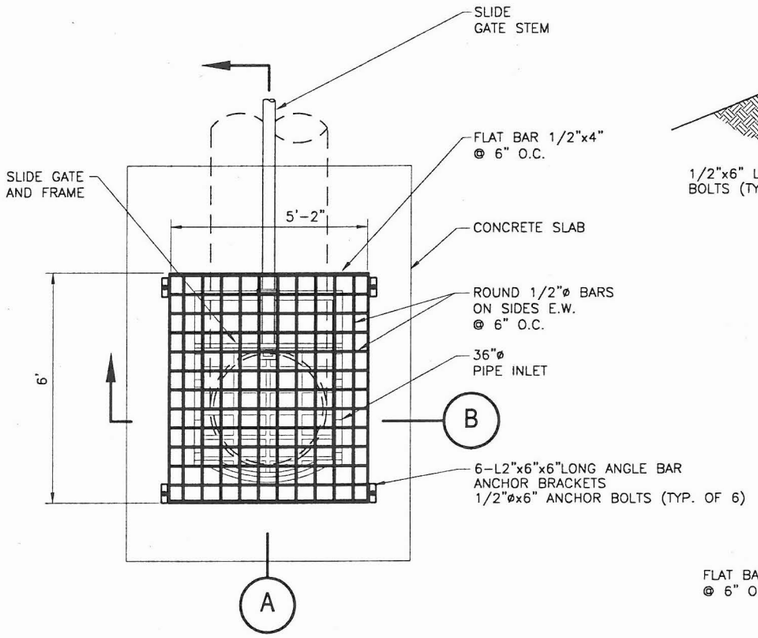
A14346.DWG 1-10-01 XREF:VTOPO

Dames & Moore Job No. 15448-007-058

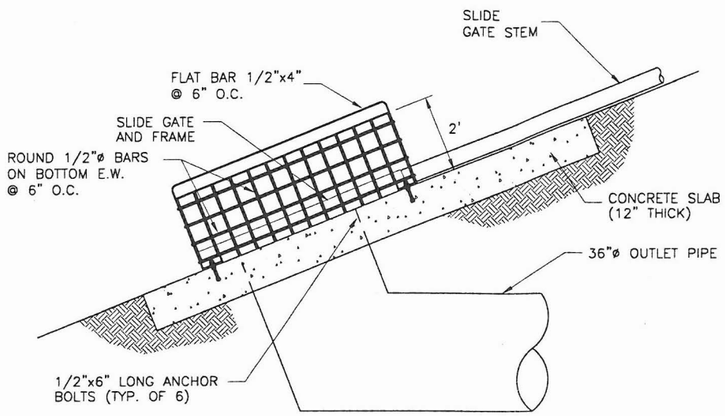
Alternative 3 - Proposed Topography and Piping Outline

Figure 4-8



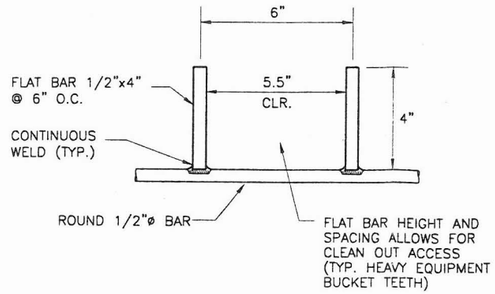
Typical Pipe Inlet Trash Rack Plan View

Not to Scale



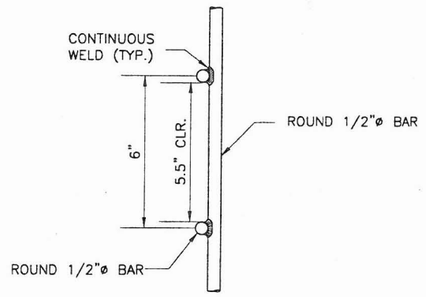
Section A

Not to Scale



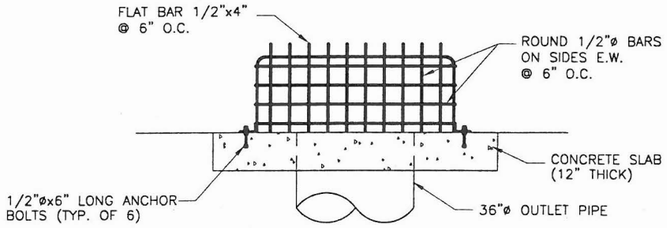
Top of Trash Rack Detail

Not to Scale



Side of Trash Rack Detail

Not to Scale



Section B

Not to Scale

Flood Control District of Maricopa County

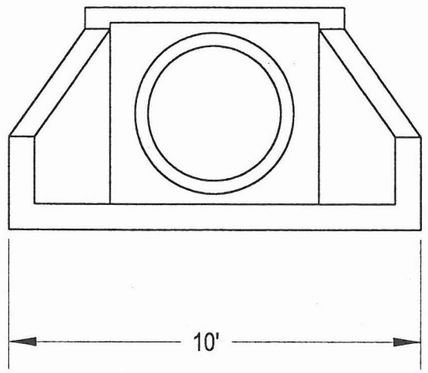
URS Dames & Moore

A14371.DWG 1-10-01

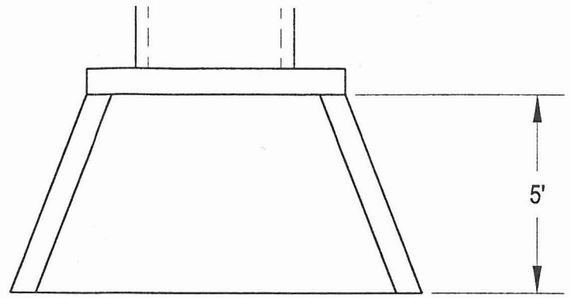
Dames & Moore Job No. 15448-007-058

Low-level Drain - Typical Inlet Structure

Figure 4-9



Front View
Not to Scale



Plan View
Not to Scale

Typical Section
Not to Scale

Flood Control District of Maricopa County

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A14367.DWG 10-30-00

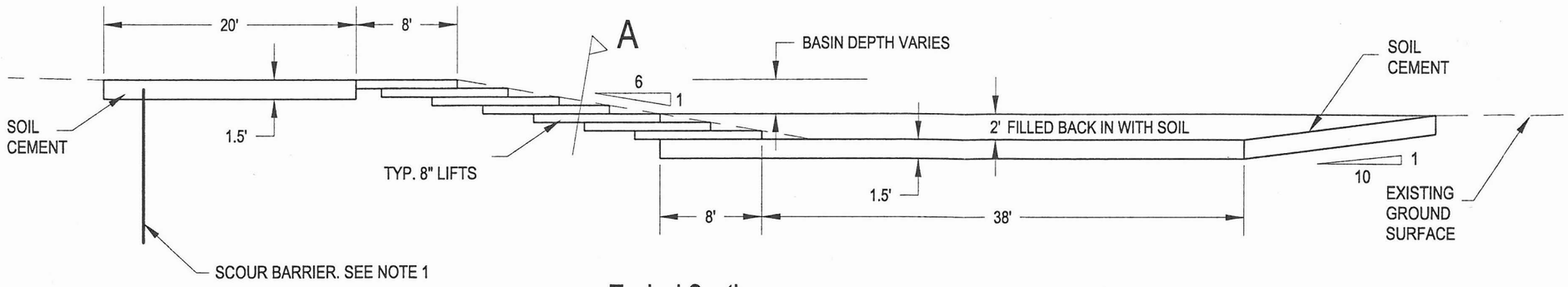
Dames & Moore Job No. 15448-007-058

NORTH

0 5 10 15 20
SCALE IN MILES

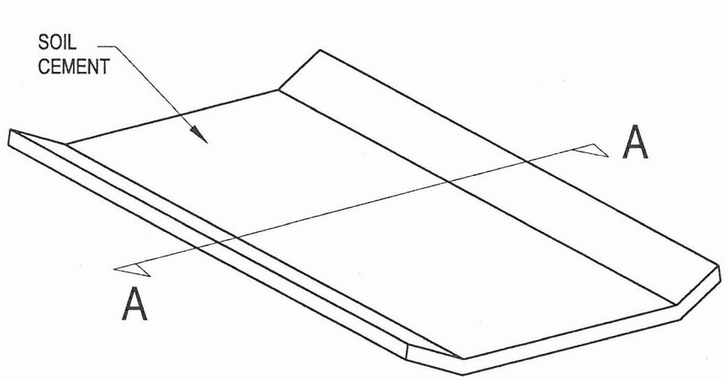
WHITE TANKS
FRS # 3

Low-level Drain - Typical Outlet Structure
Figure 4-10



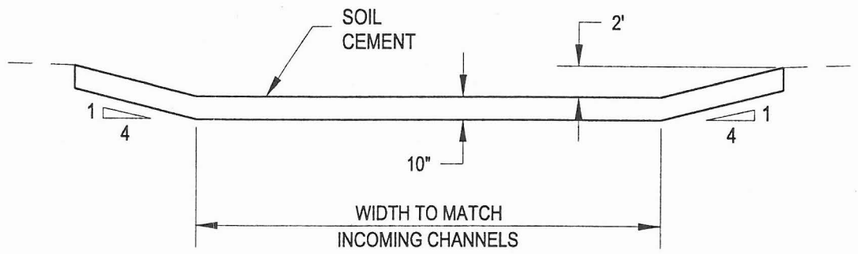
Typical Section

Not to Scale



Isometric View

Not to Scale

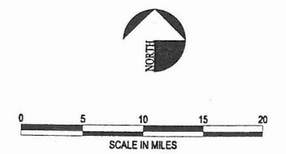


Section A

Not to Scale

Notes:

1. Scour barrier depth may vary depending on flow rates in wash. The barrier could consist of metal sheet pile or trench filled with low strength concrete.



WHITE TANKS FRS # 3

Flood Control District of Maricopa County

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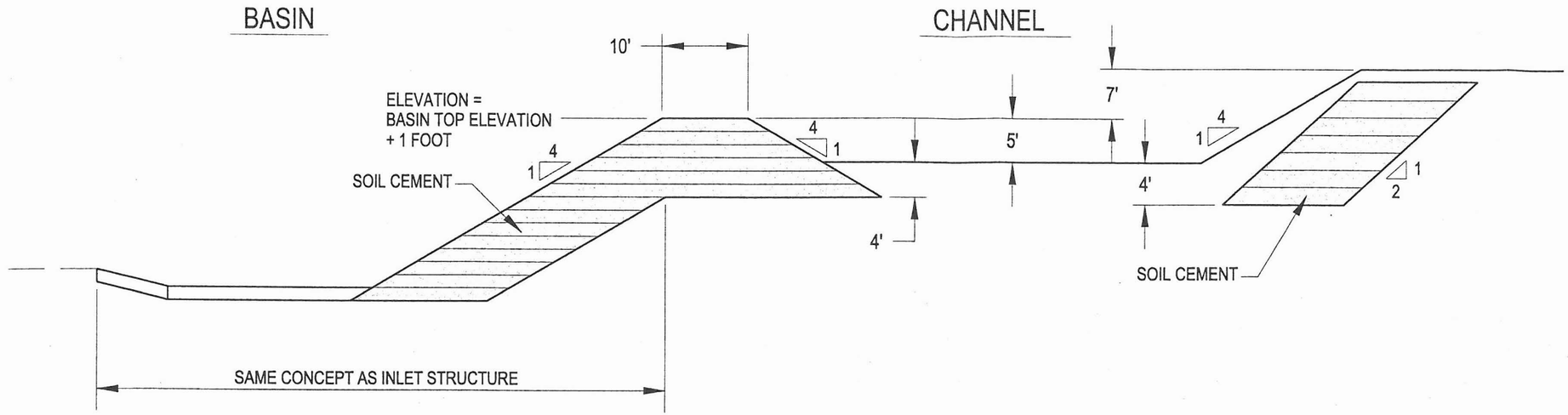
A14373.DWG 1-10-01

Dames & Moore Job No. 15448-007-058

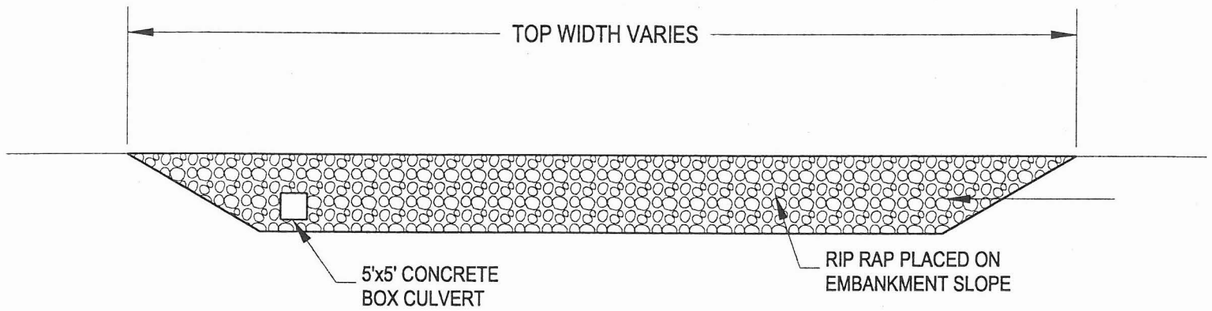
Inlet Structure - Typical Design

Figure 4-11



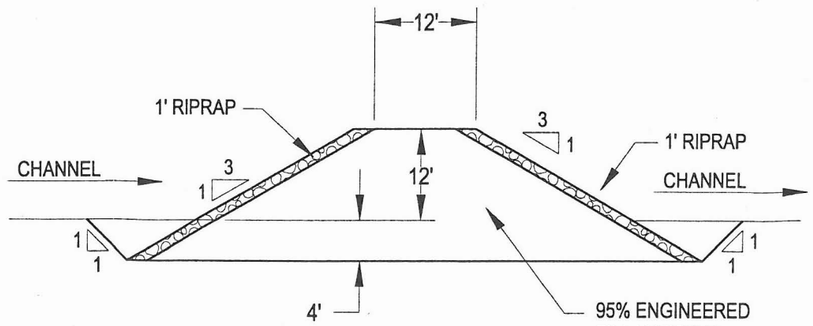
Typical Section

Not to Scale



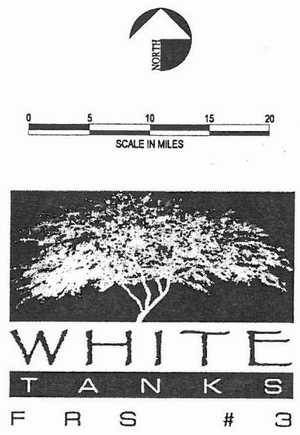
Channel Section

Not to Scale



Embankment Section

Not to Scale



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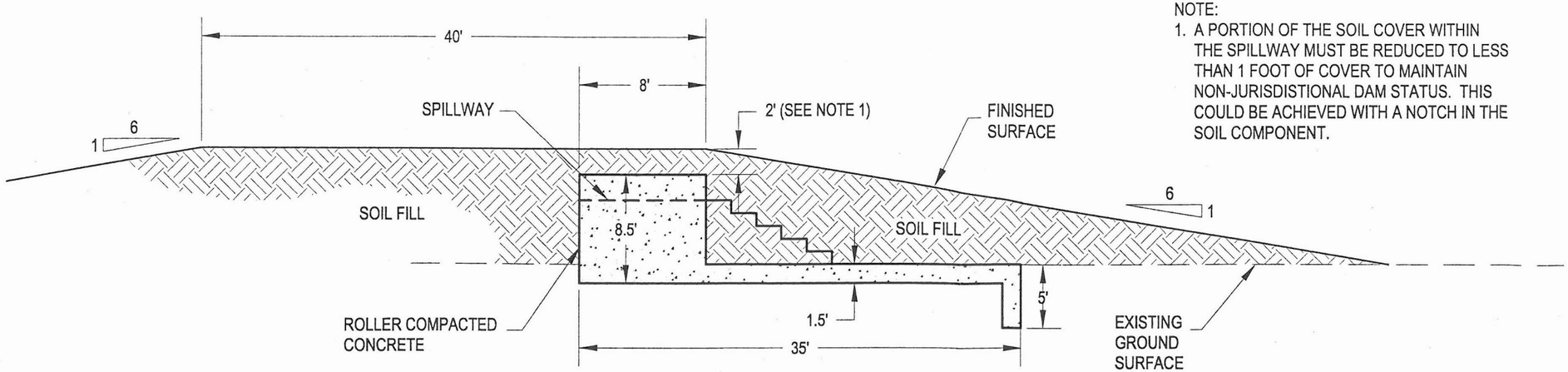
A14368.DWG 1-10-01

Dames & Moore Job No. 15448-007-058

Typical Inlet / Side Channel Weir

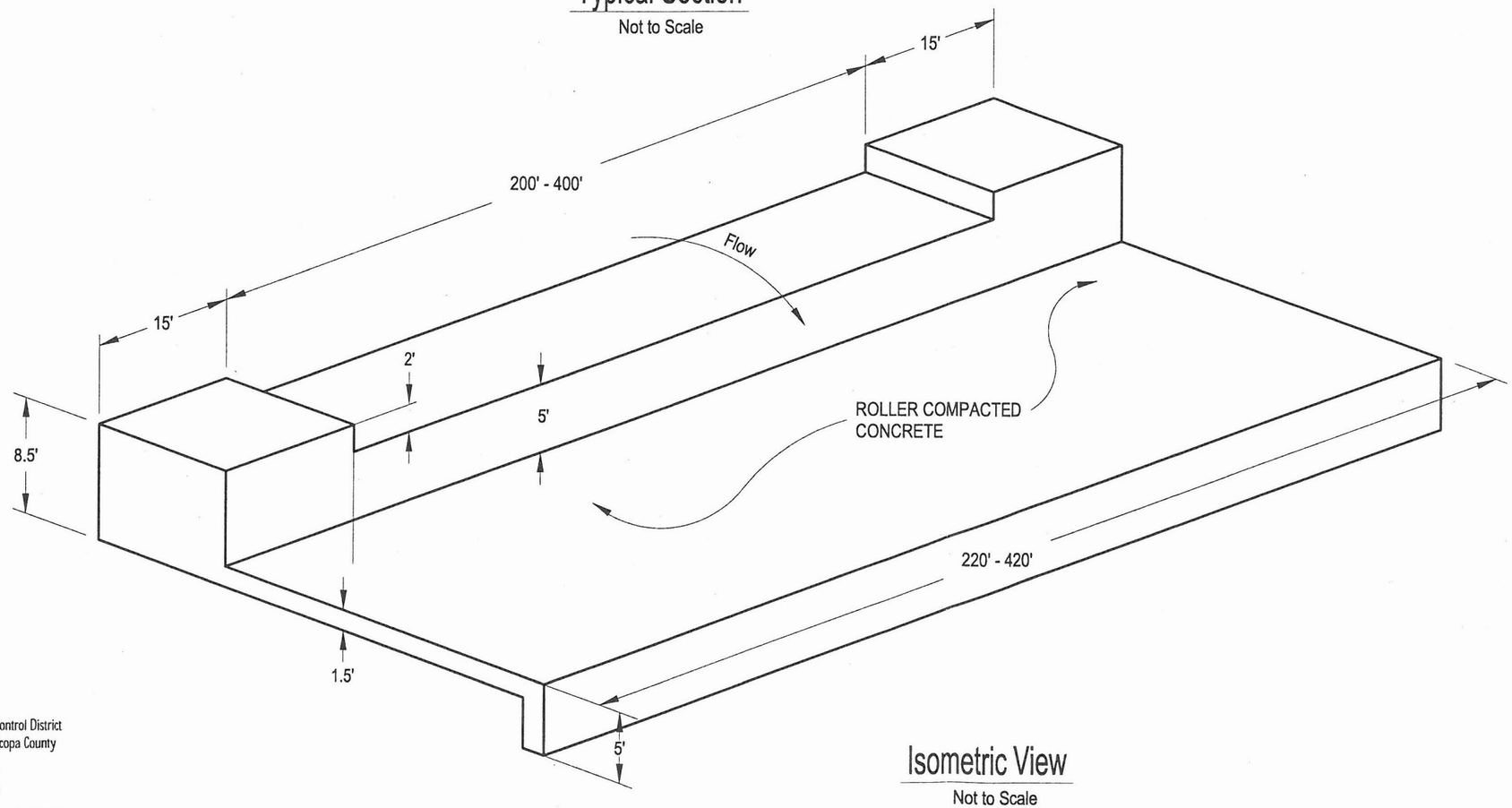
Figure 4-12

NOTE:
1. A PORTION OF THE SOIL COVER WITHIN THE SPILLWAY MUST BE REDUCED TO LESS THAN 1 FOOT OF COVER TO MAINTAIN NON-JURISDISTIONAL DAM STATUS. THIS COULD BE ACHIEVED WITH A NOTCH IN THE SOIL COMPONENT.



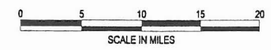
Typical Section

Not to Scale



Isometric View

Not to Scale



WHITE TANKS FRS # 3

Flood Control District of Maricopa County

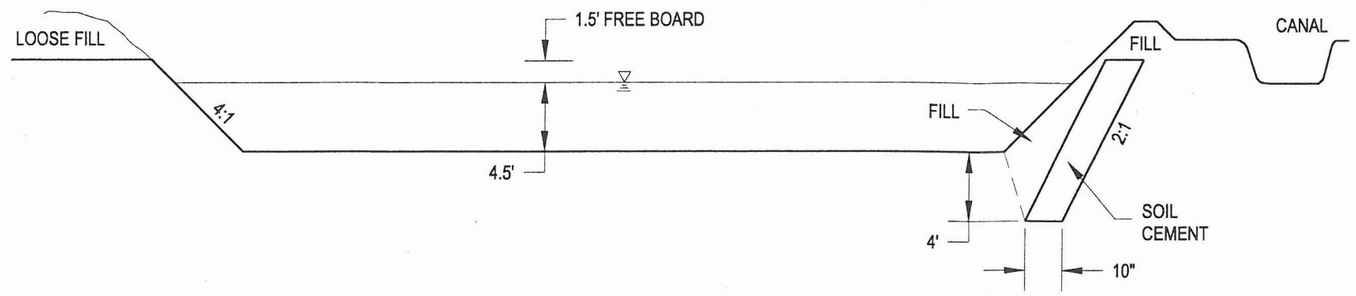
URS Dames & Moore

A14370.DWG 1-10-01

Dames & Moore Job No. 15448-007-058

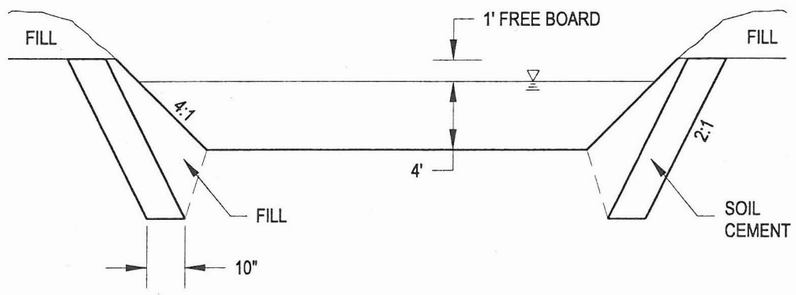
Typical Impoundment Dike

Figure 4-13



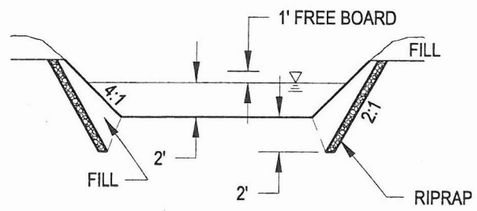
Channel with Soil Cement - One Side

Not to Scale



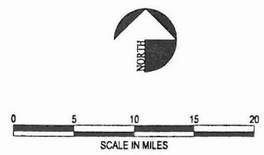
Channel with Soil Cement - Both Sides

Not to Scale



By-Pass Channel Section

Not to Scale



WHITE TANKS FRS #3

Flood Control District of Maricopa County

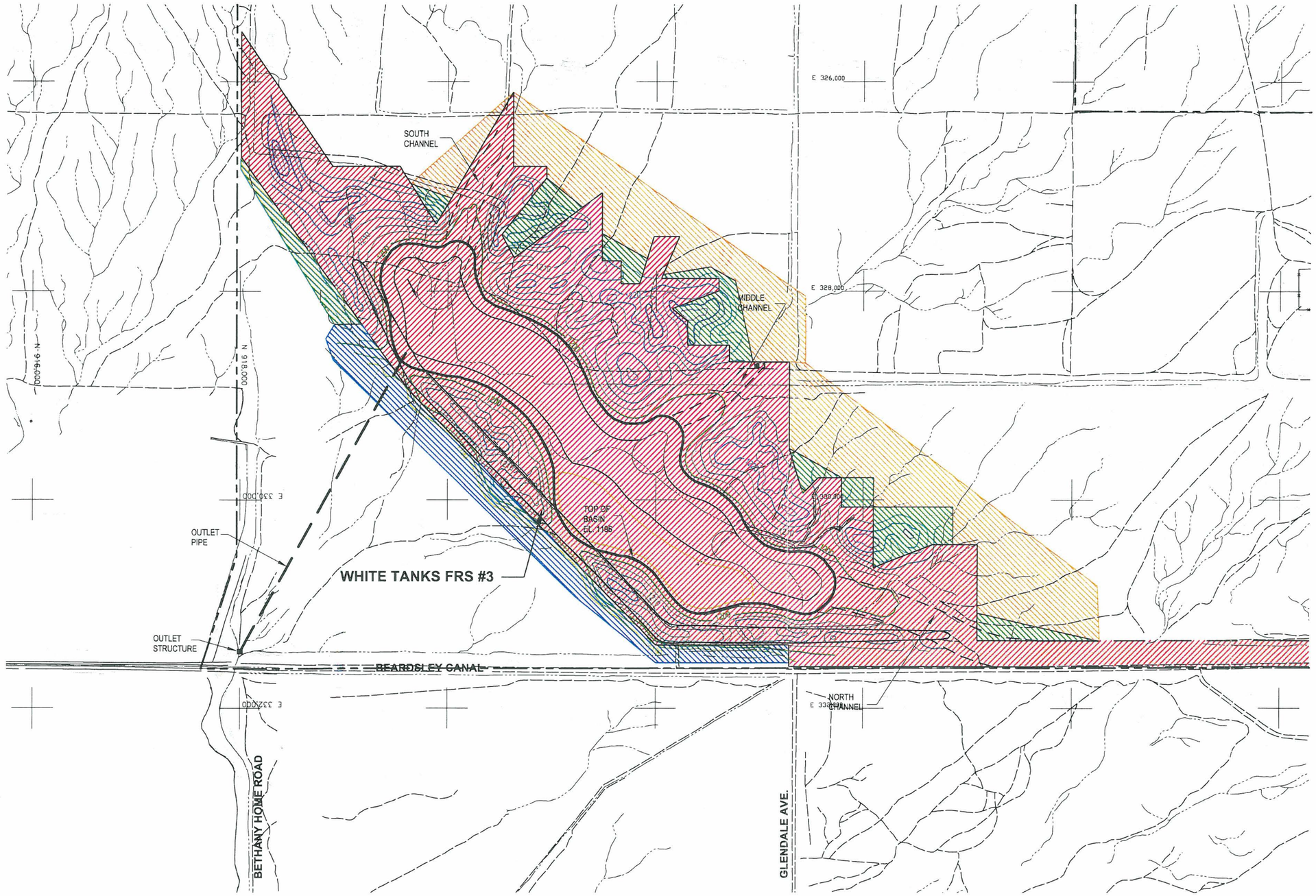
URS Dames & Moore

A14369.DWG 1-10-01

Dames & Moore Job No. 15448-007-058

Typical Channel Cross Sections

Figure 4-14



LEGEND:

- Maricopa Water District Property
- District Property
- State Trust Land
- 25% Extra State Land

NORTH

0 500 1000 1500 2000

Scale in Feet

WHITE TANKS FRS #3

Flood Control District of Maricopa County

URS Dames & Moore

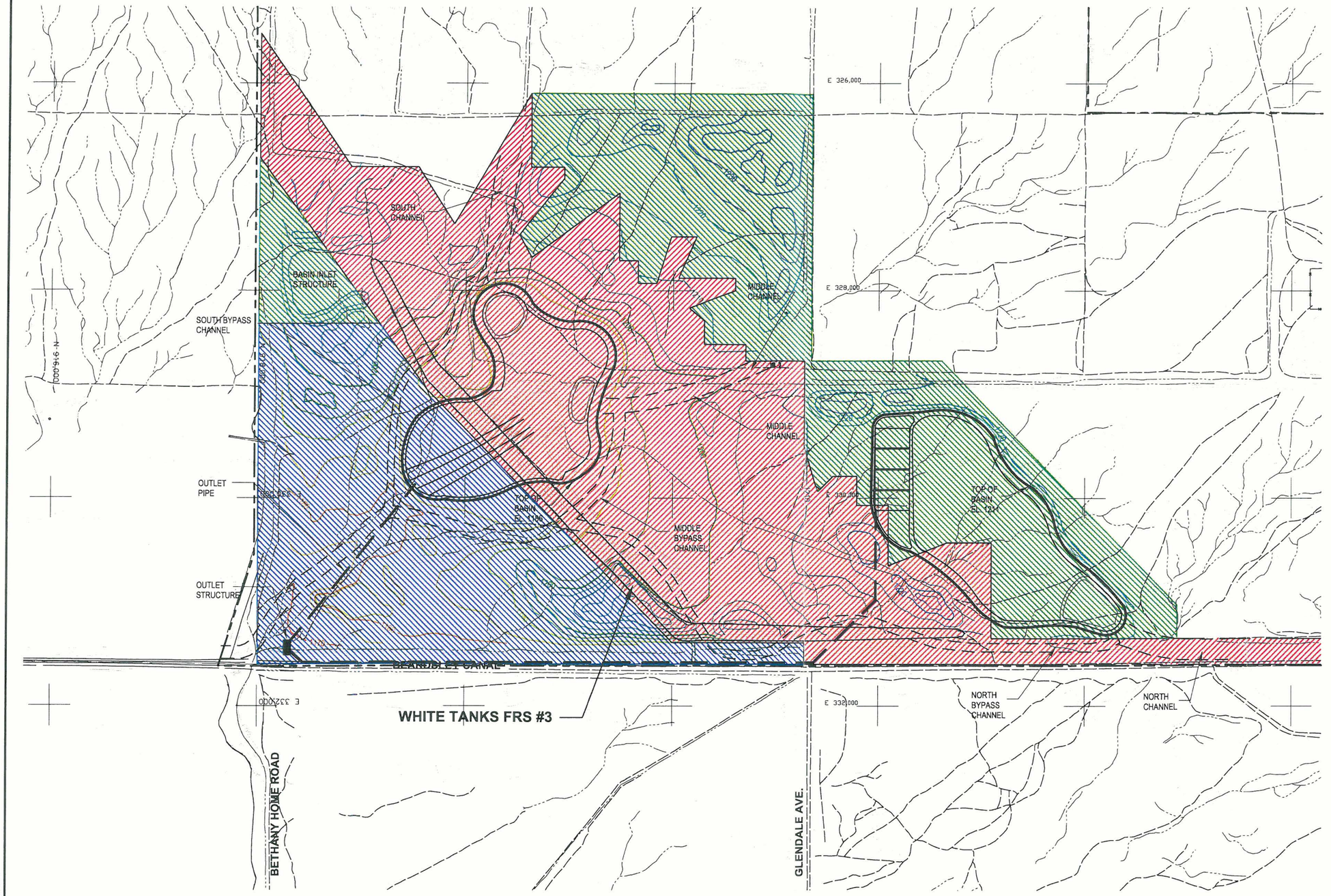
SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

A14411.DWG 1-10-01 XREF:\TOPO

Dames & Moore Job No. 15448-007-058

Alternative 1 - Land Acquisition

Figure 4-15



LEGEND:

- Maricopa Water District Property
- District Property
- State Trust Land

NORTH

0 500 1000 1500 2000
Scale in Feet

WHITE TANKS FRS #3

Flood Control District of Maricopa County

URS Dames & Moore

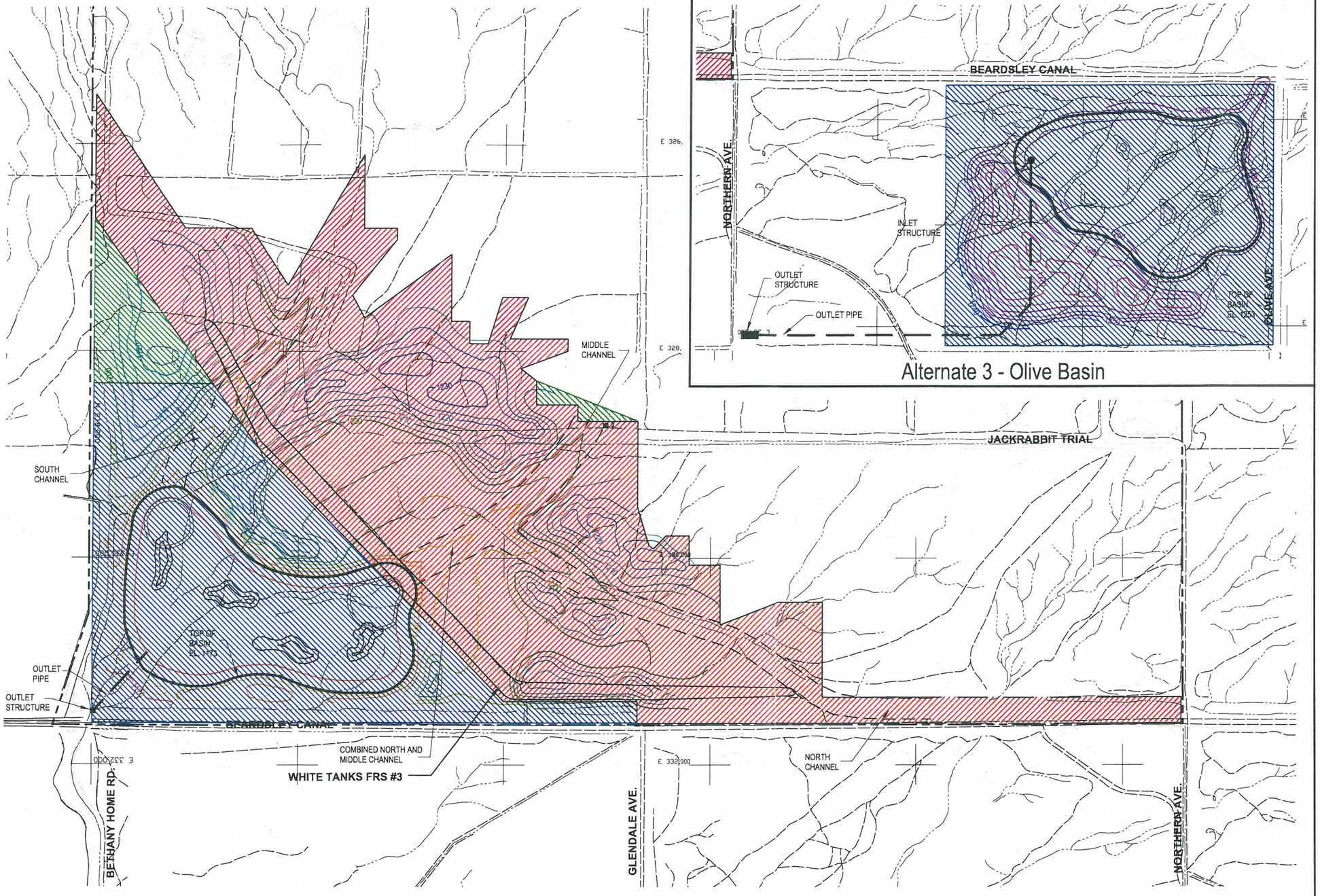
SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

A14412.DWG 1-10-01 XREF:\TOPO

Dames & Moore Job No. 15448-007-058

Alternative 2 - Land Acquisition

Figure 4-16



LEGEND:

- Maricopa Water District Property
- District Property
- State Trust Land

NORTH

0 500 1000 1500 2000

Scale in Feet

WHITE TANKS FRS #3

SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

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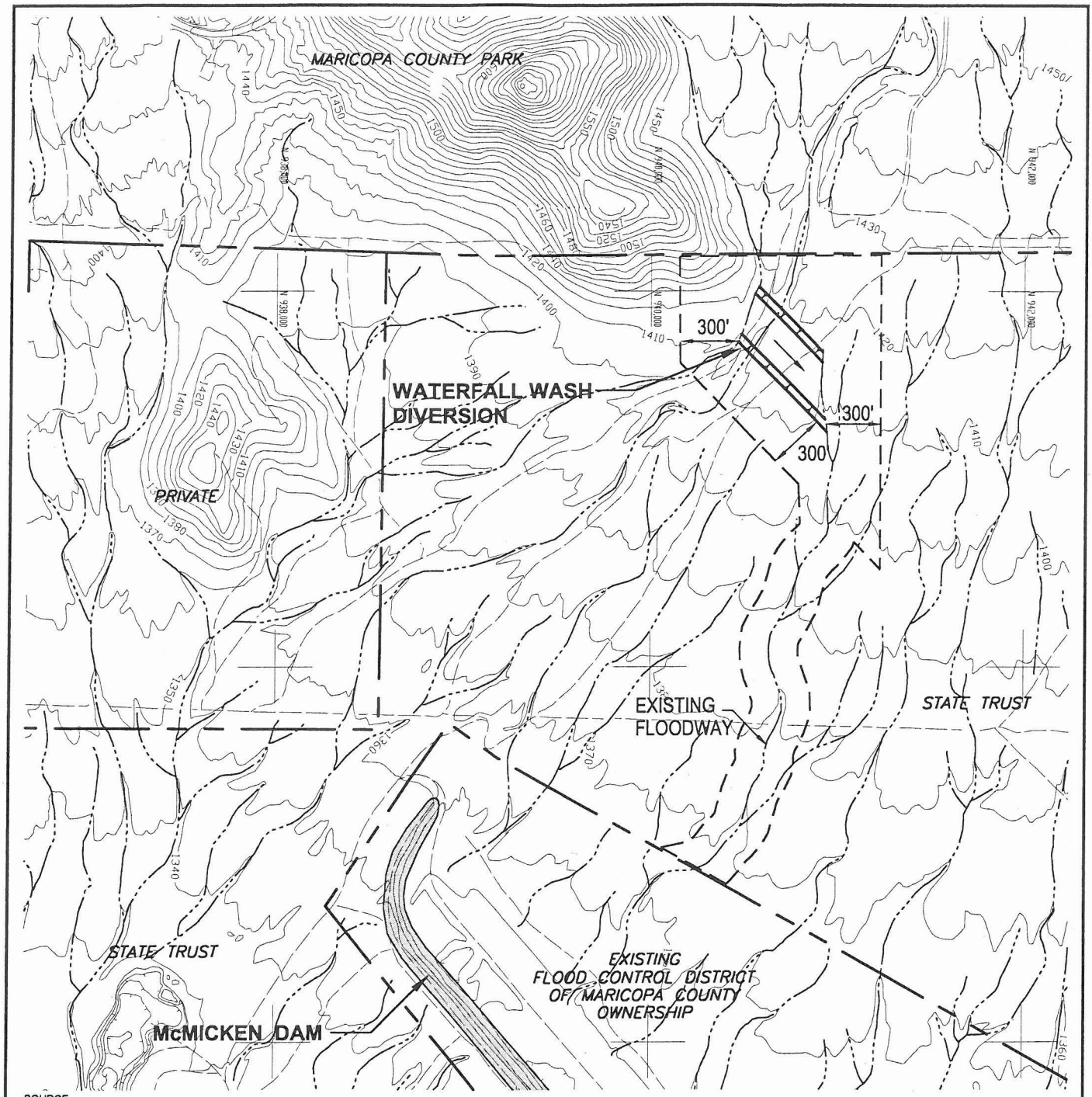
A14413.DWG 1-10-01 XREF-VTOPO

Dames & Moore Job No. 15448-007-058

Alternative 3 - Land Acquisition

Figure 4-17



SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

Legend:

Existing Land Ownership Boundary

White Tanks FRS #3 Study Area / Approximate Land Acquisition Boundary

Note:

Proposed land acquisition along existing floodway is based on a total width of 300 feet (150 feet in each direction from the centerline)

White Tanks FRS #3 Basin Alternatives Analysis

Flood Control District of Maricopa County

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NORTH

0 400 800 1200 1600
Scale in Feet

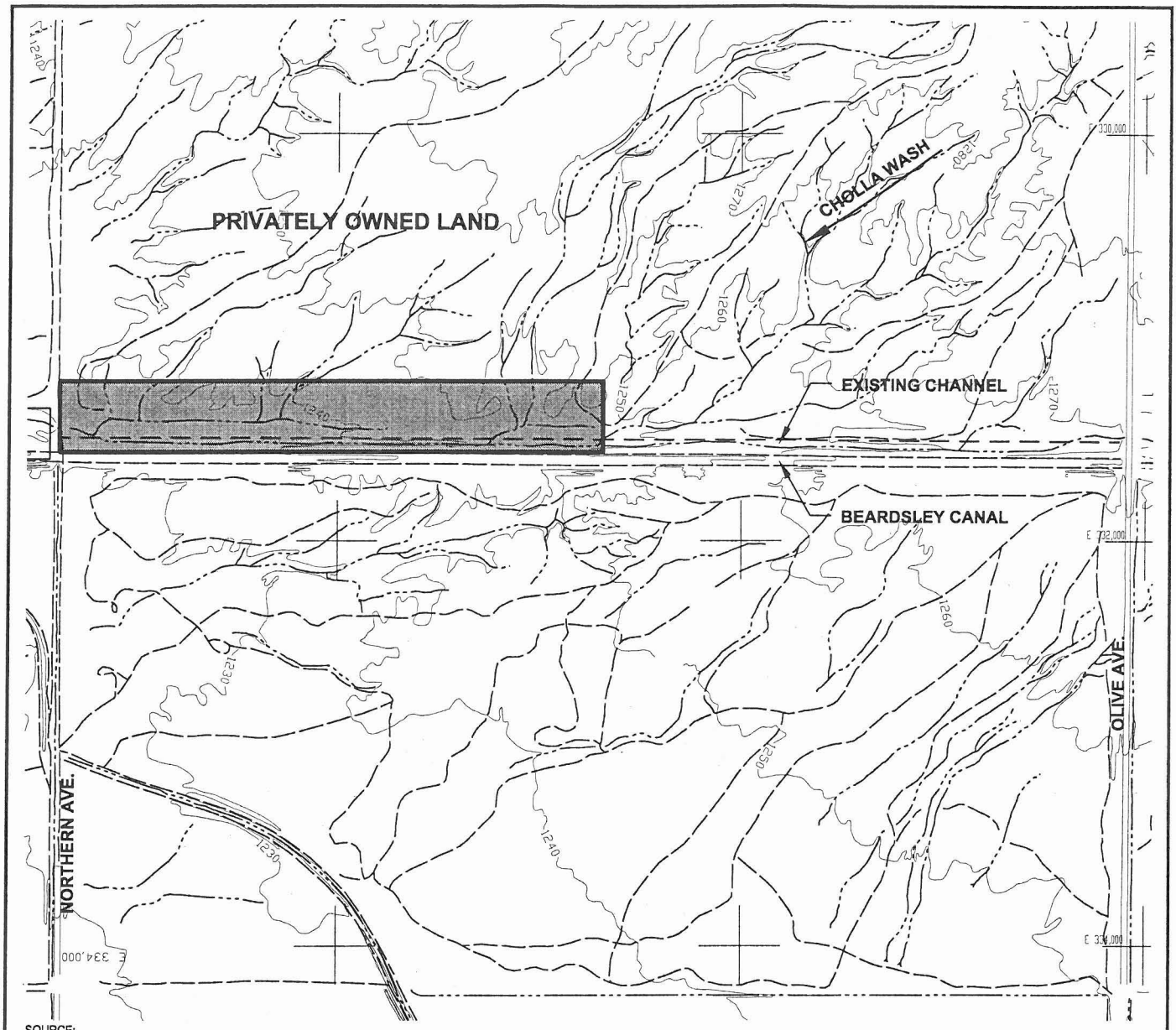
WHITE TANKS FRS # 3

A13981.DWG 1-10-01

Dames & Moore Job No. 15448-007-058

Waterfall Wash Diversion Study Area/Land Acquisition Boundary

Figure 4-18



SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

Legend:
- White Tanks FRS #3 Study Area
- Improved Channel

NORTH

0 400 800 1200 1600
Scale in Feet

ALTERNATIVE	WIDTH OF CHANNEL (ft)	MINIMUM WIDTH OF LAND ACQUISITION (ft)	ESTIMATED LAND ACQUISITION (Acres)
1	200	350	22
2	150	300	19
3	150	300	19

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WHITE TANKS FRS #3

A14572.DWG 1-10-01

Dames & Moore Job No. 15448-007-058

North Inlet Channel Improvement Outline

Figure 4-19

Pt. A

Beardsley Canal

Perryville Road

Citrus Rd.

Glendale Ave.

Bethany Home Rd.

Glendale Ave.

Northern Ave.

Olive Ave.

Legend

- Canal
- Contours
- Arterial Roads
- Proposed Contours
- Basin Outline
- Existing Half PMF
- Alternative 1 Half PMF

Note:

The breakout at Point A across the Beardsley Canal during the half-PMF will be reduced with the improvement of the North Inlet Channel. The flood limits following channel improvement are not shown.

NORTH

0 0.5 1

Scale in Miles

WHITE TANKS FRS #3

Flood Control District of Maricopa County

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Dames & Moore Job No. 15448-007-058

Alternative 1 - Half PMF Routing

Figure 4-20

Pt. A

Beardsley Canal

Perryville Road

Citrus Rd.

Glendale Ave.

Bethany Home Rd.

Glendale Ave.

Northern Ave.

Olive Ave.

Legend

- Canal
- Contours
- Arterial Roads
- Proposed Contours
- Basin Outline
- Existing Half PMF
- Alternative 2 Half PMF

Note:

The breakout at Point A across the Beardsley Canal during the half-PMF will be reduced with the improvement of the North Inlet Channel. The flood limits following channel improvement are not shown.

NORTH

0 0.5 1

Scale in Miles

WHITE TANKS FRS #3

Flood Control District of Maricopa County

URS

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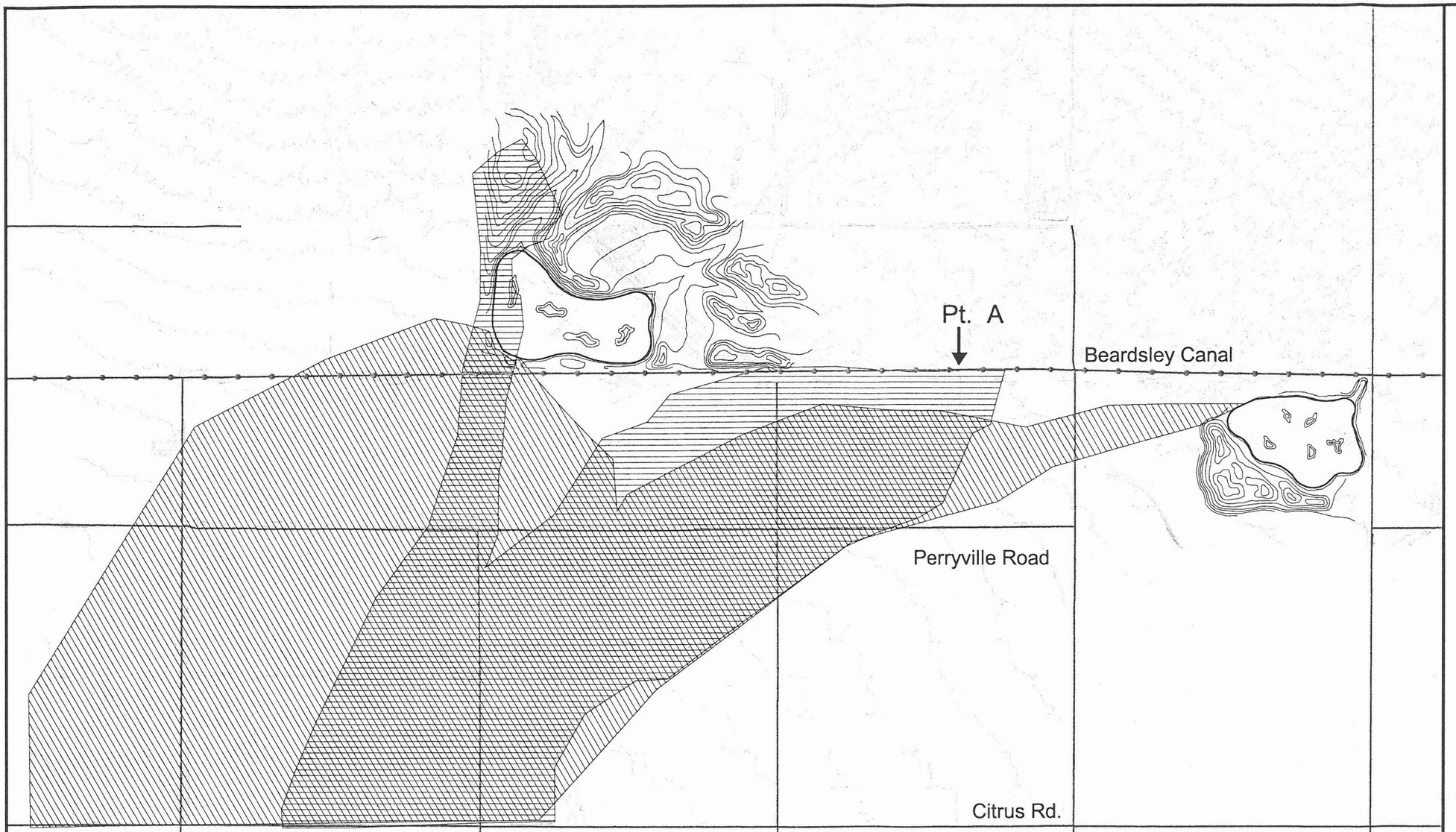
Dames & Moore Job No. 15448-007-058

Alternative 2 - Half PMF Routing

Figure 4-21



Legend

- Canal
- Contours
- Arterial Roads
- Proposed Contours
- Basin Outline
- Existing Half PMF
- Alternative 3 Half PMF

Note:

The breakout at Point A across the Beardsley Canal during the half-PMF will be reduced with the improvement of the North Inlet Channel. The flood limits following channel improvement are not shown.

NORTH

0 0.5 1

Scale in Miles

WHITE TANKS FRS #3

Flood Control District of Maricopa County

URS

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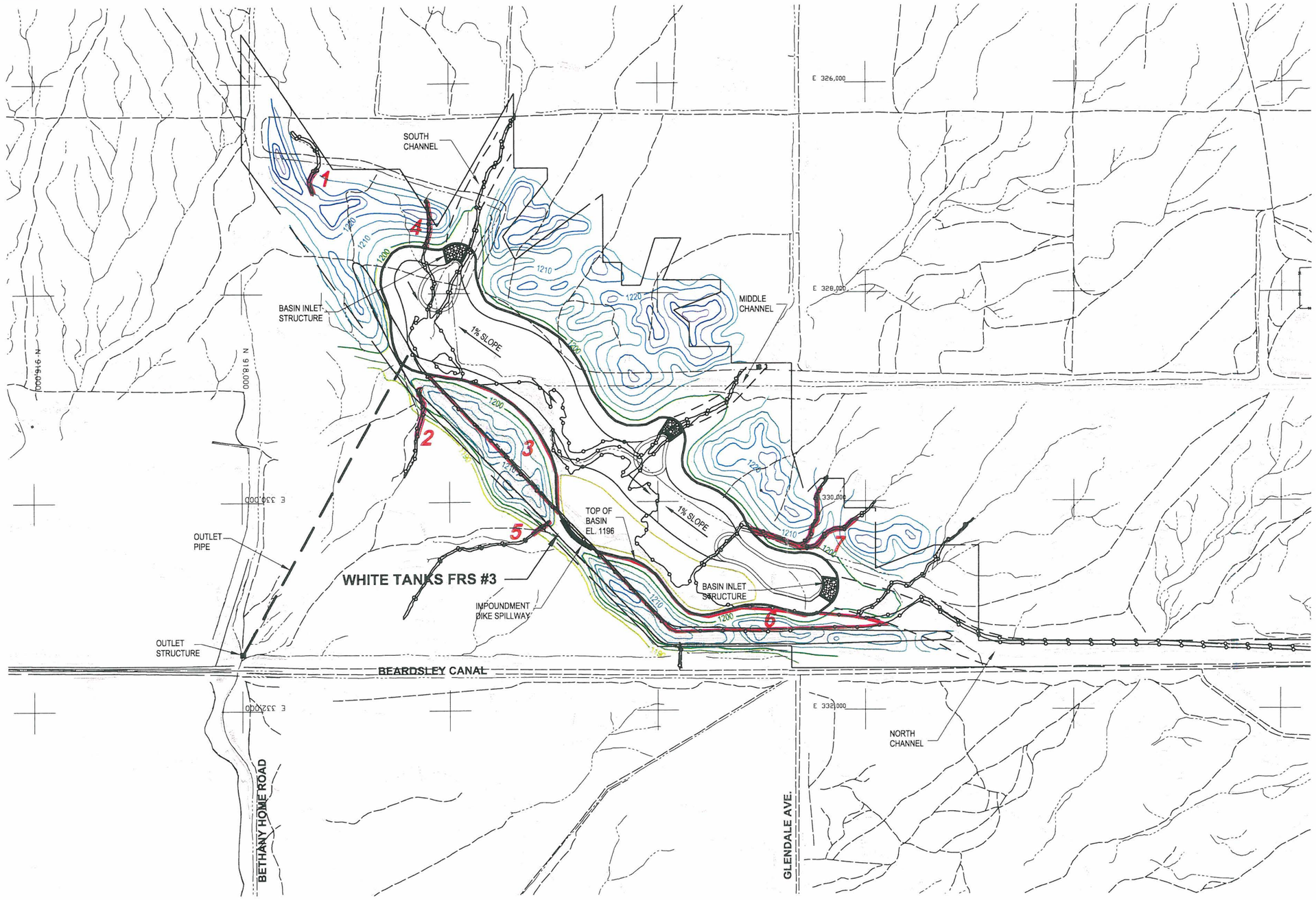
Dames & Moore Job No. 15448-007-058

Alternative 3 - Half PMF Routing

Figure 4-22



LEGEND:

- Waters of the U.S. Limits
- 3 Impacted Areas

NORTH

0 500 1000 1500 2000
Scale in Feet

WHITE TANKS FRS #3

SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

Flood Control District of Maricopa County

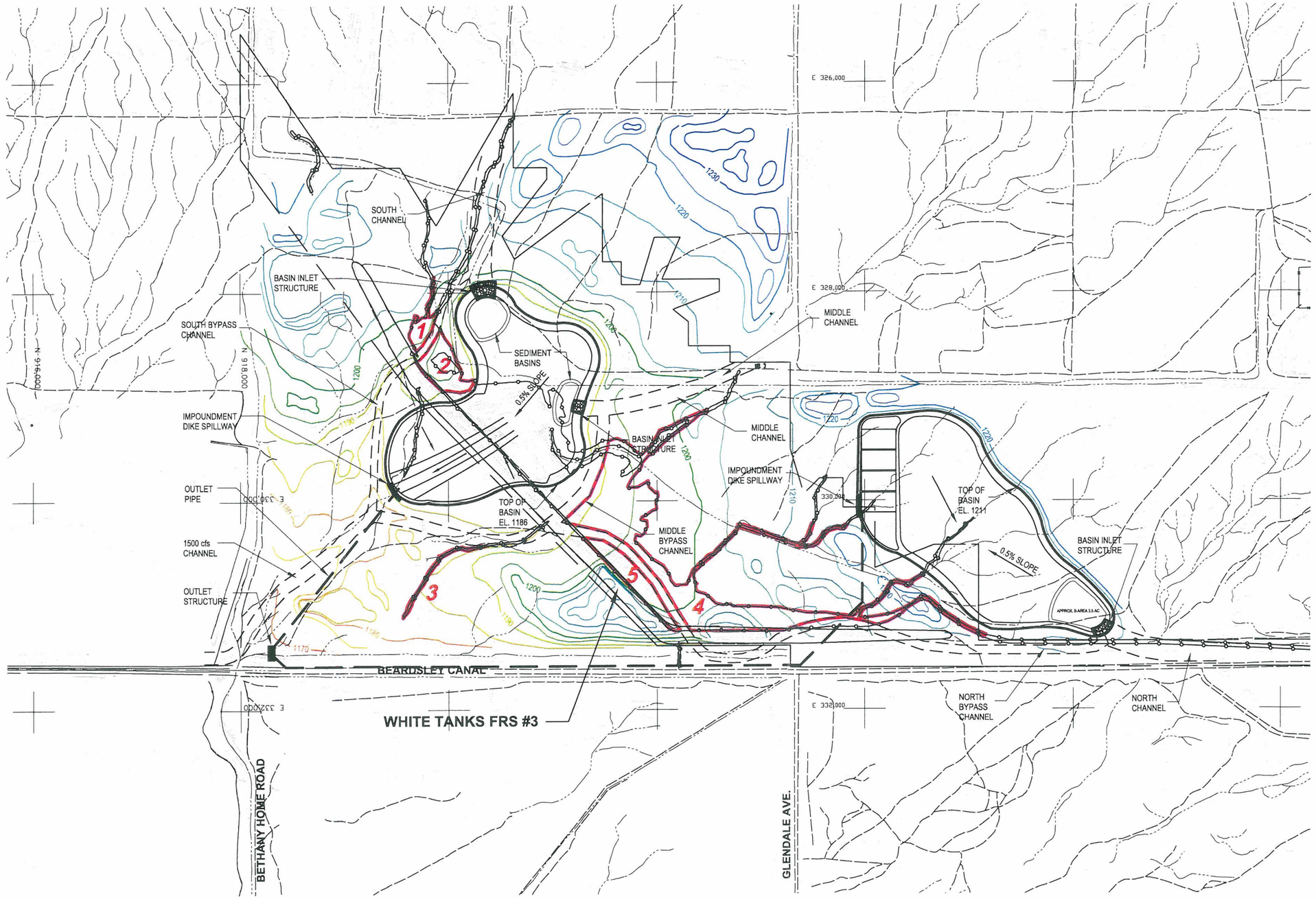
URS Dames & Moore

A14427.DWG 1-11-01 XREF:VTOPO

Dames & Moore Job No. 15448-007-058

Alternative 1 - Possible Impact on the Waters of the U.S.

Figure 5-1



LEGEND:

- Waters of the U.S. Limits
- 3 Impacted Areas

NORTH

0 500 1000 1500 2000
Scale in Feet

WHITE TANKS FRS #3

SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

Flood Control District of Maricopa County

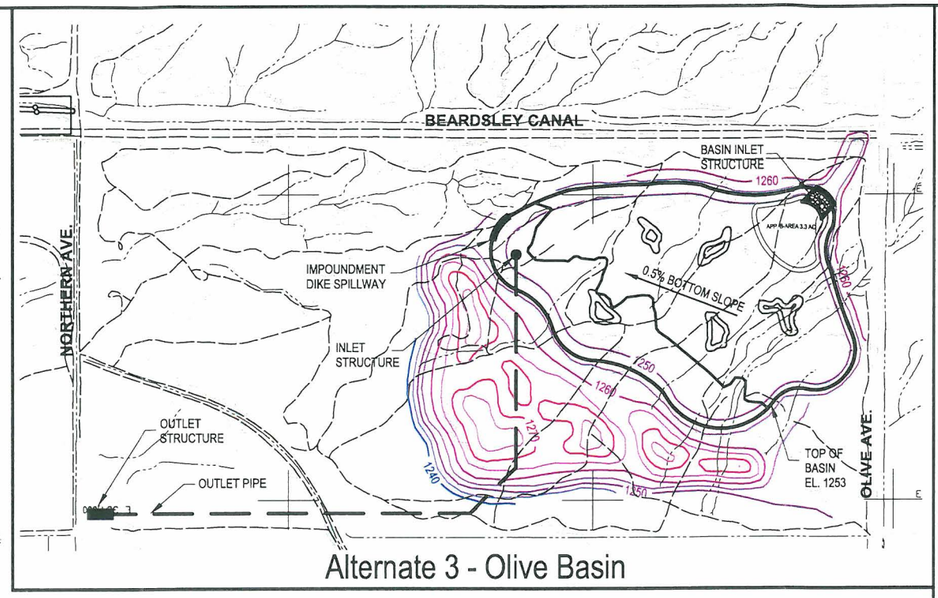
URS Dames & Moore

A14428.DWG 1-11-01 XREF:VTOPO

Dames & Moore Job No. 15448-007-058

Alternative 2 - Possible Impact on the Waters of the U.S.

Figure 5-2



Alternate 3 - Olive Basin

LEGEND:

- Waters of the U.S. Limits
- 3 Impacted Areas

NORTH

0 500 1000 1500 2000
Scale in Feet

WHITE TANKS FRS #3

Flood Control District of Maricopa County

URS Dames & Moore

SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

A14429.DWG 1-11-01 XREF:VTOPO

Dames & Moore Job No. 15448-007-058

Alternative 3 - Possible Impact on the Waters of the U.S.

Figure 5-3